

MATHEMATICAL SIMULATION OF CRYSTAL NUCLEATION,
GROWTH AND THE FORMATION OF TEXTURES

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in partial fulfillment of the requirements for the
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ABSTRACT

A computer program (MODULE-1) was developed to enable the Cartesian description of any crystal (Sempels @ Raymond 1976). This program requires standard crystallographic data (system, number of forms, Miller indices, axial ratios and interaxial angles) to calculate the general equations of the faces present, a cyclic list of vertices on each face, and the volume and surface area of the observed crystal. For verification or illustration purpose, a graphic treatment can be selected. This graphic treatment rotates, translates and scales the crystal projections according to specifications. To provide a data base for the simulation of the nucleation and growth of crystals and to verify MODULE-1's reliability, 61 minerals were processed and the results were displayed using a Milgo plotter terminal.

A review of theoretical and experimental work on crystal nucleation and growth suggested three major concepts. First, under natural conditions, nucleation often takes place via an heterogeneous mechanism and may be characterized by quasi-instantaneous rates. Second, in an intrusive context, the crystals' growth rates may be governed by any of several possible interface adsorption reactions and may show a proportionality relationship to a power function of the degree of undercooling present. Third, the development of crystal habit is governed by the type of structure and the conditions of crystallization. These

concepts have been used in the creation of MODULE-2, a computer program designed to simulate the growth of single crystals. In this model, the growth rates are such that the crystal's radii increase linearly with respect to time and the habit remains constant. Calculated cooling rates of intrusive bodies were used to demonstrate that this type of growth rate does not contradict the physicochemical principles of igneous petrology. Measurements of naturally occurring zoned plagioclase crystals support the concept of constant habit development (Sempels 1978). In order to give to the results of the simulation a more tangible nature, the theoretical crystal models were recreated and stored in a space simulating matrix made up of regularly distributed discrete points. Analyses of the loss of precision inherent in this process revealed that the resemblance between the theoretical and stored models is proportional to the size of the crystal. To illustrate this effect, the theoretical and stored models of six crystals, one of each crystallographic system, were displayed on a cathode ray tube terminal during their simulated growth and the images were recorded on film (Sempels 1974).

A third computer program (MODULE-3) was developed to simulate the nucleation and growth of crystalline aggregates. In this model, crystals were allowed to grow until they completely filled a volume of predetermined size. The simulation was repeated several times, using different parameters for the number of crystals, nucleation rates,

types of crystalline interactions, types of distribution of nucleation sites, types of orientation of the crystals, and the textures produced were recorded.

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PART 1.

INTRODUCTION

INTRODUCTION

1-0. The Problem: Understanding Crystalline Textures.

In the past, different researchers have used the term textures in the description and study of rocks in slightly different ways: the definite mutual arrangement of its forming minerals (Hatch et al. 1952); all spacial data from natural and artificial rocks (Voll 1960); the degree of crystallinity, granularity and the shape, distribution and mutual relationship of the grains (Moorhouse 1959). In this work, the term texture is used as defined by Spry (1969): the absolute and relative size of component crystals, their shape, distribution and orientation.

The precise determination of the environment of crystallization and the solidification history of crystalline rocks are classical petrologic problems (Mahan @ Rogers 1968). A correct interpretation of textural relationships contributes to the understanding of these problems. The critical factors controlling the petrogenesis and paragenesis of a rock are reflected, in variable amount, in its final texture. Thus, ideally, a complete understanding of textural relationships would allow a petrologist fluent in mineralogy, chemistry and thermodynamics to understand the history of formation of a rock. In reality, the understanding of textures is rarely a simple matter. Although many of the key factors of interest to petrologists are reflected in rock textures, because of

the large number of these factors, their interdependence and variability in time and space, correct textural interpretations are often exceedingly difficult.

In the past, the study of rock textures was generally performed by collecting data on the shape, size, orientation and distribution of crystals and by interpreting these data in terms of thermodynamic stability, crystallization history or rock deformation. In this work, mathematical modeling or simulation is used to study the formation of crystalline textures.

1-1. Previous Studies.

In the large number of publications dealing with the study of rock textures, particular aspects are often analyzed from a statistical or thermodynamic point of view. The following are some examples: crystal shape (Kretz 1966-a); size distribution (Jones @ Galwey 1966; Kretz 1966-b); grain contacts (Rogers @ Boggy 1958; Mahan @ Rogers 1968; Flinn 1969; Vistelius 1966); crystal orientation (Kamb 1959; Kranck 1960; Goguel 1965; Powell 1966; Kumazawa @ Schimazy 1967; DeVore 1969; Hara @ Paulitsch 1971). Mathematical means and computer programs have been developed to facilitate the study of textural problems (Klovan 1966; Hensler 1967; Cheng @ Sutton 1971; Watson @ Smith 1975; de

Waard et al. 1976; Haines & Dowsett 1976; Tocher 1978).

Several types of analog systems have also been devised but surprisingly few yield information about textures. Chemical analogs, often used in experimental petrology, are perhaps the best known type. Because of the reproducible nature of the results and ease with which experimental conditions can be controlled, the cause of observed effects are usually well isolated. However, the temperature, pressure and especially time limitations inherent in chemical analog approaches make these methods unsuited to study the formation of crystalline textures. Physical analog systems have also been developed and used mostly in the fields of structural and engineering geology. In general, the existing chemical and physical analog systems do not appear to apply directly to the study of textural problems. The variables largely responsible for the development and characterization of textures, such as the distribution of the nucleation sites, the nucleation and growth rates cannot easily be controlled by these methods.

Another type of analog system is the mathematical one. In recent years, this method has been introduced in different fields of geology (Harbaugh & Bonham-Carter 1970), but except for some special cases (Watson 1974-a; 1974-b; Watson & Smith 1975) has not yet been used to study the formation of rock textures.

1-2. Mathematical Simulation.

Until recently, to simulate meant to feign, to create the effect or appearance of something. With the advent of high-speed digital computers in the early 1950's, this meaning began to change and came to signify the use of mathematical models in performing experiments. In its modern sense, simulation means the use of a particular class of techniques that involves the definition of a system, the construction of a model and the use of this model to analyze the behavior of the system.

It is possible to demonstrate that simulation is in complete accord with the scientific method (Harbaugh @ Bonham-Carter 1970). In the construction of a simulation model, observations on real systems are first collected. By inductive reasoning and using these real-system observations, a model is formulated. This model is then modified and evaluated until the simulation results are in close agreement with the known real-system information. At this point, the model can be used to formulate hypotheses or answer specific question. Thus, in terms of applications, simulation is a means of solving specific problems which cannot be resolved by physical experimentation or for which a conventional mathematical solution is exceedingly complicated. In terms of research, the creation of a valid simulation model demonstrates that a real system can be adequately described and analyzed mathematically. It also

implies a synthesis and assessment of the known facts about the real system and it provides an often unique means of testing existing theories and hypotheses.

In a real situation, a system may be defined as a set of dynamically interrelated components or elements. If any of these elements is modified, repercussions are created on the rest of the system. The interdependence of components and the definition of their boundaries are important concepts in the formation of a simulation model. In the task of simulating the formation of crystalline textures, the following hierarchy of elements has been used: the nucleation and growth of single crystals, the nucleation and growth of crystalline aggregates; and finally, the crystals' interactions during complete solidification. Each of these elements is discussed according to a synthesis of existing theories, a selection of realistic parameters and their mathematical modeling.

1-3. Purpose and Scope of Present Work.

The purpose of this work is to create and evaluate mathematical models of crystal nucleation, growth and the formation of crystalline textures. A review of pertinent literature is used in the formulation of these mathematical models to allow for the selection of some realistic types of parameters. Where possible, justifications and supporting evidence are discussed in the selection process. Once the

mathematical modeling of a particular aspect of crystallization is completed, the model itself is analyzed, evaluated, and if necessary, improved, before being used in further work. The different models are then used together to simulate the formation of textures using different parameters for the conditions of crystallization.

1-4. Acknowledgements.

This study was made possible by the unfailing trust, encouragement and friendship of Dr. Ralph Kretz. The author is also grateful to Drs. J.D. Scott, F. Agterberg, D.D. Hogarth and J. Raymond for many stimulating discussions. Assistance and helpful suggestions concerning computer work were kindly provided by E. Strong, R. Perron, T. Murray, H. Vandette, M. Hull, B. Molloy, and A. Leclerc. Technical assistance was also kindly provided by M. Goulet, L. Dubeau, M. Jackson, D. Dubé, J.P. Séguin and B. Crowe.

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PART 2.

THE TREATMENT OF CRYSTALS IN CARTESIAN SPACE

THE TREATMENT OF CRYSTALS IN CARTESIAN SPACE

2-0. Notation.

- a,b,c : Standard crystallographic axes.
- a₁,a₂,a₃,c: Standard crystallographic axes for the hexagonal system.
- a:b:c : Crystallographic axial ratios.
- A* : Direction normal to the b-c plane in the monoclinic system.
- Alpha : b-c interaxial angle.
- Beta : a-c interaxial angle.
- Gamma : a-b interaxial angle.
- (h k l) : Miller indices terms.
- X,Y,Z : Standard Cartesian orthogonal axes.

2-1. Introduction.

This part describes the procedure that was developed to enable a Cartesian description of any crystal, other than dendritic and skeletal ones. The computer program that was devised for this purpose requires standard crystallographic data (system, number of forms, Miller indices, axial ratios, and interaxial angles) to calculate the general equations of the faces present and a cyclic list of vertices on each face. To verify and illustrate the results, crystals defined in Cartesian space were processed by a graphic treatment. This graphic treatment rotates,

scales, and translates crystal projections according to specifications. For many purposes, and more specifically for this project, crystals of low symmetry or complex crystallographic properties are more easily treated once expressed in a Cartesian manner.

The nature of digital approaches is incompatible with and unable to deal directly with the particularities of crystallography in describing crystals. The specification of crystals, as objects, according to a standard Cartesian method, such as by a list of their face equations, removes this incompatibility.

2-2. Existing Approaches for the Cartesian Description of Minerals.

Conventional analytic geometry provides a simple but very useful method for working with and describing objects completely bound by planar surfaces. Methods for obtaining Cartesian information from crystallographic data do exist (Tutton 1922; Phillips 1971), but all have a specific nature, mostly crystal drawing. A review of the literature shows that no direct, simple and widely applicable method exists for the Cartesian translation of crystallographic data.

2-3. Mathematical Approach Used in the Cartesian Translation of Crystallographic Data.

The following is a discussion of the mathematical procedure that was developed to obtain the Cartesian equations of crystal faces (2-3-1), the Cartesian locations of crystal vertices (2-3-2), and to provide a practical description of crystal habit or combinations of forms (2-3-3).

2-3-1. Cartesian Equations of Crystal Faces.

To obtain a Cartesian description of any crystal, the general equations of its faces must first be found. It is easy to find the general equation of a plane once its intercepts on orthogonal axes are known. Miller indices used in crystallography are the inverse of such intercepts but specific to a particular crystallographic system. That is, they carry the effect of the axial ratios and interaxial angles of the system in which they are used. If the Miller indices of a crystal face, the crystal axial ratios, and interaxial angles are known, it is then possible to calculate the face intercepts on an orthogonal system of axes.

The equivalent and orthogonal nature of the axes of the isometric system (Fig. 1-A) simplify calculations. In this case, Miller indices can be used directly as

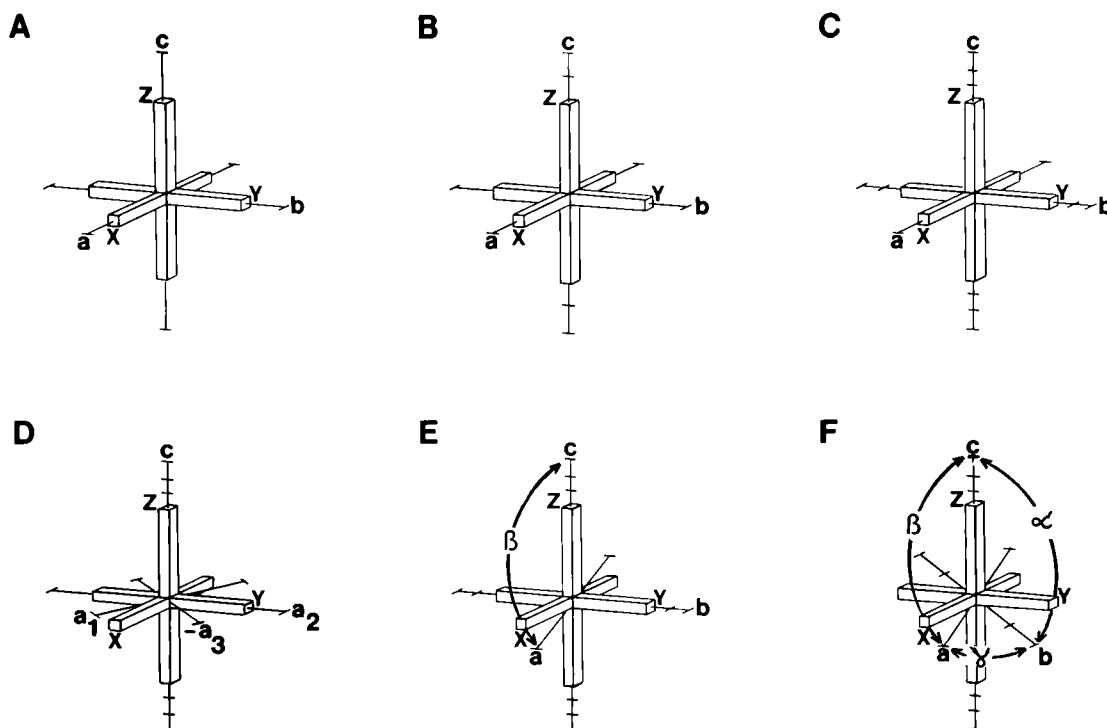


Figure 1:

Alignment of the a , b , c , (a_1 , a_2 , a_3 and c for the hexagonal system), crystallographic axes and the X , Y , Z orthogonal axes to determine the general equations of crystal faces. Crystallographic systems as follows: A: Isometric, B: Tetragonal, C: Orthorhombic, D: Hexagonal, E: Monoclinic and F: Triclinic.

coefficients in the general equation of a face.

Tetragonal crystals differ from isometric ones in the c term of their axial ratios (Fig. 1-B). In this case, Miller indices can be used as coefficients of the general equation of a face if care is taken to divide the l term of the Miller indices by the c term of the axial ratios.

For orthorhombic crystals (Fig. 1-C), an extension of the above reasoning is applied. Miller indices divided

by their respective axial ratios yield the coefficients of the general equation of a face.

The relationship between Miller indices (h k l) and axial ratios $a:b:c$, as shown above, can be expressed in the general equation of a face as follows:

$$\frac{h}{a} X + \frac{k}{b} Y + \frac{l}{c} Z = 1 \quad (1).$$

The same relationship holds for the hexagonal, monoclinic, and triclinic systems, although the non-orthogonal nature of their axes creates further complications.

For hexagonal crystals (Fig. 1-D), an X , Y , Z orthogonal system of axes can be superimposed on the four axes (a_1 , a_2 , a_3 , and c) crystallographic system such that: both systems have the same origin, Z is parallel to c , Y is parallel to a_2 , and X bisects the angle between a_1 and $-a_3$. Thus all faces other than those perpendicular to a_2 and those of the basal pinacoid have an intercept on the X orthogonal axis. Using trigonometry, this X intercept can be derived from Miller indices. As for tetragonal cases, the l term of the Miller indices must be divided by the c term of the axial ratios to obtain the Z coefficient of the general equation of the face.

In monoclinic cases (Fig. 1-E), the X , Y , Z orthogonal axes can be superimposed on the a , b , c crystallographic axes such that they have the same origin, Z

is parallel to c , Y is parallel to b , and X , a direction normally called A^* , is perpendicular to the b - c plane. The X intercept is derived by trigonometry from the Miller indices of a face and the axial ratios are used as above to calculate the coefficients of the general equation of a face. The a - c interaxial angle β , except when equal to 90 degrees, requires that a face of the form $\{0\ k\ l\}$ have an X coefficient in its general equation.

For triclinic crystals (Fig. 1-F), the a , b , c crystallographic axes and the X , Y , Z orthogonal axes are aligned such that: they have the same origin, z is parallel to c , Y lies in the b - c plane, and X is perpendicular to the b - c plane. The new X and Y intercepts are calculated by trigonometry from the Miller indices of a face and the axial ratios are used as above in evaluating the coefficients of the general equation of a face. The presence of α and β unequal to 90 degrees is sufficient to require that a face of the form $\{0\ 0\ 1\}$ has both an X and a Y coefficient in its general equation.

2-3-2. Cartesian Locations of Crystal Vertices.

Once the crystal faces are expressed as Cartesian general equations, they can be selected by non-repetitive groups of three, the minimum number of faces required to form a vertex. The presence of a non-zero determinant of a matrix made up of the coefficients of such a group of equations indicates the existence of a vertex (Campbell 1965). The solution of that group of equations yields the spacial location of the vertex. Euhedral crystals (except for twins, dendritic and skeletal or hopper crystals) are convex polyhedra. For this reason, the solution of crystal faces by groups of three occasionally yields vertices falling outside of the crystal surfaces. These mathematically real but non-existent vertices are eliminated by verifying if a crystal face lies between them and the crystal centre.

2-3-3. Habit or Combination of Forms.

Miller indices are normally expressed as simple integers. Consider an isometric crystal having a face intersecting the a, b, c axes at 10, 5, and 5 units respectively. The Miller indices of this face will be expressed as (122). Indeed it is axiomatic to crystallography that any crystal face can be moved parallel to itself without affecting the crystal symmetry or its

Miller indices. In doing so, the relative orientation of the face with respect to the axes is preserved but the real distance between the face and the crystal centre becomes immaterial. The mathematical solution of the general equations derived from the Miller indices of a crystal composed of a cube {001} and an octahedron {111} yields the octahedron alone. To compensate for this, a combination index must be evaluated for each form making up a crystal to obtain the dominant form in the desired proportion.

2-4. MODULE-1: A Computer Program for the Cartesian Translation of Crystallographic Data.

The following is a description of the computer program making up MODULE-1. The program is discussed according to its implementation (2-4-1), its necessary input data (2-4-2) and the output information it produces (2-4-3). Figure 2 is a simplified description of the functioning of MODULE-1.

2-4-1. The Program Implementation.

MODULE-1 was implemented in Fortran IV on an I.B.M. 360-165 and as no special features were used it should be easily transportable to other machines. The core requirement is 150 Kbytes, if all processing options are resident. It is possible to reduce this core requirement by

loading only those routines needed by a particular run or by using overlays. The magnetic tape output option, if selected, can be analyzed by graphic software such as 'Viewplot'.

Such an analysis produces images on a cathode ray tube or plotter terminal (in this work, a Tektronix 4013 and a Milgo plotter were used). The processing can be incorporated in the same run by using disk files. The use of such software requires an I.B.M. O.S. (Operating System) environment with access to B.T.A.M. (Basic Telecommunication Access Method, Raymond @ Gavrel 1973). Appendix 1-a is a list of the Fortran IV statements making up MODULE-1. Appendix 1-b is a description of the functions fulfilled by the different parts of MODULE-1.

2-4-2. MODULE-1 Input Data.

The crystallographic system of the crystal to be processed is signaled by an integer variable. Axial ratios are read for all systems other than the isometric one. Interaxial angles are read for monoclinic and triclinic cases. The number of forms of the crystal is specified. A combination of form index, and a list of Miller indices are read for each form. Appendix 1-c lists the sequence of data elements and commands for output options to be observed when using MODULE-1.

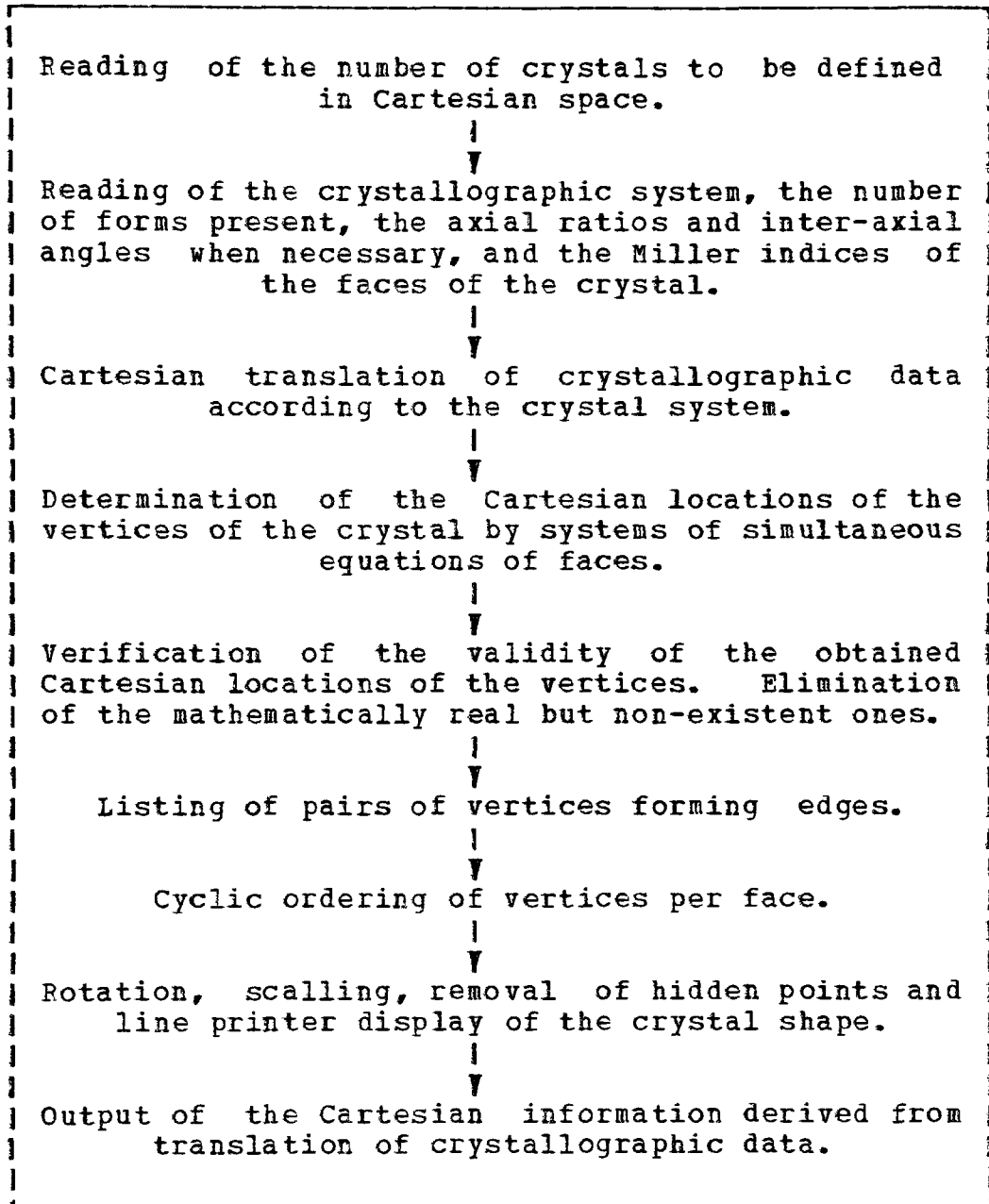


Figure 2:

Summarized description of the sequence of operations performed by MODULE-1 in transforming crystallographic to Cartesian data.

2-4-3. MODULE-1 Output Data.

The main output information consists of: the Cartesian general equations of the observed crystal faces, a list of Cartesian locations of the crystal vertices, a list of linear equations of edges and cyclically ordered vertices on each face. The output is flexible, allowing items not required to be by-passed. A direct graphic output on the line printer can be selected. In this case, an orthographic projection of the crystal in standard crystallographic orientation is obtained, along with the desired output items (see appendix 2-b). An output suitable for treatment by a graphic terminal can also be selected and stored on magnetic tape. This tape content can be processed in order to produce the crystal projections on a cathode ray tube or plotter, allowing rotations, translations, and scalings to be performed according to specifications. Appendix 2-b is the printer output of MODULE-1 when all options have been selected.

2-5. Results Obtained with MODULE-1.

In order to test the efficiency, flexibility, and dependability of MODULE-1, 61 minerals were processed. The minerals were selected to represent all six crystallographic

systems and a wide range of crystallographic complexity.

Appendix 2-a is a complete list of the crystallographic data and sources used for this analysis. Besides verifying the capability of MODULE-1, the analysis served in creating the data base (the Cartesian crystal description) necessary to continue this study. Figure 3, a Milgo plotter drawn table of the 61 selected minerals, demonstrates the illustrative ability of MODULE-1. The most significant contribution of this program is contained in appendix 2-b, a complete list of the Cartesian general equations of all faces present on the 61 selected minerals.

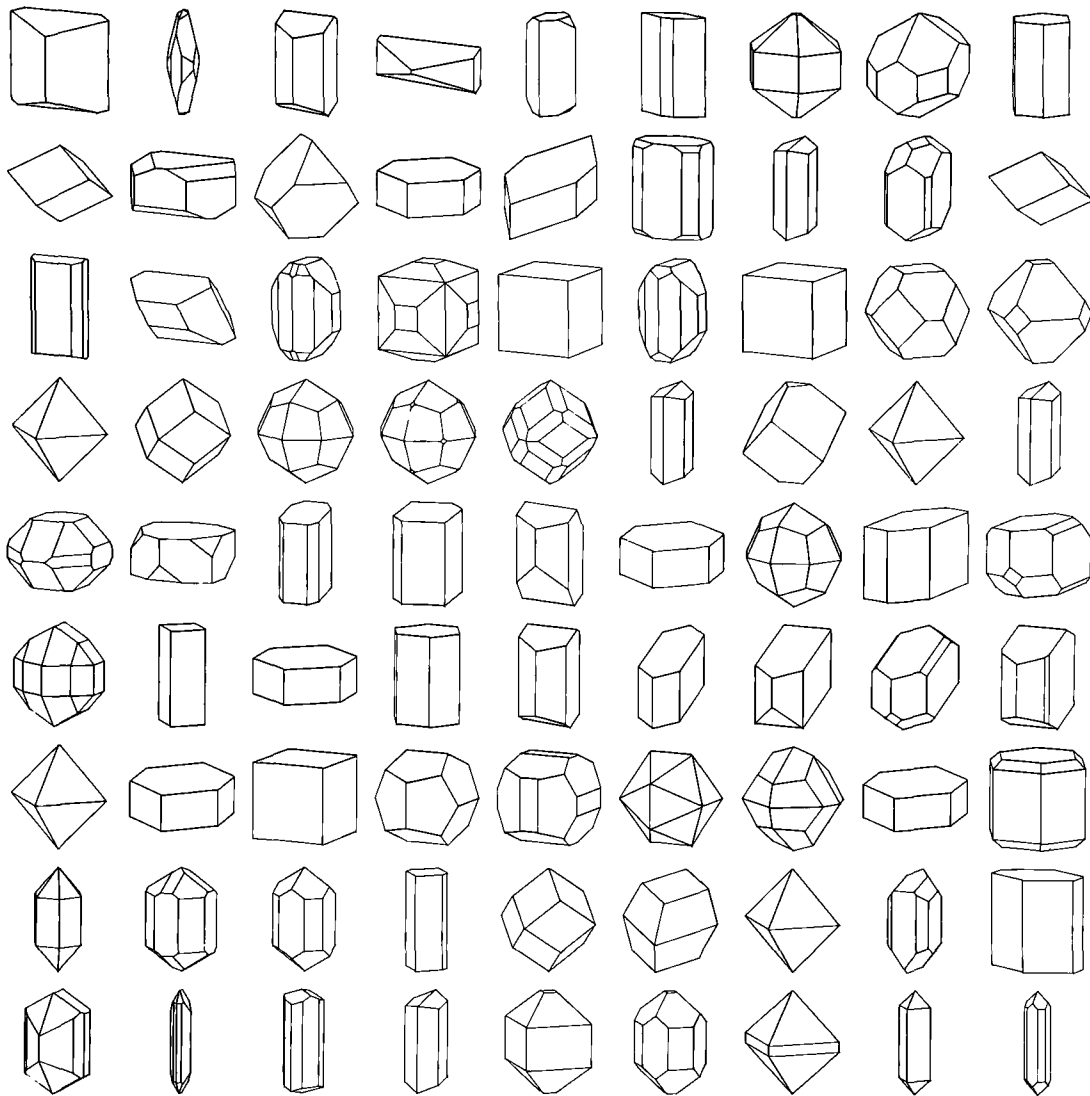


Figure 3:

Computer drawn table of the forms and combinations of forms of 61 test minerals. The crystallographic data is from Deer et al. 1967; Mason & Berry 1968; Hurlbut 1971 and is listed in appendix 2-a. Humite (column 1, row 5) is incorrectly represented. See appendix 2-a for corrected data.

PART 3.

CRYSTAL NUCLEATION

CRYSTAL NUCLEATION

3-0. Notation.

a	: Constant of numerical value related to the shape of the nucleus.
dGc	: Free energy change that accompanies the creation of a nucleus of critical radius R_c .
dGcHet.	: Critical free energy difference for heterogeneous nucleation.
dGcHom.	: Critical free energy difference for homogeneous nucleation.
dGv	: Free energy per unit volume (ergs cm. ⁻³).
G	: Molar Gibbs free energy (ergs moles ⁻¹).
Ga	: Free energy of activation for the transfer of atoms from liquid to crystal.
h	: Planck's constant (6.62×10^{-27} ergs sec.).
Hf	: Latent heat of fusion (ergs gm. ⁻¹).
I	: Nucleation rate.
K	: Boltzmann's constant (1.38×10^{-16} ergs °C. ⁻¹).
N	: The total number of atoms of a system.
N*	: Number of atoms on the surface of a nucleus of critical radius R_c .
Ni	: Number of atoms of the i th cluster.
Nic	: Number of nuclei of critical radius per unit volume.

n : Number of atoms per unit volume of liquid.

ϕ : Constant of numerical value such that $0 \leq \phi \leq 1$.

Pi : 3.14159

R : Radius of a nucleus.

Rc : The critical value for the radius of a nucleus.

Sc : Surface area of a nucleus of critical radius.

T : Temperature in degrees Kelvin.

Vlc : Surface free energy per unit area of liquid-
solid interface (ergs cm.⁻²).

Vsl : Surface free energy per unit area of solid-
liquid interface (ergs cm.⁻²).

Vsc : Surface free energy per unit area of solid-
crystal interface (ergs cm.⁻²).

Z : Rate of transfer of atoms across a liquid-solid
interface.

3-1. Introduction.

In recent years, the understanding of nucleation has been the aim of a large amount of theoretical and experimental work. Not only metallurgists but solid state physicists, geologists, chemists, and ceramists have contributed to the subject.

A brief survey of the results obtained suggests that nucleation is rather an intricate process and that, sometimes, it gives rise to conflicting theories and opinions. The lack of agreement is mostly due to the nature of the problem. Nucleation involves atomic clusters lying at, and often beyond, the limits of resolution of most modern equipment. Furthermore, the processes of nucleation, the behavior of atoms, are confined to extremely short periods of time.

Amongst the aims of the present study is the simulation of macroscopic aspects of crystal nucleation, for which simplifications are unavoidable. The understanding of fundamental nucleation events, summarized in the following sections, justifies the simplifications used.

3-2. Theory of Homogeneous Nucleation.

The classical theory of homogeneous nucleation assumes that nuclei have the same composition and structure as the final phase in bulk quantities and that solidification takes place if it reduces the total free energy of the system. Of several thermodynamic properties, the use of Gibbs free energy, G , is helpful in the description of nucleation (Brice 1965).

Let dG_v represent the difference in free energy per unit volume between the solid and liquid phase. Crystallization then decreases the free energy of a system by dG_v per unit volume of solid created. The creation of a solid, however, implies the creation of a interface, of positive free energy.

Let V_{sl} represent the interface free energy per unit area and consider a spherical nucleus. The creation of a solid will cause the system to experience a change in free energy, dG , such that:

$$dG = -\frac{4}{3}\pi R^3 dG_v + 4\pi R^2 V_{sl} \quad (2).$$

Equation 2 requires that dG increases as R increases from 0, until a critical value, say R_c , is reached. Further increase in R causes dG to decrease (Fig. 4).

The value of R_c , the nucleus critical radius, can be found by setting $d(dG)/dR=0$ for which:

$$R_c = -2 V_{sl} / dG_v \quad (3) .$$

Let dG_c represent the free energy change that accompanies the creation of a nucleus of critical radius. The value of dG_c can be found by substituting equation 3 in equation 2.

Solving,

$$dG_c = \frac{16\pi V_{sl}^3}{3dG_v^2} \quad (4) .$$

These derivations assume that V_{sl} is independent of the nucleus size, shape, and orientation. Unfortunately, it is not. A rigorous description should take into account the variations of V_{sl} with orientation, thus enabling the treatment of non-spherical nuclei of anisotropic surface energy. However, such a rigorous treatment is impossible: the total surface free energy is a discontinuous function of the nucleus size and is strongly dependent on the degree of curvature of the interface. These shortcomings are due to the use of classical thermodynamic concepts precluding extrapolation to small dimensions (Toshev 1973).

Figure 4 illustrates the relationship between the change in free energy and the radius of the nucleus and

demonstrates that for a nucleus of radius less than the

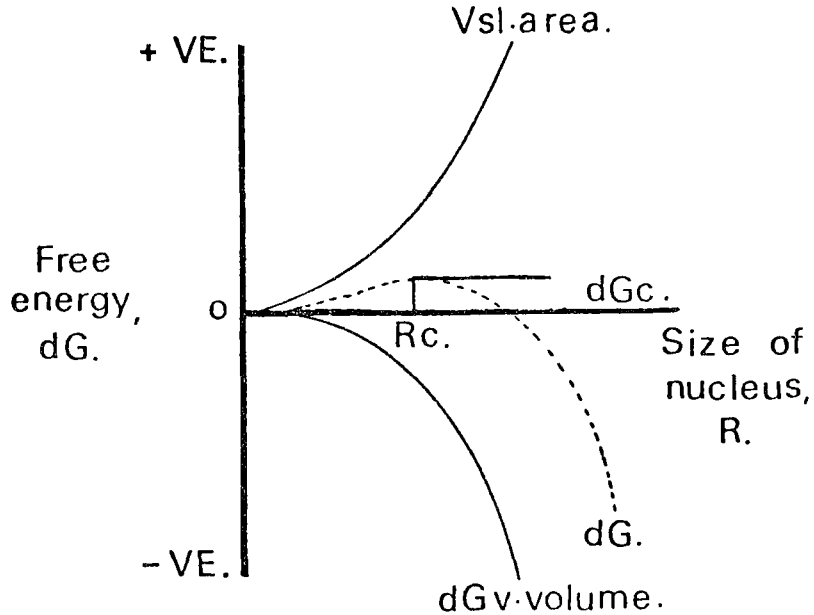


Figure 4:

Graph of the change in Gibbs free energy, dG , with increasing nucleus radius, R (after Mullin 1972).

critical value R_c , the surface energy term dominates. As $d(dG)/dR$ is positive, continuation in growth results in an increase in the free energy of the system. Such a nucleus, therefore, tends to disaggregate. The opposite is true for a nucleus of radius greater than the critical value R_c . In this case, the volume energy term dominates, and as $d(dG)/dR$ is negative, further growth decreases the free energy of the system. Such a nucleus, therefore, tends to continue growing.

Figure 4 does not justify the creation of dG_c , the critical change in free energy associated with the appearance of a nucleus of critical radius. The explanation

is that although the total free energy at constant pressure and temperature is constant, on a microscopic scale, the free energy level is not the same in all parts of a fluid. At any instant there is a statistical distribution of energy or molecular velocity about a constant mean value, a characteristic called the Boltzmann distribution. This constant mean energy value defines the temperature of the system. The Boltzmann distribution predicts that, in restricted regions, the energy level can rise temporarily to high values, of the range of dG_c .

3-2-1. Temperature dependence of R_c , the Critical Radius of the Nucleus.

The equilibrium between solid and liquid can be described by the Clapeyron equation:

$$\frac{dP}{dT} = \frac{dH_f}{T(V_l - V_s)} \quad (5),$$

where dH_f is the enthalpy of fusion, V_l and V_s are the volume of the liquid and solid respectively and dP and dT are the changes in pressure and temperature (Daniels @ Alberty 1966).

Reorganization of the terms of equation 5 yields the following expression:

$$dP = \frac{dH_f dT}{T(V_l - V_s)} \quad (6) .$$

For the special case of incompressible solids, that is those for which no work is done in their compression, the change in pressure, dP , can be equated to the change in free energy, dG (Daniels & Alberty 1966).

From equation 6 we can now define for incompressible solids:

$$dG = dH_f dT / T(V_l - V_s) \quad (7) .$$

Substitution of equation 7 in equation 3 yields a new expression for the critical radius:

$$R_c = \frac{-2V_s l}{(dH_f dT) / T(V_l - V_s)} \quad (8) .$$

Equation 8 expresses the relationship between the critical radius, R_c , and a change in temperature, dT . Figure 5 illustrates this relationship. The upper branch of figure 5, for positive dT and R_c , corresponds to a convex crystal in a supercooled liquid; the lower branch, for negative dT and R_c , corresponds to a sphere of liquid in a superheated crystal.

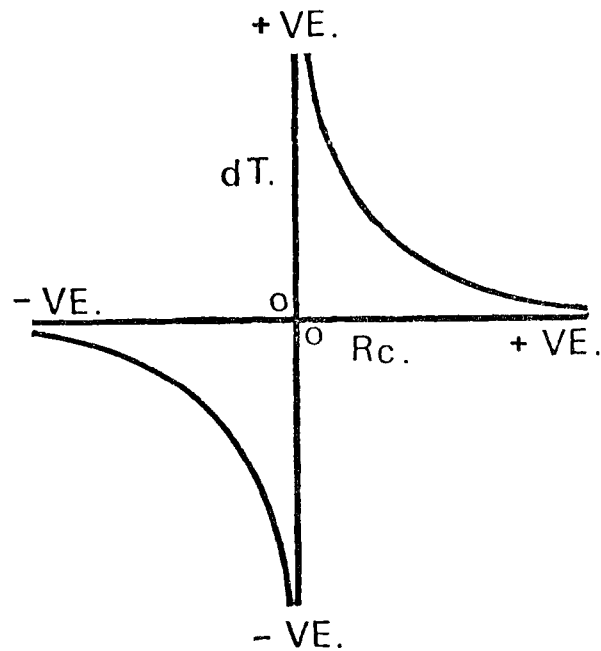


Figure 5:

Graph of the change in temperature, dT , with increasing nucleus critical radius, Rc (after Chalmers 1964).

Except for some particular cases (Gorskii @ Mikulich 1966; McLachlan 1978), no method has yet been developed for the direct measurement of Vsl , and numerical values for critical radii corresponding to certain changes in temperature cannot be calculated.

3-2-2. Nucleation Rates.

X-ray diffraction data of liquids give rise to the following interpretation: their instantaneous structure may be one in which atoms or molecules are part of crystal-like clusters, oriented randomly, with some free space and, possibly, shared atoms between neighboring clusters. This interpretation is often called the short range order or structure of liquids.

These clusters would form and disperse rapidly by the transfer of atoms across the surrounding free space. As long as these clusters are all below the critical size, R_c , corresponding to the particular temperature of the liquid, they cannot grow. However, if the temperature of the liquid is such that R_c is less than the largest cluster present, nucleation and growth can occur.

Thus, the criterion for the presence or absence of nucleation is the relationship between the critical size of nuclei and maximum cluster size present.

From a thermodynamic point of view, if the liquid is regarded as an equilibrium mixture of clusters, the relative number of different clusters is given by the Arrhenius equation:

$$N_i = N e^{(-dG/KT)} \quad (9),$$

where dG is the difference of free energy of the i th

cluster with respect to the same number of single atoms. Nucleation rate is then defined by the rate of formation of nuclei of critical size.

This approach was first developed by Volmer and Webber in 1926 for the condensation of gases and was later extended to crystallization by Turnbull (in Chalmers 1964).

Combining equations 9 and 4, the number of critical nuclei, N_{ic} , per unit volume is given by:

$$N_{ic} = N e^{(-dG_c/KT)} \quad (10).$$

If each critical nucleus grows into a crystal, the rate of formation of nuclei is then determined by the rate at which smaller clusters reach the critical size.

The nucleation rate, I , is then defined by:

$$I = Z S_c N_{ic} \quad (11),$$

where Z is the net rate of transfer of atoms across the liquid-solid interface and S_c is the surface area of the critical nucleus.

This equation can be expressed as:

$$I = K_v e^{(-(dG_c + G_a)/KT)} \quad (12),$$

where G_a is the free energy of activation for the transfer of atoms from liquid to crystal and the term K_v is defined by the following equation:

$$K_v = N^* (a V_{sl} / 9\pi KT) \frac{1}{2} (n(KT/h))$$

where a depends on the shape of the nucleus, N^* is the number of atoms on the surface of the critical nucleus and n is the number of atoms per unit volume of the liquid.

The rate equation 12, developed for condensation of gases, is unsatisfactory when applied to the problem of crystallization because of the long time necessary for equilibrium to re-establish itself when disturbed. This is due to the reduced mobility of atoms in a liquid.

Taking this effect into account, the rate of nucleation of solids is best described by:

$$I = (nKT/h) e^{(-G_a/KT)} e^{(-16\pi V_{sl}^3 \tau_e^2 / 3Hf dT^2 KT)} \quad (13).$$

(Chalmers 1964).

3-2-3. Temperature Dependence of I, the Nucleation Rate.

Inspection of equation 13 reveals that I , the nucleation rate, is affected by a change in temperature mostly by the exponential terms. G_a is relatively independent of T . Therefore, as T decreases, the exponential term $(-G_a/KT)$ increases and, as it is negative, it results in a decrease in I . Of the second exponential

term, H_f and V_{sl} are also relatively independent of T . This second term is affected mostly by dT . As dT increases, it reduces the exponential term and, as it is negative, it causes I to increase. This indicates that the nucleation rate remains very small until dT reaches a critical value, when it increases extremely fast.

The physical interpretation is as follows: at high temperatures, the nucleus critical radius is large. Despite the great atomic mobility, the maximum size of cluster present in the liquid is less than this critical size, and no nuclei form. As the temperature drops, both the nucleus critical size and atomic mobility decrease, but the first effect is more rapid. This permits clusters of size greater than the critical value to be formed and to continue growing. At lower temperatures, the nucleus critical size is small, but the atomic mobility has been reduced even more, such that growth rather than nucleation is enhanced.

Experiments demonstrate that nucleation is often instantaneous or quasi-instantaneous. This may be due to the fact that experimental cooling rates are much faster and sample size much smaller than those possible in nature. Theoretical considerations also predict large amounts of supercooling, whereas, experimental approaches show that, except for special cases involving particular treatments of the material observed (Turnbull 1950), the amounts of supercooling is generally very limited. The explanation is that true homogeneous nucleation is probably very rare and

that melts generally contain foreign particles which provide favorable nucleation sites, thereby reducing ΔG_c greatly.

3-3. Extension of the Theory to Heterogeneous Nucleation.

The necessary condition for the continuation in growth of a spherical nucleus is that its radius reaches the critical value, R_c , for the amount of supercooling present. V_{sl} , the surface energy term can be shown to be largely dependent on the degree of curvature of the solid-liquid interface.

If the nucleus is considered as being spherical, V_{sl} is then related to the sphere radius. However, for growth to continue, it is not necessary for a nucleus to be a complete sphere, but only to present a solid-liquid interface of curvature equivalent to that of a spherical critical nucleus. As any departure from the spherical shape increases the surface area and, therefore, the surface free energy per unit volume; it follows that a non-spherical nucleus has a critical volume larger than a spherical one. Consequently, it is often assumed that nuclei generally tend towards the spherical form.

Consider the shape and interfacial tensions present when a nucleus forms on a solid surface as illustrated by figure 6.

The periphery of such a nucleus will be stable when the components of the surface tensions balance. Taken horizontally, the forces are in equilibrium when:

$$V_{sl} - V_{sc} = V_{lc} \cos Q \quad (14),$$

where V_{sl} , V_{sc} , and V_{lc} are the surface free energies of the interface between solid and liquid, solid and crystal, and liquid and crystal respectively.

As the presence of an appropriate surface can induce nucleation at degrees of supercooling less than those observed for homogeneous nucleation, the critical free energy change under heterogeneous conditions, $dG_{cHet.}$, can be less than the corresponding critical free energy change under homogeneous conditions, $dG_{cHom.}$

The relationship between $dG_{cHet.}$ and $dG_{cHom.}$ can be formulated as follows:

$$dG_{cHet.} = \phi dG_{cHom.} \quad (15),$$

where ϕ is less than or equal to unity.

From equations 14 and 15, Volmer (1929) suggested that the ϕ factor be expressed in terms of Q as:

$$\phi = ((2 + \cos Q) (1 - \cos Q)^2) / 4 \quad (16).$$

When $\theta = 180$ degrees, $\phi = 1$, and equation 15 becomes:

$$dG_{cH\text{et.}} = dG_{cH\text{om.}} \quad (17).$$

When $0 < \theta < 180$ degrees, $0 < \phi < 1$, and equation 15 becomes:

$$dG_{cH\text{et.}} < dG_{cH\text{om.}} \quad (18).$$

Finally, when $\theta = 0$ degree, $\phi = 0$, and equation 15 becomes:

$$dG_{cH\text{et.}} = 0 \quad (19).$$

These three cases, expressed by equations 17 to 19, can be interpreted as follows: When there is a complete non-affinity between crystal and solid surface or substrate (a case identical to complete non-wetting in a liquid-solid system) $\theta = 180$ degrees and equation 17 applies. That is, the critical free energy change associated with heterogeneous nucleation is the same as that associated with homogeneous nucleation. For cases of partial affinity (identical to partial wetting) $0 < \theta < 180$ degrees and equation 18 applies. That is, nucleation is enhanced because $dG_{cH\text{et.}}$ is less than $dG_{cH\text{om.}}$. For cases of complete affinity (identical to complete wetting) $\theta = 0$ degrees and the critical free energy of nucleation is equal to zero.

Physically, this last case corresponds to the seeding of a supercooled system with crystals of the solute material thereby completely removing the need for nucleation.

As V_{sl} depends on the degree of curvature of the interface, when ϕ has a value approaching zero, a critical nucleus produced under heterogeneous conditions can form with a volume less than that required in the absence of a substrate. A cluster of atoms can form in the presence of a suitable substrate, a spherical cap with degree of curvature identical to a complete spherical nucleus requiring more atoms (Figs. 6 and 7).

The volume of the spherical cap of figure 7 can be calculated using the following equation:

$$\text{Vol.Cap} = \frac{1}{3} \pi H^2 (3R - H) \quad (20),$$

where H is the height of the spherical cap and R the radius of the nucleus.

Using equation 20, the ratio of the volumes of the spherical cap to the total volume of the complete sphere is:

$$\frac{\text{Vol.Cap}}{\text{Vol.Tot.}} = \frac{\frac{1}{3} \pi H^2 (3R - H)}{\frac{4}{3} \pi R^3} \quad (21).$$

For a ratio of height to radius of 0.1, the corresponding ratio of volume of cap to that of the complete sphere is 0.00725; a considerable reduction in the volume

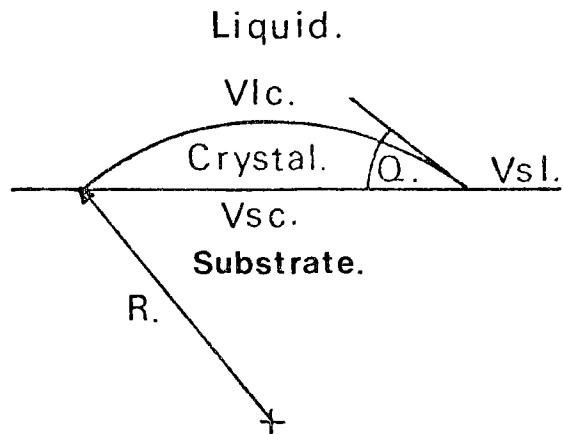


Figure 6:

Possible shape and interfacial tensions present during nucleation on a substrate (after Chalmers 1964).

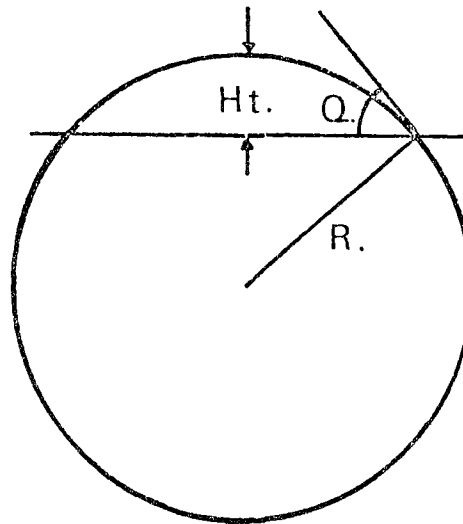


Figure 7:

Relationship between a spherical cap of height $Ht.$, and a complete sphere of radius R , of identical curvature (after Chalmers 1964).

necessary for the formation of a critical nucleus compared to the case when no substrate is present. In the above relationship a flat substrate-crystal interface is assumed. However, a convex interface produces a further decrease in the critical volume of a nucleus formed under heterogeneous conditions.

The reduction of ΔG_c by heterogeneous conditions probably explains the very small amounts of supercooling observed experimentally. In fact, completely homogeneous nucleation is probably a rare natural phenomenon.

3-4. Nucleation Sites.

Recent experimental studies have revealed the following: under heterogeneous conditions, nucleation sites are very dependent on the energy level of the immediate surroundings (Etheridge @ Hobbs 1974) and are influenced by the orientation of the nuclei relative to the substrate (Knight 1971; Gebhardt 1973). Apparently, nuclei can experience Brownian movement until reaching a favorable epitaxial position (Metois et al. 1972) and can rotate and coalesce with neighbors (Li 1962). In the case of recrystallization, nuclei seem to prefer definite sites (such as dislocation emergence points) on parent crystals (Champness 1970). Sometimes, nuclei can appear both in an oriented and unoriented state with respect to the substrate (Dippeenaar @ Honeycombe 1973). The influence of a

containing vessel in providing a thermal gradient and suitable nucleation sites has been recognized for many years. Also, gravity has been known for a long time to separate light and heavy phases.

The theory of nucleation demonstrates that the formation of critical nuclei is governed by statistical fluctuations in the energy levels of different parts of a system within the supercooled state. Presumably, under hypothetically ideal conditions, the instantaneous locations of these fluctuations could be random, as they are the effect of random collisions of atoms or molecules. The theory of nucleation also demonstrates that nucleation is very intimately linked to the presence of suitable substrates. However, in the case of natural systems, for which little is known, the spatial distribution of the substrates themselves remains hypothetical.

3-5. Nucleation Conditions Selected for Simulation.

Simple nucleation conditions were selected for the present study; but care was taken to make these simplifications in accordance with the nucleation theory. The summary presented in the previous section and the following discussion serve to demonstrate this point.

The process of nucleation itself presents no difficulty to formulate mathematically. The mathematical equivalent will be discussed in section (3-6). The

nucleation rate has been shown to be frequently quasi-instantaneous. Thus, for the simulation, an instantaneous rate was selected. Provisions were included in the programming to simulate a rapid nucleation onset followed by a variable rate of decline. Provisions were also made to reproduce random or regular distributions of nucleation sites. These two extreme cases, although not necessarily common in nature, present no contradiction to the nucleation theory. Similarly, the orientation of the nuclei was made variable, from perfectly aligned to completely random.

3-6. Mathematical Simulation of Nucleation.

The mathematical aspects of the simulation of crystal nucleation is presented in the following sections according to the following topics: the process of nucleation itself (3-6-1), the selection of nucleation sites (3-6-2), the orientation of the nuclei (3-6-3), the nucleation rates (3-6-4), and a description of the size and shapes of the nuclei (3-6-5).

3-6-1. Nucleation.

The macroscopic description of nucleation can be summarized as follows: at a definite location of a system at time T , no nucleus is present. At the same location, but at time $T + dT$, a critical nucleus is present and ready to grow into a crystal.

The simulation of this effect is achieved by a translation of the crystal defined in Cartesian space to the desired location in a space simulating matrix (see MODULE-2 Output Data, section 4-7-3).

Consider a crystal defined in Cartesian space in which the centre coincides with the origin of the space reference axes. The faces of such a crystal can be expressed by general equations of the form:

$$Ax + By + Cz = 1.0 \quad (22).$$

The translated crystal with new centre defined by the coordinates (X_c, Y_c, Z_c) has faces whose general equations are of the form:

$$Ax + By + Cz = -((A)(-X^*)) + ((B)(-Y^*)) + ((C)(-Z^*)) - 1 \quad (23),$$

where: $X^* = X_c - 0$, $Y^* = Y_c - 0$, and $Z^* = Z_c - 0$.

By repeating the above process for all faces on the crystal, the desired macroscopic nucleation effect is produced.

3-6-2. Nucleation Sites.

Generation of regularly distributed three-dimensional coordinates to be used as nucleation sites can be done manually. Random numbers are more easily generated by the computer. As random numbers are required to produce a random orientation of the nuclei, a generator was adapted from the I.B.M. subroutine RANDU. This subroutine computes uniformly distributed random real numbers between 0.0 and 1.0 and random integers between 0 and 2 exponent 31. Each entry uses as input an integer random number and produces a new integer and real random number. After the first entry is specified, the subroutine integer output is used as new entry. This subroutine, based on power residue, is specific to the system 360 and results from Hamming's work (1962). It can produce 2 exponent 29 terms before repeating. Types of seed used, run problems, and problems concerning random digits using this generation scheme were studied by Maclaren and Marsaglia (1965). A listing of the subroutine RANDU is included in appendix 6. Multiplication of the subroutine real output by an appropriate calibration factor, followed by truncation yields a list of random integers. When used as coordinates, these fall inside the simulated space and are suitable to be used as nucleation sites.

3-6-3. Orientation of the Nuclei.

Parallel orientation of the nuclei requires no further work after their translation is performed, as crystals defined in Cartesian space by MODULE-1 have the same orientation, that used in standard crystallographic descriptions. To produce a completely random orientation in the transposed crystals, three consecutive rotations are necessary:

Let Q represent the amount, in degrees, of each rotation and let Q be computed by RANDU, such that its value is random and in the range of 0 to 360 degrees. Let the first rotation be along $+X$, through an anticlockwise angle Qa , and be denoted by rotation A. Similarly, let the second rotation be along $-Y$, performed through the anticlockwise angle Qb , and be denoted by rotation B. Finally, let the third rotation be along $+Z$, through the anticlockwise angle Qc , and be denoted by rotation C.

During rotation A, the old axes, Y and Z , and the new axes Y^* and Z^* are related by:

$$Y = Y^* \cos Qa - Z^* \sin Qa \quad (24),$$

$$Z = Y^* \sin Qa + Z^* \cos Qa \quad (25).$$

Similarly, for rotation B:

$$Z = X^* \sin Qb + Z^* \cos Qb \quad (26),$$

$$X = X^* \cos Qb - Z^* \sin Qb \quad (27).$$

Finally, for rotation C:

$$X = X^* \cos Q_c - Y^* \sin Q_c \quad (28) ,$$

$$Y = X^* \sin Q_c + Y^* \cos Q_c \quad (29) .$$

In terms of the Cartesian equations of crystal faces, rotation A is performed by substituting equations 24 and 25 in equation 22. After expansion and regrouping of terms, as the rotated new axes are considered to be old axes from the next rotation point of view, equation 22 becomes:

$$Ax + (B \cos Q_a + C \sin Q_a) Y + (C \cos Q_a - B \sin Q_a) Z = 1.0 \quad (30) .$$

Let : $AR1 = a,$

$$BR1 = (B \cos Q_a + C \sin Q_a) ,$$

and $CR1 = (C \cos Q_a - B \sin Q_a) ,$ then after rotation B, equation 30 becomes:

$$(AR1 \cos Q_b + CR1 \sin Q_b) X + BR1 Y + (CR1 \cos Q_b - AR1 \sin Q_b) Z = 1 \quad (31) .$$

Let $AR2 = (AR1 \cos Q_b + CR1 \sin Q_b) ,$

$$BR2 = BR1 ,$$

and $CR2 = (CR1 \cos Q_b - AR1 \sin Q_b) ,$ then after rotation C, equation 31 becomes:

$$(AR2 \cos Q_c + BR2 \sin Q_c) X + (BR2 \cos Q_c - AR2 \sin Q_c) Y + CR2 Z = 1 \quad (32) .$$

Thus, for the three consecutive rotations necessary to make the orientation of the nuclei random, the old and new coefficients of the general equations of the crystal faces are related as follows:

$$A_{new} = ((A \cos Q_b + (C \cos Q_a - B \sin Q_a) \sin Q_b) \cos Q_c + (B \cos Q_a + C \sin Q_a) \sin Q_c) \quad X_{old} \quad (33),$$

$$B_{new} = ((B \cos Q_a + C \sin Q_a) \cos Q_c - ((A \cos Q_b + (C \cos Q_a - B \sin Q_a) \sin Q_b) \sin Q_c)) \quad Y_{old} \quad (34),$$

$$C_{new} = (((C \cos Q_a - B \sin Q_a) \cos Q_b) - A \sin Q_b) \quad Z_{old} \quad (35).$$

3-6-4. Nucleation Rates.

It has been shown in previous sections that an instantaneous nucleation rate is observed in many experimental cases. During simulation, time is synonymous with event. The time at which an event takes place with respect to the over-all simulation time is one of the variables that are controlled. If the event is nucleation, the production of the desired number of nuclei can take place before other events, for example growth and physical interactions between neighbouring crystals. In this case, the simulation time is stopped, in effect, during the manipulations necessary to reproduce nucleation, thereby making nucleation instantaneous with respect to other events. Non-instantaneous rates are reproduced by the proper timing of different events. Suppose that a rapid

onset of nucleation, followed by a known rate of decline, is desired. The effect can be achieved by nucleating the desired proportion of crystals at the same time and by withholding the appearance of the remaining nuclei while growth is taking place. In this manner, different nucleation rates can be reproduced.

3-6-5. Size and Shape of Nuclei.

The thermodynamic description of nucleation is facilitated if nuclei are assumed to be spherical. Calculations have shown that for most metals, the critical nucleus contains in the vicinity of 200 atoms (Chalmers 1964). It has been estimated that at large supercooling, the interphase may be diffuse, rendering specifications of nuclei shape unrealistic. However, macroscopic crystals do present faces, if not at nucleation time, early in their crystallization history (Chalmers 1959). In this simulation approach, crystals bound by planar surfaces were nucleated with a size much smaller than that at which physical interactions between neighbouring crystals start to appear. The shape or combinations of forms present on the nuclei were selected to be identical to the ones of fully grown crystals. This last assumption has been substantiated by measurements made on natural systems and is discussed in more details in section 4-4-1.

PART 4.

THE GROWTH OF SINGLE CRYSTALS

THE GROWTH OF SINGLE CRYSTALS

4-0. Notation.

A	: Surface area of a crystal face.
a	: Rate of addition of molecules to a cluster.
b	: Rate of removal of molecules from a cluster.
C	: Concentration of solute in bulk medium.
Ce	: Equilibrium concentration of solute in bulk solution.
D	: Solute diffusion coefficient in bulk medium $\text{(length}^2 \text{ time}^{-1}\text{)}.$
d	: Diameter of small spherical or near spherical crystals.
Dpn.	: Perpendicular distance between the centre and nth face of a crystal.
E	: Total free energy of a crystal.
f	: Thickness of a sheet-like intrusive body (cm.).
h	: Step height.
I	: Nucleation rate.
J	: Flow of solute $\text{(mass time}^{-1}\text{)}.$
K	: Constant accounting for the geometry of the crystal.
k	: Thermal diffusivities $\text{(cm. sec.}^{-1}\text{)},$ assumed to be independent of temperature. Value of k used in the discussion of the cooling of intrusives

is $0.01 \text{ cm. sec.}^2 \text{ }^{-1}$ (Jaeger, 1968).

- Nre : Reynold number $(d U V)^{-1}$.
- Nsc : Schmidt number $(V D)^{-1}$.
- R : Growth rate (length time⁻¹).
- r : Correlation coefficient.
- Rc : Radius of critical size two-dimensional nuclei.
- R{001} : Growth rate of the faces of the cubic {001} form.
- R{011} : Growth rate of the faces of the rhombic dodecahedron {011} form.
- Rn. : Growth rate of the nth face of a crystal.
- Rov. : Overall growth rate of a crystal.
- S : Supersaturation of a system $((C-Ce) Ce)^{-1}$.
- T : Absolute temperature (Kelvin degrees). In the discussion of the cooling of the intrusive bodies, T represents the temperature at specific points, in °C.
- To : Initial temperature of magma, taken to be uniform throughout its volume, (°C.).
- t : Time after intrusion, in seconds. The intrusion is assumed to take place instantaneously at t=0.
- U : Relative velocity between crystal and bulk medium (length time⁻¹).
- V : Kinematic viscosity of bulk medium, $(\text{length}^2 \text{ time}^{-1})$.

V_m : Volume of a molecule.

V_{lc} : Surface free energy per unit area of liquid-crystal interface (ergs cm.⁻²).

V_{sci} : Surface free energy per unit area of the i th face of a crystal (ergs cm.⁻²).

4-1. Introduction.

The study of crystal growth, a subject of interest for a very long time has, in recent years, experienced an explosive development. This development has been motivated mostly by increasing commercial demands and applications, as in the field of solid state electronics. So rapid has been the increase of knowledge about crystal growth that to familiarize oneself with any specific topic has become a major task and to keep abreast of all new developments quite impossible (Bardsley et al. 1973).

Disregarding the various commercial stimuli and remembering that the basic units taking part in growth are the same as those invoked during nucleation, namely atoms and molecules, the large amount of information obtained and reported is surprising. The reason is that, contrary to nucleation, many of the controlling factors may be experimentally observed and measured. Another reason for the large number of growth theories and models and for the complexity of observations, is that growth is the result of

a combination of a large number of mostly interdependent variables. A few of these variables are: temperature, degree of supersaturation or supercooling, fluid geometry and dynamics, diffusion kinetics, and the types and number of dislocations, imperfections and impurities present. It is the interdependent and complex, if not elusive, nature of most of these parameters that renders interpretations of experimental data difficult.

A brief synopsis of growth theories is presented in the following sections and forms the basis of the mathematical model developed to simulate the growth of single crystals.

4-2. Review of the Main Growth Theories.

It is interesting to realize that, although many growth theories are available, none of these has provided results which can easily be used to predict growth rates as convenient functions of important measurable parameters. In fact, crystal growth remains mostly unsolved and one cannot yet estimate growth rates a priori (Ohara @ Reid 1973).

4-2-1. Two-Dimensional Nucleation Growth Theories.

Common to all growth theories is the idea that molecules or atoms must, at some time, be adsorbed on the crystal surface. Differences in the details of the adsorption mechanisms or molecule-transport in bulk medium give rise to the different theories.

Haüy (in Phillips 1971), in the late eighteenth century, proposed that apparently flat surfaces could be made up of minute steps. In this way, different crystal forms could be explained in terms of different stackings of basic units. During the nineteenth century, Pfaff and Brauns (in Verma 1953) realized that crystal surfaces obey the law of rational indices only approximately and that many habit faces are really vicinal faces. Steps on crystal surfaces can now be observed by modern optical methods.

The origin of the steps present on crystal surfaces has been the subject of much debate. One early explanation forms the basis of the mononuclear two-dimensional nucleation growth theory and will be described shortly. Since then, refinements in optical techniques led to the recognition of the influence of dislocation emergence points, especially spiral dislocations, in providing a continuously self generating step (Verma 1953).

In addition to the presence of steps on crystal surfaces, the steps themselves are thought to include numerous kinks. The origin of these kinks is a simpler

problem than the origin of the steps. Burton and Cabrera have shown, in 1949, that along any step, there must be a concentration of kink sites at any finite temperature and that the number of kinks per length of step increases with temperature.

The concepts expressed so far have been formalized by Temkin in 1966 and the Temkin model of crystal interfaces forms the basis of most growth theories.

Suppose that there is no resistance to the mass movement of molecules in the vicinity of a growing crystal. The mononuclear two-dimensional nucleation growth theory suggests that the growth-rate-limiting factor is the formation, on the crystal surfaces, of critical size nuclei. Once formed, these nuclei would spread infinitely rapidly by lateral growth.

The growth rate normal to any face of area A is then given by:

$$R = A I h \quad (36),$$

where I was defined previously by equation (13), and h is the step height.

Inspection of equation (36) reveals a proportionality relationship between R and A , a fact that is not observed experimentally. Such a relationship suggests that large equant crystals may be the common result of growth.

The next logical step is to use the idea of the mononuclear two-dimensional nucleation growth theory but without the condition of the infinitely rapid lateral spreading of the critical nuclei. Assuming, as another alternative, a zero lateral spreading velocity, growth would then occur by the accumulation of critical size nuclei on the crystal surfaces. This other extreme alternative is named the polynuclear two-dimensional nucleation growth theory.

The growth rate normal to a face can then be expressed by the following equation:

$$R = \pi R_c^2 h I \quad (37) .$$

The disturbing growth rate - surface area relationship has been removed but now R is a complicated function of S , the supersaturation or supercooling of the system. As S increases, I increases but R_c decreases and a maximum value of R should be observed at some value of S . Unfortunately, although such relationships have been observed, (see 4-2-5), it is not, as proposed by the model, a general rule.

It is obvious that between these two extreme cases, the mononuclear and polynuclear two-dimensional nucleation growth theories, there are many possibilities for intermediate models. These intermediate cases are referred to as "Birth and Spread" models and differ in the rules used to relate lateral spreading velocities to the other

parameters of the system.

4-2-2. Surface Diffusion and Dislocation Growth Theories.

The main default of two-dimensional nucleation growth theories is the requirement for having a two-dimensional nucleus to initiate a step. To overcome this difficulty, Frank proposed in 1949 (in Chalmers 1964) the mechanism of spiral growth. Shortly after, detailed studies of crystal surfaces and of plastic deformation of metals (Cottrell 1953; Verma 1953; Amelinckx 1964) revealed the omnipresent nature of dislocations. Amongst the different types of imperfections observed, the screw dislocation has been shown to provide a self perpetuating step for a growing crystal surface. Thus no step has to be generated, molecules from the bulk can be adsorbed on the flat between steps, migrate under a surface concentration gradient to the steps and take part in the crystal lattice. These ideas form the basis of the Burton-Cabrera-Frank or BCF model of crystal growth.

The first requirement of the BCF growth theory is the development of differential equations for the concentration gradients around a straight step. Since spiral growth steps, except close to the origin, are Archimedean, far enough from the centre and over small distances, they can be approximated as being straight. From the calculated concentration gradient, an expression for the

velocity of the step can be derived. This straight step velocity expression is quite complex and involves functions of surface diffusivities, kink spacings, equilibrium surface concentrations, and parameters relating bulk surface concentrations near a step to the concentration of unincorporated molecules on a step. Nevertheless, the expression is informative as it implies a strong relationship between velocity of the step, supercooling and temperature.

Corrections necessary to account for the curvature of the spiral growth step can then be applied to the expression for the velocity of a straight step. A quantitative relationship taking into account the decrease in step velocity due to its curvature and thus, its increased surface energy, is unfortunately elusive and can only be approximated. Differential equations are then necessary to describe the behavior of the spiral growth mechanism as a function of time. A constant angular velocity of the rotation of the spiral is generally assumed to derive an expression for the growth rate of a face.

This rate expression cannot be tested as it requires values for some parameters which cannot be calculated a priori, if at all. The form of the expression shows that the growth rate should be proportional to the degree of supersaturation squared for low values of S and linear for larger values of S .

4-2-3. Mass-Transfer-Limited Growth Theories.

If one assumes that the kinetics of incorporation of atoms or molecules into a crystal lattice are infinitely rapid, the growth-limiting step is then the transfer of molecules from bulk to the crystal surfaces.

The rate of transfer of molecules from an homogeneous bulk medium to a crystal surface can be expressed as follows:

$$J = K A (C - C_e) \quad (38) ,$$

and since S is defined by:

$$S = (C - C_e) / C_e \quad (39) ;$$

equation (38) becomes:

$$J = K A C_e S \quad (40) ,$$

where K is a constant accounting for the geometry of the crystal and other important physical parameters of the system.

For small, simple geometrical shapes, experimental data indicates that K can be expressed as follows:

$$K = (2 + 0.6 N_{re}^{1/2} N_{sc}^{1/2} \frac{D}{d}) \quad (41) ,$$

where N_{re} , the Reynold number, accounts for the increase in the K value if the bulk medium is in motion with respect to the crystal and N_{sc} is the Schmidt number.

At low relative velocity between the growing crystal and the bulk medium, K can be approximated by:

$$2 D / d \quad (42) .$$

If the relative velocity between the growing crystal and bulk medium is large, K is adequately approximated by:

$$\frac{(0.6 D^{2/3} U^{1/2})}{(d^{1/2} V^{1/6})} \quad (43) .$$

From equation (40), the crystal growth rate can now be formulated as follows:

$$R = J V_m / A \quad (44) .$$

This model is interesting since J has been shown to be proportional to K (equ. 40), equation 44 implies that R is also proportional to K. Thus equations 41, 42 and 43 predict how R will be affected by some of the parameters of the system.

The predicted inverse relationship between R and A is doubtful and the lack of experimental data relating the surface area of crystal faces to other parameters makes this difficult to assess. In this model, temperature effects are taken into account by variations in D and V.

4-2-4. Probabilistic Growth Theories.

In recent years, several attempts have been made to describe growth in terms of probabilistic models; that is, in which consecutive events can be related by their probabilities. Using this approach, as proposed by Jackson in 1969, a crystal surface is thought to grow with a periodic representation of some finite surface configuration. The growth process can then be described in terms of the probability of a surface being in a particular configuration at a certain time and the rates of transitions to other configurations. A direct expression of this idea was encountered during the course of this work and is discussed further in section 4-8.

From a probabilistic point of view, the growth rate of a face can be formulated as follows:

$$R = \frac{(a - b)h^3}{A} \quad (45),$$

where a and b are the rates at which a crystal surface in a certain state gains or loses a number of molecules until an area A is completely covered by a new layer. Here, a and b are assumed to be constants at given T and S. Further modifications of equation 45 to express the growth rate in terms of the degree of supersaturation or supercooling indicates a linear R - S relationship. However, equation 45

proposes the same doubtful area dependency discussed in the section on the mass-transfer-limited growth theory.

4-2-5. Summary of Growth Theories
and Experimental Results.

The mononuclear and polynuclear two-dimensional nucleation growth theories and the intermediate "Birth and Spread" models are generally not satisfactory in predicting growth rates. Besides the rarely observed $R - S$ relationship mentioned for these models, at low values of supersaturation, predicted rates are always much less than experimental ones.

Both the mass-transfer-limited growth and probabilistic models propose an inverse relationship between growth rate and surface area of crystal faces. As mentioned above, the lack of appropriate experimental data makes this proposition difficult to evaluate, but if it were true, elongated crystals should be very common.

In general, most models predict a growth rate - supersaturation or supercooling relationship of the following form:

$$R \text{ proportional to } S^n$$

where n varies from 1 to 2 or slightly higher values (Ohara & Reid 1973). This type of relationship is also frequently observed under experimental conditions (Brice 1965;

Strickland-Constable 1968; Gray 1970). More complex R - S functions with one or more extrema have been observed with chemicals exhibiting a linear crystallization rate at constant values of supercooling (Mazhul' & Sharick 1966; Meleskho 1966).

In a geological context, the rate of crystal growth appears to be controlled by any of the following three factors: the long or short-range diffusion rates in the melt; the rate of removal of latent heat away from the growing crystal interfaces; or the adsorption reactions at the crystal-melt interfaces (Kirkpatrick 1975).

If the long range diffusion rates are the controlling processes, the growth rates are often such that crystal size tends to show a linear relationship with respect to the square root of time (Christian 1965).

Short-range diffusion rates and the rates of removal of latent heat, when present as controlling factors, generally cause crystals to adopt a cellular or dendritic morphology and show growth rates that are independent of time (Elbaum 1959; Christiansen et al. 1973).

In the case of large magma bodies undergoing crystallization at a small degree of undercooling and in which crystals may be relatively unconstrained, the growth-rate-limiting process is thought to be any of several possible interface adsorption reactions (surface nucleation, surface diffusion or dislocation mechanisms, Cahn 1967; Kirkpatrick 1974). For these interface reactions, the rate

of growth generally increases with increasing undercooling for a large temperature range. The opposite relationship is, of course, true for diffusion rates. It follows that, in a system where the undercooling is reaching a large value, diffusion rates can overtake the interface adsorption reactions as growth-rate-limiting processes, thus causing an increase in the instability of the planar interfaces of crystals, a fact observed both experimentally (Miroshnichenko 1966; Lofgren 1974-b) and in natural situations (Bryan 1972).

The stability of a growing crystal interface can be demonstrated by considering the possible types of microscopic heat flow. When a crystal is in contact with its melt, the temperature of the interface determines whether the amount of crystalline material increases, remains stationary or decreases. If the interface is flat, the equilibrium temperature is that at which neither solidification nor melting takes place. If the interface is not at equilibrium temperature, then either solidification or melting occurs at a rate that is dependent on the difference between the actual temperature and the equilibrium temperature, and on the crystallographic orientation of the interface.

When the temperature of an interface is less than the equilibrium temperature, and solidification therefore takes place, a certain amount of heat (the latent heat of fusion) is generated and tends to decrease the supercooling

of the system. If this latent heat is not removed, it eliminates the supercooling and suppresses the solidification process. The rate of removal of latent heat therefore controls the growth rate and the local rate of growth at any point on a crystal surface depends on the thermal conditions and on the crystallographic orientation of the surface.

The latent heat of fusion liberated during solidification can be disposed of in two ways: Firstly, it can be removed by conduction through the crystal into a heat sink and secondly, by conduction away from the interface into the liquid. These two cases are illustrated in figure

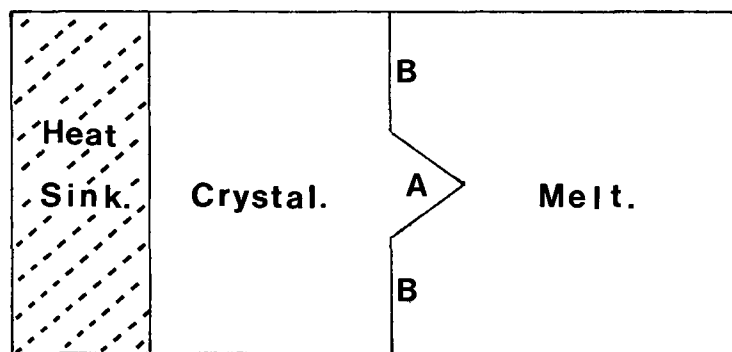


Figure 8:

Theoretical section through a crystal-melt interface in the presence of a heat sink.

8. Let the interface of a growing crystal be perturbed such that it takes the form shown in figure 8, in which the

region A is farther away from the heat sink than the rest of the interface B. if the degree of supercooling is small, the latent heat may be disposed of by conduction towards the heat sink. Since the region A is farther away from the heat sink than the rest of the interface B, less heat will flow through unit area of crystal near A than near B. The part of the crystal at A will grow more slowly than near B and the perturbation will disappear and the planar interface will be restored. This conclusion is not changed if heat is also conducted from the liquid through the interface and through the crystal to the heat sink, in addition to the latent heat that originates at the interface. In the case of a large amount of supercooling, the liquid is at a lower temperature than the interface and latent heat is dissipated by conduction through the liquid. The region near A of the perturbed interface now conducts more heat away from the interface than at B. It follows that growth is favorized at A and a dendritic form will result.

4-3. Crystal Morphology, Structure and Growth.

The most extensive early work on crystal morphology is that of Goldschmidt (1853). The earliest published work proposing a relationship between crystal morphology and internal structure is probably that of Haüy in 1801 (in Phillips 1971). In his four volume 'Traité de Minéralogie', he described his observations of the cleavage of calcite and other substances, for which he proposed that continued cleavage would ultimately produce a basic unit or 'molécule intégrante'. Regular stacking of these units would produce external faces parallel to the directions of the cleavage of the observed mineral. Furthermore, the use of different stacking patterns, by regularly omitting rows of units in successive layers, would produce faces with different slopes. An important aspect of his theory is that the variations in slope of the different faces that could be produced by different stacking patterns cannot be continuous and that the slope measurements of the faces present must show a fractional relationship in their tangent values. These observations led him to formulate the Law of Rational Indices.

During the first half of the nineteenth century, several mathematicians and crystallographers studied the different stacking possibilities of Haüy basic units. These studies led Frankenheim (in Phillips 1971) to propose, in 1842, fifteen types of possible arrangements. In 1848,

Bravais (in Phillips 1971) demonstrated that two of Frankenheim's arrangements were identical, thus reducing the number of possibilities to fourteen. These fourteen types of unit cells have since been referred to as the Bravais Lattices.

On speculative grounds, Bravais then formulated an important Law stating that, with certain restrictions, a translation lattice can be found such that: the observed crystal faces are parallel to the net planes with the highest reticular densities (or smallest mesh area) and that the greater the reticular density (or smaller the mesh area), the more morphologically important is the corresponding crystal face or form.

In 1878, Gibbs proposed the concept of total free energy by using the analogy of liquid droplets and by applying the conditions governing the growth of water droplets in a mist to the growth of crystals. Gibbs recognized that the condition for the stability of an isolated drop of fluid is that its surface free energy, hence its area, is a minimum. In a crystalline context, this condition implies that the free energy of a crystal in equilibrium with its surroundings is a minimum for a given volume. This is achieved by the development of faces which lead to a minimum total surface free energy for a given solid.

This condition can be expressed by the following equation, if one assumes a constant volume free energy per unit volume throughout the crystal:

$$\sum_{i=1}^n V_{sci} A_i = \text{minimum} \quad (46) ,$$

where V_{sci} is the surface free energy per unit area of the i th face of area A_i on a crystal bound by n faces.

In 1901, Wulff demonstrated the relationship between the equilibrium shape of a crystal and the relative surface free energies of the faces as follows:

Consider a point P within a crystal and let p_i be the perpendicular from P on the i th face of area A_i . The total volume V of the crystal is then defined by the sum of the volumes of the pyramids with P as vertex and the faces as bases or:

$$V = \frac{1}{3} \sum_{i=1}^n p_i A_i \quad (47) .$$

The total surface free energy E is given by:

$$E = \sum_{i=1}^n V_{sci} A_i \quad (48) .$$

If one set of faces grows at the expense of another, the change in volume dV may be expressed as follows:

$$dV = \sum_{i=1}^n A_i dp_i \quad (49) .$$

An equivalent expression for the change in volume can be found by differentiating equation 47 as follows:

$$dV = \frac{1}{3} \sum_{i=1}^n (A_i dp_i + p_i dA_i) \quad (50).$$

If the volume of the crystal is kept constant, $dV=0$ and from equations 49 and 50, the following expression can be obtained:

$$\sum_{i=1}^n p_i dA_i = 0 \quad (51).$$

If the total free energy of a crystal is constant and the surface free energy per unit area (V_{sc}) is independent of the area of a face, equation 46 can be expressed as:

$$\sum_{i=1}^n V_{sci} A_i = 0 \quad (52).$$

Thus from equations 51 and 52, the face for which it is possible to vary A_i independently must be situated such that:

p_i proportional to V_{sci} .

In other words, a crystal which is in equilibrium with its surroundings should form a polyhedron such that the perpendicular distances from a point P within the crystal are proportional to the specific free energies of the appropriate face. This implies that the velocities of growth of different faces of a crystal in the directions of the face normals are proportional to the appropriate

specific surface free energies. As growth is a non-reversible or disequilibrium process, this theorem cannot be applied to macroscopic crystals, but may be important in governing the shape of nuclei or small crystals.

The Law of Bravais received acceptance only after Friedel substantiated it by several observations in 1904, 1905 and 1907 (in Phillips 1971). The understanding of the effect of different space lattices on the reticular densities, reticular area and interplanar spacings allowed the prediction of the relative importance of various forms. For different types of lattices, it was then possible to calculate the reticular densities of simple planes and to formulate an order of increasing or decreasing morphological importance of the corresponding forms. In other words, it became possible to visualize why within a crystallographic system, some substances show a predominantly cubic habit; why for some others, as spinel, magnetite or diamond, the octahedral form is so morphologically important; and why garnets are commonly found with a dodecahedral habit.

Friedel, besides substantiating the Law of Bravais, realized that, although several relationships could be explained, many anomalies persisted. Of course, it was understood that some of the forms present on a crystal could be due to particular conditions of crystallization, and statistical surveys of morphological data, based on the persistence of forms at certain localities, were used to detect the influence of external causes. It was also

realized that the Law of Bravais, even in the most favourable cases, held only for dominant forms, many minor forms remaining anomalous. Often, the best lattice that could be deduced did not coincide completely with the importance of the dominant forms, and occasionally assigned dense equipoint planes to insignificant or unknown forms.

It was only some thirty years later that the Bravais principle was extended to account for these anomalies. This important extension was first fully developed by Donnay and Harker in 1937 (it was further modified in 1961 by Donnay and Donnay), by considering the effect of space groups rather than lattice types only.

Just as Bravais had been able to demonstrate that the lattice type influences the reticular densities, interplanar spacings, and therefore, the morphological importance of various forms, Donnay and Harker, by taking into account the effects of the screw axes and glide planes, or using the 230 space groups developed by Sohncke, Federov, Schoenflies and Barlow (in Phillips 1971), rather than the lattice types only, accounted for the persisting anomalies. Donnay and Harker's extension of Bravais work also led to the recognition of various morphological aspects (series of decreasing morphological significance of various forms) in any crystal system and allowed the determination of the relative importance of the forms of a given space group, or conversely, the prediction of space groups from morphological features alone.

The study of crystal habit is, however, not complete as some anomalies remain outstanding. Recent studies (Schneer 1977) generally strive for a more complete understanding by taking into account energy aspects of crystalline solids, such as by involving actual positions of structural units and bond strengths (Hartman 1973). Schneer, in 1968, showed the relationship between observed geometry and frequency of occurrence of forms of crystals of a given species with the calculated potential energies or structure factors associated with the reciprocal lattice points. In 1970 (a), the same author showed that the ensemble of the forms present on crystals of a given species is a reversible transform of the electron density and that this ensemble should approach equilibrium throughout geological time and space. As it approaches equilibrium, the observed form distribution becomes a function of the structure and the structure is a Fourier transform of the distribution (1970-b).

Another type of approach to the problem of crystal habit is through the understanding of crystal growth, some aspects of which were presented in section 4-2. Habit-modifying agents related to growth can perhaps be visualized as belonging to one of two possible types: external or internal.

Amongst the external agents, the degree of undercooling or supersaturation has been studied and documented extensively. Kern (1969) showed that ionic

crystals could experience a habit change if the undercooling exceeds a critical value. A similar effect has been reported by Flemings (1974) in the case of the solidification of castings, and by Lofgren (1974-b) for experimental observations of plagioclase crystallization. In general, the higher the degree of undercooling or supersaturation, the morphologically simpler the crystals will be (tending towards a spherulitic or dendritic shape), provided they have reached a critical size (Chernov 1963). These rapidly grown crystals also tend to show a reciprocal dimensional relationship with respect to their unit cell dimensions (Kostov 1966).

The presence of impurities is another example of a possible external-habit influencing agent. In general, the presence of impurities causes the growth rates to decrease (Hartman 1973). Certain types of impurities cause the crystal habit to undergo unusual developments (Hartman 1968).

Gravitational attraction is another example of a possible external agent. Surprisingly few studies have been reported and their results appear contradictory. Schneer (1970-b) reports no effects whatsoever with crystals grown at accelerations of up to 500g. Yushkin (1975), however, reports that gravitation can influence the development of

crystal habit, even under natural conditions.

The crystal structure can be viewed as one of many possible internal habit influencing agents. Its effect allows macroscopic growth to be expressed by a discrete set of vectors, in the directions of the face normals and with magnitudes corresponding to the face growth rates (Wulff vectors). In fact, if crystals were to grow in any directions rather than discrete ones, and if growth rates were equal, the resulting surfaces would represent a sphere. Furthermore, if crystals could grow in any directions rather than discrete ones, even with the appropriate rates, the resulting polyhedral surfaces would contradict the Law of Consistency of Interfacial Angles and of Rational Intercepts.

Dislocation-strain energies, another example of a possible internal habit-modifying agent, can affect growth rates, and consequently, crystal morphology (Schlichta 1968).

In summary, our present knowledge of crystalline solids is such that relationships between morphology and structure are often well understood and predictable. No such optimism can be expressed concerning the relationship between morphology and growth; the effects of external or internal habit-modifying agents remain mostly, like growth itself, observational rather than predictable.

4-4. Growth Conditions Selected for Simulation.

To proceed with the simulation of the growth of single crystals, a choice of a preliminary model, in which types of growth rates and habit behavior are clearly defined, must be made. This choice does not reduce the range of applications of the simulation, as provisions were included in the programming such that a variety of growth characteristics could be selected. In view of the large number of possible applications, the choice of a preliminary model merely represents a starting selection amongst the many growth conditions that must be present in nature.

The mathematical implications resulting from the choice of a type of growth rate and habit behavior will be presented in section 4-5.

4-4-1. Crystal Habit.

For the purpose of simulating crystal growth, a constant habit growth model was selected (Fig. 9). More explicitly, not only the particular forms but also the relative development of the forms present on the crystals at the onset of growth ('nucleus' in terms of the simulation, see section 3-6-5) remain constant during the simulated growth. A brief review of pertinent existing information and the evidence found to support this choice of a constant habit growth model are now presented.

Surprisingly little information is available on the development of the habit of crystals grown under natural conditions. In the past, descriptions of crystal habits have followed a comparative or deductive trend: few studies of habit development have been carried out. Thus, crystal habits produced under various conditions have been catalogued and attempts have been made at inferring the degree of undercooling from the resulting habit (Kostov 1966; Bryan 1972; Leung 1974). Also reported are the effects of crystal shape and its development on other phenomena, such as synneusis (Vance 1969) or twinning (Ross 1957; Senechal 1976).

Experimental studies of the development of crystal habit during growth (Koptsik 1956; Pokrovsky 1956; Sheftal' 1956; Hartman 1973; Lofgren 1974-a, -b) suggest that habit development is non-constant for many substances. Uncertainty as to the cause of this is indicated in the remark:

"We can only conclude that relative growth rates, and therefore, crystal shapes, do change during growth... But it is not clear that the results may not have been related to the particular conditions of the experimentation".
(Schneer 1970-b).

The object of the remaining part of this section is to demonstrate that it is possible to obtain information on the development of the habit of crystals grown under natural conditions.

In order to analyze the development of crystal habit, the faces must be located at different times during growth. Under experimental conditions, time-lapse photography can be used for this purpose. For crystals grown under natural conditions, several characteristics can indicate the positions of the faces during growth: compositional zoning, zones of inclusions or impurities, and the hourglass and Maltese cross structures.

Only those characteristics that influence as little as possible the natural development of a crystal's habit should be selected. Thus, the hourglass and Maltese cross structures commonly displayed by crystals of chloritoid and andalusite should be avoided, as they may be due to crystallographically controlled adsorption of impurities (Spry 1969), whose effect on growth rates of the faces involved have not yet been fully evaluated. The same argument applies to crystals showing zones of inclusions or impurities even though the structural control or anisotropy is less apparent than in the hourglass and Maltese cross structures.

The most suitable characteristic is compositional zoning, a common feature of plagioclase crystals that has been extensively studied (Ross 1957; Vance 1962; 1969;

Bottinga et al. 1966; Hoffer 1966; Wiebe 1968). Most zoned plagioclase crystals display compositional variations of a magnitude that has little or no influence on the final crystal morphology (Deer et al. 1967; Woensdregt 1975). Assuming that the zones indicate the positions of the faces at different times during growth, adequately selected crystals can provide the information necessary to analyze the development of their habit.

The procedure commonly used in the study of morphological development is to measure the distances from the crystal centre to the faces at different stages of growth, and to express these measurements graphically as plots of time versus distances. This method has the advantage of simultaneously displaying information on habit development and relative growth rates of the faces present. An alternative method is used in the present study: the apparent lengths of the faces (the lengths of the lines resulting from the intersection of the compositional zones and the planes of the thin section) are measured and expressed graphically as plots of compositional zone intercept-lengths versus corresponding compositional zone intercept-lengths (Fig. 9). The use of compositional zone intercept-length measurements, rather than distances to the crystal centre, does not illustrate growth rates; however, as little can be deduced about the absolute timing of the formation of the zones, this is not a disadvantage. In fact, for the study of habit development, this method is superior

in that the degree of linearity of the plots illustrating the observations (Figs. 9-C, -E, -G, 10-C, 11-C and 12-C), a quantity that can be measured statistically, is proportional to the absence of variation in the ratio of the growth rates of the faces involved. Furthermore, this method removes the necessity of orientating the crystals in order to locate precisely the position of the crystallographic axes and the crystal centre. This is a considerable advantage as it allows direct measurements from suitably selected thin sections. It is probable that the use of a universal stage to orient especially poorly set crystals may increase the precision and reproducibility of the results.

The validity of the method is based on two assumptions: firstly, that the facial development is reflected directly by a corresponding compositional zonal development, and secondly that measurements performed on semi-randomly oriented intersecting planes are valid representations of the extent of facial development. The first can be accepted intuitively; however, the second might lead to some uncertainty, depending on the relative orientation of the crystal with respect to the plane of the section. For this reason, sections were selected normal to one of the crystallographic axes of the observed euhedral crystals. In these, faces are as close as possible to perpendicular to the plane of the section, and complete

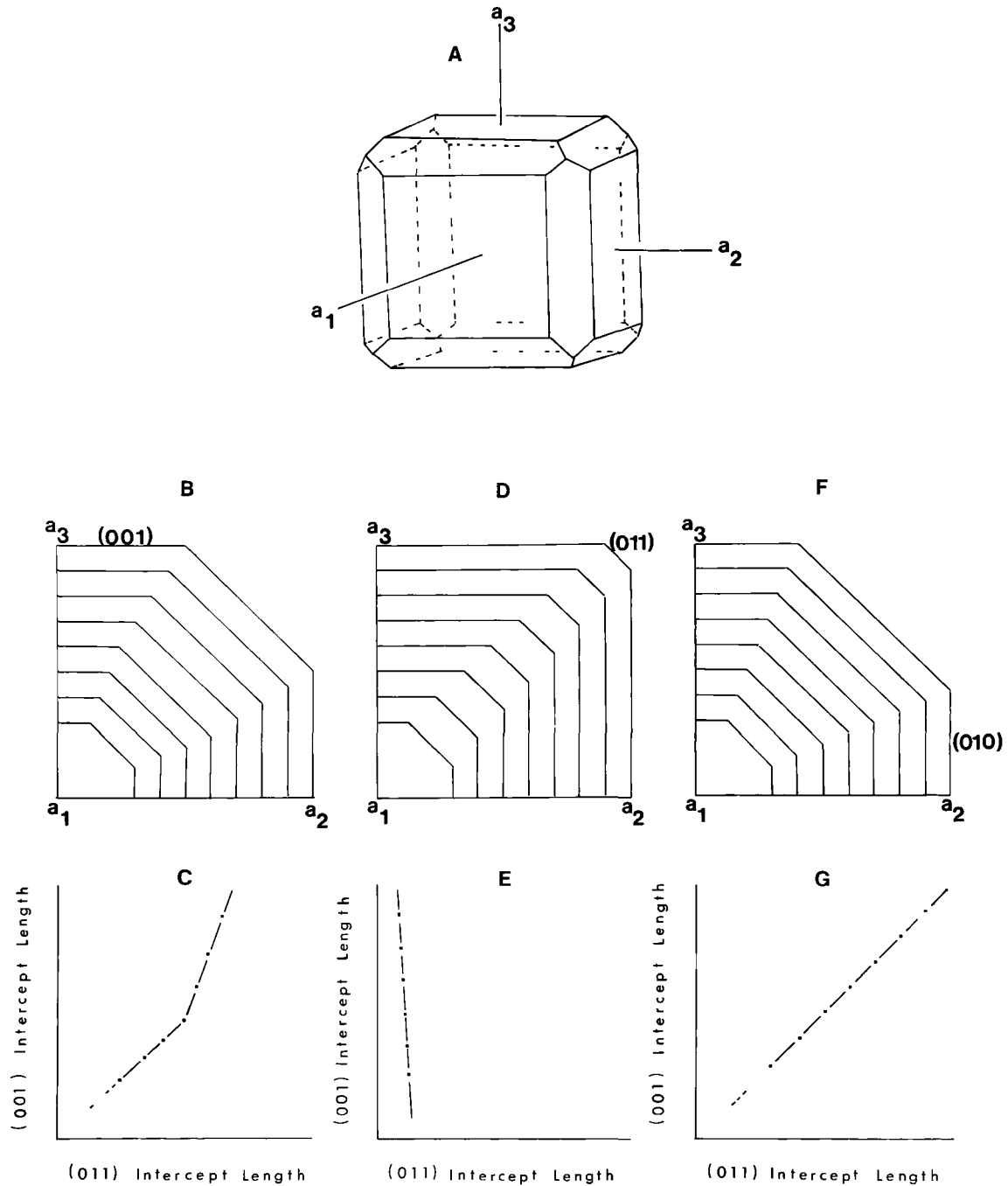


Figure 9:

A: Theoretical isomeric crystal of habit composed of the cube {001} and the rhombic dodecahedron {011} forms. B, D and F: Subset of the a_2 - a_3 plane bound by the $+a_3$ and $+a_2$ axes and the {001}, {011} and {010} faces. The facial development depends on the relative growth rates of the forms present and on the geometrical relationships of the forms. C, E and G: Plots of the corresponding compositional zone intercept-length versus compositional zone intercept-length illustrating the three possible types of habit development. Plots not passing through the origin (E), may indicate a change in crystal habit during the early stages of growth.

faces can be followed throughout crystal growth.

One hundred and fifty photographic negatives were taken of zoned plagioclase crystals from a variety of rock types, including diorite, granodiorite, porphyritic andesite, porphyritic rhyolite, granite, gabbro and basalts. On the basis of absence of alteration and physical deformation, sharpness, concentration of the zones and completeness and number of faces normal to the plane of the section, the ten most suitable crystals were selected; only the compositional zones that could be followed over several crystallographic directions were traced and their intercept lengths were measured from reconstructed diagrams (Figs. 10-B, 11-B and 12-B). The selection was performed according to the criteria described above rather than merely because of a certain type of habit development.

From these ten crystals, 55 unique compositional zone-length versus compositional zone-length relationships were established, the number of relationships being related to the number of faces N for each crystal by: $N!/2(N-2)!$. For example, if a crystal showed zones of different composition accounting for the development of four faces, the following relationships were established: 1 versus 2, 1 versus 3, 1 versus 4, 2 versus 3, 2 versus 4 and 3 versus 4.

The best linear equations that could express each of these 55 relationships were determined by least-squares regression; and the degree of association of the variables for each relationship was measured by a correlation

coefficient (Neville @ Kennedy 1964). A table with significance levels for the product-moment correlation coefficient (Neville @ Kennedy 1964) was then used to evaluate the significance level of the degree of association measured by the correlation coefficients, taking into account the number of variable (N) and the number of degrees of freedom (v or N-2).

It can be appreciated that for a crystal to grow without changing its habit, the ratio of the growth rates of the forms or faces present must not only be constant but the magnitude of the growth rates must be within a range determined by the geometrical relationship of the forms or faces. Growth rates whose values fall outside this range cause a crystal to experience a change in habit during growth, even if the ratio of the growth rates remains constant. With these facts in mind, it is possible to propose a priori that the relationships obtained by the analysis described above can belong to any one or more of the following theoretical types.

Type 1: A non-linear relationship (Fig. 9-C). This type of relationship arises when the ratios of the growth rates of the forms or faces present change during growth. Figure 9-B illustrates this possibility. During the first three growth increments, the ratio of the growth rates of the forms {001} and {011} is constant (1.0). After the third growth increment, the ratio changes in magnitude (0.8) and remains constant during the last four increments. Figure 9-C

is a graph of the {001} compositional zone intercept-length versus the {011} compositional zone intercept-length the crystal described in figure 9-B. The change in slope is a reflection of the changing ratio of the growth rates and implies a change in the crystal morphology.

Type 2: A linear relationship with negative slope (Fig. 9-E). The linearity displayed by relationships of this type indicates that the ratio of growth rates of the faces involved remained constant during growth. The negative slope indicates that the magnitude of the difference between the growth rates or the geometrical relationship of the faces involved, or both, causes one of the forms to disappear. Figure 9-D illustrates this type of relationship. The ratio of the growth rates of the {001} and {011} forms is constant (0.7) but the growth rates and geometrical relationship of the faces cause the {001} form to become dominant. Figure 9-E is a graph of the {001} compositional zone intercept-length versus the {011} compositional zone intercept-length for such a crystal.

Type 3: A linear relationship with positive slope (Fig. 9-G). As in the preceding type, the linearity displayed by these relationships indicates that the growth rates of the faces involved remained constant during growth. In this case, however, the positive slope indicates that the individual growth rates or the geometrical arrangement of the faces involved, or both, are such that the faces are able to expand externally and laterally without either one

becoming dominant or recessive. In Figure 9-F, the ratio of the growth rates of the {011} and {001} forms is 1.0 and the growth rates and the geometrical relationship present allow the crystal to grow with a constant habit. Figure 9-G is a graph of the (001) compositional zone intercept-length versus the (011) compositional zone intercept-length for such a crystal. In this study, the number of observations for each relationship varies between five and seven, and the number of relationships for each crystal varies between two and six.

Table 1 is a list of the crystal identity, number of faces, number of zones, value of the correlation coefficients obtained for each of the relationships and their level of significance for the ten selected crystals. Figures 10, 11 and 12 illustrate the crystals, the zones of different composition measured and the plots of the compositional zone intercept-length versus compositional zone intercept-length for three crystals that demonstrate constant-habit growth.

TABLE 1. DATA OBTAINED FROM THE TEN SELECTED CRYSTALS.

Crystal Number*	Number of faces	Number of zones	Correlation coefficient Level of significance
Ma-56-a	3	6	-0.98: <1% -0.82: >1%, <5% 0.91: >1%, <5%
Ma-56-k	3	7	0.93: <1% 0.99: <1% 0.99: <1%
Ma-56-c	4	6	0.98: <1% 0.99: <1% 0.98: <1% 0.98: <1% 0.99: <1% 0.98: <1%
Ma-56-g	4	6	0.88: >1%, <5% 0.98: <1% 0.89: >1%, <5% 0.96: <1% 0.92: >1%, <5% 0.93: <1%
A-92-a	4	5	-0.62: >5%, rejected 0.85: >5%, rejected -0.69: >5%, rejected -0.94: >1%, <5% 0.99: <1% -0.97: <1%
A-92-b	6	7	0.85: >1%, <5% 0.93: <1% -0.76: >1%, <5% 0.93: <1% -0.77: >1%, <5% 0.83: <1% -0.80: >1%, <5% 0.98: <1% -0.81: >1%, <5% -0.95: <1% 0.97: <1% -0.88: <1% -0.87: >1%, <5% 0.86: >1%, <5% -0.87: >1%, <5%
Q-164	4	7	0.99: <1% 0.99: <1% 0.99: <1% 0.99: <1% 0.99: <1% 0.99: <1%
Dksm-4	2	5	0.99: <1%
D-51	3	7	0.99: <1% 0.99: <1% 0.99: <1%
D-53-a	4	7	0.99: <1% 0.98: <1% 0.89: <1% 0.88: <1% 0.90: <1% 0.89: <1%

Ma-56-a, Ma-56-k, Ma-56-c and Ma-56-g: porphyritic rhyolite, Disraeli, Qibira; A-92-a and A-92-b: porphyritic andesite, Mount Pelée, Martinique; Q-164: quartz diorite, Kosciuszko National Park, Queensland, Australia; Dksm-4: granodiorite Southern California batholith; D-51: rhyolite porphyry, Abajo Mountains, Utah and D-53-a: granodiorite porphyry, Fraser river canyon, British Columbia.

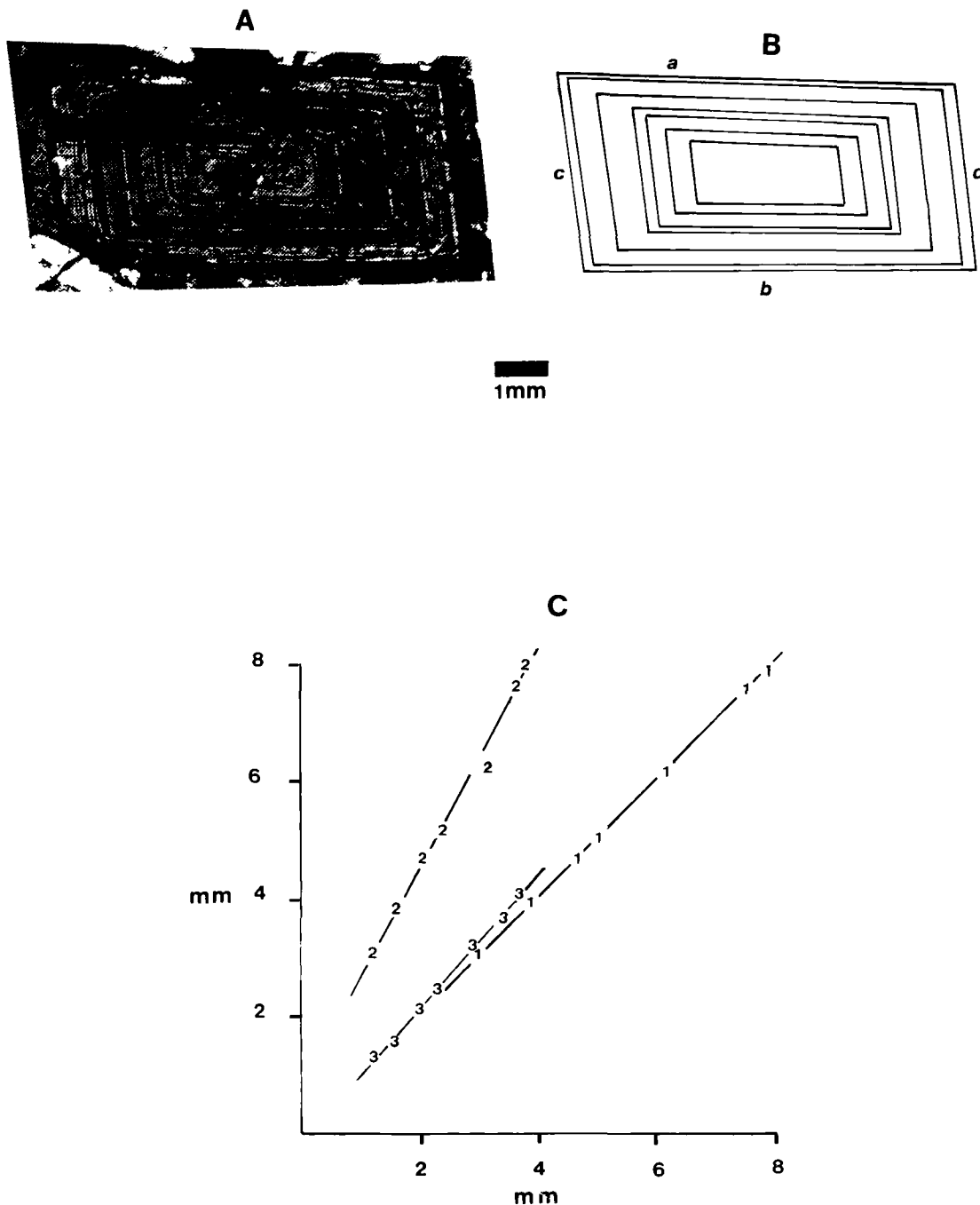


Figure 10:

A: Photograph of zoned plagioclase crystal Q-164. B: Reconstructed diagram of the selected and measured compositional zone intercept-lengths. C: Plot of three of the six unique compositional zone intercept-length relationships established. The correlation coefficients of the plotted relationships are: (1) a versus b 0.99, (2) a vs c 0.99, and (3) c versus d 0.99; all much better than the corresponding value at the 1% level of significance (0.87) for the appropriate number of degrees of freedom (5). This crystal is from a quartz diorite from Noosa National Park, Queensland, Australia. The crystal length is 7.9mm.

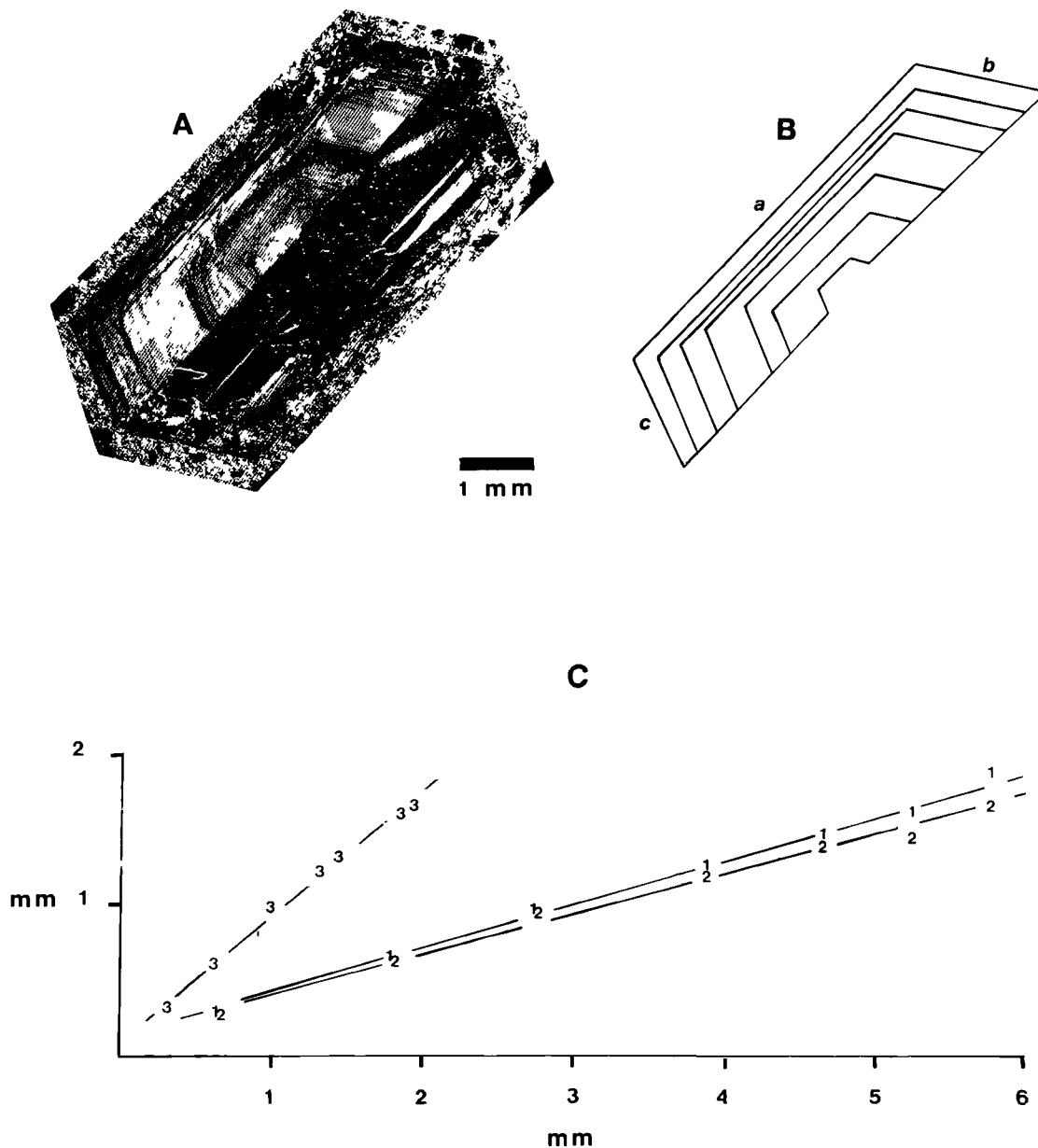


Figure 11:

A: Photograph of zoned plagioclase crystal Ma-56-k. B: Reconstructed diagram of the selected and measured compositional zone intercept-lengths. C: Plot of the three unique compositional zone intercept-length relationships established. The correlation coefficients of the relationships plotted are: (1) b versus a 0.99, (2) c versus a 0.98 and (3) c versus b 0.99; all better than the corresponding value at the 1% level of significance (0.87) for the appropriate number of degrees of freedom (5). This crystal occurs in a porphyritic rhyolite from Disraeli, Quebec. The longest dimension is 7.4mm.

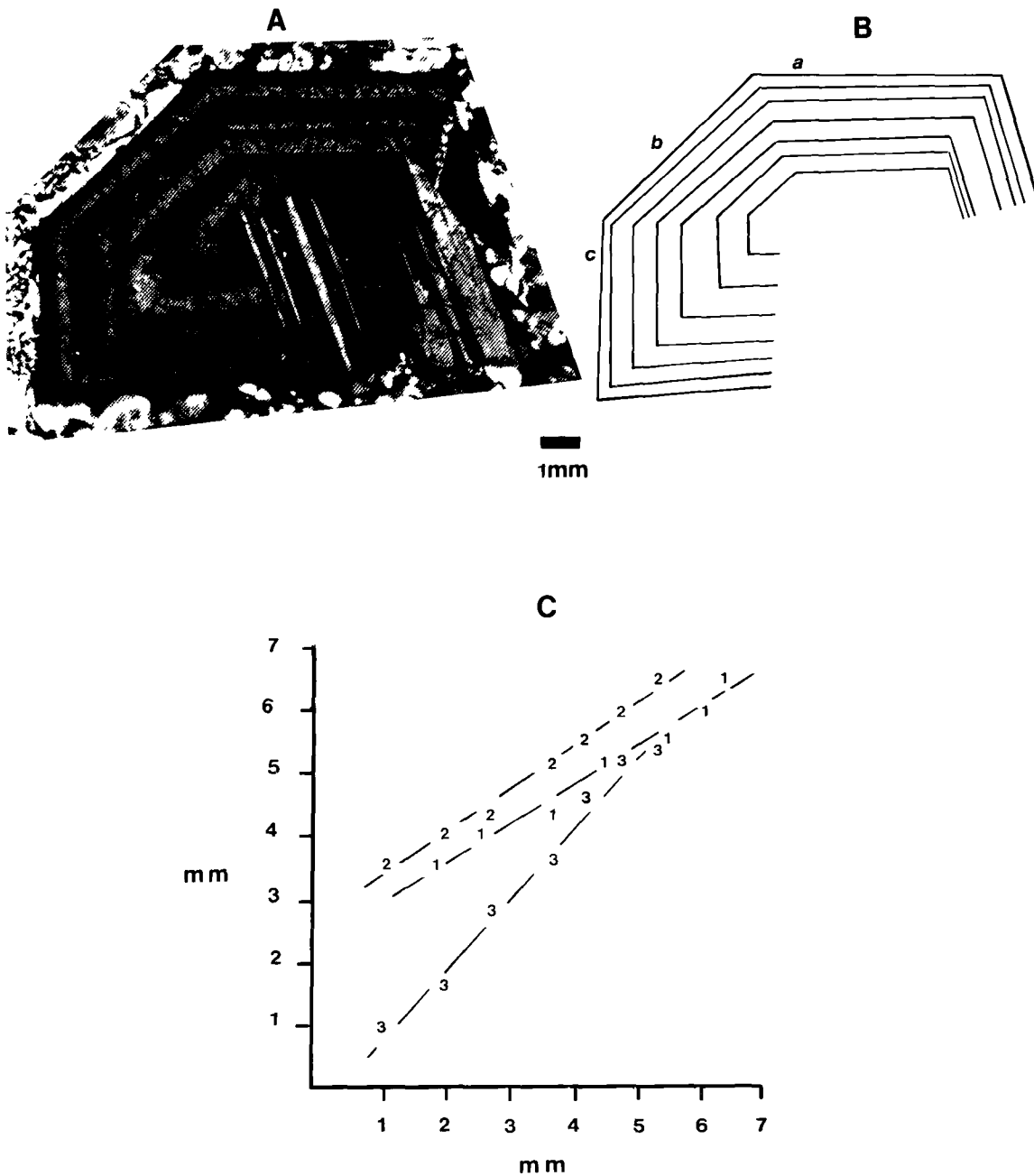


Figure 12:

A: Photograph of zoned plagioclase crystal D-51. B: Reconstructed diagram of the selected and measured compositional zone intercept-lengths. C: Plots of the three unique compositional zone intercept-length relationships established. The correlation coefficients of the relationships plotted are: (1) a versus b 0.99, (2) a versus c 0.99 and (3) b versus c 0.99; all much better than the corresponding value at the 1% level of significance (0.87) for the appropriate number of degrees of freedom (5). This crystal occurs in a diorite porphyry from the Abajo Mountains of Utah. The external zone of the series labelled a in figure 12-B measures 6.5mm.

Of the 55 relationships established, three cases do not support the constant-habit growth model. The correlation coefficients obtained for these cases are such that they fail to reject the null hypothesis that there is no association between the variables at the 5% level of significance. In other words, the correlation coefficients obtained for these three cases is such that identical results could have been obtained by chance alone in five or more cases out of 100. The 5% level of significance is an arbitrarily selected statistical threshold value marking the difference, in this case between a significant and non-significant linear relationship. This poor correlation may be due to some process giving rise to a large amount of scatter in the results of the measurements performed, or it may be due to a growth of type 1. In order to distinguish between a poor correlation due to the lack of significant linearity of the results and one due to a type 1 growth, quadratic curves could be fitted to these data and their difference from the best-fitting straight lines could be measured by means of an F-test.

Twelve cases are of type 2, that is, growth characterized by a constant ratio of the growth rates of the faces involved but accompanied by a modification of the habit. Ten of these twelve type-2 cases together with the three of type-1 occur in crystals from the same thin section (A-92, a porphyritic andesite from Mont Pelee). Most of the type-2 relationships are also characterized by a good though

not excellent degree of linearity. In these cases, the correlation coefficients generally fall in the range of the 1 to 5% level of significance, that is, they could have been produced by chance alone in one to five cases out of 100.

Finally, 40 cases are of type-3. All are characterized by correlation coefficients better than the corresponding value at the 1% level of significance. This result seems to indicate that constant habit growth is preferred in the plagioclase crystals studied. This becomes most apparent when the anomalous section mentioned above (A-92) is omitted; type-3 development then accounts for 32 out of the 34 observed cases in the five rock types studied.

The results of this study can be summarized as follows. Amongst the ten selected crystals, three do not support a constant habit development growth model. One of these shows a poor correlation in the ratio of the growth rates of some of its faces, whereas the other two are characterized by constant ratios of their facial growth rates; in the latter, habit modifications led to the disappearance of some of their faces. The seven other crystals grew with a constant habit, i.e., not only the forms and number of forms but also their exact degree of relative development remained constant during growth. The following conclusions can be drawn: First, the proposed method succeeds in providing information on the habit development of naturally formed plagioclase crystals. Second, a change in habit during growth can result from a

variation in the ratio of the growth rates of some faces, or from the relative growth rates and/or the geometrical relationship of the faces or forms present on the crystal. The proposed method allows one to distinguish between these two possibilities. Third, constant habit growth, as defined above, appears to be common in porphyritic extrusive and granitic intrusive rocks. This confirms the vectorial nature of crystal growth and seems to indicate that growth occurred in a relatively free environment, devoid of obstacles.

It would be interesting to apply this type of study, on a rigorous statistical basis, to rocks that are thought to have crystallized under very different conditions. This approach could also be performed using other types of zoning, including those types that fall outside the range of optical detection.

4-4-2. Crystal Growth Rates.

To complete the choice of the parameters required to simulate the growth of single crystals, a realistic type of growth rate must be selected.

Consider a nucleus of critical radius R_c , at time T_0 , and assume that it reaches a radius R before it stops growing at time T . Plotting the relationship between the change in radius versus the change in time yields the growth history of such a crystal. In fact, on such a plot (Fig. 13), any line joining the initial R_c and T_0 conditions to

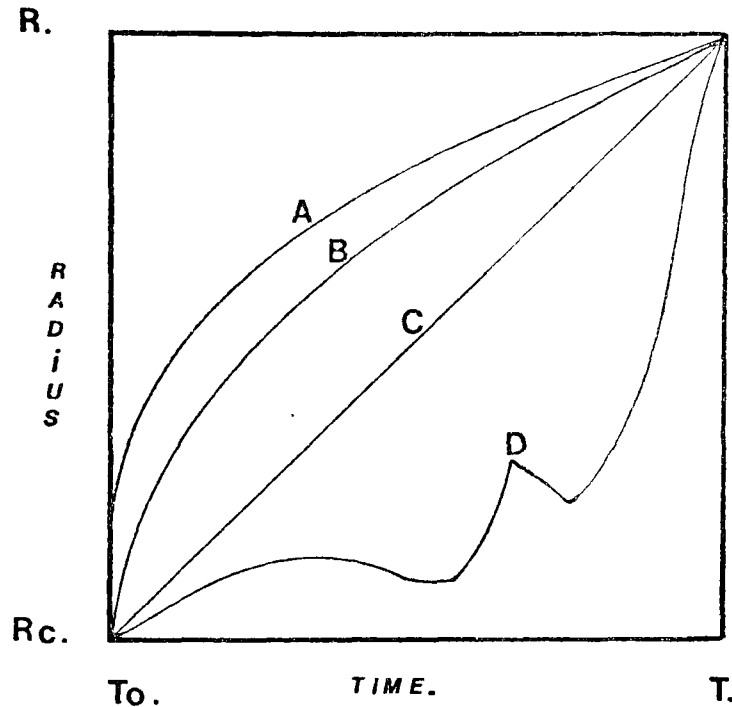


Figure 13:

Plot of crystal radius versus time for different possible growth models (after Kretz 1973; 1974). A: $d\text{Volume}/d\text{Time}=\text{constant}$, B: $d\text{Area}/d\text{Time}=\text{constant}$, C: $d\text{Radius}/d\text{Time}=\text{constant}$, and D: Model in which growth rates fluctuate.

the final R and T conditions (provided that the locus of the relationship does not proceed towards T_o), can be a possible description of the growth of a crystal. Very intense growth or dissolution periods would be expressed by nearly vertical paths and periods of absence of growth or dissolution by horizontal ones (Fig. 13-D).

It is convenient however, to consider models in which growth rates do not fluctuate. Such an approach was used by Kretz (1973; 1974) and he distinguished three growth models. In the first, the crystal radii increase by

constant amounts ($d \text{ radius} / d \text{ time} = \text{constant}$, Fig. 13-C). In the second model, the surface area of the growing crystal increases by constant amounts ($d \text{ area} / d \text{ time} = \text{constant}$, Fig. 13-B). These two models, which could be named linear radius and linear area increase, could well describe crystallization in which the rate-limiting process is one of several possible interface adsorption reactions (surface diffusion, dislocation mechanisms or surface nucleation), a condition that can probably be encountered in intrusive igneous environments (see section 4-2-5). In the third model, the volume of the growing crystal increases by constant amounts ($d \text{ volume} / d \text{ time} = \text{constant}$, figure 13-A). This could well be the case of crystallization in which the rate-limiting process is diffusion through the melt, or in metamorphic environments, solid state diffusion.

The first case, in which crystal radii increase by constant increments, was selected as basic growth model. The choice of this model is based on several reasons. It is the simplest to formulate mathematically and once programmed for a computer, it can serve as a basic model from which more complex types of growth rates can be derived. Furthermore, as discussed in the following part of this section, the choice of such a model yields results that are compatible with the ones predicted by growth theories and which do not contradict the physicochemical principles of

igneous petrology.

It has already been demonstrated that many substances have growth rates that are proportional to some power function of the degree of supercooling (section 4-2-5). Since supercooling is defined (for substances having a fixed melting point) as the magnitude of the difference between the temperature of the crystallizing melt and the crystal-melt equilibrium temperature, it can be expected that the crystal growth rates are likely to increase as a power function of time. Experimental observations supporting this proposition have been made from cooling melts by measuring the crystal dimensions at different times during their growth. Several substances have growth rates that increase until a maximum is reached, after which the increasing viscosity of the melt causes these to decline rapidly (Mazhul' @ Sharick 1966; Meleshko 1966; Ovsienko @ Alfintsev 1966). In a geological context, and more precisely in the case of intrusive bodies, some knowledge of their cooling behavior is helpful in evaluating the possible types of growth rates present.

Several authors have studied the problem of heat flow in rocks. Generally, these studies were aimed at obtaining some understanding of the changes in temperature experienced by the country rock at different times and distances from the intrusion (Larsen 1945; Carslaw @ Jaeger 1959; Jaeger 1957; 1959; 1961; 1968; Irvine 1970). Some of the equations derived for these studies are helpful as they

can be modified to determine the cooling rates present at different locations within the intrusive.

Consider the case of a sheet-like intrusive body, such as a dike or a sill. The temperature T at time t at a distance x from the mid-plane of the intrusive is derived by Carslaw and Jaeger (1959), as follows:

$$\frac{T - T_o}{T_o} = \frac{1}{2} \left[\operatorname{erf} \frac{\frac{x}{f} + 1}{\sqrt{\frac{kt}{f^2}}} - \operatorname{erf} \frac{\frac{x}{f} - 1}{\sqrt{\frac{kt}{f^2}}} \right] \quad (53),$$

where the error function is defined by:

$$\operatorname{erf}(u) = \frac{2}{\pi^{.5}} \int_0^u e^{-z^2} dz$$

which has the following important properties:

$$\operatorname{erf}(0) = 0 \quad (54),$$

$$\operatorname{erf}(-u) = -\operatorname{erf}(u) \quad (55),$$

and

$$\operatorname{erf}(\infty) = 1$$

Equation 53 can be modified to obtain the temperature at different times and locations within the intrusive body itself.

For example, the temperature at different times of points situated on the mid-plane or centre of a sheet-like intrusive ($x=0$), can be derived from equations 53 and 55 and be expressed as follows:

$$T = T_0 \left[\operatorname{erf} \frac{1}{2 \sqrt{\frac{kt}{f^2}}} \right] \quad (56).$$

Similarly, the temperature versus time relationship for points situated halfway between the centre and the edge or interface of a sheet-like intrusive ($x/f=0.5$), can be obtained from:

$$T = \frac{T_0}{2} \left[\operatorname{erf} \frac{1.5}{2 \sqrt{\frac{kt}{f^2}}} - \operatorname{erf} \frac{-0.5}{2 \sqrt{\frac{kt}{f^2}}} \right] \quad (57).$$

Incidentally, the numerical solution of this last equation requires that the two error function terms be computed separately, as this function is not additive.

Finally, the temperature versus time relationship for points located at the interface or contact of the intrusive ($x/f=1$), can be obtained from equations 53 and 55 by:

$$T = \frac{T_o}{2} \left[\operatorname{erf} \frac{\sqrt{kt}}{f} + .5 \right] \quad (58).$$

The numerical solutions of equations 56, 57 and 58 enable us to visualize the temperature decline experienced by a melt at different locations within the intrusive body. Of course, the solution of these equations depends on the initial temperature of the magma, and there are individual solutions for individual initial temperature conditions. In order to visualize the forms of the thermal declines of different locations within such an intrusive, equations 56, 57 and 58 were solved for different initial magma temperatures.

Figure 14 illustrates the temperature versus time relationship for points situated on the mid-plane of a sheet-like intrusive body (equ. 56). In figure 14-A, the melt was injected at a temperature of 1200 °C.; in figure 14-B at 1000 °C. and in figure 14-C, at 820 °C.

Figure 15 illustrates the temperature versus time relationship for points situated halfway between the centre

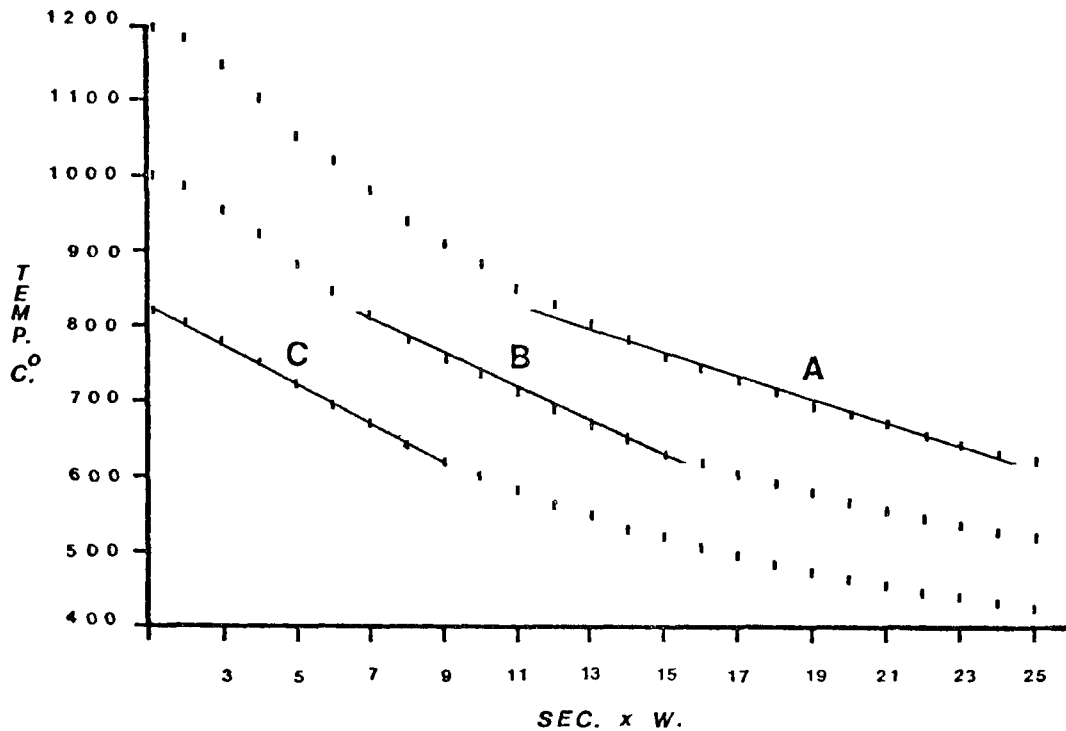


Figure 14:

Graph of temperature (°C.) versus time (sec. x width factor) illustrating the cooling rates of points situated on the mid-plane of a sheet-like intrusive. Melt is injected instantaneously at time=0, at the following temperatures: A: 1200 °C.; B: 1000 °C. and C: 820 °C. Solid line portions indicate sections of the cooling curves that can be approximated by linear equations.

and contact of the intrusive (equ. 57). In figure 15-A, the melt was injected at 1200 °C.; in figure 15-B at 1000 °C. and in figure 15-C at 820 °C.

Finally, figure 16 illustrates the temperature versus time relationship for points situated on the interface or contact of the intrusive. As the maximum temperature experienced at this location never exceeds half

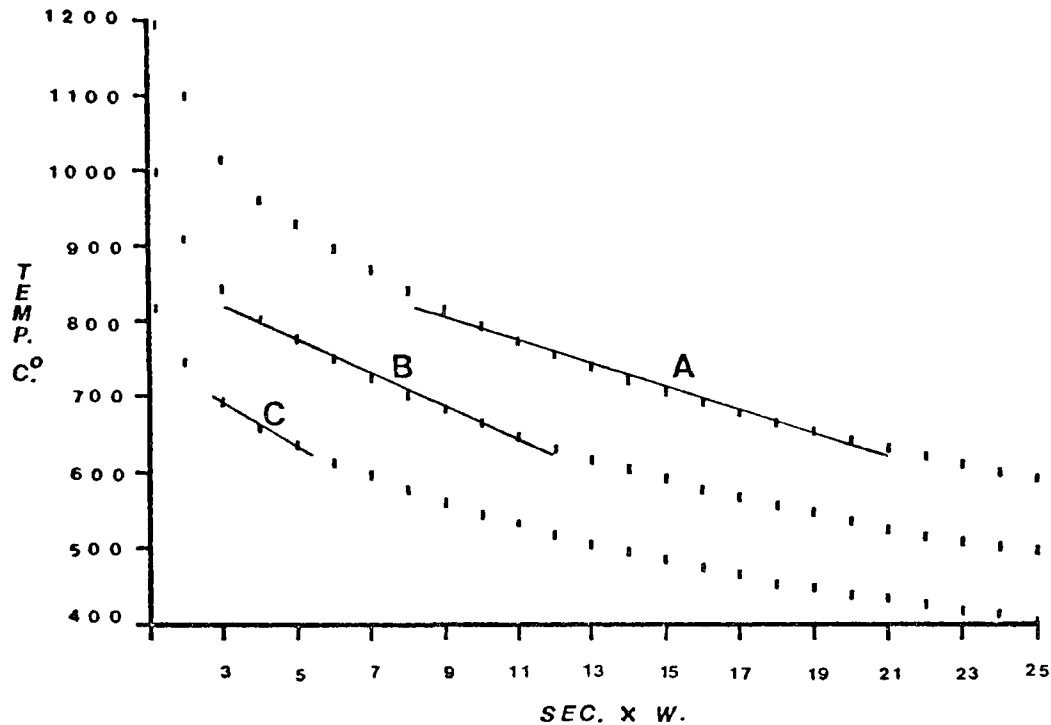


Figure 15:

Graph of temperature ($^{\circ}\text{C.}$) versus time (sec. x width factor) illustrating the cooling rates of points situated halfway between the centre and contact of a sheet-like intrusive. Injection of the melt is instantaneous at time=0, at the following temperatures: A: 1200°C. ; B: 1000°C. deg. and C: 820°C. Solid line portions indicate sections of the cooling curves that can be approximated by linear equations.

of the temperature of the injected melt, higher injection temperatures were arbitrarily selected. This was done to facilitate the comparison of the cooling behavior of the melt at that location with those of other locations, over roughly similar temperature ranges. In figure 16-A, the melt was injected at 2000°C. ; in figure 16-B at 1800°C.

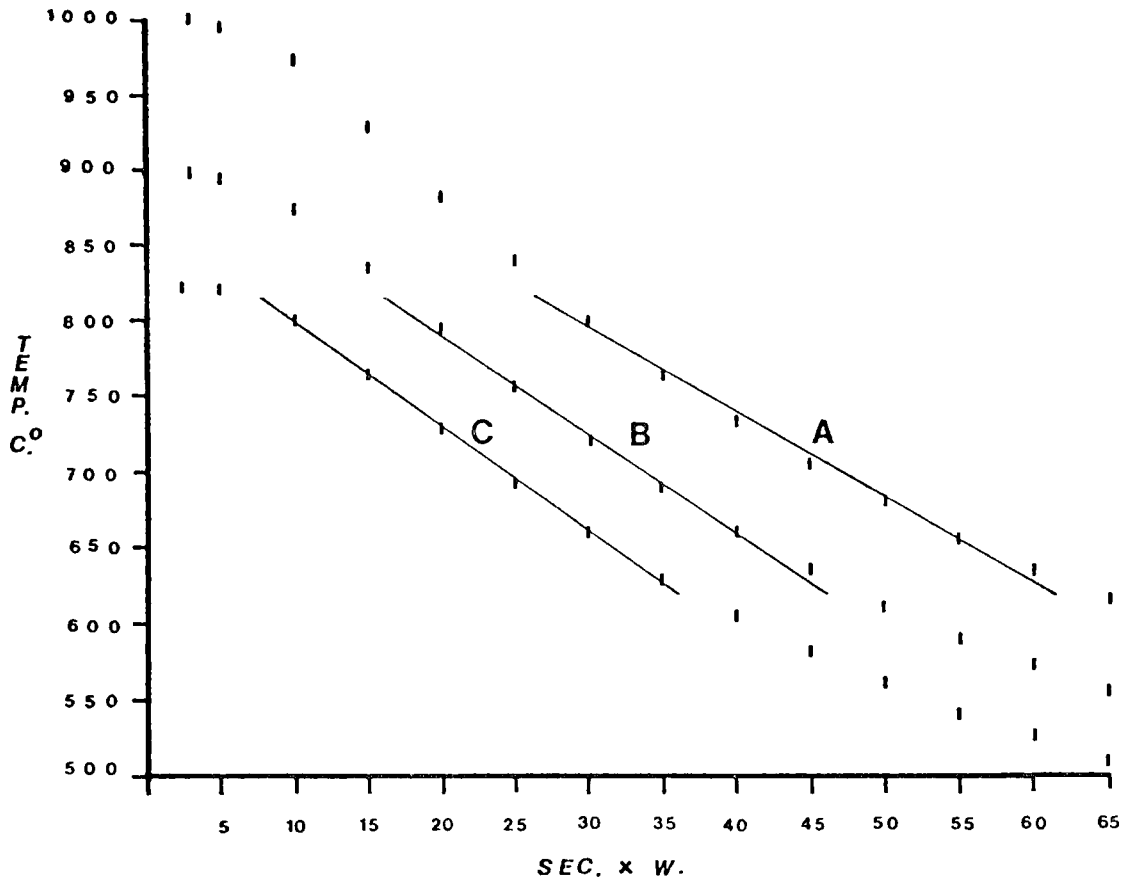


Figure 16:

Graph of temperature (°C.) versus time (sec. x width factor) illustrating the cooling rates of points situated on the contacts of a sheet-like intrusive. Melt is injected instantaneously at time=0, at the following temperatures: A: 2000 °C.; B: 1800 °C. and C: 1650 °C. Solid line portions indicate sections of the cooling curves that can be approximated by linear equations.

and in figure 16-C at 1650 °C.

The numerical solution of equations 56, 57 and 58 also reveals the influence of the width of the intrusive on

the time required for cooling. This influence can be expressed as a width factor w where:

$$w = \frac{4 + 2 (\log_{10} (\text{Width in meters}))}{\text{time in seconds} \times 10} \quad (59).$$

Inspection of figures 14, 15 and 16 reveals that all these cooling relationships have a slightly sigmoidal character, of which considerable portions can be adequately approximated by straight lines (solid line portions of figures 14, 15 and 16). In other words, the cooling behavior of these intrusive bodies is such that parts of their history can, for practical purpose, be described as linear with respect to time.

It is possible to calculate using the lever rule and the phase diagram of plagioclase feldspars (Fig. 17), the amount of material crystallized at different melt temperatures using different starting compositions (Figs. 18-A for An10 and 18-B for An20).

If one assumes that parts of the cooling history of intrusive bodies can be approximated by linear relationships with respect to time, the temperature scales of figures 18-A and 18-B could be interchanged with a similarly linear time scale. A similar form of relationship is obtained by plotting the volume versus time for a crystal growing by addition of constant radii increments.

It is realized that the above discussion does not take into account the effect of the latent heat liberated

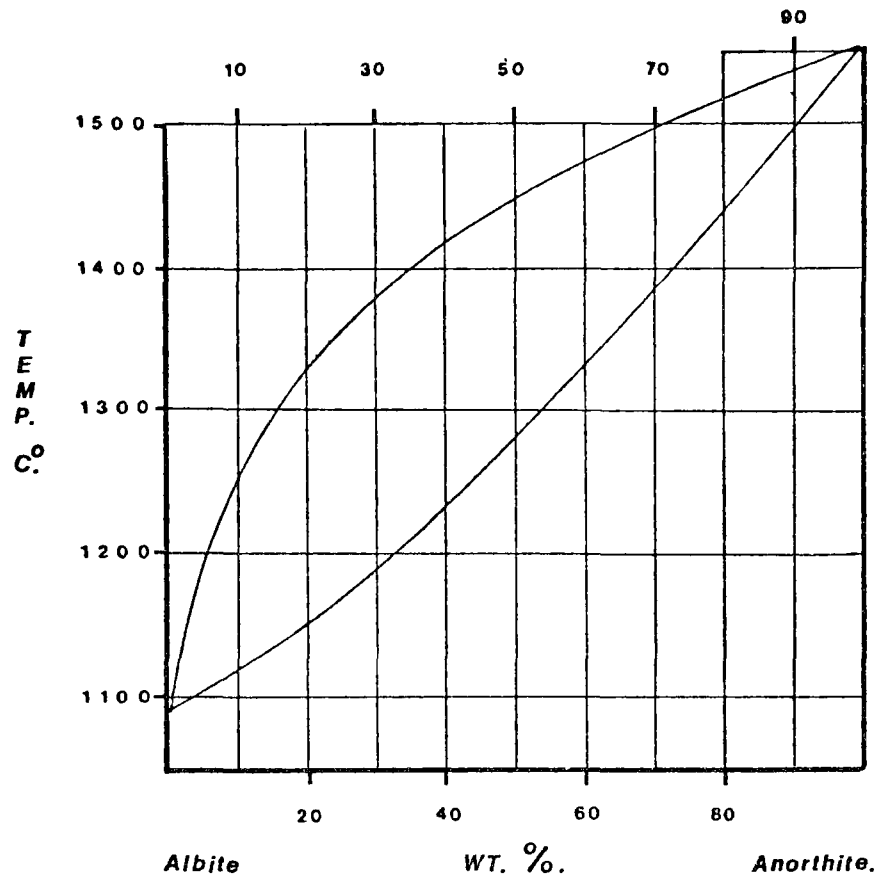


Figure 17:

Plagioclase phase diagram (after Bowen 1956).

during crystallization. However, in the case of intrusive bodies, except perhaps for very small ones, their thermal decline is so slow that latent heat dissipation probably does not play a growth-rate-limiting role.

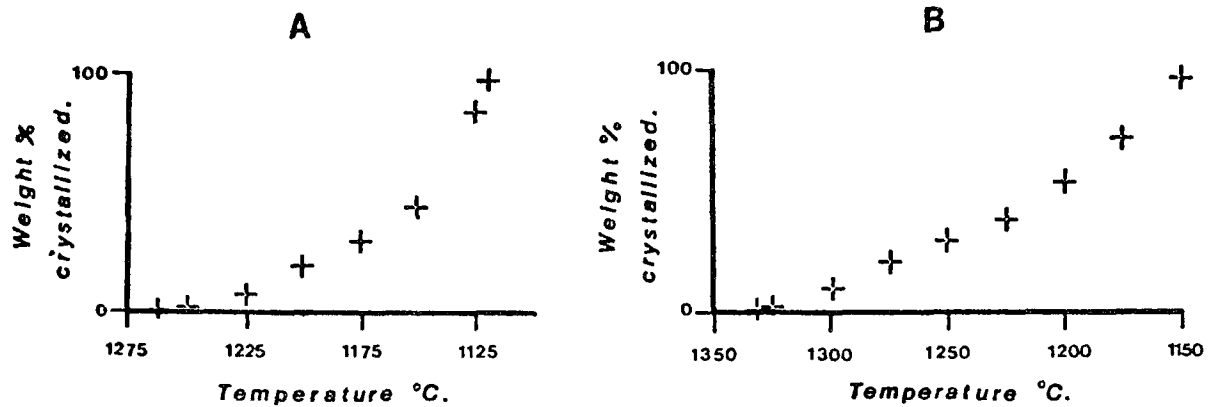


Figure 18:

Graph of percentage of material crystallized versus temperature of melt. A: An10 and B: An20.

4-5. Mathematical Simulation of the
Growth of Single Crystals.

A review of the actual understanding of crystal growth and the choice of habit and rate parameters having been presented, the simulation can now be discussed from a mathematical point of view.

The following describes the mathematical approach used in simulating a constant habit growth of single crystals.

Growth rates are expressed in terms of the amount of displacement of crystal faces along normal directions per unit of time. This displacement can be measured with respect to the previous position of a face or with respect to the centre of symmetry of the crystal (crystals lacking a centre of symmetry were not considered).

To ensure a constant habit growth, the desired over-all growth rate is subdivided into individual face growth rates by calibrating it with perpendicular distances between faces and the centre of symmetry of the crystal.

Thus, for each face present on a crystal:

$$R_n. = D_{pn}. R_{ov}. \quad (60),$$

where $R_n.$ is the growth rate of the n th face, $D_{pn}.$ is the perpendicular distance between the centre of symmetry and the n th face, and $R_{ov}.$ is the over-all growth rate.

It is possible to locate the new position of a face after a growth interval has taken place by taking into account the individual face growth rate and the two following properties: First, growth affects the spacial position of crystal faces but leaves their orientations unchanged. Second, the new position of a face and the centre of symmetry should be on opposite sides of the position occupied by that same face at the beginning of the growth increment.

The breaking down of an over-all growth rate into calibrated individual faces growth rates and the two geometrical conditions described above are sufficient to simulate growth without habit change. Linear growth rates are produced by keeping the over-all growth rate (and necessarily the individual face growth rates) linear with respect to the simulation time. More complex types of

growth rates can be obtained by deriving the magnitude of the growth increments from an external function of the simulation time.

4-6. The Necessity for the Symbolic Representation and Temporary Storage of the Geometrical Model Using Three-Dimensional Space Simulating Matrices.

To be successful, a simulation approach should resemble the natural system sufficiently to give information about its behavior. To fulfill this requirement, the simulation has to proceed simultaneously at two closely linked levels.

The modeling level is that in which operations using conventional methods of three-dimensional geometry are performed on ideal theoretical crystals defined in Cartesian terms. The Cartesian description of minerals, their simulated nucleation and growth as discussed this far belong to this level. This modeling level does not however, resemble a natural system. A list of general equations does not readily convey the shape of a crystal. In order to give the crystals defined in the modeling level more permanent and physical characteristics, they are recreated and stored in a three-dimensional matrix that forms a storage or space simulating level. In a mathematical sense, this level has properties resembling closely those of a natural system. It can be sectioned and the section planes can be scanned just

as a thin section of a rock or mineral can be scanned to determine the presence or absence and nature of material at different positions. It can already be appreciated that this storage level is instrumental in recording the formation of textures. Even if this storage level is not strictly speaking, necessary for the simulation of the growth of single crystals, it was developed during this part of the work for the following reasons: The storage of the ideal crystals in the space simulating level creates unavoidable imperfections or imprecisions. It would be very difficult to assess the magnitude and the effects of these imperfections after the simulation of the growth of a crystalline aggregate is completed. Developing the use of the storage level during the work on single crystal growth allows these imperfections to be studied and their importance to be evaluated.

4-7. MODULE-2: A Computer Program for the Simulation of Nucleation and Growth of Single Crystals.

The following describes the computer program that was developed to simulate the nucleation and growth of single crystals. As in the case of MODULE-1, it is discussed according to its implementation (4-7-1), its necessary input data (4-7-2) and the output it produces (4-7-3). Figure 19 is a schematic description of the functioning of MODULE-2.

4-7-1. The Program Implementation.

MODULE-2 was developed on an I.B.M. 360-165 using FORTRAN IV. The core requirement, when all processing options are selected, is 250 Kbytes. A large part (122 Kbytes) of this core is used for the various analyses of the precision reached during the growth simulation and can, if desired, be omitted. As in the case of MODULE-1, the magnetic tape output option, when selected, can be used as input for a graphic software such as 'Viewplot'. In this case, images on a cathode ray tube graphic or plotter terminal can be produced provided that an I.B.M. O.S. (Operating System) environment accessible to B.T.A.M. (Raymond et al. 1973) is available. Appendix 3 is a list of MODULE-2 statements.

4-7-2. MODULE-2 Input Data.

Information that is to appear as title is first read by MODULE-2. The number of faces and their Cartesian equations are read for each crystal whose growth simulation is to be performed. The type of growth (in this work, constant-habit) denoted by an integer symbol and the growth increment are read. A list of integer indicators are then used to by-pass or activate the various analyses of precision available with MODULE-2.

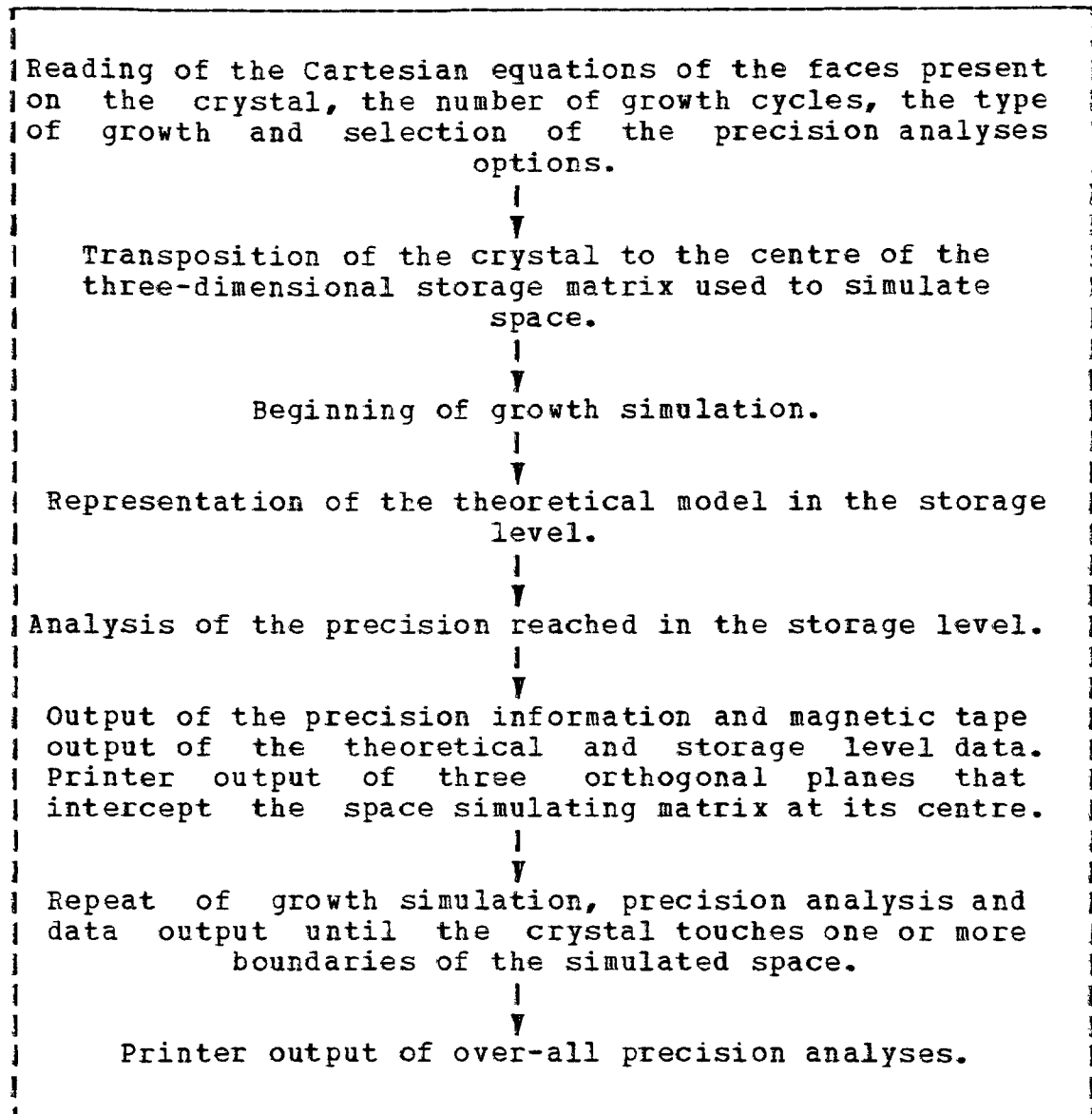


Figure 19:

Summarized description of the sequence of operations performed by MODULE-2 during the simulation of the growth of single crystals.

4-7-3. MODULE-2 Output Data.

The output of MODULE-2, when all resident options are selected, consists of the following:

A) Appearing once in a heading section of the complete growth simulation:

- 1) the title of the simulation,
- 2) a list of the input information and
- 3) a list of the Cartesian equations of the crystal after being transposed such that its centre coincides with the centre of the simulated space.

B) Appearing once after each growth cycle or incrementation:

- 1) the number of the growth cycles that have taken place,
- 2) the number of space simulating matrix points used in defining the surface and the interior of the crystal,
- 3) the maximum and minimum perpendicular distances (called shifts) between the theoretical crystal surface and the space simulating matrix points used to define this surface,
- 4) the minimum and maximum radii of both the theoretical guiding and stored models,
- 5) the maximum and minimum values of the errors involved in defining the crystal (the maximum and minimum displacements of surface points divided by their distance to

the crystal centre),

6) a frequency distribution histogram (number of shifted or displaced surface points versus the magnitude of their shift or displacement) of all points used to define the crystal surfaces in the space simulating or storage level,

7) three section planes passing orthogonally through the image matrix centre and

8) the theoretical crystal surface area and volume.

C) Appearing at the end of the growth simulation:

1 @ 2) plots of the maximum and minimum relative errors, as defined above, versus the minimum and maximum radii of the crystal stored in the space simulating level (called 'Variation of Precision Analyses No. 1 @ 2'),

3) plots of the maximum and minimum relative errors, as defined above, versus the number of space simulating matrix points used to define the surface of the crystal (called 'Variation of Precision Analysis No. 3'),

4) plots of the maximum and minimum relative errors, as defined above, versus the total number of space simulating matrix points used to define the crystal in the storage level (called 'Variation of Precision Analysis No. 4'),

5 @ 6) plots of the number of growth cycles (called 'Events' in the simulation sense) versus the minimum and maximum radii of the crystal stored in the space

simulating level (called 'Growth Analyses No. 1 @ 2'),

7) plots of the number of growth cycles versus the number of space simulating matrix points used to define the surface of the crystal (called 'Growth Analysis No. 3') and

8) plots of the number of growth cycles versus the number of space simulating matrix points used to define the crystal in the storage level (called 'Growth Analysis No. 4').

D) Appearing at the very end of the simulation the words: 'Normal Ending of Operations' which by their presence indicate that all desired operations have been successfully completed.

The single crystal growth simulation and the various analyses of precision listed above were performed using six crystals, one of each crystallographic system and of varying complexity. The results obtained by treating these crystals with MODULE-2 are listed in appendices 4-a to 4-f (4-a: fluorite, 4-b: rutile, 4-c: fayalite, 4-d: nepheline, 4-e: aegirine and 4-f: labradorite). The results obtained with MODULE-2 are discussed in more details the following section (4-8).

4-8. Evaluation of the Simulation.

Before discussing the results obtained with MODULE-2, it may be useful to recall the following points: in order to give the products of the simulation a tangible nature, they have to be recreated in a three-dimensional space simulating matrix made up of regularly distributed discrete points. Because of the regular and discrete nature of these points, faces inclined to any of the reference axes have a step-like nature. In deciding whether or not any point of the space simulating matrix contributes to the representation of a crystal, the following rules were used: 1) points inside the crystal (on the same side as its geometrical centre with respect to all its faces) denote its interior and carry no imprecision; 2) points directly on any of the crystal faces also contribute to its representation and carry no imprecision; and finally, 3) points outside any of the crystal faces, but whose perpendicular distance to the plane they define is less than or equal to one-half of the distance between two neighboring matrix points, are considered as part of the crystal surface, but do superimpose a variable imprecision on the ideal theoretical model.

In order to evaluate the performance of the present approach, it is clear that the loss of precision inherent in the use of space simulating matrices must be defined. Without this knowledge, the simulation of the

formation of crystalline textures could produce interfaces of very doubtful value.

The first step in analyzing this loss of precision is to differentiate surface from interior points, as only surface points contain a variable amount of displacement. This is done by scanning the space simulating matrix back and forth in the directions of the Cartesian reference axes until a point representing the crystal is found. From then on, it is designated as surface point. The amount of displacement of each surface point from the plane it defines is then calculated. To convey a measure of the relative importance of the surface imprecision with respect to the over-all representation of the crystal, the following arbitrary ratio is established:

$$\text{Imprecision} = \text{Error} / \text{Distance} \quad (61),$$

where Imprecision is a measure of the over-all imprecision in the crystal definition; Error is the perpendicular distance from a surface point to the plane it defines and Distance is the distance between the above point and the centre of the crystal.

The results obtained with MODULE-2 show that this over-all imprecision ratio always decreases rapidly during growth. In other words, as the simulated growth takes place, the crystal stored in the space simulating matrix resembles more and more its guiding theoretical model. It

follows that nuclei and very small crystals are very poorly represented whereas larger ones have a shape similar to that of the ideal theoretical model. This characteristic is important in calculating a minimum distance between neighbors in the simulation of the growth of crystal aggregates.

The over-all imprecision ratio, as defined above, reflects the magnitude but not the amount of irregularities present on the crystal surfaces. In order to measure what proportion of the crystal surfaces is displaced from its theoretical position as well as by how much it is displaced, histograms of the number of surface points versus the amount of their displacement are constructed by MODULE-2 after each growth increment. These histograms reveal that, except for fluorite in which the simulated crystal surfaces are always perfectly defined as they are all parallel to two of the space reference axes, all other crystals display a very peculiar behavior. These can best be described as repeating or cyclic with a periodicity particular to the crystal undergoing growth. This effect can be understood, at least intuitively, when one recalls that growth takes place according to constant increments and that the crystals are recreated in a space made up of regularly distributed discrete points. It is also interesting to recall that this form of development closely resembles the concepts of the

probabilistic growth theories (section 4-2-4).

In order to convey some image of the crystal stored in the space simulating matrix, three orthogonal planes passing through the space and crystal centre are displayed after each growth cycle. As the growth model developed thus far may later be used in an iterative fashion to obtain other types of growth rates, it is important to calculate characteristics other than surface precision. The following parameters are therefore calculated and listed by MODULE-2 after each growth cycle: the simulated crystal's minimum and maximum radii, its number of surface and interior points (an approximation of its surface area and volume) and the theoretical crystal surface area and volume.

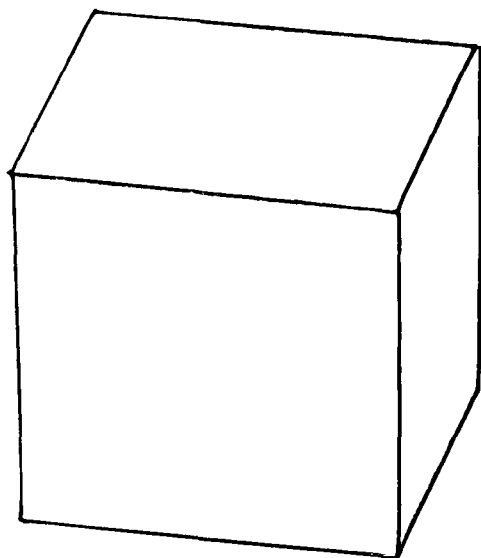
After a crystal has grown to a predetermined size, MODULE-2 produces various plots. These are of two types: 1) plots listed in part c, 1 to 4 of the preceding section (4-7-3) illustrate the variations in the crystal's over-all precision with respect to its size, surface area and volume. These are used to determine what crystal size, surface area or volume is required to reach a given over-all precision, and are useful in determining the minimum distance between neighbors in the growth simulation of crystalline aggregates; 2) plots listed in part c, 5 to 8 of the preceding section (4-7-3) display the growth behavior with respect to size, surface area and volume of both the theoretical model and its counterpart stored in the space simulating matrix. These plots show that, in general, the

two versions are in poor agreement at and shortly after nucleation. However, as growth proceeds, they rapidly become similar.

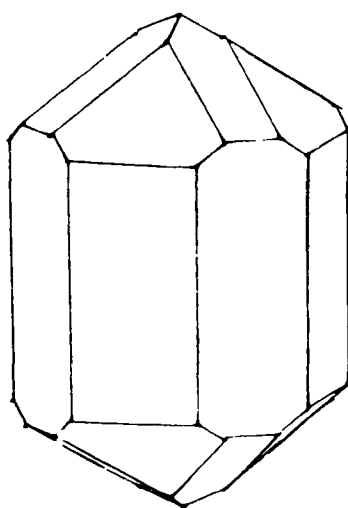
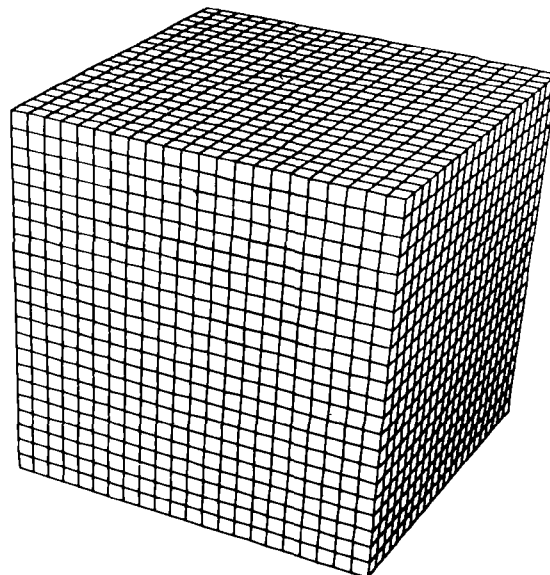
It soon became apparent that the use of three orthogonal planes of intersection is a very inadequate means of conveying the over-all shape of the crystal stored in the space simulating matrix. After all, the critical point of the simulation's approach developed thus far is the surface imprecision inherent in the use of the storage matrices, a fact not readily observed on these intersection planes. To convey a better image of the stored crystals, a program named VISION and listed in appendix 5 was developed. This program treats the crystal stored in the space simulating matrix as a solid object, superimposes a grid pattern on its surfaces, removes all hidden points, lines and planes according to the position of the observer's eyes with respect to the crystal centre and displays the resulting image on a cathode ray tube terminal (Tektronix 4013). A 16 mm. film, entitled 'Computer Simulation of Crystal Growth' was produced using the results of MODULE-2 and VISION. It displays for each of the six selected crystals, its name, its crystallographic system, a wireframe drawing of its theoretical model, the crystal stored in the space simulating matrix during growth and a rotation of the stored crystal once it has reached a predetermined size. Figures 20 and 21 illustrate the six selected theoretical models and their stored counterparts. The grid system superimposed on

the stored crystal surfaces was designed to convey an impression of topography and its density is generally related to the degree of parallelism between a face and any of the reference axes. These models were allowed to grow until they started to impinge on the boundaries of an imaginary cubic space of 40 units (or matrix points) edge length.

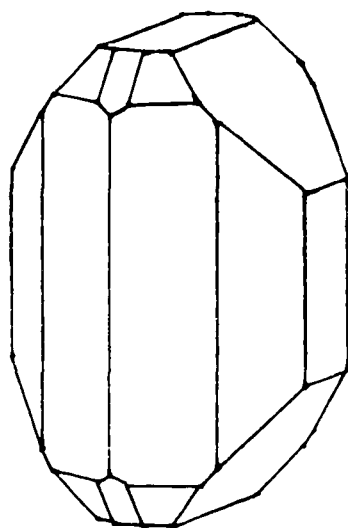
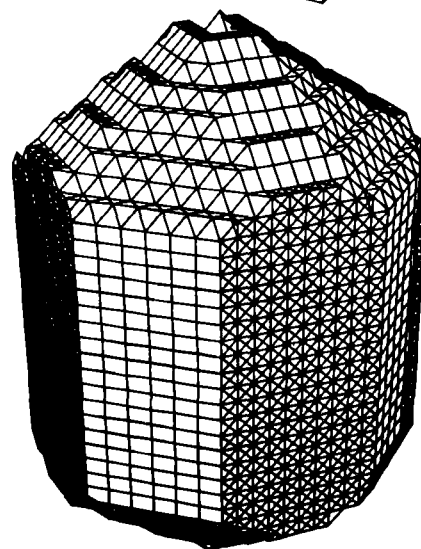
In summary, the present approach permits the simulation of the growth of any single crystal, once it is defined in Cartesian terms. In this study, growth takes place without habit change and by constant radii increments. Provisions were made in the programming for guiding the relative development of individual forms and to reproduce other types of growth rates. The theoretical model, made up of general equations of faces, is always perfectly defined but lacks tangibility and must be recreated in a space simulating matrix. This process involves a loss of precision. Analysis of this loss of precision reveals that this effect becomes negligible as the simulated crystals increase in size. This indicates that as long as some distance is kept between nuclei, the present approach can be used to simulate the nucleation and growth of crystalline aggregates and the formation of textures.



A



B



C

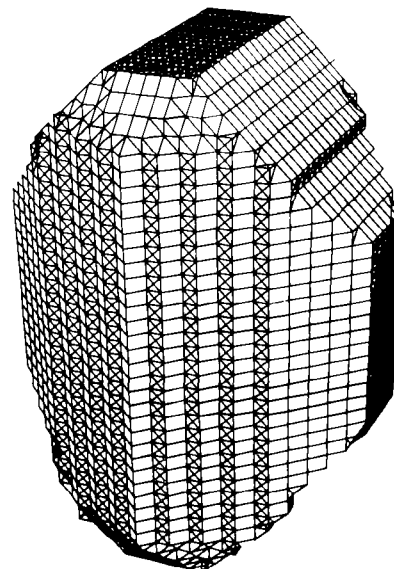
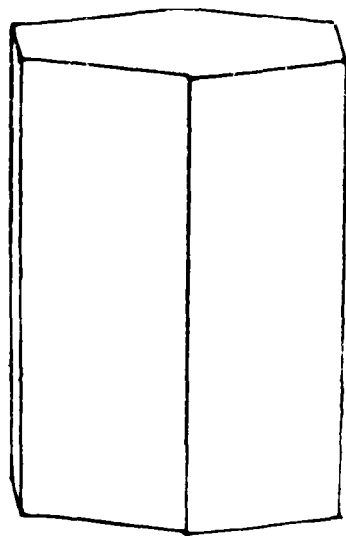
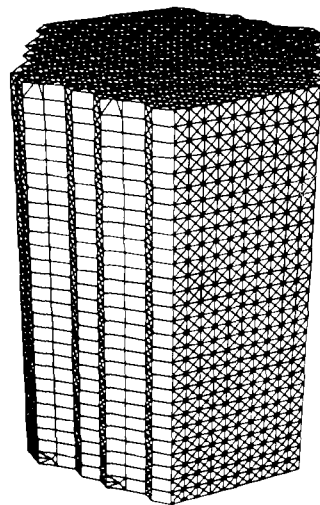


Figure 20:

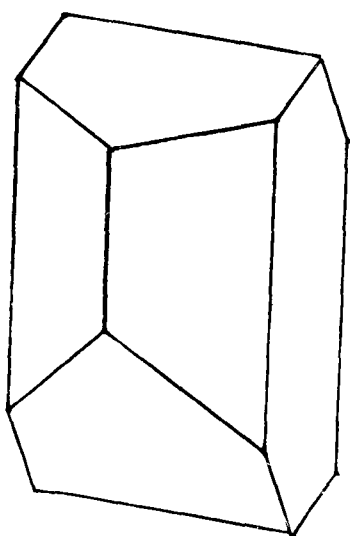
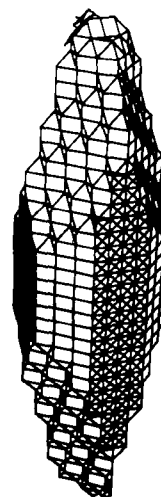
Photographs of the theoretical models (left) and the version stored in the space simulating matrix (right). A: Fluorite, B: Rutile and C: Fayalite.



A



B



C

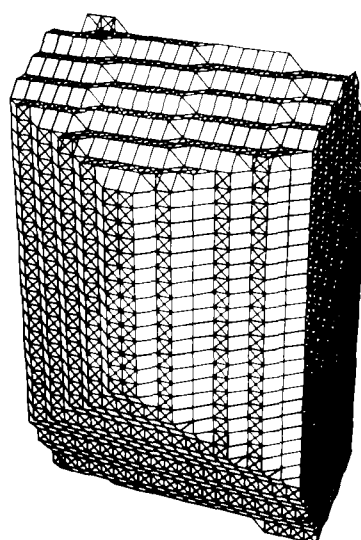


Figure 21:

Photographs of the theoretical models (left) and the version stored in the space simulating matrix (right). A: Nepheline, B: Aegirine and C: Labradorite.

PART 5.

THE GROWTH OF CRYSTALLINE AGGREGATES
AND THE FORMATION OF TEXTURES

THE GROWTH OF CRYSTALLINE AGGREGATES
AND THE FORMATION OF TEXTURES

5-0. Introduction.

The model developed for the simulation of the nucleation and growth of crystalline aggregates differs from the one used to simulate the growth of single crystals in two major aspects. Firstly, it permits the creation of a variable number of nuclei. Secondly, it enables one to control the interactions that occur when neighboring crystals start to impinge on each other. In other words, it can reproduce the effects of different crystalloblastic forces. These two new aspects will now be discussed.

5-1. The Simulation of the Nucleation and
Growth of Crystalline Aggregates.

The modeling of the nucleation of a variable number of crystals is done in three steps. First, the model selects the desired number of sites within the space simulating matrix. If a random distribution of nucleation sites is desired, the random number generator discussed in section 3-6-2 is used to produce a list of coordinates. In the case of regularly distributed sites, the model attempts to order the desired number of sites as regularly as

possible within the space simulating matrix.

The distance between neighboring sites is then calculated and compared with the value obtained from the analyses of precision performed on the models stored in the space simulating matrix during the growth of single crystals. This ensures that all crystal representations will have reached a acceptable precision before interactions can occur. It may be argued that this process prevents the generation of truly random sites. However, the use of this model shows that generally, because of the relative smallness of the minimum allowable distance between neighbors compared to the dimensions of the space simulating matrix, very few coordinates have to be rejected.

Once the desired nucleation sites have been selected and verified, nucleation itself is performed in two steps. First, the desired type of crystals, defined by the Cartesian general equations of their faces, are translated to individual sites. This translation process, discussed in section 3-6-1, is repeated until the appropriate number of nuclei has been generated. At this point, if a random orientation of nuclei is desired, the model uses the same random number generator to perform three consecutive rotations on each nucleus according to the procedure discussed in section 3-6-3. If a regular orientation of nuclei is desired, the model by-passes this rotation process and leaves the nuclei in their standard crystallographic

orientation.

Completing the simulation of nucleation according to the three steps outlined above before allowing growth to take place simulates an instantaneous nucleation rate. Provisions were also included in the programming of this model to reproduce other types of rates by allowing growth to begin before the appearance of the last nucleus.

The simulation of the growth of the members of the aggregates follows the procedure described in section 4-5. At this point, the nature of digital computers creates an unavoidable obstacle: the growth of several crystals can only be simulated in sequential manner. In other words, during the simulation, members of a crystalline aggregate cannot grow concurrently as they do under natural conditions. This seemingly large defect can be minimized by a judicious choice of growth rates. Selecting a growth rate such that the changes in the crystals' radii are small with respect to the change in the simulation's time creates an over-all effect that approaches concurrent growth. Other methods of overcoming this defect could be developed, but would impose demands on calculation time and memory space that would render the approach impractical, if not unfeasible. Even though care was used in selecting small growth rates, the effect of sequential growth remains present and must, like the loss of precision due to the use of space simulating matrices, be evaluated (section 5-5).

5-2. The Formation of Textures.

The effect of interactions between crystals is probably the last major process that may influence the development of textures in a solidifying melt. The relation between a growing crystal and a solid environment is still not clearly understood. The idea that crystals can exert a pressure on their surroundings has existed for a long time and appears easy to substantiate. Frost heaving is a very common example. An equivalent example amongst minerals making up a rock is not so easy to find. In fact, it is very rare to find any evidence that a growing crystal can mechanically disturb other mineral phases. The frost heaving analogy may be a poor example of what takes place in the formation of a rock, as it is a process that is driven by a gradient of such magnitude that it cannot be reversed by the pressure of the confining body. It appears that in a geological context, and especially in metamorphic environments, crystals do not grow outward by driving forward their boundaries as rigid walls that force the matrix aside. Instead, the interface may advance by the addition of selected units which diffuse through the matrix as others diffuse away. Some impurities may be enclosed by the advancing interface, others may be displaced and may or may not attach preferentially to the crystal surfaces.

The sequence of appearance of minerals in a consolidating melt has also been recognized for a long time

and used to explain why a given mineral may be allotriomorphic towards certain associated minerals and idiomorphic towards others. Nevertheless, minerals display different tendencies towards the formation of faces and it has been proposed that there is a distinct correlation between high hardness, high surface energy, high surface energy anisotropy and the development of faces (Spry 1969). A complete survey of theories on crystalline interactions would form a major study in itself. In this preliminary approach, only two types of interactions were considered.

First, the interactions that occur between crystals showing a similar tendency towards the development of faces. In this case, the model was designed to simulate the expansion of faces wherever free space or melt is the surrounding medium. Upon reaching a solid obstacle, such a face stops growing, either completely if the obstacle covers the whole face, or partially if the obstacle covers only part of the face. Applying the same growth criteria to all members of the aggregate ensures that each crystal has a similar tendency and ability to develop faces.

Second, the interactions that occur between crystals of dissimilar crystalloblastic force. In this case, the model was programmed such that some crystals of the aggregate follow the argument described above. The other members of the aggregate, however, continue their growth even in the presence of obstacles. It can be argued that this represents a crystal that pushes aside surrounding

mineral phases. It was nevertheless used as it could equally well represent a crystal that grows where a surrounding phase may be diffusing away from the interface. Furthermore, contrasting cases were intentionally designed for the preliminary applications of this simulation.

5-3. MODULE-3: A Computer Program for
the Simulation of the Nucleation and
Growth of Crystalline Aggregates.

The following is a description of the computer program making up MODULE-3. The program is discussed according to its implementation (5-3-1), the required input data (5-3-2), and the information it produces (5-3-3). Figure 22 is a simplified description of the sequence of operations performed by MODULE-3.

5-3-1. The Program Implementation.

MODULE-3 was developed on an I.B.M. 360-165 using Fortran IV. The memory space necessary for the use of this program is 250 Kbytes. It tends unfortunately to use a large amount of time. For this reason, the Fortran H level was used for compilation and execution. Input information is read from cards and the output is designed to be stored on magnetic tape as well as to be printed. Appendix 6 is a list of the statements of MODULE-3.

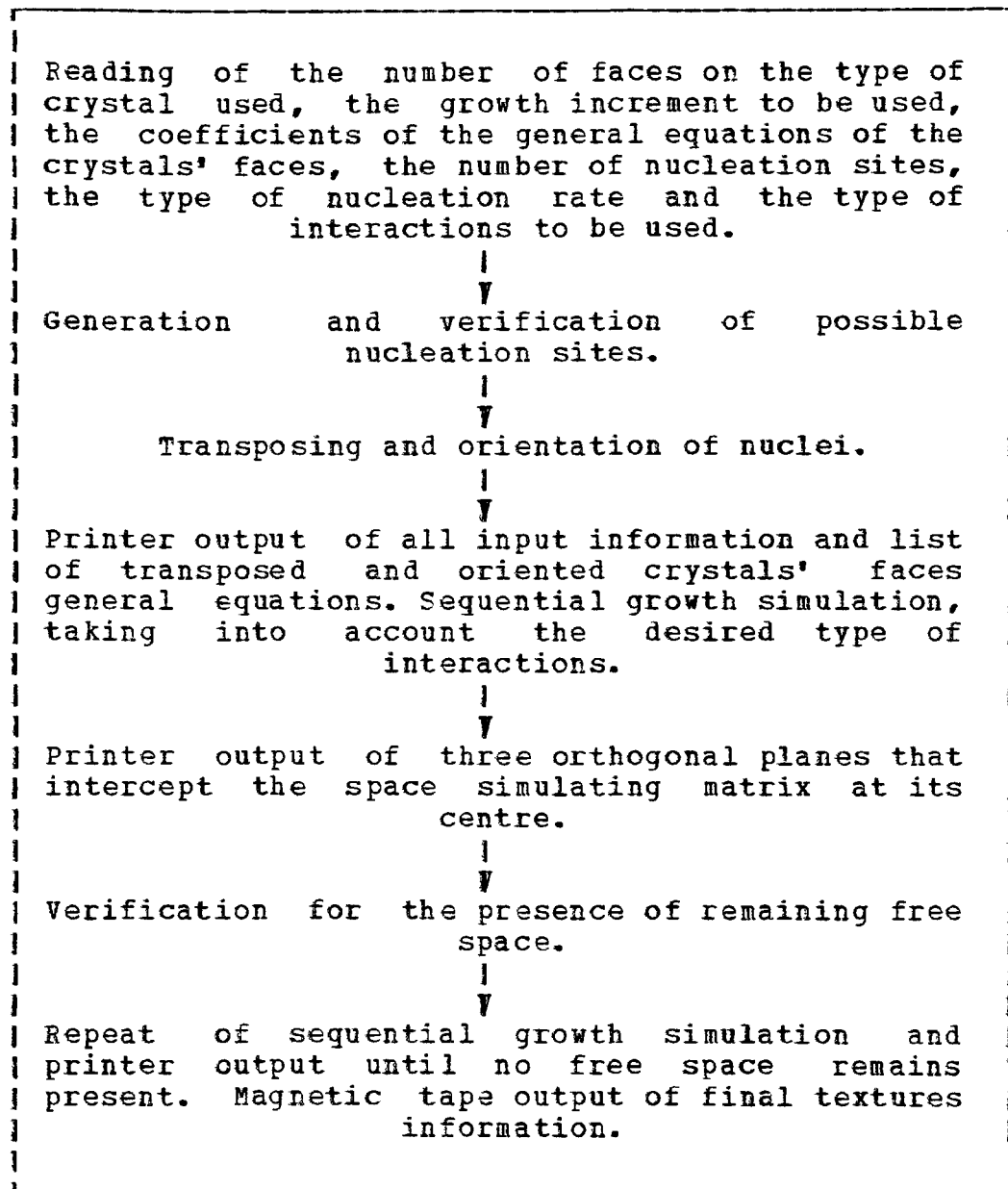


Figure 22:

Summarized description of the sequence of operations performed by MODULE-3 during the simulation of crystallization.

5-3-2. MODULE-3 Input Data.

Information concerning the type of simulation desired is first read by this program. These consist of: the number of faces on the type of crystal used, the growth increment to be used, the coefficients of the general equations of the crystals' faces, the number of nucleation sites, the type of distribution of the nucleation sites, the type of nucleation rate and the type of interactions desired. All this information is read from punched cards.

5-3-3. MODULE-3 Output Data.

The printer output of MODULE-3 consists of:

A) Appearing once in a heading section:

- 1) six lines of general information describing the conditions used for the simulation,
- 2) the number of faces present on the type of crystal used and the growth increment used,
- 3) the coefficients of the general equations of the crystal's faces in standard crystallographic orientation,
- 4) a list of coordinates that have been selected as suitable nucleation sites,
- 5) if a random orientation of nuclei is desired, a list of the random angles used to perform three rotations for each crystal, and

6) a list of the general equations of the faces of the desired number of crystals after being transposed and oriented.

B) Appearing once for each complete sequential growth simulation:

1) the simulation's time, and

2) three orthogonal planes that intercept the space simulating matrix at its centre.

C) Appearing once at the very end of the simulation, the words: 'Normal Ending of Operations', which by their presence indicate that all desired operations have been successfully completed.

5-4. Results Obtained with MODULE-3.

MODULE-3 was used to simulate the nucleation and growth of crystals, and the formation of textures under different sets of conditions. It is admitted that, in some cases, some of the conditions used (mineralogy, type of distribution of the nucleation sites) may not be very realistic. However, this is necessary to observe and evaluate the effects of different crystallization conditions on the textures produced.

Five main types of applications were designed to evaluate the effect of the type of distribution of the nucleation sites, the sequential nature of the simulated growth, the type of orientation of nuclei, the number of

nuclei and different crystalloblastic forces and nucleation rates, on the textures produced. The textures produced by these simulations are displayed using section planes passing through the centre of the space simulating matrix. This approach was used as it represents a type of observation with which geologists are very familiar, that is, it resembles a thin section. At this point, it is necessary to mention that all intercept planes contain a small amount of distortion making them rectangular instead of square. This distortion results from the use of computer printers and could be removed by using other means of display (cathode ray tube or plotter terminal). As this distortion is constant, printers were nevertheless used to display the results of these preliminary applications of the simulation.

The effect of the type of distribution of nucleation sites on textures is illustrated by figure 23. In figure 23-A, nine crystals of fluorite were nucleated instantaneously using regularly distributed nucleation sites.

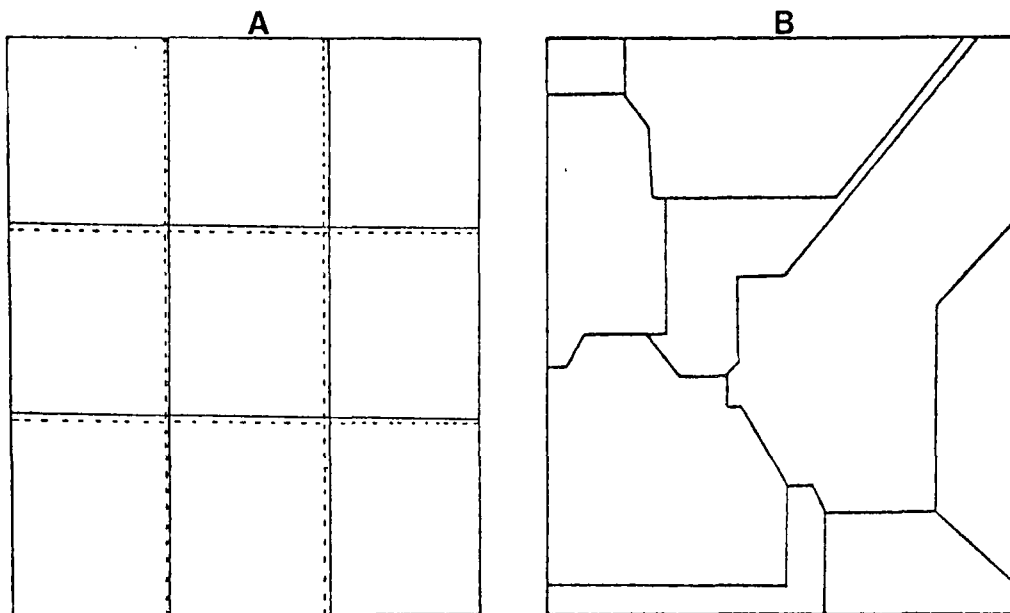


Figure 23:

Effect of type of distribution of nucleation sites on textures. A: Regularly distributed nucleation sites, and B: Randomly distributed nucleation sites.

All crystals have the same orientation. These were allowed to grow with a rate such that $d\text{Radius}/d\text{Time}=1.0$, and were designed to have equal crystalloblastic forces. The dash lines of figure 23-A show the positions of interfaces that would have been produced by concurrent growth. The solid lines represent the positions of the interfaces produced by the computer sequential simulation of growth. In figure 23-B, the same crystallization conditions were used (nine fluorite cubic crystals, instantaneous nucleation, regular orientation, growth according to $d\text{Radius}/d\text{Time}=1.0$, equal crystalloblastic forces), except that in this case, a random distribution of nucleation sites was used.

The effect of sequential rather than concurrent growth is illustrated by figure 24. In figure 24-A, nine fluorite crystals were allowed to nucleate and grow with conditions similar to those described for figure 23-B.

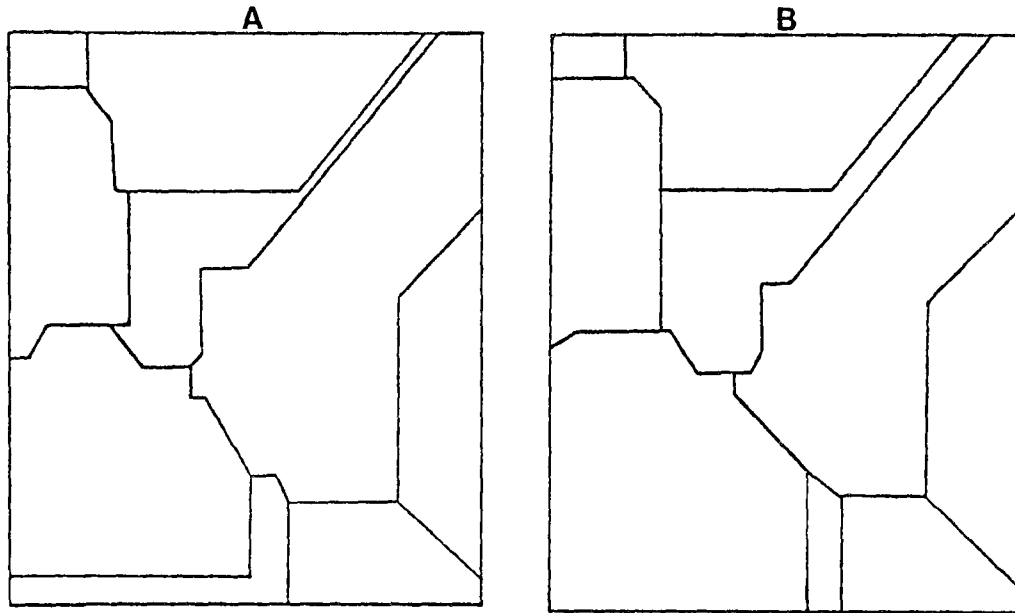


Figure 24:

Effect of sequential growth on the formation of textures. A: Normal growth sequence, and B: Reversed growth sequence.

Each growth cycle uses a crystal number sequence from one to nine. In figure 24-B, the same crystallization conditions were used except that the sequence of growth was reversed, that is, from crystal number nine to crystal number one. Comparison of figure 24-A and 24-B demonstrates the effect of opposite growth sequences on the textures produced.

The effect of crystal orientation on textures is demonstrated by figure 25. In figure 25-A, nine fluorite

crystals were nucleated instantaneously, the crystals' distribution is random, their orientation is regular, they have equal crystalloblastic forces, and the growth rate is such that $d\text{Radius}/d\text{Time}=1.0$.

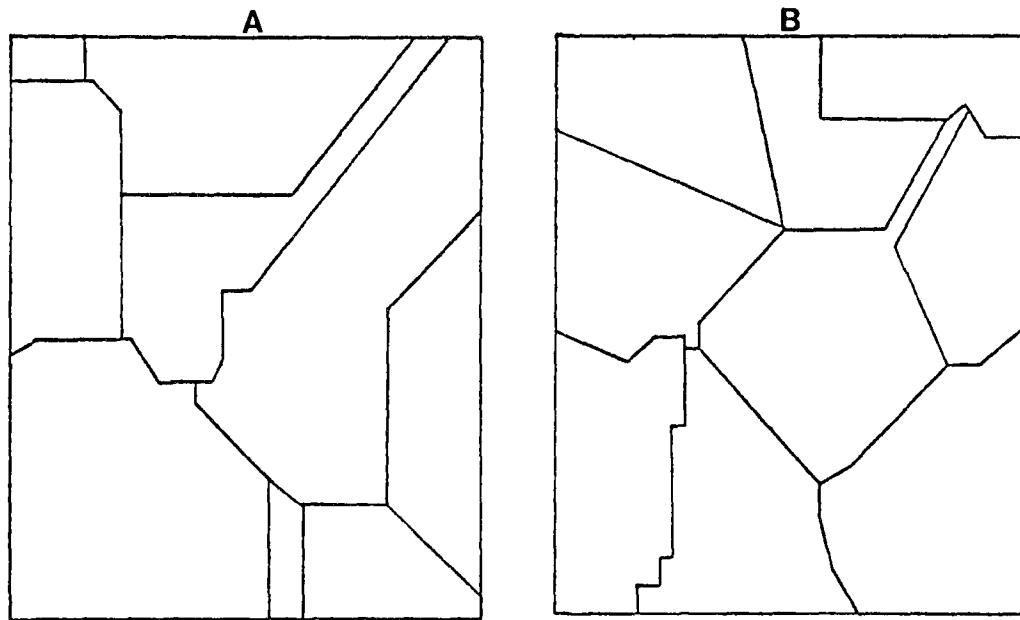


Figure 25:

Effect of crystal orientation on the formation of textures. A: Regular orientation, and B: Random orientation.

In figure 25-B, the same conditions (including growth sequence) were used except that the crystals' orientation is completely random. Comparison of figures 25-A and 25-B illustrates the difference in the textures produced by regularly and randomly oriented crystals.

The effect of a different number of nuclei is illustrated in figure 26. In figure 26-A, nine fluorite crystals were nucleated instantaneously, using randomly

distributed sites and random orientation.

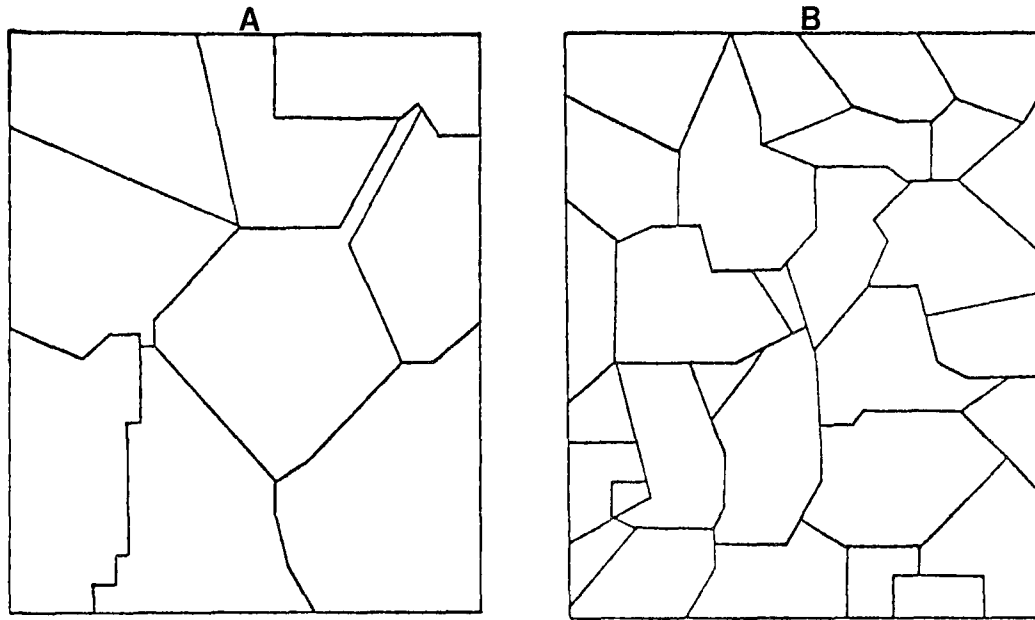


Figure 26:

Effect of a different number of nuclei on the formation of textures. A: Nine fluorite crystals, and B: Fifty fluorite crystals.

These were allowed to grow with a rate such that $d\text{Radius}/d\text{Time}=1.0$, and with equal crystalloblastic forces. The same conditions were used in figure 26-B, except that in this case, fifty fluorite nuclei were used. The use of a larger number of nuclei within an equivalent size of space necessarily implies that their average grain size will be smaller. This explains why not all fifty crystals are visible on the plane of intercept.

Finally, the effects of different crystalloblastic forces and different nucleation rates are illustrated by figure 27.

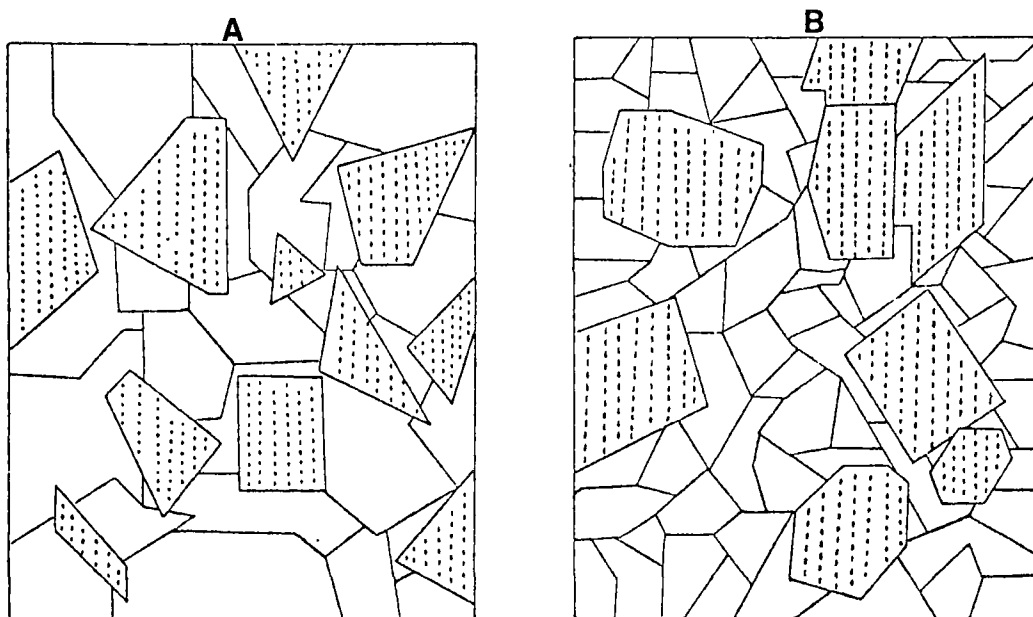


Figure 27:

Effects of different crystalloblastic forces and different nucleation rates on the formation of textures.

In figure 27-A, the conditions of crystallization used are as follows: fifty fluorite crystals were allowed to nucleate instantaneously and to grow with identical rates. A stronger tendency towards the development of faces was attributed to some of them (dotted crystals). In figure 27-B, nucleation has taken place in two steps. First, nine plagioclase crystals (dotted) were allowed to nucleate with random sites and orientations, and to grow with a strong tendency towards the development of faces. These were allowed to grow through seven growth cycles before random nucleation of 100 other plagioclase crystals took place. These last crystals developed using an equal tendency towards the development of

faces.

5-5. Evaluation of the Simulation.

Some preliminary applications of the simulation yield promising results. A change in initial conditions appears to alter the visual aspect of the textures produced.

The major problem associated with this method seems to be the unavoidable sequential nature of the simulated growth, the effects of which are illustrated by figure 24. It is possible that this approach may fail in the simulation of the formation of textures guided by less contrasting conditions than those used above.

A problem encountered at this point is the lack of standard means of measuring textures from a descriptive point of view. Most of the analysis used routinely in the study of rock's textures (point counting, mineral distribution and orientation) are designed at reaching an understanding of what is, in this case, used as known initial parameters. To compare the results of the simulation with naturally occurring textures, purely descriptive means should be used but do not seem to be readily available.

CONCLUSIONS

The results obtained with MODULE-1 indicate that the method is flexible, efficient and precise in transforming crystallographic to Cartesian data. It appears that this program fulfills a useful role, both from an illustrative point of view, and in providing a means to describe and work with crystals, if these can be assumed to be convex polyhedra.

The development of MODULE-2, a program designed to simulate the growth of single crystals, led to the use of space simulating matrices as a means of recreating the theoretical crystal models. This represents a turning point in the development of the over-all simulation model. It is certainly a most convenient and useful way of recording the development of crystals and the formation of textures. However, it seems that the imprecision inherent in this method imposes a very serious drawback on its use: below a critical crystal size, the imprecision present in the representation of interfaces renders their interpretation very difficult. The author now feels that some work should be directed to develop other means of recording the formation of textures, possibly by using systems of Cartesian general equations without having to recreate the

theoretical models.

MODULE-3 nevertheless demonstrates that the method can be applied to simulate the formation of crystalline textures using different starting parameters for the number of nuclei, their orientation and distribution, their rate of nucleation, and the type of crystalline interactions. Comparison of simulated and natural textures is difficult due to the lack of quantitative descriptive methods. Nevertheless, a preliminary visual observation of the results obtained with MODULE-3 suggests that the method could be used to predict the type of textures that would arise under different crystallization conditions.

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APPENDICES.

APPROXIMATE

Listing of the Computer Program for the
Cartesian Translation of Crytallographic Data, Module 1.

```

C
C      B F G I N N I N G   O F   M A I N   .
C
      INTIAL N(10),H(10,50),K(10,50),L(10,50),M(10,50),O,P,Q,R,S,T,U,CO A 1
      UNITS(20),SCALEF(HU)/80**100/ A 2
      RFAL X(100),Y(100),Z(100),D(100),X1(2000),X2(2000),X3(2000),Y1(200 A 3
      10),Y2(2000),Y3(2000),X4(500),X5(500),X6(500),COFO(10) A 4
      DATA Y59/Y1/ A 5
      DIFFUSION HEADER(2,80) A 6
      KLAT(5,130,END=68)A43 A 7
      IF (A43.EQ.Y59) GO TO 1 A 8
68  I46=7 A 9
      GO TO 2 A 10
      I46=2 A 11
2   WRITE (I46,31) A 12
      WRITE (3,36) A 13
      WRITE (3,37) A 14
C   ***** A 15
C   ** A 16
C   ** READING OF THE NUMBER OF CRYSTALS TO BE DEFINED, OF TWO ** A 17
C   ** COMMENT CARDS PER CRYSTAL, (H*ADFF), OF THE CRYSTALLOGRA- ** A 18
C   ** PHIC SYSTEM OF EACH CRYSTAL, N2-1-ISO, 2=TRICK, 1=OPTHO, ** A 19
C   ** 4=HICIA, 5=MONO, 6=TRICIL, OF THE NUMBER OF FORMS OF THE ** A 20
C   ** CRYSTAL (14), OF THE AXIAL LENGTHS, OF THE INTER-AXIAL ** A 21
C   ** ANGLES WHEN PRESENT, OF THE NUMBER OF INDICES PER FORM ** A 22
C   ** N(1), THE COMBINATION INDEX OF THE FORMS AND THE MILLER ** A 23
C   ** INDICES OF THE FACES. OPTIONAL PRINTOUT OF THE ** A 24
C   ** ABOVE DATA. BRANCHING TO THE PROPER CONVERSION ** A 25
C   ** SUBROUTINE FOR EACH CRYSTAL, ACCORDING TO ITS SYSTEM. ** A 26
C   ** A 27
C   ***** A 28
      RFAD (5,44) (PRIVE(1),I=1,15) A 29
      READ (1,38) N1 A 30
      AB=0.005 A 31
      IB=1 A 32
      IA=(FIX(SORT(FLOAT(N1))+0.9999)) A 33
      WRITE (I46,32) IA,IA,IB A 34
      WRITE (I46,33) A 35
      WRITE (I46,34) A 36
      WRITE (I46,35) AB A 37
      DO 29 LI=1,N1 A 38
      READ (1,39) ((HEADER(I,J),I=1,2),J=1,80) A 39
      IF (PRIVE(1).EQ.1) WRITE (3,40) ((HEADER(I,J),I=1,2),J=1,80) A 40
      READ (1,38) N2 A 41
      IF (N2.EQ.1) GO TO 3 A 42
      IF (N2.EQ.2) GO TO 5 A 43
      IF (N2.EQ.3) GO TO 7 A 44
      IF (N2.EQ.4) GO TO 9 A 45
      IF (N2.EQ.5) GO TO 11 A 46
      IF (N2.EQ.6) GO TO 13 A 47
      WRITE (3,41) N2 A 48
      GO TO 29 A 49
3   READ (1,38) N4 A 50
      IF (PRIVE(2).EQ.1) WRITE (3,42) N4 A 51
      DO 4 I=1,N4 A 52
      READ (1,43) N(I),COFO(I) A 53
      KLN=N(I) A 54
      READ (1,44) (H(I,J),K(I,J),L(I,J),J=1,KLN) A 55
      *****
4   CONTINUE A 56
      CALL IFO (N4,N,COFO,H,K,L,X,Y,Z,N3) A 57
      GO TO 15 A 58
5   READ (1,43) N4,ALC A 59
      IF (PRIVE(2).EQ.1) WRITE (3,45) ALC,N4 A 60
      DO 6 I=1,N4 A 61
      RFAD (1,43) N(I),COFO(I) A 62
      KLN=N(I) A 63
      READ (1,44) (H(I,J),K(I,J),L(I,J),J=1,KLN) A 64
      CONTINUE A 65
      CALL TETRA (N4,ALC,N,COFO,H,K,L,X,Y,Z,N3) A 66
      GO TO 15 A 67
7   READ (1,46) N4,ALA,ALB,ALC A 68
      IF (PRIVE(2).EQ.1) WRITE (3,47) ALA,ALB,ALC,N4 A 69
      DO 8 I=1,N4 A 70
      RFAD (1,43) N(I),COFO(I) A 71
      KLN=N(I) A 72
      READ (1,44) (H(I,J),K(I,J),L(I,J),J=1,KLN) A 73
      CONTINUE A 74
      CALL CATHO (N4,ALA,ALB,ALC,N,COFO,H,K,L,X,Y,Z,N3) A 75
      GO TO 15 A 76
9   READ (1,43) N4,ALC A 77
      IF (PRIVE(2).EQ.1) WRITE (3,48) ALC,N4 A 78
      DO 10 I=1,N4 A 79
      RFAD (1,43) N(I),COFO(I) A 80
      KLN=N(I) A 81
      READ (1,44) (H(I,J),K(I,J),L(I,J),J=1,KLN) A 82
      CONTINUE A 83
      CALL HEXA (N4,ALC,N,COFO,H,K,L,X,Y,Z,N3) A 84
      GO TO 15 A 85
11  READ (1,49) N4,ALA,ALB,ALC,BETA A 86
      IF (PRIVE(2).EQ.1) WRITE (3,50) ALA,ALB,ALC,BETA,N4 A 87
      DO 12 I=1,N4 A 88
      RFAD (1,43) N(I),COFO(I) A 89
      KLN=N(I) A 90
      RFAD (1,44) (H(I,J),K(I,J),L(I,J),J=1,KLN) A 91
      CONTINUE A 92
      CALL OCTO (N4,ALA,ALB,ALC,BETA,N,COFO,H,K,L,X,Y,Z,N3) A 93
      GO TO 15 A 94
13  READ (1,51) N4,ALA,ALB,ALC,ALPHA,BETA,GAMMA A 95
      IF (PRIVE(2).EQ.1) WRITE (3,52) ALA,ALB,ALC,ALPHA,BETA,GAMMA A 96
      IF (PRIVE(2).EQ.1) WRITE (3,53) N4 A 97
      DO 14 I=1,N4 A 98
      RFAD (1,43) N(I),COFO(I) A 99
      KLN=N(I) A 100
      RFAD (1,44) (H(I,J),K(I,J),L(I,J),J=1,KLN) A 101
      CONTINUE A 102
      CALL TRICIL (N4,ALA,ALB,ALC,ALPHA,BETA,GAMMA,N,COFO,H,K,L,X,Y,Z,N3) A 103
      GO TO 15 A 104
15  IF (PRIVE(1).EQ.1) WRITE (3,54) N3 A 105
      IF (PRIVE(4).EQ.1) WRITE (3,55) A 106
      IF (N2.EQ.4) GO TO 17 A 107
      DO 16 I=1,N4 A 108
      KLN=N(I) A 109
      IF (PRIVE(4).EQ.1) WRITE (3,56) (H(I,J),K(I,J),L(I,J),J=1,KLN) A 110
      CONTINUE A 111
      GO TO 19 A 112
17  DO 18 I=1,N4 A 113
      KLN=N(I) A 114
      IF (PRIVE(4).EQ.1) WRITE (3,57) (H(I,J),K(I,J),L(I,J),J=1,KLN) A 115
      CONTINUE A 116
18  CONTINUE A 117

```

Apdx. 1-a, p. 2

Apdx. 1-a, p. 1

```

19  IF (PRIVE(1).EQ.1) WRITE (3,60)
    IF (PRIVE(15).EQ.1) WRITE (2,61) ('P/C/F(I),I=1,N3)
    IF (1:VI(1).EQ.1) WRITE (1,10) (X(I),Y(I),Z(I),I=1,N3)
    IF (P:VI(5).EQ.1) WRITE (3,64) (X(I),Y(I),Z(I),I=1,N3)
    IF (PRIVE(6).EQ.1) WRITE (3,60)
C .....
C **
C ** DETERMINATION OF THE LOCATIONS OF THE VERTICES BY
C ** SYSTEMS OF MATRICES.
C **
C .....
C DO 20 I=1,N3
  D(I)=1.0
20  CONTINUE
  I1I=1
  J1I=1
  J1I=1
  K1=N3-2
  DO 28 O=1,K1
    A1=X(O)
    B1=Y(O)
    C1=Z(O)
    D1=X(O)
    P=N3-1
    Q=O+1
    DO 27 Z=Q,K
      A2=X(Z)
      B2=Y(Z)
      C2=Z(Z)
      D2=D(Z)
      S=R+1
    DO 26 T=S,N3
      A3=X(T)
      B3=Y(T)
      C3=Z(T)
      D3=D(T)
      DET=((A1)*(B2*C3-C2*B3)-(B1)*(A2*C3-C2*A3)+(C1)*(A2*B3-B2*A3))
      IF (ABS(DET).LT.0.0001) GO TO 26
      X1(I1I)=((D1*(B2*C3-C2*B3)-B1*(D2*C3-C2*D3)+C1*(D2*B3-B2*D3))/DET)
      X2(I1I)=((A1*(D2*C3-C2*D3)-D1*(A2*C3-C2*A3)+C1*(A2*D3-D2*A3))/DET)
      X3(I1I)=((A1*(B2*D3-D2*B3)-B1*(A2*D3-D2*A3)+D1*(A2*B3-B2*A3))/DET)
C .....
C **
C ** VERIFICATION OF THE REALITY OF THE VERTICES
C ** ONLY THOSE OF THE INNER SHAPE ARE RETAINED.
C ** RETAINED.
C **
C .....
C DO 21 I=1,N3
  IF ((X1(I1I)*X1(I)+X2(I1I)*Y1(I)+X3(I1I)*Z1(I)).GT.1) GO TO 24
21  CONTINUE
  IF (I1I.EQ.1) GO TO 23
  JB=J1I-1
C .....
C **
C ** FILTERING OF THE VERTICES TO AVOID REPETITIONS.
C **
C .....
C DO 22 II=1,JB
  IF ((ABS(X1(I1I)-X1(II)) .LT. 0.0001 .AND. (ABS(Y2(I1I)-Y2(II)) .LT. 0
1.0001 .AND. (ABS(X3(I1I)-X3(II)) .LT. 0.0001) GO TO 25
22  CONTINUE

```

Apdx. 1-a, p. 4

```

23  IF (PRIVE(6).EQ.1) WRITE (3,61) X1(I1I),X2(I1I),X3(I1I)
    X4(J1I)=X1(I1I)
    X5(J1I)=X2(I1I)
    X6(J1I)=X3(I1I)
    J1I=J1I+1
    Y1(J1I)=X1(I1I)
    Y2(J1I)=X2(I1I)
    Y3(J1I)=X3(I1I)
    J1I=J1I+1
    I1I=I1I+1
24  CONTINUE
25  CONTINUE
26  CONTINUE
27  CONTINUE
28  CONTINUE
    JA=J1I-1
C .....
C **
C ** SUBROUTINE PLOT, X,Y,Z,=COEFFICIENTS OF THE
C ** EQUATIONS OF THE FACES, N3=NUMBER OF FACES, X4,X5,X6=3D
C ** COORDINATES OF THE CRYSTAL VERTICES, JA= NUMBER OF
C ** VERTICES PER CRYSTAL.
C **
C .....
C CALL PLOT (PRIVE,X,Y,Z,N3,X4,X5,X6,JA,I46)
CONTINUE
29  WRITE (3,62)
    STOP
C .....
130  FORMAT (A1)
30  FORMAT (3F10.4)
31  FORMAT ('PAGE')
32  FORMAT ('P',3I5)
33  FORMAT (' ')
34  FORMAT ('TOLERANCE')
35  FORMAT (F10.4)
36  FORMAT ('1',29('/',50X,' BEGINNING OF OPERATIONS.))
37  FORMAT ('1', ' ')
38  FORMAT (I3)
39  FORMAT (80A1)
40  FORMAT ('1',T30,80A1/T30,80F1)
41  FORMAT ('1',10X,'IFPOR : M2 OR '14,4X,' IS AN IMPOSSIBLE INDICATO
    TP FOR THE CRYSTALLOGRAPHIC SYSTEM.')
42  FORMAT ('0',//,' ISOTROPIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90,
    CRYSTAL COMPOSED OF '13,2X,' FORM(S).')
43  FORMAT (I1,F10.4)
44  FORMAT (40I2)
45  FORMAT ('0',//,' TETRAGONAL SYSTEM: A=B<C=1:1:1, F10.4,3X, ' ALPHA=B
    ETAG=90, CRYSTAL COMPOSED OF '13,2X,' FORM(S).')
46  FORMAT (I1,F10.4)
47  FORMAT ('0',//,' ORTHORHOMBIC SYSTEM : A:B<C=F10.4, ' F10.4, '
    '1,F10.4, ' ALPHA=BETA=GAMMA=90, CRYSTAL COMPOSED OF '13,2X,' FORM(
    2S).')
48  FORMAT ('0',//,' HEXAGONAL SYTEM : A1:A2:A3=C=1 1:1,F10.4, '
    '1ALPHA=BETA=GAMMA=90, CRYSTAL COMPOSED OF '13,2X,' FORM(2).')
49  FORMAT (I3,4F10.4)
50  FORMAT ('0',//,' MONOCLINIC SYSTEM : A:B<C=F10.4, ' F10.4, ' F
    110.4, ' ALPHA GAMMA=90, BETA=F10.4, ' CRYSTAL COMPOSED OF '13,
    2F10.4, ' ')
51  FORMAT (I1,4F10.4)
52  FORMAT ('0',//,' TRICLINIC SYTEM, A:B:C=F10.4, ' F10.4, ' F1
    10.4,3X, ' ALPHA=F10.4,2X, ' BETA=F10.4,2X, ' GAMMA=F10.4)

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53 FORMAT ('0',///,' CRYSTAL COMPOUND OF ',I3,X,' FORM(S).') A 241
54 FORMAT ('-',///,'10X,' NUMBER OF FACTS OF MILLER INDICES ',I10) A 242
55 FORMAT ('-',///,'10X,' GIVEN MILLER INDICES :') A 243
56 FORMAT ('0',///,'4X,3I10) A 244
57 FORMAT ('0',///,'40X,4I10) A 245
58 FORMAT ('-',///,'39X,' THE CARTESIAN EQUATIONS OF THE CRYSTAL'S A 246
  1FACE ARE :') A 247
59 FORMAT ('-',///,'40X,F10.4,' X = ',F10.4,' Y = ',F10.4,' Z = 1 ') A 248
60 FORMAT ('-',///,'40X,'THE CRYSTAL VERTICES ARE LOCATED AT:') A 249
61 FORMAT ('-',///,'30X,' (' ,3I20.4 ,10X,') ') A 250
62 FORMAT ('-',///,'20 (/),46X,' NORMAL ENDING OF OPERATIONS. ') A 251
63 FORMAT (A0A1) A 252
  END A 253-

```

C SUBROUTINE PLOT .

```

C SUPROUTINE PLOT (PRIVE,D,E,F,N3,A,B,C,N,T96) B 1
C DATA DL,' ',5,'*',///,'0',///,'V',///,'STAR',///,'YA',///,'Y',///,'P',///,'ZA',///,'Z',/// B 2
C DIMENSION Y1(6000), Z2(6000), RUFFSR(133) B 3
C REAL X5(500), X6(500), X7(500), X1(500), X2(500), X3(500), A(500), B(500) B 4
C 1,C(500), Y(3000), Z(3000), D(100), E(100), F(100) B 5
C MAX=0 B 6
C MIN=0 B 7
C CONVAC=0.0 B 8
C TRIFAC=0.0 B 9
C VPAC=0.0 B 10
C YMAX=0.0 B 11
C ***** B 12
C ** B 13
C ** SEARCH FOR THE MAXIMUM VALUE OF THE VERTICES LOCATIONS. ** B 14
C ** DETERMINATION OF A CONVERSION FACTOR (TRIFAC), FOR 'VIEW ** B 15
C ** PLOT'. ** B 16
C ** ** B 17
C ***** B 18
C DO 1 KK=1,N B 19
C YMAX=AMAX1(ABS(A(KK)),ABS(B(KK)),ABS(C(KK)),YMAX) B 20
C CONTINUE B 21
C TRIFAC=900.0/YMAX B 22
C LALI=1 B 23
C J1=1 B 24
C J2=N-1 B 25
C J4=1 B 26
C J5=N3-1 B 27
C ***** B 28
C ** B 29
C ** SEARCH FOR VERTICES FORMING EDGES: 2 VERTICES IN 2 PLANES ** B 30
C ** AT THE SAME TIME, STORING OF THESE VERTICES AND THEIR ** B 31
C ** INDICES X1,X2,X3,X4 . ** B 32
C ** ** B 33
C ***** B 34
C DO 6 I=J1,J2 B 35
C J3=I+1 B 36
C DO 5 II=J3,N B 37
C DO 4 III=J4,J5 B 38
C J6=III+1 B 39
C DO 3 IIII=J6,N3 B 40
C IF (ABS(A(I)*D(IIII)+B(I)*E(IIII)+C(I)*F(IIII)-1.0).LT.0.0001.AND.ABS B 41
C 1(A(I)*D(IIII)+B(I)*E(IIII)+C(I)*F(IIII)-1.0).LT.0.0001.AND.ABS(A(I) B 42
C 2I)*D(IIII)+B(II)*E(IIII)+C(II)*F(IIII)-1.0).LT.0.0001.AND.ABS(A(II)*D B 43
C 3(IIII)+B(II)*E(IIII)+C(II)*F(IIII)-1.0).LT.0.0001) GO TO 2 B 44
C GO TO 3 B 45
C ***** B 46

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```

2 X1(LALI)=A(I) B 47
  X2(LALI)=B(I) B 48
  X3(LALI)=C(I) B 49
  X4(LALI)=I B 50
  LALI=LALI+1 B 51
  X1(LALI)=A(II) B 52
  X2(LALI)=B(II) B 53
  X3(LALI)=C(II) B 54
  X4(LALI)=II B 55
  LALI=LALI+1 B 56
3 CONTINUE B 57
4 CONTINUE B 58
5 CONTINUE B 59
6 CONTINUE B 60
  N=LALI-1 B 61
  IF (PPIVE(7).EQ.1) WRITE (3,60) B 62
  IF (PPIVE(7).EQ.1) WRITE (3,61) (X1(L),X2(L),X3(L),L=1,N) B 63
  IF (PRIVE(6).EQ.1) WRITE (3,62) YMAX,TRIFAC B 64
  ***** B 65
  ** B 66
  ** CALIBRATION OF THE 3D COORDINATES OF EACH CRYSTAL'S S ** B 67
  ** VERTICES, OPTIONAL OUTPUT OF INFO FOR 'VIEWPLOT'. ** B 68
  ** ** B 69
  ***** B 70
  DO 7 I=1,N B 71
  X5(I)=A(I)*TRIFAC B 72
  X6(I)=B(I)*TRIFAC B 73
  X7(I)=C(I)*TRIFAC B 74
  CONTINUE B 75
7 IF (PPIVE(9).EQ.1) WRITE (3,63) B 76
  IF (PPIVE(9).EQ.1) WRITE (3,64) (X5(I),X6(I),X7(I),I=1,N) B 77
  WRITE (I46,45) B 78
  WRITE (I46,46) (X5(I),X6(I),X7(I),I=1,N) B 79
  WRITE (I46,47) B 80
  IF (PPIVE(10).EQ.1) WRITE (3,65) B 81
  IF (PPIVE(10).EQ.1) WRITE (3,66) (X4(I),I=1,N) B 82
  WRITE (I46,48) B 83
  WRITE (I46,49) (X4(I),I=1,N) B 84
  WRITE (I46,50) B 85
  WRITE (I46,51) B 86
  IF (PPIVE(11).EQ.1) WRITE (3,67) B 87
  KK=1 B 88
  ***** B 89
  ** B 90
  ** CYCLIC ORDERING OF VERTICES, LISTING OF ALL VERTICES ** B 91
  ** PER FACET AND STORAGE OF THEIR INDICES. ** B 92
  ** ** B 93
  ***** B 94
  DO 16 I=1,N3 B 95
  VP=1 B 96
  DO 9 V=1,N B 97
  IF (ABS(D(I)*A(K)+E(I)*B(K)+F(I)*C(V)-1.0).LT.0.0001) GO TO 8 B 98
  GO TO 9 B 99
8 X1(VV)=K B 100
  K=VV+1 B 101
  CONTINUE B 102
  LI=VK-1 B 103
  X1(LI)=X0(LI) B 104
  X1(LI)=0 B 105
  JJ=1 B 106
  11=2 B 107
  CONTINUE B 108

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DC 12 JK=1,N,2
IF (AY(JJ)+EQ.X4(JK).AND.X8(II).EQ.X4(JK*1).OR.AY(JJ)+EQ.X4(JK*1).
1AIP.V4(II).I3.X4(JK)) GO TO 15
12 CONTINUE
13 II=II+1
IF (II.GT.LL) GO TO 14
IF (X8(II).EQ.0) GO TO 13
GO TO 11
14 WRITE (J,60)
RETURN
15 JJ=JJ+1
AY(JJ)+X8(II)
X8(II)=0
IF (JJ.LT.LL) GO TO 10
IF (KL.GT.14) KL=14
IF (PRIVE(11).EQ.1) WRITE (3,69) (AY(KL),KL=1,LL)
WRITE (146,52) (AY(KL),KL=1,LL)
16 CONTINUE
WRITE (146,53)
WRITE (146,54)
WRITE (146,55)
WRITE (146,56)
WRITE (146,57)
WRITE (146,58)
WRITE (146,59)
*****
C **
C ** BEGINNING OF THE GRAPHICAL TREATMENT 'PRINTER' VERSION.
C ** 1: TRIGONOMETRIC CONVERSION OF CRYSTALVERTICES.
C ** 2: SEARCH FOR THE MAXIMUM.
C ** 3: CALIBRATION OF COORDINATES TO FILL 1 PAGE PER
C ** GFAPH, USING THE 'PRINTFB' VFFSION.
C ** 4: ORDERING OF VERTICES FORMING EDGES.
C ** 5: SEARCH FOR INTERMEDIATE POINTS ON EDGES.
C ** 6: PLANAR PROJECTION WITH ROTATION TO PRODUCE THE ANGLE OF
C ** SIGHT.
C **
*****
C DO 18 I=1,N
C IF (X1(I).EQ.0.AND.X2(I).EQ.0.AND.X3(I).EQ.0) GO TO 17
X1(I)=(X1(I)+0.4166)
Y(I)=(X2(I)+(-X1(I)*0.9063))
Z(I)=(X3(I)+(-X1(I)*0.4226))
GO TO 18
17 Y(I)=0.0
Z(I)=0.0
18 CONTINUE
h=N
***** 2 *****
C DO 19 I=1,N
VMAX=AMAX1 (ABS (Y(I)),ABS (Z(I)),VMAX)
19 CONTINUE
CCNFAC=18.0/VMAX
IF (PFIVE(12).EQ.1) WRITE (3,70) VMAX,CONFAC
***** 3 *****
C DO 20 I=1,N
Y(I)=Y(I)*CONFAC
Z(I)=Z(I)*CONFAC
20 CONTINUE
IF (PRIVE(13).EQ.1) WRITE (3,71)
IF (PRIVE(13).EQ.1) WRITE (3,72) (Y(I),Z(I),I=1,N)

```

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```

C IF (PFIVE(14).EQ.0) RETURN
***** 4 *****
C KI=1
DO 26 I=1,N,2
J=I+1
IM=Y(I)
IN=Y(J)
LM=Z(I)
LN=Z(J)
ML=Z(J)
IF (LM.EQ.PL) GO TO 23
IF (LN.LT.NL) GO TO 21
NM=LM
IM=NL
ML=NM
21 CONTINUE
H=FLOAT(LM)
H=H+1.0
Z1=H
***** 5 *****
C Y1=(Y(J)-Y(I))*Z1-(Y(J)*Z(I)-Y(I)*Z(J))/(Z(J)-Z(I))
YY(I)=Y1
ZZ(KI)=Z1
KI=KI+1
IF (H.LT.FLOAT(NL-1)) GO TO 22
YY(KI)=Y(I)
YY(KI+1)=Y(J)
ZZ(KI)=Z(I)
ZZ(KI+1)=Z(J)
KI=KI+2
GO TO 26
23 IF (IN.LT.IN) GO TO 24
IM=IN
IN=IM
24 CONTINUE
K=FLOAT(IM)
K=K+1.0
Y1=K
Z1=Z(I)
YY(KI)=Y1
ZZ(KI)=Z1
KI=KI+1
IF (Y.LT.FLOAT(IN-1)) GO TO 25
YY(KI)=Y(I)
YY(KI+1)=Y(J)
ZZ(KI)=Z(I)
ZZ(KI+1)=Z(J)
KI=KI+2
25 CONTINUE
KI=KI-2
***** 6 *****
C DO 27 MH=1,KI
Y(MH)=YY(MH)+0.5
Z(MH)=ZZ(MH)+0.5
27 CONTINUE
WRITE (3,73)
TT=(45*3.141593)/180
T={TAN(TT)+1.7}
N=KI
DO 28 I=1,N
MAX=MAX1 (Z(I),FLOAT(MAX))
MIN=MIN1 (Z(I),FLOAT(MIN))

```



```

C      S U B R O U T I N E   O R T H O   .
C
C      SUBROUTINE ORTHO (N4,ALA,ALB,ALC,N,COFO,H,K,L,X,Y,Z,N3)
C      ..
C      **
C      **      TREATMENT OF ORTHORHOMBIC DATA.
C      **
C      ** ALA,ALB,ALC = AXIAL LENGTHS OF A, B AND C RESPECTIVELY.
C      **      + L(I,J) / ALC = Z(KK) .
C      **
C      **      C
C      **

```

[illegible][illegible]

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C      **                               Apdx. 1-a, p. 26
C      **                               ** F 26
C      **                               ** F 27
C      **                               ** F 28
C      **                               ** F 29
C      .....
1  INT1=1, R(10), A(10,50), H(10,50), C(10,50), D(10,50)
2  REAL X(100), Y(100), Z(100), COFO(10), H(10,50), R(10,50), L(10,50), R(10
3  1,50)
4  A(1,0)=1.04719
5  KK=1
6  DO 2 I=1,N4
7  KLM=N(I)
8  DO 1 J=1,KLM
9  H(I,J)=(FLOAT(A(I,J)))/(COFO(I))
10 K(I,J)=(FLOAT(B(I,J)))/(COFO(I))
11 L(I,J)=(FLOAT(C(I,J)))/(COFO(I))
12 M(I,J)=(FLOAT(D(I,J)))/(COFO(I)*ALC)
13 CONTINUE
14 CONTINUE
15 DO 20 I=1,N4
16 KLM=N(I)
17 DO 24 J=1,KLM
18 IF ((ABS(H(I,J)))-LT.0.0001) GO TO 3
19 CAP=1/((H(I,J))
20 CAP=1/((-H(I,J))
21 IF ((ABS(K(I,J)))-LT.0.0001) GO TO 4
22 CBP=1/((K(I,J))
23 CBP=1/((-K(I,J))
24 IF ((ABS(L(I,J)))-LT.0.0001) GO TO 5
25 CCP=1/((L(I,J))
26 CCP=1/((-L(I,J))
27 IF (H(I,J)*K(I,J)+L(I,J)*M(I,J)) GO TO 6
28 IF (H(I,J)-EQ.0.AND.K(I,J)-EQ.0.AND.L(I,J)-EQ.0) GO TO 8
29 IF (H(I,J)-GT.0.AND.K(I,J)-GT.0.AND.L(I,J)-LT.0) GO TO 9
30 IF (H(I,J)-GT.0.AND.K(I,J)-LT.0.AND.L(I,J)-GT.0) GO TO 10
31 IF (H(I,J)-LT.0.AND.K(I,J)-GT.0.AND.L(I,J)-GT.0) GO TO 14
32 IF (H(I,J)-GT.0.AND.K(I,J)-LT.0.AND.L(I,J)-LT.0) GO TO 15
33 IF (H(I,J)-LT.0.AND.K(I,J)-GT.0.AND.L(I,J)-LT.0) GO TO 16
34 IF (H(I,J)-LT.0.AND.K(I,J)-LT.0.AND.L(I,J)-GT.0) GO TO 20
35 IF (H(I,J)-EQ.0.AND.K(I,J)-GT.0.AND.L(I,J)-LT.0) GO TO 21
36 IF (H(I,J)-GT.0.AND.K(I,J)-EQ.0.AND.L(I,J)-LT.0) GO TO 22
37 IF (H(I,J)-GT.0.AND.K(I,J)-LT.0.AND.L(I,J)-EQ.0) GO TO 23
38 IF (H(I,J)-EQ.0.AND.K(I,J)-LT.0.AND.L(I,J)-GT.0) GO TO 24
39 IF (H(I,J)-LT.0.AND.K(I,J)-EQ.0.AND.L(I,J)-GT.0) GO TO 25
40 IF (H(I,J)-LT.0.AND.K(I,J)-GT.0.AND.L(I,J)-EQ.0) GO TO 26
41 WRITE (3,30) H(I,J),K(I,J),L(I,J),M(I,J)
42 GO TO 7
43 IF (3,31) H(I,J),K(I,J),L(I,J),M(I,J)
44 WRITE (3,32)
45 GO TO 28
46 X(KK)=0.0
47 GO TO 27
48 CALL FUN1 (ANGLE,CCN,CBP,AB)
49 X(KK)=(1/(CBP*TAN(AB)))
50 GO TO 27
51 IF (CAP-CCP) 11,12,13
52 CALL FUN1 (ANGLE,CAP,CBN,AB)
53 X(KK)=(1/(CBN*TAN(AB)))
54 GO TO 27
55 X(KK)=0.0
56 GO TO 27
57 CALL FUN1 (ANGLE,CCP,CBN,AB)
58 X(KK)=(-1/(CBN*TAN(AB)))
59

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		Apdx. 1-a, P. 14
	GO TO 27	F 88
14	CALL FU11 (ANGLE,CAN,CBP,AB)	F 89
	X(KK) = (-1/(CBP*TAN(AB)))	F 90
	GO TO 27	F 91
15	CALL FU11 (ANGLE,CAP,CBN,AB)	F 92
	X(KK) = (1/(CBN*TAN(AB)))	F 93
	GO TO 27	F 94
16	IF (CAN-CCN) 17,18,19	F 95
17	CALL FU11 (ANGLE,CCN,CBP,AB)	F 96
	X(KK) = (1/(CBP*TAN(AB)))	F 97
	GO TO 27	F 98
18	X(KK) = 0.0	F 99
	GO TO 27	F 100
19	CALL FU11 (ANGLE,CAN,CBP,AB)	F 101
	X(KK) = (-1/(CBP*TAN(AB)))	F 102
	GO TO 27	F 103
20	CALL FU11 (ANGLE,CCP,CBN,AB)	F 104
	X(KK) = (-1/(CBN*TAN(AB)))	F 105
	GO TO 27	F 106
21	X(KK) = (1/(CBP*1.7321))	F 107
	GO TO 27	F 108
22	X(KK) = (1/(CAP*0.866))	F 109
	GO TO 27	F 110
23	X(KK) = (1/(CBN*1.7321))	F 111
	GO TO 27	F 112
24	X(KK) = (-1/(CBN*1.7321))	F 113
	GO TO 27	F 114
25	X(KK) = (-1/(CAN*0.866))	F 115
	GO TO 27	F 116
26	X(KF) = (-1/(CBP*1.7321))	F 117
27	I(KF) = (K(I,J))	F 118
	Z(K) = (M(I,J))	F 119
	KK=KF+1	F 120
28	CONTINUE	F 121
29	CONTINUE	F 122
	NJ=KK-1	F 123
	RETURN	F 124
C		F 125
30	FORMAT ('0',/,/, ' EPICP : HEXAGONAL INDICES :',4I6,3X, ' ESCAPED ISO	F 126
	METRIC CONVERSION WITHOUT APPARENT PROSON.')	F 127
31	FORMAT ('0',/,/, ' EPICP : HEXAGONAL INDICES :',4I6,3X, ' ARE CRYSTAL	F 128
	LOGOGRAPHICALLY IMPOSSIBLE, BLUE H*K*L, H*O')	F 129
32	FORMAT ('0',/,/, ' THIS PAGE WILL NOT BE CONVERTED AND WILL NOT	F 130
	BE CONSIDERED AS PART OF THE CRYSTAL.')	F 131
	END	F 132

```

C      S U B R O U T I N E  M O N O .
C
C      SUBROUTINE MONO (N4,ALA,ALP,ALC,BFTA,N,COPO,AX,BX,CY,X,Y,Z,N3)
C      .....
C      **
C      **      TREATMENT OF MONOCLINIC DATA.
C      **
C      **      THE CRYSTAL SHAPE IS HERE DETERMINED IN A CARTESIAN SYSTEM
C      **      TAVING INTO ACCOUNT THE EFFECT OF THE ANGLE BFTA ( < BFTW
C      **      *A AND *C ), AND OF THE AXIAL LENGTHS OF A, B AND C ( ALA
C      **      ALB AND ALC RESPECTIVELY )
C      **
C      **      * 1 (I,J) / ALC = Z(KK) .
C      **
C      **      C
C      **
C      **      J
C      **
C      **      J-
C

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арх. 1-а, р. 10
с. 72

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                                apdx. 1 a, p. 17
29  GO TO 40                                G 119
30  I = (A A1-1.570795) 30,11,32          G 140
    X(KK) = (-1/(CCP*COS(ARC)))            G 141
    GO TO 40                                G 142
31  X(KK) = 0.0                            G 143
    GO TO 40                                G 144
32  X(KK) = (1/(CCP*TAN(ARC)))              G 145
    GO TO 40                                G 146
33  X(KK) = 0.0                            G 147
    Y(KK) = (K(I,J))                       G 148
    Z(KK) = 0.0                            G 149
    GO TO 41                                G 150
34  AA=ARCS(BRAD-1.570795)                 G 151
    I(KK) = (1/(CAP*COS(AA)))               G 152
    GO TO 41                                G 153
35  IF (B*AD-1.570795) 36,37,38           G 154
36  I(KK) = (1/(CCN*TAN(BRAD)))             G 155
    GO TO 40                                G 156
37  X(KK) = 0.0                            G 157
    GO TO 40                                G 158
38  X(KK) = (-1/(CCN*TAN(ARC)))             G 159
    GO TO 40                                G 160
39  AA=ARCS(BRAD-1.570795)                 G 161
    X(KK) = (-1/(CAN*COS(AA)))              G 162
    Y(KK) = (A(I,J))                       G 163
    Z(KK) = (L(I,J))                       G 164
41  KK=KK+1                                G 165
42  CONTINUE                                G 166
43  CONTINUE                                G 167
    N3=KK-1                                G 168
    RETURN                                  G 169
C                                          G 170
C  FORMAT ('0',//,10X,' THE CRYSTAL WILL NOT BE CONVERTED.') G 171
44  FORMAT ('0',//,1X,' ERROR : DATA HERE =',F10.4,' IS OUTSIDE PERMISSIB G 172
45  THE LIMITS 1. - 0 TO 180 DEGREES.')    G 173
46  FORMAT ('0',//,1X,' ERROR : MONOCLINIC INDICES :',3F10.5,3X,' ESCAPED G 174
47  1 ISOMETRIC CONVERSION WITHOUT APPARENT PEAKS.') G 175
48  FORMAT ('0',//,1X,' ERROR : MONOCLINIC INDICES :',3F10.5,3X,' ARE CRY G 176
    STALLOGRAPHICALLY IMPOSSIBLE, HERE H, K AND L ARE ALL = 0.') G 177
49  FORMAT ('0',//,1X,' THIS FACE WILL NOT BE CONVERTED AND WILL NOT BE G 178
    1 CONSIDERED AS PART OF THE CRYSTAL.') G 179
    END                                    G 180-

C
C  SUBROUTINE TRICLI .
C
C  SUBROUTINE TRICLI (NU,ALA,ALB,ALC,ALPHA,BETA,GAMMA,N,COFO,AI,BX,CX H 1
    1,X,Y,Z,N3) H 2
C  ***** H 3
C  ** H 4
C  ** TREATMENT OF TRICLINIC DATA. H 5
C  ** H 6
C  ** THE CRYSTAL SHAPE IS RE-DETERMINED IN A CARTESIAN SYSTEM H 7
C  ** TAKING INTO ACCOUNT THE EFFECT OF ANGLES ALPHA ( < BETW H 8
C  ** +C AND +B ), BETA ( < BETW +C AND +A ), GAMMA ( < BETW +A H 9
C  ** +B AND +B ), AND OF THE AXIAL LENGTHS A,B, AND C ( ALA,ALB, H 10
C  ** AND ALC RESPECTIVELY ). H 11
C  ** * L(I,J) / ALC = Z(KK). H 12
C  ** C H 13
C  ** I H 14
C  ** I H 15
C  ** I H 16
C  ** I H 17

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                                apdx. 1-a, p. 18
C  ** H 18
C  ** H 19
C  ** H 20
C  ** H 21
C  ** H 22
C  ** H 23
C  ** H 24
C  ** H 25
C  ** H 26
C  ** H 27
C  ** H 28
C  ** H 29
C  ***** H 30
C  INTEGERS N(10),AX(10,50),BX(10,50),CX(10,50) H 31
C  REAL X(100),Y(100),Z(100),H(10,50),K(10,50),L(10,50),COFO(10) H 32
C  IF ((ALPHA+BETA+GAMMA).GT.360.0.OR.(ALPHA+BETA).LT.GAMMA.OR.(ALPHA H 33
    1+GAMMA).LT.BETA.OR.(BETA+GAMMA).LT.ALPHA) GO TO 1 H 34
C  GO TO 2 H 35
1  WRITE (3,221) ALPHA,BETA,GAMMA H 36
    WRITE (3,222) H 37
C  RETURN H 38
2  DO 4 I=1,N4 H 39
    KLM=4(I) H 40
    DO 3 J=1,KLM H 41
    H(I,J)=(FLOAT(AX(I,J)))/(ALA*COFO(I)) H 42
    K(I,J)=(FLOAT(BX(I,J)))/(ALB*COFO(I)) H 43
    L(I,J)=(FLOAT(CX(I,J)))/(ALC*COFO(I)) H 44
3  CONTINUE H 45
4  CONTINUE H 46
    IF (ABS(ALPHA-90.0000).LT.0.0001.AND.ABS(BETA-90.0000).LT.0.0001.A H 47
    1ND.ABS(GAMMA-90.0000).LT.0.0001) GO TO 5 H 48
    GO TO 8 H 49
5  KK=1 H 50
    DO 7 I=1,N4 H 51
    KLM=4(I) H 52
    DO 6 J=1,KLM H 53
    X(IJ)=H(I,J) H 54
    Y(IJ)=L(I,J) H 55
    Z(IJ)=L(I,J) H 56
    KK=IJ+1 H 57
6  CONTINUE H 58
7  CONTINUE H 59
    N3=KK-1 H 60
    RETURN H 61
8  CCL=3.14159 H 62
    APRC=(ALPHA*3.14159)/180.0 H 63
    BPRC=(BETA*3.14159)/180.0 H 64
    GPRC=(GAMMA*3.14159)/180.0 H 65
    A1GPM=(COS(CPRC)-COS(APRC)*COS(BPRC))/(SIN(APRC)*SIN(BPRC)) H 66
    G1GPM=(1/COS(ALC*H)) H 67
    AAC=(3.14159-APRC) H 68
    BPC=(3.14159-BPRC) H 69
    ACC=(3.14159-GPRC) H 70
    AGC=(3.14159-GAMMA) H 71
    KY=1 H 72
    DO 220 I=1,N4 H 73
    KLM=4(I) H 74
    DO 210 J=1,KLM H 75
    IF ((ABS(H(I,J)).LT.0.0001) GO TO 9 H 76
    CAP=1/(H(I,J)) H 77
    CAN=1/(-H(I,J)) H 78
9  IF ((ABS(K(I,J)).LT.0.0001) GO TO 10 H 79

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      CCP=1/(K(I,J))
      CHA=1/(-F(I,J))
10  IF ((JH-1(I(I,J)))-17*0.0001) GO TO 11
      CCP=1/(I(I,J))
      CHA=1/(-1(I,J))
11  IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-F(I,J)) GO TO 12
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-G(I,J)) GO TO 15
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-L(I,J)) GO TO 53
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-LT(I,J)) GO TO 61
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-GT(I,J)) GO TO 69
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-GT(I,J)) GO TO 77
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-GT(I,J)) GO TO 85
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-LT(I,J)) GO TO 93
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-LT(I,J)) GO TO 101
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-GT(I,J)) GO TO 109
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-F(I,J)) GO TO 117
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-F(I,J)) GO TO 118
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-L(I,J)) GO TO 122
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-L(I,J)) GO TO 130
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-F(I,J)) GO TO 131
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-F(I,J)) GO TO 135
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-G(I,J)) GO TO 140
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-G(I,J)) GO TO 148
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-G(I,J)) GO TO 156
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-L(I,J)) GO TO 161
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-L(I,J)) GO TO 169
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-F(I,J)) GO TO 177
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-L(I,J)) GO TO 181
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-L(I,J)) GO TO 189
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-L(I,J)) GO TO 197
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-G(I,J)) GO TO 201
      IF (H(I,J)-10*0.0001*AND(K(I,J)-10*0.0001*(I(J)-G(I,J)) GO TO 209
      WRITE (J,223) H(I,J),K(I,J),L(I,J)
      GO TO 13
12  WRITE (J,224) H(I,J),K(I,J),L(I,J)
13  WRITE (J,225)
      GO TO 219
14  CA=ABS(YPP)
      CC=ABS(XPP)
      IF (XFF) 15,16,17
      IF (YFF) 18,22,26
      IF (YFF) 30,31,32
      IF (YFF) 33,37,41
17  CALL FUN1 (GAMMOD,CA,CC,AB)
      AA=ABS(AB)
      IF (AB) 19,20,21
19  Y(KK)=(1/(CC*TAN(AA)))
      X(KK)=(1/(XPP))
      GO TO 217
20  Y(KK)=0.0
      X(KK)=(1/(XPP))
      GO TO 217
21  Y(KK)=(-1/(CC*TAN(AB)))
      X(KK)=(1/(XPP))
      GO TO 217
22  IF (GAMMOD-1.570795) 23,24,25
23  Y(KK)=(1/(CC*TAN(GAMMOD)))
      X(KK)=(1/(XPP))
      GO TO 217
24  Y(KK)=0.0
      X(KK)=(1/(XPP))
      GO TO 217

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25  Y(KK)=(-1/(CC*TAN(AGC)))
      X(KK)=(1/(XPP))
      GO TO 217
26  CALL FUN2 (GAMMOD,CA,CC,AB)
      AA=ABS(AB)
      IF (AB) 27,28,29
27  Y(KK)=(-1/(CC*TAN(AA)))
      X(KK)=(1/(XPP))
      GO TO 217
28  Y(KK)=0.0
      X(KK)=(1/(XPP))
      GO TO 217
29  Y(KK)=(1/(CC*TAN(AB)))
      X(KK)=(1/(XPP))
      GO TO 217
30  X(KK)=0.0
      AA=ABS(GAMMOD-1.570795)
      Y(KK)=(-1/(CA*COS(AA)))
      GO TO 217
31  X(KK)=0.0
      Y(KK)=0.0
      GO TO 217
32  X(KK)=0.0
      AA=ABS(GAMMOD-1.570795)
      Y(KK)=(1/(CA*COS(AA)))
      GO TO 217
33  CALL FUN2 (GAMMOD,CA,CC,AB)
      AA=ABS(AB)
      IF (AB) 34,35,36
34  Y(KK)=(1/(CC*TAN(AA)))
      X(KK)=(1/(XPP))
      GO TO 217
35  Y(KK)=0.0
      X(KK)=(1/(XPP))
      GO TO 217
36  Y(KK)=(-1/(CC*TAN(AB)))
      X(KK)=(1/(XPP))
      GO TO 217
37  IF (GAMMOD-1.570795) 38,39,40
38  Y(KK)=(-1/(CC*TAN(GAMMOD)))
      X(KK)=(1/(XPP))
      GO TO 217
39  Y(KK)=0.0
      X(KK)=(1/(XPP))
      GO TO 217
40  Y(KK)=(1/(CC*TAN(AGC)))
      X(KK)=(1/(XPP))
      GO TO 217
41  CALL FUN1 (GAMMOD,CA,CC,AB)
      AA=ABS(AB)
      IF (AB) 42,43,44
42  Y(KK)=(-1/(CC*TAN(AA)))
      X(KK)=(1/(XPP))
      GO TO 217
43  Y(KK)=0.0
      X(KK)=(1/(XPP))
      GO TO 217
44  Y(KK)=(1/(CC*TAN(AB)))
      X(KK)=(1/(XPP))
      GO TO 217
45  CALL FUN1 (HMOD,CAP,CCP,AB)
      AA=ABS(AB)

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		Apdx. 1-a, p. 21
	IF (AB) 46,47,48	H 204
46	XIR=-(CCT*TAN(AA))	H 205
	GO TO 49	H 206
47	XPR=0.0	H 207
	GO TO 49	H 208
48	XPR=-(CCP*TAN(AB))	H 209
49	CONTINUE	H 210
	CALL FUN1 (ARAD,CBP,CCP,AB)	H 211
	AA=ABS(AB)	H 212
	IF (AB) 50,51,52	H 213
50	YPR=-(CCP*TAN(AA))	H 214
	GO TO 14	H 215
51	YPR=0.0	H 216
	GO TO 14	H 217
52	YPR=-(CCP*TAN(AB))	H 218
	GO TO 14	H 219
53	CALL FUN1 (BRAD,CAN,CCN,AB)	H 220
	AA=ABS(AB)	H 221
	IF (AB) 54,55,56	H 222
54	XPR=-(CCN*TAN(AA))	H 223
	GO TO 57	H 224
55	XPR=0.0	H 225
	GO TO 57	H 226
56	XPR=-(CCN*TAN(AB))	H 227
57	CALL FUN1 (ARAD,CBN,CCN,AB)	H 228
	AA=ABS(AB)	H 229
	IF (AB) 58,59,60	H 230
58	YPR=-(CCN*TAN(AA))	H 231
	GO TO 14	H 232
59	YPR=0.0	H 233
	GO TO 14	H 234
60	YPR=-(CCN*TAN(AB))	H 235
	GO TO 14	H 236
61	CALL FUN2 (BRAD,CAP,CCN,AB)	H 237
	AA=ABS(AB)	H 238
	IF (AB) 62,63,64	H 239
62	XPR=-(CCN*TAN(AA))	H 240
	GO TO 65	H 241
63	XPR=0.0	H 242
	GO TO 65	H 243
64	XPR=-(CCN*TAN(AB))	H 244
65	CALL FUN2 (APAD,CBP,CCN,AB)	H 245
	AA=ABS(AB)	H 246
	IF (AB) 66,67,68	H 247
66	YPR=-(CCN*TAN(AA))	H 248
	GO TO 14	H 249
67	YPR=0.0	H 250
	GO TO 14	H 251
68	YPR=-(CCN*TAN(AB))	H 252
	GO TO 14	H 253
69	CALL FUN1 (BRAD,CAP,CCP,AB)	H 254
	AA=ABS(AB)	H 255
	IF (AB) 70,71,72	H 256
70	XPR=-(CCP*TAN(AA))	H 257
	GO TO 73	H 258
71	XPR=0.0	H 259
	GO TO 73	H 260
72	XPR=-(CCP*TAN(AB))	H 261
73	CALL FUN2 (APAD,CBN,CCP,AB)	H 262
	AA=ABS(AB)	H 263
	IF (AB) 74,75,76	H 264
74	YPR=-(CCP*TAN(AA))	H 265

		Apdx. 1-a, p. 22
	GO TO 14	H 266
75	YPR=0.0	H 267
	GO TO 14	H 268
76	YPR=-(CCP*TAN(AB))	H 269
	GO TO 14	H 270
77	CALL FUN2 (BRAD,CAN,CCP,AB)	H 271
	AA=ABS(AB)	H 272
	IF (AB) 78,79,80	H 273
78	XPR=-(CCP*TAN(AA))	H 274
	GO TO 81	H 275
79	XPR=0.0	H 276
	GO TO 81	H 277
80	XPR=-(CCP*TAN(AB))	H 278
81	CALL FUN1 (APAD,CBP,CCP,AB)	H 279
	AA=ABS(AB)	H 280
	IF (AB) 82,83,84	H 281
82	YPR=-(CCP*TAN(AA))	H 282
	GO TO 14	H 283
83	YPR=0.0	H 284
	GO TO 14	H 285
84	YPR=-(CCP*TAN(AB))	H 286
	GO TO 14	H 287
85	CALL FUN2 (BRAD,CAP,CCN,AB)	H 288
	AA=ABS(AB)	H 289
	IF (AB) 86,87,88	H 290
86	XPR=-(CCN*TAN(AA))	H 291
	GO TO 89	H 292
87	XPR=0.0	H 293
	GO TO 89	H 294
88	XPR=-(CCN*TAN(AB))	H 295
89	CALL FUN1 (APAD,CBN,CCN,AB)	H 296
	AA=ABS(AB)	H 297
	IF (AB) 90,91,92	H 298
90	YPR=-(CCN*TAN(AA))	H 299
	GO TO 14	H 300
91	YPR=0.0	H 301
	GO TO 14	H 302
92	YPR=-(CCN*TAN(AB))	H 303
	GO TO 14	H 304
93	CALL FUN1 (BPAD,CAN,CCN,AB)	H 305
	AA=ABS(AB)	H 306
	IF (AB) 94,95,96	H 307
94	XPR=-(CCN*TAN(AA))	H 308
	GO TO 97	H 309
95	XPR=0.0	H 310
	GO TO 97	H 311
96	XPR=-(CCN*TAN(AB))	H 312
97	CALL FUN2 (APAD,CBP,CCN,AB)	H 313
	AA=ABS(AB)	H 314
	IF (AB) 98,99,100	H 315
98	YPR=-(CCN*TAN(AA))	H 316
	GO TO 14	H 317
99	YPR=0.0	H 318
	GO TO 14	H 319
100	YPR=-(CCN*TAN(AB))	H 320
	GO TO 14	H 321
101	CALL FUN2 (BRAD,CAN,CCP,AB)	H 322
	AA=ABS(AB)	H 323
	IF (AB) 102,103,104	H 324
102	XPR=-(CCP*TAN(AA))	H 325
	GO TO 105	H 326
103	XPR=0.0	H 327

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104  GO TO 105                                     H 128
      X11 = (X11*TAN(AB))                         H 129
105  CALL FU41 (BRAD,CBN,CCP,AB)                   H 130
      AA=ABS(AB)                                    H 131
      IF (AB) 106,107,108                         H 132
106  YPR=(CCP*TAN(AA))                             H 133
      GO TO 14                                     H 134
107  YPR=0.0                                         H 135
      GO TO 14                                     H 136
108  YPR=- (CCP*TAN(AB))                           H 137
      GO TO 14                                     H 138
109  IF (BRAD-1.570795) 110,111,112               H 139
110  XPR=- (CCP*TAN(BRAD))                         H 340
      GO TO 113                                     H 341
111  XPR=0.0                                         H 342
      GO TO 113                                     H 343
112  XPR=(CCP*TAN(ABC))                             H 344
113  IF (ARAD-1.570795) 114,115,116               H 345
114  YPR=- (CCP*TAN(ARAD))                         H 346
      GO TO 14                                     H 347
115  YPR=0.0                                         H 348
      GO TO 14                                     H 349
116  YPR=(CCP*TAN(AAC))                             H 350
      GO TO 14                                     H 351
117  X(KK)=0.0                                       H 352
      Z(KK)=0.0                                       H 353
      AA=ABS(ARAD-1.570795)                         H 354
      YPR=(CBP*CCS(AA))                             H 355
      AA=ABS(GAMMOD-1.570795)                       H 356
      Y(KK)=(1/(YPR*CCS(AA)))                       H 357
      GO TO 218                                       H 358
118  Z(KK)=0.0                                       H 359
      AA=ABS(BRAD-1.570795)                         H 360
      XPR=(CAP*CCS(AA))                             H 361
      X(KK)=(1/(XPR))                               H 362
      IF (GAMMOD-1.570795) 119,120,121             H 363
119  Y(KK)=(-1/(XPR*TAN(GAMMOD)))                 H 364
      GO TO 218                                       H 365
120  Y(KK)=0.0                                       H 366
      GO TO 218                                       H 367
121  Y(KK)=(1/(XPR*TAN(AGC)))                       H 368
      GO TO 218                                       H 369
122  IF (BRAD-1.570795) 123,124,125               H 370
123  XPR=(CCN*TAN(BRAD))                           H 371
      GO TO 126                                       H 372
124  XPR=0.0                                         H 373
      GO TO 126                                       H 374
125  XPR=- (CCN*TAN(ABC))                           H 375
126  IF (ARAD-1.570795) 127,128,129               H 376
127  YPR=(CCN*TAN(ARAD))                           H 377
      GO TO 14                                     H 378
128  YPR=0.0                                         H 379
      GO TO 14                                     H 380
129  YPR=- (CCN*TAN(AAC))                           H 381
      GO TO 14                                     H 382
130  X(KK)=0.0                                       H 383
      Z(KK)=0.0                                       H 384
      AA=ABS(ARAD-1.570795)                         H 385
      YPR=(CBK*CCS(AA))                             H 386
      AA=ABS(GAMMOD-1.570795)                       H 387
      Y(KK)=(-1/(YPR*CCS(AA)))                     H 388
      GO TO 218                                       H 389

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131  Z(KK)=0.0                                       H 390
      AA=ABS(BRAD-1.570795)                         H 391
      XPR=(CAN*CCS(AA))                             H 392
      X(KK)=(-1/(XPR))                             H 393
      IF (GAMMOD-1.570795) 132,133,134             H 394
132  Y(KK)=(1/(XPR*TAN(GAMMOD)))                   H 395
      GO TO 218                                       H 396
133  Y(KK)=0.0                                       H 397
      GO TO 218                                       H 398
134  Y(KK)=(-1/(XPR*TAN(AGC)))                     H 399
      GO TO 218                                       H 400
135  Z(KK)=0.0                                       H 401
      AA=ABS(BRAD-1.570795)                         H 402
      XPR=(CAP*CCS(AA))                             H 403
      AA=ABS(ARAD-1.570795)                         H 404
      YPR=(CBP*CCS(AA))                             H 405
      CALL FU41 (GAMMOD,YPR,XPR,AB)                 H 406
      AP=ABS(AB)                                     H 407
      IF (AB) 136,137,138                         H 408
136  Y(KK)=(-1/(XPR*TAN(AA)))                       H 409
      GO TO 139                                       H 410
137  Y(KK)=0.0                                       H 411
      GO TO 139                                       H 412
138  Y(KK)=(1/(XPR*TAN(AB)))                         H 413
139  X(KK)=(1/(XPR))                               H 414
      GO TO 218                                       H 415
140  CALL FU41 (BRAD,CAP,CCP,AB)                   H 416
      AA=ABS(AB)                                     H 417
      IF (AB) 141,142,143                         H 418
141  XPR=- (CCP*TAN(AA))                             H 419
      GO TO 144                                       H 420
142  XPR=0.0                                         H 421
      GO TO 144                                       H 422
143  XPR=(CCP*TAN(AB))                             H 423
144  IF (ARAD-1.570795) 145,146,147               H 424
145  YPR=- (CCP*TAN(ARAD))                         H 425
      GO TO 14                                     H 426
146  YPR=0.0                                         H 427
      GO TO 14                                     H 428
147  YPR=(CCP*TAN(AAC))                             H 429
      GO TO 14                                     H 430
148  IF (BRAD-1.570795) 149,150,151               H 431
149  X1P=- (CCP*TAN(BRAD))                         H 432
      GO TO 152                                       H 433
150  XPR=0.0                                         H 434
      GO TO 152                                       H 435
151  XPR=(CCP*TAN(ABC))                             H 436
152  CALL FU41 (ARAD,CBP,CCP,AB)                   H 437
      AA=ABS(AB)                                     H 438
      IF (AB) 153,154,155                         H 439
153  YPR=- (CCP*TAN(AA))                             H 440
      GO TO 14                                     H 441
154  YPR=0.0                                         H 442
      GO TO 14                                     H 443
155  Y1P=(CCP*TAN(AB))                             H 444
      GO TO 14                                     H 445
156  Z(KK)=0.0                                       H 446
      AA=ABS(ARAD-1.570795)                         H 447
      XPR=(CAN*CCS(AA))                             H 448
      AA=ABS(ARAD-1.570795)                         H 449
      YPR=(CBK*CCS(AA))                             H 450
      CALL FU41 (GAMMOD,YPR,XPR,AB)                 H 451

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AA=10 (11)
11 (11) 1.1, 1.1, 1.1
157 Y(KK) = (1/(XPR*TAN(AA)))
GO TO 110
158 Y(KK)=0.0
GO TO 160
159 Y(KK) = (-1/(XPR*TAN(AB)))
160 X(KK) = (-1/(XPR))
GO TO 114
161 CALL FUN1 (BRAD,CAN,CCN,AB)
AA=ABS(AB)
IF (AB) 162,163,164
162 XPR=(CCN*TAN(AA))
GO TO 165
163 XPR=0.0
GO TO 165
164 XPR=- (CCN*TAN(AB))
165 IF (ATAD-1.570795) 166,167,168
166 YIP=(CCN*TAN(ARAD))
GO TO 114
167 YIP=0.0
GO TO 114
168 YPR=- (CCN*TAN(AAC))
GO TO 114
169 IF (H:TD-1.570795) 170,171,172
170 XPR=(CCN*TAN(BPAD))
GO TO 173
171 XPR=0.0
GO TO 173
172 XPR=- (CCN*TAN(ABC))
173 CALL FUN1 (ARAD,CBN,CCN,AB)
AA=ABS(AB)
IF (AB) 174,175,176
174 YPR=(CCN*TAN(AA))
GO TO 114
175 YFP=0.0
GO TO 114
176 YPR=- (CCN*TAN(AB))
GO TO 114
177 Z(KK)=0.0
AA=ABS(BPAD-1.570795)
XPR=(CAP*COB(AA))
X(KK)=(1/(XPR))
AA=ABS(A*AD-1.570795)
YPR=(CCN*COB(AA))
CALL FUN2 (GAMMOD,YPR,XPR,AB)
AA=ABS(AB)
IF (AB) 178,179,180
178 Y(KK)=(1/(XPR*TAN(AA)))
GO TO 218
179 Y(KK)=0.0
GO TO 218
180 Y(KK)=(-1/(XPR*TAN(AB)))
GO TO 218
181 CALL FUN2 (BRAD,CAP,CCN,AB)
AA=ABS(AB)
IF (AB) 182,183,184
182 XPR=- (CCN*TAN(AA))
GO TO 185
183 YPR=0.0
GO TO 185
184 XPR=(CCN*TAN(AB))

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185 IF (A*AD-1.570795) 186,187,188
186 YPP=(CCN*TAN(APAD))
GO TO 114
187 YPP=0.0
GO TO 114
188 YPR=- (CCN*TAN(AAC))
GO TO 114
189 IF (BPAD-1.570795) 190,191,192
190 XPP=(CCN*TAN(BPAD))
GO TO 193
191 XPP=0.0
GO TO 193
192 XPP=- (CCN*TAN(ABC))
193 CALL FUN2 (ARAD,CBP,CCN,AB)
AA=ABS(AB)
IF (AB) 194,195,196
194 YPR=- (CCN*TAN(AA))
GO TO 114
195 YPP=0.0
GO TO 114
196 YPR=(CCN*TAN(AB))
GO TO 114
197 Z(KK)=0.0
AA=ABS(BPAD-1.570795)
XPP=(CCN*COB(AA))
X(YK)=(1/(XPP))
AA=ABS(APAD-1.570795)
YPP=(CBP*COB(AA))
CALL FUN2 (GAMMOD,YPR,XPP,AB)
AP=ABS(AB)
IF (AP) 198,199,200
198 Y(KK)=(-1/(XPP*TAN(AA)))
GO TO 218
199 Y(YK)=0.0
GO TO 218
200 Y(YK)=(-1/(XPP*TAN(AB)))
GO TO 218
201 CALL FUN2 (BRAD,CAN,CCP,AB)
AP=ABS(AB)
IF (AP) 202,203,204
202 XPR=(CCP*TAN(AA))
GO TO 205
203 XPR=0.0
GO TO 205
204 XIP=- (CCP*TAN(AB))
205 IF (CPAD-1.570795) 206,207,208
206 YPR=(XPP*TAN(GAMMOD))
GO TO 114
207 YIP=0.0
GO TO 114
208 YIP=- (XIP*TAN(AGC))
GO TO 114
209 IF (BFPAD-1.570795) 210,211,212
210 XIP=- (CCP*TAN(BRAD))
GO TO 213
211 XPR=0.0
GO TO 213
212 XIP=- (CCP*TAN(ABC))
213 CALL FUN2 (ARAD,CBN,CCP,AB)
AA=ABS(AB)
IF (AB) 214,215,216
214 YPP=(CCN*TAN(AA))

```

```

                                Apdx. 1-a, p. 27
215 GO TO 14                               H 576
    YFN=0.0                               H 577
    GO TO 14                               H 578
216 YCR=- (CCP*TAN(AB))                   H 579
    GO TO 14                               H 580
217 Z(KN)=L(I,J)                           H 581
218 KA=KK+1                                 H 582
219 CONTINUE                                H 583
220 CONTINUE                                H 584
    N3=KK-1                                 H 585
    RETURN                                  H 586
C                                           H 587
221 FORMAT ('0',2X,'EFCR : ILLEGAL ANGLES : ALPHA:',F10.4,3X,', BET
1A :,F10.4,3X,', AND GAMMA:',F10.4,3X,', DO NOT EXCEED LIMITING VALUE
    FOR SPHERICAL TRIANGLES.')
```

H 588
H 589
H 590

```

222 FORMAT ('0',///,10X,'THE CRYSTAL WILL NOT BE CONVERTED.')
```

H 591

```

223 FCYAT ('0',///,' ERROR : TRILLING INDICES:',F10.5,3X,', ESCAPED
1ISOMETRIC CONVERSION WITHOUT APPARENT REASON.')
```

H 592
H 593

```

224 FORMAT ('0',///,' ERROR : TYPICALLY INDICES:',F10.5,3X,', ARE CRY
1TALLOGRAPHICALLY IMPOSSIBLE, HERE H, K AND L ARE ALL = 09')
```

H 594
H 595

```

225 FCYAT ('0',///,' THIS FACE WILL NOT BE CONVERTED AND WILL NOT BE
1CONSIDERED AS PART OF THE CRYSTAL.')
```

H 596
H 597
H 598-

C
C
C

S U B R O U T I N E F U N 1 .

```

SUBROUTINE FUN1 (ANGLE,CA,CC,AB)          I 1
SINAB=0.0                                I 2
CC2=0.0                                  I 3
CCT=0.0                                  I 4
CC2=(CA**2)*(CC**2)-(2.0*CA*CC*COS(ANGLE)) I 5
CCT=(SQRT(ABS(CC2)))                      I 6
SINAB=(CA*SIN(ANGLE))/CCT                 I 7
AB=ASIN(SINAB)                            I 8
IF (ANGLE-GT.1.570795) RETURN             I 9
IF (((CC/COS(ANGLE))-CA)-LT.0.AND.(ABS((CC/COS(ANGLE))-CA)).GT.(CA I 10
1=0.01)) GO TO 1                             I 11
IF (((CC/COS(ANGLE))-CA)-GT.0.AND.(ABS((CC/COS(ANGLE))-CA)).GT.(CA I 12
1=0.01)) GO TO 3                             I 13
GO TO 2                                     I 14
1 AB=-(AB)                                 I 15
RETURN                                    I 16
2 AB=0.0                                   I 17
3 RETURN                                    I 18
END                                         I 19-
```

C
C
C

S U B R O U T I N E F U N 2 .

```

SUBROUTINE FUN2 (ANGLE,CA,CC,AB)          J 1
AA=0.0                                    J 2
CC2=0.0                                    J 3
CCT=0.0                                    J 4
SINAB=0.0                                  J 5
AA=(3.14159-ANGLE)                        J 6
CC2=(CA**2)+(CC**2)-(2.0*CA*CC*COS(AA))   J 7
CCT=(SQRT(ABS(CC2)))                       J 8
CCT=(SQRT(ABS(CC2)))                       J 9
SINAB=(CA*SIN(AA))/CCT                     J 10
AB=ASIN(SINAB)                             J 11
IF (AA-GT.1.570795) RETURN                  J 12
IF ((CC/COS(AA))-CA)-LT.0.AND.(ABS((CC/COS(AA))-CA)).GT.(CA*0.01) J 13
1) GO TO 1                                   J 14
```

J 1
J 2
J 3
J 4
J 5
J 6
J 7
J 8
J 9
J 10
J 11
J 12
J 13
J 14

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```

IF (((CC/COS(AA))-CA)-GT.0.AND.(ABS((CC/COS(AA))-CA)).GT.(CA*0.01) J 15
1) GO TO 3                                   J 16
GO TO 2                                     J 17
1 AB=-(AB)                                 J 18
RETURN                                    J 19
2 AB=0.0                                   J 20
3 RETURN                                    J 21
END                                         J 22
```

C
C
C

E N D O F P R O G R A M .

Description of the Statements of Module 1.

The Program.

The program itself consists of 10 related units: the main and the subroutines PLOT, ISO, TETRA, ORTHO, HEXA, MONO, TRICLI, PONI and FUN2. The following is a description of the statements of Module 1.

The Main.

A1-A6 : Dimension statements.
 A7 : Punch option monitor.
 A8-A12 : Outputs for Viewplot.
 A15-A28 : Comments.
 A29 : Input of the printer output monitor.
 A30 : Input of the number of crystals to be processed.
 A31-A37 : Calculation of the distribution of the crystals and title creation for Viewplot.
 A41-A47 : Characterizing of crystallographic data according to the crystal system.
 A48 : Error message in crystal system data.
 A50-A58 : Input branching for isometric data.
 A59-A67 : Input branching for tetragonal data.
 A68-A76 : Input branching for orthorhombic data.
 A77-A85 : Input branching for hexagonal data.
 A86-A94 : Input branching for monoclinic data.
 A95-A104 : Input branching for triclinic data.
 A105-A118 : Printer output of Miller indices with the 4 indices option for hexagonal data.
 A119-A120 : Printer output of the coefficients of the Cartesian equations of the crystal faces.
 A122-A127 : Comments.
 A128-A152 : Non-repetitive permutations of the coefficients of the equations of the crystal faces.
 A153-A154 : Discrimination between non-unique and unique solution systems.
 A155-A157 : Solving of unique solution systems.
 A158-A164 : Comments.
 A165-A167 : Removal of vertices not belonging to inner shape.
 A168-A169 : Beginning of the removal of repeated vertices.
 A170-A174 : Comments.
 A175-A178 : Continuation of the removal of repeated vertices.
 A179 : Printer output of the list of Cartesian vertices locations.
 A180-A182 : Storing the unique vertices locations.
 A183-A184 : Storing all vertices for later sorting.
 A185-A202 : Comments.
 A203 : Call for the subroutine plot.
 A205 : Printer output of an indicator of the end of the program operations.
 A208-A252 : Formats for printer and punched outputs of the main.

The Subroutine PLOT.

B1-B6 : Initialization and dimension statements.
 B7-B12 : Initialization of variables.
 B13-B19 : Comments.
 B20-B23 : Finding the maximum and calibration factor for Viewplot.
 B24-B28 : Creation of the do loops parameters for the sorting of vertices defining an edge.
 B29-B35 : Comments.
 B36-B46 : Sorting of vertices defining edges.
 B47-B61 : Storing of the pairs of vertices defining an edge.
 B62-B64 : Printer output of pairs of vertices defining an edge and the maximum and calibration factor for Viewplot.
 B65-B70 : Comments.
 B71-B75 : Calibration of the vertices values for viewplot.
 B76-B77 : Printer output of the calibrated vertices values.
 B78-B80 : Punched output of the calibrated vertices values.
 B81-B82 : Printer output of the vertices indices for edges.
 B83-B86 : Punched output of the vertices indices for edges.
 B87 : Printer output of the title for the next print.

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B89-B94 : Comments.
 B95-B126 : Sorting and cyclic ordering of the vertices of each face a.
 B127-B133 : Punched output of preset options for Viewplot.
 B134-B146 : Comments.
 B147-B156 : Projection of the 3D vertices in 2D.
 B157-B160 : Search for the maximum and a calibration factor of the 2D data.
 B164-B170 : Calibration for the printer graphic output.
 B171-B187 : Sorting of the vertices defining an edge.
 B188-B220 : Search for intermediate points along the crystal edges.
 B221-B228 : Rotation of the data to produce the desired line of sight.
 B229-B289 : Printer graphic system.
 B282-B316 : Formats for the printer and punched outputs of the subroutine PLOT.

The Subroutine ISO.

C1 : Subroutine statement.
 C2-C24 : Comments.
 C25-C26 : Dimension statements.
 C27-C39 : Conversion of Miller indices into real numbers and their calibration according to the combination of form factor for isometric crystals.

The Subroutine TETRA.

D1 : Subroutine statement.
 D2-D28 : Comments.
 D29-D43 : Conversion of Miller indices into real numbers and their calibration according to the combination factor and axial ratios c value for tetragonal crystals.

The Subroutine ORTHO.

E1 : Subroutine statement.
 E2-E28 : Comments.
 E29-E43 : Conversion of Miller indices into real numbers and their calibration according to the combination factor and axial ratios a:b:c for orthorhombic crystals.

The Subroutine HEXA.

F1 : Subroutine statement.
 F2-F29 : Comments.
 F30-F32 : Dimension statements.
 F33-F43 : Conversion of Miller indices into real numbers and their calibration according to the combination factor and axial ratios c value for hexagonal crystals.
 F44-F45 : Conversion of Miller indices into axial intercepts if unequal to 0.
 F56 : Error detection in the Miller indices.
 F57-F69 : Branching of axial intercepts a:b:c according to the type of face undergoing Cartesian translation.
 F70 : Error message for F56.
 F71-F73 : Error detection and message for unsuccessful branching.
 F74-F123 : Conversion of the 3 horizontal hexagonal axes values into their X, Y Cartesian equivalents according to the type of face undergoing translation.
 F124-F132 : Formats for error messages for the subroutine HEXA.

The Subroutine MONO.

G1 : Subroutine statement.
 G2-G29 : Comments.
 G30-G32 : Dimension statements.
 G33-G37 : Error detection and message in the given beta value.
 G38-G45 : Conversion of Miller indices into real numbers and their calibration according to the combination factor and axial ratios a:b:c for monoclinic crystals.
 G46-G58 : Evaluation of the beta angle value given and by-passing of the Cartesian conversion if beta is very close to 90 degrees, less than 0.0001 degree.
 G60-G62 : Conversion of beta angle from degrees to radians.

G63-G71 : Conversion of Miller indices real numbers into Cartesian axial intercepts if not equal to 0.
 G72 : Error detection in the Miller indices.
 G73-G98 : Branching of axial intercepts according to the type of face undergoing Cartesian translation.
 G99-G103 : Error message for G72 and for unsuccessful branching.
 G104-G168 : Conversion of monoclinic a:b data into Cartesian X, Y, Z data according to the type of face undergoing translation.
 G171-G180 : Formats for error messages for the subroutine MONO.

The Subroutine TRICLI.

H1 : Subroutine statement.
 H2-H29 : Comments.
 H30-H32 : Dimension statements.
 H33-H37 : Error detection and message for the alpha, beta and gamma angle if in conflict with limiting values for spherical triangles.
 H39-H46 : Conversion of Miller indices into real numbers and their calibration according to the combination factor and axial ratios a:b:c for triclinic crystals.
 H47-H59 : Evaluation of alpha, beta and gamma values and by-passing of the Cartesian conversion if all angles are very close to 90 degrees. By-passing occurs if the difference between these angles and 90 degrees is less than 0.0001 degrees.
 H62-H71 : Conversion of alpha, beta and gamma from degrees to radians and finding their complementary angles.
 H72-H84 : Conversion of real Miller indices into axial intercepts if unequal to 0.
 H85 : Error detection in the Miller indices.
 H86-H110 : Branching of axial intercepts values according to the type of face undergoing Cartesian translation.
 H112-H115 : Error message for H84 and detection of unsuccessful branching.
 H116-H586 : Conversion of triclinic a:b:c intercepts into Cartesian X, Y, Z values according to the type of face undergoing translation.
 H588-H598 : Formats for error messages for the subroutine TRICLI.

The Subroutine FUN1.

I1 : Subroutine statement.
 I2-I5 : Initialization statements.
 I5-I19 : Finding the angle opposite to the one given in the argument list. This angle is also opposite to the first side given in the argument list. If the calculated angle is less than 90 degrees, return of its value, if it is equal to 90 degrees, return of a 0.0 indicator number, and if it is greater than 90 degrees, return of its negative complementary value.

The Subroutine FUN2.

J1 : Subroutine statement.
 J2-J5 : Initialization statements.
 J6-J22 : Finding the angle opposite to the complementary one of the argument list. This angle is also opposite to the first side given in the argument list. If the calculated angle is less than 90 degrees, return of its value, if it is equal to 90 degrees, return of a 0.0 indicator number, and if it is greater than 90 degrees, return of its negative complementary value.

Sequence of Data Element and Output Options of Module 1.

INPUT DATA AND INITIALS

The first data card must be an output control card (see next section on output options).

N1 in 13 : the number of crystals to be processed.

Header(1,3) in 80x1 : two complete comment cards as title per crystal.

N2 in 13 : the crystallographic system of the crystal.

If N2=1, the crystal is isometric.

N4 in 13 : the number of forms present on the observed crystal.

N(1), COFO(1) in 13 and F10.4 : the number of Miller indices of that particular form and its combination index.

H, K, L in 4012 : N(1) Miller indices, of that form.

If N2=2, the crystal is tetragonal.

N4, ALC in 13 and F10.4 : the number of forms present on the observed crystal and the c value of its axial ratios 1 : 1 : c.

N(1), COFO(1) : as above.

H, K, L : as above.

If N2=3, the crystal is orthorhombic.

N4, ALA, ALB, ALC in 13 and 3F10.4 : the number of forms on the observed crystal and its axial ratios a:b:c.

N(1), COFO(1) : as above.

H, K, L : as above.

If N2=4, the crystal is hexagonal.

N4, ALC in 13, F10.4 : the number of forms present on the observed crystal and the c value of its axial ratios 1 : 1 : 1 : c.

N(1), COFO(1) : as above.

H, K, L, M in 4012 : N(1) Miller indices.

If N2=5, the crystal is monoclinic.

N4, ALA, ALB, ALC, BETA in 13 and 4F10.4 : the number of forms present on the observed crystal, its axial ratios a:b:c and its beta angle in degrees.

N(1), COFO(1) : as above.

H, K, L : as above.

If N2=6, the crystal is triclinic.

N4, ALA, ALB, ALC, ALPHA, BETA, GAMMA in 13 and 6F10.4 : the number of forms present on the observed crystal, its axial ratios a:b:c and its alpha, beta and gamma angles, in degrees.

N(1), COFO(1) : as above.

H, K, L : as above.

Output Options.

Three main types of outputs can be obtained from Module 1. The output can be on printer only, it can be a punched card output designed to be used by Viewplot and accompanied or not by a printer output, or it can be stored directly onto magnetic tape for later processing by a graphic software.

Printer Output Options.

Once the printer output is selected, all prints from Module 1 are optional and are controlled by the first data card containing a vector of 15 positions. These positions can be filled with the number 0 or 1, 0 meaning that the print is not desired, 1 meaning that the print is required. The following is a list of these positions and their effect:

2 : Header: The two title cards per crystal.
4 : The number of forms present on the crystal, its axial ratios and interaxial angles, if present.

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6 : The number of faces on the crystal.
8 : A list of the Miller indices of the crystal.
10 : A list of the Cartesian equations of the crystal faces.
12 : A list of the Cartesian locations of the crystal vertices.
14 : A list of the Cartesian locations of the vertices defining edges.
16 : The maximum in the Cartesian locations of the vertices and the calibration factor for Viewplot.
18 : A list of the Cartesian locations of the vertices to be used as data for Viewplot.
20 : A list of the crystal edges defined by pairs of vertices indices.
22 : A list of the vertices, in rotational order, for each of the crystal faces.
24 : The maximum value of the 2D vertices and the calibration factor for the printer graph.
26 : A list of the vertices defining edges after conversion to 2D.
28 : The printer diagram of the crystal.
30 : A list of the Cartesian equations of the faces, to be punched.

Note : The punched output or the magnetic tape storage of the graphic information produced by Module 1 is completely independent of the above options.

Punched cards output:

The punched cards output, if desired, is fixed and cannot be modified without changing the program. This is to ensure that the prescribed approach to Viewplot is constant. The punched output itself consists of the following :

PAGE

TF Ia, Ia, Ib

Ia is IPIX the square root of the number of crystals to be plotted. This value may have to be modified as it controls the absolute dimensions of the individual plots. Ib is the number of comment cards to follow as title of the plot. Ib cards as title for the plot.

TOLFRANCE

The tolerance or precision desired during the operations of Viewplot. In the course of this work, a tolerance of 0.005 was used.

VEPTICES

A list of Cartesian locations of the vertices of the observed crystal, in format F10.4.

99999.000099999.000099999.0000

The indicator of the end of the data, that is the end of the list of the Cartesian vertices locations.

EDGPS

A list of the vertices indices defining all the crystal edges in format 2i5.

999999999

The indicator of the end of the data for the crystal edges.

FACES

A list of all vertices indices per face in rotational order and in format 14i5.

99999

The indicator of the end of the data for the crystal faces.

VIEWPOINT

00000.000000000.000000000.0000

This option will produce plots viewed as if looking towards the crystal center.

EYE

90000.000000000.000020000.0000

This option sets the observer's eye at the above Cartesian location with respect to the crystal center. The effect of this Cartesian location is to rotate the crystal to produce an image that is in a standard crystallographic orientation.

PIOT

F P P 0.25

This preset option produces the following : the plot is expanded proportionally to fill the allowed area, hidden lines are to be removed, and margins are not to be drawn but are to be 0.25 inches thick. For further details on

the graphic options offered, consult the Viewplot manual. The remainder of the punched output is a repetition of
VERTICES, EDGES, FACES, VIEWPOINT, IYF and PLOT packages for each crystal.
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Automatic Tape Storage of Output Information.

This option can be obtained by specifying the type of device (tape) unto which the output information is to be stored. This is done at the JCL (Job Control Language) level for any run of Module 1.

List of the Crystallographic Data and Reference Used in the
Calculation Translation of the 61 Test Minerals.

Note: The following data is in the sequence and format described in Appendix
1-c, section on Input Data.

81
ADULARIA : ROGERS, 1937, p. 430
5
3 0.6580 1.0 0.5550 116.05
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0
2 1.50
0 0 1 0 0-1
2 1.70
1 0-1-1 0 1
ALGIRINI : FORMS : DEER HOWIE AND ZUSSMAN, 1967, p. 137,
AXIAL RATIOS : MASON AND BERRY, 1968, p. 472
5
5 1.099 1.0 0.601 106.0166
2 0.5
1 0 0-1 0 0
2 0.5
0 1 0 0-1 0
4 0.70
1 1 0-1 1 0-1-1 0 1-1 0
8 4.0
4 6 1-4 6 1-4-6 1 4-6 1 4 6-1-4 6-1-4-6-1 4-6-1
8 3.0
1 1 1-1 1 1-1-1 1 1-1 1 1-1-1 1-1-1-1 1-1-1
ALBITE 1 : ROGERS, 1937, p. 432
6
4 0.6369 1.0 0.5599 94.2666 116.5990 87.6666
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0
2 0.5
0 1 0 0-1 0
2 1.50
0 0 1 0 0-1
2 1.70
-1 0 1 1 0-1
ALBITE 2 : ROGERS, 1937, p. 434
6
4 0.6369 1.0 0.5599 94.2666 116.5990 87.6666
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0
2 0.80
0 1 0 0-1 0
2 0.50
0 0 1 0 0-1
2 0.60
-1 0 1 1 0-1
ANDALOSITE : DEER HOWIE AND ZUSSMAN, 1967, p. 38
3
3 0.9823 1.0 0.7032
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0
2 2.5
0 0 1 0 0-1
4 3.0
0 1 1 0-1 1 0 1-1 0-1-1
Apdx. 2-a, p. 2
ANTHOPHYLLITE GEDRITE : FORMS : DEER HOWIE AND ZUSSMAN, 1967, p. 156,
AXIAL RATIOS : MASON AND BERRY, 1968, p. 462
3
3 1.027 1.0 0.292
2 1.0
1 0 0-1 0 0
4 2.50
2 1 0-2 1 0-2-1 0 2-1 0
2 12.0
0 0 1 0 0-1
APATITE : ROGERS, 1937, p. 410
4
3 0.735
6 1.0
1 0-1 0 0 1-1 0-1 1 0 0-1 0 1 0 1-1 0 0
12 1.50
1 0-1 1 0 1-1 1-1 1 0 1-1 0 1 1 0-1 1 1 0-1-1 0 1-1-1-1 1 0-1-1 0 1-1
0-1 1-1 1-1 0-1
2 1.40
0 0 0 1 0 0 0-1
AUGITE PERFOUGITE : AXIAL RATIOS : MASON AND BERRY, 1968, p. 471
FORMS : ROGERS, 1937, p. 446
5
4 1.092 1.0 0.589 105.8333
2 1.0
1 0 0-1 0 0
2 1.0
0 1 0 0-1 0
4 1.50
1 1 0-1 1 0-1-1 0 1-1 0
8 2.0
1 1 1-1 1 1-1-1 1 1-1-1 1 1-1-1-1 1-1-1
BERYL : ROGERS, 1937, p. 456
4
2 0.9989
6 1.0
1 0-1 0 0 1-1 0-1 1 0 0-1 0 1 0 0-1 1 0 1-1 0 0
2 1.5
0 0 0 1 0 0 0-1
CALCITE 1 : MASON AND BERRY, 1968, p. 331
4
1 0.8550
6 1.0
1 0-1 1-1 1 0 1 0-1 1 1 1-1 0-1 0 1-1-1-1 0 1-1
CALCITE 2 : MASON AND BERRY, 1968, p. 331
4
3 0.8550
6 1.0
1 0-1 0 0 1-1 0-1 1 0 0-1 0 1 0 0-1 1 0 1-1 0 0
2 0.50
0 0 0 1 0 0 0-1
6 1.60
1 0-1-2 0 1-1 2-1 1 0-2-1 0 1 2 0-1 1-2 1-1 0 2
CHALCOPYRITE : MASON AND BERRY, 1968, p. 219
2
2 1.9716
4 1.0
1-1 2 1 1-2-1 1 2-1-1-2
4 1.50
1-1-2-1-1 2 1 1 2-1 1-2
CHLORITE : FORMS : DEER HOWIE AND ZUSSMAN, 1967, p. 231
AXIAL RATIOS : MASON AND BERRY, 1968, p. 454

5
 3 0.58 1.0 1.53 96.2013
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.6
 0 1 0 0-1 0
 2 0.14
 0 0 1 0 0-1
 HEDBERGITE : DEER HOWIE AND ZUSSMAN, 1967, p. 52
 5
 3 1.7272 1.0 3.3090 102.00
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.75
 0 1 0 0-1 0
 2 0.10
 0 0 1 0 0-1
 ORDILHITI : DEER HOWIE AND ZUSSMAN, 1967, p. 84
 3
 5 0.5672 1.0 0.5497
 2 1.0
 1 0 0-1 0 0
 4 1.50
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.85
 0 1 0 0-1 0
 2 2.0
 0 0 1 0 0-1
 8 3.25
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 HUMMINGBOLTITE (QUENITE) : FORMS : DEER HOWIE AND ZUSSMAN, 1967, p. 160
 AXIAL RATIOS : MASON AND BERRY, 1968, p. 463
 5
 3 0.523 1.0 0.292 101.9166
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.5
 0 1 0 0-1 0
 4 0.0
 0 1 1 0-1 1 0-1-1 0 1-1
 STOPSIDE HEDBERGITE LOMANNSENITE : AXIAL RATIOS - ROGERS, 1937, p. 484
 FORMS : DEER HOWIE AND ZUSSMAN, 1967, p. 115
 5
 3 1.092 1.00 0.589 108.8333
 2 1.0
 1 0 0-1 0 0
 2 1.0
 0 1 0 0-1 0
 4 1.80
 1 1 0-1 1 0-1-1 0 1-1 0
 2 3.0
 0 0 1 0 0-1
 8 3.50
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 DOLOMITE : MASON AND BERRY, 1968, p. 341
 4
 1 0.8235
 6 1.0
 1 0-1 1-1 1 0 1 0-1 1 1 1-1 0-1 0 1-1-1-1 0 1-1
 ENSTATITE OPTHOPEEROSILITE - DEER HOWIE AND ZUSSMAN, 1967, p. 108
 (HYPERSTHENE).
 3

4 2.0692 1.0000 0.5891
 2 0.25
 1 0 0-1 0 0
 2 1.00
 0 1 0 0-1 0
 4 1.20
 2 1 0-2 1 0-2-1 0 2-1 0
 4 3.0
 1 0 1-1 0 1 1 0-1-1 0-1
 EPIDOTE : MASON AND BERRY, 1968, p. 488
 5
 4 1.5780 1.0 1.8120 115.34
 2 0.60
 0 0 1 0 0-1
 2 1.0
 1 0 0-1 0 0
 2 1.0
 -1 0 1 1 0-1
 4 2.0
 1 1 1-1 1 1 1-1-1-1-1-1
 FAYALITE : DEER HOWIE AND ZUSSMAN, 1967, p. 1
 (OLIVINE GROUP).
 3
 7 0.8597 1.0 0.5827
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 4 1.30
 1 2 0-1 2 0-1-2 0 1-2 0
 2 0.50
 0 1 0 0-1 0
 4 1.50
 0 2 1 0 2-1 0-2 1 0-2-1
 2 1.25
 0 0 1 0 0-1
 4 1.95
 1 0 1 1 0-1-1 0-1-1 0 1
 8 2.0
 1 1 1 1-1 1 1 1-1 1-1-1-1 1 1-1-1 1-1 1-1-1-1-1
 FLUORITE 1 : MASON AND BERRY, 1968, p. 323
 1
 2
 6 1.0
 1 0 0 0 1 0-1 0 0 0-1 0 0 0 1 0 0-1
 24 2.25
 1 2 0 2 1 0 1 0 2 2 0 1 0 1 2 0-2 1 0-1 0 2 0 1 0-1 2 0-2 1 1-2 0 2
 -1 0 1 0-2 2 0-1 0 1-2 0 2-1-1-2 0-2-1 0-1 0-2-2 0-1 0-1-2 0-2-1
 FLUORITE 2 : HALITY : MASON AND BERRY, 1968, p. 323, 320
 1
 6 1.0
 1 0 0 0 1 0-1 0 0 0-1 0 0 0 1 0 0-1
 FORSTIPIT : DEER HOWIE AND ZUSSMAN, 1967, p. 1
 (OLIVINE GROUP).
 3
 6 0.4465 1.0 0.5866
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 4 1.10
 1 2 0-1 2 0-1-2 0 1-2 0
 2 0.50
 0 1 0 0-1 0
 4 1.50

0 2 1 0 2-1 0-2 1 0-2-1
 2 1.25
 0 0 1 0 0-1
 4 1.45
 1 0 1 1 0-1-1 0-1-1 0 1
 GALENA 1 : MASON AND BERRY, 1968, P. 229
 1
 1
 6 1.0
 1 0 0-1 0 0 0 1 0 0-1 0 0 0 1 0 0-1
 GALENA 2 : MASON AND BERRY, 1968, P. 229
 1
 2
 6 1.0
 1 0 0-1 0 0 0 1 0 0-1 0 0 0 1 0 0-1
 8 1.70
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 GALENA 3 : MASON AND BERRY, 1968, P. 229
 1
 2
 6 1.0
 1 0 0-1 0 0 0 1 0 0-1 0 0 0 1 0 0-1
 8 1.30
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 GALENA 4 : MASON AND BERRY, 1968, P. 229
 1
 1
 8 1.0
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 GARNET 1 : DANA'S MANUAL OF MINERALOGY, 17TH ED., P. 401
 1
 12
 12 1.0
 0 1 1 1 0 1 1 1 0 0-1 1-1 0 1-1 1 0 0 1-1 1 0-1 1-1 0 0-1-1-1 0-1-1-1 0
 GARNET 2 : DANA'S MANUAL OF MINERALOGY, 17TH ED., P. 401
 1
 24
 24 1.0
 1-1 2-1 1-2 1-2 1-1 2-1 1-2-1-1 2 1 1-1-2-1 1 2 1 1-2-1-1 2 1 2-1-1-2 1 1 2 1-1
 -2-1 1 1 2-1-1-2 2-1 1-2 1-1 2-1-1-2 1 1 2 1-1-2-1 1 2 1 1-2-1-1
 GARNET 3 : DANA'S MANUAL OF MINERALOGY, 17TH ED., P. 401
 1
 2
 24 1.0
 1-1 2-1 1-2 1-2 1-1 2-1 1-2-1-1 2 1 1-1-2-1 1 2 1 1-2-1-1 2 1 2-1-1-2 1 1 2 1-1
 -2-1 1 1 2-1-1-2 2-1 1-2 1-1 2-1-1-2 1 1 2 1-1-2-1 1 2 1 1-2-1-1
 12 0.65
 0 1 1 1 0 1 1 1 0 0-1 1-1 0 1-1 1 0 0 1-1 1 0-1 1-1 0 0-1-1-1 0-1-1-1 0
 GARNET 4 : DANA'S MANUAL OF MINERALOGY, 17TH ED., P. 401
 1
 2
 24 2.0
 1-1 2-1 1-2 1-2 1-1 2-1 1-2-1-1 2 1 1-1-2-1 1 2 1 1-2-1-1 2 1 2-1-1-2 1 1 2 1-1
 -2-1 1 1 2-1-1-2 2-1 1-2 1-1 2-1-1-2 1 1 2 1-1-2-1 1 2 1 1-2-1-1
 12 1.10
 0 1 1 1 0 1 1 1 0 0-1 1-1 0 1-1 1 0 0 1-1 1 0-1 1-1 0 0-1-1-1 0-1-1-1 0
 GLAUCOPHANE FIEBECKITE : AXIAL RATIOS : MASON AND BERRY, 1968, P. 466
 FORMS : DEER HOWIE AND ZUSSMAK, 1967, P. 179
 5
 3 0.54 1.0 0.30 104.0000
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0

2 0.5
 0 1 0 0-1 0
 4 4.0
 0 1 1 0-1 1 0-1-1 0 1-1
 HERCINITE : MASON AND BERRY, 1968, P. 291
 4
 2 2.75
 6 1.0
 0 1-1 2 1 0-1-2 1-1 0 2-1 1 0-2-1 0 1 2 0-1 1-2
 2 0.40
 0 0 0 1 0 0 0-1
 BAUYERITE : ROGERS, 1937, P. 441
 1
 1
 8 1.0
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 HORNBLende : MASON AND BERRY, 1968, P. 465
 5
 3 0.547 1.0 0.295 105.5166
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.5
 0 1 0 0-1 0
 4 4.0
 0 1 1 0-1 1 0-1-1 0 1-1
 HOPKITE : DEER HOWIE AND ZUSSMAK, 1967, P. 11
 NO DATA ON AXIAL RATIO SO USE : 1 1
 1
 6
 4 1.0
 1 0 1 1 0-1-1 0 1-1 0-1
 8 1.30
 1 1 1 1 1-1 1-1-1 1-1 1-1 1 1-1 1-1-1-1-1-1 1
 4 1.20
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.80
 0 1 0 0-1 0
 4 1.0
 0 1 1 0 1-1 0-1 1 0-1-1
 2 0.60
 0 0 1 0 0-1
 ILIMAITE : MASON AND BERRY, 1968, P. 294
 4
 3 2.75
 6 1.0
 1 1-2 0-1 2-1 0-2 1 1 0-1-1 2 0 1-2 1 0 2-1-1 0
 2 0.09
 0 0 0 1 0 0 0-1
 6 0.70
 0 1-1 2-1 1 0-2-1 0 1 2 0-1 1-2 1-1 0 2 1 0-1-2
 JADEITE : AXIAL RATIOS : MASON AND BERRY, 1968, P. 471
 FORMS : DEER HOWIE AND ZUSSMAK, 1967, P. 137
 5
 4 1.104 1.0 0.610 107.3333
 2 1.0
 1 0 0-1 0 0
 2 1.0
 0 1 0 0-1 0
 4 1.6
 1 1 0-1 1 0-1-1 0 1-1 0
 2 1.0
 0 0 1 0 0-1

NOTE CORRECT AXIAL RATIOS: a:b:c = 4.4:1:2.16
 ORTHORHOMBIC (DEER et al, 1962)

KYANITE : DEER HOWIE AND ZUSSMAN, 1967, P. 41

6
4 0.9173 1.0 0.7196 90.09 101.03 105.35
2 1.0
1 0 0-1 0 0
2 1.0
0 1 0 0-1 0
2 1.5
1-1 0-1 1 0
2 2.0
0 0 1 0 0-1

LABRADORITE BITOWNITE ANORTHITE : ROGERS, 1937, P. 437

6
4 0.6350 1.0 1.1003 93.1666 115.8500 91.2166
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0
2 0.50
0 1 0 0-1 0
2 0.75
0 0 1 0 0-1
2 0.85
-1 0 1 1 0-1

LEPIDOLITE : AXIAL RATIOS : MASON AND BERRY, 1968, P. 452

FORMS : DEER HOWIE AND ZUSSMAN, 1967, P. 217

5
3 0.5181 1.0 2.248 100.80
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0
2 0.6
0 1 0 0-1 0
2 0.10
0 0 1 0 0-1
LEUCITE : ROGERS, 1937, P. 439
1
1
24 1.0
1-1 2-1 1-2 1-2 1 1-1-2-1 2-1 1-2-1-1 2 1-1 1 2 1 1-2-1-1 2 1 2-1-1-2 1 1 2 1-1
-2-1 1 1 2-1-1-2 2-1 1-2 1-1 2-1-1-2 1 1 2 1-1-2-1 1 2 1 1-2-1-1

MICROCLINE 1 : ROGERS, 1937, P. 421

6
3 0.6614 1.0 0.5570 90.6500 90.6500 115.9222
2 0.5
0 1 0 0-1 0
4 1.50
1 1 0-1 1 0-1-1 0 1-1 0
2 1.0
0 0 1 0 0-1

MICROCLINE 2 : ROGERS, 1937, P. 431

6
3 0.6614 1.0 0.5570 90.6500 90.6500 115.9222
2 0.50
0 1 0 0-1 0
4 1.50
1 1 0-1 1 0-1-1 0 1-1 0
2 1.0
0 0 1 0 0-1
2 3.0
2 0-1-2 0 1
4 1.80
0 2 1 0 2-1 0-2-1 0-2 1
4 1.80
1 1-1 1-1-1-1 1 1-1-1 1

MONTICELLITE : DEER HOWIE AND ZUSSMAN, 1967, P. 10

3
7 0.4345 1.0 0.5749
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0
4 1.0
0 1 1 0 1-1 0-1 1 0-1-1
4 1.30
1 2 0-1 2 0-1-2 0 1-2 0
4 1.30
0 2 1 0 2-1 0-2 1 0-2-1
2 0.50
0 1 0 0-1 0
8 1.30
1 1 1 1-1 1-1-1 1-1 1-1 1 1-1 1-1-1-1-1-1 1
8 1.60
1 2 1 1 2-1 1-2-1 1-2 1-1 2 1-1 2-1-1-2-1-1-2 1

MULLITE : DEER HOWIE AND ZUSSMAN, 1967, P. 37

3
2 0.9818 1.0 0.3753
2 5.0
0 0 1 0 0-1
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0

MUSCOVITE : AXIAL RATIOS : MASON AND BERRY, 1968, P. 449

FORMS : DEER HOWIE AND ZUSSMAN, 1967, P. 201

5
3 0.575 1.0 2.220 95.5000
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0
2 0.6
0 1 0 0-1 0
2 0.10
0 0 1 0 0-1

NEPHELINE : ROGERS, 1937, P. 440

4
2 0.8400
6 1.0
1 0-1 0 0 1-1 0-1 1 0 0-1 0 1 0 0-1 1 0 1-1 0 0
2 1.50
0 0 0 1 0 0 0-1

OLIGOCLASE ANDESINE : ROGERS, 1937, P. 435, 436

6
4 0.6169 1.0 0.5599 94.266 116.5990 87.6666
4 1.0
1 1 0-1 1 0-1-1 0 1-1 0
2 0.50
0 1 0 0-1 0
2 1.50
0 0 1 0 0-1
2 1.70
-1 0 1 1 0-1

ORTHOCLASE 1 : ROGERS, 1937, P. 428

5
3 0.6580 1.0 0.5550 116.0500
2 0.5
0 1 0 0-1 0
4 1.50
1 1 0-1 1 0-1-1 0 1-1 0
2 1.0
0 0 1 0 0-1

ORTHOCLASE 2 : ROGERS, 1937, P. 428

5
 4 0.6580 1.0 0.5550 116.05
 2 0.40
 0 1 0 0-1 0
 4 1.50
 1 1 0-1 1 0-1-1 0 1-1 0
 2 1.0
 0 0 1 0 0-1
 2 3.0
 2 0-1-2 0 1
 ORTHOCLASE 3 : ROGERS, 1937, p. 428
 5
 6 0.6580 1.0 0.5550 116.0500
 2 0.50
 0 1 0 0-1 0
 4 1.50
 1 1 0-1 1 0-1-1 0 1-1 0
 2 1.0
 0 0 1 0 0-1
 2 3.0
 2 0-1-2 0 1
 4 1.80
 0 2 1 0 2-1 0-2-1 0-2 1
 4 1.80
 1 1-1 1-1-1-1 1 1-1-1 1
 ORTHOCLASE 4 : ROGERS, 1937, p. 428
 5
 5 0.6580 1.0 0.5550 116.050
 2 0.50
 0 1 0 0-1 0
 4 1.50
 1 1 0-1 1 0-1-1 0 1-1 0
 4 2.40
 1 3 0-1 3 0-1-3 0 1-3 0
 2 1.80
 1 0-1-1 0 1
 2 1.50
 0 0 1 0 0-1
 PEPICLASE : MASON AND BERRY, 1968, p. 27
 1
 1
 8 1.0
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 PHLOGOPITE BLOTITE : MASON AND BERRY, 1968, p. 451
 5
 3 0.575 1.0 2.248 100.80
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.6
 0 1 0 0-1 0
 2 0.10
 0 0 1 0 0-1
 PYRITE 1 : ROGERS, 1937, p. 291
 1
 1
 6 1.0
 1 0 0-1 0 0 0 1 0 0-1 0 0 0 1 0 0-1
 PYRITE 2 : ROGERS, 1937, p. 291
 1
 1
 12 1.0
 2-1 0 2 1 0-2 1 0-2-1 0 1 0 2-1 0 2 1 0-2-1 0-2 0 2 1 0 2-1 0-2 1 0-2-1

PYRITE 3 : ROGERS, 1937, p. 291
 1
 2
 6 0.45
 1 0 0 0 1 0 0 0-1 0-1 0 0 0 1 0 0-1
 12 1.0
 2-1 0 2 1 0-2 1 0-2-1 0 1 0 2-1 0 2 1 0-2-1 0-2 0 2 1 0 2-1 0-2 1 0-2-1
 PYRITE 4 : ROGERS, 1937, p. 291
 1
 2
 12 1.0
 2-1 0 2 1 0-2 1 0-2-1 0 1 0 2-1 0 2 1 0-2-1 0-2 0 2 1 0 2-1 0-2 1 0-2-1
 8 0.75
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 PYRITE 5 : ROGERS, 1937, p. 291
 1
 1
 24 1.0
 -3 2 1-3 2-1-3-2-1-3-2 1 3 2 1 3 2-1 3-2-1 3-2 1 2-1 3-2-1 3-2 1 3-2 1-3-2-1-3 2
 -1-3 2 1 3 2 1-3-1 3 2 1 3 2-1 3-2 1 3-2-1-3-2 1-3-2 1-3 2-1-3 2
 PYROPHYLLITE TALC : DEER HOWIE AND ZUSSMAN, 1967, p. 225
 5
 3 0.578 1.0 2.067 100.00
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.6
 0 1 0 0-1 0
 2 0.10
 0 0 1 0 0-1
 PYRRHOTITE : MASON AND BERRY, 1968, p. 242
 4
 3 1.6692
 6 1.0
 1 0-1 0 0 1-1 0-1 1 0 0-1 0 1 0 0-1 1 0 1-1 0 0
 2 0.50
 0 0 0-1 0 0 0 1
 12 1.80
 1 0-1 2 0 1-1 2-1 1 0 2-1 1 2 0-1 1 2 1-1 0 2 1 0-1-2 0 1-1-2-1 1 0-2-1 0 1-2
 0-1 1-2 1-1 0-2
 LOW QUARTZ 1 : MASON AND BERRY, 1968, p. 409
 4
 2 1.100
 12 1.50
 1 0-1 1 0 1-1 1-1 1 0 1-1 0 1 1 0-1 1 1 1-1 0 1 1 0-1-1 0 1-1-1-1 0 1-1 0 1-1
 0-1 1-1 1-1 0-1
 6 0.80
 1 0-1 0 0 1-1 0-1 1 0 0-1 0 1 0 0-1 1 0 1-1 0 0
 RUTILE : MASON AND BERRY, 1968, p. 300
 2
 4 0.6439
 4 1.0
 1 0 0-1 0 0 0 1 0 0-1 0
 4 1.40
 1 1 0-1 1 0-1-1 0 1-1 0
 8 2.50
 1 0 1 0 1 1-1 0 1 0-1 1 1 0-1 0 1-1-1 0-1 0-1-1
 8 2.70
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 SCAPOLITE : ROGERS, 1937, p. 468
 2
 4 0.629
 2 1.0

1 0 0-1 0 0
 2 1.0
 0 1 0 0-1 0
 4 1.50
 1 1 0-1 1 0-1-1 0 1-1 0
 8 3.0
 1 1 1-1 1 1-1-1 1 1-1 1 1-1-1-1 1-1-1
 SILLIMANITE : DEER HOWIE AND ZUSSMAN, 1967, P. 34
 3
 3 0.9802 1.0 0.7575
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.80
 0 1 0 0-1 0
 2 2.50
 0 0 1 0 0-1
 SODALITE : FOGERS, 1937, P. 441
 1
 12 1.0
 0 1 1 1 0 1 1 0 0-1 1-1 0 1-1 1 0 0 1-1 1 0-1 1-1 0 0-1-1-1 0-1-1-1 0
 SPHERE : MASON AND BERRY, 1968, P. 507
 5
 3 0.753 1.0 0.854 119.66
 4 1.0
 1 1 1-1 1-1-1-1-1 1-1 1
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.6
 0 0 1 0 0-1
 SPINEL MAGNETITE CHROMITE FRANKLINITE : MASON AND BERRY, 1968, P. 281,282,285
 1
 8 1.0
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 SPODUMENE : AXIAL RATIOS : MASON AND BERRY, 1968, P. 474
 FORMS : DEER HOWIE AND ZUSSMAN, 1967, P. 136
 5
 6 1.144 1.0 0.631 110.3333
 2 1.0
 1 0 0-1 0 0
 2 1.0
 0 1 0 0-1 0
 4 1.60
 1 1 0-1 1 0-1-1 0 1-1 0
 2 3.0
 0 0 1 0 0-1
 4 4.0
 0 2 1 0-2 1 0 2-1 0-2-1
 4 4.5
 -2 2 1-2-2 1 2 2-1 2-2-1
 STAUROLITE : DEER HOWIE AND ZUSSMAN, 1967, P. 49
 3
 3 0.4730 1.0 0.3353
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.65
 0 1 0 0-1 0
 2 2.0
 0 0 1 0 0-1
 TEPHROITE : DEER HOWIE AND ZUSSMAN, 1967, P. 9
 (OLIVINE GROUP).

3
 5 0.4622 1.0 0.5896
 4 1.0
 1 2 0-1 2 0-1-2 0 1-2 0
 4 1.30
 1 3 0-1 3 0-1-3 0 1-3 0
 2 0.38
 0 1 0 0-1 0
 4 1.0
 0 1 1 0-1 1 0-1-1 0 1-1
 8 1.25
 1 1 1 1-1 1 1-1-1 1 1-1-1 1 1-1-1 1-1-1-1 1-1-1
 TOPAZ : DEER HOWIE AND ZUSSMAN, 1967, P. 45
 3
 4 0.5284 1.0 0.9538
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 4 1.25
 1 2 0-1 2 0-1-2 0 1-2 0
 4 3.0
 0 2 1 0-2 1 0 2-1 0-2-1
 8 3.30
 1 1 1-1 1 1-1-1 1 1-1 1 1 1-1-1 1-1-1-1 1-1-1
 TOURMALINE : MASON AND BERRY, 1968, P. 481
 4
 3 0.4480
 6 1.0
 1 1-2 0 2-1-1 0 1-2 1 0-1-1 2 0-2 1 1 0-1 2-1 0
 3 0.50
 1-1 0 0 0 1-1 0-1 0 1 0
 6 3.0
 1 0-1 1-1 1 0 1 0-1 1 1 0 1-1-1-1 0 1-1 1-1 0-1
 TEOKOLITE FERROACTINOLITE : MASON AND BERRY, 1968, P. 463
 5
 3 0.545 1.0 0.293 104.7000
 4 1.0
 1 1 0-1 1 0-1-1 0 1-1 0
 2 0.5
 0 1 0 0-1 0
 4 4.0
 0 1 1 0-1 1 0-1-1 0 1-1
 VESUVIANITE 1 : FOGERS, 1937, P. 470
 2
 3 0.7564
 4 1.0
 1 1 0-1 1 0 1-1 0-1-1 0
 8 1.60
 1 1 1-1 1 1 1-1 1-1-1 1 1 1-1-1 1-1-1-1 1-1-1
 2 1.40
 0 0 1 0 0-1
 VESUVIANITE 2 : FOGERS, 1937, P. 470
 2
 5 0.7564
 4 1.0
 1 1 0-1 1 0 1-1 0-1-1 0
 8 1.60
 1 1 1-1 1 1 1-1 1-1-1 1 1 1-1-1 1-1-1-1 1-1-1
 2 1.45
 0 0 1 0 0-1
 2 0.70
 1 0 0-1 0 0
 2 0.70

0 1 0 0-1 0
 ZIRCON 1 : ROGERS, 1937, p. 471
 2
 2 0.9060
 8 1.0
 1 1 1 1-1 1-1-1 1-1 1-1 1 1-1 1-1-1-1-1-1 1
 4 0.90
 1 1 0 1-1 0-1 1 0-1-1 0
 ZIRCON 2 : ROGERS, 1937, p. 471
 2
 2 0.9060
 8 1.0
 1 1 1 1-1 1-1-1 1-1 1-1 1 1-1 1-1-1-1-1-1 1
 4 0.30
 1 1 0 1-1 0-1 1 0-1-1 0
 ZIRCON 3 : ROGERS, 1937, p. 471
 2
 3 0.9060
 8 1.0
 1 1 1-1 1 1-1-1 1 1-1 1 1-1-1 1-1-1-1 1-1-1
 4 0.30
 1 1 0 1-1 0-1 1 0-1-1 0
 4 0.20
 1 0 0 0 1 0-1 0 0 0-1 0

APPENDIX 2-b.

Output of Module 1 for the 61 Test Minerals..

Note: The following appendix represents the output of Module 1, as it is produced on a printer unit.

BEGINNING OF OPERATIONS.

ADULARIA : ROGERS, 1937, p. 430
 MONOCLINIC SYSTEM : A:B:C= 0.6480: 1.0000: 0.5550 ,ALPHA=GA*PA=90, BETA= 116.0500 , 3 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 8
 MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	0	1
0	0	-1
1	0	-1
-1	0	1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.6916 X +	1.0000 Y +	0.0 Z =	1
-1.6916 X +	1.0000 Y +	0.0 Z =	1
-1.6916 X +	-1.0000 Y +	0.0 Z =	1
1.6916 X +	-1.0000 Y +	0.0 Z =	1
0.5872 X +	0.0 Y +	1.2012 Z =	1
-0.5872 X +	0.0 Y +	-1.2012 Z =	1
0.4770 X +	0.0 Y +	-1.0599 Z =	1
-0.4770 X +	0.0 Y +	1.0599 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.0	1.0000	0.8325	)
(	0.0	1.0000	-0.8325	)
(	0.5912	0.0	0.5435	)
(	0.5912	0.0	-0.6775	)
(	0.1182	0.8000	-0.8903	)
(	-0.5912	0.0	-0.5435	)
(	-0.5912	0.0	0.6775	)
(	-0.1182	0.8000	0.8903	)
(	0.0	-1.0000	0.8325	)
(	0.0	-1.0000	-0.8325	)
(	-0.1182	-0.8000	0.8903	)
(	0.1182	-0.8000	-0.8903	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.0	1.0000	0.8325	)	-----	(	0.0	1.0000	-0.8325	)
(	0.0	1.0000	0.8325	)	-----	(	0.5912	0.0	0.5435	)
(	0.0	1.0000	0.8325	)	-----	(	-0.1182	0.8000	0.8903	)
(	0.0	1.0000	-0.8325	)	-----	(	0.1182	0.8000	-0.8903	)
(	0.0	1.0000	-0.8325	)	-----	(	-0.5912	0.0	-0.5435	)
(	0.5912	0.0	0.5435	)	-----	(	0.5912	0.0	-0.6775	)
(	0.5912	0.0	0.5435	)	-----	(	0.0	-1.0000	0.8325	)
(	0.5912	0.0	-0.6775	)	-----	(	0.1182	-0.8000	-0.8903	)
(	0.5912	0.0	-0.6775	)	-----	(	0.1182	-0.8000	-0.8903	)
(	-0.5912	0.0	-0.5435	)	-----	(	-0.5912	0.0	0.6775	)
(	-0.5912	0.0	-0.5435	)	-----	(	0.0	-1.0000	-0.8325	)
(	-0.5912	0.0	0.6775	)	-----	(	-0.1182	0.8000	0.8903	)
(	-0.5912	0.0	0.6775	)	-----	(	-0.1182	-0.8000	0.8903	)
(	-0.1182	0.8000	0.8903	)	-----	(	-0.1182	-0.8000	0.8903	)
(	0.0	-1.0000	0.8325	)	-----	(	0.0	-1.0000	-0.8325	)
(	0.0	-1.0000	0.8325	)	-----	(	-0.1182	-0.8000	0.8903	)
(	0.0	-1.0000	-0.8325	)	-----	(	0.1182	-0.8000	-0.8903	)

THE MAXIMUM IS:
 VERTICES

1.0000 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 900.0000

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0.0	900.0000	749.2502
0.0	900.0000	-749.2502
532.0396	0.0	489.1819
532.0393	0.0	-609.7168
106.4073	720.0007	-801.2637
-532.0396	0.0	-489.1819
-532.0393	0.0	609.7168
-106.4073	720.0007	801.2637
0.0	-900.0000	749.2502
0.0	-900.0000	-749.2502
-106.4073	-720.0007	801.2637
106.4073	-720.0007	-801.2637

EDGES

1	2
1	3
1	8
2	5
2	6
3	4
3	9
4	5
4	12
5	12
6	7
6	10
7	8
7	11
8	11
9	10
9	11
10	12

FACES

1	2	5	4	3
1	2	6	7	8
6	7	11	9	10
3	4	12	10	9
1	3	8	11	8
2	5	12	10	6
4	5	12		
7	8	11		

THE MAXIMUM IS:

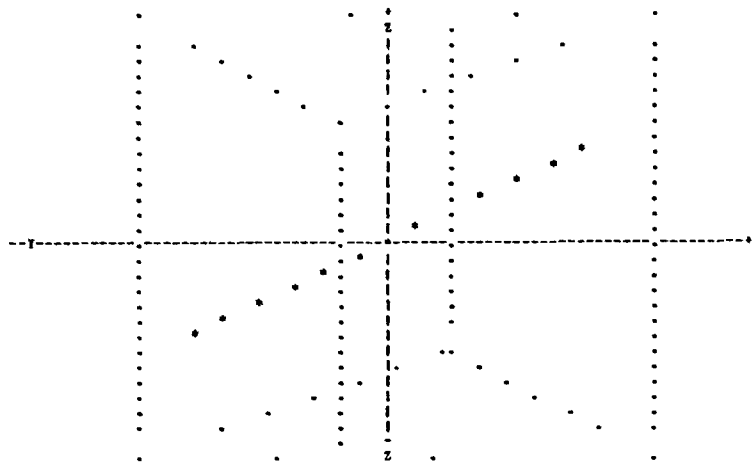
1.0000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.0000000000

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(	18.0000	14.9850	)	-----	(	18.0000	-14.9850	)
(	18.0000	14.9850	)	-----	(	-4.0176	-7.9103	)
(	18.0000	14.9850	)	-----	(	15.2035	16.3999	)
(	18.0000	-14.9850	)	-----	(	13.5965	-16.3999	)
(	18.0000	-14.9850	)	-----	(	4.0176	-7.9103	)
(	-4.0176	-7.9103	)	-----	(	-4.0176	-14.0677	)
(	-4.0176	-7.9103	)	-----	(	-18.0000	14.9850	)
(	-4.0176	-14.0677	)	-----	(	13.5965	-16.3999	)
(	-4.0176	-14.0677	)	-----	(	-15.2035	-16.3999	)
(	13.5965	-16.3999	)	-----	(	-15.2035	-16.3999	)
(	4.0176	-7.9103	)	-----	(	4.0176	14.0677	)
(	4.0176	-7.9103	)	-----	(	-18.0000	-14.9850	)
(	4.0176	14.0677	)	-----	(	15.2035	16.3999	)
(	4.0176	14.0677	)	-----	(	-13.5965	16.3999	)
(	15.2035	16.3999	)	-----	(	-13.5965	16.3999	)
(	-18.0000	14.9850	)	-----	(	-18.0000	-14.9850	)
(	-18.0000	14.9850	)	-----	(	-13.5965	16.3999	)
(	-18.0000	-14.9850	)	-----	(	-15.2035	-16.3999	)

CRYSTAL SHAPE:

.....



ARGIRINE : FORMS : DEER HOWIE AND ZUSSMAN, 1967, P. 132,
 AXIAL RATIOS : MASON AND BIRBY, 1968, P. 472
 MONOCLINIC SYSTEM : A:B:C= 1.0990: 1.0000: 0.6010 , ALPHA=90, BETA= 106.8166 , 5 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 24
 MILLER INDICES :

1	0	0
-1	0	0
0	1	0
0	-1	0
1	1	0
-1	1	0
1	-1	0
-1	-1	0
4	6	1
-4	6	1
-4	-6	1
4	-6	1
4	6	-1
-4	6	-1
-4	-6	-1
4	-6	-1
1	1	1
-1	1	1
1	-1	1
-1	-1	1
1	1	-1
-1	1	-1
1	-1	-1
-1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :
 $1.9011 X + 0.0 Y + 0.0 Z = 1$

-1.9011 X +	0.0 Y +	0.0 Z =	1
0.0 X +	2.0000 Y +	0.0 Z =	1
0.0 X +	-2.0000 Y +	0.0 Z =	1
1.3580 X +	1.4286 Y +	0.0 Z =	1
-1.3580 X +	1.4286 Y +	0.0 Z =	1
-1.3580 X +	-1.4286 Y +	0.0 Z =	1
1.3580 X +	-1.4286 Y +	0.0 Z =	1
1.0763 X +	1.5000 Y +	0.4160 Z =	1
-0.8248 X +	1.5000 Y +	0.4160 Z =	1
-0.8248 X +	-1.5000 Y +	0.4160 Z =	1
1.0763 X +	-1.5000 Y +	0.4160 Z =	1
0.8248 X +	1.5000 Y +	-0.4160 Z =	1
-1.0763 X +	1.5000 Y +	-0.4160 Z =	1
-1.0763 X +	-1.5000 Y +	-0.4160 Z =	1
0.8248 X +	-1.5000 Y +	-0.4160 Z =	1
0.4845 X +	0.3333 Y +	0.5546 Z =	1
-0.4845 X +	0.3333 Y +	0.5546 Z =	1
-0.4845 X +	-0.3333 Y +	0.5546 Z =	1
0.4845 X +	-0.3333 Y +	0.5546 Z =	1
0.1492 X +	0.3333 Y +	-0.5546 Z =	1
-0.1492 X +	0.3333 Y +	-0.5546 Z =	1
-0.1492 X +	-0.3333 Y +	-0.5546 Z =	1
0.1492 X +	-0.3333 Y +	-0.5546 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5260	0.2000	0.3218	)
(	0.5260	0.2000	-0.6398	)
(	0.5260	-0.2000	0.3218	)
(	0.5260	-0.2000	-0.6398	)
(	0.5260	0.0	1.0430	)
(	0.5260	0.0	-1.3610	)
(	-0.5260	0.2000	0.6398	)
(	-0.5260	0.2000	-0.3218	)
(	-0.5260	-0.2000	0.6398	)
(	-0.5260	-0.2000	-0.3218	)
(	-0.5260	0.0	1.3610	)
(	-0.5260	0.0	-1.0430	)
(	0.2104	0.5000	0.0566	)
(	0.2104	0.5000	-0.1838	)
(	-0.2104	0.5000	0.1838	)
(	-0.2104	0.5000	-0.0566	)
(	0.0	0.5000	0.6010	)
(	0.0	0.5000	-0.6010	)
(	0.0000	0.2000	1.6928	)
(	0.3507	0.0	1.4967	)
(	-0.3507	0.0000	1.7086	)
(	-0.0000	-0.2000	1.6028	)
(	0.0000	0.2000	-1.6028	)
(	0.3507	0.0000	-1.7086	)
(	-0.3507	0.0	-1.4967	)
(	-0.0000	-0.2000	-1.6028	)
(	-0.0000	0.0	1.6010	)
(	-0.0000	0.0	-1.6010	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.5260	0.2000	0.3218	)	-----	(	0.5260	0.2000	-0.6398	)
(	0.5260	0.2000	0.3218	)	-----	(	0.5260	0.0	1.0430	)
(	0.5260	0.2000	0.3218	)	-----	(	0.2104	0.5000	0.0566	)

(	0.5260	0.2000	-0.6198	)	-----	(	0.5260	0.0	-1.3610	)
(	0.5260	0.2000	-0.6198	)	-----	(	0.2104	0.5000	-0.1818	)
(	0.5260	-0.2000	0.3218	)	-----	(	0.5260	-0.2000	-0.6198	)
(	0.5260	-0.2000	0.3218	)	-----	(	0.5260	0.0	1.0430	)
(	0.5260	-0.2000	0.3218	)	-----	(	0.2104	-0.5000	0.0566	)
(	0.5260	-0.2000	-0.6198	)	-----	(	0.5260	0.0	-1.3610	)
(	0.5260	-0.2000	-0.6198	)	-----	(	0.2104	-0.5000	-0.1818	)
(	0.5260	0.0	1.0430	)	-----	(	0.1507	0.0	1.4967	)
(	0.5260	0.0	-1.3610	)	-----	(	0.3507	0.0000	-1.7086	)
(	-0.5260	0.2000	0.6198	)	-----	(	-0.5260	0.2000	-0.1214	)
(	-0.5260	0.2000	0.6198	)	-----	(	-0.5260	0.0	1.3610	)
(	-0.5260	0.2000	0.6198	)	-----	(	-0.2104	0.5000	0.1818	)
(	-0.5260	0.2000	-0.3218	)	-----	(	-0.5260	0.0	-1.0430	)
(	-0.5260	0.2000	-0.3218	)	-----	(	-0.2104	0.5000	-0.0566	)
(	-0.5260	-0.2000	0.6198	)	-----	(	-0.5260	-0.2000	-0.3218	)
(	-0.5260	-0.2000	0.6198	)	-----	(	-0.5260	0.0	1.3610	)
(	-0.5260	-0.2000	0.6198	)	-----	(	-0.2104	-0.5000	0.1818	)
(	-0.5260	-0.2000	-0.3218	)	-----	(	-0.5260	0.0	-1.0430	)
(	-0.5260	-0.2000	-0.3218	)	-----	(	-0.2104	-0.5000	-0.0566	)
(	-0.5260	0.0	1.3610	)	-----	(	-0.3507	0.0000	1.7086	)
(	-0.5260	0.0	-1.0430	)	-----	(	-0.3507	0.0	-1.4967	)
(	0.2104	0.5000	0.0566	)	-----	(	0.2104	0.5000	-0.1818	)
(	0.2104	0.5000	0.0566	)	-----	(	0.0	0.5000	0.6010	)
(	0.2104	0.5000	-0.1818	)	-----	(	0.0	0.5000	-0.6010	)
(	-0.2104	0.5000	0.1818	)	-----	(	-0.2104	0.5000	-0.0566	)
(	-0.2104	0.5000	0.1818	)	-----	(	0.0	0.5000	0.6010	)
(	-0.2104	0.5000	-0.0566	)	-----	(	0.0	0.5000	-0.6010	)
(	0.0	0.5000	0.6010	)	-----	(	0.0000	0.2000	1.6828	)
(	0.0	0.5000	-0.6010	)	-----	(	0.0000	0.2000	-1.6828	)
(	-0.2104	-0.5000	0.1818	)	-----	(	-0.2104	-0.5000	-0.0566	)
(	-0.2104	-0.5000	0.1818	)	-----	(	0.0	-0.5000	0.6010	)
(	-0.2104	-0.5000	-0.0566	)	-----	(	0.0	-0.5000	-0.6010	)
(	-0.2104	-0.5000	0.0566	)	-----	(	0.2104	-0.5000	-0.1818	)
(	0.2104	-0.5000	0.0566	)	-----	(	0.0	-0.5000	0.6010	)
(	0.2104	-0.5000	-0.1818	)	-----	(	0.0	-0.5000	-0.6010	)
(	0.0	-0.5000	0.6010	)	-----	(	-0.0000	-0.2000	1.6828	)
(	0.0	-0.5000	-0.6010	)	-----	(	-0.0000	-0.2000	-1.6828	)
(	0.0000	0.2000	1.6828	)	-----	(	0.3507	0.0	1.4967	)
(	0.0000	0.2000	1.6828	)	-----	(	-0.3507	0.0000	1.7086	)
(	0.3507	0.0	1.4967	)	-----	(	-0.0000	0.0	1.8030	)
(	0.3507	0.0	1.4967	)	-----	(	-0.0000	-0.2000	1.6828	)
(	-0.3507	0.0000	1.7086	)	-----	(	-0.0000	0.0	1.8030	)
(	-0.3507	0.0000	1.7086	)	-----	(	-0.0000	-0.2000	-1.6828	)
(	-0.0000	-0.2000	1.6828	)	-----	(	-0.0000	0.0	1.8030	)
(	-0.0000	-0.2000	-1.6828	)	-----	(	0.3507	0.0000	-1.7086	)
(	0.0000	0.2000	-1.6828	)	-----	(	-0.3507	0.0	-1.4967	)
(	0.0000	0.2000	1.6828	)	-----	(	-0.0000	0.0	-1.8030	)
(	0.3507	0.0000	-1.7086	)	-----	(	-0.0000	-0.2000	-1.6828	)
(	0.3507	0.0000	-1.7086	)	-----	(	-0.0000	0.0	-1.8030	)
(	-0.3507	0.0	-1.4967	)	-----	(	-0.0000	0.0	-1.8030	)
(	-0.3507	0.0	-1.4967	)	-----	(	-0.0000	0.0	-1.8030	)
(	-0.0000	-0.2000	-1.6828	)	-----	(	-0.0000	0.0	-1.8030	)

THE MAXIMUM IS: 1.8030 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 499.1680

VERTICES
 262.5630 99.8336 160.6458
 262.5630 99.8336 -319.3550
 262.5630 -99.8336 160.6458
 262.5630 -99.8336 -319.3550
 262.5630 0.0 520.6455
 262.5630 0.0 -679.3547
 -262.5630 99.8336 319.3550

-262.5630 99.8336 -160.6458
 -262.5630 -99.8336 319.3550
 -262.5630 -99.8336 -160.6458
 -262.5630 0.0 679.3547
 -262.5630 0.0 -520.6455
 105.0254 249.5840 28.2577
 105.0254 249.5840 -91.7412
 -105.0254 249.5840 91.7412
 -105.0254 249.5840 -28.2577
 0.0 249.5840 299.9998
 0.0 249.5840 -299.9998
 -105.0254 -249.5840 91.7412
 -105.0254 -249.5840 -28.2577
 105.0254 -249.5840 28.2577
 105.0254 -249.5840 -91.7412
 0.0 -249.5840 299.9998
 0.0 -249.5840 -299.9998
 0.0001 99.8337 840.0000
 175.0421 0.0 747.0962
 -175.0417 0.0000 852.9026
 -0.0001 -99.8336 839.9995
 0.0001 99.8336 -839.9995
 175.0417 0.0000 -852.9026
 -175.0421 0.0 -747.0962
 -0.0001 -99.8337 -840.0000
 -0.0001 0.0 899.9995
 -0.0001 0.0 -899.9995

EDGES
 1 2
 1 5
 1 13
 2 6
 2 14
 3 4
 3 5
 3 21
 4 6
 4 22
 5 26
 6 30
 7 8
 7 11
 7 15
 8 12
 8 16
 9 10
 9 11
 9 19
 10 12
 10 20
 11 27
 12 31
 13 14
 13 17
 14 18
 15 16
 15 17
 16 18
 17 25
 18 29
 19 20
 19 23

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20 24
21 22
21 23
22 24
23 28
24 32
25 26
25 27
25 33
26 28
26 33
27 28
27 33
28 33
29 30
29 31
29 34
30 32
30 34
31 32
31 34
32 34
FACES
1 2 6 4 3 5
7 8 12 10 9 11
13 14 18 16 15 17
19 20 24 22 21 23
1 2 14 13
7 8 16 15
9 10 20 19
3 4 22 21
1 5 26 25 17 13
7 11 27 25 17 15
9 11 27 28 23 19
3 5 26 28 23 21
2 6 30 29 18 14
8 12 31 29 18 16
10 12 31 32 24 20
4 6 30 32 24 22
25 26 33
25 27 33
27 28 33
26 28 33
29 30 34
29 31 34
31 32 34
30 32 34

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THE MAXIMUM IS:

1.8029994965

THE CONVERSION FACTOR FOR VIFWPLT IS :

9.9833631516

```

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.0140 2.2884 )----- ( 0.0140 -7.3116 )
( 0.0140 2.2884 )----- ( -1.9827 9.4884 )
( 0.0140 2.2884 )----- ( 4.1986 0.1953 )
( 0.0140 -7.3116 )----- ( -1.9827 -14.5116 )
( 0.0140 -7.3116 )----- ( 4.1986 -2.2046 )
( -3.9794 2.2884 )----- ( -3.9794 -7.3116 )
( -3.9794 2.2884 )----- ( -1.9827 9.4884 )
( -3.9794 2.2884 )----- ( -5.7848 0.1953 )
( -3.9794 -7.3116 )----- ( -1.9827 -14.5116 )
( -3.9794 -7.3116 )----- ( -5.7848 -2.2046 )
( -1.9827 9.4884 )----- ( -1.3218 14.3256 )
( -1.9827 -14.5116 )----- ( -1.3218 -17.6744 )
( 3.9794 7.3116 )----- ( 3.9794 -2.2884 )

```

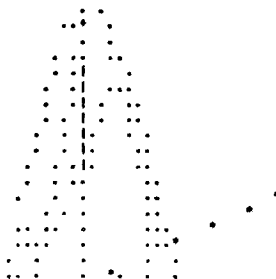
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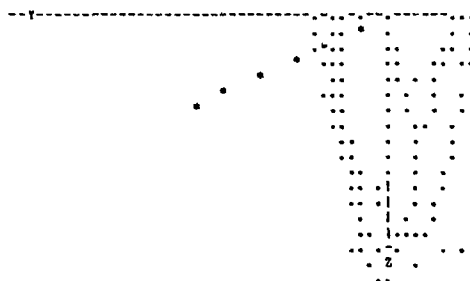
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( 3.9794 7.3116 )----- ( 1.9827 14.5116 )
( 3.9794 7.3116 )----- ( 5.7848 2.2046 )
( 3.9794 -2.2884 )----- ( 1.9827 -9.4884 )
( 3.9794 -2.2884 )----- ( 5.7848 -0.1953 )
( -0.0140 7.3116 )----- ( -0.0140 -2.2884 )
( -0.0140 7.3116 )----- ( 1.9827 14.5116 )
( -0.0140 7.3116 )----- ( 4.1986 2.2046 )
( -0.0140 -2.2884 )----- ( 1.9827 -9.4884 )
( -0.0140 -2.2884 )----- ( 4.1986 -0.1953 )
( 1.9827 14.5116 )----- ( 1.3218 17.6744 )
( 1.9827 -9.4884 )----- ( 1.3218 -14.3256 )
( 4.1986 0.1953 )----- ( 4.1986 -2.2046 )
( 4.1986 0.1953 )----- ( 4.9917 6.0000 )
( 4.1986 -2.2046 )----- ( 4.9917 -6.0000 )
( 5.7848 2.2046 )----- ( 5.7848 -0.1953 )
( 5.7848 2.2046 )----- ( 4.9917 6.0000 )
( 5.7848 -0.1953 )----- ( 4.9917 -6.0000 )
( 4.9917 6.0000 )----- ( 1.9967 16.8000 )
( 4.9917 -6.0000 )----- ( 1.9967 -16.8000 )
( -4.1986 2.2046 )----- ( -4.1986 -0.1953 )
( -4.1986 2.2046 )----- ( -4.9917 6.0000 )
( -4.1986 -0.1953 )----- ( -4.9917 -6.0000 )
( -5.7848 0.1953 )----- ( -5.7848 -2.2046 )
( -5.7848 0.1953 )----- ( -4.9917 6.0000 )
( -5.7848 -2.2046 )----- ( -4.9917 -6.0000 )
( -4.9917 6.0000 )----- ( -1.9967 16.8000 )
( -4.9917 -6.0000 )----- ( -1.9967 -16.8000 )
( 1.9967 16.8000 )----- ( 1.3218 14.3256 )
( 1.9967 16.8000 )----- ( 1.3218 17.6744 )
( 1.9967 16.8000 )----- ( 0.0000 18.0000 )
( -1.3218 14.3256 )----- ( -1.9967 16.8000 )
( -1.3218 14.3256 )----- ( 0.0000 18.0000 )
( 1.3218 17.6744 )----- ( -1.9967 16.8000 )
( 1.3218 17.6744 )----- ( 0.0000 18.0000 )
( -1.9967 16.8000 )----- ( 0.0000 18.0000 )
( 1.9967 -16.8000 )----- ( -1.3218 -17.6744 )
( 1.9967 -16.8000 )----- ( 1.3218 -14.3256 )
( 1.9967 -16.8000 )----- ( 0.0000 -18.0000 )
( -1.3218 -17.6744 )----- ( -1.9967 -16.8000 )
( -1.3218 -17.6744 )----- ( 0.0000 -18.0000 )
( 1.3218 -14.3256 )----- ( -1.9967 -16.8000 )
( 1.3218 -14.3256 )----- ( 0.0000 -18.0000 )
( -1.9967 -16.8000 )----- ( 0.0000 -18.0000 )

```

CRYSTAL SHAPE:





ALBITE 1 : ROGPS, 1937, p. 432
 TRICLINIC SYSTEM, A:B:C= 0.6369: 1.0000: 0.5599 ALPHA= 94.2666 , BETA= 116.5990 , GAMMA= 87.6666
 : 4 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 10
 MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	0
0	-1	0
0	0	1
0	0	-1
-1	0	0
1	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.7559 X +	0.9882 Y +	0.0 Z =	1
-1.7559 X +	1.0174 Y +	0.0 Z =	1
-1.7559 X +	-0.9882 Y +	0.0 Z =	1
1.7559 X +	-1.0174 Y +	0.0 Z =	1
0.0 X +	2.0056 Y +	0.0 Z =	1
0.0 X +	-2.0056 Y +	0.0 Z =	1
0.5962 X +	0.0839 Y +	1.1907 Z =	1
-0.5962 X +	-0.0839 Y +	-1.1907 Z =	1
-0.5068 X +	0.0 Y +	1.0506 Z =	1
0.5068 X +	-0.0826 Y +	-1.0506 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5695	0.0	0.5547	)
(	0.5695	0.0	-0.6771	)
(	0.2889	0.4986	0.6601	)
(	0.2889	0.4986	-0.8517	)
(	-0.5695	0.0	-0.5547	)
(	-0.5695	0.0	0.6771	)
(	-0.2806	0.4986	-0.7345	)
(	-0.2806	0.4986	0.8165	)
(	-0.2889	-0.4986	-0.6601	)
(	-0.2889	-0.4986	0.8125	)
(	0.2806	-0.4986	0.7345	)
(	0.2806	-0.4986	-0.7773	)
(	-0.1496	0.4986	0.8796	)
(	-0.1180	0.4986	-0.9341	)
(	-0.0782	-0.4986	0.9141	)
(	0.1098	-0.4986	-0.8597	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.5695	0.0	0.5547	)	-----	(	0.5695	0.0	-0.6771	)
(	0.5695	0.0	0.5547	)	-----	(	0.2889	0.4986	0.6601	)
(	0.5695	0.0	0.5547	)	-----	(	0.2806	-0.4986	0.7345	)
(	0.5695	0.0	-0.6771	)	-----	(	0.2889	0.4986	-0.8517	)
(	0.5695	0.0	-0.6771	)	-----	(	0.2806	-0.4986	-0.7773	)
(	0.2889	0.4986	0.6601	)	-----	(	0.2889	0.4986	-0.8517	)
(	0.2889	0.4986	0.6601	)	-----	(	-0.1496	0.4986	0.8796	)
(	0.2889	0.4986	-0.8517	)	-----	(	0.1180	0.4986	-0.9341	)
(	-0.5695	0.0	-0.5547	)	-----	(	-0.5695	0.0	0.6771	)
(	-0.5695	0.0	-0.5547	)	-----	(	-0.2806	0.4986	-0.7345	)
(	-0.5695	0.0	-0.5547	)	-----	(	-0.2889	-0.4986	-0.6601	)
(	-0.5695	0.0	0.6771	)	-----	(	-0.2806	0.4986	0.8165	)
(	-0.5695	0.0	0.6771	)	-----	(	-0.2889	-0.4986	0.8125	)
(	-0.2806	0.4986	-0.7345	)	-----	(	-0.2806	0.4986	0.8165	)
(	-0.2806	0.4986	-0.7345	)	-----	(	0.1180	0.4986	-0.9341	)
(	-0.2806	0.4986	0.8165	)	-----	(	-0.1496	0.4986	0.8796	)
(	-0.2889	-0.4986	-0.6601	)	-----	(	-0.2889	-0.4986	0.8125	)
(	-0.2889	-0.4986	-0.6601	)	-----	(	0.1098	-0.4986	-0.8597	)
(	-0.2889	-0.4986	0.8125	)	-----	(	-0.0782	-0.4986	0.9141	)
(	0.2806	-0.4986	0.7345	)	-----	(	0.2806	-0.4986	-0.7773	)
(	0.2806	-0.4986	0.7345	)	-----	(	-0.0782	-0.4986	0.9141	)
(	0.2806	-0.4986	-0.7773	)	-----	(	0.1098	-0.4986	-0.8597	)
(	-0.1496	0.4986	0.8796	)	-----	(	-0.0782	-0.4986	0.9141	)
(	0.1180	0.4986	-0.9341	)	-----	(	0.1098	-0.4986	-0.8597	)

THE MAXIMUM IS:

0.9341

THE CONVERSION FACTOR FOR THE PINTER GRAPH IS :

963.5134

VERTICES

548.7136	0.0	534.4438
548.7136	0.0	-652.3921
278.3481	480.4048	635.9839
278.3479	480.4053	-820.5872
-548.7136	0.0	-534.4438
-548.7136	0.0	652.3921
-270.3672	480.4048	-707.6658
-270.3672	480.4053	786.6714
-278.3481	-480.4048	-635.9839
-278.3479	-480.4053	782.8213
270.3672	-480.4048	707.6658
270.3672	-480.4053	-748.9050
-144.1647	480.4050	847.5512
113.7327	480.4050	-899.9998
-75.3197	-480.4050	880.7649
105.7517	-480.4050	-828.1181

EDGES

1	2
1	3
1	11
2	4
2	12
3	4
3	13
4	14
5	6
5	7
5	9
6	8
6	10
7	8
7	14
8	13
9	10
9	16
10	15

```

11 12
11 15
12 16
13 15
14 16
FACES
1 2 4 3
5 6 8 7
5 6 10 9
1 2 12 11
3 4 14 7 8 13
9 10 15 11 12 16
1 3 13 15 11
5 7 14 16 9
6 8 13 15 10
2 4 14 16 12

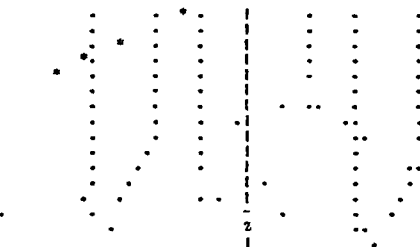
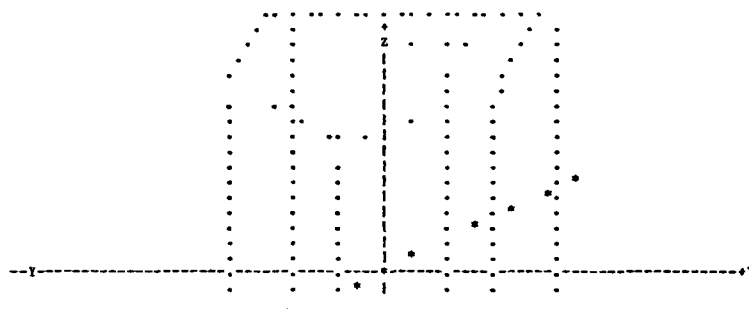
```

THE MAXIMUM IS: 0.9548628330 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.8508605957

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(-4.0533 8.5862)	-----	(-4.0533 -14.6539)
(-4.0533 8.5862)	-----	(7.3428 11.4841)
(-4.0533 8.5862)	-----	(-11.3962 12.9140)
(-4.0533 -14.6539)	-----	(7.3429 -17.0133)
(-4.0533 -14.6539)	-----	(-11.3962 -15.5834)
(7.3428 11.4841)	-----	(7.3429 -17.0133)
(7.3428 11.4841)	-----	(10.4639 17.0787)
(7.3429 -17.0133)	-----	(8.5589 -18.0000)
(4.0533 -8.5862)	-----	(4.0533 14.6539)
(4.0533 -8.5862)	-----	(11.3962 -12.9140)
(4.0533 -8.5862)	-----	(-7.3428 -11.4841)
(4.0533 14.6539)	-----	(11.3962 16.3223)
(4.0533 14.6539)	-----	(-7.3429 16.2744)
(11.3962 -12.9140)	-----	(11.3962 16.3223)
(11.3962 -12.9140)	-----	(8.5589 -18.0000)
(11.3962 16.3223)	-----	(10.4639 17.0787)
(-7.3428 -11.4841)	-----	(-7.3429 16.2744)
(-7.3428 -11.4841)	-----	(-10.1802 -16.5701)
(-7.3429 16.2744)	-----	(-8.8426 17.4913)
(-11.3962 12.9140)	-----	(-11.3962 -15.5834)
(-11.3962 12.9140)	-----	(-8.8426 17.4913)
(-11.3962 -15.5834)	-----	(-10.1802 -16.5701)
(10.4639 17.0787)	-----	(-8.8426 17.4913)
(8.5589 -18.0000)	-----	(-10.1802 -16.5701)

CRYSTAL SHAPE:



ALBITE 2 : ROGERS, 1937, P. 434
 TRICLINIC SYSTEM, A:B:C= 0.6369: 1.0000: 0.5599 ALPHA= 94.2666 , BETA= 116.5990 , GAMMA= 87.6666
 FORM(S) :
 NUMBER OF FACES OR MILLER INDICES 10
 MILLER INDICES :

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.7559 X +	0.9882 Y +	0.0 Z =	1
-1.7559 X +	1.0174 Y +	0.0 Z =	1
-1.7559 X +	-0.9882 Y +	0.0 Z =	1
1.7559 X +	-1.0174 Y +	0.0 Z =	1
0.0 X +	1.2535 Y +	0.0 Z =	1
0.0 X +	-1.2535 Y +	0.0 Z =	1
1.7887 X +	0.2516 Y +	3.5721 Z =	1
-1.7887 X +	-0.2516 Y +	-3.5721 Z =	1
-1.4360 X +	0.0 Y +	2.9767 Z =	1
1.4360 X +	-0.2340 Y +	-2.9767 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(0.5695 0.0 -0.0052)
(0.5695 0.0 -0.0612)
(0.1205 0.7978 0.1634)
(0.1205 0.7978 -0.3405)
(-0.5695 0.0 -0.0052)
(-0.5695 0.0 -0.0612)
(-0.1073 0.7978 0.2775)
(-0.1073 0.7978 -0.2824)
(-0.1134 0.7973 0.2413)
(-0.1205 -0.7978 -0.1634)
(-0.1205 -0.7978 0.2775)
(0.1073 -0.7978 0.2424)
(0.1073 -0.7978 -0.2215)
(0.0636 0.7978 -0.1640)
(0.0002 -0.7978 0.1640)
(0.0003 -0.7978 -0.2424)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(0.5695 0.0 -0.0052)	-----	(0.5695 0.0 -0.0612)
(0.5695 0.0 -0.0052)	-----	(0.1205 0.7978 0.1634)

```

( 0.5695 0.0 -0.0052 )----- ( 0.1073 -0.7978 0.2824 )
( 0.5695 0.0 -0.0612 )----- ( 0.1205 0.7978 -0.3405 )
( 0.5695 0.0 -0.0612 )----- ( 0.1073 -0.7978 -0.2215 )
( 0.1205 0.7978 0.1634 )----- ( 0.1205 0.7978 -0.3405 )
( 0.1205 0.7978 0.1634 )----- ( -0.1073 0.7978 0.2775 )
( 0.1205 0.7978 -0.3405 )----- ( 0.0616 0.7978 -0.3680 )
( -0.5695 0.0 0.0052 )----- ( -0.5695 0.0 0.0612 )
( -0.5695 0.0 0.0612 )----- ( -0.1073 0.7978 -0.2824 )
( -0.5695 0.0 0.0052 )----- ( -0.1205 -0.7978 -0.1634 )
( -0.5695 0.0 0.0612 )----- ( -0.1134 0.7978 0.2813 )
( -0.5695 0.0 0.0612 )----- ( -0.1205 -0.7978 -0.2775 )
( -0.1073 0.7978 0.2775 )----- ( -0.1073 0.7978 -0.2824 )
( -0.1073 0.7978 -0.2824 )----- ( -0.1134 0.7978 0.2813 )
( -0.1134 0.7978 0.2813 )----- ( 0.0616 0.7978 -0.3680 )
( -0.1205 -0.7978 -0.1634 )----- ( 0.0002 -0.7978 0.3360 )
( -0.1205 -0.7978 -0.1634 )----- ( -0.1205 -0.7978 0.2775 )
( -0.1205 -0.7978 -0.1634 )----- ( 0.0501 -0.7978 -0.2489 )
( -0.1205 -0.7978 0.2775 )----- ( 0.0002 -0.7978 0.3360 )
( 0.1073 -0.7978 0.2824 )----- ( 0.1073 -0.7978 -0.2215 )
( 0.1073 -0.7978 0.2824 )----- ( 0.0002 -0.7978 0.3360 )
( 0.1073 -0.7978 -0.2215 )----- ( 0.0503 -0.7978 -0.2489 )
( 0.0616 0.7978 -0.3680 )----- ( 0.0503 -0.7978 -0.2489 )

```

THE MAXIMUM IS: 0.7978 THE CONVERSION FACTOR FOR THE PFWINTER GRAPH IS : 1128.1693

VERTICES

642.4812	0.0	-5.8868
642.4812	0.0	-69.0511
135.9732	899.9998	184.3399
135.9731	899.9998	-384.1509
-642.4812	0.0	5.8865
-642.4812	0.0	69.0511
-121.0217	899.9998	313.0273
-121.0217	899.9998	-318.6313
-127.8875	888.1501	317.3000
-135.9732	-899.9998	-184.3399
-135.9731	-899.9998	313.3994
121.0217	-899.9998	318.6313
121.0217	-899.9998	-249.8611
71.7227	899.9998	-415.1462
0.2406	-899.9998	379.1113
56.7733	-899.9998	-280.8555

EDGES

1	2
1	3
1	12
2	4
2	13
3	4
3	7
4	14
5	6
5	8
5	10
6	9
6	11
7	8
7	9
8	14
9	15
10	11
10	16
11	15
12	13

12	15
13	16
14	16

FACES

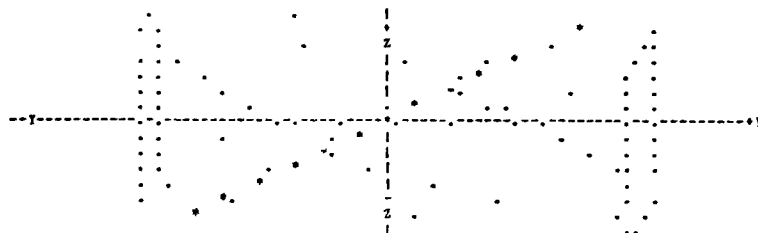
1	2	4	3
5	6	9	7
5	6	11	10
1	2	13	12
3	4	14	8
10	11	15	12
1	3	7	9
5	8	14	16
6	9	15	11
2	4	14	16

THE MAXIMUM IS: 0.8382586241 THE CONVERSION FACTOR FOR VIEWPLOT IS : 21.4730834961

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(-4.6171 -2.2650)	-----	(-4.6171 -3.4672)
(-4.6171 -2.2650)	-----	(16.1531 3.0530)
(-4.6171 -2.2650)	-----	(-18.0000 5.6592)
(-4.6171 -3.4672)	-----	(16.1531 -7.7674)
(-4.6171 -3.4672)	-----	(-18.0000 -5.1613)
(16.1531 3.0530)	-----	(16.1531 -7.7674)
(16.1531 3.0530)	-----	(18.0000 6.3636)
(16.1531 -7.7674)	-----	(16.6148 -8.1421)
(4.6171 2.2650)	-----	(4.6171 3.4672)
(4.6171 2.2650)	-----	(18.0000 -5.6592)
(4.6171 2.2650)	-----	(-16.1531 -3.0530)
(4.6171 3.4672)	-----	(17.8238 6.4679)
(4.6171 3.4672)	-----	(-16.1531 6.4208)
(18.0000 6.3636)	-----	(18.0000 -5.6592)
(18.0000 6.3636)	-----	(17.8238 6.4679)
(18.0000 -5.6592)	-----	(16.6148 -8.1421)
(17.8238 6.4679)	-----	(-17.1320 7.2151)
(-16.1531 -3.0530)	-----	(-16.1531 6.4208)
(-16.1531 -3.0530)	-----	(-17.5383 -5.5360)
(-16.1531 6.4208)	-----	(-17.1320 7.2151)
(-18.0000 5.6592)	-----	(-18.0000 -5.1613)
(-18.0000 5.6592)	-----	(-17.1320 7.2151)
(-18.0000 -5.1613)	-----	(-17.5383 -5.5360)
(16.6148 -8.1421)	-----	(-17.5383 -5.5360)

CRYSTAL SHAPE:



ANDALUSITE : DEPR HOWIE AND ZHOSMAN, 1967, P. 38
 ORTHORHOMBIC SYSTEM : A:B:C = 0.9923: 1.0000: 0.7932, ALPHA=BETA=GAMMA=90, 3 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 10
 MILLER INDICES :

1	1	0
-1	1	0

```

      -1      -1      0
      1      -1      0
      0      0      1
      0      0     -1
      0      1      1
      0      -1      1
      0      -1     -1
      0      -1     -1
THE CARTESIAN COORDINATES OF THE CRYSTAL FACES ARE :
      1.0180 X + 1.0000 Y + 0.0 Z = 1
     -1.0180 X + 1.0000 Y + 0.0 Z = 1
     -1.0180 X + -1.0000 Y + 0.0 Z = 1
      1.0180 X + -1.0000 Y + 0.0 Z = 1
      0.0 X + 0.0 Y + 0.5688 Z = 1
      0.0 X + 0.0 Y + -0.5688 Z = 1
      0.0 X + 0.3333 Y + 0.4740 Z = 1
      0.0 X + -0.3333 Y + 0.4740 Z = 1
      0.0 X + 0.3333 Y + -0.4740 Z = 1
      0.0 X + -0.3333 Y + -0.4740 Z = 1
THE POSITIONS OF THE CRYSTAL VERTICES ARE :
      0.0 1.0000 1.4064
      0.0 1.0000 -1.4064
      0.9823 0.0 1.7580
      0.9823 0.0 -1.7580
      0.4912 0.5000 1.7580
      0.4912 0.5000 -1.7580
     -0.9823 0.0 1.7580
     -0.9823 0.0 -1.7580
     -0.4912 0.5000 1.7580
     -0.4912 0.5000 -1.7580
      0.0 -1.0000 1.4064
      0.0 -1.0000 -1.4064
     -0.4912 -0.5000 1.7580
     -0.4912 -0.5000 -1.7580
      0.4912 -0.5000 1.7580
      0.4912 -0.5000 -1.7580
THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
      0.0 1.0000 1.4064 )----- ( 0.0 1.0000 -1.4064 )
      0.0 1.0000 1.4064 )----- ( 0.4912 0.5000 1.7580 )
      0.0 1.0000 1.4064 )----- ( -0.4912 0.5000 1.7580 )
      0.0 1.0000 -1.4064 )----- ( 0.4912 0.5000 -1.7580 )
      0.0 1.0000 -1.4064 )----- ( -0.4912 0.5000 -1.7580 )
      0.9823 0.0 1.7580 )----- ( 0.9823 0.0 -1.7580 )
      0.9823 0.0 1.7580 )----- ( 0.4912 0.5000 1.7580 )
      0.9823 0.0 1.7580 )----- ( 0.4912 -0.5000 1.7580 )
      0.9823 0.0 -1.7580 )----- ( 0.4912 0.5000 -1.7580 )
      0.9823 0.0 -1.7580 )----- ( 0.4912 -0.5000 -1.7580 )
      0.4912 0.5000 1.7580 )----- ( -0.4912 0.5000 1.7580 )
      0.4912 0.5000 -1.7580 )----- ( -0.4912 0.5000 -1.7580 )
     -0.9823 0.0 1.7580 )----- ( -0.9823 0.0 -1.7580 )
     -0.9823 0.0 1.7580 )----- ( -0.4912 0.5000 1.7580 )
     -0.9823 0.0 1.7580 )----- ( -0.4912 -0.5000 1.7580 )
     -0.9823 0.0 -1.7580 )----- ( -0.4912 0.5000 -1.7580 )
     -0.9823 0.0 -1.7580 )----- ( -0.4912 -0.5000 -1.7580 )
      0.0 -1.0000 1.4064 )----- ( 0.0 -1.0000 -1.4064 )
      0.0 -1.0000 1.4064 )----- ( 0.4912 -0.5000 1.7580 )
      0.0 -1.0000 1.4064 )----- ( 0.4912 -0.5000 -1.7580 )
      0.0 -1.0000 -1.4064 )----- ( 0.4912 -0.5000 1.7580 )
      0.0 -1.0000 -1.4064 )----- ( 0.4912 -0.5000 -1.7580 )
     -0.4912 -0.5000 1.7580 )----- ( 0.4912 -0.5000 1.7580 )
     -0.4912 -0.5000 -1.7580 )----- ( 0.4912 -0.5000 -1.7580 )
THE MAXIMUM IS: 1.7580 THE CONVERSION FACTOR FOR THE PINTER GRAPH IS : 511.9456

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VERTICES
0.0 511.9456 719.9990
0.0 511.9456 -719.9990
502.8840 0.0 899.9998
502.8840 0.0 -899.9998
251.4423 255.9725 899.9998
251.4423 255.9725 -899.9998
-502.8840 0.0 899.9998
-502.8840 0.0 -899.9998
-251.4423 255.9725 899.9998
-251.4423 255.9725 -899.9998
0.0 -511.9456 719.9990
0.0 -511.9456 -719.9990
-251.4423 -255.9725 899.9998
-251.4423 -255.9725 -899.9998
251.4423 -255.9725 899.9998
251.4423 -255.9725 -899.9998
EDGES
1 2
1 5
1 9
2 6
2 10
3 4
3 5
3 15
4 6
4 16
5 9
6 10
7 8
7 9
7 13
8 10
8 14
11 12
11 13
11 15
12 14
12 16
13 15
14 16
FACES
1 2 6 4 3 5
1 2 10 8 7 9
7 8 14 12 11 13
3 4 16 12 11 15
3 5 9 7 13 15
4 6 10 8 14 16
1 5 9
11 13 15
2 6 10
12 14 16
THE MAXIMUM IS: 1.9309377676 THE CONVERSION FACTOR FOR VIEWPLOT IS : 9.3218946457

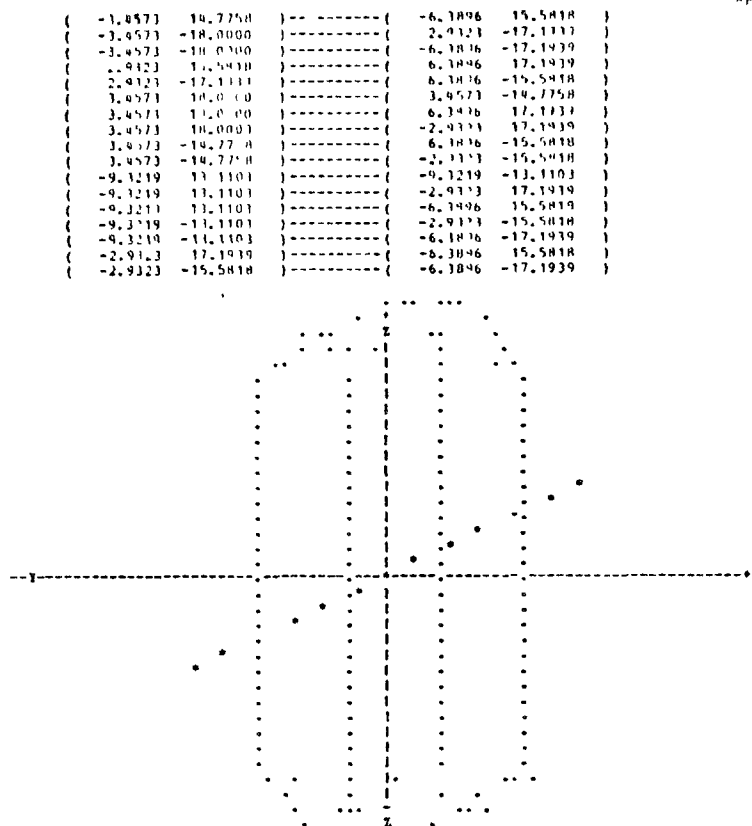
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THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 9.3219 13.1103 )----- ( 9.3219 -13.1103 )
( 9.3219 13.1103 )----- ( 2.9123 15.5018 )
( 9.3219 13.1103 )----- ( 6.3896 17.1919 )
( 9.3219 -13.1103 )----- ( 2.9123 -17.1919 )
( 9.3219 -13.1103 )----- ( 6.3896 -15.5018 )
( -3.4573 14.7758 )----- ( -3.4573 -14.0000 )
( -3.4573 14.7758 )----- ( 2.9123 15.5018 )

```


CRYSTAL SHAPE:



ARTHOPLYLLITE GEDRITE : POPPS - DEFR HOWIE AND ZUSSMAN , 1967, p. 156,
 AXIAL RATIOS : MASON AND BERRY, 1968, p. 462
 ORTHORHOMBIC SYSTEM : A:B:C= 1.0270 : 1.0000 : 0.7920 , ALPHA=BETA-GAMMA=90 , 3 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 8
 MILLER INDICES :

1	0	0
-1	0	0
2	1	0

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

0.9737 X +	0.0 Y +	0.0 Z =	1
-0.9737 X +	0.0 Y +	0.0 Z =	1
0.7790 X +	0.4000 Y +	0.0 Z =	1
-0.7790 X +	0.4000 Y +	0.0 Z =	1
-0.7790 X +	-0.4000 Y +	0.0 Z =	1
0.7790 X +	-0.4000 Y +	0.0 Z =	1
0.0 X +	0.0 Y +	0.2854 Z =	1
0.0 X +	0.0 Y +	-0.2854 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	1.0270	0.5000	3.5040	)
(	1.0270	-0.5000	-3.5040	)
(	1.0270	-0.5000	3.5040	)
(	1.0270	-0.5000	-3.5040	)
(	-1.0270	0.5000	3.5040	)
(	-1.0270	0.5000	-3.5040	)
(	-1.0270	-0.5000	3.5040	)
(	-1.0270	-0.5000	-3.5040	)
(	0.0	2.5000	3.5040	)
(	0.0	2.5000	-3.5040	)
(	0.0	-2.5000	3.5040	)
(	0.0	-2.5000	-3.5040	)

THE 3D EDGES OF THE CRYSTAL ARE DESCRIBED BY THE FOLLOWING POINTS :

(	1.0270	0.5000	3.5040	)	-----	(	1.0270	0.5000	-3.5040	)
(	1.0270	0.5000	3.5040	)	-----	(	1.0270	-0.5000	3.5040	)
(	1.0270	0.5000	3.5040	)	-----	(	0.0	2.5000	3.5040	)
(	1.0270	0.5000	-3.5040	)	-----	(	1.0270	-0.5000	-3.5040	)
(	1.0270	-0.5000	3.5040	)	-----	(	0.0	2.5000	-3.5040	)
(	1.0270	-0.5000	3.5040	)	-----	(	1.0270	-0.5000	-3.5040	)
(	1.0270	-0.5000	-3.5040	)	-----	(	0.0	-2.5000	3.5040	)
(	1.0270	-0.5000	-3.5040	)	-----	(	0.0	-2.5000	-3.5040	)
(	-1.0270	0.5000	3.5040	)	-----	(	-1.0270	0.5000	-3.5040	)
(	-1.0270	0.5000	3.5040	)	-----	(	-1.0270	-0.5000	3.5040	)
(	-1.0270	0.5000	-3.5040	)	-----	(	0.0	2.5000	3.5040	)
(	-1.0270	0.5000	-3.5040	)	-----	(	-1.0270	-0.5000	-3.5040	)
(	-1.0270	-0.5000	3.5040	)	-----	(	0.0	2.5000	-3.5040	)
(	-1.0270	-0.5000	3.5040	)	-----	(	-1.0270	-0.5000	-3.5040	)
(	-1.0270	-0.5000	-3.5040	)	-----	(	0.0	-2.5000	3.5040	)
(	-1.0270	-0.5000	-3.5040	)	-----	(	0.0	-2.5000	-3.5040	)

THE MAXIMUM IS:

VERTICES
 263.7837 128.4246 899.9993
 263.7837 128.4246 899.9993
 263.7837 128.4246 899.9993
 263.7837 128.4246 899.9993
 263.7837 128.4246 899.9993
 263.7837 128.4246 899.9993
 263.7837 128.4246 899.9993
 263.7837 128.4246 899.9993
 0.0 642.1230 899.9993
 0.0 642.1230 899.9993
 0.0 642.1230 899.9993
 0.0 642.1230 899.9993
 0.0 642.1230 899.9993

THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :

256.8491

```

1 3
1 9
2 4
2 10
3 4
3 11
4 12
5 6
5 7
5 9
6 8
6 10
7 8
7 11
8 12
9 10
11 12
FACES
1 2 4 3
5 6 8 7
1 2 10 9
5 6 10 9
7 8 12 11
3 4 12 11
1 3 11 7 5 9
2 4 12 8 6 10
THE MAXIMUM IS: 3.6848087311 THE CONVERSION FACTOR FOR VIEWPLOT IS : 4.8849210739
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.5483 16.2335 )----- ( 0.5483 -18.0000 )
( 0.5483 16.2335 )----- ( -4.3366 16.2335 )
( 0.5483 16.2335 )----- ( 12.2123 17.1168 )
( 0.5483 -18.0000 )----- ( -4.3366 -18.0000 )
( 0.5483 -18.0000 )----- ( 12.2123 -17.1168 )
( -4.3366 16.2335 )----- ( -4.3366 -18.0000 )
( -4.3366 16.2335 )----- ( -12.2123 17.1168 )
( -4.3366 -18.0000 )----- ( -12.2123 -17.1168 )
( 4.3366 18.0000 )----- ( 4.3366 -16.2335 )
( 4.3366 18.0000 )----- ( -0.5483 18.0000 )
( 4.3366 18.0000 )----- ( 12.2123 17.1168 )
( 4.3366 -16.2335 )----- ( -0.5483 -16.2335 )
( 4.3366 -16.2335 )----- ( 12.2123 -17.1168 )
( -0.5483 18.0000 )----- ( -0.5483 -16.2335 )
( -0.5483 18.0000 )----- ( -12.2123 17.1168 )
( -0.5483 -16.2335 )----- ( -12.2123 -17.1168 )
( 12.2123 17.1168 )----- ( 12.2123 -17.1168 )
( -12.2123 17.1168 )----- ( -12.2123 -17.1168 )
CRYSTAL SHAPE:

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APATITE : BOGERS, 1937, P. 410
HEXAGONAL SYSTEM : A1:A2:A3:C=1:1:1: 0.7350 , ALPHA=BETA=GAMMA=90 , 3 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 20
MILLER INDICES :
1 0 -1 0
0 1 -1 0
-1 1 0 0
-1 0 1 0
0 -1 1 0
1 -1 0 0
1 0 -1 1
0 1 -1 1
-1 1 0 1
-1 0 1 1
0 -1 1 1
1 -1 0 1
1 0 -1 -1
0 1 -1 -1
-1 1 0 -1
-1 0 1 -1
0 -1 1 -1
1 -1 0 -1
1 0 -1 1
0 1 -1 1
0 0 0 0
THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :
1.1547 Y + 0.0 Y + 0.0 Z = 1
0.5773 X + 1.0000 Y + 0.0 Z = 1
-0.5773 X + 1.0000 Y + 0.0 Z = 1
-1.1547 Y + 0.0 Y + 0.0 Z = 1
-0.5773 X + -1.0000 Y + 0.0 Z = 1
0.5773 Y + -1.0000 Y + 0.0 Z = 1
0.7698 X + 0.0 Y + 0.9070 Z = 1
0.3849 X + 0.6667 Y + 0.9070 Z = 1
-0.3849 X + 0.6667 Y + 0.9070 Z = 1
-0.7698 X + 0.0 Y + 0.9070 Z = 1
-0.3849 Y + -0.6667 Y + 0.9070 Z = 1
0.3849 Y + -0.6667 Y + 0.9070 Z = 1
0.7698 X + 0.0 Y + -0.9070 Z = 1
0.3849 X + 0.6667 Y + -0.9070 Z = 1
-0.3849 X + 0.6667 Y + -0.9070 Z = 1
-0.7698 X + 0.0 Y + -0.9070 Z = 1

```

-0.1049 X + -0.0667 Y + -0.9070 Z = 1
 0.1049 X + -0.0667 Y + -0.9070 Z = 1
 0.0 X + 0.0 Y + 0.9711 Z = 1
 0.0 X + 0.0 Y + -0.9711 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.0000	0.5000	0.3675	)
(	0.0000	0.5000	-0.3675	)
(	0.0000	-0.5000	0.3675	)
(	0.0000	-0.5000	-0.3675	)
(	0.0	1.0000	0.3675	)
(	0.0	1.0000	-0.3675	)
(	-0.0000	0.5000	0.3675	)
(	-0.0000	0.5000	-0.3675	)
(	-0.0000	-0.5000	0.3675	)
(	-0.0000	-0.5000	-0.3675	)
(	0.0	-1.0000	0.3675	)
(	0.0	-1.0000	-0.3675	)
(	0.0000	0.0500	1.0290	)
(	0.0000	-0.0500	1.0290	)
(	-0.0000	0.1000	1.0290	)
(	-0.0000	0.0500	1.0290	)
(	-0.0000	-0.0500	1.0290	)
(	0.0000	-0.1000	1.0290	)
(	0.0000	0.0500	-1.0290	)
(	0.0000	-0.0500	-1.0290	)
(	-0.0000	0.1000	-1.0290	)
(	-0.0000	0.0500	-1.0290	)
(	-0.0000	-0.0500	-1.0290	)
(	0.0000	-0.1000	-1.0290	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.0000	0.5000	0.3675	)	-----	(	0.0000	0.5000	-0.3675	)
(	0.0000	0.5000	0.3675	)	-----	(	0.0000	-0.5000	0.3675	)
(	0.0000	0.5000	0.3675	)	-----	(	0.0	1.0000	0.3675	)
(	0.0000	0.5000	0.3675	)	-----	(	0.0000	0.5000	1.0290	)
(	0.0000	0.5000	-0.3675	)	-----	(	0.0000	-0.5000	-0.3675	)
(	0.0000	0.5000	-0.3675	)	-----	(	0.0	1.0000	-0.3675	)
(	0.0000	0.5000	-0.3675	)	-----	(	0.0000	0.5000	-1.0290	)
(	0.0000	-0.5000	0.3675	)	-----	(	0.0000	-0.5000	-0.3675	)
(	0.0000	-0.5000	0.3675	)	-----	(	0.0	-1.0000	0.3675	)
(	0.0000	-0.5000	0.3675	)	-----	(	0.0000	-0.5000	-1.0290	)
(	0.0000	-0.5000	0.3675	)	-----	(	0.0	-1.0000	-0.3675	)
(	0.0000	-0.5000	-0.3675	)	-----	(	0.0000	-0.5000	-1.0290	)
(	0.0000	-0.5000	-0.3675	)	-----	(	0.0	1.0000	-0.3675	)
(	0.0	1.0000	0.3675	)	-----	(	-0.0000	0.5000	0.3675	)
(	0.0	1.0000	0.3675	)	-----	(	-0.0000	0.1000	1.0290	)
(	0.0	1.0000	-0.3675	)	-----	(	-0.0000	0.5000	-0.3675	)
(	0.0	1.0000	-0.3675	)	-----	(	-0.0000	0.1000	-1.0290	)
(	-0.0000	0.5000	0.3675	)	-----	(	-0.0000	0.5000	-0.3675	)
(	-0.0000	0.5000	0.3675	)	-----	(	-0.0000	-0.5000	0.3675	)
(	-0.0000	0.5000	-0.3675	)	-----	(	-0.0000	0.5000	1.0290	)
(	-0.0000	0.5000	-0.3675	)	-----	(	-0.0000	-0.5000	-0.3675	)
(	-0.0000	0.5000	-0.3675	)	-----	(	-0.0000	0.5000	-1.0290	)
(	-0.0000	-0.5000	0.3675	)	-----	(	-0.0000	-0.5000	-0.3675	)
(	-0.0000	-0.5000	0.3675	)	-----	(	0.0	-1.0000	0.3675	)
(	-0.0000	-0.5000	0.3675	)	-----	(	-0.0000	-0.5000	1.0290	)
(	-0.0000	-0.5000	-0.3675	)	-----	(	0.0	-1.0000	-0.3675	)
(	-0.0000	-0.5000	-0.3675	)	-----	(	-0.0000	-0.5000	-1.0290	)
(	0.0	-1.0000	0.3675	)	-----	(	0.0	-1.0000	-0.3675	)
(	0.0	-1.0000	0.3675	)	-----	(	0.0000	-0.1000	1.0290	)
(	0.0	-1.0000	-0.3675	)	-----	(	0.0000	-0.1000	-1.0290	)
(	0.0000	0.0500	1.0290	)	-----	(	0.0000	-0.0500	1.0290	)
(	0.0000	0.0500	1.0290	)	-----	(	0.0000	0.1000	1.0290	)

(	0.0000	-0.0500	1.0290	)	-----	(	0.0000	-0.1000	1.0290	)
(	-0.0000	0.1000	1.0290	)	-----	(	-0.0000	0.0500	1.0290	)
(	-0.0000	0.0500	1.0290	)	-----	(	-0.0000	-0.0500	1.0290	)
(	-0.0000	-0.0500	1.0290	)	-----	(	0.0000	-0.1000	1.0290	)
(	0.0000	0.0500	-1.0290	)	-----	(	0.0000	-0.0500	-1.0290	)
(	0.0000	0.0500	-1.0290	)	-----	(	-0.0000	0.1000	-1.0290	)
(	0.0000	-0.0500	-1.0290	)	-----	(	-0.0000	-0.1000	-1.0290	)
(	-0.0000	0.1000	-1.0290	)	-----	(	-0.0000	0.0500	-1.0290	)
(	-0.0000	0.0500	-1.0290	)	-----	(	-0.0000	-0.0500	-1.0290	)
(	-0.0000	-0.0500	-1.0290	)	-----	(	0.0000	-0.1000	-1.0290	)

THE MAXIMUM IS:

1.0290

THE CONVERSION FACTOR FOR THE PINTER GRAPH IS :

874.6360

VERTICES

757.4358 437.3423 321.4280
 757.4358 437.3423 -321.4280
 757.4358 -437.3423 321.4280
 757.4358 -437.3423 -321.4280
 0.0 874.6360 321.4285
 0.0 874.6360 -321.4285
 -757.4358 437.3423 321.4277
 -757.4358 437.3423 -321.4277
 -757.4358 -437.3423 321.4280
 -757.4358 -437.3423 -321.4280
 0.0 -874.6360 321.4285
 0.0 -874.6360 -321.4285
 75.7432 43.7343 899.9998
 75.7432 -43.7343 899.9998
 -0.0001 87.4631 899.9998
 -75.7432 43.7342 899.9998
 -75.7432 -43.7343 899.9998
 0.0001 -87.4631 899.9998
 75.7432 43.7343 -899.9998
 75.7432 -43.7343 -899.9998
 -0.0001 87.4631 -899.9998
 -75.7432 43.7342 -899.9998
 -75.7432 -43.7343 -899.9998
 0.0001 -87.4631 -899.9998

EDGES

1 2
 1 3
 1 5
 1 13
 2 4
 2 6
 2 19
 3 4
 3 11
 3 14
 4 12
 4 20
 5 6
 5 7
 5 15
 6 8
 6 21
 7 8
 7 9
 7 16
 8 10
 8 22
 9 10
 9 11
 9 17

10 12
10 23
11 12
11 18
12 24
13 14
13 15
14 18
15 16
16 17
17 18
19 20
19 21
20 24
21 22
22 23
23 24

FACES

1 2 4 3
1 2 6 5
5 6 8 7
7 8 10 9
9 10 12 11
3 4 12 11
1 3 14 13
1 5 15 13
5 7 16 15
7 9 17 16
9 11 18 17
3 11 18 14
2 4 20 19
2 6 21 19
6 8 22 21
8 10 23 22
10 12 24 23
4 12 24 20
13 14 18 17
19 20 24 23

THE MAXIMUM IS:

16 15
22 21

1.0442447662

THE CONVERSION FACTOR FOR VIEWPLOT IS :

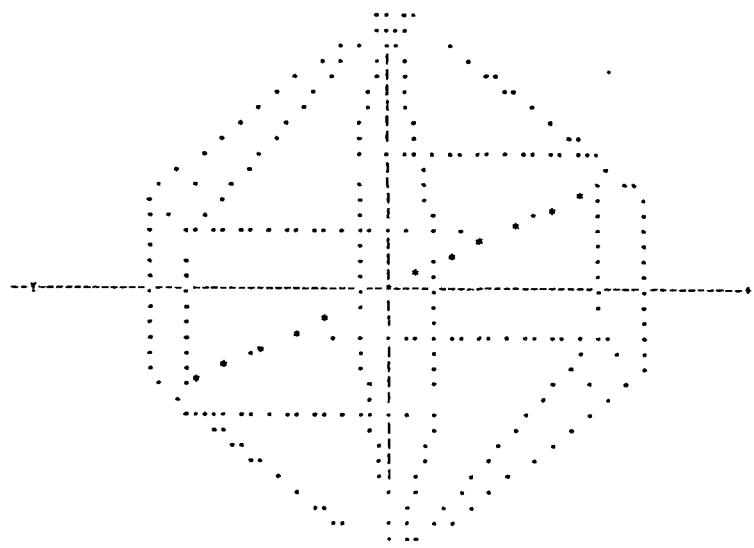
17.2373352051

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(2.9830 3.7066)	-----	(2.9830 -8.9628)
(2.9830 3.7066)	-----	(-14.2553 3.7066)
(2.9830 3.7066)	-----	(17.2373 6.3347)
(2.9830 3.7066)	-----	(0.2983 17.4744)
(2.9830 -8.9628)	-----	(-14.2553 -8.9628)
(2.9830 -8.9628)	-----	(17.2373 -6.3347)
(2.9830 -8.9628)	-----	(0.2983 -18.0000)
(-14.2553 3.7066)	-----	(-14.2553 -8.9628)
(-14.2553 3.7066)	-----	(-17.2373 6.3347)
(-14.2553 3.7066)	-----	(-1.4255 17.4744)
(-14.2553 -8.9628)	-----	(-17.2373 -6.3347)
(-14.2553 -8.9628)	-----	(-1.4255 -18.0000)
(17.2373 6.3347)	-----	(17.2373 -6.3347)
(17.2373 6.3347)	-----	(14.2553 8.9628)
(17.2373 6.3347)	-----	(1.7237 17.7372)
(17.2373 -6.3347)	-----	(14.2553 -3.7066)
(17.2373 -6.3347)	-----	(1.7237 -17.7372)
(14.2553 8.9628)	-----	(14.2553 -3.7066)
(14.2553 8.9628)	-----	(-2.9830 8.9628)
(14.2553 8.9628)	-----	(1.4255 18.0000)
(14.2553 -3.7066)	-----	(-2.9830 -3.7066)
(14.2553 -3.7066)	-----	(1.4255 -17.4744)

(-2.9830 8.9628)	-----	(-2.9830 -3.7066)
(-2.9830 8.9628)	-----	(-17.2373 6.3347)
(-2.9830 8.9628)	-----	(-0.2983 18.0000)
(-2.9830 -3.7066)	-----	(-17.2373 -6.3347)
(-2.9830 -3.7066)	-----	(-0.2983 -17.4744)
(-17.2373 6.3347)	-----	(-17.2373 -6.3347)
(-17.2373 6.3347)	-----	(-1.7237 17.7372)
(-17.2373 6.3347)	-----	(-1.7237 -17.7372)
(0.2983 17.4744)	-----	(-1.4255 17.4744)
(0.2983 17.4744)	-----	(1.7237 17.7372)
(-1.4255 17.4744)	-----	(-1.7237 17.7372)
(1.7237 17.7372)	-----	(1.4255 18.0000)
(1.4255 18.0000)	-----	(-0.2983 18.0000)
(-0.2983 18.0000)	-----	(-1.7237 17.7372)
(0.2983 -18.0000)	-----	(-1.4255 -18.0000)
(0.2983 -18.0000)	-----	(1.7237 -17.7372)
(-1.4255 -18.0000)	-----	(-1.7237 -17.7372)
(1.7237 -17.7372)	-----	(1.4255 -17.4744)
(1.4255 -17.4744)	-----	(-0.2983 -17.4744)
(-0.2983 -17.4744)	-----	(-1.7237 -17.7372)

CRYSTAL SHAPE:



AUGITP PFRBOANGITP : AXIAL RATIOS : MASON AND BEERY, 1968, p. 471
FOIMS : POGIBS, 1937, p. 446
MONOCLINIC SYSTEM : A:B:C= 1.0420: 1.0000: 0.5090, ALPHA-GAMMA=90, BETA= 105.8133, 4 FORM(S).
NUMBER OF PLACES OF MILLER INDICES : 16
MILLER INDICES :

```

      1      0      0
     -1      0      0
      0      1      0
      0     -1      0
      1      1      0
     -1      1      0
     -1     -1      0
      1     -1      0
      1      1      1
     -1      1      1
     -1     -1      1
      1     -1      1
      1      1     -1
     -1      1     -1
     -1     -1     -1
      1     -1     -1

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

0.9519 X + 0.0 Y + 0.0 Z = 1
-0.9519 X + 0.0 Y + 0.0 Z = 1
0.0 X + 1.0000 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + 0.0 Z = 1
0.6346 X + 0.6667 Y + 0.0 Z = 1
-0.6346 X + 0.6667 Y + 0.0 Z = 1
-0.6346 X + -0.6667 Y + 0.0 Z = 1
0.6346 X + -0.6667 Y + 0.0 Z = 1
0.7167 X + 0.5000 Y + 0.8489 Z = 1
-0.2352 X + 0.5000 Y + 0.8489 Z = 1
-0.2352 X + -0.5000 Y + 0.8489 Z = 1
0.7167 X + -0.5000 Y + 0.8489 Z = 1
0.2352 X + 0.5000 Y + -0.8489 Z = 1
-0.7167 X + 0.5000 Y + -0.8489 Z = 1
-0.7167 X + -0.5000 Y + -0.8489 Z = 1
0.2352 X + -0.5000 Y + -0.8489 Z = 1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 1.0506 0.5000 -0.0034 )
( 1.0506 0.5000 -0.5924 )
( 1.0506 -0.5000 -0.0034 )
( 1.0506 -0.5000 -0.5924 )
( 1.0506 0.0 0.2911 )
( 1.0506 0.0 -0.8869 )
( -1.0506 0.5000 0.5924 )
( -1.0506 0.5000 0.0034 )
( -1.0506 -0.5000 0.5924 )
( -1.0506 -0.5000 0.0034 )
( -1.0506 0.0 0.8869 )
( -1.0506 0.0 -0.2911 )
( 0.5253 1.0000 0.1455 )
( 0.5253 1.0000 -0.4435 )
( -0.5253 1.0000 0.4435 )
( -0.5253 1.0000 -0.1455 )
( 0.0 1.0000 0.5890 )
( 0.0 1.0000 -0.5890 )
( -0.5253 -1.0000 0.4435 )
( -0.5253 -1.0000 -0.1455 )
( 0.5253 -1.0000 0.1455 )
( 0.5253 -1.0000 -0.4435 )
( 0.0 -1.0000 0.5890 )
( 0.0 -1.0000 -0.5890 )
( 0.0 0.0 1.1780 )
( 0.0 0.0 -1.1780 )

```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 1.0506 0.5000 -0.0034 )----- ( 1.0506 0.5000 -0.5924 )

```

```

( 1.0506 0.5000 -0.0034 )----- ( 1.0506 0.0 0.2911 )
( 1.0506 0.5000 -0.0034 )----- ( 0.5253 1.0000 0.1455 )
( 1.0506 0.5000 -0.5924 )----- ( 1.0506 0.0 -0.8869 )
( 1.0506 0.5000 -0.5924 )----- ( 0.5253 1.0000 -0.4435 )
( 1.0506 -0.5000 -0.0034 )----- ( 1.0506 -0.5000 -0.5924 )
( 1.0506 -0.5000 -0.0034 )----- ( 1.0506 0.0 0.2911 )
( 1.0506 -0.5000 -0.0034 )----- ( 0.5253 -1.0000 0.1455 )
( 1.0506 -0.5000 -0.5924 )----- ( 1.0506 0.0 -0.8869 )
( 1.0506 -0.5000 -0.5924 )----- ( 0.5253 -1.0000 -0.4435 )
( 1.0506 0.0 0.2911 )----- ( 0.0 0.0 1.1780 )
( 1.0506 0.0 -0.8869 )----- ( 0.0 0.0 -1.1780 )
( -1.0506 0.5000 0.5924 )----- ( -1.0506 0.5000 0.0034 )
( -1.0506 0.5000 0.5924 )----- ( -1.0506 0.0 0.8869 )
( -1.0506 0.5000 0.5924 )----- ( -0.5253 1.0000 0.4435 )
( -1.0506 0.5000 0.0034 )----- ( -1.0506 0.0 -0.2911 )
( -1.0506 0.5000 0.0034 )----- ( -0.5253 1.0000 -0.1455 )
( -1.0506 -0.5000 0.5924 )----- ( -1.0506 -0.5000 0.0034 )
( -1.0506 -0.5000 0.5924 )----- ( -1.0506 0.0 0.8869 )
( -1.0506 -0.5000 0.5924 )----- ( -0.5253 1.0000 0.4435 )
( -1.0506 -0.5000 0.0034 )----- ( -1.0506 0.0 -0.2911 )
( -1.0506 0.0 0.8869 )----- ( 0.0 0.0 1.1780 )
( -1.0506 0.0 -0.2911 )----- ( 0.0 0.0 -1.1780 )
( 0.5253 1.0000 0.1455 )----- ( 0.5253 1.0000 -0.4435 )
( 0.5253 1.0000 0.1455 )----- ( 0.0 1.0000 0.5890 )
( 0.5253 1.0000 -0.4435 )----- ( 0.0 1.0000 -0.5890 )
( -0.5253 1.0000 0.4435 )----- ( -0.5253 1.0000 -0.1455 )
( -0.5253 1.0000 0.4435 )----- ( 0.0 1.0000 0.5890 )
( -0.5253 1.0000 -0.1455 )----- ( 0.0 1.0000 -0.5890 )
( 0.0 1.0000 0.5890 )----- ( 0.0 0.0 1.1780 )
( 0.0 1.0000 -0.5890 )----- ( 0.0 0.0 -1.1780 )
( -0.5253 -1.0000 0.4435 )----- ( -0.5253 -1.0000 -0.1455 )
( -0.5253 -1.0000 0.4435 )----- ( 0.0 -1.0000 0.5890 )
( -0.5253 -1.0000 -0.1455 )----- ( 0.0 -1.0000 -0.5890 )
( 0.5253 -1.0000 0.1455 )----- ( 0.5253 -1.0000 -0.4435 )
( 0.5253 -1.0000 0.1455 )----- ( 0.0 -1.0000 0.5890 )
( 0.5253 -1.0000 -0.4435 )----- ( 0.0 -1.0000 -0.5890 )
( 0.0 -1.0000 0.5890 )----- ( 0.0 0.0 1.1780 )
( 0.0 -1.0000 -0.5890 )----- ( 0.0 0.0 -1.1780 )

```

THE MAXIMUM IS:

1.1780

THE CONVERSION FACTOR FOR THE PAPER GRAPH IS :

764.0071

```

VERTICES
802.6409 382.0039 -2.6258
802.6409 382.0039 -452.6274
802.6409 -382.0039 -2.6258
802.6409 -382.0039 -452.6274
802.6409 0.0 222.3744
802.6409 0.0 -677.6277
-802.6409 382.0039 452.6274
-802.6409 382.0039 2.6258
-802.6409 -382.0039 452.6274
-802.6409 -382.0039 2.6258
-802.6409 0.0 677.6277
-802.6409 0.0 -222.3744
401.3208 764.0071 111.1869
401.3208 764.0071 -338.8137
-401.3208 764.0071 338.8137
-401.3208 764.0071 -111.1869
0.0 764.0071 450.0000
0.0 764.0071 -450.0000
-401.3208 -764.0071 338.8137
-401.3208 -764.0071 -111.1869
401.3208 -764.0071 111.1869

```

```

401.3208 -764.0071 -338.8137
0.0 -764.0071 450.0000
0.0 -764.0071 -450.0000
0.0 0.0 899.9998
0.0 0.0 -899.9998

```

EDGES

```

1 2
1 5
1 13
2 6
2 14
3 4
3 5
3 21
4 6
4 22
5 25
6 26
7 8
7 11
7 15
8 12
8 16
9 10
9 11
9 19
10 12
10 20
11 25
12 26
13 14
13 17
14 18
15 16
15 17
16 18
17 25
18 26
19 20
19 23
20 24
21 22
21 23
22 24
23 25
24 26

```

FACES

```

1 2 6 4 3 5
7 8 12 10 9 11
13 14 18 16 15 17
19 20 24 22 21 23
1 2 14 13
7 8 16 15
9 10 20 19
3 4 22 21
1 5 25 17 13
7 11 25 17 15
9 11 25 23 19
3 5 25 23 21
2 6 26 18 14
8 12 26 19 16
10 12 26 24 20

```

```

4 6 26 24 22
THE MAXIMUM IS: 1.1983280182 THE CONVERSION FACTOR FOR VIEWPLOT IS : 15.0209283829

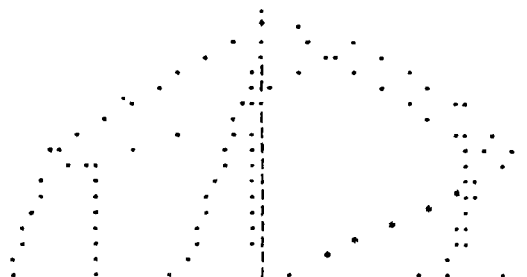
```

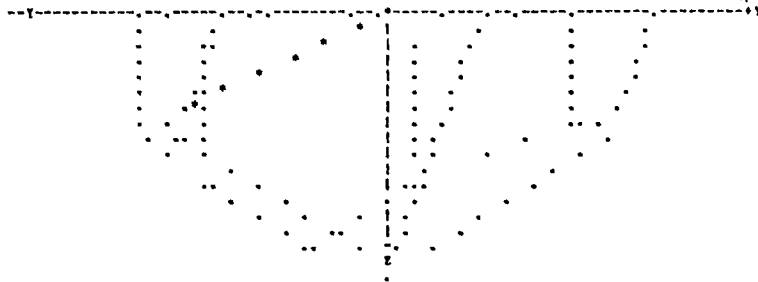
```

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 1.5523 -2.8299 )----- ( 1.5523 -11.6772 )
( 1.5523 -2.8299 )----- ( -5.9582 1.5938 )
( 1.5523 -2.8299 )----- ( 12.0418 0.7969 )
( 1.5523 -11.6772 )----- ( -5.9582 -16.1009 )
( 1.5523 -11.6772 )----- ( 12.0418 -8.0504 )
( -13.4686 -2.8299 )----- ( -13.4686 -11.6772 )
( -13.4686 -2.8299 )----- ( -5.9582 1.5938 )
( -13.4686 -2.8299 )----- ( -18.0000 0.7969 )
( -13.4686 -11.6772 )----- ( -5.9582 -16.1009 )
( -13.4686 -11.6772 )----- ( -18.0000 -8.0504 )
( -5.9582 1.5938 )----- ( 0.0 17.6946 )
( -5.9582 -16.1009 )----- ( 0.0 -17.6946 )
( 13.4686 11.6772 )----- ( 13.4686 2.8299 )
( 13.4686 11.6772 )----- ( 5.9582 16.1009 )
( 13.4686 11.6772 )----- ( 18.0000 8.0504 )
( 13.4686 2.8299 )----- ( 5.9582 -1.5938 )
( 13.4686 2.8299 )----- ( 18.0000 -0.7969 )
( -1.5523 11.6772 )----- ( -1.5523 2.8299 )
( -1.5523 11.6772 )----- ( 5.9582 16.1009 )
( -1.5523 11.6772 )----- ( 12.0418 8.0504 )
( -1.5523 2.8299 )----- ( 5.9582 -1.5938 )
( -1.5523 2.8299 )----- ( 12.0418 -0.7969 )
( 5.9582 16.1009 )----- ( 0.0 17.6946 )
( 5.9582 -1.5938 )----- ( 0.0 -17.6946 )
( 12.0418 0.7969 )----- ( 12.0418 -8.0504 )
( 12.0418 0.7969 )----- ( 15.0209 8.8473 )
( 12.0418 -8.0504 )----- ( 15.0209 -8.8473 )
( 18.0000 8.0504 )----- ( 18.0000 -0.7969 )
( 18.0000 8.0504 )----- ( 15.0209 8.8473 )
( 18.0000 -0.7969 )----- ( 15.0209 -8.8473 )
( 15.0209 8.8473 )----- ( 0.0 17.6946 )
( 15.0209 -8.8473 )----- ( 0.0 -17.6946 )
( -12.0418 8.0504 )----- ( -12.0418 -0.7969 )
( -12.0418 8.0504 )----- ( -15.0209 8.8473 )
( -12.0418 -0.7969 )----- ( -15.0209 -8.8473 )
( -18.0000 0.7969 )----- ( -18.0000 -8.0504 )
( -18.0000 0.7969 )----- ( -15.0209 8.8473 )
( -18.0000 -8.0504 )----- ( -15.0209 -8.8473 )
( -15.0209 8.8473 )----- ( 0.0 17.6946 )
( -15.0209 -8.8473 )----- ( 0.0 -17.6946 )

```

CRYSTAL SHAPE:





BERYL : ROGERS, 1937, P. 456
 HEXAGONAL SYSTEM : A1:A2:A3:C=1:1:1: 0.9989 , ALPHA=BETA=GAMMA=90 , 2 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

1	0	-1	0
0	1	-1	0
-1	1	0	0
-1	0	1	0
0	-1	1	0
1	-1	0	0
0	0	0	1
0	0	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.1547 X +	0.0 Y +	0.0 Z =	1
0.5773 X +	1.0000 Y +	0.0 Z =	1
-0.5773 X +	1.0000 Y +	0.0 Z =	1
-1.1547 X +	0.0 Y +	0.0 Z =	1
-0.5773 X +	-1.0000 Y +	0.0 Z =	1
0.5773 X +	-1.0000 Y +	0.0 Z =	1
0.0 X +	0.0 Y +	0.6674 Z =	1
0.0 X +	0.0 Y +	-0.6674 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.8660	0.5000	1.4983	)
(	0.8660	0.5000	-1.4983	)
(	0.8660	-0.5000	1.4983	)
(	0.8660	-0.5000	-1.4983	)
(	0.0	1.0000	1.4983	)
(	0.0	1.0000	-1.4983	)
(	-0.8660	0.5000	1.4983	)
(	-0.8660	0.5000	-1.4983	)
(	-0.8660	-0.5000	1.4983	)
(	-0.8660	-0.5000	-1.4983	)
(	0.0	-1.0000	1.4983	)
(	0.0	-1.0000	-1.4983	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.8660	0.5000	1.4983	)	-----	(	0.8660	0.5000	-1.4983	)
(	0.8660	0.5000	1.4983	)	-----	(	0.8660	-0.5000	1.4983	)
(	0.8660	0.5000	1.4983	)	-----	(	0.0	1.0000	1.4983	)
(	0.8660	0.5000	-1.4983	)	-----	(	0.8660	-0.5000	-1.4983	)
(	0.8660	0.5000	-1.4983	)	-----	(	0.0	1.0000	-1.4983	)
(	0.8660	-0.5000	1.4983	)	-----	(	0.8660	-0.5000	-1.4983	)
(	0.8660	-0.5000	1.4983	)	-----	(	0.0	-1.0000	1.4983	)
(	0.8660	-0.5000	-1.4983	)	-----	(	0.0	-1.0000	-1.4983	)
(	0.0	1.0000	1.4983	)	-----	(	0.0	1.0000	-1.4983	)

(	0.0	1.0000	1.4983	)	-----	(	-0.8660	0.5000	1.4983	)
(	0.0	1.0000	-1.4983	)	-----	(	-0.8660	0.5000	-1.4983	)
(	-0.8660	0.5000	1.4983	)	-----	(	-0.8660	0.5000	-1.4983	)
(	-0.8660	0.5000	1.4983	)	-----	(	-0.8660	-0.5000	1.4983	)
(	-0.8660	0.5000	-1.4983	)	-----	(	-0.8660	-0.5000	-1.4983	)
(	-0.8660	-0.5000	1.4983	)	-----	(	-0.8660	-0.5000	-1.4983	)
(	-0.8660	-0.5000	1.4983	)	-----	(	0.0	-1.0000	1.4983	)
(	-0.8660	-0.5000	-1.4983	)	-----	(	0.0	-1.0000	-1.4983	)
(	0.0	-1.0000	1.4983	)	-----	(	0.0	-1.0000	-1.4983	)

THE MAXIMUM IS:

1.4983

THE CONVERSION FACTOR FOR THE PINTER GRAPE IS :

600.6609

VERTICES

520.1726	300.3474	899.9998
520.1726	300.3474	-899.9998
520.1726	-300.3474	899.9998
520.1726	-300.3474	-899.9998
0.0	600.6609	899.9998
0.0	600.6609	-899.9998
-520.1726	300.3474	899.9998
-520.1726	300.3474	-899.9998
-520.1726	-300.3474	899.9998
-520.1726	-300.3474	-899.9998
0.0	-600.6609	899.9998
0.0	-600.6609	-899.9998

EDGES

1	2
1	3
1	5
2	4
2	6
3	4
3	11
4	12
5	6
5	7
6	8
7	8
7	9
8	10
9	10
9	11
10	12
11	12

FACES

1	2	4	3
1	2	6	5
5	6	8	7
7	8	10	9
9	10	12	11
3	4	12	11
1	3	11	9
2	4	12	10

THE MAXIMUM IS:

1.6508121490

THE CONVERSION FACTOR FOR VIEWPIOT IS :

10.9037237167

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

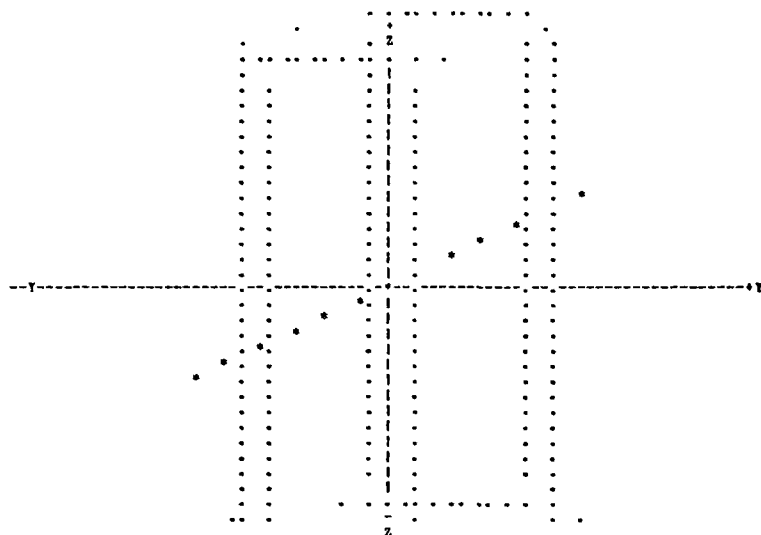
(	1.8870	14.6752	)	-----	(	1.8870	-18.0000	)
(	1.8870	14.6752	)	-----	(	-9.0174	14.6752	)
(	1.8870	14.6752	)	-----	(	10.9017	16.3376	)
(	1.8870	-18.0000	)	-----	(	-9.0174	-18.0000	)
(	1.8870	-18.0000	)	-----	(	10.9017	-16.3376	)
(	-9.0174	14.6752	)	-----	(	-9.0174	-18.0000	)
(	-9.0174	14.6752	)	-----	(	-10.9017	16.3376	)
(	-9.0174	-18.0000	)	-----	(	-10.9017	-16.3376	)
(	10.9017	16.3376	)	-----	(	10.9017	-16.3376	)

CRYSTAL SHAPE:

```

( 10.9037 16.1376 )----- ( 9.0174 18.0000 )
( 10.9037 -16.1376 )----- ( 9.0174 -14.6752 )
( 9.0174 18.0000 )----- ( 9.0174 -14.6752 )
( 9.0174 18.0000 )----- ( -1.8870 18.0000 )
( 9.0174 -14.6752 )----- ( -1.8870 -14.6752 )
( -1.8870 18.0000 )----- ( -1.8870 -14.6752 )
( -1.8870 18.0000 )----- ( -10.9037 16.1376 )
( -1.8870 -14.6752 )----- ( -10.9037 -16.1376 )
( -10.9037 16.1376 )----- ( -10.9037 -16.1376 )

```



CALCITE 1 : MASON AND BERRY, 1968, P. 331
 HEXAGONAL SYSTEM : A1:A2:A3:C=1:1:1: 0.8550 , ALPHA=BETA=GAMMA=90 , 1 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 6
 MILLER INDICES :

1	0	-1	1
-1	1	0	1
0	-1	1	1
1	-1	0	-1
0	1	-1	-1
-1	0	1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

1.1547 X + 0.0 Y + 1.1696 Z = 1
-0.5773 X + 1.0000 Y + 1.1696 Z = 1
-0.5773 X + -1.0000 Y + 1.1696 Z = 1
0.5773 X + -1.0000 Y + -1.1696 Z = 1
0.5773 X + 1.0000 Y + -1.1696 Z = 1

```

-1.1547 X + 0.0 Y + -1.1696 Z = 1
 THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.0	0.0	0.8550	)
(	0.5773	1.0000	0.2850	)
(	0.5773	-1.0000	0.2850	)
(	1.1547	0.0	-0.2850	)
(	-1.1547	0.0	-0.2850	)
(	-0.5773	1.0000	-0.2850	)
(	-0.5773	-1.0000	-0.2850	)
(	0.0	0.0000	-0.8550	)

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :

(	0.0	0.0	0.8550	)-----	(	0.5773	1.0000	0.2850	)
(	0.0	0.0	0.8550	)-----	(	0.5773	-1.0000	0.2850	)
(	0.0	0.0	0.8550	)-----	(	-1.1547	-0.0000	0.2850	)
(	0.5773	1.0000	0.2850	)-----	(	1.1547	0.0	-0.2850	)
(	0.5773	1.0000	0.2850	)-----	(	-0.5773	1.0000	-0.2850	)
(	0.5773	-1.0000	0.2850	)-----	(	1.1547	0.0	-0.2850	)
(	0.5773	-1.0000	0.2850	)-----	(	-0.5773	-1.0000	-0.2850	)
(	1.1547	0.0	-0.2850	)-----	(	0.0	0.0000	-0.8550	)
(	-1.1547	-0.0000	0.2850	)-----	(	-0.5773	1.0000	-0.2850	)
(	-1.1547	-0.0000	0.2850	)-----	(	-0.5773	-1.0000	-0.2850	)
(	-0.5773	1.0000	-0.2850	)-----	(	0.0	0.0000	-0.8550	)
(	-0.5773	-1.0000	-0.2850	)-----	(	0.0	0.0000	-0.8550	)

THE MAXIMUM IS: 1.1547 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 779.4299

VERTICES

0.0	0.0	666.4131
449.9998	779.4299	222.1292
449.9998	-779.4299	222.1292
899.9990	0.0	-222.1545
-899.9998	-0.0002	222.1545
-450.0000	779.4299	-222.1292
-450.0000	-779.4299	-222.1292
0.0	0.0002	-666.4131

EDGES

1	2
1	3
1	5
2	4
2	6
3	4
3	7
4	8
5	6
5	7
6	8
7	8

FACES

1	2	4	3
1	2	6	5
1	3	7	5
3	4	8	7
2	4	8	6
5	6	8	7

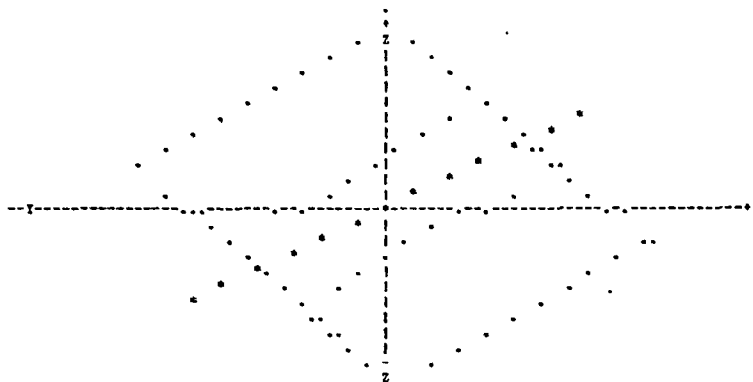
THE MAXIMUM IS: 1.2179841995 THE CONVERSION FACTOR FOR VIEWPLOT IS : 14.7785167694

THE 2D EDGES ARE DEFINED BY THE FOLLOWING POINTS :

(	0.0	12.6356	)-----	(	11.5570	2.7096	)
(	0.0	12.6356	)-----	(	-10.0000	2.7096	)
(	0.0	12.6356	)-----	(	-6.4430	-7.2165	)
(	11.5570	2.7096	)-----	(	10.0000	-7.2165	)
(	11.5570	2.7096	)-----	(	-10.0000	-7.2165	)
(	-10.0000	2.7096	)-----	(	-11.5570	-7.2165	)
(	-10.0000	2.7096	)-----	(	-11.5570	-7.2165	)


```
( -6.4430 -7.2165 )----- ( 0.0000 -12.6356 )
( 6.4430 7.2165 )----- ( 18.0000 -2.7096 )
( 6.4430 7.2165 )----- ( -11.5570 -2.7096 )
( 18.0000 -2.7096 )----- ( 0.0000 -12.6356 )
( -11.5570 -2.7096 )----- ( 0.0000 -12.6356 )
```

CRYSTAL SHAPE:



CALCITE 2 : MASON AND BERRY, 1968, P. 331
 HEXAGONAL SYSTEM : A1:A2:A3=C=1:1:1: 0.8550, ALPHA=BETA=GAMMA=90, 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 14
 MILLER INDICES :

```
1 0 -1 0
0 1 -1 0
-1 1 0 0
-1 0 1 0
0 -1 1 0
1 -1 0 0
0 0 0 1
0 0 0 -1
1 0 -1 -2
0 1 -1 2
-1 1 0 -2
-1 0 1 2
0 -1 1 -2
1 -1 0 2
```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```
1.1547 X + 0.0 Y + 0.0 Z = 1
0.5773 X + 1.0000 Y + 0.0 Z = 1
-0.5773 X + 1.0000 Y + 0.0 Z = 1
-1.1547 X + 0.0 Y + 0.0 Z = 1
-0.5773 X + -1.0000 Y + 0.0 Z = 1
0.5773 X + -1.0000 Y + 0.0 Z = 1
0.0 X + 0.0 Y + 2.3392 Z = 1
0.0 X + 0.0 Y + -2.3392 Z = 1
0.7217 X + 0.0 Y + -1.4620 Z = 1
0.3608 X + 0.6250 Y + 1.4620 Z = 1
-0.3608 X + 0.6250 Y + -1.4620 Z = 1
```

```
-0.7217 X + 0.0 Y + 1.4620 Z = 1
-0.3608 X + -0.6250 Y + -1.4620 Z = 1
0.3608 X + -0.6250 Y + 1.4620 Z = 1
```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```
( 0.8660 0.5000 -0.2565 )
( 0.8660 0.5000 0.2565 )
( 0.8660 -0.5000 -0.2565 )
( 0.8660 -0.5000 0.2565 )
( 0.8660 0.1000 0.4275 )
( 0.8660 -0.1000 0.4275 )
( 0.0 1.0000 0.2565 )
( 0.0 1.0000 -0.2565 )
( 0.5196 0.7000 -0.4275 )
( 0.3464 0.8000 -0.4275 )
( -0.8660 0.5000 -0.2565 )
( -0.8660 0.5000 0.2565 )
( -0.3464 0.8000 0.4275 )
( -0.5196 0.7000 0.4275 )
( -0.8660 -0.5000 0.2565 )
( -0.8660 -0.5000 -0.2565 )
( -0.8660 0.1000 -0.4275 )
( -0.8660 -0.1000 -0.4275 )
( 0.0 -1.0000 -0.2565 )
( 0.0 -1.0000 0.2565 )
( -0.5196 -0.7000 0.4275 )
( -0.3464 -0.8000 0.4275 )
( 0.5196 -0.7000 -0.4275 )
( 0.3464 -0.8000 -0.4275 )
```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```
( 0.8660 0.5000 -0.2565 )----- ( 0.8660 0.5000 0.2565 )
( 0.8660 0.5000 -0.2565 )----- ( 0.8660 -0.5000 -0.2565 )
( 0.8660 0.5000 -0.2565 )----- ( 0.5196 0.7000 -0.4275 )
( 0.8660 0.5000 0.2565 )----- ( 0.8660 0.1000 0.4275 )
( 0.8660 0.5000 0.2565 )----- ( 0.0 1.0000 0.2565 )
( 0.8660 -0.5000 -0.2565 )----- ( 0.8660 -0.5000 0.2565 )
( 0.8660 -0.5000 -0.2565 )----- ( 0.5196 0.7000 -0.4275 )
( 0.8660 -0.5000 0.2565 )----- ( 0.8660 -0.1000 0.4275 )
( 0.8660 -0.5000 0.2565 )----- ( 0.0 -1.0000 0.2565 )
( 0.8660 0.1000 0.4275 )----- ( 0.8660 -0.1000 0.4275 )
( 0.8660 0.1000 0.4275 )----- ( -0.3464 0.8000 0.4275 )
( 0.8660 -0.1000 0.4275 )----- ( -0.3464 -0.8000 0.4275 )
( 0.0 1.0000 0.2565 )----- ( 0.0 1.0000 -0.2565 )
( 0.0 1.0000 0.2565 )----- ( -0.3464 0.8000 0.4275 )
( 0.0 1.0000 -0.2565 )----- ( -0.3464 -0.8000 0.4275 )
( 0.5196 0.7000 -0.4275 )----- ( 0.3464 0.8000 -0.4275 )
( 0.5196 0.7000 -0.4275 )----- ( 0.5196 -0.7000 -0.4275 )
( 0.3464 0.8000 -0.4275 )----- ( -0.8660 0.5000 -0.2565 )
( -0.8660 0.5000 -0.2565 )----- ( -0.8660 0.5000 0.2565 )
( -0.8660 0.5000 -0.2565 )----- ( -0.8660 0.1000 -0.4275 )
( -0.8660 0.5000 0.2565 )----- ( -0.5196 0.7000 0.4275 )
( -0.8660 0.5000 0.2565 )----- ( -0.8660 -0.5000 0.2565 )
( -0.3464 0.8000 0.4275 )----- ( -0.5196 0.7000 0.4275 )
( -0.5196 0.7000 0.4275 )----- ( -0.5196 -0.7000 0.4275 )
( -0.8660 -0.5000 0.2565 )----- ( -0.8660 -0.5000 -0.2565 )
( -0.8660 -0.5000 0.2565 )----- ( -0.5196 -0.7000 0.4275 )
( -0.8660 -0.5000 -0.2565 )----- ( -0.8660 -0.1000 -0.4275 )
( -0.8660 -0.5000 -0.2565 )----- ( 0.0 -1.0000 0.2565 )
( -0.8660 0.1000 -0.4275 )----- ( -0.8660 -0.1000 -0.4275 )
( -0.8660 0.1000 -0.4275 )----- ( -0.3464 -0.8000 0.4275 )
( 0.0 -1.0000 0.2565 )----- ( 0.0 -1.0000 -0.2565 )
( 0.0 -1.0000 -0.2565 )----- ( -0.3464 -0.8000 0.4275 )
```

```

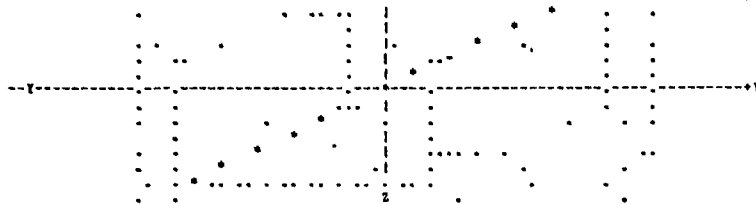
( 0.0 -1.0000 0.2565 )----- ( -0.3464 -0.8000 0.4275 )
( -0.5196 -0.7000 0.4275 )----- ( -0.3464 -0.8000 0.4275 )
( 0.5196 -0.7000 -0.4275 )----- ( 0.3464 -0.8000 -0.4275 )
THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 900.0000
VERTICES
779.4006 450.0254 -230.8496
779.4006 450.0254 230.8498
779.4006 -450.0254 -230.8496
779.4006 -450.0254 230.8498
779.4006 90.0249 384.7500
779.4006 -90.0249 384.7500
0.0 900.0000 230.8498
0.0 900.0000 -230.8498
467.6394 630.0154 -384.7500
311.7781 719.9998 -384.7500
-779.4006 450.0254 -230.8496
-779.4006 450.0254 230.8498
-311.7781 719.9998 384.7500
-467.6394 630.0154 384.7500
-779.4006 -450.0254 230.8498
-779.4006 -450.0254 -230.8498
-779.4006 90.0249 -384.7500
-779.4006 -90.0249 -384.7500
0.0 -900.0000 230.8498
0.0 -900.0000 -230.8498
-467.6394 -630.0154 384.7500
-311.7781 -719.9998 384.7500
467.6394 -630.0154 -384.7500
311.7781 -719.9998 -384.7500
EDGES
1 2
1 3
1 9
2 5
2 7
3 4
3 23
4 6
4 20
5 6
5 13
6 22
7 8
7 13
8 10
8 11
9 10
9 23
10 17
11 12
11 17
12 14
12 15
13 14
14 21
15 16
15 21
16 18
16 19
17 18
18 24
19 20

```

```

19 24
20 22
21 22
23 24
FACES
1 2 5 6 4 3
1 2 7 8 10 9
7 8 11 12 14 13
11 12 15 16 18 17
15 16 19 20 22 21
3 4 20 19 24 23
5 6 22 21 14 13
9 10 17 18 24 23
1 3 23 9
2 5 13 7
8 10 17 11
12 14 21 15
16 18 24 19
4 6 22 20
THE MAXIMUM IS: 1.0000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.0000000000
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 3.1150 -7.3613 )----- ( 3.1150 1.8726 )
( 3.1150 -7.3613 )----- ( -14.8860 -7.3613 )
( 3.1150 -7.3613 )----- ( 9.0690 -9.3416 )
( 3.1150 1.8726 )----- ( -4.0850 4.9507 )
( 3.1150 1.8726 )----- ( 18.0000 4.6170 )
( -14.8860 -7.3613 )----- ( -14.8860 1.8726 )
( -14.8860 -7.3613 )----- ( -16.1316 -9.3416 )
( -14.8860 1.8726 )----- ( -7.6860 4.9507 )
( -14.8860 1.8726 )----- ( -18.0000 4.6170 )
( -4.0850 4.9507 )----- ( -7.6860 4.9507 )
( -4.0850 4.9507 )----- ( 16.7543 8.7928 )
( -7.6860 4.9507 )----- ( -12.0457 8.7928 )
( 18.0000 4.6170 )----- ( 18.0000 -4.6170 )
( 18.0000 4.6170 )----- ( 16.7543 8.7928 )
( 18.0000 -4.6170 )----- ( 12.0457 -8.7928 )
( 18.0000 -4.6170 )----- ( 14.8860 -1.8726 )
( 9.0690 -9.3416 )----- ( 12.0457 -8.7928 )
( 9.0690 -9.3416 )----- ( -16.1316 -9.3416 )
( 12.0457 -8.7928 )----- ( 7.6860 -4.9507 )
( 14.8860 -1.8726 )----- ( 14.8860 7.3613 )
( 14.8860 -1.8726 )----- ( 7.6860 -4.9507 )
( 14.8860 7.3613 )----- ( 16.1316 9.3416 )
( 14.8860 7.3613 )----- ( -3.1150 7.3613 )
( 16.7543 8.7928 )----- ( 16.1316 9.3416 )
( 16.1316 9.3416 )----- ( -9.0690 9.3416 )
( -3.1150 7.3613 )----- ( -3.1150 -1.8726 )
( -3.1150 7.3613 )----- ( -9.0690 9.3416 )
( -3.1150 -1.8726 )----- ( 4.0850 -4.9507 )
( -3.1150 -1.8726 )----- ( -18.0000 -4.6170 )
( 7.6860 -4.9507 )----- ( 4.0850 -4.9507 )
( 4.0850 -4.9507 )----- ( -16.7543 -8.7928 )
( -18.0000 -4.6170 )----- ( -18.0000 4.6170 )
( -18.0000 -4.6170 )----- ( -16.7543 -8.7928 )
( -18.0000 4.6170 )----- ( -12.0457 8.7928 )
( -9.0690 9.3416 )----- ( -12.0457 8.7928 )
( -16.1316 -9.3416 )----- ( -16.7543 -8.7928 )
CRYSTAL SHAPE:

```



CHALCOPYRITE MASON AND DEBRI, 1968, p. 239
TETRAGONAL SYSTEM: A:B:C=1:1: 1.9716 ALPHA=BETA=GAMMA=90, , 2 FOUR(S).
NUMBER OF FACES OF MILLER INDICES = 8
MILLER INDICES :

1 -1 2
1 -2
-1 1 2
-1 -1 -2
1 -1 -2
-1 -1 2
1 1 2
-1 1 -2

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X + -1.0000 Y + 1.0144 Z = 1
1.0000 X + 1.0000 Y + -1.0144 Z = 1
-1.0000 X + 1.0000 Y + 1.0144 Z = 1
-1.0000 X + -1.0000 Y + -1.0144 Z = 1
0.6667 X + -0.6667 Y + -0.6763 Z = 1
-0.6667 X + -0.6667 Y + 0.6763 Z = 1
0.6667 X + 0.6667 Y + 0.6763 Z = 1
-0.6667 X + 0.6667 Y + -0.6763 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(1.0000 -0.2500 -0.2464)
(1.0000 0.2500 0.2465)
(-0.2500 -0.2500 0.9858)
(0.2500 0.2500 0.9858)
(-0.2500 -1.0000 -0.2464)
(0.2500 1.0000 0.2464)
(-0.2500 1.0000 -0.2465)
(0.2500 -0.2500 -0.9858)
(-0.2500 0.2500 -0.9858)
(-1.0000 -0.2500 0.2465)
(-1.0000 0.2500 -0.2464)

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :

(1.0000 -0.2500 -0.2464)----- (1.0000 0.2500 0.2465)
(1.0000 -0.2500 -0.2464)----- (0.2500 -1.0000 -0.2464)
(1.0000 -0.2500 -0.2464)----- (0.2500 -0.2500 -0.9858)
(1.0000 0.2500 0.2465)----- (0.2500 0.2500 0.9858)
(1.0000 0.2500 0.2465)----- (0.2500 1.0000 0.2464)
(-0.2500 -0.2500 0.9858)----- (0.2500 0.2500 0.9858)
(-0.2500 -0.2500 0.9858)----- (-0.2500 -1.0000 0.2465)
(-0.2500 -0.2500 0.9858)----- (-1.0000 -0.2500 0.2465)
(0.2500 0.2500 0.9858)----- (0.2500 1.0000 0.2464)
(0.2500 -1.0000 -0.2464)----- (-0.2500 -1.0000 0.2465)
(0.2500 -1.0000 -0.2464)----- (0.2500 -0.2500 -0.9858)
(-0.2500 -1.0000 0.2465)----- (-1.0000 -0.2500 0.2465)
(0.2500 1.0000 0.2464)----- (-0.2500 1.0000 -0.2465)

(-0.2500 1.0000 -0.2465)----- (-0.2500 0.2500 -0.9858)
(-0.2500 1.0000 -0.2465)----- (-1.0000 0.2500 -0.2464)
(0.2500 -0.2500 -0.9858)----- (-0.2500 0.2500 -0.9858)
(0.2500 0.2500 -0.9858)----- (-1.0000 0.2500 -0.2464)
(-1.0000 -0.2500 0.2465)----- (-1.0000 0.2500 -0.2464)

THE MAXIMUM IS:

1.0000

THE CONVERSION FACTOR FOR THE PPIINTER GRAPH IS :

900.0000

VERTICES

900.0000 -225.0000 -221.8049
900.0000 225.0000 221.8051
-224.9998 -224.9999 887.2202
224.9999 224.9998 887.2202
225.0000 -900.0000 -221.8049
-225.0000 -900.0000 221.8051
225.0000 900.0000 221.8049
-225.0000 900.0000 -221.8051
224.9999 -224.9998 -887.2202
-224.9998 224.9999 -887.2202
-900.0000 -225.0000 221.8051
-900.0000 225.0000 -221.8049

EDGES

1 2
1 5
1 9
2 4
2 7
3 4
3 6
3 11
4 7
5 6
5 9
6 11
7 8
8 10
8 12
9 10
10 12
11 12

FACES

1 2 4 3 6 5
1 2 7 8 10 9
3 4 7 8 12 11
5 6 11 12 10 9
1 5 9
3 6 11
2 4 7
8 10 12

THE MAXIMUM IS:

1.0943908691

THE CONVERSION FACTOR FOR VIEWPLOT IS :

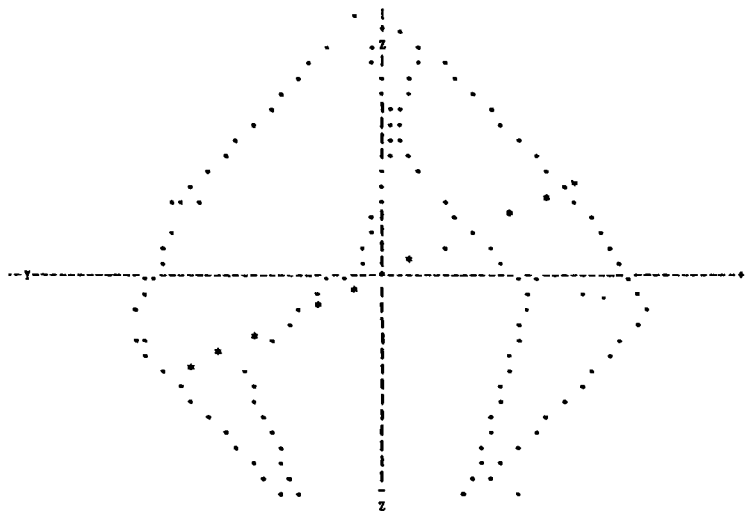
16.4474945068

THE 2D EDGES ARE DEFINED BY THE FOLLOWING POINTS :

(-10.3219 -6.9491)----- (-2.0981 1.1578)
(-10.3219 -6.9491)----- (-18.0000 -4.7774)
(-10.3219 -6.9491)----- (-5.6644 -16.9379)
(-2.0981 1.1578)----- (2.5594 15.4900)
(-2.0981 1.1578)----- (14.8950 3.3296)
(-2.5594 16.9379)----- (2.5594 15.4900)
(-2.5594 16.9379)----- (-14.8950 4.7774)
(-2.5594 16.9379)----- (2.0981 6.9492)
(2.5594 15.4900)----- (14.8950 3.3296)
(-10.0000 -4.7774)----- (-14.8950 4.7774)
(-10.0000 -4.7774)----- (-5.6644 -16.9379)
(-14.8950 4.7774)----- (2.0981 6.9492)
(14.8950 3.3296)----- (18.0000 -1.3246)

```
( 10.0000 -3.3296 )----- ( 5.6644 -15.4900 )
( 10.0000 -3.3296 )----- ( 10.1219 -1.1578 )
( -5.6644 -16.9379 )----- ( 5.6644 -15.4900 )
( 5.6644 -15.4900 )----- ( 10.1219 -1.1578 )
( 2.0981 6.9492 )----- ( 10.1219 -1.1578 )
```

CRYSTAL SHAPE:



CHLORITE : FORMS : DEER HOWIE AND ZUSSMAN, 1967, p. 231
 AXIAL RATIOS : MASON AND BERRY, 1969, p. 454
 MONOCLINIC SYSTEM : A:B:C= 0.5800: 1.0000: 1.5300 ,ALPHA=90, BETA= 96.2833 , 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

```
1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 1 0
0 -1 0
0 0 -1
0 0 1
```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```
1.7346 X + 1.0000 Y + 0.0 Z = 1
-1.7346 X + 1.0000 Y + 0.0 Z = 1
-1.7346 X + -1.0000 Y + 0.0 Z = 1
1.7346 X + -1.0000 Y + 0.0 Z = 1
0.0 X + 1.6667 Y + 0.0 Z = 1
0.0 X + -1.6667 Y + 0.0 Z = 1
0.5140 X + 0.0 Y + 4.6685 Z = 1
-0.5140 X + 0.0 Y + -4.6685 Z = 1
```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```
( 0.5765 0.0 0.1507 )
( 0.5765 0.0 -0.2777 )
( 0.2306 0.6000 0.1888 )
( 0.2306 0.6000 -0.2396 )
( -0.5765 0.0 0.2777 )
( -0.5765 0.0 -0.1507 )
( -0.2306 0.6000 0.2396 )
( -0.2306 0.6000 -0.1888 )
( -0.2306 -0.6000 0.2396 )
( -0.2306 -0.6000 -0.1888 )
( 0.2306 -0.6000 0.1888 )
( 0.2306 -0.6000 -0.2396 )
```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```
( 0.5765 0.0 0.1507 )----- ( 0.5765 0.0 -0.2777 )
( 0.5765 0.0 0.1507 )----- ( 0.2306 0.6000 0.1888 )
( 0.5765 0.0 0.1507 )----- ( 0.2306 -0.6000 0.1888 )
( 0.5765 0.0 -0.2777 )----- ( 0.2306 0.6000 -0.2396 )
( 0.5765 0.0 -0.2777 )----- ( 0.2306 -0.6000 -0.2396 )
( 0.2306 0.6000 0.1888 )----- ( 0.2306 0.6000 -0.2396 )
( 0.2306 0.6000 0.1888 )----- ( -0.2306 0.6000 0.2396 )
( 0.2306 0.6000 -0.2396 )----- ( -0.2306 0.6000 -0.1888 )
( -0.5765 0.0 0.2777 )----- ( -0.5765 0.0 -0.1507 )
( -0.5765 0.0 0.2777 )----- ( -0.2306 0.6000 0.2396 )
( -0.5765 0.0 0.2777 )----- ( -0.2306 -0.6000 0.2396 )
( -0.5765 0.0 -0.1507 )----- ( -0.2306 0.6000 -0.1888 )
( -0.5765 0.0 -0.1507 )----- ( -0.2306 -0.6000 -0.1888 )
( -0.2306 0.6000 0.2396 )----- ( -0.2306 0.6000 -0.1888 )
( -0.2306 -0.6000 0.2396 )----- ( -0.2306 -0.6000 -0.1888 )
( -0.2306 -0.6000 0.2396 )----- ( 0.2306 -0.6000 0.1888 )
( -0.2306 -0.6000 -0.1888 )----- ( 0.2306 -0.6000 -0.2396 )
( 0.2306 -0.6000 0.1888 )----- ( 0.2306 -0.6000 -0.2396 )
```

THE MAXIMUM IS:

0.6000

THE CONVERSION FACTOR FOR THE P-INTER GRAPH IS :

1499.9995

VERTICES

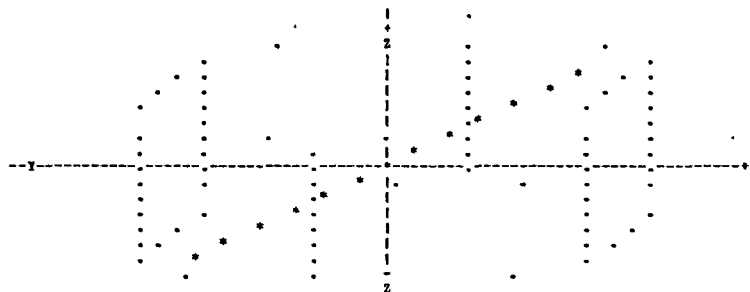
```
864.7749 0.0 226.0830
864.7749 0.0 -416.5166
345.9094 899.9998 283.2126
345.9094 899.9998 -359.3862
-864.7749 0.0 416.5166
-864.7749 0.0 -226.0830
-345.9094 899.9998 359.3862
-345.9094 899.9998 -283.2126
-345.9094 -899.9998 359.3862
-345.9094 -899.9998 -283.2126
345.9094 -899.9998 283.2126
345.9094 -899.9998 -359.3862
```

EDGES

```
1 2
1 3
1 11
2 4
2 12
3 4
3 7
4 8
5 6
5 7
5 9
6 8
6 10
7 8
9 10
```

9 11
 10 12
 11 12
 FACES
 1 2 4 3
 5 6 8 7
 5 6 10 9
 1 2 12 11
 3 4 8 7
 9 10 12 11
 1 3 7 5
 2 4 8 6
 9 11
 10 12
 THE MAXIMUM IS: 0.6870688796 THE CONVERSION FACTOR FOR VIEWPLOT IS: 26.1982421875
 THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
 (-5.7026 1.2896)----- (-5.7026 -9.9338)
 (-5.7026 1.2896)----- (13.4379 3.8828)
 (-5.7026 1.2896)----- (-18.0000 7.3405)
 (-5.7026 -9.9338)----- (13.4379 -7.3405)
 (-5.7026 -9.9338)----- (-18.0000 -7.3405)
 (13.4379 3.8828)----- (13.4379 -7.3405)
 (13.4379 3.8828)----- (18.0000 7.3405)
 (13.4379 -7.3405)----- (18.0000 -3.8828)
 (5.7026 9.9338)----- (5.7026 -1.2896)
 (5.7026 9.9338)----- (18.0000 7.3405)
 (5.7026 9.9338)----- (-13.4379 7.3405)
 (5.7026 -1.2896)----- (18.0000 -3.8828)
 (5.7026 -1.2896)----- (-13.4379 -3.8828)
 (18.0000 7.3405)----- (18.0000 -3.8828)
 (-13.4379 7.3405)----- (-13.4379 -3.8828)
 (-13.4379 7.3405)----- (-18.0000 3.8828)
 (-13.4379 -3.8828)----- (-18.0000 -7.3405)
 (-18.0000 3.8828)----- (-18.0000 -7.3405)

CRYSTAL SHAPE:



CHLORITOID : DEER ROWIE AND ZUSSMAN, 1967, P. 52
 MONOCLINIC SYSTEM : A:B:C= 1.7272: 1.0000: 3.3090 , ALPHA=GAMMA=90, BETA= 102.0000 , 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

1 1 0
 -1 1 0
 -1 -1 0
 1 -1 0
 0 1 0

0 -1 0
 0 0 1
 0 0 -1
 THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :
 0.5919 X + 1.0000 Y + 0.0 Z = 1
 -0.5919 X + 1.0000 Y + 0.0 Z = 1
 -0.5919 X + -1.0000 Y + 0.0 Z = 1
 0.5919 X + -1.0000 Y + 0.0 Z = 1
 0.0 X + 1.3333 Y + 0.0 Z = 1
 0.0 X + -1.3333 Y + 0.0 Z = 1
 0.6424 X + 0.0 Y + 3.0221 Z = 1
 -0.6424 X + 0.0 Y + -3.0221 Z = 1

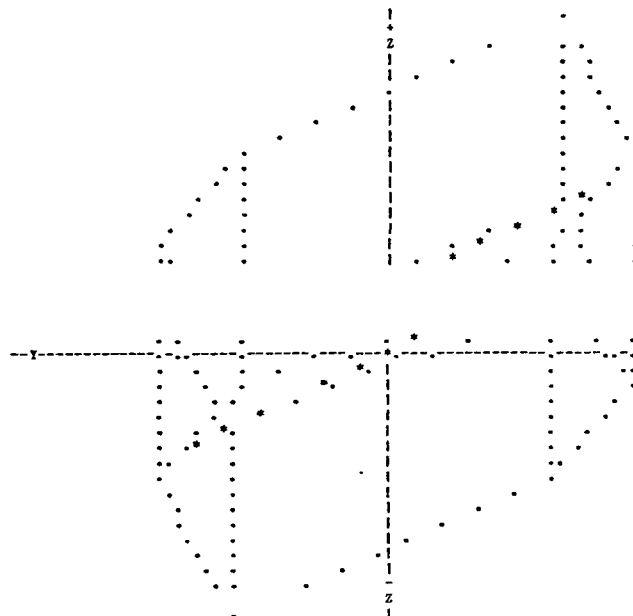
THE POSITIONS OF THE CRYSTAL VERTICES ARE :
 (1.6895 0.0 -0.0282)
 (1.6895 0.0 -0.6900)
 (0.4224 0.7500 0.2411)
 (0.4224 0.7500 -0.4207)
 (-1.6895 0.0 0.6900)
 (-1.6895 0.0 0.0282)
 (-0.4224 0.7500 0.4207)
 (-0.4224 0.7500 -0.2411)
 (-0.4224 -0.7500 0.4207)
 (-0.4224 -0.7500 -0.2411)
 (0.4224 -0.7500 0.2411)
 (0.4224 -0.7500 -0.4207)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
 (1.6895 0.0 -0.0282)----- (1.6895 0.0 -0.6900)
 (1.6895 0.0 -0.0282)----- (0.4224 0.7500 0.2411)
 (1.6895 0.0 -0.0282)----- (0.4224 -0.7500 0.2411)
 (1.6895 0.0 -0.6900)----- (0.4224 0.7500 -0.4207)
 (1.6895 0.0 -0.6900)----- (0.4224 -0.7500 -0.4207)
 (0.4224 0.7500 0.2411)----- (0.4224 0.7500 -0.4207)
 (0.4224 0.7500 0.2411)----- (-0.4224 0.7500 0.4207)
 (0.4224 0.7500 -0.4207)----- (-0.4224 0.7500 -0.2411)
 (-1.6895 0.0 0.6900)----- (-1.6895 0.0 0.0282)
 (-1.6895 0.0 0.6900)----- (-0.4224 0.7500 0.4207)
 (-1.6895 0.0 0.6900)----- (-0.4224 -0.7500 0.4207)
 (-1.6895 0.0 0.0282)----- (-0.4224 0.7500 -0.2411)
 (-1.6895 0.0 0.0282)----- (-0.4224 -0.7500 -0.2411)
 (-0.4224 0.7500 0.4207)----- (-0.4224 0.7500 -0.2411)
 (-0.4224 -0.7500 0.4207)----- (-0.4224 -0.7500 -0.2411)
 (-0.4224 -0.7500 -0.2411)----- (0.4224 -0.7500 -0.4207)
 (-0.4224 -0.7500 -0.2411)----- (0.4224 0.7500 -0.4207)
 (0.4224 -0.7500 -0.4207)----- (0.4224 0.7500 -0.4207)

THE MAXIMUM IS: 1.6895 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS: 532.7158

VERTICES
 899.9998 0.0 -15.0255
 899.9998 0.0 -367.5767
 224.9998 399.5369 128.4504
 224.9998 399.5369 -224.1007
 -899.9998 0.0 367.5767
 -899.9998 0.0 15.0255
 -224.9998 399.5369 224.1007
 -224.9998 399.5369 -128.4504
 -224.9998 -399.5369 224.1007
 -224.9998 -399.5369 -128.4504
 224.9998 -399.5369 128.4504
 224.9998 -399.5369 -224.1007
 EDGES
 1 2
 1 3
 1 11

2 4
 2 12
 3 4
 3 7
 4 8
 5 6
 5 7
 5 9
 6 8
 6 10
 7 8
 9 10
 9 11
 10 12
 11 12
 FACES
 1 2 4 3
 5 6 8 7
 5 6 10 9
 1 2 12 11
 3 4 8 7
 9 10 12 11
 1 3 7 5
 2 4 8 6
 9 11
 10 12
 THE MAXIMUM IS: 0.9874426126 THE CONVERSION FACTOR FOR VIEWPLOT IS: 18.2288970947
 THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
 (-11.6278 -5.9361)----- (-11.6278 -18.0000)
 (-11.6278 -5.9361)----- (10.7647 3.0399)
 (-11.6278 -5.9361)----- (-16.5786 3.0399)
 (-11.6278 -18.0000)----- (10.7647 -9.0239)
 (-11.6278 -18.0000)----- (-16.5786 -9.0239)
 (10.7647 3.0399)----- (10.7647 -9.0239)
 (10.7647 3.0399)----- (16.5786 9.0239)
 (10.7647 -9.0239)----- (16.5786 -3.0399)
 (11.6278 18.0000)----- (11.6278 5.9361)
 (11.6278 18.0000)----- (16.5786 9.0239)
 (11.6278 18.0000)----- (-10.7647 9.0239)
 (11.6278 5.9361)----- (16.5786 -3.0399)
 (11.6278 5.9361)----- (-10.7647 -3.0399)
 (16.5786 9.0239)----- (16.5786 -3.0399)
 (-10.7647 9.0239)----- (-10.7647 -3.0399)
 (-10.7647 9.0239)----- (-16.5786 3.0399)
 (-10.7647 -3.0399)----- (-16.5786 -9.0239)
 (-16.5786 3.0399)----- (-16.5786 -9.0239)
 CRYSTAL SHAPE:



CORDIERITE : DEER HOWIE AND ZUSSMAN, 1967, P. 84
 ORTHORHOMBIC SYSTEM : A:B:C= 0.5672: 1.0000: 0.5497 , ALPHA=BETA=GAMMA=90, , 5 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 18
 MILLER INDICES :

1	0	0
-1	0	0
1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	0
0	-1	0
0	0	1
0	0	-1
1	1	1
-1	1	1
-1	-1	1
1	-1	1
1	1	-1
-1	1	-1
-1	-1	-1
1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.7630 X +	0.0 Y +	0.0 Z =	1
-1.7630 X +	0.0 Y +	0.0 Z =	1
1.1754 X +	0.6667 Y +	0.0 Z =	1
-1.1754 X +	0.6667 Y +	0.0 Z =	1
-1.1754 X +	-0.6667 Y +	0.0 Z =	1
1.1754 X +	-0.6667 Y +	0.0 Z =	1
0.0 X +	1.1765 Y +	0.0 Z =	1
0.0 X +	-1.1765 Y +	0.0 Z =	1
0.0 X +	0.0 Y +	0.9096 Z =	1
0.0 X +	0.0 Y +	-0.9096 Z =	1
0.5425 X +	0.3077 Y +	0.5597 Z =	1
-0.5425 X +	0.3077 Y +	0.5597 Z =	1
0.5425 X +	-0.3077 Y +	0.5597 Z =	1
-0.5425 X +	-0.3077 Y +	0.5597 Z =	1
0.5425 X +	0.3077 Y +	-0.5597 Z =	1
-0.5425 X +	0.3077 Y +	-0.5597 Z =	1
0.5425 X +	-0.3077 Y +	-0.5597 Z =	1
-0.5425 X +	-0.3077 Y +	-0.5597 Z =	1

THE POSITION OF THE CRYSTAL FACES ARE :
 (0.5672 0.5000 0.9620)

```

( 0.5672 0.5000 -0.9620 )
( 0.5672 -0.5000 0.9620 )
( 0.5672 -0.5000 -0.9620 )
( 0.5672 0.2500 1.0994 )
( 0.5672 -0.2500 1.0994 )
( 0.5672 0.2500 -1.0994 )
( 0.5672 -0.2500 -1.0994 )
( -0.5672 0.5000 0.9620 )
( -0.5672 0.5000 -0.9620 )
( -0.5672 -0.5000 0.9620 )
( -0.5672 -0.5000 -0.9620 )
( -0.5672 0.2500 1.0994 )
( -0.5672 -0.2500 1.0994 )
( -0.5672 0.2500 -1.0994 )
( -0.5672 -0.2500 -1.0994 )
( 0.3687 0.8500 0.9620 )
( 0.3687 0.8500 -0.9620 )
( -0.3687 0.8500 0.9620 )
( -0.3687 0.8500 -0.9620 )
( -0.3687 -0.8500 0.9620 )
( -0.3687 -0.8500 -0.9620 )
( 0.3687 -0.8500 0.9620 )
( 0.3687 -0.8500 -0.9620 )
( 0.2269 0.8500 1.0994 )
( -0.2269 0.8500 1.0994 )
( 0.2269 0.8500 -1.0994 )
( -0.2269 0.8500 -1.0994 )
( 0.2269 -0.8500 1.0994 )
( -0.2269 -0.8500 1.0994 )
( 0.2269 -0.8500 -1.0994 )
( -0.2269 -0.8500 -1.0994 )
THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.5672 0.5000 0.9620 )----- ( 0.5672 0.5000 -0.9620 )
( 0.5672 0.5000 0.9620 )----- ( 0.5672 0.2500 1.0994 )
( 0.5672 0.5000 0.9620 )----- ( 0.3687 0.8500 0.9620 )
( 0.5672 0.5000 -0.9620 )----- ( 0.5672 0.2500 -1.0994 )
( 0.5672 0.5000 -0.9620 )----- ( 0.3687 0.8500 -0.9620 )
( 0.5672 -0.5000 0.9620 )----- ( 0.5672 -0.5000 -0.9620 )
( 0.5672 -0.5000 0.9620 )----- ( 0.5672 -0.2500 1.0994 )
( 0.5672 -0.5000 0.9620 )----- ( 0.3687 -0.8500 0.9620 )
( 0.5672 -0.5000 -0.9620 )----- ( 0.5672 -0.2500 -1.0994 )
( 0.5672 -0.5000 -0.9620 )----- ( 0.3687 -0.8500 -0.9620 )
( 0.5672 0.2500 1.0994 )----- ( 0.5672 -0.2500 1.0994 )
( 0.5672 0.2500 1.0994 )----- ( 0.2269 0.8500 1.0994 )
( 0.5672 -0.2500 1.0994 )----- ( 0.2269 -0.8500 1.0994 )
( 0.5672 -0.2500 -1.0994 )----- ( 0.5672 -0.2500 -1.0994 )
( 0.5672 0.2500 -1.0994 )----- ( 0.2269 0.8500 -1.0994 )
( 0.5672 -0.2500 -1.0994 )----- ( 0.2269 -0.8500 -1.0994 )
( -0.5672 0.5000 0.9620 )----- ( -0.5672 0.5000 -0.9620 )
( -0.5672 0.5000 0.9620 )----- ( -0.5672 0.2500 1.0994 )
( -0.5672 0.5000 0.9620 )----- ( -0.3687 0.8500 0.9620 )
( -0.5672 0.5000 -0.9620 )----- ( -0.5672 0.2500 -1.0994 )
( -0.5672 0.5000 -0.9620 )----- ( -0.3687 0.8500 -0.9620 )
( -0.5672 -0.5000 0.9620 )----- ( -0.5672 -0.5000 -0.9620 )
( -0.5672 -0.5000 0.9620 )----- ( -0.5672 -0.2500 1.0994 )
( -0.5672 -0.5000 0.9620 )----- ( -0.3687 -0.8500 0.9620 )
( -0.5672 -0.5000 -0.9620 )----- ( -0.5672 -0.2500 -1.0994 )
( -0.5672 -0.5000 -0.9620 )----- ( -0.3687 -0.8500 -0.9620 )
( -0.5672 0.2500 1.0994 )----- ( -0.5672 -0.2500 1.0994 )
( -0.5672 0.2500 1.0994 )----- ( -0.2269 0.8500 1.0994 )
( -0.5672 -0.2500 1.0994 )----- ( -0.2269 -0.8500 1.0994 )
( -0.5672 0.2500 -1.0994 )----- ( -0.5672 -0.2500 -1.0994 )

```

```

( -0.5672 0.2500 -1.0994 )----- ( -0.2269 0.8500 -1.0994 )
( -0.5672 -0.2500 -1.0994 )----- ( -0.2269 -0.8500 -1.0994 )
( 0.3687 0.8500 0.9620 )----- ( 0.3687 0.8500 -0.9620 )
( 0.3687 0.8500 0.9620 )----- ( 0.2269 0.8500 1.0994 )
( 0.3687 0.8500 -0.9620 )----- ( 0.2269 0.8500 -1.0994 )
( -0.3687 0.8500 0.9620 )----- ( -0.3687 0.8500 -0.9620 )
( -0.3687 0.8500 0.9620 )----- ( -0.2269 0.8500 1.0994 )
( -0.3687 0.8500 -0.9620 )----- ( -0.2269 0.8500 -1.0994 )
( -0.3687 -0.8500 0.9620 )----- ( -0.3687 -0.8500 -0.9620 )
( -0.3687 -0.8500 0.9620 )----- ( -0.2269 -0.8500 1.0994 )
( -0.3687 -0.8500 -0.9620 )----- ( -0.2269 -0.8500 -1.0994 )
( 0.3687 -0.8500 0.9620 )----- ( 0.3687 -0.8500 -0.9620 )
( 0.3687 -0.8500 0.9620 )----- ( 0.2269 -0.8500 1.0994 )
( 0.3687 -0.8500 -0.9620 )----- ( 0.2269 -0.8500 -1.0994 )
( 0.2269 0.8500 1.0994 )----- ( -0.2269 0.8500 1.0994 )
( 0.2269 0.8500 1.0994 )----- ( -0.2269 0.8500 -1.0994 )
( -0.2269 -0.8500 1.0994 )----- ( 0.2269 -0.8500 1.0994 )
( -0.2269 -0.8500 1.0994 )----- ( 0.2269 -0.8500 -1.0994 )
THE MAXIMUM IS: 1.0994 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS : 818.6287

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VERTICES
464.3262 409.3147 787.4995
464.3262 409.3147 -787.4995
464.3262 -409.3147 787.4995
464.3262 -409.3147 -787.4995
464.3262 204.6571 899.9998
464.3262 -204.6571 899.9998
464.3262 204.6571 -899.9998
464.3262 -204.6571 -899.9998
464.3262 409.3147 787.4995
464.3262 409.3147 -787.4995
464.3262 -409.3147 787.4995
464.3262 -409.3147 -787.4995
464.3262 204.6571 899.9998
464.3262 -204.6571 899.9998
464.3262 204.6571 -899.9998
464.3262 -204.6571 -899.9998
301.8120 695.8347 787.4998
301.8120 695.8347 -787.4998
301.8120 695.8347 787.4998
301.8120 695.8347 -787.4998
301.8120 -695.8347 787.4998
301.8120 -695.8347 -787.4998
301.8120 -695.8347 787.4998
301.8120 -695.8347 -787.4998
185.7304 695.8347 899.9998
185.7304 695.8347 -899.9998
185.7304 695.8347 899.9998
185.7304 695.8347 -899.9998
185.7304 -695.8347 899.9998
185.7304 -695.8347 -899.9998
185.7304 -695.8347 899.9998
185.7304 -695.8347 -899.9998
PDGFS
1 2
1 5
1 17
2 7
2 18
3 4
3 6
3 23
4 8

```

4 24
5 6
5 25
6 30
7 8
7 27
8 32
9 10
9 13
9 19
10 15
10 20
11 12
11 14
11 21
12 16
12 22
13 14
13 26
14 29
15 16
15 28
16 31
17 18
17 25
18 27
19 20
19 26
20 28
21 22
21 29
22 31
23 24
23 30
24 32
25 26
27 28
29 30
31 32

FACES

1	2	7	8	4	3	6	5
1	10	15	16	12	11	14	13
1	2	18	17				
9	10	20	19				
11	12	22	21				
3	4	24	23				
17	18	27	28	20	19	26	25
21	22	31	32	24	23	30	29
5	6	30	29	14	13	26	25
7	8	32	31	16	15	28	27
1	5	25	17				
9	13	26	19				
11	14	29	21				
3	6	30	23				
2	7	27	18				
10	15	28	20				
12	16	31	22				
4	8	32	24				

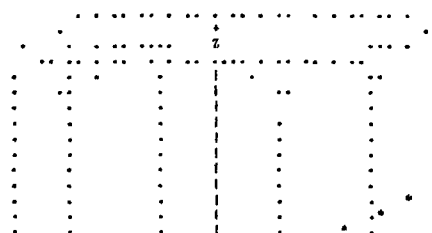
THE MAXIMUM IS: 1.1992578506 THE CONVERSION FACTOR FOR VIEWPLOT IS : 15.0092821121

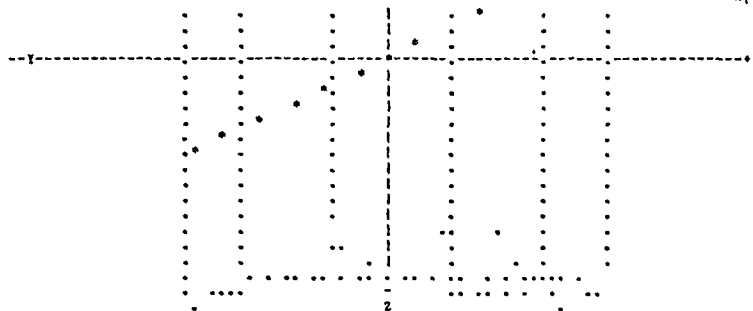
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(4.2903 12.9397)	-----	(4.2903 -15.9373)
(4.2903 12.9397)	-----	(0.5380 15.0024)

(4.2903 12.9397)	-----	(10.6686 13.4643)
(4.2903 -15.9373)	-----	(0.5380 -18.0000)
(-10.7190 -15.9373)	-----	(10.6686 -15.4127)
(-10.7190 12.9397)	-----	(-10.7190 -15.9373)
(-10.7190 12.9397)	-----	(-6.9666 15.0024)
(-10.7190 12.9397)	-----	(-14.8472 13.4643)
(-10.7190 -15.9373)	-----	(-6.9666 -18.0000)
(-10.7190 -15.9373)	-----	(-14.8472 -15.4127)
(0.5380 15.0024)	-----	(-6.9666 15.0024)
(0.5380 15.0024)	-----	(11.4722 15.9017)
(-6.9666 15.0024)	-----	(-14.0436 15.9017)
(0.5380 -18.0000)	-----	(-6.9666 -18.0000)
(0.5380 -18.0000)	-----	(11.4722 -17.1007)
(-6.9666 -18.0000)	-----	(-14.0436 -17.1007)
(10.7190 15.9373)	-----	(10.7190 -12.9397)
(10.7190 15.9373)	-----	(6.9666 18.0000)
(10.7190 15.9373)	-----	(14.8472 15.4127)
(10.7190 -12.9397)	-----	(6.9666 -15.0024)
(10.7190 -12.9397)	-----	(14.8472 -13.4643)
(-4.2903 15.9373)	-----	(-4.2903 -12.9397)
(-4.2903 15.9373)	-----	(-0.5380 18.0000)
(-4.2903 15.9373)	-----	(-10.6686 15.4127)
(-4.2903 -12.9397)	-----	(-0.5380 -15.0024)
(-4.2903 -12.9397)	-----	(-10.6686 -13.4643)
(6.9666 18.0000)	-----	(-0.5380 18.0000)
(6.9666 18.0000)	-----	(14.0436 17.1007)
(-0.5380 18.0000)	-----	(-11.4722 17.1007)
(6.9666 -15.0024)	-----	(-0.5380 -15.0024)
(6.9666 -15.0024)	-----	(14.0436 -15.9017)
(-0.5380 -15.0024)	-----	(-11.4722 -15.9017)
(10.6686 13.4643)	-----	(10.6686 -15.4127)
(10.6686 13.4643)	-----	(11.4722 15.9017)
(10.6686 -15.4127)	-----	(11.4722 -17.1007)
(14.8472 15.4127)	-----	(14.8472 -13.4643)
(14.8472 15.4127)	-----	(14.0436 17.1007)
(14.8472 -13.4643)	-----	(14.0436 -15.9017)
(-10.6686 15.4127)	-----	(-10.6686 -13.4643)
(-10.6686 15.4127)	-----	(-11.4722 17.1007)
(-10.6686 -13.4643)	-----	(-11.4722 -15.9017)
(-14.8472 13.4643)	-----	(-14.8472 -15.4127)
(-14.8472 13.4643)	-----	(-14.0436 15.9017)
(-14.8472 -15.4127)	-----	(-14.0436 -17.1007)
(11.4722 15.9017)	-----	(14.0436 17.1007)
(11.4722 -17.1007)	-----	(14.0436 -15.9017)
(-11.4722 17.1007)	-----	(-14.0436 15.9017)
(-11.4722 -15.9017)	-----	(-14.0436 -17.1007)

CRYSTAL SHAPE:





CUNNINGTONITE GRUNERITE : FORMS : DEER HOWIE AND ZUSSMAN, 1967, P. 160
 AXIAL RATIOS : MASON AND BEFFRY, 1968, P. 463
 MONOCLINIC SYSTEM : A:B:C= 0.5230: 1.0000: 0.2920 , ALPHA=90, BETA= 101.9166 , 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 10
 MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	0
0	-1	0
0	1	1
0	-1	1
0	-1	-1
0	1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.9542 X +	1.0000 Y +	0.0 Z =	1
-1.9542 X +	1.0000 Y +	0.0 Z =	1
-1.9542 X +	-1.0000 Y +	0.0 Z =	1
1.9542 X +	-1.0000 Y +	0.0 Z =	1
0.0 X +	2.0000 Y +	0.0 Z =	1
0.0 X +	-2.0000 Y +	0.0 Z =	1
0.1807 X +	0.2500 Y +	0.8562 Z =	1
0.1807 X +	-0.2500 Y +	0.8562 Z =	1
-0.1807 X +	-0.2500 Y +	-0.8562 Z =	1
-0.1807 X +	0.2500 Y +	-0.8562 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5117	0.0	1.0600	)
(	0.5117	0.0	-1.2760	)
(	0.2559	0.5000	0.9680	)
(	0.2559	0.5000	-1.0760	)
(	-0.5117	0.0	1.2760	)
(	-0.5117	0.0	-1.0600	)
(	-0.2559	0.5000	1.0760	)
(	-0.2559	0.5000	-0.9680	)
(	-0.2559	-0.5000	1.0760	)
(	-0.2559	-0.5000	-0.9680	)
(	0.2559	-0.5000	0.9680	)
(	0.2559	-0.5000	-1.0760	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.5117	0.0	1.0600	)	-----	(	0.5117	0.0	-1.2760	)

(	0.5117	0.0	1.0600	)	-----	(	0.2559	0.5000	0.9680	)
(	0.5117	0.0	1.0600	)	-----	(	-0.5117	0.0	1.2760	)
(	0.5117	0.0	1.0600	)	-----	(	0.2559	-0.5000	0.9680	)
(	0.5117	0.0	-1.2760	)	-----	(	0.2559	0.5000	-1.0760	)
(	0.5117	0.0	-1.2760	)	-----	(	-0.5117	0.0	-1.0600	)
(	0.5117	0.0	-1.2760	)	-----	(	0.2559	-0.5000	-1.0760	)
(	0.2559	0.5000	0.9680	)	-----	(	0.2559	0.5000	-1.0760	)
(	0.2559	0.5000	0.9680	)	-----	(	-0.2559	0.5000	1.0760	)
(	0.2559	0.5000	-1.0760	)	-----	(	-0.2559	0.5000	-0.9680	)
(	-0.5117	0.0	1.2760	)	-----	(	-0.5117	0.0	-1.0600	)
(	-0.5117	0.0	1.2760	)	-----	(	-0.2559	-0.5000	1.0760	)
(	-0.5117	0.0	1.2760	)	-----	(	-0.2559	-0.5000	1.0760	)
(	-0.5117	0.0	-1.0600	)	-----	(	-0.2559	0.5000	-0.9680	)
(	-0.5117	0.0	-1.0600	)	-----	(	-0.2559	-0.5000	-0.9680	)
(	-0.2559	0.5000	1.0760	)	-----	(	-0.2559	0.5000	-0.9680	)
(	-0.2559	-0.5000	1.0760	)	-----	(	-0.2559	-0.5000	-0.9680	)
(	-0.2559	-0.5000	1.0760	)	-----	(	0.2559	-0.5000	0.9680	)
(	-0.2559	-0.5000	-0.9680	)	-----	(	0.2559	-0.5000	-1.0760	)
(	-0.2559	-0.5000	-0.9680	)	-----	(	0.2559	-0.5000	-1.0760	)

THE MAXIMUM IS:

1.2760

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :

705.3333

VERTICES
 360.9395 0.0 747.6575
 360.9395 0.0 -899.9998
 180.4697 352.6665 682.7649
 180.4697 352.6665 -758.9360
 -360.9395 0.0 899.9998
 -360.9395 0.0 -747.6575
 -180.4697 352.6665 758.9360
 -180.4697 352.6665 -682.7649
 -180.4697 -352.6665 758.9360
 -180.4697 -352.6665 -682.7649
 180.4697 -352.6665 682.7649
 180.4697 -352.6665 -758.9360

EDGES

1	2
1	3
1	5
1	11
2	4
2	6
2	12
3	4
3	7
4	8
5	6
5	7
5	9
6	8
6	10
7	8
9	10
9	11
10	12
11	12

FACES

1	2	4	3
5	6	8	7
5	6	10	9
1	2	12	11
3	4	8	7
9	10	12	11
1	3	7	5

1 5 9 11
2 6 10 12
2 4 8 6
THE MAXIMUM IS:

1.3660840988

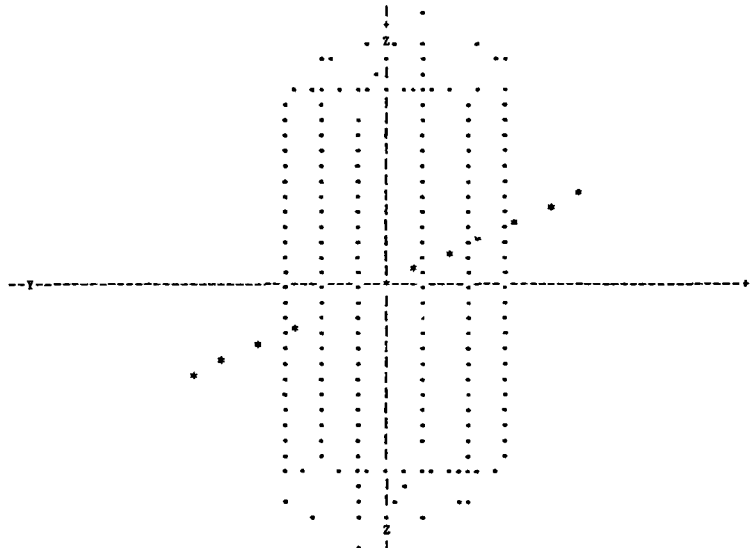
THE CONVERSION FACTOR FOR WPMPLT IS :

13.1763477325

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(-2.5458 12.7799)	-----	(-2.5458 -18.0000)
(-2.5458 12.7799)	-----	(5.3153 12.1612)
(-2.5458 12.7799)	-----	(2.5458 18.0000)
(-2.5458 12.7799)	-----	(-7.8611 12.1612)
(-2.5458 -18.0000)	-----	(5.3153 -14.7712)
(-2.5458 -18.0000)	-----	(2.5458 -12.7799)
(-2.5458 -18.0000)	-----	(-7.8611 -14.7712)
(5.3153 12.1612)	-----	(5.3153 -14.7712)
(5.3153 12.1612)	-----	(7.8611 14.7712)
(5.3153 -14.7712)	-----	(7.8611 -12.1612)
(2.5458 18.0000)	-----	(2.5458 -12.7799)
(2.5458 18.0000)	-----	(7.8611 14.7712)
(2.5458 18.0000)	-----	(-5.3153 14.7712)
(2.5458 -12.7799)	-----	(7.8611 -12.1612)
(2.5458 -12.7799)	-----	(-5.3153 -12.1612)
(7.8611 14.7712)	-----	(7.8611 -12.1612)
(-5.3153 14.7712)	-----	(-5.3153 -12.1612)
(-5.3153 14.7712)	-----	(-7.8611 12.1612)
(-5.3153 -12.1612)	-----	(-7.8611 -14.7712)
(-7.8611 12.1612)	-----	(-7.8611 -14.7712)

CRYSTAL SHAPE:



DIOPSIDE HEDENBERGITE LOHANNSENITE : AXIAL RATIOS : ROGERS, 1937, p. 444
FORMS : DEER HOWIE AND ZUSSMAN, 1967, p. 115
MONOCLINIC SYSTEM : A:B:C= 1.0920: 1.0000: 0.5890 , ALPHA=90, BETA= 108.8333 , 5 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 18
MILLER INDICES :

1	0	0
-1	0	0
0	1	0
0	-1	0
1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	0	1
0	0	-1
1	1	1
-1	1	1
-1	-1	1
1	-1	1
1	1	-1
-1	1	-1
-1	-1	-1
1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

0.9576 X +	0.0 Y +	0.0 Z =	1
-0.9576 X +	0.0 Y +	0.0 Z =	1
0.0 X +	1.0000 Y +	0.0 Z =	1
0.0 X +	-1.0000 Y +	0.0 Z =	1
0.5375 X +	0.5556 Y +	0.0 Z =	1
-0.5375 X +	0.5556 Y +	0.0 Z =	1
-0.5375 X +	-0.5556 Y +	0.0 Z =	1
0.5375 X +	-0.5556 Y +	0.0 Z =	1
0.1930 X +	0.0 Y +	0.5659 Z =	1
-0.1930 X +	0.0 Y +	-0.5659 Z =	1
0.4419 X +	0.2857 Y +	0.4851 Z =	1
-0.1110 X +	0.2857 Y +	0.4851 Z =	1
-0.1110 X +	-0.2857 Y +	0.4851 Z =	1
0.4419 X +	-0.2857 Y +	0.4851 Z =	1
0.1110 X +	0.2857 Y +	-0.4851 Z =	1
-0.4419 X +	0.2857 Y +	-0.4851 Z =	1
-0.4419 X +	-0.2857 Y +	-0.4851 Z =	1
0.1110 X +	-0.2857 Y +	-0.4851 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(1.0335 0.8000 0.6488)
(1.0335 0.8000 -1.3538)
(1.0335 -0.8000 0.6488)
(1.0335 -0.8000 -1.3538)
(1.0335 0.0 1.1200)
(1.0335 0.0 -1.1200)
(-1.0335 0.8000 1.3538)
(-1.0335 0.8000 -0.6488)
(-1.0335 -0.8000 1.3538)
(-1.0335 -0.8000 -0.6488)
(-1.0335 0.0 1.1200)
(-1.0335 0.0 -1.1200)
(0.8268 1.0000 0.7193)
(0.8268 1.0000 -1.2933)
(-0.8268 1.0000 1.2933)
(-0.8268 1.0000 -0.7193)
(0.0 1.0000 1.4725)
(0.0 1.0000 -1.4725)
(-0.8268 -1.0000 1.2933)

(	-0.8268	-1.0000	-0.7193	)
(	0.8268	-1.0000	0.7193	)
(	0.5168	-1.0000	-1.2833	)
(	0.0	-1.0000	1.4725	)
(	0.0	-1.0000	-1.4725	)
(	0.0	0.5000	1.7670	)
(	0.5168	0.0	1.5907	)
(	-0.5168	0.0	1.9433	)
(	0.0	-0.5000	1.7670	)
(	0.0	0.5000	-1.7670	)
(	0.5168	0.0	-1.9433	)
(	-0.5168	0.0	-1.5907	)
(	0.0	-0.5000	-1.7670	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	1.0335	0.8000	0.6488	)	-----	(	1.0335	0.8000	-1.3538	)
(	1.0335	0.8000	0.6488	)	-----	(	1.0335	0.0	1.1200	)
(	1.0335	0.8000	0.6488	)	-----	(	0.8268	1.0000	0.7193	)
(	1.0335	0.8000	-1.3538	)	-----	(	1.0335	0.0	-1.8250	)
(	1.0335	0.8000	-1.3538	)	-----	(	0.8268	1.0000	-1.2833	)
(	1.0335	-0.8000	0.6488	)	-----	(	1.0335	-0.8000	-1.3538	)
(	1.0335	-0.8000	0.6488	)	-----	(	1.0335	0.0	1.1200	)
(	1.0335	-0.8000	0.6488	)	-----	(	0.8268	-1.0000	0.7193	)
(	1.0335	-0.8000	-1.3538	)	-----	(	1.0335	0.0	-1.8250	)
(	1.0335	-0.8000	-1.3538	)	-----	(	0.8268	-1.0000	-1.2833	)
(	1.0335	0.0	1.1200	)	-----	(	0.5168	0.0	1.5907	)
(	1.0335	0.0	-1.8250	)	-----	(	0.5168	0.0	-1.9433	)
(	-1.0335	0.8000	1.3538	)	-----	(	-1.0335	0.8000	-0.6488	)
(	-1.0335	0.8000	1.3538	)	-----	(	-1.0335	0.0	1.8250	)
(	-1.0335	0.8000	1.3538	)	-----	(	-0.8268	1.0000	1.2833	)
(	-1.0335	0.8000	-0.6488	)	-----	(	-1.0335	0.0	-1.1200	)
(	-1.0335	0.8000	-0.6488	)	-----	(	-0.8268	1.0000	-0.7193	)
(	-1.0335	-0.8000	1.3538	)	-----	(	-1.0335	-0.8000	-0.6488	)
(	-1.0335	-0.8000	1.3538	)	-----	(	-1.0335	0.0	1.8250	)
(	-1.0335	-0.8000	1.3538	)	-----	(	-0.8268	-1.0000	1.2833	)
(	-1.0335	-0.8000	-0.6488	)	-----	(	-1.0335	0.0	-1.1200	)
(	-1.0335	-0.8000	-0.6488	)	-----	(	-0.8268	-1.0000	-0.7193	)
(	-1.0335	0.0	1.8250	)	-----	(	-0.5168	0.0	1.9433	)
(	-1.0335	0.0	-1.1200	)	-----	(	-0.5168	0.0	-1.5907	)
(	0.8268	1.0000	0.7193	)	-----	(	0.8268	1.0000	-1.2833	)
(	0.8268	1.0000	0.7193	)	-----	(	0.0	1.0000	1.4725	)
(	0.8268	1.0000	-1.2833	)	-----	(	0.0	1.0000	-1.4725	)
(	-0.8268	1.0000	1.2833	)	-----	(	-0.8268	1.0000	-0.7193	)
(	-0.8268	1.0000	1.2833	)	-----	(	0.0	1.0000	1.4725	)
(	-0.8268	1.0000	-0.7193	)	-----	(	0.0	1.0000	-1.4725	)
(	0.0	1.0000	1.4725	)	-----	(	0.0	0.5000	1.7670	)
(	0.0	1.0000	-1.4725	)	-----	(	0.0	0.5000	-1.7670	)
(	-0.8268	-1.0000	1.2833	)	-----	(	-0.8268	-1.0000	-0.7193	)
(	-0.8268	-1.0000	1.2833	)	-----	(	0.0	-1.0000	1.4725	)
(	-0.8268	-1.0000	-0.7193	)	-----	(	0.0	-1.0000	-1.4725	)
(	0.8268	-1.0000	0.7193	)	-----	(	0.8268	-1.0000	-1.2833	)
(	0.8268	-1.0000	0.7193	)	-----	(	0.0	-1.0000	1.4725	)
(	0.8268	-1.0000	-1.2833	)	-----	(	0.0	-1.0000	-1.4725	)
(	0.0	-1.0000	1.4725	)	-----	(	0.0	-0.5000	1.7670	)
(	0.0	-1.0000	-1.4725	)	-----	(	0.0	-0.5000	-1.7670	)
(	0.0	0.5000	1.7670	)	-----	(	0.5168	0.0	1.5907	)
(	0.0	0.5000	1.7670	)	-----	(	-0.5168	0.0	1.9433	)
(	0.5168	0.0	1.5907	)	-----	(	0.0	-0.5000	1.7670	)
(	-0.5168	0.0	1.9433	)	-----	(	0.0	-0.5000	-1.7670	)
(	0.0	0.5000	-1.7670	)	-----	(	0.5168	0.0	-1.5907	)
(	0.0	0.5000	-1.7670	)	-----	(	-0.5168	0.0	-1.9433	)
(	0.5168	0.0	-1.9433	)	-----	(	0.0	-0.5000	1.7670	)
(	-0.5168	0.0	-1.5907	)	-----	(	0.0	-0.5000	-1.7670	)

THE MAXIMUM IS: 1.9433

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :

VERTICES

478.6711	370.5117	300.4805
478.6711	370.5117	-627.0049
478.6711	-370.5117	300.4805
478.6711	-370.5117	-627.0049
478.6711	0.0	518.7117
478.6711	0.0	-845.2368
-478.6711	370.5117	627.0049
-478.6711	370.5117	-300.4805
-478.6711	-370.5117	627.0049
-478.6711	-370.5117	-300.4805
-478.6711	0.0	845.2368
-478.6711	0.0	-518.7117
382.9368	463.1399	333.1328
382.9368	463.1399	-594.3523
-382.9368	463.1399	594.3523
-382.9368	463.1399	-333.1328
0.0	463.1399	681.9734
0.0	463.1399	-681.9734
-382.9368	-463.1399	594.3523
-382.9368	-463.1399	-333.1328
382.9368	-463.1399	333.1328
382.9368	-463.1399	-594.3523
0.0	-463.1399	681.9734
0.0	-463.1399	-681.9734
0.0	231.5704	818.3677
239.3378	0.0	736.7356
-239.3356	0.0	819.9948
0.0	-231.5704	818.3677
0.0	231.5704	-818.3677
239.3356	0.0	-699.9948
-239.3378	0.0	-736.7356
0.0	-231.5704	-818.3677

EDGES

1	2
1	5
1	13
2	6
2	14
3	4
3	5
3	21
4	6
4	22
5	26
6	30
7	8
7	11
7	15
8	12
8	16
9	10
9	11
9	19
10	12
10	20
11	27
12	31
13	14
13	17
14	18

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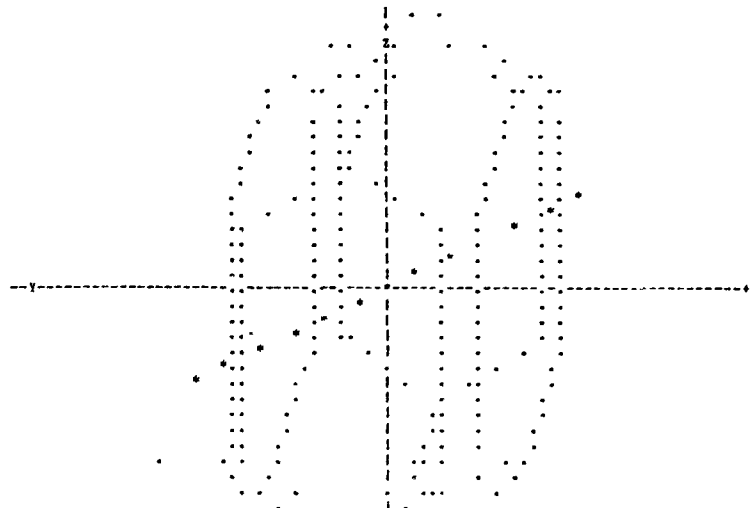
15 16
15 17
16 18
17 25
18 29
19 20
19 23
20 24
21 22
21 23
22 24
23 28
24 32
25 26
25 27
26 28
27 28
29 30
29 31
30 32
31 32
FACES
1 2 6 4 3 5
7 8 12 10 9 11
13 14 18 16 15 17
19 20 24 22 21 23
1 2 14 13
7 8 16 15
9 10 20 19
3 4 22 21
25 26 28 27
29 30 32 31
1 5 26 25 17 13
7 11 27 25 17 15
9 11 27 28 23 19
3 5 26 28 23 21
2 6 30 29 18 14
8 12 31 29 18 16
10 12 31 32 24 20
4 6 30 32 24 22
THE MAXIMUM IS: 2.0342359543 THE CONVERSION FACTOR FOR VIEWPLOT IS : 8.8485307693
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 3.6259 4.1308 )----- ( 3.6259 -13.5893 )
( 3.6259 4.1308 )----- ( -3.4529 8.3002 )
( 3.6259 4.1308 )----- ( 6.0862 5.0766 )
( 3.6259 -13.5893 )----- ( -3.4529 -17.7587 )
( 3.6259 -13.5893 )----- ( 6.0862 -12.6435 )
( -10.5317 4.1308 )----- ( -10.5317 -13.5893 )
( -10.5317 4.1308 )----- ( -3.4529 8.3002 )
( -10.5317 4.1308 )----- ( -11.6109 5.0766 )
( -10.5317 -13.5893 )----- ( -3.4529 -17.7597 )
( -10.5317 -13.5893 )----- ( -11.6109 -12.6435 )
( -3.4529 8.3002 )----- ( -1.7265 13.2707 )
( -3.4529 -17.7587 )----- ( -1.7265 -18.0000 )
( 10.5317 13.5893 )----- ( 10.5317 -4.1308 )
( 10.5317 13.5893 )----- ( 3.4529 17.7587 )
( 10.5317 13.5893 )----- ( 11.6109 12.6435 )
( 10.5317 -4.1308 )----- ( 3.4529 -8.3002 )
( 10.5317 -4.1308 )----- ( 11.6109 -5.0766 )
( -3.6259 13.5893 )----- ( -3.6259 -4.1308 )
( -3.6259 13.5893 )----- ( 3.4529 17.7587 )
( -3.6259 13.5893 )----- ( -6.0862 12.6435 )

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```

( -3.6259 -4.1308 )----- ( 3.4529 -8.3002 )
( -3.6259 -4.1308 )----- ( -6.0862 -5.0766 )
( 3.4529 17.7587 )----- ( 1.7265 18.0000 )
( 3.4529 -8.3002 )----- ( 1.7265 -13.2707 )
( 6.0862 5.0766 )----- ( 6.0862 -12.6435 )
( 6.0862 5.0766 )----- ( 8.8485 13.0295 )
( 6.0862 -12.6435 )----- ( 8.8485 -13.0295 )
( 11.6109 12.6435 )----- ( 11.6109 -5.0766 )
( 11.6109 12.6435 )----- ( 8.8485 13.0295 )
( 11.6109 -5.0766 )----- ( 8.8485 -13.0295 )
( 8.8485 13.0295 )----- ( 4.4243 15.6353 )
( 8.8485 -13.0295 )----- ( 4.4243 -15.6353 )
( -6.0862 12.6435 )----- ( -6.0862 -5.0766 )
( -6.0862 12.6435 )----- ( -8.8485 13.0295 )
( -6.0862 -5.0766 )----- ( -8.8485 -13.0295 )
( -11.6109 5.0766 )----- ( -11.6109 -12.6435 )
( -11.6109 5.0766 )----- ( -8.8485 13.0295 )
( -11.6109 -12.6435 )----- ( -8.8485 -13.0295 )
( -8.8485 13.0295 )----- ( -4.4243 15.6353 )
( -8.8485 -13.0295 )----- ( -4.4243 -15.6353 )
( 4.4243 15.6353 )----- ( 1.7265 18.0000 )
( 4.4243 15.6353 )----- ( -1.7265 -13.2707 )
( -1.7265 13.2707 )----- ( -4.4243 15.6353 )
( 1.7265 18.0000 )----- ( -4.4243 15.6353 )
( 4.4243 -15.6353 )----- ( -1.7265 -13.2707 )
( 4.4243 -15.6353 )----- ( -4.4243 15.6353 )
( -1.7265 -13.2707 )----- ( -4.4243 15.6353 )
( 1.7265 -13.2707 )----- ( -4.4243 15.6353 )
CRYSTAL SHAPE:

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DOLomite : MASON AND PERRY, 1968, P. 141
 HEXAGONAL SYSTEM : A1:A2:A3:C=1:1:1: 0.8235 , ALPHA=BETA=GAMMA=90 , 1 FORM(5).
 NUMBER OF FACES OR MILLER INDICES = 6
 MILLER INDICES :

1	0	-1	1
-1	1	0	1
0	-1	1	1
1	-1	0	-1
0	1	-1	-1
-1	0	1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.1547 X +	0.0 Y +	1.2143 Z =	1
-0.5773 X +	1.0000 Y +	1.2143 Z =	1
-0.5773 X +	-1.0000 Y +	1.2143 Z =	1
0.5773 X +	-1.0000 Y +	-1.2143 Z =	1
0.5773 X +	1.0000 Y +	-1.2143 Z =	1
-1.1547 X +	0.0 Y +	-1.2143 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.0	0.0	0.8235	)
(	0.5773	1.0000	0.2745	)
(	0.5773	-1.0000	0.2745	)
(	1.1547	0.0	-0.2745	)
(	-1.1547	0.0	-0.2745	)
(	-0.5773	1.0000	-0.2745	)
(	-0.5773	-1.0000	-0.2745	)
(	0.0	0.0	-0.8235	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.0	0.0	0.8235	)	-----	(	0.5773	1.0000	0.2745	)
(	0.0	0.0	0.8235	)	-----	(	0.5773	-1.0000	0.2745	)
(	0.0	0.0	0.8235	)	-----	(	-1.1547	-0.0000	0.2745	)
(	0.5773	1.0000	0.2745	)	-----	(	1.1547	0.0	-0.2745	)
(	0.5773	1.0000	0.2745	)	-----	(	-0.5773	1.0000	-0.2745	)
(	0.5773	-1.0000	0.2745	)	-----	(	1.1547	0.0	-0.2745	)
(	0.5773	-1.0000	0.2745	)	-----	(	-0.5773	-1.0000	-0.2745	)
(	1.1547	0.0	-0.2745	)	-----	(	0.0	0.0	-0.8235	)
(	-1.1547	0.0	-0.2745	)	-----	(	-0.5773	1.0000	-0.2745	)
(	-1.1547	-0.0000	0.2745	)	-----	(	-0.5773	-1.0000	-0.2745	)
(	-0.5773	1.0000	-0.2745	)	-----	(	0.0	0.0	-0.8235	)
(	-0.5773	-1.0000	-0.2745	)	-----	(	0.0	0.0	-0.8235	)

THE MAXIMUM IS:

VERTICES			
0.0	0.0	641.8606	
449.9995	779.4299	213.9454	
449.9995	-779.4299	213.9454	
899.9990	0.0	-213.9698	
-899.9998	-0.0002	213.9697	
-449.9998	779.4299	-213.9454	
-449.9998	-779.4299	-213.9454	
0.0	0.0	-641.8608	

EDGES

1	2
1	3
1	5
2	4
2	6
3	4
3	7
4	8
5	6

THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :

779.4299

5	7
6	8
7	8

FACES

1	2	4	3
1	2	6	5
1	3	7	5
3	4	8	7
2	4	8	6
5	6	8	7

THE MAXIMUM IS:

1.2179841995

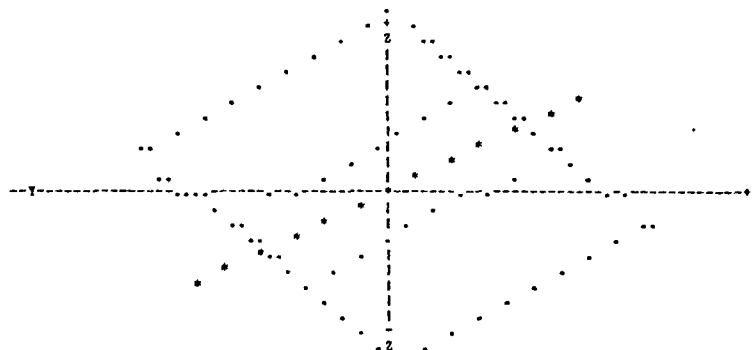
THE CONVERSION FACTOR FOR VIEWPLOT IS :

14.7785167694

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.0	12.1701	)	-----	(	11.5570	2.5544	)
(	0.0	12.1701	)	-----	(	-18.0000	2.5544	)
(	0.0	12.1701	)	-----	(	6.4430	7.0613	)
(	11.5570	2.5544	)	-----	(	-6.4430	-7.0613	)
(	11.5570	2.5544	)	-----	(	18.0000	-2.5544	)
(	-18.0000	2.5544	)	-----	(	-6.4430	-7.0613	)
(	-18.0000	2.5544	)	-----	(	-11.5570	-2.5544	)
(	-6.4430	-7.0613	)	-----	(	0.0	-12.1701	)
(	6.4430	7.0613	)	-----	(	18.0000	-2.5544	)
(	6.4430	7.0613	)	-----	(	-11.5570	-2.5544	)
(	18.0000	-2.5544	)	-----	(	0.0	-12.1701	)
(	-11.5570	-2.5544	)	-----	(	0.0	-12.1701	)

CRYSTAL SHAPE:



ENSTATITE ORTHOPHOSPHOSILITE : DEEP HOWIE AND ZUSSMAN, 1967, P. 108

{ HYPERSTHENE }.

ORTHORHOMBIC SYSTEM : A:B:C= 1.0000: 0.5891 , ALPHA=BETA=GAMMA=90 , 4 FORM(5).
 NUMBER OF FACES OR MILLER INDICES = 12
 MILLER INDICES :

1	0	0
-1	0	0
0	1	0
0	-1	0
2	1	0
-2	1	0
-2	-1	0
2	-1	0

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACETS ARE :

1.9331 X +	0.0	Y +	0.0	Z =	1	
-1.9331 X +	0.0	Y +	0.0	Z =	1	
0.0	X +	1.0000	Y +	0.0	Z =	1
0.0	X +	-1.0000	Y +	0.0	Z =	1
0.8055 X +	0.8333	Y +	0.0	Z =	1	
-0.8055 X +	0.8333	Y +	0.0	Z =	1	
-0.8055 X +	-0.8333	Y +	0.0	Z =	1	
0.8055 X +	-0.8333	Y +	0.0	Z =	1	
0.1611 X +	0.0	Y +	0.5658	Z =	1	
-0.1611 X +	0.0	Y +	0.5658	Z =	1	
0.1611 X +	0.0	Y +	-0.5658	Z =	1	
-0.1611 X +	0.0	Y +	-0.5658	Z =	1	

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5173	0.7000	1.6200	)
(	0.5173	0.7000	-1.6200	)
(	0.5173	-0.7000	1.6200	)
(	0.5173	-0.7000	-1.6200	)
(	-0.5173	0.7000	1.6200	)
(	-0.5173	0.7000	-1.6200	)
(	-0.5173	-0.7000	1.6200	)
(	-0.5173	-0.7000	-1.6200	)
(	0.2069	1.0000	1.7084	)
(	0.2069	1.0000	-1.7084	)
(	-0.2069	1.0000	1.7084	)
(	-0.2069	1.0000	-1.7084	)
(	0.0	1.0000	1.7673	)
(	0.0	1.0000	-1.7673	)
(	-0.2069	-1.0000	1.7084	)
(	-0.2069	-1.0000	-1.7084	)
(	0.2069	-1.0000	1.7084	)
(	0.2069	-1.0000	-1.7084	)
(	0.0	-1.0000	1.7673	)
(	0.0	-1.0000	-1.7673	)

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :

(	0.5173	0.7000	1.6200	)	-----	(	0.5173	0.7000	-1.6200	)
(	0.5173	0.7000	1.6200	)	-----	(	0.5173	-0.7000	1.6200	)
(	0.5173	0.7000	1.6200	)	-----	(	0.2069	1.0000	1.7084	)
(	0.5173	0.7000	-1.6200	)	-----	(	0.5173	-0.7000	-1.6200	)
(	0.5173	0.7000	-1.6200	)	-----	(	0.2069	1.0000	-1.7084	)
(	0.5173	-0.7000	1.6200	)	-----	(	0.5173	-0.7000	-1.6200	)
(	0.5173	-0.7000	1.6200	)	-----	(	0.2069	-1.0000	1.7084	)
(	0.5173	-0.7000	-1.6200	)	-----	(	0.2069	-1.0000	-1.7084	)
(	-0.5173	0.7000	1.6200	)	-----	(	-0.5173	0.7000	-1.6200	)
(	-0.5173	0.7000	1.6200	)	-----	(	-0.5173	-0.7000	1.6200	)
(	-0.5173	0.7000	1.6200	)	-----	(	-0.2069	1.0000	1.7084	)
(	-0.5173	0.7000	-1.6200	)	-----	(	-0.5173	-0.7000	-1.6200	)
(	-0.5173	0.7000	-1.6200	)	-----	(	-0.2069	1.0000	-1.7084	)
(	-0.5173	-0.7000	1.6200	)	-----	(	-0.5173	-0.7000	-1.6200	)
(	-0.5173	-0.7000	1.6200	)	-----	(	-0.2069	-1.0000	1.7084	)
(	-0.5173	-0.7000	-1.6200	)	-----	(	-0.2069	-1.0000	-1.7084	)
(	0.2069	1.0000	1.7084	)	-----	(	0.2069	1.0000	-1.7084	)
(	0.2069	1.0000	1.7084	)	-----	(	0.0	1.0000	1.7673	)
(	0.2069	1.0000	-1.7084	)	-----	(	0.0	1.0000	-1.7673	)
(	-0.2069	1.0000	1.7084	)	-----	(	-0.2069	1.0000	-1.7084	)
(	-0.2069	1.0000	1.7084	)	-----	(	0.0	1.0000	1.7673	)
(	-0.2069	1.0000	-1.7084	)	-----	(	0.0	1.0000	-1.7673	)
(	0.0	1.0000	1.7673	)	-----	(	0.0	-1.0000	1.7673	)

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(	0.0	1.0000	-1.7673	)	-----	(	0.0	-1.0000	-1.7673	)
(	-0.2069	-1.0000	1.7084	)	-----	(	-0.2069	-1.0000	-1.7084	)
(	-0.2069	-1.0000	1.7084	)	-----	(	0.0	-1.0000	1.7673	)
(	-0.2069	-1.0000	-1.7084	)	-----	(	0.0	-1.0000	-1.7673	)
(	0.2069	-1.0000	1.7084	)	-----	(	0.2069	-1.0000	-1.7084	)
(	0.2069	-1.0000	1.7084	)	-----	(	0.0	-1.0000	1.7673	)
(	0.2069	-1.0000	-1.7084	)	-----	(	0.0	-1.0000	-1.7673	)

THE MAXIMUM IS:

1.7673

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :

509.2515

VERTICES

263.4358	356.4756	824.9993
263.4358	356.4756	-824.9993
263.4358	-356.4756	824.9993
263.4358	-356.4756	-824.9993
-263.4358	356.4756	824.9993
-263.4358	356.4756	-824.9993
-263.4358	-356.4756	824.9993
-263.4358	-356.4756	-824.9993
105.3742	509.2515	869.9995
105.3742	509.2515	-869.9995
-105.3742	509.2515	869.9995
-105.3742	509.2515	-869.9995
0.0	509.2515	899.9998
0.0	509.2515	-899.9998
-105.3742	-509.2515	869.9995
-105.3742	-509.2515	-869.9995
105.3742	-509.2515	869.9995
105.3742	-509.2515	-869.9995
0.0	-509.2515	899.9998
0.0	-509.2515	-899.9998

EDGES

1	2
1	3
1	9
2	4
2	10
3	4
3	17
4	18
5	6
5	7
5	11
6	8
6	12
7	8
7	15
8	16
9	10
9	13
10	14
11	12
11	13
12	14
13	19
14	20
15	16
15	19
16	20
17	18
17	19
18	20

FACTS

1	2	4	3

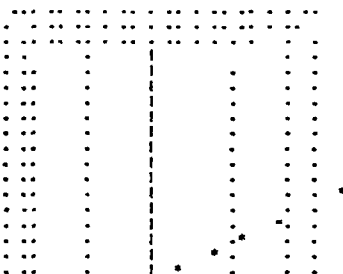
5 6 8 7
9 10 14 12 11 13
15 16 20 18 17 19
1 2 10 9
5 6 12 11
7 8 16 15
3 4 18 17
1 3 17 14 13 9
5 7 15 19 13 11
2 4 18 20 14 10
6 8 16 20 14 12

THE MAXIMUM IS: 1.767296521 THE CONVERSION FACTOR FOR VIEWPLOT IS: 10.1850299835

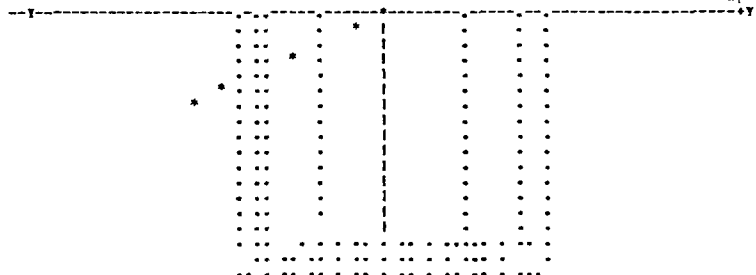
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(5.1402 15.5724)	-----	(5.1402 -17.4276)
(5.1402 15.5724)	-----	(-9.1188 15.5724)
(5.1402 15.5724)	-----	(9.3893 17.0290)
(5.1402 -17.4276)	-----	(-9.1188 -17.4276)
(5.1402 -17.4276)	-----	(9.3893 -17.7710)
(-9.1188 15.5724)	-----	(-9.1188 -17.4276)
(-9.1188 15.5724)	-----	(-10.9807 17.0290)
(-9.1188 -17.4276)	-----	(-10.9807 -17.7710)
(9.1188 17.4276)	-----	(9.1188 -15.5724)
(9.1188 17.4276)	-----	(-5.1402 17.4276)
(9.1188 17.4276)	-----	(10.1807 17.7710)
(9.1188 -15.5724)	-----	(-5.1402 -15.5724)
(9.1188 -15.5724)	-----	(10.1807 -17.0290)
(-5.1402 17.4276)	-----	(-5.1402 -15.5724)
(-5.1402 17.4276)	-----	(-9.3893 17.7710)
(-5.1402 -15.5724)	-----	(-9.3893 -17.0290)
(9.3893 17.0290)	-----	(9.3893 -17.7710)
(9.3893 17.0290)	-----	(10.1850 18.0000)
(9.3893 -17.7710)	-----	(10.1850 -18.0000)
(10.9807 17.7710)	-----	(10.9807 -17.0290)
(10.9807 17.7710)	-----	(10.1850 18.0000)
(10.9807 -17.0290)	-----	(10.1850 -18.0000)
(10.1850 18.0000)	-----	(-10.1850 18.0000)
(10.1850 -18.0000)	-----	(-10.1850 -18.0000)
(-9.3893 17.7710)	-----	(-9.3893 -17.0290)
(-9.3893 17.7710)	-----	(-10.1850 18.0000)
(-9.3893 -17.0290)	-----	(-10.1850 -18.0000)
(-10.9807 17.0290)	-----	(-10.9807 -17.7710)
(-10.9807 17.0290)	-----	(-10.1850 18.0000)
(-10.9807 -17.7710)	-----	(-10.1850 -18.0000)

CRYSTAL SHAPE:



Apdx. 2-b, p. 62



EPIDOTE : MASON AND BEPPY, 1968, P. 488
MONOCLINIC SYSTEM : A:B:C= 1.5780: 1.0000: 1.8120 , ALPHA=90, BETA= 115.3400 , 4 FORM(S).
NUMBER OF FACES OF MILLER INDICES = 10
MILLER INDICES :

0	0	1
0	0	-1
1	0	0
-1	0	0
-1	0	1
1	0	-1
-1	1	1
-1	1	-1
-1	-1	1
-1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

0.4356 X + 0.0 Y + 0.9198 Z = 1
-0.4356 X + 0.0 Y + -0.9198 Z = 1
0.7012 X + 0.0 Y + 0.0 Z = 1
-0.7012 X + 0.0 Y + 0.0 Z = 1
-0.4398 X + 0.0 Y + 0.5519 Z = 1
0.4398 X + 0.0 Y + -0.5519 Z = 1
0.4813 X + 0.5000 Y + 0.2759 Z = 1
-0.2199 X + 0.5000 Y + 0.2759 Z = 1
0.2199 X + -0.5000 Y + -0.2759 Z = 1
-0.4813 X + -0.5000 Y + -0.2759 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(1.4262 0.4000 0.4118)
(1.4262 -1.6000 0.4118)
(-0.5705 1.0000 1.3573)
(-0.5705 -2.2000 1.3573)
(0.0 1.4000 1.0872)
(0.0 -2.6000 1.0872)
(-1.4262 1.6000 -0.4118)
(-1.4262 -0.4000 -0.4118)
(0.5705 2.2000 -1.3573)
(0.5705 -1.0000 -1.3573)
(0.0 2.6000 -1.0872)
(0.0 -1.4000 -1.0872)
(1.4262 1.0000 -0.6754)
(1.4262 -1.0000 -0.6754)
(-1.4262 1.0000 0.6754)
(-1.4262 -1.0000 0.6754)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(1.4262 0.4000 0.4118)	-----	(1.4262 -1.6000 0.4118)

```

( 1.4262 0.4000 0.4118 )----- ( 0.0 1.4000 1.0072 )
( 1.4262 0.4000 0.4118 )----- ( 1.4262 1.0000 -0.6754 )
( 1.4262 -1.6000 0.4118 )----- ( 0.0 -2.6000 1.0072 )
( 1.4262 -1.6000 0.4118 )----- ( 1.4262 -1.0000 -0.6754 )
( -0.5705 1.0000 1.3573 )----- ( -0.5705 -2.2000 1.3573 )
( -0.5705 1.0000 1.3573 )----- ( 0.0 1.4000 1.0072 )
( -0.5705 1.0000 1.3573 )----- ( -1.4262 1.0000 0.6754 )
( -0.5705 -2.2000 1.3573 )----- ( 0.0 -2.6000 1.0072 )
( -0.5705 -2.2000 1.3573 )----- ( -1.4262 -1.0000 0.6754 )
( 0.0 1.4000 1.0072 )----- ( 0.0 2.6000 -1.0072 )
( 0.0 -2.6000 1.0072 )----- ( 0.0 -1.4000 -1.0072 )
( -1.4262 1.6000 -0.4118 )----- ( -1.4262 -0.4000 -0.4118 )
( -1.4262 1.6000 -0.4118 )----- ( 0.0 2.6000 -1.0072 )
( -1.4262 1.6000 -0.4118 )----- ( -1.4262 1.0000 0.6754 )
( -1.4262 -0.4000 -0.4118 )----- ( 0.0 -1.4000 -1.0072 )
( -1.4262 -0.4000 -0.4118 )----- ( -1.4262 -1.0000 0.6754 )
( 0.5705 2.2000 -1.3573 )----- ( 0.5705 -1.0000 -1.3573 )
( 0.5705 2.2000 -1.3573 )----- ( 0.0 2.6000 -1.0072 )
( 0.5705 2.2000 -1.3573 )----- ( 1.4262 1.0000 -0.6754 )
( 0.5705 -1.0000 -1.3573 )----- ( 0.0 -1.4000 -1.0072 )
( 0.5705 -1.0000 -1.3573 )----- ( 1.4262 -1.0000 -0.6754 )
( 1.4262 1.0000 -0.6754 )----- ( 1.4262 -1.0000 -0.6754 )
( -1.4262 1.0000 0.6754 )----- ( -1.4262 -1.0000 0.6754 )

```

THE MAXIMUM IS: 2.6000 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 346.1538

VERTICES

493.6741	138.4633	142.5573
493.6741	-553.8455	142.5573
-197.4696	346.1538	469.8503
-197.4696	-761.5388	469.8503
0.0	484.6150	376.3381
0.0	-899.9995	376.3381
-493.6741	553.8455	-142.5573
-493.6741	-138.4633	-142.5573
197.4696	761.5388	-469.8503
197.4696	-346.1538	-469.8503
0.0	899.9995	-376.3381
0.0	-484.6150	-376.3381
493.6741	346.1548	-233.7799
493.6741	-346.1538	-233.7799
-493.6741	346.1538	233.7799
-493.6741	-346.1548	233.7799

EDGES

1	2
1	5
1	13
2	6
2	14
3	4
3	5
3	15
4	6
4	16
5	11
6	12
7	8
7	11
7	15
8	12
8	16
9	10
9	11
9	13

10 12
10 14
13 14
15 16

FACES

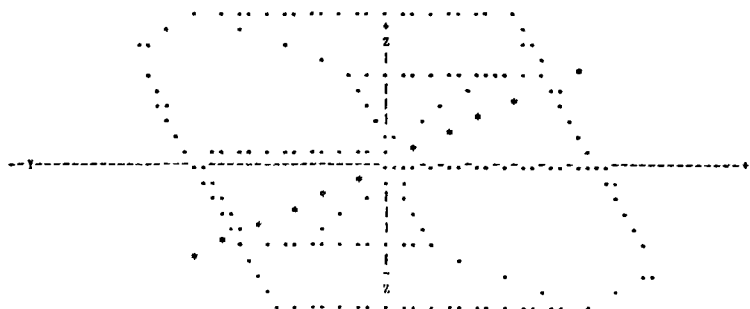
1	2	6	4	3	5
1	8	12	10	9	11
1	2	14	13		
7	8	16	15		
3	4	16	15		
9	10	14	13		
1	5	11	9	13	
3	5	11	7	15	
2	6	12	10	14	
4	6	12	8	16	

THE MAXIMUM IS: 2.5999994278 THE CONVERSION FACTOR FOR VIEWPLOT IS : 6.9230775833

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(-0.9586 1.1129)	-----	(-14.8048 1.1129)
(-0.9586 1.1129)	-----	(9.6923 7.5268)
(-0.9586 1.1129)	-----	(3.1952 -6.4139)
(-14.8048 1.1129)	-----	(-18.0000 7.5268)
(-14.8048 1.1129)	-----	(-10.6510 -6.4139)
(8.4142 10.0923)	-----	(-13.7396 10.0923)
(8.4142 10.0923)	-----	(9.6923 7.5268)
(8.4142 10.0923)	-----	(10.6510 6.4139)
(-13.7396 10.0923)	-----	(-18.0000 7.5268)
(-13.7396 10.0923)	-----	(-3.1952 6.4139)
(9.6923 7.5268)	-----	(18.0000 -7.5268)
(-18.0000 7.5268)	-----	(-9.6923 -7.5268)
(14.8048 -1.1129)	-----	(0.9586 -1.1129)
(14.8048 -1.1129)	-----	(18.0000 -7.5268)
(14.8048 -1.1129)	-----	(10.6510 6.4139)
(0.9586 -1.1129)	-----	(-9.6923 -7.5268)
(0.9586 -1.1129)	-----	(-3.1952 6.4139)
(13.7396 -10.0923)	-----	(-8.4142 -10.0923)
(13.7396 -10.0923)	-----	(18.0000 -7.5268)
(13.7396 -10.0923)	-----	(3.1952 -6.4139)
(-8.4142 -10.0923)	-----	(-9.6923 -7.5268)
(-8.4142 -10.0923)	-----	(-10.6510 -6.4139)
(3.1952 -6.4139)	-----	(-10.6510 -6.4139)
(10.6510 6.4139)	-----	(-3.1952 6.4139)

CRYSTAL SHAPE:



100
1
FAYALITE : DEEP HOWIE AND ZUSSMAN, 1967, v. 1
(OLIVINE GROUP).
ORTHORHOMBIC SYSTEM : A:B:C = 0.4597: 1.0000: 0.5827 , ALPHA=BETA=GAMMA=90 , 7 FORM(5).
NUMBER OF FACES OR MILLER INDICES = 28
MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
1	2	0
-1	2	0
-1	-2	0
1	-2	0
0	1	0
0	-1	0
0	2	1
0	2	-1
0	-2	1
0	-2	-1
0	0	1
0	0	-1
1	0	1
1	0	-1
-1	0	-1
-1	0	1
1	1	1
1	-1	1
1	1	-1
1	-1	-1
-1	1	1
-1	-1	1
-1	1	-1
-1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

2.1753 X +	1.0000 Y +	0.0 Z =	1
-2.1753 X +	1.0000 Y +	0.0 Z =	1
-2.1753 X +	-1.0000 Y +	0.0 Z =	1
2.1753 X +	-1.0000 Y +	0.0 Z =	1
1.6733 X +	1.5385 Y +	0.0 Z =	1
-1.6733 X +	1.5385 Y +	0.0 Z =	1
-1.6733 X +	-1.5385 Y +	0.0 Z =	1
1.6733 X +	-1.5385 Y +	0.0 Z =	1
0.0 X +	2.0000 Y +	0.0 Z =	1
0.0 X +	-2.0000 Y +	0.0 Z =	1
0.0 X +	1.3333 Y +	1.1441 Z =	1
0.0 X +	1.3333 Y +	-1.1441 Z =	1
0.0 X +	-1.3333 Y +	1.1441 Z =	1
0.0 X +	-1.3333 Y +	-1.1441 Z =	1
0.0 X +	0.0 Y +	1.3729 Z =	1
0.0 X +	0.0 Y +	-1.3729 Z =	1
1.1156 X +	0.0 Y +	0.8801 Z =	1
1.1156 X +	0.0 Y +	-0.8801 Z =	1
-1.1156 X +	0.0 Y +	0.8801 Z =	1
-1.1156 X +	0.0 Y +	-0.8801 Z =	1
1.0877 X +	0.5000 Y +	0.8581 Z =	1
1.0877 X +	-0.5000 Y +	0.8581 Z =	1
1.0877 X +	0.5000 Y +	-0.8581 Z =	1
1.0877 X +	-0.5000 Y +	-0.8581 Z =	1
-1.0877 X +	0.5000 Y +	0.8581 Z =	1
-1.0877 X +	-0.5000 Y +	0.8581 Z =	1
-1.0877 X +	0.5000 Y +	-0.8581 Z =	1
-1.0877 X +	-0.5000 Y +	-0.8581 Z =	1

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THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.4597	0.0	0.5536	)
(	0.4597	0.0	-0.5536	)
(	0.3218	0.3000	0.5244	)
(	0.3218	0.3000	-0.5244	)
(	0.3448	0.2500	0.5827	)
(	0.3448	0.2500	-0.5827	)
(	0.4367	0.0500	0.5827	)
(	0.4367	0.0500	-0.5827	)
(	-0.4597	0.0	-0.5536	)
(	-0.4597	0.0	0.5536	)
(	-0.3218	0.3000	0.5244	)
(	-0.3218	0.3000	-0.5244	)
(	-0.3448	0.2500	0.5827	)
(	-0.3448	0.2500	-0.5827	)
(	-0.4367	0.0500	-0.5827	)
(	-0.4367	0.0500	0.5827	)
(	-0.3218	-0.3000	0.5244	)
(	-0.3218	-0.3000	-0.5244	)
(	-0.3448	-0.2500	0.5827	)
(	-0.3448	-0.2500	-0.5827	)
(	-0.4367	-0.0500	-0.5827	)
(	-0.4367	-0.0500	0.5827	)
(	0.3218	-0.3000	0.5244	)
(	0.3218	-0.3000	-0.5244	)
(	0.3448	-0.2500	0.5827	)
(	0.3448	-0.2500	-0.5827	)
(	0.4367	-0.0500	0.5827	)
(	0.4367	-0.0500	-0.5827	)
(	0.1379	0.5000	0.2914	)
(	0.1379	0.5000	-0.2914	)
(	-0.1379	0.5000	0.2914	)
(	-0.1379	0.5000	-0.2914	)
(	-0.1379	-0.5000	0.2914	)
(	-0.1379	-0.5000	-0.2914	)
(	0.1379	-0.5000	0.2914	)
(	0.1379	-0.5000	-0.2914	)
(	0.2873	0.1250	0.7284	)
(	-0.2873	0.1250	0.7284	)
(	0.2873	0.1250	-0.7284	)
(	-0.2873	0.1250	-0.7284	)
(	0.2873	-0.1250	0.7284	)
(	-0.2873	-0.1250	0.7284	)
(	0.2873	-0.1250	-0.7284	)
(	-0.2873	-0.1250	-0.7284	)
(	0.3218	0.0500	0.7284	)
(	0.3218	-0.0500	0.7284	)
(	-0.3218	0.0500	0.7284	)
(	-0.3218	-0.0500	0.7284	)
(	0.3218	0.0500	-0.7284	)
(	0.3218	-0.0500	-0.7284	)
(	-0.3218	0.0500	-0.7284	)
(	-0.3218	-0.0500	-0.7284	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.4597	0.0	0.5536	)	-----	(	0.4597	0.0	-0.5536	)
(	0.4597	0.0	0.5536	)	-----	(	0.4367	0.0500	0.5827	)
(	0.4597	0.0	0.5536	)	-----	(	0.4367	-0.0500	0.5827	)
(	0.4597	0.0	-0.5536	)	-----	(	0.4167	0.0500	-0.5827	)
(	0.4597	0.0	-0.5536	)	-----	(	0.4167	-0.0500	-0.5827	)
(	0.3218	0.1000	0.5244	)	-----	(	0.3118	0.1000	-0.5244	)
(	0.3218	0.1000	0.5244	)	-----	(	0.3448	0.2500	0.5827	)
(	0.3218	0.1000	0.5244	)	-----	(	0.3118	0.2500	-0.5827	)

0.3218	0.3000	-0.5244	0.1848	0.2500	-0.5827
0.3210	0.3000	-0.5244	0.1179	0.5000	-0.2914
0.4408	0.2500	0.5827	0.4367	0.0500	0.5827
0.1488	0.2500	0.5827	0.2173	0.1250	0.7284
0.3448	0.2500	-0.5827	0.4367	0.0500	-0.5827
0.3448	0.2500	-0.5827	0.2473	0.1250	-0.7284
0.3167	0.0500	0.5827	0.3218	0.0500	0.7284
0.4367	0.0500	-0.5827	0.3218	0.0500	-0.7284
-0.4597	0.0	-0.5536	-0.4597	0.0	-0.5536
-0.4597	0.0	-0.5536	-0.4367	0.0500	-0.5827
-0.4597	0.0	-0.5536	-0.4367	-0.0500	-0.5827
-0.4597	0.0	0.5536	-0.4367	0.0500	0.5827
-0.4597	0.0	0.5536	-0.4367	-0.0500	0.5827
-0.3218	0.3000	0.5244	-0.3218	0.3000	-0.5244
-0.3218	0.3000	0.5244	-0.3448	0.2500	-0.5827
-0.3218	0.3000	0.5244	-0.1379	0.5000	-0.2914
-0.3218	0.3000	-0.5244	-0.1848	0.2500	-0.5827
-0.3218	0.3000	-0.5244	-0.1379	0.5000	-0.2914
-0.3448	0.2500	0.5827	-0.4367	0.0500	-0.5827
-0.3448	0.2500	0.5827	-0.2973	0.1250	0.7284
-0.3448	0.2500	-0.5827	-0.2973	0.0500	-0.5827
-0.3448	0.2500	-0.5827	-0.2473	0.1250	-0.7284
-0.4367	0.0500	-0.5827	-0.3218	0.0500	-0.7284
-0.4367	0.0500	0.5827	-0.3218	0.0500	0.7284
-0.3218	-0.3000	0.5244	-0.3218	-0.3000	-0.5244
-0.3218	-0.3000	0.5244	-0.3448	-0.2500	-0.5827
-0.3218	-0.3000	0.5244	-0.1379	-0.5000	-0.2914
-0.3218	-0.3000	-0.5244	-0.3448	-0.2500	-0.5827
-0.3218	-0.3000	-0.5244	-0.1379	-0.5000	-0.2914
-0.3448	-0.2500	0.5827	-0.4367	-0.0500	-0.5827
-0.3448	-0.2500	0.5827	-0.2973	-0.1250	0.7284
-0.3448	-0.2500	-0.5827	-0.4367	-0.0500	-0.5827
-0.3448	-0.2500	-0.5827	-0.2973	-0.1250	-0.7284
-0.4367	-0.0500	0.5827	-0.3218	-0.0500	0.7284
-0.3218	-0.3000	0.5244	-0.3218	-0.3000	-0.5244
-0.3218	-0.3000	0.5244	-0.3448	-0.2500	-0.5827
-0.3218	-0.3000	0.5244	-0.1379	-0.5000	-0.2914
-0.3218	-0.3000	-0.5244	-0.3448	-0.2500	-0.5827
-0.3218	-0.3000	-0.5244	-0.1379	-0.5000	-0.2914
-0.3448	-0.2500	0.5827	0.4367	-0.0500	0.5827
-0.3448	-0.2500	0.5827	0.2973	-0.1250	0.7284
-0.3448	-0.2500	-0.5827	0.4367	-0.0500	-0.5827
-0.3448	-0.2500	-0.5827	0.2973	-0.1250	-0.7284
-0.4367	-0.0500	0.5827	0.3218	-0.0500	0.7284
-0.4367	-0.0500	-0.5827	0.3218	-0.0500	-0.7284
-0.1379	0.5000	0.2914	-0.1379	0.5000	-0.2914
-0.1379	0.5000	0.2914	-0.1379	0.5000	-0.2914
-0.1379	0.5000	-0.2914	-0.1379	0.5000	-0.2914
-0.1379	0.5000	-0.2914	-0.1379	0.5000	-0.2914
-0.1379	0.5000	0.2914	-0.1379	0.5000	-0.2914
-0.1379	0.5000	0.2914	-0.1379	0.5000	-0.2914
-0.1379	0.5000	-0.2914	-0.1379	0.5000	-0.2914
-0.1379	0.5000	-0.2914	-0.1379	0.5000	-0.2914
-0.2873	0.1250	0.7284	-0.2873	0.1250	0.7284
-0.2873	0.1250	0.7284	-0.3218	0.0500	0.7284
-0.2873	0.1250	0.7284	-0.3218	0.0500	0.7284
-0.2873	0.1250	-0.7284	-0.2973	0.1250	-0.7284
-0.2873	0.1250	-0.7284	-0.3218	0.0500	

(-0.2873	-0.1250	0.7284	)	----	(-0.3218	-0.0500	0.7284	)
(-0.2873	-0.1250	0.7284	)	----	(-0.2873	-0.1250	-0.7284	)
(-0.2873	-0.1250	-0.7284	)	----	(0.3218	-0.0500	-0.7284	)
-0.2873	-0.1250	-0.7284	)	----	(0.3218	-0.0500	-0.7284	)
(0.3218	0.0500	0.7284	)	----	(0.3218	-0.0500	0.7284	)
(-0.3218	0.0500	0.7284	)	----	(-0.3218	-0.0500	0.7284	)
(0.3218	0.0500	-0.7284	)	----	(0.3218	-0.0500	-0.7284	)
(-0.3218	0.0500	-0.7284	)	----	(-0.3218	-0.0500	-0.7284	)

U.7284

THE CONVERSION FACTOR FOR THE PRINTED GRAPH IS :

1235.6270

VERTICES		
568.0176	0.0	683.9988
568.0176	0.0	-683.9988
397.6128	370.6875	648.0005
397.6128	370.6875	-648.0005
426.0132	308.9070	719.9995
426.0132	308.9070	-719.9995
539.6162	61.7825	719.9995
539.6162	61.7825	-719.9995
-568.0176	0.0	-683.9988
-568.0176	0.0	683.9988
-397.6128	370.6875	648.0005
-397.6128	370.6875	-648.0005
-426.0132	308.9070	719.9995
-426.0132	308.9070	-719.9995
-539.6162	61.7825	719.9995
-539.6162	61.7825	-719.9995
-397.6128	-370.6875	648.0005
-397.6128	-370.6875	-648.0005
-426.0132	-308.9070	719.9995
-426.0132	-308.9070	-719.9995
-539.6162	-61.7825	719.9995
-539.6162	-61.7825	-719.9995
397.6128	-370.6875	648.0005
397.6128	-370.6875	-648.0005
426.0132	-308.9070	719.9995
426.0132	-308.9070	-719.9995
539.6162	-61.7825	719.9995
539.6162	-61.7825	-719.9995
170.4052	617.8132	360.0000
170.4052	617.8132	-360.0000
-170.4052	617.8132	360.0000
-170.4052	617.8132	-360.0000
170.4052	-617.8132	360.0000
170.4052	-617.8132	-360.0000
170.4052	-617.8132	360.0000
170.4052	-617.8132	-360.0000
355.0107	154.4534	892.9998
-355.0107	154.4534	892.9998
355.0107	154.4534	-892.9998
-355.0107	154.4534	-892.9998
355.0107	154.4534	892.9998
-355.0107	154.4534	892.9998
355.0107	154.4534	-892.9998
-355.0107	154.4534	-892.9998
397.6116	-61.7826	892.9998
-397.6116	-61.7826	892.9998
397.6116	-61.7826	-892.9998
-397.6116	-61.7826	-892.9998
397.6116	61.7826	892.9998
-397.6116	61.7826	892.9998
397.6116	61.7826	-892.9998
-397.6116	61.7826	-892.9998

EDGES
1 2
1 7
1 27
2 8
2 28
3 4
3 5
3 29
4 6
4 30
5 7
5 37
6 8
6 39
7 45
8 49
9 10
9 15
9 21
10 16
10 22
11 12
11 13
11 31
12 14
12 32
13 16
13 38
14 15
14 40
15 51
16 47
17 18
17 19
17 33
18 20
18 34
19 22
19 42
20 21
20 44
21 52
22 48
23 24
23 25
23 35
24 26
24 36
25 27
25 41
26 28
26 43
27 46
28 50
29 30
29 31
30 32
31 32
33 34
33 35
34 36

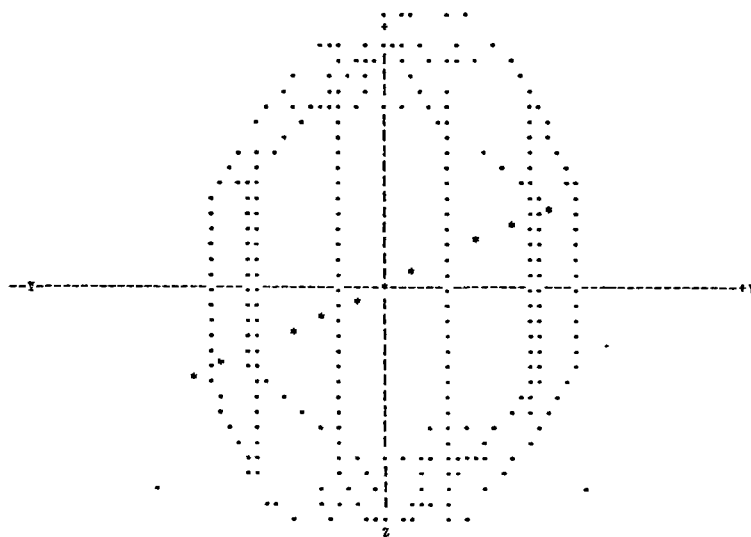
35 36
37 38
37 45
38 47
39 40
39 49
40 51
41 42
41 46
42 48
43 44
43 50
44 52
45 46
47 48
49 50
51 52
FACES
1 2 8 6 4 3 5 7
9 10 16 13 11 12 14 15
9 10 22 19 17 18 20 21
1 2 28 26 24 23 25 27
3 4 30 29
11 12 32 31
17 18 34 33
23 24 36 35
29 30 32 31
33 34 36 35
3 5 37 38 13 11 31 29
4 6 39 40 14 12 32 30
17 19 42 41 25 23 35 33
18 20 44 43 26 24 36 34
37 38 47 48 42 41 46 45
39 40 51 52 44 43 50 49
1 7 45 46 27
2 8 49 50 28
9 15 51 52 21
10 16 47 48 22
5 7 45 37
25 27 46 41
6 8 49 39
26 28 50 43
13 16 47 38
19 22 48 42
14 15 51 40
20 21 52 44

THE MAXIMUM IS: 0.7850276828 THE CONVERSION FACTOR FOR VIEWPLOT IS : 22.9291229248
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
(-3.9797 10.8370)----- (-3.9797 -14.5485)
(-3.9797 10.8370)----- (-2.6343 11.5979)
(-3.9797 10.8370)----- (-4.9272 11.5979)
(-3.9797 -14.5485)----- (-2.6343 -15.1237)
(-3.9797 -14.5485)----- (-4.9272 -15.1237)
(4.0929 10.7257)----- (4.0929 -13.3237)
(4.0929 10.7257)----- (2.7475 11.4690)
(4.0929 10.7257)----- (10.2706 6.1237)
(4.0929 -13.3237)----- (2.7475 -14.7526)
(4.0929 -13.3237)----- (10.2706 -7.2371)
(2.7475 11.4690)----- (-2.6343 11.5979)
(2.7475 11.4690)----- (0.3788 15.5412)
(2.7475 -14.7526)----- (-2.6343 -15.1237)
(2.7475 -14.7526)----- (0.3788 -17.8608)

```
( -2.6343 11.5979 )-----(-1.6393 15.4020 )
( -2.6343 -15.1217 )-----(-1.6393 -18.0000 )
( 3.9797 -10.8170 )-----(-3.9797 14.5485 )
( 3.9797 -10.8170 )-----(-4.9272 -11.5979 )
( 3.9797 -10.8170 )-----(-2.6343 -11.5979 )
( 3.9797 14.5485 )-----(-4.9272 15.1217 )
( 3.9797 14.5485 )-----(-2.6343 15.1217 )
( 9.6645 13.3217 )-----(-9.6645 -10.7257 )
( 9.6645 13.3217 )-----(-8.7171 14.7526 )
( 9.6645 13.3217 )-----(-12.6585 7.2371 )
( 9.6645 -10.7257 )-----(-8.7171 -11.9690 )
( 9.6645 -10.7257 )-----(-12.6585 -6.1237 )
( 8.7171 14.7526 )-----(-4.9272 15.1217 )
( 8.7171 14.7526 )-----(-5.3535 17.8608 )
( 8.7171 -11.9690 )-----(-4.9272 -11.5979 )
( 8.7171 -11.9690 )-----(-5.3535 -15.5412 )
( 4.9272 -11.5979 )-----(-3.9323 -15.4020 )
( 4.9272 15.1217 )-----(-3.9323 18.0000 )
( -4.0929 13.3217 )-----(-4.0929 -10.7257 )
( -4.0929 13.3217 )-----(-2.7475 14.7526 )
( -4.0929 13.3217 )-----(-10.2706 7.2371 )
( -4.0929 -10.7257 )-----(-2.7475 -11.9690 )
( -4.0929 -10.7257 )-----(-10.2706 -6.1237 )
( -2.7475 14.7526 )-----(-2.6343 15.1217 )
( -2.7475 14.7526 )-----(-0.1788 17.8608 )
( -2.7475 -11.9690 )-----(-2.6343 -11.5979 )
( -2.7475 -11.9690 )-----(-0.1788 -15.5412 )
( 2.6343 -11.5979 )-----(-1.6393 -15.4020 )
( 2.6343 15.1217 )-----(-1.6393 18.0000 )
( -9.6645 10.7257 )-----(-9.6645 -13.3217 )
( -9.6645 10.7257 )-----(-8.7171 11.9690 )
( -9.6645 10.7257 )-----(-12.6585 6.1237 )
( -9.6645 -13.3217 )-----(-8.7171 -14.7526 )
( -9.6645 -13.3217 )-----(-12.6585 -7.2371 )
( -8.7171 11.9690 )-----(-4.9272 11.5979 )
( -8.7171 11.9690 )-----(-5.3535 15.5412 )
( -8.7171 -14.7526 )-----(-4.9272 -15.1217 )
( -8.7171 -14.7526 )-----(-5.3535 -17.8608 )
( -4.9272 11.5979 )-----(-3.9323 15.4020 )
( -4.9272 -15.1217 )-----(-3.9323 -18.0000 )
( 10.2706 6.1237 )-----(-10.2706 -7.2371 )
( 10.2706 6.1237 )-----(-12.6585 7.2371 )
( 10.2706 -7.2371 )-----(-12.6585 -6.1237 )
( 12.6585 7.2371 )-----(-10.2706 -6.1237 )
( -10.2706 7.2371 )-----(-12.6585 6.1237 )
( -10.2706 -6.1237 )-----(-12.6585 -7.2371 )
( -12.6585 6.1237 )-----(-12.6585 -7.2371 )
( 0.3788 15.5412 )-----(-5.3535 17.8608 )
( 0.3788 15.5412 )-----(-1.6393 15.4020 )
( 5.3535 17.8608 )-----(-3.9323 18.0000 )
( 0.3788 -17.8608 )-----(-5.3535 -15.5412 )
( 0.3788 -17.8608 )-----(-1.6393 -18.0000 )
( 5.3535 -15.5412 )-----(-3.9323 -15.4020 )
( -5.3535 15.5412 )-----(-0.3788 17.8608 )
( -5.3535 15.5412 )-----(-3.9323 15.4020 )
( -0.3788 17.8608 )-----(-1.6393 18.0000 )
( -5.3535 -17.8608 )-----(-0.3788 -15.5412 )
( -5.3535 -17.8608 )-----(-3.9323 -18.0000 )
( -0.3788 -15.5412 )-----(-1.6393 -15.4020 )
( -1.6393 15.4020 )-----(-3.9323 15.4020 )
( 3.9323 18.0000 )-----(-1.6393 18.0000 )
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( -1.6393 -18.0000 )-----(-3.9323 -18.0000 )
( 3.9323 -15.4020 )-----(-1.6393 -15.4020 )
```

CRYSTAL SHAPE:



FLUORITE 1 : MASON AND BERRY, 1968, P. 323
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 2 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 30
 MILLER INDICES :

1	0	0
0	1	0
-1	0	0
0	-1	0
0	0	1
0	0	-1
1	2	0
2	1	0
1	0	2
2	0	1
0	1	2
0	2	1
-1	2	0
-2	1	0
-1	0	2
-2	0	1
0	-1	2
0	-2	1
1	-2	0

2	-1	0
1	0	-2
2	0	-1
0	1	-2
0	2	-1
-1	-2	0
-2	-1	0
-1	0	-2
-2	0	-1
0	-1	-2
0	-2	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72																											

THE POSITIONS OF THE CRYSTAL VESTICES ARE :

(	1.0000	0.2500	0.2500	)
(	1.0000	0.2500	-0.2500	)
(	1.0000	-0.2500	0.2500	)
(	1.0000	-0.2500	-0.2500	)
(	0.2500	1.0000	0.2500	)
(	0.2500	1.0000	-0.2500	)
(	-0.2500	1.0000	0.2500	)
(	-0.2500	1.0000	-0.2500	)
(	-1.0000	0.2500	0.2500	)
(	-1.0000	0.2500	-0.2500	)
(	-1.0000	-0.2500	0.2500	)
(	-1.0000	-0.2500	-0.2500	)
(	0.2500	-1.0000	0.2500	)
(	-0.2500	-1.0000	0.2500	)
(	0.2500	-1.0000	-0.2500	)
(	-0.2500	-1.0000	-0.2500	)
(	0.2500	0.2500	1.0000	)
(	0.2500	-0.2500	1.0000	)
(	-0.2500	0.2500	1.0000	)

(	-0.2500	-0.2500	1.0000	)
(	0.2500	0.2500	-1.0000	)
(	0.2500	-0.2500	-1.0000	)
(	-0.2500	0.2500	-1.0000	)
(	-0.2500	-0.2500	-1.0000	)
(	0.7500	0.7500	0.7500	)
(	0.7500	0.7500	-0.7500	)
(	0.7500	-0.7500	0.7500	)
(	-0.7500	0.7500	0.7500	)
(	-0.7500	0.7500	-0.7500	)
(	-0.7500	-0.7500	0.7500	)
(	0.7500	-0.7500	-0.7500	)
(	-0.7500	-0.7500	-0.7500	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

EDGES OF THE CRATER ARE DETERMINED BY THE FOLLOWING VECTORS	
(1.0000 0.2500 0.2500)	(1.0000 0.2500 -0.2500)
(1.0000 0.2500 0.2500)	(1.0000 -0.2500 0.2500)
(1.0000 0.2500 0.2500)	(0.7500 0.7500 0.7500)
(1.0000 0.2500 -0.2500)	(1.0000 -0.2500 -0.2500)
(1.0000 0.2500 -0.2500)	(0.7500 0.7500 -0.7500)
(1.0000 -0.2500 0.2500)	(1.0000 -0.2500 -0.2500)
(1.0000 -0.2500 0.2500)	(0.7500 -0.7500 0.7500)
(1.0000 -0.2500 -0.2500)	(0.7500 -0.7500 -0.7500)
(0.2500 1.0000 0.2500)	(0.2500 1.0000 -0.2500)
(0.2500 1.0000 0.2500)	(-0.2500 1.0000 0.2500)
(0.2500 1.0000 0.2500)	(0.7500 0.7500 0.7500)
(0.2500 1.0000 -0.2500)	(-0.2500 1.0000 -0.2500)
(0.2500 1.0000 -0.2500)	(0.7500 0.7500 -0.7500)
(-0.2500 1.0000 0.2500)	(-0.2500 1.0000 -0.2500)
(-0.2500 1.0000 0.2500)	(-0.7500 0.7500 0.7500)
(-0.2500 1.0000 -0.2500)	(-0.7500 0.7500 -0.7500)
(-1.0000 0.2500 0.2500)	(-1.0000 0.2500 -0.2500)
(-1.0000 0.2500 0.2500)	(-1.0000 -0.2500 0.2500)
(-1.0000 0.2500 0.2500)	(-0.7500 0.7500 0.7500)
(-1.0000 0.2500 -0.2500)	(-1.0000 -0.2500 -0.2500)
(-1.0000 0.2500 -0.2500)	(-0.7500 0.7500 -0.7500)
(-1.0000 -0.2500 0.2500)	(-1.0000 -0.2500 -0.2500)
(-1.0000 -0.2500 0.2500)	(-0.7500 -0.7500 0.7500)
(-1.0000 -0.2500 -0.2500)	(-0.7500 -0.7500 -0.7500)
(0.2500 -1.0000 0.2500)	(-0.2500 -1.0000 0.2500)
(0.2500 -1.0000 0.2500)	(0.2500 -1.0000 -0.2500)
(0.2500 -1.0000 0.2500)	(0.7500 -0.7500 0.7500)
(-0.2500 -1.0000 0.2500)	(-0.2500 -1.0000 -0.2500)
(-0.2500 -1.0000 0.2500)	(-0.7500 -0.7500 0.7500)
(0.2500 -1.0000 -0.2500)	(-0.2500 -1.0000 -0.2500)
(0.2500 -1.0000 -0.2500)	(-0.7500 -0.7500 -0.7500)
(-0.2500 -1.0000 -0.2500)	(-0.7500 -0.7500 -0.7500)
(0.2500 0.2500 1.0000)	(0.2500 -0.2500 1.0000)
(0.2500 0.2500 1.0000)	(-0.2500 0.2500 1.0000)
(0.2500 0.2500 1.0000)	(0.7500 0.7500 0.7500)
(0.2500 -0.2500 1.0000)	(-0.2500 -0.2500 1.0000)
(0.2500 -0.2500 1.0000)	(0.7500 -0.7500 0.7500)
(-0.2500 0.2500 1.0000)	(-0.2500 -0.2500 1.0000)
(-0.2500 0.2500 1.0000)	(-0.7500 0.7500 0.7500)
(-0.2500 -0.2500 1.0000)	(-0.7500 -0.7500 0.7500)
(0.2500 0.2500 -1.0000)	(0.2500 -0.2500 -1.0000)
(0.2500 0.2500 -1.0000)	(-0.2500 0.2500 -1.0000)
(0.2500 0.2500 -1.0000)	(0.7500 0.7500 -0.7500)
(0.2500 -0.2500 -1.0000)	(-0.2500 -0.2500 -1.0000)
(0.2500 -0.2500 -1.0000)	(-0.7500 -0.7500 -0.7500)
(-0.2500 0.2500 -1.0000)	(-0.2500 -0.2500 -1.0000)
(-0.2500 0.2500 -1.0000)	(-0.7500 -0.7500 -0.7500)
(-0.2500 -0.2500 -1.0000)	(-0.7500 -0.7500 -0.7500)

(	0.7500	0.7500	0.7500	)	-----	(	0.7500	0.7500	-0.7500	)
(	0.7500	0.7500	0.7500	)	-----	(	0.7500	-0.7500	0.7500	)
(	0.7500	0.7500	0.7500	)	-----	(	-0.7500	0.7500	0.7500	)
(	0.7500	0.7500	-0.7500	)	-----	(	-0.7500	0.7500	-0.7500	)
(	0.7500	0.7500	-0.7500	)	-----	(	0.7500	-0.7500	-0.7500	)
(	0.7500	-0.7500	0.7500	)	-----	(	-0.7500	-0.7500	0.7500	)
(	0.7500	-0.7500	0.7500	)	-----	(	0.7500	-0.7500	-0.7500	)
(	-0.7500	0.7500	0.7500	)	-----	(	-0.7500	0.7500	-0.7500	)
(	-0.7500	0.7500	0.7500	)	-----	(	-0.7500	-0.7500	0.7500	)
(	-0.7500	0.7500	-0.7500	)	-----	(	-0.7500	-0.7500	-0.7500	)
(	-0.7500	-0.7500	0.7500	)	-----	(	-0.7500	-0.7500	0.7500	)
(	0.7500	-0.7500	-0.7500	)	-----	(	-0.7500	-0.7500	-0.7500	)

THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 900.0000

VERTICES

900.0000	225.0002	225.0002
900.0000	225.0002	-225.0002
900.0000	-225.0002	225.0002
900.0000	-225.0002	-225.0002
225.0002	900.0000	225.0002
225.0002	900.0000	-225.0002
-225.0002	900.0000	225.0002
-225.0002	900.0000	-225.0002
-900.0000	225.0002	225.0002
-900.0000	225.0002	-225.0002
-900.0000	-225.0002	225.0002
-900.0000	-225.0002	-225.0002
225.0002	-900.0000	225.0002
-225.0002	-900.0000	225.0002
225.0002	-900.0000	-225.0002
-225.0002	-900.0000	-225.0002
225.0002	225.0002	900.0000
225.0002	-225.0002	900.0000
-225.0002	225.0002	900.0000
-225.0002	-225.0002	900.0000
225.0002	225.0002	-900.0000
225.0002	-225.0002	-900.0000
-225.0002	225.0002	-900.0000
-225.0002	-225.0002	-900.0000
675.0000	675.0000	675.0000
675.0000	675.0000	-675.0000
675.0000	-674.9998	675.0000
-675.0000	675.0000	675.0000
-675.0000	675.0000	-675.0000
-675.0000	-674.9998	675.0000
675.0000	-675.0000	-675.0000
-675.0000	-675.0000	-675.0000

EDGES

1	2
1	3
1	25
2	4
2	26
3	4
3	27
4	31
5	6
5	7
5	25
6	8
6	26
7	8
7	28

8	29
9	10
9	11
9	28
10	12
10	29
11	12
11	30
12	32
13	14
13	15
13	27
14	16
14	30
15	16
15	31
16	32
17	18
17	19
17	25
18	20
18	27
19	20
19	28
20	30
21	22
21	23
21	26
22	24
22	31
23	24
23	29
24	32
25	26
25	27
25	28
26	29
26	31
27	30
27	31
28	29
28	30
29	32
30	32
31	32

FACES

1	2	4	3
5	6	8	7
9	10	12	11
13	14	16	15
17	18	20	19
21	22	24	23
5	6	26	25
1	2	26	25
17	18	27	25
1	3	27	25
17	19	28	25
5	7	28	25
7	8	29	28
9	10	29	28
19	20	30	28
9	11	30	28

10 20 30 27
 13 14 30 27
 13 15 31 27
 3 4 31 27
 21 22 31 26
 2 4 31 26
 21 23 29 26
 6 8 24 26
 14 16 32 30
 11 12 32 30
 23 24 32 29
 10 12 32 29
 22 24 32 31
 15 16 32 31

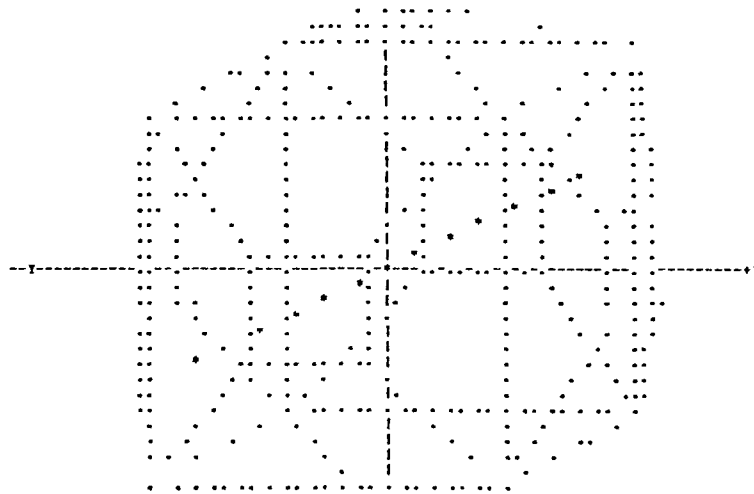
THE MAXIMUM IS: #1.0943908691 THE CONVERSION FACTOR FOR VIEWPLOT IS : 16.4474945068

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(-2.0981 1.2162)	(-2.0981 -7.0075)
(-2.0981 1.2162)	(-10.3219 1.2162)
(-2.0981 1.2162)	(7.6781 10.1639)
(-2.0981 -7.0075)	(-10.3219 -7.0075)
(-2.0981 -7.0075)	(7.6781 -14.5074)
(-10.3219 1.2162)	(-10.3219 -7.0075)
(-10.3219 1.2162)	(-16.9931 10.1639)
(-10.3219 -7.0075)	(-16.9931 -14.5074)
(14.8950 3.3880)	(14.8950 -4.8358)
(14.8950 3.3880)	(18.0000 4.8358)
(14.8950 3.3880)	(7.6781 10.1639)
(14.8950 -4.8358)	(18.0000 -3.3880)
(14.8950 -4.8358)	(7.6781 -14.5074)
(18.0000 4.8358)	(18.0000 -3.3880)
(18.0000 4.8358)	(16.9931 14.5074)
(18.0000 -3.3880)	(16.9931 -10.1639)
(10.3219 7.0075)	(10.3219 -1.2162)
(10.3219 7.0075)	(2.0981 7.0075)
(10.3219 7.0075)	(16.9931 14.5074)
(10.3219 -1.2162)	(2.0981 -1.2162)
(10.3219 -1.2162)	(16.9931 -10.1639)
(2.0981 7.0075)	(2.0981 -1.2162)
(2.0981 7.0075)	(-7.6781 14.5074)
(2.0981 -1.2162)	(-7.6781 -10.1639)
(-18.0000 3.3880)	(-14.8950 4.8358)
(-18.0000 3.3880)	(-18.0000 -4.8358)
(-18.0000 3.3880)	(-16.9931 10.1639)
(-14.8950 4.8358)	(-14.8950 -3.3880)
(-14.8950 4.8358)	(-7.6781 14.5074)
(-18.0000 -4.8358)	(-14.8950 -3.3880)
(-18.0000 -4.8358)	(-16.9931 -14.5074)
(-14.8950 -3.3880)	(-7.6781 -10.1639)
(2.5594 15.7236)	(-5.6644 15.7236)
(2.5594 15.7236)	(5.6644 17.1714)
(2.5594 15.7236)	(7.6781 10.1639)
(-5.6644 15.7236)	(-2.5594 17.1714)
(-5.6644 15.7236)	(-16.9931 10.1639)
(5.6644 17.1714)	(-2.5594 17.1714)
(5.6644 17.1714)	(16.9931 14.5074)
(-2.5594 17.1714)	(-7.6781 14.5074)
(2.5594 -17.1714)	(-5.6644 -17.1714)
(2.5594 -17.1714)	(5.6644 -15.7236)
(2.5594 -17.1714)	(7.6781 -14.5074)
(-5.6644 -17.1714)	(-2.5594 -15.7236)
(-5.6644 -17.1714)	(-16.9931 -14.5074)
(5.6644 -15.7236)	(-2.5594 -15.7236)

(5.6644 -15.7236)	(16.9931 -10.1639)
(-2.5594 -15.7236)	(-7.6781 -10.1639)
(7.6781 10.1639)	(7.6781 -14.5074)
(7.6781 10.1639)	(-16.9931 10.1639)
(7.6781 10.1639)	(16.9931 14.5074)
(7.6781 -14.5074)	(16.9931 -10.1639)
(7.6781 -14.5074)	(-16.9931 -14.5074)
(-16.9931 10.1639)	(-7.6781 14.5074)
(-16.9931 10.1639)	(-16.9931 -14.5074)
(16.9931 14.5074)	(16.9931 -10.1639)
(16.9931 14.5074)	(-7.6781 14.5074)
(16.9931 -10.1639)	(-7.6781 -10.1639)
(-7.6781 14.5074)	(-7.6781 -10.1639)
(-16.9931 -14.5074)	(-7.6781 -10.1639)

CRYSTAL SHAPE:



FLUORITE 2 : HALITE : MASON AND BERRY, 1968, P.323, 320
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 1 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 6
 MILLER INDICES :

1	0	0
0	1	0
-1	0	0
0	-1	0
0	0	1
0	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :
 1.0000 X + 0.0 Y + 0.0 Z = 1
 0.0 X + 1.0000 Y + 0.0 Z = 1

```

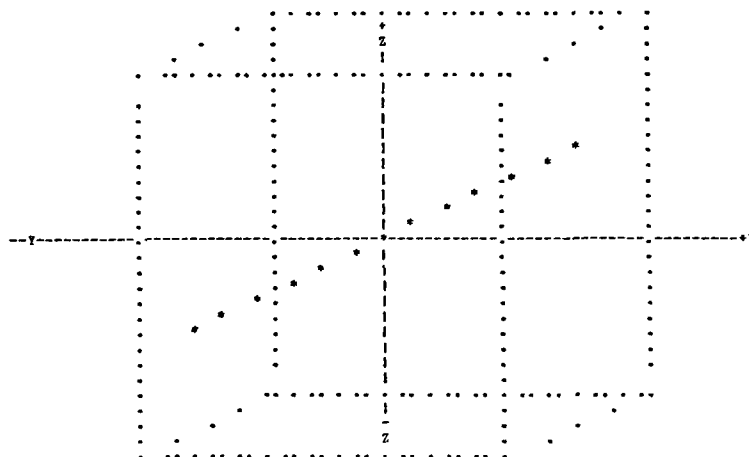
-1.0000 X + 0.0 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + 0.0 Z = 1
0.0 X + 0.0 Y + 1.0000 Z = 1
0.0 X + 0.0 Y + -1.0000 Z = 1
THE POSITIONS OF THE CRYSTAL VERTICES ARE :
( 1.0000 1.0000 1.0000 )
( 1.0000 1.0000 -1.0000 )
( 1.0000 -1.0000 1.0000 )
( 1.0000 -1.0000 -1.0000 )
( -1.0000 1.0000 1.0000 )
( -1.0000 1.0000 -1.0000 )
( -1.0000 -1.0000 1.0000 )
( -1.0000 -1.0000 -1.0000 )
THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
( 1.0000 1.0000 1.0000 )----- ( 1.0000 1.0000 -1.0000 )
( 1.0000 1.0000 1.0000 )----- ( 1.0000 -1.0000 1.0000 )
( 1.0000 1.0000 1.0000 )----- ( 1.0000 -1.0000 -1.0000 )
( 1.0000 1.0000 -1.0000 )----- ( 1.0000 -1.0000 1.0000 )
( 1.0000 1.0000 -1.0000 )----- ( 1.0000 -1.0000 -1.0000 )
( 1.0000 1.0000 -1.0000 )----- ( -1.0000 1.0000 1.0000 )
( 1.0000 -1.0000 1.0000 )----- ( -1.0000 1.0000 -1.0000 )
( 1.0000 -1.0000 1.0000 )----- ( -1.0000 -1.0000 1.0000 )
( 1.0000 -1.0000 -1.0000 )----- ( -1.0000 -1.0000 -1.0000 )
( -1.0000 1.0000 1.0000 )----- ( -1.0000 1.0000 -1.0000 )
( -1.0000 1.0000 1.0000 )----- ( -1.0000 -1.0000 1.0000 )
( -1.0000 1.0000 1.0000 )----- ( -1.0000 -1.0000 -1.0000 )
( -1.0000 -1.0000 1.0000 )----- ( -1.0000 -1.0000 -1.0000 )
( -1.0000 -1.0000 -1.0000 )----- ( 1.0000 1.0000 1.0000 )
THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 900.0000
VERTICES
900.0000 900.0000 900.0000
900.0000 900.0000 -900.0000
900.0000 -900.0000 900.0000
900.0000 -900.0000 -900.0000
-900.0000 900.0000 900.0000
-900.0000 900.0000 -900.0000
-900.0000 -900.0000 900.0000
-900.0000 -900.0000 -900.0000
EDGES
1 2
1 3
1 5
2 4
2 6
3 4
3 7
4 8
5 6
5 7
6 8
7 8
FACES
1 2 4 3
1 2 6 5
5 6 8 7
3 4 8 7
1 3 7 5
2 4 8 6
THE MAXIMUM IS: 1.3775644302 THE CONVERSION FACTOR FOR VIEWPLOT IS : 13.0665388107
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 8.1331 10.7661 )----- ( 8.1331 -15.3670 )
( 8.1331 10.7661 )----- ( -18.0000 10.7661 )
( 8.1331 10.7661 )----- ( 18.0000 15.3670 )
( 8.1331 -15.3670 )----- ( -18.0000 -15.3670 )

```

```

( 8.1331 -15.3670 )----- ( 18.0000 -10.7661 )
( -18.0000 10.7661 )----- ( -18.0000 -15.3670 )
( -18.0000 10.7661 )----- ( -8.1331 15.3670 )
( -18.0000 -15.3670 )----- ( -8.1331 -10.7661 )
( 18.0000 15.3670 )----- ( 18.0000 -10.7661 )
( 18.0000 15.3670 )----- ( -8.1331 15.3670 )
( 18.0000 -10.7661 )----- ( -8.1331 -10.7661 )
( -8.1331 15.3670 )----- ( -8.1331 -10.7661 )
CRYSTAL SHAPE:

```



FORSTERITE : DEEP HOWIE AND ZUSSMAN, 1967, p. 1
(Olivine Group).
ORTHORHOMBIC SYSTEM : A:B:C = 0.4665: 1.0000: 0.5866 , ALPHA=BETA=GAMMA=90 , 6 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 20
MILLER INDICES :

```

1 1 0
-1 1 0
-1 -1 0
1 -1 0
1 2 0
-1 2 0
-1 -2 0
1 -2 0
0 1 0
0 -1 0
0 2 1
0 2 -1
0 -2 1
0 -2 -1
0 0 1
0 0 -1
1 0 -1
1 0 -1

```



```

      -1      0      -1
      -1      0      1
THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :
2.1436 X + 1.0000 Y + 0.0 Z = 1
-2.1436 X + 1.0000 Y + 0.0 Z = 1
-2.1436 X + -1.0000 Y + 0.0 Z = 1
2.1436 X + -1.0000 Y + 0.0 Z = 1
1.6489 X + 1.5385 Y + 0.0 Z = 1
-1.6489 X + 1.5385 Y + 0.0 Z = 1
-1.6489 X + -1.5385 Y + 0.0 Z = 1
1.6489 X + -1.5385 Y + 0.0 Z = 1
0.0 X + 2.0000 Y + 0.0 Z = 1
0.0 X + -2.0000 Y + 0.0 Z = 1
0.0 X + 1.3333 Y + 1.1365 Z = 1
0.0 X + 1.3333 Y + -1.1365 Z = 1
0.0 X + -1.3333 Y + 1.1365 Z = 1
0.0 X + -1.3333 Y + -1.1365 Z = 1
0.0 X + 0.0 Y + 1.3638 Z = 1
0.0 X + 0.0 Y + -1.3638 Z = 1
1.0993 X + 0.0 Y + 0.8742 Z = 1
1.0993 X + 0.0 Y + -0.8742 Z = 1
-1.0993 X + 0.0 Y + 0.8742 Z = 1
-1.0993 X + 0.0 Y + -0.8742 Z = 1
THE POSITIONS OF THE CRYSTAL VERTICES ARE :
( 0.4665 0.0 0.5573 )
( 0.4665 0.0 -0.5573 )
( 0.3266 0.3000 0.5279 )
( 0.3266 0.3000 -0.5279 )
( 0.3810 0.1833 0.6648 )
( 0.3810 0.1833 -0.6648 )
( -0.4665 0.0 0.5573 )
( -0.4665 0.0 -0.5573 )
( -0.3266 0.3000 0.5279 )
( -0.3266 0.3000 -0.5279 )
( -0.3810 0.1833 0.6648 )
( -0.3810 0.1833 -0.6648 )
( -0.3266 -0.3000 0.5279 )
( -0.3266 -0.3000 -0.5279 )
( -0.3810 -0.1833 0.6648 )
( -0.3810 -0.1833 -0.6648 )
( 0.3266 -0.3000 0.5279 )
( 0.3266 -0.3000 -0.5279 )
( 0.3810 -0.1833 0.6648 )
( 0.3810 -0.1833 -0.6648 )
( 0.1399 0.5000 0.2933 )
( 0.1399 0.5000 -0.2933 )
( -0.1399 0.5000 0.2933 )
( -0.1399 0.5000 -0.2933 )
( -0.1399 -0.5000 0.2933 )
( -0.1399 -0.5000 -0.2933 )
( 0.1399 -0.5000 0.2933 )
( 0.1399 -0.5000 -0.2933 )
( 0.3265 0.1250 0.7333 )
( 0.3265 0.1250 -0.7333 )
( -0.3265 0.1250 0.7333 )
( -0.3265 0.1250 -0.7333 )
( 0.3265 -0.1250 0.7333 )
( 0.3265 -0.1250 -0.7333 )
( -0.3265 -0.1250 0.7333 )
( -0.3265 -0.1250 -0.7333 )
THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.4665 0.0 0.5573 )----- ( 0.4665 0.0 -0.5573 )

```

Apdx. 2-b, p. 82

```

( 0.4665 0.0 0.5573 )----- ( 0.3810 0.1833 0.6648 )
( 0.4665 0.0 0.5573 )----- ( 0.3810 -0.1833 0.6648 )
( 0.4665 0.0 -0.5573 )----- ( 0.3810 0.1833 -0.6648 )
( 0.4665 0.0 -0.5573 )----- ( 0.3810 -0.1833 -0.6648 )
( 0.3266 0.3000 0.5279 )----- ( 0.3266 0.3000 -0.5279 )
( 0.3266 0.3000 0.5279 )----- ( 0.3810 0.1833 0.6648 )
( 0.3266 0.3000 0.5279 )----- ( 0.3810 0.1833 -0.6648 )
( 0.3266 0.3000 -0.5279 )----- ( 0.1399 0.5000 0.2933 )
( 0.3266 0.3000 -0.5279 )----- ( 0.1399 0.5000 -0.2933 )
( 0.3266 0.3000 -0.5279 )----- ( 0.3810 0.1833 0.6648 )
( 0.3266 0.3000 -0.5279 )----- ( 0.3810 0.1833 -0.6648 )
( 0.3810 0.1833 0.6648 )----- ( 0.3265 0.1250 0.7333 )
( 0.3810 0.1833 0.6648 )----- ( 0.3265 0.1250 -0.7333 )
( -0.4665 0.0 -0.5573 )----- ( -0.3810 0.1833 0.6648 )
( -0.4665 0.0 -0.5573 )----- ( -0.3810 0.1833 -0.6648 )
( -0.4665 0.0 0.5573 )----- ( -0.3810 0.1833 0.6648 )
( -0.4665 0.0 0.5573 )----- ( -0.3810 0.1833 -0.6648 )
( -0.3266 0.3000 0.5279 )----- ( -0.3266 0.3000 -0.5279 )
( -0.3266 0.3000 0.5279 )----- ( -0.3810 0.1833 0.6648 )
( -0.3266 0.3000 0.5279 )----- ( -0.3810 0.1833 -0.6648 )
( -0.3266 0.3000 -0.5279 )----- ( -0.1399 0.5000 0.2933 )
( -0.3266 0.3000 -0.5279 )----- ( -0.1399 0.5000 -0.2933 )
( -0.3266 0.3000 -0.5279 )----- ( -0.3810 0.1833 0.6648 )
( -0.3266 0.3000 -0.5279 )----- ( -0.3810 0.1833 -0.6648 )
( -0.3810 0.1833 0.6648 )----- ( -0.3265 0.1250 0.7333 )
( -0.3810 0.1833 0.6648 )----- ( -0.3265 0.1250 -0.7333 )
( -0.3266 -0.3000 0.5279 )----- ( -0.3266 -0.3000 -0.5279 )
( -0.3266 -0.3000 0.5279 )----- ( -0.3810 0.1833 0.6648 )
( -0.3266 -0.3000 0.5279 )----- ( -0.3810 0.1833 -0.6648 )
( -0.3266 -0.3000 -0.5279 )----- ( -0.1399 0.5000 0.2933 )
( -0.3266 -0.3000 -0.5279 )----- ( -0.1399 0.5000 -0.2933 )
( -0.3810 0.1833 0.6648 )----- ( -0.3265 0.1250 0.7333 )
( -0.3810 0.1833 0.6648 )----- ( -0.3265 0.1250 -0.7333 )
( 0.3266 -0.3000 0.5279 )----- ( 0.3266 -0.3000 -0.5279 )
( 0.3266 -0.3000 0.5279 )----- ( 0.3810 0.1833 0.6648 )
( 0.3266 -0.3000 0.5279 )----- ( 0.3810 0.1833 -0.6648 )
( 0.3266 -0.3000 -0.5279 )----- ( 0.1399 0.5000 0.2933 )
( 0.3266 -0.3000 -0.5279 )----- ( 0.1399 0.5000 -0.2933 )
( 0.3810 0.1833 0.6648 )----- ( 0.3265 0.1250 0.7333 )
( 0.3810 0.1833 0.6648 )----- ( 0.3265 0.1250 -0.7333 )
( 0.3265 0.1250 0.7333 )----- ( 0.3265 0.1250 -0.7333 )
( 0.3265 0.1250 0.7333 )----- ( 0.3265 -0.1250 0.7333 )
( 0.3265 0.1250 0.7333 )----- ( 0.3265 -0.1250 -0.7333 )
( 0.3265 0.1250 -0.7333 )----- ( 0.3265 -0.1250 0.7333 )
( 0.3265 0.1250 -0.7333 )----- ( 0.3265 -0.1250 -0.7333 )
( -0.3265 0.1250 0.7333 )----- ( -0.3265 0.1250 -0.7333 )
( -0.3265 0.1250 0.7333 )----- ( -0.3265 -0.1250 0.7333 )
( -0.3265 0.1250 0.7333 )----- ( -0.3265 -0.1250 -0.7333 )
( -0.3265 0.1250 -0.7333 )----- ( -0.3265 -0.1250 0.7333 )
( -0.3265 0.1250 -0.7333 )----- ( -0.3265 -0.1250 -0.7333 )
THE MAXIMUM IS: 0.7333 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS: 1227.4119
VERTICES
572.5176 0.0 683.9993
572.5876 0.0 -683.9993
400.8115 368.2229 648.0012
400.8115 368.2229 -648.0012
467.6120 225.0259 815.9198
467.6120 225.0259 -815.9198
-572.5876 0.0 -683.9993

```

```

-572.5876 0.0 681.9993
-400.8115 368.2229 648.0012
-400.8115 368.2229 -648.0012
-467.6128 225.0259 815.9998
-467.6128 225.0259 -815.9998
-400.8115 -368.2229 648.0012
-400.8115 -368.2229 -648.0012
-467.6128 -225.0259 815.9998
-467.6128 -225.0259 -815.9998
400.8115 -368.2229 648.0012
400.8115 -368.2229 -648.0012
467.6128 -225.0259 815.9998
467.6128 -225.0259 -815.9998
171.7763 613.7058 359.9998
171.7763 613.7058 -359.9998
-171.7763 613.7058 359.9998
-171.7763 613.7058 -359.9998
-171.7763 -613.7058 359.9998
-171.7763 -613.7058 -359.9998
171.7763 -613.7058 359.9998
171.7763 -613.7058 -359.9998
400.8110 153.4263 899.9998
-400.8110 153.4263 899.9998
400.8110 153.4263 -899.9998
-400.8110 153.4263 -899.9998
400.8110 -153.4263 899.9998
-400.8110 -153.4263 899.9998
400.8110 -153.4263 -899.9998
-400.8110 -153.4263 -899.9998

```

```

EDGES
1 2
1 5
1 19
2 6
2 20
3 4
3 5
3 21
4 6
4 22
5 29
6 31
7 8
7 12
7 16
8 11
8 15
9 10
9 11
9 23
10 12
10 24
11 30
12 32
13 14
13 15
13 25
14 16
14 26
15 34
16 36
17 18

```

```

17 19
17 27
18 20
18 28
19 33
20 35
21 22
21 23
22 24
23 24
25 26
25 27
26 28
27 28
29 30
29 33
30 34
31 32
31 35
32 36
33 34
35 36

```

FACES

```

1 2 6 4 3 5
7 8 11 9 10 12
7 8 15 13 14 16
1 2 20 18 17 19
3 4 22 21
9 10 24 23
13 14 26 25
17 18 28 27
21 22 24 23
25 26 28 27
3 5 29 30 11 9 23 21
4 6 31 32 12 10 24 22
13 15 34 33 19 17 27 25
14 16 36 35 20 18 28 26
29 30 34 33
31 32 36 35
1 5 29 33 19
2 6 31 35 20
7 12 32 36 16
8 11 30 34 15

```

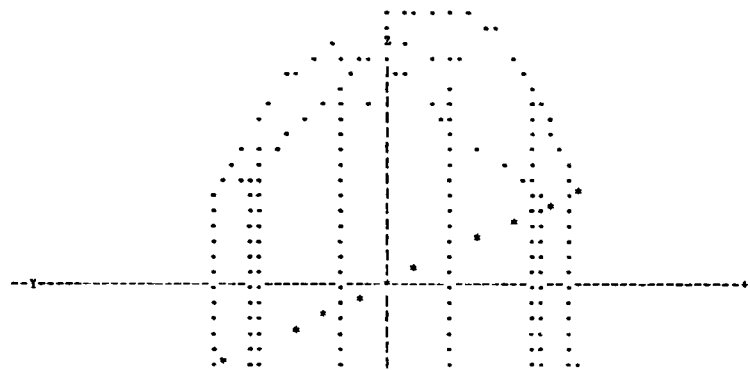
THE MAXIMUM IS: 0.7907407880 THE CONVERSION FACTOR FOR VIEWPLOT IS : 22.7634582520

```

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( -4.0094 10.8158 )----- ( -4.0094 -14.5549 )
( -4.0094 10.8158 )----- ( 0.8990 13.6066 )
( -4.0094 10.8158 )----- ( -7.4477 13.6066 )
( -4.0094 -14.5549 )----- ( 0.8990 -16.6602 )
( -4.0094 -14.5549 )----- ( -7.4477 -16.6602 )
( 4.0224 10.7091 )----- ( 4.0224 -13.3265 )
( 4.0224 10.7091 )----- ( 0.8990 13.6066 )
( 4.0224 10.7091 )----- ( 10.1789 6.1157 )
( 4.0224 -13.3265 )----- ( 0.8190 -16.6602 )
( 4.0224 -13.3265 )----- ( 10.1789 -7.2174 )
( 0.8990 13.6066 )----- ( 0.0348 15.3826 )
( 0.8990 -16.6602 )----- ( 0.0348 -18.0000 )
( 4.0094 -10.8158 )----- ( 4.0094 14.5549 )
( 4.0094 -10.8158 )----- ( 7.4477 -13.6066 )
( 4.0094 -10.8158 )----- ( -0.8990 -13.6066 )
( 4.0094 14.5549 )----- ( 7.4477 16.6602 )
( 4.0094 14.5549 )----- ( -0.8990 16.6602 )

```

CRYSTAL SHAPE:



GALENA 1 : MASON AND BERRY , 1968, P. 229
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, , 1 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 6
 MILLER INDICES :

1	0	0
-1	0	0
0	1	0
0	-1	0
0	0	1
0	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000	X +	0.0	Y +	0.0	Z =	1
-1.0000	X +	0.0	Y +	0.0	Z =	1
0.0	X +	1.0000	Y +	0.0	Z =	1
0.0	X +	-1.0000	Y +	0.0	Z =	1
0.0	X +	0.0	Y +	1.0000	Z =	1
0.0	X +	0.0	Y +	-1.0000	Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

{	1.0000	1.0000	1.0000	}
{	1.0000	1.0000	-1.0000	}
{	1.0000	-1.0000	1.0000	}
{	1.0000	-1.0000	-1.0000	}
{	-1.0000	1.0000	1.0000	}
{	-1.0000	1.0000	-1.0000	}
{	-1.0000	-1.0000	1.0000	}
{	-1.0000	-1.0000	-1.0000	}

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

{	1.0000	1.0000	1.0000	}	{	1.0000	1.0000	-1.0000	}
{	1.0000	1.0000	1.0000	}	{	1.0000	-1.0000	1.0000	}
{	1.0000	1.0000	1.0000	}	{	-1.0000	1.0000	1.0000	}
{	1.0000	1.0000	-1.0000	}	{	1.0000	-1.0000	-1.0000	}
{	1.0000	1.0000	-1.0000	}	{	-1.0000	1.0000	-1.0000	}
{	1.0000	-1.0000	1.0000	}	{	1.0000	1.0000	-1.0000	}
{	1.0000	-1.0000	1.0000	}	{	-1.0000	-1.0000	1.0000	}
{	1.0000	-1.0000	-1.0000	}	{	-1.0000	1.0000	1.0000	}
{	-1.0000	1.0000	1.0000	}	{	-1.0000	1.0000	-1.0000	}
{	-1.0000	1.0000	1.0000	}	{	-1.0000	-1.0000	-1.0000	}
{	-1.0000	1.0000	-1.0000	}	{	-1.0000	-1.0000	1.0000	}
{	-1.0000	-1.0000	1.0000	}	{	-1.0000	-1.0000	-1.0000	}

THE MAXIMUM IS:

1.0000

THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :

900.0000

VERTICES

900.0000	900.0000	900.0000
900.0000	900.0000	-900.0000
900.0000	-900.0000	900.0000
900.0000	-900.0000	-900.0000
-900.0000	900.0000	900.0000
-900.0000	900.0000	-900.0000
-900.0000	-900.0000	900.0000
-900.0000	-900.0000	-900.0000

END

```

1 2
1 1
1 5
2 4
2 6
3 4
3 7
4 8
5 6
5 7
6 8
7 8
FACES
1 2 4 3
5 6 8 7
1 2 6 5
3 4 8 7
1 3 7 5
2 4 8 6

```

THE MAXIMUM IS:

1.3775644302

THE CONVERSION FACTOR FOR VIEWPLOT IS :

13.0665388107

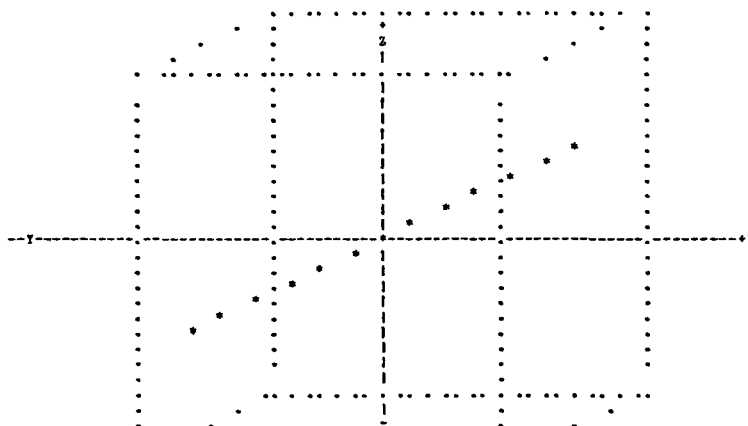
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 8.1331 10.7661 )----- ( 8.1331 -15.3670 )
( 8.1331 10.7661 )----- ( -18.0000 10.7661 )
( 8.1331 10.7661 )----- ( 18.0000 15.3670 )
( 8.1331 -15.3670 )----- ( -18.0000 -15.3670 )
( 8.1331 -15.3670 )----- ( 18.0000 -10.7661 )
( -18.0000 10.7661 )----- ( -18.0000 -15.3670 )
( -18.0000 10.7661 )----- ( -8.1331 15.3670 )
( -18.0000 -15.3670 )----- ( -8.1331 -10.7661 )
( 18.0000 15.3670 )----- ( 18.0000 -10.7661 )
( 18.0000 15.3670 )----- ( 8.1331 15.3670 )
( 18.0000 -10.7661 )----- ( 8.1331 -10.7661 )
( -8.1331 15.3670 )----- ( -8.1331 -10.7661 )

```

CRYSTAL SHAPE:



GALENA 2 : MASON AND BERRY, 1968, P. 229
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 2 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 14
 MILLER INDICES :

```

1 0 0
-1 0 0
0 1 0
0 -1 0
0 0 1
0 0 -1
1 1 1
-1 1 1
1 -1 1
-1 -1 1
1 1 -1
-1 1 -1
-1 -1 -1
1 -1 -1

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

1.0000 X + 0.0 Y + 0.0 Z = 1
-1.0000 X + 0.0 Y + 0.0 Z = -1
0.0 X + 1.0000 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + 0.0 Z = -1
0.0 X + 0.0 Y + 1.0000 Z = 1
0.0 X + 0.0 Y + -1.0000 Z = -1
0.5882 X + 0.5882 Y + 0.5882 Z = 1
-0.5882 X + 0.5882 Y + 0.5882 Z = -1
-0.5882 X + -0.5882 Y + 0.5882 Z = 1
0.5882 X + -0.5882 Y + 0.5882 Z = -1
0.5882 X + 0.5882 Y + -0.5882 Z = 1
-0.5882 X + 0.5882 Y + -0.5882 Z = -1
-0.5882 X + -0.5882 Y + -0.5882 Z = 1
0.5882 X + -0.5882 Y + -0.5882 Z = -1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 1.0000 0.0 0.7000 )
( 1.0000 0.7000 0.0 )
( 1.0000 0.0 0.0 )
( 1.0000 -0.7000 0.0 )
( -1.0000 0.0 0.7000 )
( -1.0000 0.7000 0.0 )
( -1.0000 0.0 0.0 )
( -1.0000 -0.7000 0.0 )
( 0.0 1.0000 0.7000 )
( 0.7000 1.0000 0.0 )
( -0.7000 1.0000 0.0 )
( 0.0 0.0 1.0000 )
( 0.0 1.0000 -0.7000 )
( 0.0 -1.0000 0.7000 )
( -0.7000 -1.0000 0.0 )
( 0.7000 -1.0000 0.0 )
( 0.0 -1.0000 -0.7000 )
( 0.0 0.7000 1.0000 )
( 0.7000 0.0 1.0000 )
( -0.7000 0.0 1.0000 )
( 0.0 -0.7000 1.0000 )
( 0.0 0.7000 -1.0000 )
( 0.7000 0.0 -1.0000 )
( -0.7000 0.0 -1.0000 )
( 0.0 0.0 -0.7000 )
( 0.0 0.0 0.7000 )

```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 1.0000 0.0 0.7000 )----- ( 1.0000 0.7000 0.0 )

```

```

( 1.0000 0.0 0.7000 )----- ( 1.0000 -0.7000 0.0 )
( 1.0000 0.0 0.7000 )----- ( 0.7000 0.0 1.0000 )
( 1.0000 0.7000 0.0 )----- ( 1.0000 0.0 -0.7000 )
( 1.0000 0.7000 0.0 )----- ( 0.7000 1.0000 0.0 )
( 1.0000 -0.7000 0.0 )----- ( 1.0000 0.0 -0.7000 )
( 1.0000 -0.7000 0.0 )----- ( 0.7000 -1.0000 0.0 )
( 1.0000 0.0 -0.7000 )----- ( 0.7000 0.0 -1.0000 )
( -1.0000 0.0 0.7000 )----- ( -1.0000 0.7000 0.0 )
( -1.0000 0.0 0.7000 )----- ( -1.0000 -0.7000 0.0 )
( -1.0000 0.0 0.7000 )----- ( -0.7000 0.0 1.0000 )
( -1.0000 0.7000 0.0 )----- ( -1.0000 0.0 -0.7000 )
( -1.0000 0.7000 0.0 )----- ( -0.7000 1.0000 0.0 )
( -1.0000 -0.7000 0.0 )----- ( -1.0000 0.0 -0.7000 )
( -1.0000 -0.7000 0.0 )----- ( -0.7000 -1.0000 0.0 )
( -1.0000 0.0 -0.7000 )----- ( -0.7000 0.0 -1.0000 )
( 0.0 1.0000 0.7000 )----- ( 0.7000 1.0000 0.0 )
( 0.0 1.0000 0.7000 )----- ( -0.7000 1.0000 0.0 )
( 0.0 1.0000 0.7000 )----- ( 0.0 0.7000 1.0000 )
( 0.7000 1.0000 0.0 )----- ( 0.0 1.0000 -0.7000 )
( -0.7000 1.0000 0.0 )----- ( 0.0 1.0000 -0.7000 )
( 0.0 1.0000 -0.7000 )----- ( 0.0 0.7000 -1.0000 )
( 0.0 -1.0000 0.7000 )----- ( -0.7000 -1.0000 0.0 )
( 0.0 -1.0000 0.7000 )----- ( 0.7000 -1.0000 0.0 )
( 0.0 -1.0000 0.7000 )----- ( 0.0 -0.7000 1.0000 )
( -0.7000 -1.0000 0.0 )----- ( 0.0 -1.0000 -0.7000 )
( 0.7000 -1.0000 0.0 )----- ( 0.0 -1.0000 -0.7000 )
( 0.0 -1.0000 -0.7000 )----- ( 0.0 -0.7000 -1.0000 )
( 0.0 0.7000 1.0000 )----- ( 0.7000 0.0 1.0000 )
( 0.0 0.7000 1.0000 )----- ( -0.7000 0.0 1.0000 )
( 0.7000 0.0 1.0000 )----- ( 0.0 -0.7000 1.0000 )
( -0.7000 0.0 1.0000 )----- ( 0.0 -0.7000 1.0000 )
( 0.0 0.7000 -1.0000 )----- ( 0.7000 0.0 -1.0000 )
( 0.0 0.7000 -1.0000 )----- ( -0.7000 0.0 -1.0000 )
( 0.7000 0.0 -1.0000 )----- ( 0.0 -0.7000 -1.0000 )
( -0.7000 0.0 -1.0000 )----- ( 0.0 -0.7000 -1.0000 )

```

THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 900.0000

VERTICES

900.0000	0.0	629.9988
900.0000	629.9988	0.0
900.0000	-629.9988	0.0
900.0000	0.0	-629.9988
-900.0000	0.0	629.9988
-900.0000	629.9988	0.0
-900.0000	-629.9988	0.0
-900.0000	0.0	-629.9988
0.0	900.0000	629.9988
629.9988	900.0000	0.0
-629.9988	900.0000	0.0
0.0	900.0000	-629.9988
0.0	-900.0000	629.9988
-629.9988	-900.0000	0.0
629.9988	-900.0000	0.0
0.0	-900.0000	-629.9988
0.0	629.9988	900.0000
629.9988	0.0	900.0000
-629.9988	0.0	900.0000
0.0	-629.9988	900.0000
0.0	629.9988	-900.0000
629.9988	0.0	-900.0000
-629.9988	0.0	-900.0000
0.0	-629.9988	-900.0000

EDGES

```

1 2
1 3
1 18
2 4
2 10
3 4
3 15
4 22
5 6
5 7
5 19
6 8
6 11
7 8
7 14
8 23
9 10
9 11
9 17
10 12
11 12
12 21
13 14
13 15
13 20
14 16
15 16
16 24
17 18
17 19
18 20
19 20
21 22
21 23
22 24
23 24

```

FACES

1	2	4	3
5	6	8	7
9	10	12	11
13	14	16	15
17	18	20	19
21	22	24	23
1	2	10	9
5	6	11	9
5	7	14	13
1	3	15	13
2	4	22	21
6	8	23	21
7	8	23	24
3	4	22	24

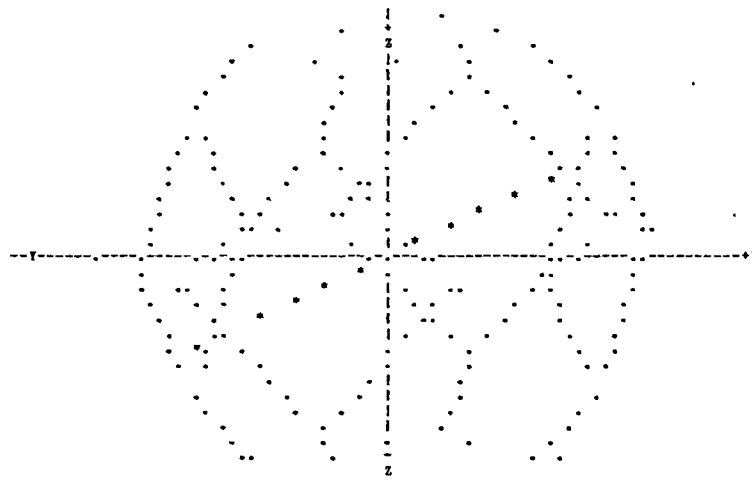
THE MAXIMUM IS: 1.2642946243 THE CONVERSION FACTOR FOR VIEWPLOT IS : 14.2371873856

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

-5.3755	7.4595	4.5906	-2.5065
-5.3755	7.4595	-15.3415	-2.5065
-5.3755	7.4595	-3.7628	12.4026
4.5906	-2.5065	-5.3755	-12.4725
4.5906	-2.5065	10.4744	-1.7546
-15.3415	-2.5065	-5.3755	-12.4725
-15.3415	-2.5065	-10.0000	-1.7546
-5.3755	-12.4725	-3.7628	-15.0917
5.3755	12.4725	15.3415	2.5065

```
( 5.3755 12.4725 )-----(-4.5906 2.5065 )
( 5.3755 12.4725 )-----(-3.7628 15.9917 )
( 15.3415 2.5065 )-----(-5.3755 -7.4595 )
( 15.3415 2.5065 )-----(-18.0000 1.7546 )
( -4.5906 2.5065 )-----(-5.3755 -7.4595 )
( -4.5906 2.5065 )-----(-10.4744 1.7546 )
( 5.3755 -7.4595 )-----(-3.7628 -12.4826 )
( 14.2372 9.9660 )-----(-10.4744 -1.7546 )
( 14.2372 9.9660 )-----(-10.0000 1.7546 )
( 14.2372 9.9660 )-----(-9.9660 14.2372 )
( 10.4744 -1.7546 )-----(-14.2372 -9.9660 )
( 18.0000 1.7546 )-----(-14.2372 -9.9660 )
( 14.2372 -9.9660 )-----(-9.9660 -14.2372 )
( -14.2372 9.9660 )-----(-10.4744 1.7546 )
( -14.2372 9.9660 )-----(-18.0000 -1.7546 )
( -14.2372 9.9660 )-----(-9.9660 14.2372 )
( -10.4744 1.7546 )-----(-14.2372 -9.9660 )
( -18.0000 -1.7546 )-----(-14.2372 -9.9660 )
( -14.2372 -9.9660 )-----(-9.9660 -14.2372 )
( 9.9660 14.2372 )-----(-3.7628 12.4826 )
( 9.9660 14.2372 )-----(-3.7628 15.9917 )
( -3.7628 12.4826 )-----(-9.9660 14.2372 )
( 3.7628 15.9917 )-----(-9.9660 14.2372 )
( 9.9660 -14.2372 )-----(-3.7628 -15.9917 )
( 9.9660 -14.2372 )-----(-3.7628 -12.4826 )
( -3.7628 -15.9917 )-----(-9.9660 -14.2372 )
( 3.7628 -12.4826 )-----(-9.9660 -14.2372 )
```

CRYSTAL SHAPE:



GALENA 3 : MASON AND BERRY, 1968, P. 229
ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 2 FORM(S).

NUMBER OF FACES OR MILLER INDICES = 14
MILLER INDICES :

```
1 0 0
-1 0 0
0 1 0
0 -1 0
0 0 1
0 0 -1
1 1 1
-1 1 1
-1 -1 1
1 -1 1
-1 1 -1
-1 -1 -1
1 -1 -1
```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```
1.0000 X + 0.0 Y + 0.0 Z = 1
-1.0000 X + 0.0 Y + 0.0 Z = -1
0.0 X + 1.0000 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + 0.0 Z = -1
0.0 X + 0.0 Y + 1.0000 Z = 1
0.0 X + 0.0 Y + -1.0000 Z = -1
0.7692 X + 0.7692 Y + 0.7692 Z = 1
-0.7692 X + 0.7692 Y + 0.7692 Z = -1
-0.7692 X + -0.7692 Y + 0.7692 Z = 1
0.7692 X + -0.7692 Y + 0.7692 Z = -1
0.7692 X + 0.7692 Y + -0.7692 Z = 1
-0.7692 X + 0.7692 Y + -0.7692 Z = -1
-0.7692 X + -0.7692 Y + -0.7692 Z = 1
0.7692 X + -0.7692 Y + -0.7692 Z = -1
```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```
( 1.0000 0.0 0.3000 )
( 1.0000 0.3000 0.0 )
( 1.0000 -0.3000 0.0 )
( 1.0000 0.0 -0.3000 )
( -1.0000 0.0 0.3000 )
( -1.0000 0.3000 0.0 )
( -1.0000 -0.3000 0.0 )
( -1.0000 0.0 -0.3000 )
( 0.0 1.0000 0.3000 )
( 0.3000 1.0000 0.0 )
( -0.3000 1.0000 0.0 )
( 0.0 1.0000 -0.3000 )
( 0.0 -1.0000 0.3000 )
( -0.3000 -1.0000 0.0 )
( 0.0 -1.0000 -0.3000 )
( 0.0 0.3000 1.0000 )
( 0.3000 0.0 1.0000 )
( -0.3000 0.0 1.0000 )
( 0.0 0.3000 -1.0000 )
( 0.3000 0.0 -1.0000 )
( -0.3000 0.0 -1.0000 )
( 0.0 -0.3000 1.0000 )
( -0.3000 0.3000 0.0 )
( 0.0 -0.3000 -1.0000 )
( -0.3000 -0.3000 0.0 )
( 0.0 -0.3000 1.0000 )
```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```
( 1.0000 0.0 0.3000 )-----(-1.0000 0.3000 0.0 )
( 1.0000 0.0 0.3000 )-----(-1.0000 -0.3000 0.0 )
( 1.0000 0.0 0.3000 )-----(-1.0000 0.0 1.0000 )
( 1.0000 0.3000 0.0 )-----(-1.0000 0.0 1.0000 )
( 1.0000 0.3000 0.0 )-----(-1.0000 0.3000 0.0 )
```

(	1.0000	-0.3000	0.0	)	-----	(	1.0000	0.0	-0.3000	)
(	1.0000	-0.3000	0.0	)	-----	(	0.3000	-1.0000	0.0	)
(	1.0000	0.0	-0.3000	)	-----	(	0.3000	0.0	-1.0000	)
(	-1.0000	0.0	0.3000	)	-----	(	-1.0000	0.3000	0.0	)
(	-1.0000	0.0	0.3000	)	-----	(	-1.0000	-0.3000	0.0	)
(	-1.0000	0.0	0.3000	)	-----	(	-0.3000	0.0	1.0000	)
(	-1.0000	0.3000	0.0	)	-----	(	-1.0000	0.0	-0.3000	)
(	-1.0000	0.3000	0.0	)	-----	(	-0.3000	1.0000	0.0	)
(	-1.0000	-0.3000	0.0	)	-----	(	-1.0000	0.0	-0.3000	)
(	-1.0000	-0.3000	0.0	)	-----	(	-0.3000	-1.0000	0.0	)
(	-1.0000	0.0	-0.3000	)	-----	(	-0.3000	0.0	-1.0000	)
(	0.0	1.0000	0.3000	)	-----	(	0.3000	1.0000	0.0	)
(	0.0	1.0000	0.3000	)	-----	(	-0.3000	1.0000	0.0	)
(	0.0	1.0000	0.3000	)	-----	(	0.0	0.3000	1.0000	)
(	0.3000	1.0000	0.0	)	-----	(	0.0	1.0000	-0.3000	)
(	-0.3000	1.0000	0.0	)	-----	(	0.0	1.0000	-0.3000	)
(	0.0	1.0000	-0.3000	)	-----	(	0.0	0.3000	-1.0000	)
(	0.0	-1.0000	0.3000	)	-----	(	-0.3000	-1.0000	0.0	)
(	0.0	-1.0000	0.3000	)	-----	(	0.3000	-1.0000	0.0	)
(	0.0	-1.0000	0.3000	)	-----	(	0.0	-0.3000	1.0000	)
(	-0.3000	-1.0000	0.0	)	-----	(	0.0	-1.0000	-0.3000	)
(	-0.3000	-1.0000	0.0	)	-----	(	0.0	-1.0000	-0.3000	)
(	0.0	-1.0000	-0.3000	)	-----	(	0.0	-0.3000	-1.0000	)
(	0.0	0.3000	1.0000	)	-----	(	0.3000	0.0	1.0000	)
(	0.0	0.3000	1.0000	)	-----	(	-0.3000	0.0	1.0000	)
(	0.3000	0.0	1.0000	)	-----	(	0.0	-0.3000	1.0000	)
(	-0.3000	0.0	1.0000	)	-----	(	0.0	-0.3000	1.0000	)
(	0.0	0.3000	-1.0000	)	-----	(	0.3000	0.0	-1.0000	)
(	0.0	0.3000	-1.0000	)	-----	(	-0.3000	0.0	-1.0000	)
(	0.3000	0.0	-1.0000	)	-----	(	0.0	-0.3000	-1.0000	)
(	-0.3000	0.0	-1.0000	)	-----	(	0.0	-0.3000	-1.0000	)

THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS : 900.0000

VERTICES

900.0000	0.0	269.9993
900.0000	269.9993	0.0
900.0000	-269.9993	0.0
900.0000	0.0	-269.9993
-900.0000	0.0	269.9993
-900.0000	269.9993	0.0
-900.0000	-269.9993	0.0
-900.0000	0.0	-269.9993
0.0	900.0000	269.9993
269.9993	900.0000	0.0
-269.9993	900.0000	0.0
0.0	900.0000	-269.9993
0.0	-900.0000	269.9993
-269.9993	-900.0000	0.0
269.9993	-900.0000	0.0
0.0	-900.0000	-269.9993
0.0	269.9993	900.0000
269.9993	0.0	900.0000
-269.9993	0.0	900.0000
0.0	-269.9993	900.0000
0.0	269.9993	-900.0000
269.9993	0.0	-900.0000
-269.9993	0.0	-900.0000
0.0	-269.9993	-900.0000

EDGES

1	2
1	3
1	18
2	4

2	10
3	4
3	15
4	22
5	6
5	7
5	19
6	8
6	11
7	8
7	14
8	23
9	10
9	11
9	17
10	12
11	12
12	21
13	14
13	15
13	20
14	16
15	16
16	24
17	18
17	19
18	20
19	20
21	22
21	23
22	24
23	24

FACES

1	2	4	3
5	6	8	7
9	10	12	11
13	14	16	15
17	18	20	19
21	22	24	23
1	2	10	9
5	6	11	9
5	7	14	13
1	3	15	13
2	4	22	21
6	8	23	21
7	8	23	24
3	4	22	24

THE MAXIMUM IS: 1.1132688522 THE CONVERSION FACTOR FOR VIEWPLOT IS : 16.1685943604

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

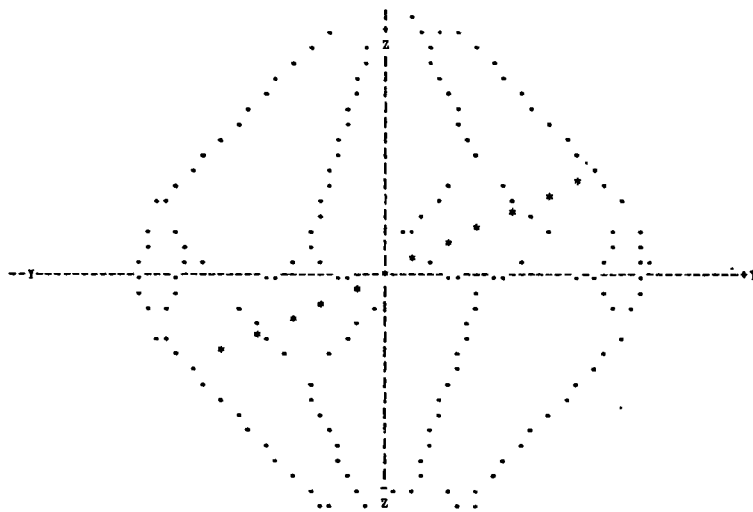
(	-6.1047	2.0040	)	-----	(	-1.2541	-2.8466	)
(	-6.1047	2.0040	)	-----	(	-10.9553	-2.8466	)
(	-6.1047	2.0040	)	-----	(	-1.8314	15.3146	)
(	-1.2541	-2.8466	)	-----	(	-6.1047	-7.6971	)
(	-1.2541	-2.8466	)	-----	(	14.3372	-0.8540	)
(	-10.9553	-2.8466	)	-----	(	-6.1047	-7.6971	)
(	-10.9553	-2.8466	)	-----	(	-10.0000	-0.8540	)
(	-6.1047	-7.6971	)	-----	(	-1.8314	-17.0226	)
(	6.1047	7.6971	)	-----	(	10.9553	2.8466	)
(	6.1047	7.6971	)	-----	(	1.2541	2.8466	)
(	6.1047	7.6971	)	-----	(	1.8314	17.0226	)
(	10.9553	2.8466	)	-----	(	6.1047	-2.0040	)
(	10.9553	2.8466	)	-----	(	10.0000	0.8540	)

```

( 1.2541 2.8466 )----- ( 6.1047 -2.0040 )
( 1.2541 2.8466 )----- ( -14.3372 0.8540 )
( 6.1047 -2.0040 )----- ( 1.8314 -15.3146 )
( 16.1686 4.8506 )----- ( 14.3372 -0.8540 )
( 16.1686 4.8506 )----- ( 18.0000 0.8540 )
( 16.1686 4.8506 )----- ( 4.8506 16.1686 )
( 14.3372 -0.8540 )----- ( 16.1686 -4.8506 )
( 18.0000 0.8540 )----- ( 16.1686 -4.8506 )
( 16.1686 -4.8506 )----- ( 4.8506 -16.1686 )
( -16.1686 4.8506 )----- ( -14.3372 0.8540 )
( -16.1686 4.8506 )----- ( -18.0000 -0.8540 )
( -16.1686 4.8506 )----- ( -4.8506 16.1686 )
( -14.3372 0.8540 )----- ( -16.1686 -4.8506 )
( -18.0000 -0.8540 )----- ( -16.1686 -4.8506 )
( -16.1686 -4.8506 )----- ( -4.8506 -16.1686 )
( 4.8506 16.1686 )----- ( -1.8314 15.3146 )
( 4.8506 16.1686 )----- ( 1.8314 17.0226 )
( -1.8314 15.3146 )----- ( -4.8506 16.1686 )
( 1.8314 17.0226 )----- ( -1.8314 -17.0226 )
( 4.8506 -16.1686 )----- ( 1.8314 -15.3146 )
( -1.8314 -17.0226 )----- ( -4.8506 -16.1686 )
( 1.8314 -15.3146 )----- ( -4.8506 -16.1686 )

```

CRYSTAL SHAPE:



GALENA 4 : MASON AND BERRY , 1968 , P. 229
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, , 1 FOPH(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

```

      1      1      1
     -1      1      1
     -1     -1      1
      1     -1      1
      1      1     -1
     -1      1     -1
     -1     -1     -1
      1     -1     -1

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

1.0000 X + 1.0000 Y + 1.0000 Z = 1
-1.0000 X + 1.0000 Y + 1.0000 Z = 1
-1.0000 X + -1.0000 Y + 1.0000 Z = 1
1.0000 X + -1.0000 Y + 1.0000 Z = -1
1.0000 X + 1.0000 Y + -1.0000 Z = 1
-1.0000 X + 1.0000 Y + -1.0000 Z = 1
-1.0000 X + -1.0000 Y + -1.0000 Z = 1
1.0000 X + -1.0000 Y + -1.0000 Z = 1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 0.0 0.0 1.0000 )
( 0.0 1.0000 0.0 )
( 1.0000 0.0 0.0 )
( -1.0000 0.0 0.0 )
( 0.0 -1.0000 0.0 )
( 0.0 0.0 -1.0000 )

```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 0.0 0.0 1.0000 )----- ( 0.0 1.0000 0.0 )
( 0.0 0.0 1.0000 )----- ( 1.0000 0.0 0.0 )
( 0.0 0.0 1.0000 )----- ( -1.0000 0.0 0.0 )
( 0.0 1.0000 0.0 )----- ( 0.0 0.0 1.0000 )
( 0.0 1.0000 0.0 )----- ( -1.0000 0.0 0.0 )
( 0.0 1.0000 0.0 )----- ( 0.0 0.0 -1.0000 )
( 1.0000 0.0 0.0 )----- ( 0.0 0.0 1.0000 )
( 1.0000 0.0 0.0 )----- ( 0.0 0.0 -1.0000 )
( -1.0000 0.0 0.0 )----- ( 0.0 0.0 1.0000 )
( -1.0000 0.0 0.0 )----- ( 0.0 0.0 -1.0000 )
( 0.0 -1.0000 0.0 )----- ( 0.0 0.0 1.0000 )
( 0.0 -1.0000 0.0 )----- ( 0.0 0.0 -1.0000 )

```

THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PINTER GRAPH IS : 900.0000

VERTICES

```

0.0 0.0 900.0000
0.0 900.0000 0.0
900.0000 0.0 0.0
-900.0000 0.0 0.0
0.0 -900.0000 0.0
0.0 0.0 -900.0000

```

EDGES

```

1 2
1 3
1 4
1 5
2 3
2 4
2 6
3 5
3 6
4 5
4 6
5 6

```

FACTS

```

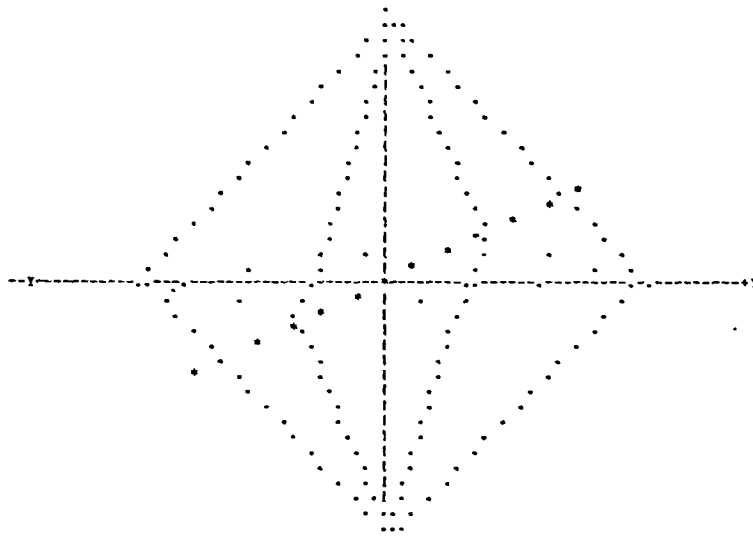
1 2 3
1 2 4
1 4 5

```


1 3 5
2 4 6
2 4 6
4 5 6
3 5 6
THE MAXIMUM IS:

1.0000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.0000000000
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
(0.0 18.0000)----- (18.0000 0.0)
(0.0 18.0000)----- (-6.7962 -3.1690)
(0.0 18.0000)----- (6.7962 3.1690)
(0.0 18.0000)----- (-18.0000 0.0)
(18.0000 0.0)----- (-6.7962 -3.1690)
(18.0000 0.0)----- (6.7962 3.1690)
(18.0000 0.0)----- (0.0 -18.0000)
(-6.7962 -3.1690)----- (-18.0000 0.0)
(-6.7962 -3.1690)----- (0.0 -18.0000)
(6.7962 3.1690)----- (-18.0000 0.0)
(6.7962 3.1690)----- (0.0 -18.0000)
(-18.0000 0.0)----- (0.0 -18.0000)

CRYSTAL SHAPE:



GARNET 1 : DANA'S MANUAL OF MINERALOGY, 17TH ED., P. 401
ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 1 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 12
MILLER INDICES :

0	1	1
1	0	1

Apdx. 2-b, p. 98

1	1	0
0	-1	1
-1	0	1
-1	1	0
0	1	-1
1	0	-1
1	-1	0
0	-1	-1
-1	0	-1
-1	-1	0

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

0.0 X + 1.0000 Y + 1.0000 Z = 1
1.0000 X + 0.0 Y + 1.0000 Z = 1
1.0000 X + 1.0000 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + 1.0000 Z = 1
-1.0000 X + 0.0 Y + 1.0000 Z = 1
-1.0000 X + 1.0000 Y + 0.0 Z = 1
0.0 X + 1.0000 Y + -1.0000 Z = 1
1.0000 X + 0.0 Y + -1.0000 Z = 1
1.0000 X + -1.0000 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + -1.0000 Z = 1
-1.0000 X + 0.0 Y + -1.0000 Z = 1
-1.0000 X + -1.0000 Y + 0.0 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(0.5000 0.5000 0.5000)	(0.0 0.0 1.0000)
(0.0 0.0 1.0000)	(0.0 1.0000 0.0)
(0.0 1.0000 0.0)	(1.0000 0.0 0.0)
(-0.5000 0.5000 0.5000)	(0.0 0.0 0.5000)
(1.0000 0.0 0.0)	(0.0 0.0 0.5000)
(0.5000 -0.5000 0.5000)	(0.5000 0.5000 -0.5000)
(0.5000 0.5000 -0.5000)	(-0.5000 0.5000 0.5000)
(-0.5000 0.0 0.0)	(0.0 0.0 0.0)
(-1.0000 0.0 0.0)	(0.0 0.0 0.0)
(-0.5000 0.5000 -0.5000)	(0.5000 -0.5000 0.5000)
(0.0 0.0 0.0)	(-1.0000 0.0 0.0)
(0.5000 -0.5000 0.5000)	(0.5000 0.5000 -0.5000)
(-0.5000 0.5000 0.5000)	(-0.5000 0.5000 -0.5000)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(0.5000 0.5000 0.5000)	(0.0 0.0 1.0000)
(0.5000 0.5000 0.5000)	(0.0 1.0000 0.0)
(0.5000 0.5000 0.5000)	(1.0000 0.0 0.0)
(0.0 0.0 1.0000)	(-0.5000 0.5000 0.5000)
(0.0 0.0 1.0000)	(0.5000 -0.5000 0.5000)
(0.0 0.0 1.0000)	(-0.5000 -0.5000 0.5000)
(0.0 1.0000 0.0)	(-0.5000 0.5000 0.5000)
(0.0 1.0000 0.0)	(0.5000 0.5000 -0.5000)
(0.0 1.0000 0.0)	(-0.5000 0.5000 -0.5000)
(-0.5000 0.5000 0.5000)	(-1.0000 0.0 0.0)
(1.0000 0.0 0.0)	(0.5000 -0.5000 0.5000)
(1.0000 0.0 0.0)	(0.5000 0.5000 -0.5000)
(1.0000 0.0 0.0)	(-0.5000 0.5000 -0.5000)
(0.5000 -0.5000 0.5000)	(0.0 -1.0000 0.0)
(0.5000 -0.5000 0.5000)	(0.0 0.0 -1.0000)
(-0.5000 -0.5000 0.5000)	(0.0 -1.0000 0.0)
(-0.5000 -0.5000 0.5000)	(-1.0000 0.0 0.0)
(0.0 -1.0000 0.0)	(0.5000 -0.5000 -0.5000)
(0.0 -1.0000 0.0)	(-0.5000 -0.5000 -0.5000)
(-1.0000 0.0 0.0)	(-0.5000 0.5000 -0.5000)
(-1.0000 0.0 0.0)	(0.5000 -0.5000 -0.5000)
(-0.5000 0.5000 -0.5000)	(0.0 0.0 -1.0000)
(0.0 0.0 -1.0000)	(0.5000 -0.5000 -0.5000)

THE MAXIMUM IS: (0.0 0.0 -1.0000)----- (-0.5000 -0.5000 -0.5000)
 1.0000 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 900.0000

VERTICES
 450.0000 450.0000 450.0000
 0.0 0.0 900.0000
 0.0 900.0000 0.0
 -450.0000 450.0000 450.0000
 900.0000 0.0 0.0
 450.0000 -450.0000 450.0000
 450.0000 450.0000 -450.0000
 -450.0000 -450.0000 450.0000
 0.0 -900.0000 0.0
 -900.0000 0.0 0.0
 -450.0000 450.0000 -450.0000
 0.0 0.0 -900.0000
 450.0000 -450.0000 -450.0000
 -450.0000 -450.0000 -450.0000

EDGES

1 2
 1 3
 1 5
 2 4
 2 6
 2 8
 3 4
 3 7
 3 11
 4 10
 5 6
 5 7
 5 13
 6 9
 7 12
 8 9
 8 10
 9 13
 9 14
 10 11
 10 14
 11 12
 12 13
 12 14

FACES

1 2 4 3
 1 2 6 5
 1 3 7 5
 2 6 9 8
 2 4 10 8
 3 4 10 11
 3 7 12 11
 5 7 12 13
 5 6 9 13
 9 13 12 14
 10 11 12 14
 8 9 14 10

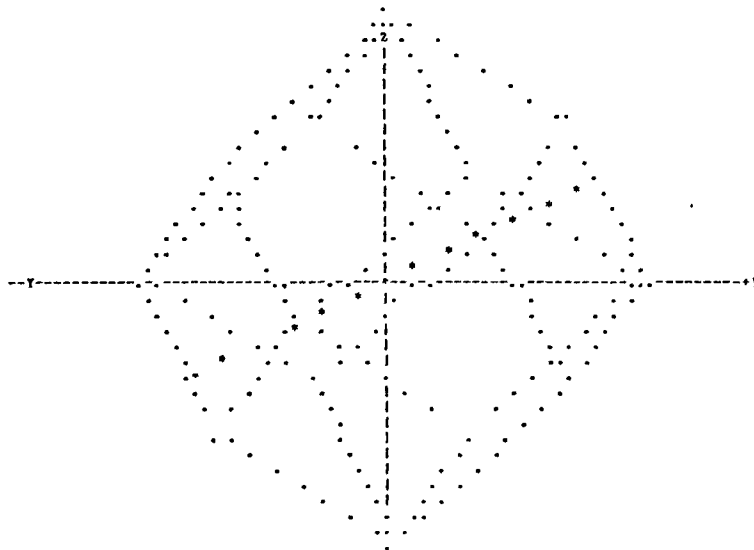
THE MAXIMUM IS: 1.0000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.0000000000

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
 (5.6019 7.4155)----- (0.0 18.0000)
 (5.6019 7.4155)----- (18.0000 0.0)
 (5.6019 7.4155)----- (-6.7962 -3.1690)
 (0.0 18.0000)----- (12.3981 10.5845)
 (0.0 18.0000)----- (-12.3981 7.4155)

Apdx. 2-b, p. 100

(0.0 18.0000)----- (-5.6019 10.5845)
 (18.0000 0.0)----- (12.3981 10.5845)
 (18.0000 0.0)----- (5.6019 -10.5845)
 (18.0000 0.0)----- (12.3981 -7.4155)
 (12.3981 10.5845)----- (6.7962 3.1690)
 (-6.7962 -3.1690)----- (-12.3981 7.4155)
 (-6.7962 -3.1690)----- (5.6019 -10.5845)
 (-6.7962 -3.1690)----- (-12.3981 -10.5845)
 (-12.3981 7.4155)----- (-18.0000 0.0)
 (5.6019 -10.5845)----- (0.0 -18.0000)
 (-5.6019 10.5845)----- (-18.0000 0.0)
 (-5.6019 10.5845)----- (6.7962 3.1690)
 (-18.0000 0.0)----- (-12.3981 -10.5845)
 (-18.0000 0.0)----- (-5.6019 -7.4155)
 (6.7962 3.1690)----- (12.3981 -7.4155)
 (6.7962 3.1690)----- (-5.6019 -7.4155)
 (12.3981 -7.4155)----- (0.0 -18.0000)
 (0.0 -18.0000)----- (-12.3981 -10.5845)
 (0.0 -18.0000)----- (-5.6019 -7.4155)

CRYSTAL SHAPE:



GARNET 2 : DANA'S MANUAL OF MINERALOGY, 17TH ED., P. 401
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 1 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 24
 MILLER INDICES :

1 -1 2
 -1 1 -2

1.0000	X +	-1.0000	Y +	2.0000	Z =	1
-1.0000	X +	1.0000	Y +	-2.0000	Z =	1
1.0000	X +	-2.0000	Y +	1.0000	Z =	1
-1.0000	X +	2.0000	Y +	-1.0000	Z =	1
1.0000	X +	-2.0000	Y +	-1.0000	Z =	1
-1.0000	X +	2.0000	Y +	1.0000	Z =	1
1.0000	X +	-1.0000	Y +	-2.0000	Z =	1
-1.0000	X +	1.0000	Y +	2.0000	Z =	1
1.0000	X +	1.0000	Y +	-2.0000	Z =	1
-1.0000	X +	-1.0000	Y +	2.0000	Z =	1
1.0000	X +	2.0000	Y +	-1.0000	Z =	1
-1.0000	X +	-2.0000	Y +	1.0000	Z =	1
1.0000	X +	2.0000	Y +	1.0000	Z =	1
-1.0000	X +	-2.0000	Y +	-1.0000	Z =	1
1.0000	X +	1.0000	Y +	2.0000	Z =	1
-1.0000	X +	-1.0000	Y +	-2.0000	Z =	1
2.0000	X +	-1.0000	Y +	1.0000	Z =	1
-2.0000	X +	1.0000	Y +	-1.0000	Z =	1
2.0000	X +	-1.0000	Y +	-1.0000	Z =	1
-2.0000	X +	1.0000	Y +	1.0000	Z =	1
2.0000	X +	1.0000	Y +	-1.0000	Z =	1
-2.0000	X +	-1.0000	Y +	1.0000	Z =	1
2.0000	X +	1.0000	Y +	1.0000	Z =	1
-2.0000	X +	-1.0000	Y +	-1.0000	Z =	1

Apdx. 2-b, p. 102

(	0.0	0.3333	0.3333	)
(	-0.2500	0.2500	0.2500	)
(	0.3333	0.0	-0.3333	)
(	-0.3333	0.0	0.3333	)
(	0.2500	0.2500	-0.2500	)
(	-0.2500	-0.2500	0.2500	)
(	0.3333	0.3333	0.0	)
(	-0.3333	-0.3333	0.0	)
(	0.2500	0.2500	0.2500	)
(	-0.2500	-0.2500	-0.2500	)
(	0.5000	0.0	0.0	)
(	-0.5000	0.0	0.0	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :									
0.0	-0.3333	0.3333	----	(	0.2500	-0.2500	0.2500	----	)
0.0	-0.3333	0.3333	----	(	0.0	0.0	0.5000	----	)
0.0	-0.3333	0.3333	----	(	0.0	-0.5000	0.0	----	)
0.0	-0.3333	0.3333	----	(	-0.2500	-0.2500	0.2500	----	)
0.2500	-0.2500	0.2500	----	(	0.3333	0.0	0.3333	----	)
0.2500	-0.2500	0.2500	----	(	0.3333	-0.3333	0.0	----	)
0.0	0.0	0.5000	----	(	0.3333	0.0	0.3333	----	)
0.0	0.0	0.5000	----	(	0.0	0.3333	0.3333	----	)
0.0	0.0	0.5000	----	(	-0.3333	0.0	0.3333	----	)
0.3333	0.0	0.3333	----	(	0.2500	0.2500	0.2500	----	)
0.3333	0.0	0.3333	----	(	0.5000	0.0	0.0	----	)
0.0	0.3333	-0.3333	----	(	-0.2500	0.2500	-0.2500	----	)
0.0	0.3333	-0.3333	----	(	0.0	0.0	-0.5000	----	)
0.0	0.3333	-0.3333	----	(	0.0	0.5000	0.0	----	)
0.0	0.3333	-0.3333	----	(	0.2500	0.2500	-0.2500	----	)
-0.2500	0.2500	-0.2500	----	(	-0.3333	0.0	-0.3333	----	)
-0.2500	0.2500	-0.2500	----	(	-0.3333	0.3333	0.0	----	)
0.0	0.0	-0.5000	----	(	-0.3333	0.0	-0.3333	----	)
0.0	0.0	-0.5000	----	(	0.0	-0.3333	-0.3333	----	)
0.0	0.0	-0.5000	----	(	0.3333	0.0	-0.3333	----	)
-0.3333	0.0	-0.3333	----	(	-0.2500	-0.2500	-0.2500	----	)
-0.3333	0.0	-0.3333	----	(	-0.5000	0.0	0.0	----	)
0.0	-0.5000	0.0	----	(	0.3333	-0.3333	0.0	----	)
0.0	-0.5000	0.0	----	(	-0.0	-0.3333	-0.3333	----	)
0.0	-0.5000	0.0	----	(	-0.3333	-0.3333	0.0	----	)
0.3333	-0.3333	0.0	----	(	0.2500	-0.2500	0.2500	----	)
0.3333	-0.3333	0.0	----	(	0.5000	0.0	0.0	----	)
0.0	0.5000	0.0	----	(	-0.3333	0.3333	0.0	----	)
0.0	0.5000	0.0	----	(	0.0	0.3333	0.3333	----	)
0.0	0.5000	0.0	----	(	0.3333	0.3333	0.0	----	)
-0.3333	0.3333	0.0	----	(	-0.2500	0.2500	0.2500	----	)
-0.3333	0.3333	0.0	----	(	-0.5000	0.0	0.0	----	)
0.0	-0.3333	-0.3333	----	(	0.2500	-0.2500	-0.2500	----	)
0.0	-0.3333	-0.3333	----	(	-0.2500	-0.2500	-0.2500	----	)
0.2500	-0.2500	-0.2500	----	(	0.3333	0.0	-0.3333	----	)
0.0	0.3333	0.3333	----	(	-0.2500	0.2500	0.2500	----	)
0.0	0.3333	0.3333	----	(	0.2500	0.2500	0.2500	----	)
-0.2500	0.2500	0.2500	----	(	-0.3333	0.0	0.3333	----	)
0.3333	0.0	-0.3333	----	(	0.2500	0.2500	-0.2500	----	)
0.3333	0.0	-0.3333	----	(	0.5000	0.0	0.0	----	)
-0.3333	0.0	0.3333	----	(	-0.2500	-0.2500	0.2500	----	)
-0.3333	0.0	0.3333	----	(	-0.5000	0.0	0.0	----	)
0.2500	0.2500	-0.2500	----	(	0.3333	0.3333	0.0	----	)
-0.2500	-0.2500	0.2500	----	(	-0.3333	-0.3333	0.0	----	)
0.3333	0.3333	0.0	----	(	0.2500	0.2500	0.2500	----	)
0.3333	0.3333	0.0	----	(	0.5000	0.0	0.0	----	)
-0.3333	-0.3333	0.0	----	(	-0.2500	-0.2500	-0.2500	----	)
-0.3333	-0.3333	0.0	----	(					

```

VERTICES
0.0 -599.9998 599.9998
450.0000 -450.0000 450.0000
0.0 0.0 900.0000
599.9998 0.0 599.9998
0.0 599.9998 -599.9998
-450.0000 450.0000 -450.0000
0.0 0.0 -900.0000
-599.9998 0.0 -599.9998
0.0 -900.0000 0.0
599.9998 -599.9998 0.0
0.0 900.0000 0.0
-599.9998 599.9998 0.0
0.0 -599.9998 -599.9998
450.0000 -450.0000 -450.0000
0.0 599.9998 599.9998
-450.0000 450.0000 450.0000
599.9998 0.0 -599.9998
-599.9998 0.0 599.9998
450.0000 450.0000 -450.0000
-450.0000 -450.0000 450.0000
599.9998 599.9998 0.0
-599.9998 -599.9998 0.0
450.0000 450.0000 450.0000
-450.0000 -450.0000 -450.0000
900.0000 0.0 0.0
-900.0000 0.0 0.0

```

```

EDGES
1 2
1 3
1 9
1 20
2 4
2 10
3 4
3 15
3 18
4 23
4 25
5 6
5 7
5 11
5 19
6 8
6 12
7 8
7 13
7 17
8 24
8 26
9 10
9 13
9 22
10 14
10 25
11 12
11 15
11 21
12 16
12 26
13 14
13 24

```

```

14 17
15 16
15 23
16 18
17 19
17 25
18 20
18 26
19 21
20 22
21 23
21 25
22 24
22 26

```

```

FACES
1 2 4 3
5 6 8 7
1 2 10 9
5 6 12 11
9 10 14 13
11 12 16 15
7 13 14 17
3 15 16 18
5 7 17 19
1 3 18 20
5 11 21 19
1 9 22 20
11 15 23 21
9 13 24 22
3 4 23 15
7 8 24 13
2 4 25 10
6 8 26 12
10 14 17 25
12 16 18 26
17 19 21 25
10 20 22 26
4 23 21 25
8 24 22 26

```

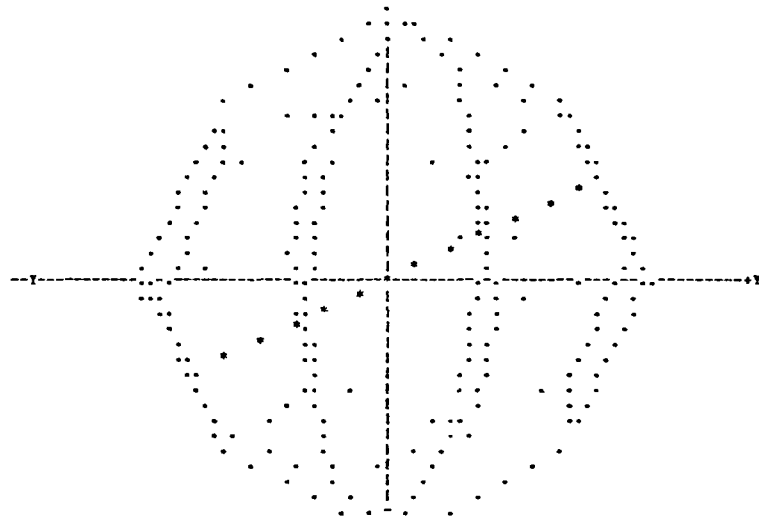
```

THE MAXIMUM IS: 0.5000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 36.0000000000
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( -12.0000 12.0000 )----- ( -12.3981 7.4155 )
( -12.0000 12.0000 )----- ( 0.0 18.0000 )
( -12.0000 12.0000 )----- ( -18.0000 0.0 )
( -12.0000 12.0000 )----- ( -5.6019 10.5845 )
( -12.3981 7.4155 )----- ( -4.5308 9.8873 )
( -12.3981 7.4155 )----- ( -16.5308 -2.1127 )
( 0.0 18.0000 )----- ( -4.5308 9.8873 )
( 0.0 18.0000 )----- ( 12.0000 12.0000 )
( 0.0 18.0000 )----- ( 4.5308 14.1127 )
( -4.5308 9.8873 )----- ( 5.6019 7.4155 )
( -4.5308 9.8873 )----- ( -6.7962 -3.1690 )
( 12.0000 -12.0000 )----- ( 12.3981 -7.4155 )
( 12.0000 -12.0000 )----- ( 0.0 -18.0000 )
( 12.0000 -12.0000 )----- ( 18.0000 0.0 )
( 12.0000 -12.0000 )----- ( 5.6019 -10.5845 )
( 12.3981 -7.4155 )----- ( 4.5308 -9.8873 )
( 12.3981 -7.4155 )----- ( 16.5308 2.1127 )
( 0.0 -18.0000 )----- ( 4.5308 -9.8873 )
( 0.0 -18.0000 )----- ( -12.0000 -12.0000 )
( 0.0 -18.0000 )----- ( -4.5308 -14.1127 )
( 4.5308 -9.8873 )----- ( -5.6019 -7.4155 )

```

CRYSTAL SHAPE:

(	4.5308	-9.4873	)	-----	(	6.7962	3.1690	)
(	-18.0000	0.0	)	-----	(	-16.5308	-2.1127	)
(	-18.0000	0.0	)	-----	(	-12.0000	-12.0000	)
(	-18.0000	0.0	)	-----	(	-7.4692	2.1127	)
(	-16.5308	-2.1127	)	-----	(	-12.3981	-10.5845	)
(	-16.5308	-2.1127	)	-----	(	-6.7962	-1.1690	)
(	18.0000	0.0	)	-----	(	16.5308	2.1127	)
(	18.0000	0.0	)	-----	(	12.0000	12.0000	)
(	18.0000	0.0	)	-----	(	7.4692	-2.1127	)
(	16.5308	2.1127	)	-----	(	12.3981	10.5845	)
(	16.5308	2.1127	)	-----	(	6.7962	3.1690	)
(	-12.0000	-12.0000	)	-----	(	-12.3981	-10.5845	)
(	-12.0000	-12.0000	)	-----	(	-5.6019	-7.4155	)
(	-12.3981	-10.5845	)	-----	(	-4.5308	-14.1127	)
(	12.0000	12.0000	)	-----	(	12.3981	10.5845	)
(	12.0000	12.0000	)	-----	(	5.6019	7.4155	)
(	12.3981	10.5845	)	-----	(	4.5308	14.1127	)
(	-4.5308	-14.1127	)	-----	(	5.6019	-10.5845	)
(	-4.5308	-14.1127	)	-----	(	-6.7962	-3.1690	)
(	4.5308	14.1127	)	-----	(	-5.6019	10.5845	)
(	4.5308	14.1127	)	-----	(	6.7962	3.1690	)
(	5.6019	-10.5845	)	-----	(	7.4692	-2.1127	)
(	-5.6019	10.5845	)	-----	(	-7.4692	2.1127	)
(	7.4692	-2.1127	)	-----	(	5.6019	7.4155	)
(	7.4692	-2.1127	)	-----	(	-6.7962	-3.1690	)
(	-7.4692	2.1127	)	-----	(	-5.6019	-7.4155	)
(	-7.4692	2.1127	)	-----	(	6.7962	3.1690	)



GARNET 3 : DANA'S MANUAL OF MINERALOGY, 17TH ED., P. 401
ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 2 FORM(S).
NUMBER OF FACES OF MILLER INDICES 36
MILLER INDICES :

1	-1	2
-1	1	-2
1	-2	1
-1	2	-1
1	-2	1
-1	2	-1
1	-1	-2
-1	1	2
1	1	-2
-1	-1	2
1	2	-1
-1	-2	1
1	2	1
-1	-2	-1
1	1	2
-1	-1	-2
2	-1	1
-2	1	-1
2	-1	-1
-2	1	1
2	-1	1
-2	-1	-1
2	-1	-1
0	1	1
1	0	1
-1	0	1
0	1	0
-1	0	1
1	0	-1
1	-1	0
0	-1	-1
-1	0	-1
-1	-1	0

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X +	-1.0000 Y +	2.0000 Z =	1
-1.0000 X +	1.0000 Y +	-2.0000 Z =	1
1.0000 X +	-2.0000 Y +	1.0000 Z =	1
-1.0000 X +	2.0000 Y +	-1.0000 Z =	1
1.0000 X +	-2.0000 Y +	-1.0000 Z =	1
-1.0000 X +	2.0000 Y +	1.0000 Z =	1
1.0000 Y +	-1.0000 Z +	-2.0000 X =	1
-1.0000 Y +	1.0000 Z +	2.0000 X =	1
1.0000 X +	1.0000 Y +	-2.0000 Z =	1
-1.0000 X +	-1.0000 Y +	2.0000 Z =	1
1.0000 X +	2.0000 Y +	-1.0000 Z =	1
-1.0000 X +	-2.0000 Y +	1.0000 Z =	1
1.0000 X +	-2.0000 Y +	-1.0000 Z =	1
-1.0000 X +	2.0000 Y +	-1.0000 Z =	1
1.0000 X +	1.0000 Y +	2.0000 Z =	1
-1.0000 X +	-1.0000 Y +	-2.0000 Z =	1
2.0000 Y +	-1.0000 Z +	1.0000 X =	1
-2.0000 Y +	1.0000 Z +	-1.0000 X =	1
2.0000 Y +	-1.0000 Z +	-1.0000 X =	1

Apdx. 2-b, p. 108

(	0.2500	0.2500	0.2500	)
(	0.0250	0.3250	0.3250	)
(	0.3250	0.3250	0.0250	)
(	-0.2500	-0.2500	-0.2500	)
(	-0.0250	-0.3250	-0.3250	)
(	-0.3250	-0.3250	-0.0250	)
(	0.3250	0.0250	0.3250	)
(	-0.3250	-0.0250	-0.3250	)
(	0.5000	0.0	0.0	)
(	0.3500	-0.3000	0.0	)
(	0.3500	0.0	0.3000	)
(	-0.5000	0.0	0.0	)
(	-0.3500	0.3000	0.0	)
(	-0.3500	0.0	-0.3000	)
(	0.3500	0.0	-0.3000	)
(	-0.3500	0.0	0.3000	)
(	0.3500	0.3000	0.0	)
(	-0.3500	-0.3000	0.0	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :								
(	0.2500	-0.2500	0.2500	(	0.0250	-0.3250	0.3250	)
(	0.2500	-0.2500	0.2500	(	0.3250	-0.0250	0.3250	)
(	0.2500	-0.2500	0.2500	(	0.3250	-0.3250	0.0250	)
(	0.0250	-0.3250	0.3250	(	0.0	-0.3000	0.3500	)
(	0.0250	-0.3250	0.3250	(	0.0	-0.3500	0.3000	)
(	0.0	0.0	0.5000	(	0.0	-0.3000	0.3500	)
(	0.0	0.0	0.5000	(	0.3000	0.0	0.3500	)
(	0.0	0.0	0.5000	(	-0.3000	0.0	0.3500	)
(	0.0	0.0	0.5000	(	0.0	0.3000	0.3500	)
(	0.0	-0.3000	0.3500	(	-0.0250	-0.3250	0.3250	)
(	0.3000	0.0	0.3500	(	0.3250	-0.0250	0.3250	)
(	0.3000	0.0	0.3500	(	0.3250	0.0250	0.3250	)
(	0.3250	-0.0250	0.3250	(	0.3500	0.0	0.3000	)
(	-0.2500	0.2500	-0.2500	(	-0.0250	0.3250	-0.3250	)
(	-0.2500	0.2500	-0.2500	(	-0.3250	0.0250	-0.3250	)
(	-0.2500	0.2500	-0.2500	(	-0.3250	0.3250	-0.0250	)
(	-0.0250	0.3250	-0.3250	(	0.0	0.3500	-0.3500	)
(	-0.0250	0.3250	-0.3250	(	0.0	0.3500	-0.3000	)
(	0.0	0.0	-0.5000	(	0.0	0.3000	-0.3500	)
(	0.0	0.0	-0.5000	(	-0.3000	0.0	-0.3500	)
(	0.0	0.0	-0.5000	(	0.3000	0.0	-0.3500	)
(	0.0	0.0	-0.5000	(	0.0	-0.3000	-0.3500	)
(	0.0	0.3000	-0.3500	(	0.0250	0.3250	-0.3250	)
(	-0.3000	0.0	-0.3500	(	0.3250	0.0250	-0.3250	)
(	-0.3000	0.0	-0.3500	(	-0.3250	-0.0250	-0.3250	)
(	-0.3250	0.0250	-0.3250	(	-0.3500	0.0	-0.3000	)
(	0.0	-0.5000	0.0	(	0.3000	-0.3500	0.0	)
(	0.0	-0.5000	0.0	(	0.0	-0.3500	0.3000	)
(	0.0	-0.5000	0.0	(	0.0	-0.3500	-0.3000	)
(	0.0	-0.5000	0.0	(	-0.3000	-0.3500	0.0	)
(	0.3000	-0.3500	0.0	(	0.1250	-0.1250	0.0250	)
(	0.3000	-0.3500	0.0	(	0.1250	-0.3250	-0.0250	)
(	0.3250	-0.3500	0.3000	(	-0.0250	-0.3250	0.3250	)
(	0.3250	-0.3500	0.0250	(	0.3500	-0.3000	0.0	)
(	0.0	0.5000	0.0	(	-0.3000	0.3500	0.0	)
(	0.0	0.5000	0.0	(	0.0	0.3500	-0.3000	)
(	0.0	0.5000	0.0	(	0.0	0.3500	0.3000	)
(	0.0	0.5000	0.0	(	0.0	0.3000	0.0	)
(	-0.3000	0.3500	0.0	(	-0.1250	0.1250	-0.0250	)
(	-0.3000	0.3500	0.0	(	-0.1250	0.3250	0.0250	)
(	0.0	0.3500	-0.3000	(	0.0250	0.3500	-0.1250	)
(	-0.1250	0.1250	-0.0250	(	0.0250	0.3000	0.0	)
(	-0.3500	-0.2500	-0.2500	(	-0.1500	-0.1250	-0.1250	)

(	0.2500	-0.2500	-0.2500	)	-----	(	0.3250	-0.3250	-0.0250	)
(	0.2500	-0.2500	-0.2500	)	-----	(	0.3250	-0.0250	-0.3250	)
(	0.0250	-0.3250	-0.1250	)	-----	(	0.0	-0.1500	-0.3000	)
(	0.0250	-0.1250	-0.1250	)	-----	(	0.0	-0.1000	-0.1500	)
(	0.0	-0.1500	-0.1000	)	-----	(	-0.0250	-0.1500	-0.3250	)
(	0.3250	-0.3250	-0.0250	)	-----	(	0.1500	-0.1000	0.0	)
(	-0.2500	0.2500	0.2500	)	-----	(	-0.0250	0.1250	0.1250	)
(	-0.2500	0.2500	0.2500	)	-----	(	-0.1250	0.3250	0.0250	)
(	-0.2500	0.2500	0.2500	)	-----	(	-0.3250	0.0750	0.3250	)
(	-0.0250	0.3250	0.3250	)	-----	(	0.0	0.1500	0.3000	)
(	-0.0250	0.3250	0.3250	)	-----	(	0.0	0.3000	0.3500	)
(	0.0	0.1500	0.3000	)	-----	(	0.0250	0.3250	0.3250	)
(	-0.3250	0.3250	0.0250	)	-----	(	-0.3500	0.3000	0.0	)
(	0.3000	0.0	-0.3500	)	-----	(	0.3250	-0.0250	-0.3250	)
(	0.3000	0.0	-0.3500	)	-----	(	0.3250	0.0750	-0.3250	)
(	0.0	-0.1000	-0.1500	)	-----	(	-0.0250	-0.3250	-0.3250	)
(	0.3250	-0.0250	-0.3250	)	-----	(	0.3500	0.0	-0.1000	)
(	-0.3000	0.0	0.3500	)	-----	(	-0.3250	0.0250	0.3250	)
(	-0.3000	0.0	0.1500	)	-----	(	-0.3250	-0.0250	0.3250	)
(	0.0	0.3000	0.3500	)	-----	(	0.0250	0.3250	0.3250	)
(	-0.3250	0.0250	0.3250	)	-----	(	-0.3500	0.0	0.3000	)
(	0.2500	0.2500	-0.2500	)	-----	(	0.0250	0.3250	-0.1250	)
(	0.2500	0.2500	-0.2500	)	-----	(	0.3250	0.0250	-0.3250	)
(	0.2500	0.2500	-0.2500	)	-----	(	0.3250	0.3250	-0.0250	)
(	0.3250	0.0250	-0.3250	)	-----	(	0.3500	0.0	-0.3000	)
(	-0.2500	-0.2500	0.2500	)	-----	(	-0.0250	-0.3250	0.3250	)
(	-0.2500	-0.2500	0.2500	)	-----	(	-0.3250	-0.0250	0.3250	)
(	-0.2500	-0.2500	0.2500	)	-----	(	-0.3250	-0.3250	0.0250	)
(	-0.3250	-0.0250	0.3250	)	-----	(	-0.3500	0.0	0.1000	)
(	0.3000	0.3500	0.0	)	-----	(	0.3250	0.3250	-0.0250	)
(	0.3000	0.3500	0.0	)	-----	(	0.3250	0.3250	0.0250	)
(	0.3250	0.3250	-0.0250	)	-----	(	0.3500	0.3000	0.0	)
(	-0.3000	-0.3500	0.0	)	-----	(	-0.3250	-0.3250	0.0250	)
(	-0.3000	-0.3500	0.0	)	-----	(	-0.3250	-0.1250	-0.0250	)
(	-0.3250	-0.3250	0.0250	)	-----	(	-0.3500	-0.1000	0.0	)
(	0.2500	0.2500	0.2500	)	-----	(	0.0250	0.3250	0.3250	)
(	0.2500	0.2500	0.2500	)	-----	(	0.3250	0.3250	0.0250	)
(	0.2500	0.2500	0.2500	)	-----	(	0.3250	0.0250	0.3250	)
(	0.3250	0.3250	0.0250	)	-----	(	0.3500	0.3000	0.0	)
(	-0.2500	-0.2500	-0.2500	)	-----	(	-0.0250	-0.3250	-0.3250	)
(	-0.2500	-0.2500	-0.2500	)	-----	(	-0.3250	-0.3250	-0.0250	)
(	-0.2500	-0.2500	-0.2500	)	-----	(	-0.3250	-0.0250	-0.3250	)
(	-0.3250	-0.3250	-0.0250	)	-----	(	-0.3500	-0.3000	0.0	)
(	0.3250	0.0250	0.3250	)	-----	(	0.3500	0.0	0.3000	)
(	-0.3250	-0.0250	-0.3250	)	-----	(	-0.3500	0.0	-0.3000	)
(	0.5000	0.0	0.0	)	-----	(	0.3500	-0.3000	0.0	)
(	0.5000	0.0	0.0	)	-----	(	0.3500	0.0	0.3000	)
(	0.5000	0.0	0.0	)	-----	(	0.3500	0.0	-0.3000	)
(	0.5000	0.0	0.0	)	-----	(	0.3500	0.3000	0.0	)
(	-0.5000	0.0	0.0	)	-----	(	-0.3500	0.3000	0.0	)
(	-0.5000	0.0	0.0	)	-----	(	-0.3500	0.0	-0.3000	)
(	-0.5000	0.0	0.0	)	-----	(	-0.3500	0.0	0.3000	)
(	-0.5000	0.0	0.0	)	-----	(	-0.3500	-0.3000	0.0	)

THE MAXIMUM IS: 0.5000 THE CONVERSION FACTOR FOR THE PPIINTER GRAPH IS : 1800.0000

VERTICES

450.0000	-450.0000	450.0000
44.9991	-585.0002	585.0002
0.0	0.0	900.0000
0.0	-540.0010	629.9993
540.0010	0.0	629.9993
585.0002	-44.9991	585.0002
-450.0000	450.0000	-450.0000

-44.9991	585.0002	-585.0002
0.0	0.0	-900.0000
0.0	540.0010	-629.9993
-540.0010	0.0	-629.9993
-585.0002	44.9991	-585.0002
0.0	-900.0000	0.0
540.0010	-629.9993	0.0
0.0	-629.9993	540.0010
585.0002	-585.0002	44.9991
0.0	900.0000	0.0
-540.0010	629.9993	0.0
0.0	629.9993	-540.0010
-585.0002	585.0002	-44.9991
450.0000	-450.0000	-450.0000
44.9991	-585.0002	-585.0002
0.0	-629.9993	-540.0010
585.0002	-585.0002	-44.9991
-450.0000	450.0000	450.0000
-44.9991	585.0002	515.0002
0.0	629.9993	540.0010
-585.0002	585.0002	44.9991
540.0010	0.0	-629.9993
0.0	-540.0010	-629.9993
585.0002	-44.9991	-585.0002
-540.0010	0.0	629.9993
0.0	540.0010	629.9993
-585.0002	44.9991	585.0002
450.0000	450.0000	-450.0000
44.9991	585.0002	-585.0002
585.0002	44.9991	-585.0002
-450.0000	-450.0000	450.0000
-44.9991	-585.0002	585.0002
-585.0002	-44.9991	585.0002
540.0010	629.9993	0.0
585.0002	585.0002	-44.9991
-540.0010	-629.9993	0.0
-585.0002	-585.0002	44.9991
450.0000	450.0000	450.0000
44.9991	585.0002	585.0002
585.0002	585.0002	44.9991
-450.0000	-450.0000	-450.0000
-44.9991	-585.0002	-585.0002
-585.0002	-585.0002	-44.9991
585.0002	44.9991	585.0002
-585.0002	-44.9991	-585.0002
900.0000	0.0	0.0
629.9993	-540.0010	0.0
629.9993	0.0	540.0010
-900.0000	0.0	0.0
-629.9993	540.0010	0.0
-629.9993	0.0	-540.0010
629.9993	0.0	-540.0010
-629.9993	0.0	540.0010
629.9993	540.0010	0.0
-629.9993	-540.0010	0.0

EDGES

1	2
1	6
1	16
2	4
2	15
3	4

1 5
 3 32
 3 33
 4 39
 5 6
 5 51
 6 55
 7 8
 7 12
 7 20
 8 10
 8 19
 9 10
 9 11
 9 29
 9 30
 10 36
 11 12
 11 52
 12 58
 13 14
 13 15
 13 23
 13 43
 14 16
 14 24
 15 39
 16 54
 17 18
 17 19
 17 27
 17 41
 18 20
 18 28
 19 36
 20 57
 21 22
 21 24
 21 31
 22 23
 22 30
 23 49
 24 54
 25 26
 25 28
 25 34
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 26 33
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 28 57
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 29 37
 30 49
 31 59
 32 34
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 33 46
 34 60
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 35 42
 37 59

38 39
 38 40
 38 44
 40 60
 41 42
 41 47
 42 61
 43 44
 43 50
 44 62
 45 46
 45 47
 45 51
 47 61
 48 49
 48 50
 48 52
 50 62
 51 55
 52 58
 53 54
 53 55
 53 59
 53 61
 56 57
 56 58
 56 60
 56 62
 FACES
 1 2 4 3 5 6
 7 8 10 9 11 12
 1 2 15 13 14 16
 7 8 19 17 18 20
 13 14 24 21 22 23
 17 18 28 25 26 27
 9 29 31 21 22 30
 3 32 34 25 26 33
 9 10 36 35 37 29
 3 4 39 38 40 32
 17 19 36 35 42 41
 13 15 39 38 44 43
 17 27 46 45 47 41
 13 23 49 48 50 43
 3 5 51 45 46 33
 9 11 52 48 49 30
 1 6 55 53 54 16
 7 12 58 56 57 20
 21 24 54 53 59 31
 25 28 57 56 60 34
 35 37 59 53 61 42
 38 40 60 56 62 44
 45 47 61 53 55 51
 48 50 62 56 58 52
 26 27 46 33
 5 6 55 51
 41 42 61 47
 2 4 39 15
 32 34 60 40
 18 20 57 28
 8 10 36 19
 29 31 59 37
 14 16 54 24

22 23 49 30
11 12 58 52
43 44 62 50
THE MAXIMUM IS:

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0.5000000000 THE CONVERSION FACTOR FOR VIPWLOT IS : 36.0000000000

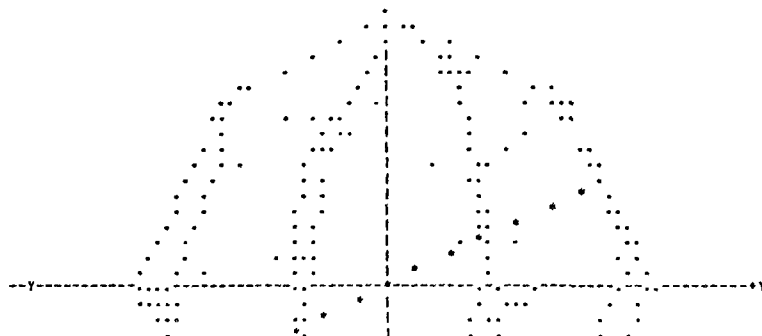
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

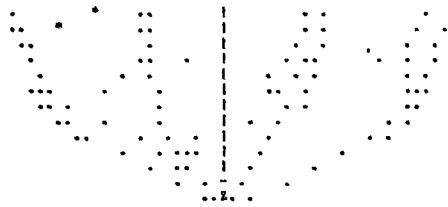
(-12.3981 7.4155)	(-12.0398 11.5416)
(-12.3981 7.4155)	(-5.3175 9.6402)
(-12.3981 7.4155)	(-16.1175 -1.1599)
(-12.0398 11.5416)	(-10.8000 12.6000)
(-12.0398 11.5416)	(-12.6000 10.8000)
(0.0 18.0000)	(-10.8000 12.6000)
(0.0 18.0000)	(-4.0777 10.6986)
(0.0 18.0000)	(4.0777 14.5014)
(0.0 18.0000)	(-10.8000 12.6000)
(-10.8000 12.6000)	(-11.3602 11.8585)
(-4.0777 10.6986)	(-5.3175 9.6402)
(-4.0777 10.6986)	(-3.5175 9.6402)
(-5.3175 9.6402)	(-4.7573 8.5817)
(12.3981 -7.4155)	(-12.0398 -11.5416)
(12.3981 -7.4155)	(5.3175 -9.6402)
(12.3981 -7.4155)	(16.1175 -1.1599)
(12.0398 -11.5416)	(10.8000 -12.6000)
(12.0398 -11.5416)	(12.6000 -10.8000)
(0.0 -18.0000)	(10.8000 -12.6000)
(0.0 -18.0000)	(4.0777 -10.6986)
(0.0 -18.0000)	(-4.0777 -14.5014)
(0.0 -18.0000)	(-10.8000 -12.6000)
(10.8000 -12.6000)	(11.3602 -11.8585)
(4.0777 -10.6986)	(5.3175 -9.6402)
(4.0777 -10.6986)	(3.5175 -9.6402)
(5.3175 -9.6402)	(4.7573 -8.5817)
(-18.0000 0.0)	(-16.6777 -1.9014)
(-18.0000 0.0)	(-12.6000 10.8000)
(-18.0000 0.0)	(-12.6000 -10.8000)
(-18.0000 0.0)	(-8.5223 1.9014)
(-16.6777 -1.9014)	(-16.1175 -1.1599)
(-16.6777 -1.9014)	(-16.1175 -2.9598)
(-12.6000 10.8000)	(-11.3602 11.8585)
(-16.1175 -1.1599)	(-15.5573 -2.2183)
(18.0000 0.0)	(16.6777 1.9014)
(18.0000 0.0)	(12.6000 -10.8000)
(18.0000 0.0)	(12.6000 10.8000)
(18.0000 0.0)	(8.5223 -1.9014)
(16.6777 1.9014)	(16.1175 1.1599)
(16.6777 1.9014)	(16.1175 2.9598)
(12.6000 -10.8000)	(11.3602 -11.8585)
(16.1175 1.1599)	(15.5573 2.2183)
(-12.3981 -10.5845)	(-12.0398 -11.8585)
(-12.3981 -10.5845)	(-16.1175 -2.9598)
(-12.3981 -10.5845)	(-5.3175 -13.7598)
(-12.0398 -11.8585)	(-12.6000 -10.8000)
(-12.0398 -11.8585)	(-10.8000 -12.6000)
(-12.6000 -10.8000)	(-11.3602 -11.5416)
(-16.1175 -2.9598)	(-15.5573 -2.2183)
(12.3981 10.5845)	(12.0398 11.8585)
(12.3981 10.5845)	(16.1175 2.9598)
(12.3981 10.5845)	(5.3175 13.7598)
(12.0398 11.8585)	(12.6000 10.8000)
(12.0398 11.8585)	(10.8000 12.6000)
(12.6000 10.8000)	(11.3602 11.5416)
(16.1175 2.9598)	(15.5573 2.2183)
(-4.0777 -14.5014)	(-5.3175 -13.7598)

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(-4.0777 -14.5014)	(-3.5175 -13.7598)
(-10.8000 -12.6000)	(-11.3602 -11.5416)
(-5.3175 -13.7598)	(-4.7573 -13.0183)
(4.0777 14.5014)	(5.3175 13.7598)
(4.0777 14.5014)	(3.5175 13.7598)
(10.8000 12.6000)	(11.3602 11.5416)
(5.3175 13.7598)	(4.7573 13.0183)
(5.6019 -10.5845)	(11.3602 -11.8585)
(5.6019 -10.5845)	(-3.5175 -13.7598)
(5.6019 -10.5845)	(7.2825 -2.9598)
(-3.5175 -13.7598)	(-4.7573 -13.0183)
(-5.6019 10.5845)	(-11.3602 11.8585)
(-5.6019 10.5845)	(3.5175 13.7598)
(-5.6019 10.5845)	(7.2825 2.9598)
(3.5175 13.7598)	(4.7573 13.0183)
(8.5223 -1.9014)	(7.2825 -2.9598)
(8.5223 -1.9014)	(7.2825 -1.1599)
(7.2825 -2.9598)	(6.0427 -2.2183)
(-8.5223 1.9014)	(-7.2825 2.9598)
(-8.5223 1.9014)	(-7.2825 1.1599)
(-7.2825 2.9598)	(-6.0427 2.2183)
(5.6019 7.4155)	(11.3602 11.5416)
(5.6019 7.4155)	(7.2825 -1.1599)
(5.6019 7.4155)	(-3.5175 9.6402)
(7.2825 -1.1599)	(6.0427 -2.2183)
(-5.6019 -7.4155)	(-11.3602 -11.5416)
(-5.6019 -7.4155)	(7.2825 1.1599)
(-5.6019 -7.4155)	(3.5175 -9.6402)
(-7.2825 1.1599)	(-6.0427 2.2183)
(-3.5175 9.6402)	(-4.7573 8.5817)
(3.5175 -9.6402)	(4.7573 -8.5817)
(-6.7962 -3.1690)	(-15.5573 -2.2183)
(-6.7962 -3.1690)	(-4.7573 8.5817)
(-6.7962 -3.1690)	(-4.7573 -13.0183)
(-6.7962 -3.1690)	(6.0427 -2.2183)
(6.7962 3.1690)	(15.5573 2.2183)
(6.7962 3.1690)	(4.7573 -8.5817)
(6.7962 3.1690)	(4.7573 13.0183)
(6.7962 3.1690)	(-6.0427 2.2183)

CRYSTAL SHAPE:





GARNET 4 : DANA'S MANUAL OF MINERALOGY, 17TH ED., P. 401
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 2 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 36
 MILLER INDICES :

1	-1	2
-1	1	-2
1	-2	1
-1	2	-1
1	-2	-1
-1	2	1
1	-1	-2
-1	1	2
1	1	-2
-1	-1	2
1	2	-1
-1	-2	1
1	2	1
-1	-2	-1
1	1	2
-1	-1	-2
2	-1	1
-2	1	-1
2	-1	-1
-2	1	1
2	-1	-1
-2	1	1
2	-1	1
-2	1	-1
0	1	1
1	0	1
1	1	0
0	-1	1
-1	0	1
-1	1	0
0	1	-1
1	0	-1
1	-1	0
0	-1	-1
-1	0	-1
-1	-1	0

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

0.5000 X +	-0.5000 Y +	1.0000 Z =	1
-0.5000 X +	0.5000 Y +	-1.0000 Z =	1
0.5000 X +	-1.0000 Y +	0.5000 Z =	1
-0.5000 X +	1.0000 Y +	-0.5000 Z =	1
0.5000 X +	-1.0000 Y +	-0.5000 Z =	1
-0.5000 X +	1.0000 Y +	0.5000 Z =	1
0.5000 X +	-0.5000 Y +	-1.0000 Z =	1

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-0.5000 X +	0.5000 Y +	1.0000 Z =	1
0.5000 X +	0.5000 Y +	-1.0000 Z =	1
-0.5000 X +	-0.5000 Y +	1.0000 Z =	1
0.5000 X +	1.0000 Y +	-0.5000 Z =	1
-0.5000 X +	-1.0000 Y +	0.5000 Z =	1
0.5000 X +	1.0000 Y +	0.5000 Z =	1
-0.5000 X +	-1.0000 Y +	-0.5000 Z =	1
0.5000 X +	0.5000 Y +	1.0000 Z =	1
-0.5000 X +	-0.5000 Y +	-1.0000 Z =	1
1.0000 X +	-0.5000 Y +	0.5000 Z =	1
-1.0000 X +	0.5000 Y +	-0.5000 Z =	1
1.0000 X +	-0.5000 Y +	-0.5000 Z =	1
-1.0000 X +	0.5000 Y +	0.5000 Z =	1
1.0000 X +	0.5000 Y +	-0.5000 Z =	1
-1.0000 X +	-0.5000 Y +	0.5000 Z =	1
1.0000 X +	0.5000 Y +	0.5000 Z =	1
-1.0000 X +	-0.5000 Y +	-0.5000 Z =	1
0.0 X +	0.9091 Y +	0.9091 Z =	1
0.9091 X +	0.0 Y +	0.9091 Z =	1
0.9091 X +	0.9091 Y +	0.0 Z =	1
0.0 X +	-0.9091 Y +	0.9091 Z =	1
-0.9091 X +	0.0 Y +	0.9091 Z =	1
-0.9091 X +	0.9091 Y +	0.0 Z =	1
0.0 X +	0.9091 Y +	-0.9091 Z =	1
0.9091 X +	0.0 Y +	-0.9091 Z =	1
0.9091 X +	-0.9091 Y +	0.0 Z =	1
0.0 X +	-0.9091 Y +	-0.9091 Z =	1
-0.9091 X +	0.0 Y +	-0.9091 Z =	1
-0.9091 X +	-0.9091 Y +	0.0 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5000	-0.5000	0.5000	)
(	0.3500	-0.5500	0.5500	)
(	0.0	0.0	1.0000	)
(	0.0	-0.2000	0.9000	)
(	0.2000	0.0	0.9000	)
(	0.5500	-0.3500	0.5500	)
(	-0.5000	0.5000	-0.5000	)
(	-0.3500	0.5500	-0.5500	)
(	0.0	0.0	-1.0000	)
(	0.0	0.2000	-0.9000	)
(	-0.2000	0.0	-0.9000	)
(	-0.5500	0.3500	-0.5500	)
(	0.0	-1.0000	0.0	)
(	0.2000	-0.9000	0.0	)
(	0.0	-0.9000	0.2000	)
(	0.5500	-0.5500	0.3500	)
(	0.0	1.0000	0.0	)
(	-0.2000	0.9000	0.0	)
(	0.0	0.9000	-0.2000	)
(	-0.5500	0.5500	-0.3500	)
(	0.5000	-0.5000	-0.5000	)
(	0.3500	-0.5500	-0.5500	)
(	0.0	-0.9000	-0.2000	)
(	0.5500	-0.5500	-0.3500	)
(	-0.5000	0.5000	0.5000	)
(	-0.3500	0.5500	0.5500	)
(	0.0	0.9000	0.2000	)
(	-0.5500	0.5500	0.3500	)
(	0.2000	0.0	-0.9000	)
(	0.0	-0.2000	-0.9000	)
(	0.5500	-0.3500	-0.5500	)
(	-0.5000	0.0	0.5000	)

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(0.2000	-0.9000	0.0	)	-----	(0.5500	-0.5500	-0.3500	)
(0.0	-0.9000	0.2000	)	-----	(-0.3500	-0.5500	0.5500	)
(0.5500	-0.5500	0.3500	)	-----	(0.9000	-0.2000	0.0	)
(0.0	1.0000	0.0	)	-----	(-0.2000	0.9000	0.0	)
(0.0	1.0000	0.0	)	-----	(0.0	0.9000	-0.2000	)
(0.0	1.0000	0.0	)	-----	(0.0	0.9000	0.2000	)
(0.0	1.0000	0.0	)	-----	(0.2000	0.9000	0.0	)
(-0.2000	0.9000	0.0	)	-----	(-0.5500	0.5500	-0.3500	)
(-0.2000	0.9000	0.0	)	-----	(-0.5500	0.5500	0.3500	)
(0.0	0.9000	-0.2000	)	-----	(0.3500	0.5500	-0.5500	)
(-0.5500	0.5500	-0.3500	)	-----	(-0.9000	0.2000	0.0	)
(0.5000	-0.5000	-0.5000	)	-----	(0.3500	-0.5500	-0.5500	)
(0.5000	-0.5000	-0.5000	)	-----	(0.5500	-0.5500	-0.3500	)
(0.5000	-0.5000	-0.5000	)	-----	(0.5500	-0.3500	-0.5500	)
(0.3500	-0.5500	-0.5500	)	-----	(0.0	-0.9000	-0.2000	)
(0.3500	-0.5500	-0.5500	)	-----	(0.0	-0.2000	-0.9000	)
(0.0	-0.9000	-0.2000	)	-----	(-0.3500	-0.5500	-0.5500	)
(0.5500	-0.5500	-0.3500	)	-----	(0.9000	-0.2000	0.0	)
(-0.5000	0.5000	0.5000	)	-----	(-0.3500	0.5500	0.5500	)
(-0.5000	0.5000	0.5000	)	-----	(0.5500	0.5500	0.3500	)
(-0.5000	0.5000	0.5000	)	-----	(-0.5500	0.5500	0.5500	)
(-0.3500	0.5500	0.5500	)	-----	(0.0	0.9000	0.2000	)
(-0.3500	0.5500	0.5500	)	-----	(0.0	0.2000	0.9000	)
(0.0	0.9000	0.2000	)	-----	(0.3500	0.5500	0.5500	)
(-0.5500	0.5500	0.3500	)	-----	(-0.9000	0.2000	0.0	)
(0.2000	0.0	-0.9000	)	-----	(0.5500	-0.3500	-0.5500	)
(0.2000	0.0	-0.9000	)	-----	(0.5500	0.3500	-0.5500	)
(0.0	-0.2000	-0.9000	)	-----	(-0.3500	-0.5500	-0.5500	)
(0.5500	-0.3500	-0.5500	)	-----	(0.9000	0.0	-0.2000	)
(-0.2000	0.0	0.9000	)	-----	(-0.5500	0.3500	0.5500	)
(-0.2000	0.0	0.9000	)	-----	(-0.5500	-0.3500	0.5500	)
(0.0	0.2000	0.9000	)	-----	(0.3500	0.5500	0.5500	)
(-0.5500	0.3500	0.5500	)	-----	(-0.9000	0.0	0.2000	)
(0.5000	0.5000	-0.5000	)	-----	(0.3500	0.5500	-0.5500	)
(0.5000	0.5000	-0.5000	)	-----	(0.5500	0.3500	-0.5500	)
(0.5000	0.5000	-0.5000	)	-----	(0.5500	0.5500	-0.3500	)
(0.5500	0.3500	-0.5500	)	-----	(0.9000	0.0	-0.2000	)
(-0.5000	-0.5000	0.5000	)	-----	(-0.3500	-0.5500	0.5500	)
(-0.5000	-0.5000	0.5000	)	-----	(-0.5500	-0.3500	0.5500	)
(-0.5000	-0.5000	0.5000	)	-----	(-0.5500	-0.5500	0.3500	)
(-0.5500	-0.3500	0.5500	)	-----	(-0.7000	0.0	0.2000	)
(0.2000	0.9000	0.0	)	-----	(0.5500	0.5500	-0.3500	)
(0.2000	0.9000	0.0	)	-----	(0.5500	0.5500	0.3500	)
(0.5500	0.5500	-0.3500	)	-----	(0.9000	0.2000	0.0	)
(-0.2000	-0.9000	0.0	)	-----	(-0.5500	-0.5500	0.3500	)
(-0.2000	-0.9000	0.0	)	-----	(-0.5500	-0.5500	-0.3500	)
(-0.5000	-0.5000	0.5000	)	-----	(-0.9000	-0.2000	0.0	)
(0.5000	0.5000	0.5000	)	-----	(0.3500	0.5500	0.5500	)

	{	-1.0000	0.0	0.0	}	-----	{	-0.9000	0.0		-0.2000	}
	{	-1.0000	0.0	0.0	}	-----	{	-0.9000	0.0		0.2000	}
	{	-1.0000	0.0	0.0	}	-----	{	-0.9000	-0.2000		0.0	}
THE MAXIMUM IS:		1.0000				THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :					900.0000	

VERTICES

450.0000	-450.0000	450.0000
315.0005	-494.9995	494.9995
0.0	0.0	900.0000
0.0	-179.9990	810.0002
179.9990	0.0	810.0002
494.9995	-315.0005	494.9995
-450.0000	450.0000	-450.0000
-315.0005	494.9995	-494.9995
0.0	0.0	-900.0000
0.0	179.9990	-810.0002
-179.9990	0.0	-810.0002
-494.9995	315.0005	-494.9995
0.0	-900.0000	0.0
179.9990	-810.0002	0.0
0.0	-810.0002	179.9990
494.9995	-494.9995	315.0005
0.0	900.0000	0.0
-179.9990	810.0002	0.0
0.0	810.0002	-179.9990
-494.9995	494.9995	-315.0005
450.0000	-450.0000	-450.0000
315.0005	-494.9995	-494.9995
0.0	-810.0002	-179.9990
494.9995	-494.9995	-315.0005
-450.0000	450.0000	450.0000
-315.0005	494.9995	494.9995
0.0	810.0002	179.9990
-494.9995	494.9995	315.0005
179.9990	0.0	-810.0002
0.0	-179.9990	-810.0002
494.9995	-315.0005	-494.9995
-179.9990	0.0	810.0002
0.0	179.9990	810.0002
-494.9995	315.0005	494.9995
450.0000	450.0000	-450.0000
315.0005	494.9995	-494.9995
494.9995	315.0005	-494.9995
-450.0000	-450.0000	450.0000
-315.0005	-494.9995	494.9995
-494.9995	-315.0005	494.9995
179.9990	810.0002	0.0
494.9995	494.9995	-315.0005
-179.9990	-810.0002	0.0
-494.9995	-494.9995	315.0005
450.0000	450.0000	450.0000
315.0005	494.9995	494.9995
494.9995	494.9995	315.0005
-450.0000	-450.0000	-450.0000
-315.0005	-494.9995	-494.9995
-494.9995	-494.9995	-315.0005
494.9995	315.0005	494.9995
-494.9995	-315.0005	-494.9995
900.0000	0.0	0.0
810.0002	-179.9990	0.0
810.0002	0.0	179.9990
-900.0000	0.0	0.0
-810.0002	179.9990	0.0

-810.0002	0.0	-179.9990
810.0002	0.0	-179.9990
-810.0002	0.0	179.9990
810.0002	179.9990	0.0
-810.0002	-179.9990	0.0

EDGES

1	2
1	6
1	16
2	4
2	15
3	4
3	5
3	32
3	33
4	39
5	6
5	51
6	55
7	8
7	12
7	20
8	10
8	19
9	10
9	11
9	29
9	30
10	36
11	12
11	52
12	58
13	14
13	15
13	23
13	43
14	16
14	24
15	39
16	54
17	18
17	19
17	27
17	41
18	20
18	28
19	36
20	57
21	22
21	24
21	31
22	23
22	30
23	49
24	54
25	26
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26	27
26	33
27	46
28	57

29 31
29 37
30 49
31 59
32 34
32 40
33 46
34 60
35 36
35 37
35 42
37 59
38 39
38 40
38 44
40 60
41 42
41 47
42 61
43 44
43 50
44 62
45 46
45 47
45 51
47 61
48 49
48 50
48 52
50 62
51 55
52 58
53 54
53 55
53 59
53 61
56 57
56 58
56 60
56 62

FACES

1	2	4	3	5	6
7	8	10	9	11	12
1	2	15	13	14	16
7	8	19	17	18	20
13	14	24	21	22	23
17	18	28	25	26	27
9	29	31	21	22	30
3	32	34	25	26	33
9	10	36	35	37	29
3	4	39	38	40	32
17	19	36	35	42	41
13	15	39	38	44	43
17	27	46	45	47	41
13	23	49	48	50	43
3	5	51	45	46	33
9	11	52	48	49	30
1	6	55	53	54	16
7	12	58	56	57	20
21	24	54	53	59	31
25	28	57	56	60	34

38	40	60	56	62	44
45	47	61	53	55	51
48	50	62	56	58	52
26	27	46	33		
5	6	55	51		
41	42	61	47		
2	4	39	15		
32	34	60	40		
18	20	57	28		
8	10	36	19		
29	31	59	37		
14	16	54	24		
22	23	49	30		
11	12	58	52		
43	44	62	50		

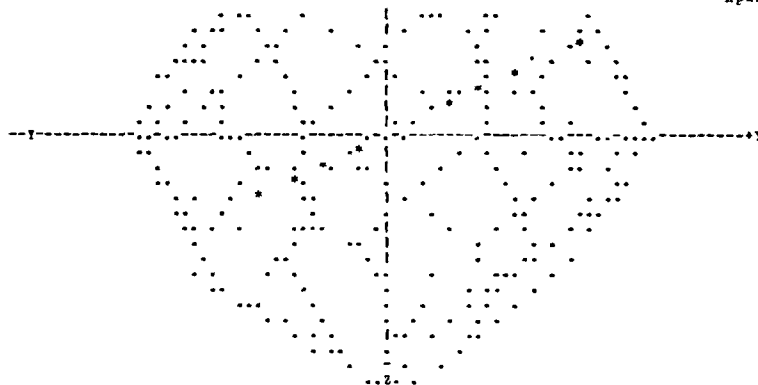
THE MAXIMUM IS: 1.0000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.0000000000

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(	-12.3981	7.4155	)	-----	(	-12.2787	8.7908	)
(	-12.3981	7.4155	)	-----	(	-10.0379	8.1571	)
(	-12.3981	7.4155	)	-----	(	-13.6379	4.5571	)
(	-12.2787	8.7908	)	-----	(	-3.6000	16.2000	)
(	-12.2787	8.7908	)	-----	(	-16.2000	3.6000	)
(	0.0	18.0000	)	-----	(	-3.6000	16.2000	)
(	0.0	18.0000	)	-----	(	-1.3592	15.5662	)
(	0.0	18.0000	)	-----	(	1.3592	16.8338	)
(	0.0	18.0000	)	-----	(	3.6000	16.2000	)
(	-3.6000	16.2000	)	-----	(	-7.5213	11.0091	)
(	-1.3592	15.5662	)	-----	(	-10.0379	8.1571	)
(	-1.3592	15.5662	)	-----	(	2.5621	8.1571	)
(	-10.0379	8.1571	)	-----	(	-6.1165	0.7479	)
(	12.3981	-7.4155	)	-----	(	12.2787	-8.7908	)
(	12.3981	-7.4155	)	-----	(	10.0379	-8.1571	)
(	12.3981	-7.4155	)	-----	(	13.6379	-4.5571	)
(	12.2787	-8.7908	)	-----	(	3.6000	-16.2000	)
(	12.2787	-8.7908	)	-----	(	16.2000	-3.6000	)
(	0.0	-18.0000	)	-----	(	3.6000	-16.2000	)
(	0.0	-18.0000	)	-----	(	1.3592	-15.5662	)
(	0.0	-18.0000	)	-----	(	-1.3592	-16.8338	)
(	0.0	-18.0000	)	-----	(	-3.6000	-16.2000	)
(	3.6000	-16.2000	)	-----	(	7.5213	-11.0091	)
(	1.3592	-15.5662	)	-----	(	10.0379	-8.1571	)
(	1.3592	-15.5662	)	-----	(	-2.5621	-8.1571	)
(	10.0379	-8.1571	)	-----	(	6.1165	-0.7479	)
(	-18.0000	0.0	)	-----	(	-17.5592	-0.6338	)
(	-18.0000	0.0	)	-----	(	-16.2000	3.6000	)
(	-18.0000	0.0	)	-----	(	-16.2000	-3.6000	)
(	-18.0000	0.0	)	-----	(	-16.8408	0.6338	)
(	-17.5592	-0.6338	)	-----	(	-13.6379	4.5571	)
(	-17.5592	-0.6338	)	-----	(	-13.6379	-8.0430	)
(	-16.2000	3.6000	)	-----	(	-7.5213	11.0091	)
(	-13.6379	4.5571	)	-----	(	-9.7165	-2.8521	)
(	18.0000	0.0	)	-----	(	17.5592	0.6338	)
(	18.0000	0.0	)	-----	(	16.2000	-3.6000	)
(	18.0000	0.0	)	-----	(	16.2000	3.6000	)
(	18.0000	0.0	)	-----	(	16.8408	-0.6338	)
(	17.5592	0.6338	)	-----	(	13.6379	-4.5571	)
(	17.5592	0.6338	)	-----	(	13.6379	8.0430	)
(	16.2000	-3.6000	)	-----	(	7.5213	-11.0091	)
(	13.6379	-4.5571	)	-----	(	9.7165	-2.8521	)
(	-12.3981	-10.5845	)	-----	(	-12.2787	-11.0091	)
(	-12.3981	-10.5845	)	-----	(	-13.6379	-8.0430	)
(	-12.3981	-10.5845	)	-----	(	-10.0379	-11.0091	)

```
( -12.2787 -11.0091 )-----(-16.2000 -3.6000 )
( -12.2787 -11.0091 )-----(-3.6000 -16.2000 )
( -16.2000 -3.6000 )-----(-7.5213 -8.7908 )
( -13.6379 -8.0430 )-----(-9.7165 -2.8521 )
( 12.3981 10.5845 )-----(-12.2787 11.0091 )
( 12.3981 10.5845 )-----(-13.6379 8.0430 )
( 12.3981 10.5845 )-----(-10.0379 11.6429 )
( 12.2787 11.0091 )-----(-16.2000 3.6000 )
( 12.2787 11.0091 )-----(-3.6000 16.2000 )
( 16.2000 3.6000 )-----(-7.5213 8.7908 )
( 13.6379 8.0430 )-----(-9.7165 2.8521 )
( -1.3592 -16.6338 )-----(-10.0379 -11.6429 )
( -1.3592 -16.6338 )-----(-2.5621 -11.6429 )
( -3.6000 -16.2000 )-----(-7.5213 -8.7908 )
( -10.0379 -11.6429 )-----(-6.1165 -6.4521 )
( 1.3592 16.6338 )-----(-10.0379 11.6429 )
( 1.3592 16.6338 )-----(-2.5621 11.6429 )
( 3.6000 16.2000 )-----(-7.5213 8.7908 )
( 10.0379 11.6429 )-----(-6.1165 6.4521 )
( 5.6019 -10.5445 )-----(-7.5213 -11.0091 )
( 5.6019 -10.5445 )-----(-2.5621 -11.6429 )
( 5.6019 -10.5445 )-----(-6.1621 -8.0430 )
( 2.5621 -11.6429 )-----(-6.1165 -6.4521 )
( -5.6019 10.5845 )-----(-7.5213 11.0091 )
( -5.6019 10.5845 )-----(-2.5621 11.6429 )
( -5.6019 10.5845 )-----(-6.1621 8.0430 )
( -2.5621 11.6429 )-----(-6.1165 6.4521 )
( 14.8408 -0.6338 )-----(-6.1621 -8.0430 )
( 14.8408 -0.6338 )-----(-6.1621 4.5571 )
( 6.1621 -8.0430 )-----(-2.5166 -2.8521 )
( -14.8408 0.6338 )-----(-6.1621 8.0430 )
( -14.8408 0.6338 )-----(-6.1621 -4.5571 )
( -6.1621 8.0430 )-----(-2.5166 2.8521 )
( 5.6019 7.4155 )-----(-7.5213 8.7908 )
( 5.6019 7.4155 )-----(-6.1621 4.5571 )
( 5.6019 7.4155 )-----(-2.5621 8.1571 )
( 6.1621 4.5571 )-----(-2.5166 -2.8521 )
( -5.6019 -7.4155 )-----(-7.5213 -8.7908 )
( -5.6019 -7.4155 )-----(-6.1621 -4.5571 )
( -5.6019 -7.4155 )-----(-2.5621 -8.1571 )
( -6.1621 -4.5571 )-----(-2.5166 2.8521 )
( 2.5621 8.1571 )-----(-6.1165 0.7479 )
( -2.5621 -8.1571 )-----(-6.1165 -0.7479 )
( -6.7962 -3.1690 )-----(-9.7165 -2.8521 )
( -6.7962 -3.1690 )-----(-6.1165 -0.7479 )
( -6.7962 -3.1690 )-----(-6.1165 -6.4521 )
( -6.7962 -3.1690 )-----(-2.5166 -2.8521 )
( 6.7962 3.1690 )-----(-9.7165 2.8521 )
( 6.7962 3.1690 )-----(-6.1165 -0.7479 )
( 6.7962 3.1690 )-----(-6.1165 6.4521 )
( 6.7962 3.1690 )-----(-2.5166 2.8521 )
```

CRYSTAL SHAPE:



GLAUCOPHANE FIEBFCKITZ : AXIAL RATIOS : MASON AND BERRY, 1968, P. 466
 FORMS : DEER HOWIE AND ZUSMAN, 1967, P. 179
 MONOCLINIC SYSTEM : A:B:C= 0.5400; 1.0000; 0.3000 ,ALPHA=GAMMA=90, BETA= 104.0000 , 3 FORM(S).
 NUMBER OF FACES ON MILLER INDICES = 10
 MILLER INDICES :

```
1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 1 0
0 -1 0
0 1 1
0 -1 1
0 -1 -1
0 1 -1
```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```
1.9085 X + 1.0000 Y + 0.0 Z = 1
-1.9085 X + 1.0000 Y + 0.0 Z = 1
-1.9085 X + -1.0000 Y + 0.0 Z = 1
1.9085 X + -1.0000 Y + 0.0 Z = 1
0.0 X + 2.0000 Y + 0.0 Z = 1
0.0 X + -2.0000 Y + 0.0 Z = 1
0.2078 X + 0.2500 Y + 0.8333 Z = 1
0.2078 X + -0.2500 Y + 0.8333 Z = 1
-0.2078 X + -0.2500 Y + -0.8333 Z = 1
-0.2078 X + 0.2500 Y + -0.8333 Z = 1
```

THE POSITIONS OF THE CRYSTAL VERFICES ARE :

```
( 0.5240 0.0 1.0694 )
( 0.5240 0.0 -1.3306 )
( 0.2620 0.5000 0.9047 )
( 0.2620 0.5000 -1.1153 )
( -0.5240 0.0 1.3306 )
( -0.5240 0.0 -1.0694 )
( -0.2620 0.5000 1.1153 )
( -0.2620 0.5000 -0.9047 )
( -0.2620 -0.5000 1.1153 )
```

```

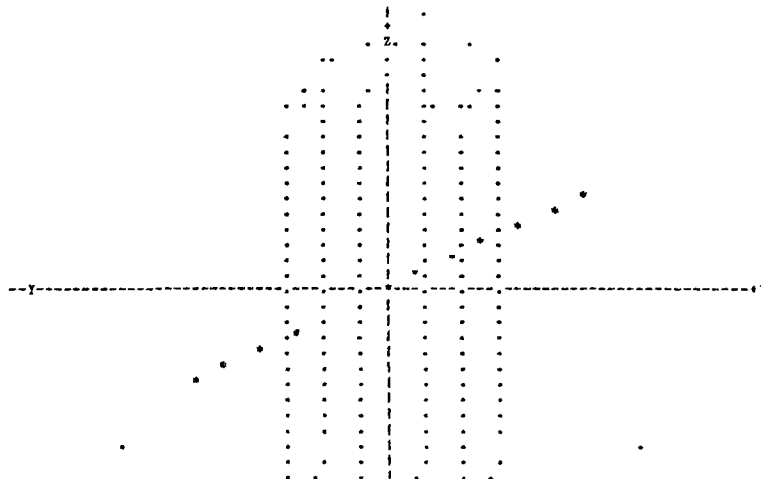
(      -0.2620      -0.5000      -0.9887      )
(      0.2620      -0.5000      0.9887      )
(      0.2620      -0.5000      -1.1153      )
THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
(      0.5240      0.0      1.0694      )----- (      0.5240      0.0      -1.3306      )
(      0.5240      0.0      1.0694      )----- (      0.2620      0.5000      0.9887      )
(      0.5240      0.0      1.0694      )----- (      -0.5240      0.0      1.3306      )
(      0.5240      0.0      1.0694      )----- (      0.2620      -0.5000      0.9887      )
(      0.5240      0.0      -1.3306      )----- (      0.2620      0.5000      -1.1153      )
(      0.5240      0.0      -1.3306      )----- (      -0.5240      0.0      -1.0694      )
(      0.5240      0.0      -1.3306      )----- (      0.2620      -0.5000      -1.1153      )
(      0.2620      0.5000      0.9887      )----- (      0.2620      0.5000      -1.1153      )
(      0.2620      0.5000      0.9887      )----- (      -0.2620      0.5000      1.1153      )
(      -0.5240      0.0      1.3306      )----- (      -0.2620      0.5000      -0.9887      )
(      -0.5240      0.0      1.3306      )----- (      -0.2620      0.5000      1.1153      )
(      -0.5240      0.0      1.3306      )----- (      -0.2620      -0.5000      1.1153      )
(      -0.5240      0.0      -1.0694      )----- (      -0.2620      0.5000      -0.9887      )
(      -0.5240      0.0      -1.0694      )----- (      -0.2620      -0.5000      -0.9887      )
(      -0.2620      0.5000      1.1153      )----- (      -0.2620      -0.5000      -0.9887      )
(      -0.2620      -0.5000      1.1153      )----- (      0.2620      -0.5000      0.9887      )
(      -0.2620      -0.5000      0.9887      )----- (      0.2620      -0.5000      -1.1153      )
(      0.2620      -0.5000      0.9887      )----- (      0.2620      -0.5000      -1.1153      )
THE MAXIMUM IS:      1.3306      THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :      676.3677
VERTICES
354.3894      0.0      723.2810
354.3894      0.0      -899.9998
177.1947      338.1838      666.0066
177.1947      338.1838      -754.3657
-354.3894      0.0      899.9998
-354.3894      0.0      -723.2810
-177.1947      338.1838      754.3657
-177.1947      338.1838      -666.0066
-177.1947      -338.1838      754.3657
-177.1947      -338.1838      -666.0066
177.1947      -338.1838      666.0066
177.1947      -338.1838      -754.3657
EDGES
1      2
1      3
1      11
2      4
2      6
2      12
3      4
3      7
4      8
5      6
5      7
5      9
6      8
6      10
7      8
9      10
9      11
10      12
11      12
FACES
1      2      4      3
5      6      8      7

```

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5      6      10      9
1      2      12      11
3      4      8      7
9      10      12      11
1      3      7      5
1      5      9      11
2      6      10      12
2      4      8      6
THE MAXIMUM IS:      1.4228820801      THE CONVERSION FACTOR FOR VIFWLOT IS :      12.6503801346
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
(      -2.5026      12.3609      )----- (      -2.5026      -18.0000      )
(      -2.5026      12.3609      )----- (      5.0739      11.8731      )
(      -2.5026      12.3609      )----- (      2.5026      18.0000      )
(      -2.5026      12.3609      )----- (      -7.5765      11.8731      )
(      -2.5026      -18.0000      )----- (      5.0739      -14.6927      )
(      -2.5026      -18.0000      )----- (      2.5026      -12.3609      )
(      -2.5026      -18.0000      )----- (      -7.5765      -14.6927      )
(      5.0739      11.8731      )----- (      5.0739      -14.6927      )
(      5.0739      11.8731      )----- (      7.5765      14.6927      )
(      5.0739      -14.6927      )----- (      7.5765      -11.8731      )
(      2.5026      18.0000      )----- (      2.5026      -12.3609      )
(      2.5026      18.0000      )----- (      7.5765      14.6927      )
(      2.5026      18.0000      )----- (      -5.0739      14.6927      )
(      2.5026      -12.3609      )----- (      7.5765      -11.8731      )
(      2.5026      -12.3609      )----- (      -5.0739      -11.8731      )
(      7.5765      14.6927      )----- (      7.5765      -11.8731      )
(      -5.0739      14.6927      )----- (      -5.0739      -11.8731      )
(      -5.0739      14.6927      )----- (      -7.5765      11.8731      )
(      -5.0739      -11.8731      )----- (      -7.5765      -14.6927      )
(      -7.5765      11.8731      )----- (      -7.5765      -14.6927      )
CRYSTAL SHAPE:

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CRYSTAL TYPE : MAGNETITE, 1968, P. 291
 HEXAGONAL SYSTEM : A1:A2:A3=C=1:1:1: 2.7500, ALPHA=90.0, BETA=90.0, GAMMA=90.0, 2 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

0	1	-1	2
1	0	-1	-2
1	-1	0	2
-1	1	0	-2
-1	0	1	2
0	-1	1	-2
0	0	0	-1
0	0	0	1

THE CARTESIAN COORDINATES OF THE CRYSTAL FACES ARE :

0.5773	X +	1.0000	Y +	0.7273	Z =	1
1.1547	X +	0.0	Y +	-0.7273	Z =	1
0.5773	X +	-1.0000	Y +	0.7273	Z =	1
-0.5773	X +	1.0000	Y +	-0.7273	Z =	1
-1.1547	X +	0.0	Y +	0.7273	Z =	1
-0.5773	X +	-1.0000	Y +	-0.7273	Z =	1
0.0	X +	0.0	Y +	0.9091	Z =	1
0.0	X +	0.0	Y +	-0.9091	Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	1.1547	-0.0000	0.4584	)
(	0.5773	1.0000	-0.4583	)
(	0.3464	0.0000	1.1000	)
(	-0.5773	1.0000	0.4583	)
(	-0.1732	0.3000	1.1000	)
(	0.5773	-1.0000	-0.4583	)
(	0.1732	0.3000	-1.1000	)
(	0.1732	-0.3000	-1.1000	)
(	-0.5773	-1.0000	0.4583	)
(	-0.1732	-0.3000	1.1000	)
(	-1.1547	-0.0000	-0.4584	)
(	-0.3464	0.0000	-1.1000	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	1.1547	-0.0000	0.4584	)	-----	(	0.5773	1.0000	-0.4583	)
(	1.1547	-0.0000	0.4584	)	-----	(	0.3464	0.0000	1.1000	)
(	1.1547	-0.0000	0.4584	)	-----	(	0.5773	-1.0000	-0.4583	)
(	0.5773	1.0000	-0.4583	)	-----	(	-0.5773	1.0000	0.4583	)
(	0.5773	1.0000	-0.4583	)	-----	(	0.1732	0.3000	-1.1000	)
(	0.3464	0.0000	1.1000	)	-----	(	-0.1732	0.3000	1.1000	)
(	0.3464	0.0000	1.1000	)	-----	(	-0.1732	-0.3000	1.1000	)
(	-0.5773	1.0000	0.4583	)	-----	(	-0.1732	0.3000	1.1000	)
(	-0.5773	1.0000	0.4583	)	-----	(	-1.1547	-0.0000	-0.4584	)
(	-0.1732	0.3000	1.1000	)	-----	(	-0.1732	-0.3000	1.1000	)
(	0.5773	-1.0000	-0.4583	)	-----	(	0.1732	-0.3000	-1.1000	)
(	0.5773	-1.0000	-0.4583	)	-----	(	-0.5773	-1.0000	0.4583	)
(	0.1732	0.3000	-1.1000	)	-----	(	0.1732	-0.3000	-1.1000	)
(	0.1732	0.3000	-1.1000	)	-----	(	-0.3464	0.0000	-1.1000	)
(	0.1732	-0.3000	-1.1000	)	-----	(	-0.3464	0.0000	-1.1000	)
(	-0.5773	-1.0000	0.4583	)	-----	(	-0.1732	-0.3000	1.1000	)
(	-0.5773	-1.0000	0.4583	)	-----	(	-1.1547	-0.0000	-0.4584	)
(	-1.1547	-0.0000	-0.4584	)	-----	(	-0.3464	0.0000	-1.1000	)

THE MAXIMUM IS: 1.1547 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS: 779.9307
 VERTICES
 899.9998 -0.0002 357.2661
 450.0002 779.9307 -357.2253

270.0110 0.0000 857.3730
 -450.0002 779.9307 357.2256
 -134.9978 233.8250 857.3730
 450.0002 -779.9307 -357.2256
 134.9978 233.8253 -857.3730
 134.9978 -233.8253 -857.3730
 -450.0002 -779.9307 357.2256
 -134.9978 -233.8250 857.3730
 -899.9998 -0.0002 -357.2661
 -270.0110 0.0000 -857.3730

EDGES

1	2
1	3
1	6
2	4
2	7
3	5
3	10
4	5
4	11
5	10
6	8
6	9
7	8
7	12
8	12
9	10
9	11
11	12

FACES

1	2	4	5	3
1	2	7	8	6
1	3	10	9	6
2	4	11	12	7
4	5	10	9	11
6	8	12	11	9
3	5	10		
7	8	12		

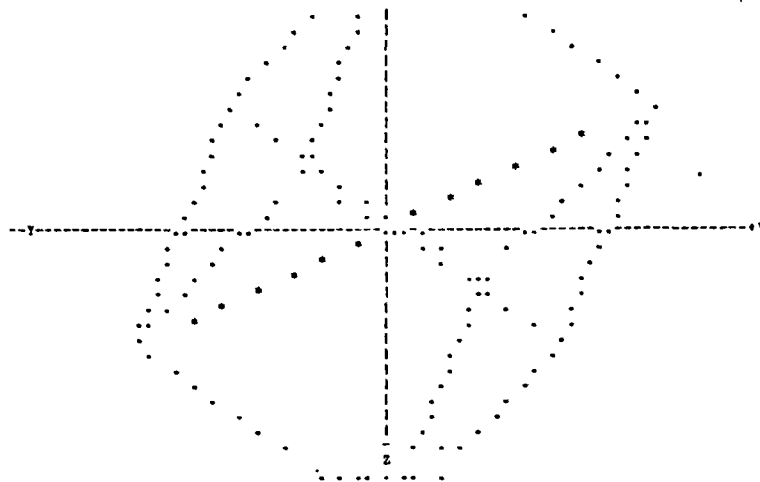
THE MAXIMUM IS: 1.2119841995 THE CONVERSION FACTOR FOR PLOTTER IS: 14.7285167694

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(	-6.4430	3.7697	)	-----	(	11.5570	-8.2754	)
(	-6.4430	3.7697	)	-----	(	-1.9330	15.3550	)
(	-6.4430	3.7697	)	-----	(	-18.0000	-8.2754	)
(	11.5570	-8.2754	)	-----	(	18.0000	8.2754	)
(	11.5570	-8.2754	)	-----	(	3.4671	-16.7070	)
(	-1.9330	15.3550	)	-----	(	5.3999	16.7070	)
(	-1.9330	15.3550	)	-----	(	-3.4670	16.7070	)
(	18.0000	8.2754	)	-----	(	5.3999	16.7070	)
(	18.0000	8.2754	)	-----	(	1.4430	-3.7697	)
(	-5.3999	16.7070	)	-----	(	-3.4670	16.7070	)
(	-18.0000	-8.2754	)	-----	(	-5.3999	-16.7070	)
(	-18.0000	-8.2754	)	-----	(	-11.5570	8.2754	)
(	3.4671	-16.7070	)	-----	(	-5.3999	-16.7070	)
(	3.4671	-16.7070	)	-----	(	1.9330	-15.3550	)
(	-5.3999	-16.7070	)	-----	(	1.9330	-15.3550	)
(	-11.5570	8.2754	)	-----	(	-3.4670	16.7070	)
(	-11.5570	8.2754	)	-----	(	6.4430	-3.7697	)
(	6.4430	-3.7697	)	-----	(	1.4430	-3.7697	)

CRYSTAL SHAPE:

4
 7



HAUYNE : POGFSS, 1937, P. 441
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 1 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

1	1	1
-1	1	1
-1	-1	1
1	-1	1
1	1	-1
-1	1	-1
-1	-1	-1
1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X +	1.0000 Y +	1.0000 Z = 1
-1.0000 X +	1.0000 Y +	1.0000 Z = 1
-1.0000 X +	-1.0000 Y +	1.0000 Z = 1
1.0000 X +	-1.0000 Y +	1.0000 Z = 1
1.0000 X +	1.0000 Y +	-1.0000 Z = 1
-1.0000 X +	1.0000 Y +	-1.0000 Z = 1
-1.0000 X +	-1.0000 Y +	-1.0000 Z = 1
1.0000 X +	-1.0000 Y +	-1.0000 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.0	0.0	1.0000	)
(	0.0	1.0000	0.0	)
(	1.0000	0.0	0.0	)
(	-1.0000	0.0	0.0	)
(	0.0	-1.0000	0.0	)
(	0.0	0.0	-1.0000	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.0	0.0	1.0000	)	-----	(	0.0	1.0000	0.0	)
(	0.0	0.0	1.0000	)	-----	(	1.0000	0.0	0.0	)

Apdx. 2-b, p. 130

(	0.0	0.0	1.0000	)	-----	(	-1.0000	0.0	0.0	)
(	0.0	0.0	1.0000	)	-----	(	0.0	-1.0000	0.0	)
(	0.0	1.0000	0.0	)	-----	(	1.0000	0.0	0.0	)
(	0.0	1.0000	0.0	)	-----	(	-1.0000	0.0	0.0	)
(	0.0	1.0000	0.0	)	-----	(	0.0	0.0	-1.0000	)
(	1.0000	0.0	0.0	)	-----	(	0.0	-1.0000	0.0	)
(	1.0000	0.0	0.0	)	-----	(	0.0	0.0	-1.0000	)
(	-1.0000	0.0	0.0	)	-----	(	0.0	-1.0000	0.0	)
(	-1.0000	0.0	0.0	)	-----	(	0.0	0.0	-1.0000	)
(	0.0	-1.0000	0.0	)	-----	(	0.0	0.0	-1.0000	)

THE MAXIMUM IS:

1.0000

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :

900.0000

VERTICES

0.0	0.0	900.0000
0.0	900.0000	0.0
900.0000	0.0	0.0
-900.0000	0.0	0.0
0.0	-900.0000	0.0
0.0	0.0	-900.0000

EDGES

1	2
1	3
1	4
1	5
2	3
2	4
2	6
3	5
3	6
4	5
4	6
5	6

FACES

1	2	3
1	2	4
1	4	5
1	3	5
2	3	6
2	4	6
4	5	6
3	5	6

THE MAXIMUM IS:

1.0000000000

THE CONVERSION FACTOR FOR PLOT IS :

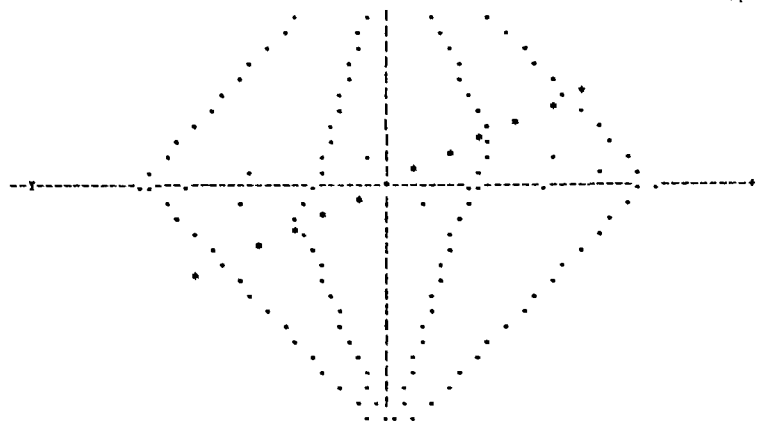
18.0000000000

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.0	18.0000	)	-----	(	18.0000	0.0	)
(	0.0	18.0000	)	-----	(	-6.7962	-3.1690	)
(	0.0	18.0000	)	-----	(	6.7962	3.1690	)
(	0.0	18.0000	)	-----	(	-18.0000	0.0	)
(	18.0000	0.0	)	-----	(	-6.7962	-3.1690	)
(	18.0000	0.0	)	-----	(	6.7962	3.1690	)
(	18.0000	0.0	)	-----	(	0.0	-18.0000	)
(	-6.7962	-3.1690	)	-----	(	-18.0000	0.0	)
(	-6.7962	-3.1690	)	-----	(	0.0	-18.0000	)
(	6.7962	3.1690	)	-----	(	0.0	-18.0000	)
(	6.7962	3.1690	)	-----	(	0.0	-18.0000	)
(	-18.0000	0.0	)	-----	(	0.0	-18.0000	)

CRYSTAL SHAPE:





BORNBLINDE : MASON AND BERRY , 1968, P. 465
 MONOCLINIC SYSTEM : A:B:C= 0.5470: 1.0000: 0.2950 ,ALPHA=GAMMA=90, BETA= 105.5166 , 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 10
 MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	0
0	-1	0
0	1	1
0	-1	1
0	-1	-1
0	1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.8973 X +	1.0000 Y +	0.0 Z =	1
-1.8973 X +	1.0000 Y +	0.0 Z =	1
-1.8973 X +	-1.0000 Y +	0.0 Z =	1
1.8973 X +	-1.0000 Y +	0.0 Z =	1
0.0 X +	2.0000 Y +	0.0 Z =	1
0.0 X +	-2.0000 Y +	0.0 Z =	1
0.7353 X +	0.2500 Y +	0.8475 Z =	1
0.2353 X +	-0.2500 Y +	0.8475 Z =	1
-0.2353 X +	-0.2500 Y +	-0.8475 Z =	1
-0.2353 X +	0.2500 Y +	-0.8475 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5271	0.0	1.0337	)
(	0.5271	0.0	-1.3763	)
(	0.2635	0.5000	0.9593	)
(	0.2635	0.5000	-1.1057	)
(	-0.5271	0.0	1.3263	)
(	-0.5271	0.0	-1.0337	)
(	-0.2635	0.5000	1.1057	)

Apdx. 2-b, p. 132

(	-0.2635	0.5000	-0.9593	)
(	-0.2635	-0.5000	1.1057	)
(	-0.2635	-0.5000	-0.9593	)
(	0.2635	-0.5000	0.9593	)
(	0.2635	-0.5000	-1.1057	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.5271	0.0	1.0337	)	-----	(	0.5271	0.0	-1.3263	)
(	0.5271	0.0	1.0337	)	-----	(	0.2635	0.5000	0.9593	)
(	0.5271	0.0	1.0337	)	-----	(	-0.5271	0.0	1.3263	)
(	0.5271	0.0	1.0337	)	-----	(	0.2635	-0.5000	0.9593	)
(	0.5271	0.0	-1.3263	)	-----	(	0.2635	0.5000	-1.1057	)
(	0.5271	0.0	-1.3263	)	-----	(	-0.5271	0.0	-1.0337	)
(	0.5271	0.0	-1.3263	)	-----	(	0.2635	-0.5000	-1.1057	)
(	0.2635	0.5000	0.9593	)	-----	(	0.2635	0.5000	-1.1057	)
(	0.2635	0.5000	0.9593	)	-----	(	-0.2635	0.5000	1.1057	)
(	0.2635	0.5000	-1.1057	)	-----	(	-0.2635	0.5000	-0.9593	)
(	-0.5271	0.0	1.3263	)	-----	(	-0.5271	0.0	-1.0337	)
(	-0.5271	0.0	1.3263	)	-----	(	-0.2635	0.5000	1.1057	)
(	-0.5271	0.0	1.3263	)	-----	(	-0.2635	-0.5000	1.1057	)
(	-0.5271	0.0	-1.0337	)	-----	(	-0.2635	0.5000	-0.9593	)
(	-0.5271	0.0	-1.0337	)	-----	(	-0.2635	-0.5000	-0.9593	)
(	-0.2635	0.5000	1.1057	)	-----	(	-0.2635	0.5000	-0.9593	)
(	-0.2635	-0.5000	1.1057	)	-----	(	0.2635	-0.5000	0.9593	)
(	-0.2635	-0.5000	0.9593	)	-----	(	0.2635	-0.5000	-1.1057	)
(	-0.2635	-0.5000	-0.9593	)	-----	(	0.2635	-0.5000	-1.1057	)

THE MAXIMUM IS:

1.3263

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :

678.5635

VERTICES

357.6462	0.0	701.4077
357.6462	0.0	-899.9998
178.8232	339.2817	650.9685
178.8232	339.2817	-750.2639
-357.6462	0.0	899.9998
-357.6462	0.0	-701.4077
-178.8232	339.2817	750.2639
-178.8232	339.2817	-650.9685
-178.8232	-339.2817	750.2639
-178.8232	-339.2817	-650.9685
178.8232	-339.2817	650.9685
178.8232	-339.2817	-750.2639

EDGES

1	2
1	3
1	5
1	11
2	4
2	6
2	12
3	4
3	7
4	8
5	6
5	7
5	9
6	8
6	10
7	8
9	10
9	11
10	12
11	12

FACES

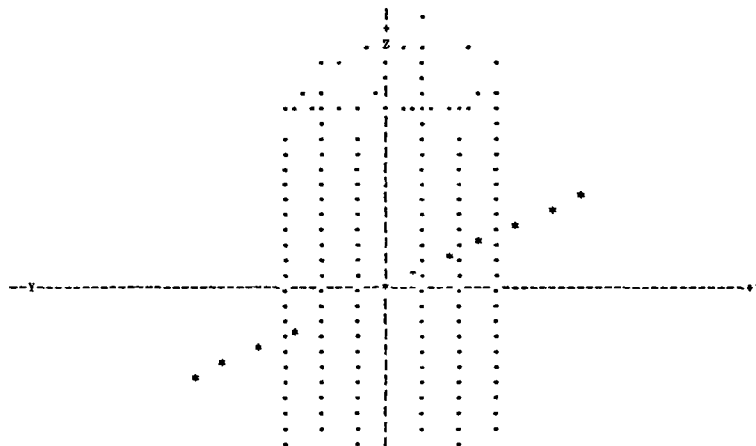
1 2 4 3
5 6 8 7
5 6 10 9
1 2 12 11
3 4 8 7
9 10 12 11
1 3 7 5
1 5 9 11
2 6 10 12
2 4 8 6

THE MAXIMUM IS: 1.4191226959 THF CONVERSION FACTOR FOR VIEWPLOT IS : 12.6838922501

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(-2.5241 11.9339)	-----	(-2.5241 -18.0000)
(-2.5241 11.9339)	-----	(5.0799 11.5796)
(-2.5241 11.9339)	-----	(2.5241 18.0000)
(-2.5241 11.9339)	-----	(-7.6040 11.5796)
(-2.5241 -18.0000)	-----	(5.0799 -14.6126)
(-2.5241 -18.0000)	-----	(2.5241 -11.9339)
(-2.5241 -18.0000)	-----	(-7.6040 -14.6126)
(5.0799 11.5796)	-----	(5.0799 -14.6126)
(5.0799 11.5796)	-----	(7.6040 14.6126)
(5.0799 -14.6126)	-----	(7.6040 -11.5796)
(2.5241 18.0000)	-----	(2.5241 -11.9339)
(2.5241 18.0000)	-----	(7.6040 14.6126)
(2.5241 18.0000)	-----	(-5.0799 14.6126)
(2.5241 -11.9339)	-----	(7.6040 -11.5796)
(2.5241 -11.9339)	-----	(-5.0799 -11.5796)
(7.6040 14.6126)	-----	(7.6040 -11.5796)
(-5.0799 14.6126)	-----	(-5.0799 -11.5796)
(-5.0799 14.6126)	-----	(-7.6040 11.5796)
(-5.0799 -11.5796)	-----	(-7.6040 -14.6126)
(-7.6040 11.5796)	-----	(-7.6040 -14.6126)

CRYSTAL SHAPE:



Apdx. 2-b, p. 134

1 2 4 3
5 6 8 7
5 6 10 9
1 2 12 11
3 4 8 7
9 10 12 11
1 3 7 5
1 5 9 11
2 6 10 12
2 4 8 6

RUMITE : DEER HOWIP AND ZUSSMAN, 1967, p. 11
NO DATA ON AXIAL RATIO SO USE 1 1 1 ISO.
ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 6 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 24
MILLER INDICES :

1	0	1
1	0	-1
-1	0	1
-1	0	-1
1	1	1
1	1	-1
1	-1	1
1	-1	-1
-1	1	1
-1	1	-1
-1	-1	1
-1	-1	-1
1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	0
0	-1	0
0	1	1
0	1	-1
0	-1	1
0	-1	-1
0	0	1
0	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X + 0.0 Y + 1.0000 Z = 1
1.0000 X + 0.0 Y + -1.0000 Z = 1
-1.0000 X + 0.0 Y + 1.0000 Z = 1
-1.0000 X + 0.0 Y + -1.0000 Z = 1
0.7692 X + 0.7692 Y + 0.7692 Z = 1
0.7692 X + 0.7692 Y + -0.7692 Z = 1
0.7692 X + -0.7692 Y + 0.7692 Z = 1
0.7692 X + -0.7692 Y + -0.7692 Z = 1
-0.7692 X + 0.7692 Y + 0.7692 Z = 1
-0.7692 X + 0.7692 Y + -0.7692 Z = 1
-0.7692 X + -0.7692 Y + 0.7692 Z = 1
-0.7692 X + -0.7692 Y + -0.7692 Z = 1
0.8333 X + 0.8333 Y + 0.0 Z = 1
-0.8333 X + 0.8333 Y + 0.0 Z = 1
-0.8333 X + -0.8333 Y + 0.0 Z = 1
0.8333 X + -0.8333 Y + 0.0 Z = 1
0.0 X + 1.2500 Y + 0.0 Z = 1
0.0 X + -1.2500 Y + 0.0 Z = 1
0.0 X + 1.0000 Y + 1.0000 Z = 1
0.0 X + 1.0000 Y + -1.0000 Z = 1
0.0 X + -1.0000 Y + 1.0000 Z = 1
0.0 X + -1.0000 Y + -1.0000 Z = 1
0.0 X + 0.0 Y + 1.6667 Z = 1
0.0 X + 0.0 Y + -1.6667 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	1.0000	0.2000	0.0	)
(	1.0000	-0.2000	0.0	)
(	0.4000	0.3000	0.1000	)
(	0.4000	0.3000	0.6000	)
(	0.4000	-0.3000	0.1000	)
(	0.4000	-0.3000	0.6000	)
(	0.4000	0.3000	-0.1000	)
(	0.4000	0.3000	-0.6000	)
(	0.4000	-0.3000	-0.1000	)
(	0.4000	-0.3000	-0.6000	)
(	-1.0000	0.2000	0.0	)
(	-1.0000	-0.2000	0.0	)
(	-0.4000	0.3000	0.1000	)
(	-0.4000	0.3000	0.6000	)
(	-0.4000	-0.3000	0.1000	)
(	-0.4000	-0.3000	0.6000	)
(	-0.4000	0.3000	-0.1000	)
(	-0.4000	0.3000	-0.6000	)
(	-0.9000	-0.3000	-0.1000	)
(	-0.9000	-0.3000	-0.6000	)
(	0.4000	0.8000	0.1000	)
(	0.3000	0.8000	0.2000	)
(	0.3000	0.4000	0.6000	)
(	0.4000	0.8000	-0.1000	)
(	0.3000	0.8000	-0.2000	)
(	0.4000	-0.8000	-0.1000	)
(	0.3000	-0.8000	-0.2000	)
(	0.4000	-0.8000	-0.6000	)
(	0.3000	-0.8000	-0.1000	)
(	0.3000	-0.8000	0.2000	)
(	0.3000	-0.4000	0.6000	)
(	-0.4000	0.8000	0.1000	)
(	-0.3000	0.8000	0.2000	)
(	-0.3000	0.4000	0.6000	)
(	-0.4000	0.8000	-0.1000	)
(	-0.3000	0.8000	-0.2000	)
(	-0.4000	-0.8000	-0.1000	)
(	-0.3000	-0.8000	-0.2000	)
(	-0.4000	-0.8000	-0.6000	)
(	-0.3000	-0.8000	-0.1000	)
(	-0.3000	-0.8000	0.2000	)
(	-0.3000	-0.4000	0.6000	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	1.0000	0.2000	0.0	)	-----	(	1.0000	-0.2000	0.0	)
(	1.0000	0.2000	0.0	)	-----	(	0.9000	0.3000	0.1000	)
(	1.0000	0.2000	0.0	)	-----	(	0.9000	0.3000	-0.1000	)
(	1.0000	-0.2000	0.0	)	-----	(	0.9000	-0.3000	0.1000	)
(	1.0000	-0.2000	0.0	)	-----	(	0.9000	-0.3000	-0.1000	)
(	0.9000	0.3000	0.1000	)	-----	(	0.4000	0.3000	0.6000	)
(	0.9000	0.3000	0.1000	)	-----	(	0.4000	0.8000	0.1000	)
(	0.4000	0.3000	0.6000	)	-----	(	0.4000	-0.3000	0.6000	)
(	0.4000	0.3000	0.6000	)	-----	(	0.3000	0.4000	0.6000	)
(	0.9000	-0.3000	0.1000	)	-----	(	0.4000	-0.3000	0.6000	)
(	0.9000	-0.3000	0.1000	)	-----	(	0.4000	-0.8000	0.1000	)
(	0.4000	-0.3000	0.6000	)	-----	(	0.3000	-0.4000	0.6000	)
(	0.9000	0.3000	-0.1000	)	-----	(	0.4000	0.3000	-0.6000	)
(	0.9000	0.3000	-0.1000	)	-----	(	0.4000	0.8000	-0.1000	)
(	0.4000	0.3000	-0.6000	)	-----	(	0.4000	-0.3000	-0.6000	)
(	0.4000	0.3000	-0.6000	)	-----	(	0.3000	0.4000	-0.6000	)
(	0.9000	-0.3000	-0.1000	)	-----	(	0.4000	-0.3000	-0.6000	)

(	0.9000	-0.3000	-0.1000	)	-----	(	0.4000	-0.8000	-0.1000	)
(	0.4000	-0.3000	-0.6000	)	-----	(	0.3000	-0.4000	-0.6000	)
(	-1.0000	0.2000	0.0	)	-----	(	-1.0000	-0.2000	0.0	)
(	-1.0000	0.2000	0.0	)	-----	(	-0.9000	0.3000	0.1000	)
(	-1.0000	0.2000	0.0	)	-----	(	-0.9000	0.3000	-0.1000	)
(	-1.0000	-0.2000	0.0	)	-----	(	-0.9000	-0.3000	0.1000	)
(	-1.0000	-0.2000	0.0	)	-----	(	-0.9000	-0.3000	-0.1000	)
(	-0.9000	0.3000	0.1000	)	-----	(	-0.4000	0.3000	0.6000	)
(	-0.9000	0.3000	0.1000	)	-----	(	-0.4000	0.8000	0.1000	)
(	-0.4000	0.3000	0.6000	)	-----	(	-0.4000	-0.3000	0.6000	)
(	-0.4000	0.3000	0.6000	)	-----	(	-0.3000	0.4000	0.6000	)
(	-0.9000	-0.3000	0.1000	)	-----	(	-0.4000	-0.3000	0.6000	)
(	-0.9000	-0.3000	0.1000	)	-----	(	-0.4000	-0.8000	0.1000	)
(	-0.4000	-0.3000	0.6000	)	-----	(	-0.3000	-0.4000	0.6000	)
(	-0.9000	0.3000	-0.1000	)	-----	(	-0.4000	0.3000	-0.6000	)
(	-0.9000	0.3000	-0.1000	)	-----	(	-0.4000	0.8000	-0.1000	)
(	-0.4000	0.3000	-0.6000	)	-----	(	-0.3000	-0.4000	-0.6000	)
(	-0.9000	-0.3000	-0.1000	)	-----	(	-0.4000	-0.3000	-0.6000	)
(	-0.9000	-0.3000	-0.1000	)	-----	(	-0.4000	-0.8000	-0.1000	)
(	-0.4000	-0.3000	-0.6000	)	-----	(	-0.3000	-0.4000	-0.6000	)
(	0.4000	0.8000	0.1000	)	-----	(	0.3000	0.4000	0.2000	)
(	0.4000	0.8000	0.1000	)	-----	(	0.4000	0.8000	-0.1000	)
(	0.3000	0.8000	0.2000	)	-----	(	0.3000	0.4000	0.6000	)
(	0.3000	0.8000	0.2000	)	-----	(	-0.3000	0.8000	0.2000	)
(	0.3000	0.4000	0.6000	)	-----	(	-0.3000	0.4000	0.6000	)
(	0.4000	0.8000	-0.1000	)	-----	(	0.3000	0.8000	-0.2000	)
(	0.3000	0.8000	-0.2000	)	-----	(	0.3000	0.4000	-0.6000	)
(	0.3000	0.8000	-0.2000	)	-----	(	-0.3000	0.8000	-0.2000	)
(	0.3000	0.4000	-0.6000	)	-----	(	-0.3000	0.4000	-0.6000	)
(	0.4000	-0.8000	-0.1000	)	-----	(	0.3000	-0.8000	-0.2000	)
(	0.4000	-0.8000	-0.1000	)	-----	(	0.3000	-0.4000	-0.6000	)
(	0.3000	-0.8000	-0.2000	)	-----	(	-0.3000	-0.8000	-0.2000	)
(	0.3000	-0.8000	-0.2000	)	-----	(	-0.3000	-0.4000	-0.6000	)
(	0.4000	-0.8000	0.1000	)	-----	(	0.3000	-0.8000	0.2000	)
(	0.3000	-0.8000	0.2000	)	-----	(	0.3000	-0.4000	0.6000	)
(	0.3000	-0.4000	0.2000	)	-----	(	-0.3000	-0.8000	0.2000	)
(	0.3000	-0.4000	0.2000	)	-----	(	-0.3000	-0.4000	0.6000	)
(	0.4000	0.8000	0.1000	)	-----	(	-0.4000	0.8000	0.1000	)
(	0.4000	0.8000	0.1000	)	-----	(	-0.3000	0.8000	-0.2000	)
(	0.3000	0.8000	-0.1000	)	-----	(	-0.3000	0.4000	-0.6000	)
(	0.3000	0.8000	-0.1000	)	-----	(	-0.4000	-0.8000	-0.2000	)
(	0.3000	-0.8000	-0.2000	)	-----	(	-0.3000	-0.8000	-0.2000	)
(	0.4000	-0.8000	-0.1000	)	-----	(	-0.3000	-0.4000	-0.6000	)
(	0.4000	-0.8000	-0.1000	)	-----	(	-0.3000	-0.8000	0.2000	)
(	0.3000	-0.8000	0.1000	)	-----	(	-0.3000	-0.4000	0.6000	)
(	0.3000	-0.8000	0.1000	)	-----	(	-0.3000	-0.8000	0.2000	)

THE MAXIMUM IS:

1.0000

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :

900.0000

VERTICES

900.0000	179.9999	0.0
900.0000	-179.9999	0.0
810.0005	269.9993	89.9994
359.9995	269.9995	540.0002
810.0005	-269.9993	89.9994
359.9995	-269.9995	540.0002
810.0005	269.9993	-89.9994
359.9995	269.9995	-540.0002
810.0005	-269.9993	-89.9994
359.9995	-269.9995	-540.0002
-900.0000	179.9999	0.0

-900.0000	-179.9999	0.0
-810.0005	269.9993	89.9994
-359.9995	269.9995	540.0002
-810.0005	-269.9993	89.9994
-359.9995	-269.9995	540.0002
-810.0005	269.9993	-89.9994
-359.9995	269.9995	-540.0002
-810.0005	-269.9993	-89.9994
-359.9995	-269.9995	-540.0002
360.0000	720.0002	89.9998
269.9993	720.0000	179.9999
269.9995	359.9998	540.0002
360.0000	720.0002	-89.9998
269.9993	720.0000	-179.9999
269.9995	359.9998	-540.0002
360.0000	-720.0002	-89.9998
269.9993	-720.0000	-179.9999
269.9995	-359.9998	-540.0002
360.0000	-720.0002	89.9998
269.9993	-720.0000	179.9999
269.9995	-359.9998	540.0002
-360.0000	720.0002	89.9998
-269.9993	720.0000	179.9999
-269.9995	359.9998	540.0002
-360.0000	720.0002	-89.9998
-269.9993	720.0000	-179.9999
-269.9995	359.9998	-540.0002
-360.0000	-720.0002	-89.9998
-269.9993	-720.0000	-179.9999
-269.9995	-359.9998	-540.0002
-360.0000	-720.0002	89.9998
-269.9993	-720.0000	179.9999
-269.9995	-359.9998	540.0002

EDGFS

1	2
1	3
1	7
2	5
2	9
3	4
3	21
4	6
4	23
5	6
5	30
6	32
7	8
7	24
8	10
8	26
9	10
9	27
10	29
11	12
11	13
11	17
12	15
12	19
13	14
13	33
14	16
14	35

15	16
15	42
16	44
17	18
17	36
18	20
18	38
19	20
19	39
20	41
21	22
21	24
22	23
22	34
23	35
24	25
25	26
25	37
26	38
27	28
27	30
28	29
28	40
29	41
30	31
31	32
31	43
32	44
33	34
33	36
34	35
36	37
37	38
39	40
39	42
40	41
42	43
43	44

FACES

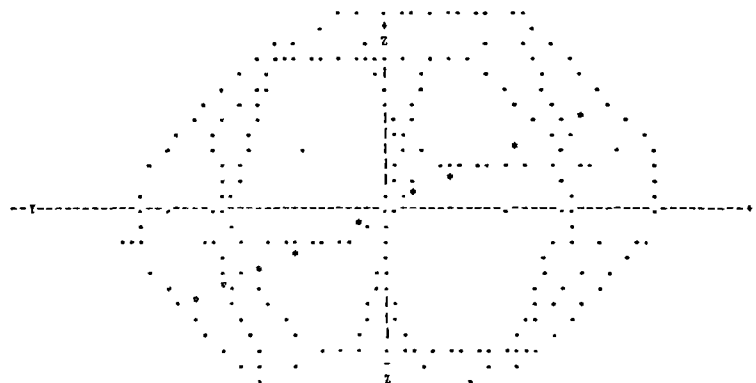
1	2	5	6	4	3
1	2	9	10	8	7
11	12	15	16	14	13
11	12	19	20	18	17
3	4	23	22	21	
7	8	26	25	24	
9	10	29	28	27	
5	6	32	31	30	
13	14	35	34	33	
17	18	38	37	36	
19	20	41	40	39	
15	16	44	43	42	
1	3	21	24	7	
11	13	33	36	17	
12	15	42	39	19	
2	5	30	27	9	
21	22	34	33	36	37
27	28	40	39	42	43
22	23	35	34		
25	26	38	37		
31	32	44	43		
28	29	41	40		
4	6	32	44	16	14
				15	23

THE 20 VALUES ARE DETERMINED BY THE FOLLOWING POINTS:

(-3.1607 -1.3122)	(-10.9315 -1.1063)
(-3.1607 -1.3122)	(-0.7535 -1.1063)
(-3.1607 -1.3122)	(-0.7535 -0.8916)
(-10.9315 -3.1122)	(-12.1096 -1.1063)
(-10.9315 -3.1122)	(-12.1096 -0.8916)
(-0.7535 -1.1063)	(2.8196 10.0233)
(-0.7535 -1.1063)	(12.2831 0.5598)
(2.8196 10.0233)	(-0.5365 10.0233)
(2.8196 10.0233)	(5.4269 10.1565)
(-12.1096 -1.1063)	(-8.5365 10.0233)
(-12.1096 -1.1063)	(-18.0000 0.5598)
(-8.5365 10.0233)	(-9.7146 10.1565)
(-0.7535 -0.8916)	(2.8196 -12.6890)
(-0.7535 -0.8916)	(12.2831 -1.2255)
(2.8196 -12.6890)	(-8.5365 -12.6890)
(2.8196 -12.6890)	(5.4269 -12.1558)
(-12.1096 -0.8916)	(-8.5365 -12.6890)
(-12.1096 -0.8916)	(-18.0000 -3.2255)
(-8.5365 -12.6890)	(-9.7146 -12.1558)
(10.9315 3.1122)	(3.1607 1.3322)
(10.9315 3.1122)	(12.1096 0.8916)
(10.9315 3.1122)	(12.1096 1.1063)
(3.1607 3.1122)	(0.7535 0.8916)
(3.1607 3.1122)	(0.7535 1.1063)
(12.1096 0.8916)	(8.5365 12.6890)
(12.1096 0.8916)	(18.0000 3.2255)
(8.5365 12.6890)	(-2.8196 12.6890)
(8.5365 12.6890)	(9.7146 12.1558)
(0.7535 0.8916)	(-2.8196 12.6890)
(0.7535 0.8916)	(-12.2831 1.2255)
(-2.8196 12.6890)	(-5.4269 12.3558)
(-2.8196 12.6890)	(8.5365 -10.0233)
(12.1096 1.1063)	(18.0000 -0.5598)
(12.1096 1.1063)	(-2.8196 -10.0233)
(8.5365 -10.0233)	(-9.7146 -10.3565)
(8.5365 -10.0233)	(-2.8196 -10.0233)
(0.7535 1.1063)	(-12.2831 -0.5598)
(0.7535 1.1063)	(-5.4269 -10.3565)
(-2.8196 -10.0233)	(12.9977 2.7857)
(-2.8196 -10.0233)	(12.2831 0.5598)
(12.2831 0.5598)	(5.4269 10.1565)
(12.9977 2.7857)	(17.2854 4.7850)
(12.9977 2.7857)	(9.7146 12.3558)
(5.4269 10.1565)	(12.2831 -3.2255)
(5.4269 10.1565)	(12.9977 -4.7850)
(12.2831 -3.2255)	(5.4269 -12.3558)
(12.9977 -4.7850)	(17.2854 -2.7857)
(12.9977 -4.7850)	(9.7146 -10.3565)
(5.4269 -12.3558)	(-17.2854 -4.7850)
(5.4269 -12.3558)	(-18.0000 0.5598)
(-18.0000 0.5598)	(-9.7146 -12.3558)
(-18.0000 0.5598)	(-12.9977 -2.7857)
(-17.2854 -4.7850)	(-5.4269 -10.3565)
(-17.2854 -4.7850)	(-17.2854 -2.7857)
(-9.7146 -12.3558)	(-9.7146 10.3565)
(-9.7146 -12.3558)	(-12.9977 4.7850)
(-17.2854 2.7857)	(-5.4269 12.3558)
(-17.2854 2.7857)	(17.2854 4.7850)
(-9.7146 10.3565)	(18.0000 3.2255)
(-9.7146 10.3565)	(18.0000 -0.5598)
(18.0000 3.2255)	(9.7146 12.3558)
(17.2854 4.7850)	

(18.0000 -0.5598)	(17.2854 -2.7857)
(17.2854 -2.7857)	(9.7146 -10.3565)
(-12.2831 -0.5598)	(-12.9977 -2.7857)
(-12.2831 -0.5598)	(-12.2831 3.2255)
(-12.9977 -2.7857)	(-5.4269 -10.3565)
(-12.2831 3.2255)	(-12.9977 4.7850)
(-12.9977 4.7850)	(-5.4269 12.3558)

CRYSTAL SHAPE:



ILMPHINT : MASON AND BERRY, 1968, P. 294
HEXAGONAL SYSTEM : A1:A2:A3:C=1:1:1: 2.7500 , ALPHA=BETA=GAMMA=90, , 3 FORM(S).
NUMBER OF FACES OF MILLER INDICES = 14
MILLER INDICES :

1	1	-2	0
-1	2	-1	0
-2	1	1	0
-1	-1	2	0
1	-2	1	0
2	-1	-1	0
0	0	0	1
0	0	0	-1
0	1	-1	2
-1	1	0	-2
-1	0	1	2
0	-1	1	-2
1	-1	0	2
1	0	-1	-2

THE CARTESIAN COORDINATES OF THE CRYSTAL FACES ARE :

1.7321	X +	1.0000	Y +	0.0	Z = 1
0.0	X +	2.0000	Y +	0.0	Z = 1
-1.7321	X +	1.0000	Y +	0.0	Z = 1
-1.7321	X +	-1.0000	Y +	0.0	Z = 1
0.0	X +	-2.0000	Y +	0.0	Z = 1
1.7321	X +	-1.0000	Y +	0.0	Z = 1
0.0	X +	0.0	Y +	4.0000	Z = 1
0.0	X +	0.0	Y +	-4.0000	Z = 1
0.0	X +	0.0	Y +	0.0	Z = 1
0.0	X +	0.0	Y +	0.0	Z = 1

```

-0.8298 X + 1.4206 Y + -1.0390 Z = 1
-1.6496 X + 0.0 Y + 1.0390 Z = 1
-0.8298 X + -1.4206 Y + -1.0390 Z = 1
0.8298 X + -1.4206 Y + 1.0390 Z = 1
1.6496 X + 0.0 Y + -1.0390 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :
( 0.2887 0.5000 -0.2475 )
( 0.2887 0.5000 0.0458 )
( 0.5774 0.0 0.2475 )
( 0.5774 0.0 -0.0458 )
( 0.4157 0.2800 0.2475 )
( 0.4503 0.2200 -0.2475 )
( -0.2887 0.5000 0.2475 )
( -0.2887 0.5000 -0.0458 )
( 0.0346 0.5000 0.2475 )
( -0.0346 0.5000 -0.2475 )
( -0.5774 0.0 0.0458 )
( -0.4503 0.2200 0.2475 )
( -0.4157 0.2800 -0.2475 )
( -0.2887 -0.5000 0.2475 )
( -0.2887 -0.5000 -0.0458 )
( -0.4503 -0.2200 0.2475 )
( -0.4157 -0.2800 -0.2475 )
( 0.2887 -0.5000 -0.2475 )
( 0.2887 -0.5000 0.0458 )
( 0.0346 -0.5000 0.2475 )
( -0.0346 -0.5000 -0.2475 )
( 0.4157 -0.2800 0.2475 )
( 0.4503 -0.2200 -0.2475 )

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.2887 0.5000 -0.2475 )----- ( 0.2887 0.5000 0.0458 )
( 0.2887 0.5000 -0.2475 )----- ( 0.4503 0.2200 -0.2475 )
( 0.2887 0.5000 -0.2475 )----- ( -0.0346 0.5000 -0.2475 )
( 0.2887 0.5000 0.0458 )----- ( 0.4157 0.2800 0.2475 )
( 0.2887 0.5000 0.0458 )----- ( 0.0346 0.5000 0.2475 )
( 0.5774 0.0 0.2475 )----- ( 0.5774 0.0 -0.0458 )
( 0.5774 0.0 0.2475 )----- ( 0.4157 0.2800 0.2475 )
( 0.5774 0.0 0.2475 )----- ( 0.4157 -0.2800 0.2475 )
( 0.5774 0.0 -0.0458 )----- ( 0.4503 0.2200 -0.2475 )
( 0.5774 0.0 -0.0458 )----- ( 0.4503 -0.2200 -0.2475 )
( 0.4157 0.2800 0.2475 )----- ( 0.0346 0.5000 0.2475 )
( 0.4503 0.2200 0.2475 )----- ( 0.4503 -0.2200 -0.2475 )
( -0.2887 0.5000 0.2475 )----- ( -0.2887 0.5000 -0.0458 )
( -0.2887 0.5000 0.2475 )----- ( 0.0346 0.5000 0.2475 )
( -0.2887 0.5000 0.2475 )----- ( -0.4503 0.2200 0.2475 )
( -0.2887 0.5000 -0.0458 )----- ( -0.0346 0.5000 -0.2475 )
( -0.2887 0.5000 -0.0458 )----- ( -0.4157 0.2800 -0.2475 )
( -0.0346 0.5000 -0.2475 )----- ( -0.4157 0.2800 0.2475 )
( -0.5774 0.0 -0.2475 )----- ( -0.5774 0.0 0.0458 )
( -0.5774 0.0 -0.2475 )----- ( -0.4157 0.2800 -0.2475 )
( -0.5774 0.0 -0.2475 )----- ( -0.4157 -0.2800 -0.2475 )
( -0.5774 0.0 0.0458 )----- ( -0.4503 0.2200 0.2475 )
( -0.5774 0.0 0.0458 )----- ( -0.4503 -0.2200 0.2475 )
( -0.4503 0.2200 0.2475 )----- ( -0.4503 -0.2200 -0.2475 )
( -0.2887 -0.5000 0.2475 )----- ( -0.2887 -0.5000 -0.0458 )
( -0.2887 -0.5000 0.2475 )----- ( -0.4503 -0.2200 -0.2475 )
( -0.2887 -0.5000 0.2475 )----- ( 0.0346 -0.5000 0.2475 )
( -0.2887 -0.5000 -0.0458 )----- ( -0.4157 -0.2800 -0.2475 )
( -0.2887 -0.5000 -0.0458 )----- ( -0.0346 -0.5000 -0.2475 )
( -0.4157 -0.2800 -0.2475 )----- ( -0.0346 -0.5000 0.2475 )
( 0.2887 -0.5000 -0.2475 )----- ( 0.2887 -0.5000 0.0458 )

```

```

( 0.2887 -0.5000 -0.2475 )----- ( -0.0346 -0.5000 -0.2475 )
( 0.2887 -0.5000 -0.2475 )----- ( 0.4503 -0.2200 -0.2475 )
( 0.2887 -0.5000 0.0458 )----- ( 0.0346 -0.5000 0.2475 )
( 0.2887 -0.5000 0.0458 )----- ( 0.4157 -0.2800 0.2475 )
( 0.0346 -0.5000 0.2475 )----- ( 0.4157 -0.2800 0.2475 )

THE MAXIMUM IS: 0.5774 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 1558.8457

VERTICES
449.9998 779.4226 -385.8140
449.9998 779.4229 71.4577
899.9998 0.0 385.8140
899.9998 0.0 -71.4065
647.9902 436.4932 385.8137
701.9797 342.9805 -385.8140
-449.9998 779.4229 385.8140
-449.9998 779.4229 -71.4581
54.0023 779.4229 385.8140
-54.0023 779.4229 -385.8140
-899.9998 0.0 -385.8140
-899.9998 0.0 71.4065
-701.9797 342.9805 385.8140
-647.9902 436.4932 -385.8137
-449.9998 -779.4226 385.8140
-449.9998 -779.4229 -71.4577
-701.9797 -342.9805 385.8140
-647.9902 -436.4932 -385.8137
-449.9998 -779.4229 -385.8140
-449.9998 -779.4229 71.4581
54.0023 -779.4229 385.8140
-54.0023 -779.4229 -385.8140
647.9902 -436.4932 385.8137
701.9797 -342.9805 -385.8140

EDGES
1 2
1 6
1 10
2 5
2 9
3 4
3 5
3 23
4 6
4 24
5 9
6 24
7 8
7 9
7 13
8 10
8 14
10 14
11 12
11 14
11 18
12 13
12 17
13 17
15 16
15 17
15 21
16 18
16 22
18 22

```

19 20
19 22
19 24
20 21
20 23
21 23
FACES
1 2 5 3 4 6
1 2 9 7 8 10
7 8 14 11 12 13
11 12 17 15 16 18
15 16 22 19 20 21
3 4 24 19 20 23
3 5 9 7 13 17 15 21 23
1 6 24 19 22 18 11 14 10
2 5 9
8 10 14
12 13 17
16 18 22
20 21 23
4 6 24
THE MAXIMUM IS: 0.6089934111 THE CONVERSION FACTOR FOR VIEWPLOT IS : 29.5569610596
THE 20 EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
(11.5570 -8.8175)----- (11.5570 -0.1473)
(11.5570 -8.8175)----- (1.4778 -9.6587)
(11.5570 -8.8175)----- (15.1651 -7.1351)
(11.5570 -0.1473)----- (3.6373 5.1523)
(11.5570 -0.1473)----- (14.3919 7.1351)
(-6.4430 4.3110)----- (-6.4430 -4.3583)
(-6.4430 4.3110)----- (3.6373 5.1523)
(-6.4430 4.3110)----- (-12.9152 5.1523)
(-6.4430 -4.3583)----- (1.4778 -9.6587)
(-6.4430 -4.3583)----- (-11.5286 -9.6587)
(3.6373 5.1523)----- (14.3919 7.1351)
(1.4778 -9.6587)----- (-11.5286 -9.6587)
(18.0000 8.8175)----- (18.0000 0.1473)
(18.0000 8.8175)----- (14.3919 7.1351)
(18.0000 8.8175)----- (11.5286 9.6587)
(18.0000 0.1473)----- (15.1651 -7.1351)
(18.0000 0.1473)----- (12.9152 -5.1523)
(15.1651 -7.1351)----- (12.9152 -5.1523)
(6.4430 -4.3110)----- (6.4430 4.3583)
(6.4430 -4.3110)----- (12.9152 -5.1523)
(6.4430 -4.3110)----- (-3.6373 -5.1523)
(6.4430 4.3583)----- (11.5286 9.6587)
(6.4430 4.3583)----- (-1.4778 9.6587)
(11.5286 9.6587)----- (-1.4778 9.6587)
(-11.5570 8.8175)----- (-11.5570 0.1473)
(-11.5570 8.8175)----- (-1.4778 9.6587)
(-11.5570 8.8175)----- (-15.1651 7.1351)
(-11.5570 0.1473)----- (-3.6373 -5.1523)
(-11.5570 0.1473)----- (-14.3919 -7.1351)
(-3.6373 -5.1523)----- (-14.3919 -7.1351)
(-18.0000 -8.8175)----- (-18.0000 -0.1473)
(-18.0000 -8.8175)----- (-14.3919 -7.1351)
(-18.0000 -8.8175)----- (-11.5286 -9.6587)
(-18.0000 -0.1473)----- (-15.1651 7.1351)
(-18.0000 -0.1473)----- (-12.9152 5.1523)
(-15.1651 7.1351)----- (-12.9152 5.1523)
CRYSTAL SHAPE:

MONOCLINIC SYSTEM : A:B:C= 1.1040: 1.0000: 0.6100 ,ALPHA=90°, BETA= 107.3333 , 4 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 10
MILLER INDICES :
1 0 0
-1 0 0
0 1 0
0 -1 0
1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 0 1
0 0 -1
THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :
0.9489 X + 0.0 Y + 0.0 Z = 1
-0.9489 X + 0.0 Y + 0.0 Z = 1
0.0 X + 1.0000 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + 0.0 Z = 1
0.5931 X + 0.6250 Y + 0.0 Z = 1
-0.5931 X + 0.6250 Y + 0.0 Z = 1
-0.5931 X + -0.6250 Y + 0.0 Z = 1
0.5931 X + -0.6250 Y + 0.0 Z = 1
0.1705 X + 0.0 Y + 0.5864 Z = 1
-0.1705 X + 0.0 Y + -0.5864 Z = 1
THE POSITIONS OF THE CRYSTAL VERTICES ARE :
(1.0539 0.6000 1.5011)
(1.0539 0.6000 -2.1589)
(1.0539 -0.6000 1.5011)
(1.0539 -0.6000 -2.1589)
(-1.0539 0.6000 2.1589)
(-1.0539 0.6000 -1.5011)
(-1.0539 -0.6000 2.1589)
(-1.0539 -0.6000 -1.5011)
(0.6323 1.0000 1.6326)
(0.6323 1.0000 -2.0273)
(-0.6323 1.0000 2.0273)
(-0.6323 1.0000 -1.6326)
(0.6323 -1.0000 2.0273)
(0.6323 -1.0000 -1.6326)
(-0.6323 -1.0000 1.6326)
(-0.6323 -1.0000 -2.0273)
THE 20 EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :


```

( 1.0539 0.6000 1.5011 )----- ( 1.0539 0.6000 -2.1589 )
( 1.0539 0.6000 1.5011 )----- ( 1.0539 -0.6000 1.5011 )
( 1.0539 0.6000 1.5011 )----- ( 0.6323 1.0000 1.6326 )
( 1.0539 0.6000 -2.1589 )----- ( 1.0539 -0.6000 -2.1589 )
( 1.0539 0.6000 -2.1589 )----- ( 0.6323 1.0000 -2.1589 )
( 1.0539 -0.6000 1.5011 )----- ( 1.0539 -0.6000 1.6326 )
( 1.0539 -0.6000 1.5011 )----- ( 0.6323 -1.0000 -2.0273 )
( 1.0539 -0.6000 -2.1589 )----- ( -1.0539 0.6000 -1.5011 )
( -1.0539 0.6000 2.1589 )----- ( -1.0539 -0.6000 2.1589 )
( -1.0539 0.6000 2.1589 )----- ( -0.6323 1.0000 2.0273 )
( -1.0539 0.6000 -1.5011 )----- ( -1.0539 -0.6000 -1.5011 )
( -1.0539 0.6000 -1.5011 )----- ( -0.6323 1.0000 -1.6326 )
( -1.0539 -0.6000 2.1589 )----- ( -1.0539 -0.6000 -1.5011 )
( -1.0539 -0.6000 2.1589 )----- ( -0.6323 -1.0000 2.0273 )
( -1.0539 -0.6000 -1.5011 )----- ( -0.6323 -1.0000 -1.6326 )
( 0.6323 1.0000 1.6326 )----- ( 0.6323 1.0000 -2.0273 )
( 0.6323 1.0000 -2.0273 )----- ( -0.6323 1.0000 -1.6326 )
( -0.6323 1.0000 2.0273 )----- ( -0.6323 1.0000 -1.6326 )
( -0.6323 -1.0000 2.0273 )----- ( -0.6323 -1.0000 -1.6326 )
( -0.6323 -1.0000 -1.6326 )----- ( 0.6323 -1.0000 -2.0273 )
( 0.6323 -1.0000 1.6326 )----- ( 0.6323 -1.0000 -2.0273 )

```

THE MAXIMUM IS: 2.1589 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 416.8762

VERTICES

439.3306	250.1255	625.7664
439.3306	250.1255	-899.9995
439.3306	-250.1255	625.7664
439.3306	-250.1255	-899.9995
-439.3306	250.1255	899.9995
-439.3306	250.1255	-625.7664
-439.3306	-250.1255	899.9995
-439.3306	-250.1255	-625.7664
263.5981	416.8762	680.6125
263.5981	416.8762	-845.1528
-263.5981	416.8762	845.1528
-263.5981	416.8762	-680.6125
-263.5981	-416.8762	845.1528
-263.5981	-416.8762	-680.6125
263.5981	-416.8762	680.6125
263.5981	-416.8762	-845.1528

EDGES

1	2
1	3
1	9
2	4
2	10
3	4
3	15
4	16
5	6
5	7
5	11
6	8
6	12
7	8
7	13
8	14
9	10
9	11
10	12

11 12
13 14
13 15
14 16
15 16

FACES

1	2	4	3
5	6	8	7
9	10	12	11
13	14	16	15
1	2	10	9
5	6	12	11
7	8	14	13
3	4	16	15
1	3	15	13
2	4	16	14

THE MAXIMUM IS: 2.3444509506 THE CONVERSION FACTOR FOR VIEWPLOT IS : 1.6777029037

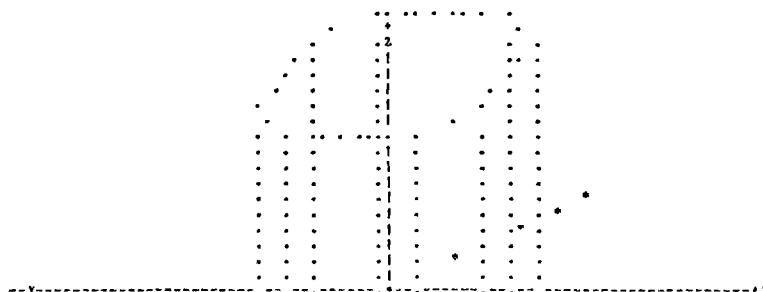
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

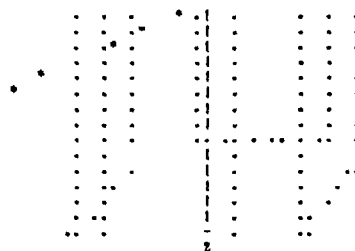
```

( 1.5516 10.1004 )----- ( 1.5516 -18.0000 )
( 1.5516 10.1004 )----- ( -7.6616 10.1004 )
( 1.5516 10.1004 )----- ( 5.8447 11.6803 )
( 1.5516 -18.0000 )----- ( -7.6616 -18.0000 )
( 1.5516 -18.0000 )----- ( 5.8447 -16.4201 )
( -7.6616 10.1004 )----- ( -7.6616 -18.0000 )
( -7.6616 10.1004 )----- ( -9.5107 11.6803 )
( -7.6616 -18.0000 )----- ( -9.5107 -16.4201 )
( 7.6616 18.0000 )----- ( 7.6616 -10.1004 )
( 7.6616 18.0000 )----- ( -1.5516 18.0000 )
( 7.6616 18.0000 )----- ( 9.5107 16.4201 )
( 7.6616 -10.1004 )----- ( -1.5516 -10.1004 )
( 7.6616 -10.1004 )----- ( 9.5107 -11.6803 )
( -1.5516 18.0000 )----- ( -1.5516 -10.1004 )
( -1.5516 18.0000 )----- ( -5.8447 16.4201 )
( -1.5516 -10.1004 )----- ( -5.8447 -11.6803 )
( 5.8447 11.6803 )----- ( 5.8447 -16.4201 )
( 5.8447 11.6803 )----- ( 9.5107 16.4201 )
( 5.8447 -16.4201 )----- ( 9.5107 -11.6803 )
( 9.5107 16.4201 )----- ( 9.5107 -11.6803 )
( -5.8447 16.4201 )----- ( -5.8447 -11.6803 )
( -5.8447 16.4201 )----- ( -9.5107 11.6803 )
( -5.8447 -11.6803 )----- ( -9.5107 -16.4201 )
( -9.5107 11.6803 )----- ( -9.5107 -16.4201 )

```

CRYSTAL SHAPE:





TRICLINIC SYSTEM, A:B:C= 0.9173: 1.0000: 0.7196 ALPHA= 90.0900 , BETA= 101.0300 , GAMMA= 105.1500
 FORM(S): 4

NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

1 0 0
 -1 0 0
 0 1 0
 0 -1 0
 1 -1 0
 -1 1 0
 0 0 1
 0 0 -1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.1107 X + 0.3115 Y + 0.0 Z = 1
 -1.1107 X + -0.3115 Y + 0.0 Z = 1
 0.0 X + 1.0354 Y + 0.0 Z = 1
 0.0 X + -1.0354 Y + 0.0 Z = 1
 0.7404 X + -0.4847 Y + 0.0 Z = 1
 -0.7404 X + 0.4847 Y + 0.0 Z = 1
 0.1354 X + 0.0391 Y + -0.6948 Z = 1
 -0.1354 X + -0.0391 Y + -0.6948 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(0.6304 0.9629 1.2621)
 (0.6304 0.9629 -1.6163)
 (1.0354 -0.4814 1.2645)
 (1.0354 -0.4814 -1.6139)
 (-0.6304 -0.9629 1.6163)
 (-0.6304 -0.9629 -1.2621)
 (-1.0354 0.4814 1.6139)
 (-1.0354 0.4814 -1.2645)
 (-0.7202 0.9629 1.5254)
 (-0.7202 0.9629 -1.3530)
 (0.7202 -0.9629 1.3530)
 (0.7202 -0.9629 -1.5254)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(0.6304 0.9629 1.2621)----- (0.6304 0.9629 -1.6163)
 (0.6304 0.9629 1.2621)----- (1.0354 -0.4814 1.2645)
 (0.6304 0.9629 1.2621)----- (-0.7202 0.9629 1.5254)
 (0.6304 0.9629 -1.6163)----- (1.0354 -0.4814 -1.6139)
 (0.6304 0.9629 -1.6163)----- (-0.7202 0.9629 -1.3530)
 (1.0354 -0.4814 1.2645)----- (1.0354 -0.4814 -1.6139)
 (1.0354 -0.4814 1.2645)----- (0.7202 -0.9629 1.3530)
 (1.0354 -0.4814 -1.6139)----- (0.7202 -0.9629 -1.5254)
 (-0.6304 -0.9629 1.6163)----- (-0.6304 -0.9629 -1.2621)

Apdx. 2-b, p. 148

(-0.6304 -0.9629 1.6163)----- (-1.0354 0.4814 1.6139)
 (-0.6304 -0.9629 1.6163)----- (0.7202 -0.9629 1.3530)
 (-0.6304 -0.9629 -1.2621)----- (-1.0354 0.4814 -1.2645)
 (-0.6304 -0.9629 -1.2621)----- (0.7202 -0.9629 -1.5254)
 (-1.0354 0.4814 1.6139)----- (-1.0354 0.4814 -1.2645)
 (-1.0354 0.4814 1.6139)----- (0.7202 -0.9629 1.3530)
 (-1.0354 0.4814 -1.2645)----- (-0.7202 0.9629 -1.3530)
 (-0.7202 0.9629 1.5254)----- (-0.7202 0.9629 -1.3530)
 (0.7202 -0.9629 1.3530)----- (0.7202 -0.9629 -1.5254)

THE MAXIMUM IS:

1.6163

THE CONVERSION FACTOR FOR THE PINTER GRAPH IS :

556.8381

VERTICES

351.0039 536.1567 702.7998
 351.0039 536.1567 -899.9995
 576.5259 -268.0764 704.1125
 576.5259 -268.0764 -898.6890
 -351.0039 -536.1567 899.9995
 -351.0039 -536.1567 -702.7998
 -576.5259 268.0764 898.6890
 -576.5259 268.0764 -704.1125
 -401.0222 536.1567 849.3887
 -401.0222 536.1567 -753.4128
 401.0222 -536.1567 753.4128
 401.0222 -536.1567 -849.3887

EDGES

1 2
 1 3
 1 9
 2 4
 2 10
 3 4
 3 11
 4 12
 5 6
 5 7
 5 11
 6 8
 6 12
 7 8
 7 9
 8 10
 9 10
 11 12

FACES

1 2 4 3
 5 6 8 7
 1 2 10 9
 5 6 12 11
 3 4 12 11
 7 8 10 9
 1 3 11 5 7 9
 2 4 12 6 8 10

THE MAXIMUM IS:

1.7961940765

THE CONVERSION FACTOR FOR VIEWPLOT IS :

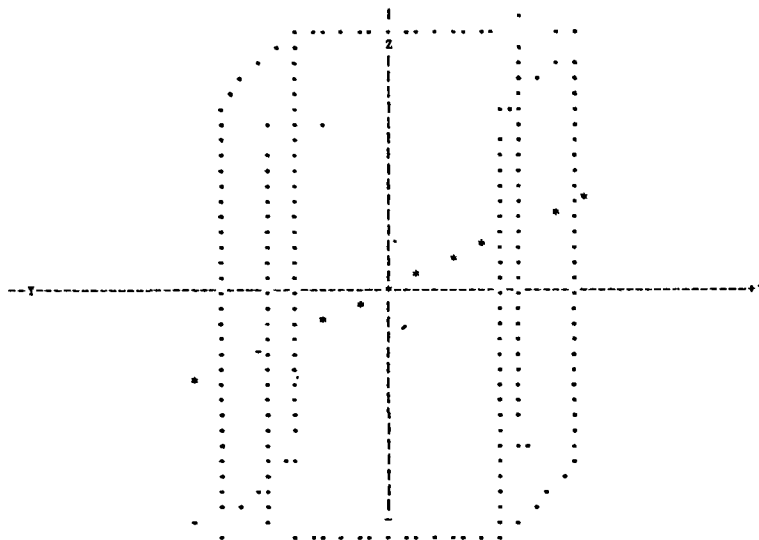
10.0211887360

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(7.2640 11.5359)----- (7.2640 -17.3090)
 (7.2640 11.5359)----- (-8.7419 10.8450)
 (7.2640 11.5359)----- (12.3739 16.5567)
 (7.2640 -17.3090)----- (-8.7419 -18.0000)
 (7.2640 -17.3090)----- (12.3739 -12.2883)
 (-8.7419 10.8450)----- (-8.7419 -18.0000)
 (-8.7419 10.8450)----- (-12.3739 12.2883)
 (-8.7419 -18.0000)----- (-12.3739 -16.5567)
 (-7.2640 17.3090)----- (-7.2640 -11.5359)

```
( -7.2640 17.3090 )----- ( 8.7419 18.0000 )
( -7.2640 17.3090 )----- ( -12.3739 12.2883 )
( -7.2640 -11.5359 )----- ( 8.7419 -10.8450 )
( -7.2640 -11.5359 )----- ( -12.3739 -16.5567 )
( 8.7419 18.0000 )----- ( 8.7419 -10.8450 )
( 8.7419 18.0000 )----- ( -12.3739 -16.5567 )
( 8.7419 -10.8450 )----- ( 12.3739 12.2883 )
( 12.3739 16.5567 )----- ( 12.3739 -12.2883 )
( -12.3739 12.2883 )----- ( -12.3739 -16.5567 )
```

CRYSTAL SHAPE:



LAPDOWITE BITOWNITE ANORTHITE : ROGERS, 1937, P. 437
 TRICLINIC SYSTEM, A:B:C= 0.6350: 1.0000: 1.1003 ALPHA= 93.1666 , BETA= 115.8500 , GAMMA= 91.2166
 ,: 4 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 10
 MILLER INDICES :

```
1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 -1 0
0 0 1
0 0 -1
-1 0 1
1 0 -1
```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```
1.7499 X + 1.0912 Y + 0.0 Z = 1
-1.7499 X + 0.9144 Y + 0.0 Z = 1
-1.7499 X + -1.0912 Y + 0.0 Z = 1
1.7499 X + -0.9144 Y + 0.0 Z = 1
0.0 X + 2.0056 Y + 0.0 Z = 1
0.0 X + -2.0056 Y + 0.0 Z = 1
0.5871 X + 0.0968 Y + 1.2118 Z = 1
-0.5871 X + -0.0968 Y + -1.2118 Z = 1
-1.5407 X + 0.0 Y + 1.0692 Z = 1
1.5407 X + 0.0184 Y + -1.0692 Z = 1
```

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THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```
( 0.5715 0.0 0.5484 )
( 0.5715 0.0 -0.1118 )
( 0.2606 0.4986 0.6592 )
( 0.2606 0.4986 -0.5512 )
( -0.5715 0.0 -0.5484 )
( -0.5715 0.0 -0.1118 )
( -0.3109 0.4986 -0.7144 )
( -0.3109 0.4986 0.4873 )
( -0.2606 -0.4986 -0.6592 )
( -0.2606 -0.4986 0.5598 )
( 0.3109 -0.4986 -0.7144 )
( 0.3109 -0.4986 -0.4958 )
( -0.0778 0.4986 0.8231 )
( 0.0320 0.4986 -0.8806 )
( -0.0365 -0.4986 0.8877 )
( 0.0823 -0.4986 -0.8253 )
```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```
( 0.5715 0.0 0.5484 )----- ( 0.5715 0.0 -0.1118 )
( 0.5715 0.0 0.5484 )----- ( 0.2606 0.4986 0.6592 )
( 0.5715 0.0 0.5484 )----- ( 0.3109 -0.4986 0.7144 )
( 0.5715 0.0 -0.1118 )----- ( 0.2606 0.4986 -0.5512 )
( 0.5715 0.0 -0.1118 )----- ( 0.3109 -0.4986 -0.4958 )
( 0.2606 0.4986 0.6592 )----- ( 0.2606 0.4986 -0.5512 )
( 0.2606 0.4986 0.6592 )----- ( -0.0778 0.4986 0.8231 )
( 0.2606 0.4986 -0.5512 )----- ( 0.0320 0.4986 -0.8806 )
( -0.5715 0.0 -0.5484 )----- ( -0.5715 0.0 -0.1118 )
( -0.5715 0.0 -0.5484 )----- ( -0.3109 0.4986 -0.7144 )
( -0.5715 0.0 -0.5484 )----- ( -0.2606 -0.4986 -0.6592 )
( -0.5715 0.0 -0.1118 )----- ( -0.3109 0.4986 0.4873 )
( -0.5715 0.0 0.1118 )----- ( -0.2606 -0.4986 0.5598 )
( -0.3109 0.4986 -0.7144 )----- ( -0.3109 0.4986 0.4873 )
( -0.3109 0.4986 -0.7144 )----- ( -0.0778 0.4986 0.8231 )
( -0.3109 0.4986 -0.4873 )----- ( -0.2606 -0.4986 -0.6592 )
( -0.2606 -0.4986 -0.6592 )----- ( -0.2606 -0.4986 0.5598 )
( -0.2606 -0.4986 0.5598 )----- ( -0.0365 -0.4986 0.8877 )
( 0.3109 -0.4986 0.7144 )----- ( 0.3109 -0.4986 -0.4958 )
( 0.3109 -0.4986 0.7144 )----- ( -0.0365 -0.4986 0.8877 )
( 0.3109 -0.4986 -0.4958 )----- ( 0.0823 -0.4986 -0.8253 )
( -0.0778 0.4986 0.8231 )----- ( -0.0365 -0.4986 0.8877 )
( 0.0320 0.4986 -0.8806 )----- ( 0.0823 -0.4986 -0.8253 )
```

THE MAXIMUM IS:

```
VERTICES
582.6545 0.0 559.0942
582.6543 0.0 -114.0146
265.6582 508.3669 672.0798
265.6584 508.3669 -562.0251
-582.6545 0.0 -559.0942
-582.6545 0.0 114.0143
-116.9973 508.3669 -128.4019
-116.9971 508.3669 411.8044
```

0.8821

THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :

1019.5859

```

-265.6582 -508.3669 -672.0798
-265.6584 -508.3669 570.7798
316.9973 -508.3669 728.4019
316.9971 -508.3669 -505.5541
-79.3503 508.3672 839.2154
32.6330 508.3672 -897.7969
-37.1799 -508.3672 899.9398
83.8972 -508.3672 -841.4385

```

EDGES

```

1 2
1 3
1 11
2 4
2 12
3 4
3 13
4 14
5 6
5 7
5 9
6 8
6 10
7 8
7 14
8 13
9 10
9 16
10 15
11 12
11 15
12 16
13 15
14 16

```

FACES

```

1 2 4 3
5 6 8 7
5 6 10 9
1 2 12 11
3 4 14 7 8 13
9 10 15 11 12 16
1 3 13 15 11
5 7 14 16 9
6 8 13 15 10
2 4 14 16 12

```

THE MAXIMUM IS: 0.8891311288 THE CONVERSION FACTOR FOR VIEWPLOT IS: 20.2444763184

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

```

( -4.3680 9.0644 )----- ( -4.3680 -4.3006 )
( -4.3680 9.0644 )----- ( 8.1023 12.4159 )
( -4.3680 9.0644 )----- ( -12.4704 13.3547 )
( -4.3680 -4.3006 )----- ( 8.1023 -12.0880 )
( -4.3680 -4.3006 )----- ( -12.4704 -11.1463 )
( 8.1023 12.4159 )----- ( 8.1023 -12.0880 )
( 8.1023 12.4159 )----- ( 10.6888 16.9409 )
( 8.1023 -12.0880 )----- ( 9.8493 -17.9404 )
( 4.3680 -9.0644 )----- ( 4.3680 4.3006 )
( 4.3680 -9.0644 )----- ( 12.4704 -13.3547 )
( 4.3680 -9.0644 )----- ( -8.1023 -12.4159 )
( 4.3680 4.3006 )----- ( 12.4704 10.9725 )
( 4.3680 4.3006 )----- ( -8.1023 12.2618 )
( 12.4704 -13.3547 )----- ( 12.4704 10.9725 )
( 12.4704 -13.3547 )----- ( 9.8493 -17.9404 )
( 12.4704 10.9725 )----- ( 10.6888 16.9409 )

```

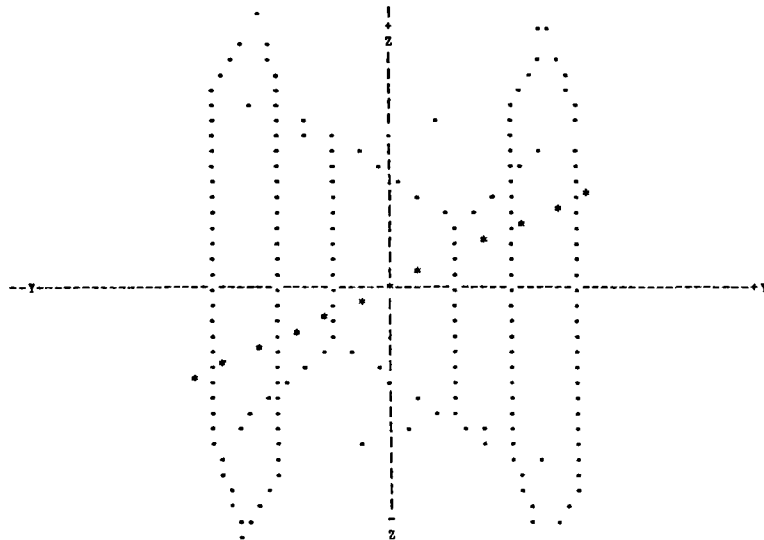
Apdx. 2-b, p. 152

```

( -8.1023 -12.4159 )----- ( -8.1023 12.2618 )
( -8.1023 -12.4159 )----- ( -10.7229 -17.0005 )
( -8.1023 12.2618 )----- ( -9.8152 18.0000 )
( -12.4704 13.3547 )----- ( -12.4704 -11.1463 )
( -12.4704 13.3547 )----- ( -9.8152 18.0000 )
( -12.4704 -11.1463 )----- ( -10.7229 -17.0005 )
( 10.6888 16.9409 )----- ( -9.8152 18.0000 )
( 9.8493 -17.9404 )----- ( -10.7229 -17.0005 )

```

CRYSTAL SHAPE:



LEPIDOLITE : AXIAL RATIOS : MASON AND D'APPY, 1968, P. 452
 FORMS : DFER HOWIE AND ZUSCHMAN, 1967, P. 217
 MONOCLINIC SYSTEM : A:B:C= 0.5181: 1.0000: 2.2480, ALPHA=90, BETA= 100.8000, 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

```

1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 1 0
0 -1 0
0 0 1
0 0 -1

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

1.9649 X + 1.0000 Y + 0.0 Z = 1
-1.9649 X + 1.0000 Y + 0.0 Z = 1
-1.1649 X - 1.0000 Y + 0.0 Z = 1

```

1.9649 X + -1.0000 Y + 0.0 Z = 1
 0.0 X + 1.8667 Y + 0.0 Z = 1
 0.0 X + -1.8667 Y + 0.0 Z = 1
 0.8486 X + 0.0 Y + 0.4484 Z = 1
 -0.8486 X + 0.0 Y + -0.4484 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5089	0.0	0.1277	)
(	0.5089	0.0	-0.3219	)
(	0.2036	0.6000	0.1860	)
(	0.2036	0.6000	-0.2636	)
(	-0.5089	0.0	0.3219	)
(	-0.5089	0.0	-0.1277	)
(	-0.2036	0.6000	0.2636	)
(	-0.2036	0.6000	-0.1860	)
(	-0.2036	-0.6000	0.2636	)
(	-0.2036	-0.6000	-0.1860	)
(	0.2036	-0.6000	0.1860	)
(	0.2036	-0.6000	-0.2636	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.5089	0.0	0.1277	)	-----	(	0.5089	0.0	-0.3219	)
(	0.5089	0.0	0.1277	)	-----	(	0.2036	0.6000	0.1860	)
(	0.5089	0.0	0.1277	)	-----	(	0.2036	-0.6000	0.1860	)
(	0.5089	0.0	-0.3219	)	-----	(	0.2036	0.6000	-0.2636	)
(	0.5089	0.0	-0.3219	)	-----	(	0.2036	-0.6000	-0.2636	)
(	0.2036	0.6000	0.1860	)	-----	(	0.2036	0.6000	-0.2636	)
(	0.2036	0.6000	0.1860	)	-----	(	-0.2036	0.6000	0.2636	)
(	0.2036	0.6000	-0.2636	)	-----	(	-0.2036	0.6000	-0.1860	)
(	-0.5089	0.0	0.3219	)	-----	(	-0.5089	0.0	-0.1277	)
(	-0.5089	0.0	0.3219	)	-----	(	-0.2036	0.6000	0.2636	)
(	-0.5089	0.0	-0.1277	)	-----	(	-0.2036	-0.6000	0.2636	)
(	-0.5089	0.0	-0.1277	)	-----	(	-0.2036	0.6000	-0.1860	)
(	-0.2036	0.6000	0.2636	)	-----	(	-0.2036	0.6000	-0.1860	)
(	-0.2036	-0.6000	0.2636	)	-----	(	-0.2036	-0.6000	-0.1860	)
(	-0.2036	-0.6000	0.2636	)	-----	(	0.2036	-0.6000	0.1860	)
(	-0.2036	-0.6000	-0.1860	)	-----	(	0.2036	-0.6000	-0.2636	)
(	0.2036	-0.6000	0.1860	)	-----	(	0.2036	-0.6000	-0.2636	)

THE MAXIMUM IS:

0.6000

THE CONVERSION FACTOR FOR THE PINTER GRAPH IS :

1499.9993

VERTICES

763.3845	0.0	191.5758
763.3845	0.0	-482.8232
305.3535	899.9998	278.9500
305.3535	899.9998	-395.4487
-763.3845	0.0	482.8232
-763.3845	0.0	-191.5758
-305.3535	899.9998	395.4487
-305.3535	899.9998	-278.9500
-305.3535	-899.9998	395.4487
-305.3535	-899.9998	-278.9500
305.3535	-899.9998	278.9500
305.3535	-899.9998	-395.4487

EDGES

1	2
1	3
1	11
2	4
2	12
3	4
3	7
4	8
5	6
5	7

5	9
6	8
6	10
7	8
9	10
9	11
10	12
11	12

FACES

1	2	4	3
5	6	8	7
5	6	10	9
1	2	12	11
3	4	8	7
9	10	12	11
1	3	7	5
2	4	8	6
		9	11
		10	12

THE MAXIMUM IS:

0.6768606305

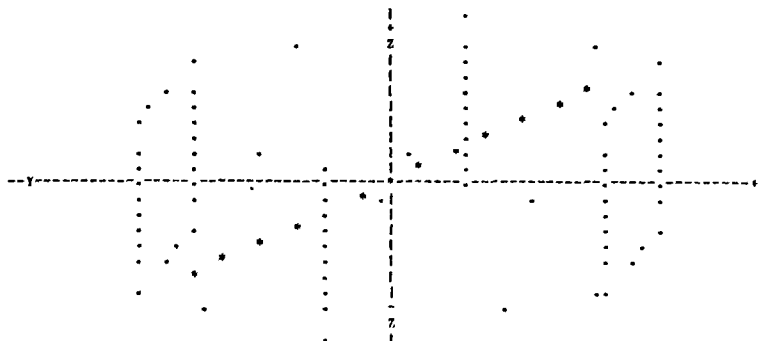
THE CONVERSION FACTOR FOR VIEWPLOT IS :

26.5933532715

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(	-5.1100	1.0137	)	-----	(	-5.1100	-10.9427	)
(	-5.1100	1.0137	)	-----	(	13.9120	3.9924	)
(	-5.1100	1.0137	)	-----	(	-18.0000	3.9924	)
(	-5.1100	-10.9427	)	-----	(	13.9120	-7.9640	)
(	-5.1100	-10.9427	)	-----	(	-18.0000	-7.9640	)
(	13.9120	3.9924	)	-----	(	13.9120	-7.9640	)
(	13.9120	3.9924	)	-----	(	-18.0000	7.9640	)
(	13.9120	-7.9640	)	-----	(	-18.0000	-3.9924	)
(	5.1100	10.9427	)	-----	(	5.1100	-1.0137	)
(	5.1100	10.9427	)	-----	(	-18.0000	7.9640	)
(	5.1100	10.9427	)	-----	(	-13.9120	7.9640	)
(	5.1100	-1.0137	)	-----	(	-18.0000	-3.9924	)
(	5.1100	-1.0137	)	-----	(	-13.9120	-3.9924	)
(	18.0000	7.9640	)	-----	(	-18.0000	-3.9924	)
(	-13.9120	7.9640	)	-----	(	-13.9120	-3.9924	)
(	-13.9120	7.9640	)	-----	(	-18.0000	3.9924	)
(	-13.9120	-3.9924	)	-----	(	-18.0000	-7.9640	)
(	-18.0000	3.9924	)	-----	(	-18.0000	-7.9640	)

CRYSTAL SHAPE:



THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :		
1.0000 X	-1.0000 Y	2.0000 Z = 1
-1.0000 X	+1.0000 Y	-2.0000 Z = 1
1.0000 X	-2.0000 Y	1.0000 Z = 1
1.0000 X	-1.0000 Y	-2.0000 Z = 1
-1.0000 X	2.0000 Y	-1.0000 Z = 1
1.0000 X	-2.0000 Y	-1.0000 Z = 1
-1.0000 X	2.0000 Y	1.0000 Z = 1
-1.0000 X	1.0000 Y	2.0000 Z = 1
1.0000 X	1.0000 Y	-2.0000 Z = 1
-1.0000 X	-1.0000 Y	2.0000 Z = 1
1.0000 X	2.0000 Y	-1.0000 Z = 1
-1.0000 X	-2.0000 Y	1.0000 Z = 1
1.0000 X	2.0000 Y	1.0000 Z = 1
-1.0000 X	-2.0000 Y	-1.0000 Z = 1
1.0000 X	1.0000 Y	2.0000 Z = 1
-1.0000 X	-1.0000 Y	-2.0000 Z = 1
2.0000 X	-1.0000 Y	-1.0000 Z = 1
-2.0000 X	1.0000 Y	-1.0000 Z = 1
2.0000 X	1.0000 Y	-1.0000 Z = 1
-2.0000 X	-1.0000 Y	1.0000 Z = 1
2.0000 X	-1.0000 Y	1.0000 Z = 1
-2.0000 X	1.0000 Y	1.0000 Z = 1
2.0000 X	1.0000 Y	1.0000 Z = 1
-2.0000 X	-1.0000 Y	-1.0000 Z = 1

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```
(      0.0      -0.3333      -0.3333      )
(      0.2500     -0.2500     -0.2500      )
(      0.3333      0.0      -0.3333      )
(      0.0      0.5000      0.0      )
(     -0.3333     0.3333      0.0      )
(      0.0      0.3333     0.3333      )
(     -0.2500     0.2500     0.2500      )
(     -0.3333      0.0      0.3333      )
(      0.2500     0.2500     -0.2500      )
(     -0.2500     -0.2500     0.2500      )
(      0.3333     0.3333      0.0      )
(     -0.3333     -0.3333      0.0      )
(      0.2500     0.2500     0.2500      )
(     -0.2500     -0.2500     -0.2500      )
(      0.5000      0.0      0.0      )
(     -0.5000      0.0      0.0      )
```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :					
0.0	-0.3333	0.3333	0.2500	-0.2500	0.2500
0.0	-0.3333	0.3333	0.0	0.0	0.5000
0.0	-0.3333	0.3333	0.0	-0.5000	0.0
0.0	-0.3333	0.3333	-0.2500	-0.2500	0.2500
0.2500	-0.2500	0.2500	0.3333	0.3333	0.3333
0.5000	-0.2500	0.2500	0.3333	-0.3333	0.3333
0.0	0.0	0.5000	0.3333	0.0	0.3333
0.0	0.0	0.5000	0.0	0.3333	0.3333
0.0	0.0	0.5000	-0.3333	0.0	0.3333
0.3333	0.0	0.3333	0.2500	0.2500	0.2500
0.3333	0.0	0.3333	0.5000	0.0	0.0
0.0	0.0	-0.5000	0.0	0.3333	-0.3333
0.0	0.0	-0.5000	-0.3333	0.0	-0.3333
0.0	0.0	-0.5000	0.0	-0.3333	-0.3333
0.0	0.0	-0.5000	0.3333	0.0	-0.3333
0.0	0.3333	-0.3333	-0.2500	0.2500	-0.2500
0.0	0.3333	-0.3333	0.0	0.5000	0.0
0.0	0.3333	-0.3333	0.2500	0.2500	-0.2500
-0.2500	0.2500	-0.2500	0.3333	0.0	-0.3333
-0.2500	0.2500	-0.2500	-0.3333	0.3333	0.0
-0.3333	0.0	-0.3333	-0.2500	-0.2500	-0.2500
-0.3333	0.0	-0.3333	-0.5000	0.0	0.0
0.0	-0.5000	0.0	0.3333	-0.3333	0.0
0.0	-0.5000	0.0	0.0	-0.3333	-0.3333
0.0	-0.5000	0.0	-0.3333	-0.3333	0.0
0.3333	-0.3333	0.0	0.2500	-0.2500	-0.2500
0.3333	-0.3333	0.0	0.5000	0.0	0.0
0.0	-0.3333	-0.3333	0.2500	-0.2500	-0.2500
0.0	-0.3333	-0.3333	-0.2500	-0.2500	-0.2500
0.2500	-0.2500	-0.2500	0.3333	0.0	-0.3333
0.3333	0.0	-0.3333	0.2500	0.2500	-0.2500
0.3333	0.0	-0.3333	0.5000	0.0	0.0
0.0	0.5000	0.0	-0.3333	0.3333	0.0
0.0	0.5000	0.0	0.0	0.3333	0.3333
0.0	0.5000	0.0	0.3333	0.3333	0.0
-0.3333	0.3333	0.0	-0.2500	0.2500	0.2500
-0.3333	0.3333	0.0	-0.5000	0.0	0.0
0.0	0.3333	0.3333	-0.2500	0.2500	0.2500
0.0	0.3333	0.3333	0.2500	0.2500	0.2500
-0.2500	0.2500	0.2500	-0.3333	0.0	0.3333
-0.3333	0.0	0.3333	-0.2500	-0.2500	0.2500
-0.3333	0.0	0.3333	-0.5000	0.0	0.0
0.2500	0.2500	-0.2500	0.3333	0.3333	0.0
-0.2500	-0.2500	0.2500	-0.3333	-0.3333	0.0
0.3333	0.3333	0.0	0.2500	0.2500	0.2500

```

( 0.3333 0.3333 0.0 )-----{ 0.5000 0.0 0.0 }
( -0.3333 -0.3333 0.0 )-----{ -0.2500 -0.2500 -0.2500 }
( -0.3333 -0.3333 0.0 )-----{ -0.5000 0.0 0.0 }
0.5000 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 1800.0000

THE MAXIMUM IS:
VERTICES
0.0 -599.9998 599.9998
450.0000 -450.0000 450.0000
0.0 0.0 900.0000
599.9998 0.0 599.9998
0.0 0.0 -900.0000
0.0 599.9998 -599.9998
-450.0000 450.0000 -450.0000
-599.9998 0.0 -599.9998
0.0 -900.0000 0.0
599.9998 -599.9998 0.0
0.0 -599.9998 -599.9998
450.0000 -450.0000 -450.0000
599.9998 0.0 -599.9998
0.0 900.0000 0.0
-599.9998 599.9998 0.0
0.0 599.9998 599.9998
-450.0000 450.0000 450.0000
-599.9998 0.0 599.9998
450.0000 450.0000 -450.0000
-450.0000 -450.0000 450.0000
599.9998 599.9998 0.0
-599.9998 -599.9998 0.0
450.0000 450.0000 450.0000
-450.0000 -450.0000 -450.0000
900.0000 0.0 0.0
-900.0000 0.0 0.0
EDGES
1 2
1 3
1 9
1 20
2 4
2 10
3 4
3 16
3 18
4 23
4 25
5 6
5 8
5 11
5 13
6 7
6 14
6 19
7 8
7 15
8 24
8 26
9 10
9 11
9 22
10 12
10 25
11 12
11 24
12 13

```

```

13 19
13 25
14 15
14 16
14 21
15 17
15 26
16 17
16 23
17 18
18 20
18 26
19 21
20 22
21 23
21 25
22 24
22 26
FACES
1 2 4 3
5 6 7 8
1 2 10 9
5 11 12 13
6 7 15 14
9 10 12 11
14 15 17 16
3 16 17 18
5 6 19 13
1 3 18 20
6 14 21 19
1 9 22 20
14 16 23 21
9 11 24 22
3 4 23 16
5 8 24 11
2 4 25 10
7 8 26 15
10 12 13 25
15 17 18 26
13 19 21 25
10 20 22 26
4 23 21 25
8 24 22 26
THE MAXIMUM IS: 0.5000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 36.0000000000
THP 2D PDGFS ARE DETERMINED BY THE FOLLOWING POINTS :
( -12.0000 12.0000 )-----{ -12.3981 7.4155 }
( -12.0000 12.0000 )-----{ 0.0 18.0000 }
( -12.0000 12.0000 )-----{ -18.0000 0.0 }
( -12.0000 12.0000 )-----{ -5.6019 10.5045 }
( -12.3981 7.4155 )-----{ -4.5308 9.8873 }
( -12.3981 7.4155 )-----{ -16.5308 -2.1127 }
( 0.0 18.0000 )-----{ -4.5308 9.8873 }
( 0.0 18.0000 )-----{ 12.0000 12.0000 }
( 0.0 18.0000 )-----{ 4.5308 14.1127 }
( -4.5308 9.8873 )-----{ 5.6019 7.4155 }
( -4.5308 9.8873 )-----{ -6.7962 -3.1640 }
( 0.0 -18.0000 )-----{ 12.0000 -12.0000 }
( 0.0 -18.0000 )-----{ 4.5308 -9.8873 }
( 0.0 -18.0000 )-----{ -17.0000 -12.0000 }
( 0.0 -18.0000 )-----{ -4.5308 -14.1127 }
( 12.0000 -12.0000 )-----{ 12.3981 -7.4155 }
( 12.0000 -12.0000 )-----{ 18.0000 0.0 }

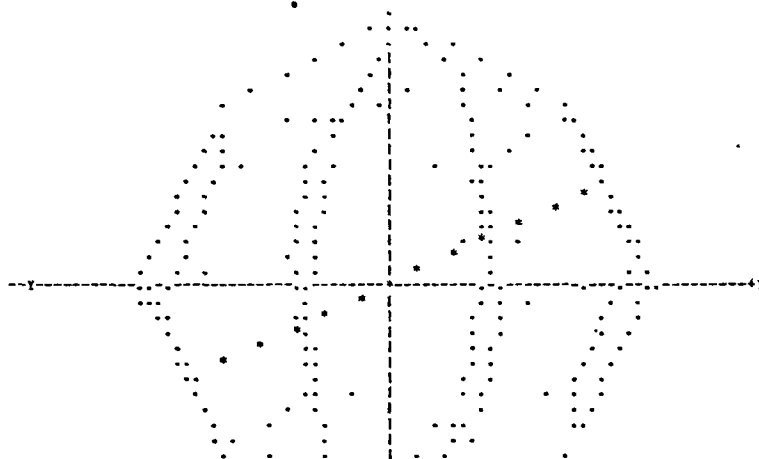
```

```

( 12.0000 -12.0000 )----- ( 5.6019 -10.5845 )
( 12.3981 -7.4155 )----- ( 4.5308 -9.4873 )
( 12.3981 -7.4155 )----- ( 16.5308 2.1127 )
( 4.5308 -9.4873 )----- ( -5.6019 -7.4155 )
( 4.5308 -9.4873 )----- ( 6.7962 3.1690 )
( -14.0300 0.0 )----- ( -16.5308 -2.1127 )
( -18.0000 0.0 )----- ( -12.0000 -12.0000 )
( -10.0000 0.0 )----- ( -7.4692 2.1127 )
( -16.5308 -2.1127 )----- ( -12.3981 -10.5845 )
( -16.5308 -2.1127 )----- ( -6.7962 -3.1690 )
( -12.0000 -12.0000 )----- ( -12.3981 -10.5845 )
( -12.0000 -12.0000 )----- ( -5.6019 -7.4155 )
( -12.3981 -10.5845 )----- ( -4.5308 -14.1127 )
( -4.5308 -14.1127 )----- ( 5.6019 -10.5845 )
( -4.5308 -14.1127 )----- ( -6.7962 -3.1690 )
( 18.0000 0.0 )----- ( 16.5308 2.1127 )
( 18.0100 0.0 )----- ( 12.0000 12.0000 )
( 18.0000 0.0 )----- ( 7.4692 -2.1127 )
( 16.5308 2.1127 )----- ( 12.3981 10.5845 )
( 16.5308 2.1127 )----- ( 6.7962 3.1690 )
( 12.0000 12.0000 )----- ( 12.3981 10.5845 )
( 12.0000 12.0000 )----- ( 5.6019 7.4155 )
( 12.3981 10.5845 )----- ( 4.5308 14.1127 )
( 4.5308 14.1127 )----- ( -5.6019 10.5845 )
( 4.5308 14.1127 )----- ( 6.7962 3.1690 )
( 5.6019 -10.5845 )----- ( 7.4692 -2.1127 )
( -5.6019 10.5845 )----- ( -7.4692 2.1127 )
( 7.4692 -2.1127 )----- ( 5.6019 7.4155 )
( 7.4692 -2.1127 )----- ( -6.7962 -3.1690 )
( -7.4692 2.1127 )----- ( -5.6019 -7.4155 )
( -7.4692 2.1127 )----- ( 6.7962 3.1690 )

```

CRYSTAL SHAPE:



Apdx. 2-b, p. 160

MICROCLINE 1 : ROGERS, 1937, P. 421
 0.6614: 1.0000: 0.5570 ALPHA= 90.6500 , BETA= 90.6500 , GAMMA= 115.9222
 TRICLINIC SYSTEM, A:B:C= 0.6614: 1.0000: 0.5570
 ,: 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

```

0 1 0
0 -1 0
1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 0 1
0 0 -1

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

0.0 X + 2.2241 Y + 0.0 Z = 1
0.0 X + -2.2241 Y + 0.0 Z = 1
1.0080 X + 1.2316 Y + 0.0 Z = 1
-1.0080 X + 0.2512 Y + 0.0 Z = 1
-1.0080 X + -1.2316 Y + 0.0 Z = 1
1.0080 X + -0.2512 Y + 0.0 Z = 1
0.0204 X + 0.0326 Y + 1.7953 Z = 1
-0.0204 X + -0.0326 Y + -1.7953 Z = 1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 0.4427 0.4496 0.5438 )
( 0.4427 0.4496 -0.5702 )
( -0.8800 0.4496 0.5588 )
( -0.8800 0.4496 -0.5552 )
( -0.4427 -0.4496 0.5702 )
( -0.4427 -0.4496 -0.5438 )
( 0.8800 -0.4496 0.5552 )
( 0.8800 -0.4496 -0.5588 )
( 0.9920 0.0 0.5457 )
( 0.9920 0.0 -0.5683 )
( -0.9920 0.0 0.5683 )
( -0.9920 0.0 -0.5457 )

```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 0.4427 0.4496 0.5438 )----- ( 0.4427 0.4496 -0.5702 )
( 0.4427 0.4496 0.5438 )----- ( -0.8800 0.4496 0.5588 )
( 0.4427 0.4496 0.5438 )----- ( 0.9920 0.0 0.5457 )
( 0.4427 0.4496 -0.5702 )----- ( -0.8800 0.4496 -0.5552 )
( 0.4427 0.4496 -0.5702 )----- ( 0.9920 0.0 -0.5683 )
( -0.8800 0.4496 0.5588 )----- ( -0.8800 0.4496 -0.5552 )
( -0.8800 0.4496 0.5588 )----- ( -0.9920 0.0 0.5683 )
( -0.8800 0.4496 -0.5552 )----- ( -0.9920 0.0 -0.5457 )
( -0.4427 -0.4496 0.5702 )----- ( -0.4427 -0.4496 -0.5438 )
( -0.4427 -0.4496 0.5702 )----- ( 0.8800 -0.4496 0.5552 )
( -0.4427 -0.4496 -0.5438 )----- ( 0.8800 -0.4496 -0.5588 )
( -0.4427 -0.4496 -0.5438 )----- ( 0.9920 0.0 0.5457 )
( 0.8800 -0.4496 0.5552 )----- ( 0.8800 -0.4496 -0.5588 )
( 0.8800 -0.4496 0.5552 )----- ( 0.9920 0.0 -0.5683 )
( 0.9920 0.0 0.5457 )----- ( 0.9920 0.0 -0.5683 )
( -0.9920 0.0 0.5683 )----- ( -0.9920 0.0 -0.5457 )

```

THE MAXIMUM IS:
VERTICES

0.9920 THE CONVERSION FACTOR FOR THE PRINTED GRAPH IS: 907.244

401.6343 407.9067 493.3701
 401.6343 407.9067 -517.2771
 -798.3655 407.9067 506.9846
 -798.3655 407.9067 -501.6626
 -401.6343 -407.9067 517.2771
 -401.6343 -407.9067 -493.3701
 798.3655 -407.9067 501.6626
 798.3655 -407.9067 -506.9846
 899.9998 0.0 495.1125
 899.9998 0.0 -515.5344
 -899.9998 0.0 515.5347
 -899.9998 0.0 -495.1123

EDGES

1 2
 1 3
 1 9
 2 4
 2 10
 3 4
 3 11
 4 12
 5 6
 5 7
 5 11
 6 8
 6 12
 7 8
 7 9
 8 10
 9 10
 11 12

FACES

1 2 4 3
 5 6 8 7
 1 2 10 9
 3 4 12 11
 5 6 12 11
 7 8 10 9
 1 3 11 5
 2 4 12 6
 7 9
 8 10

THE MAXIMUM IS:

0.7818808556

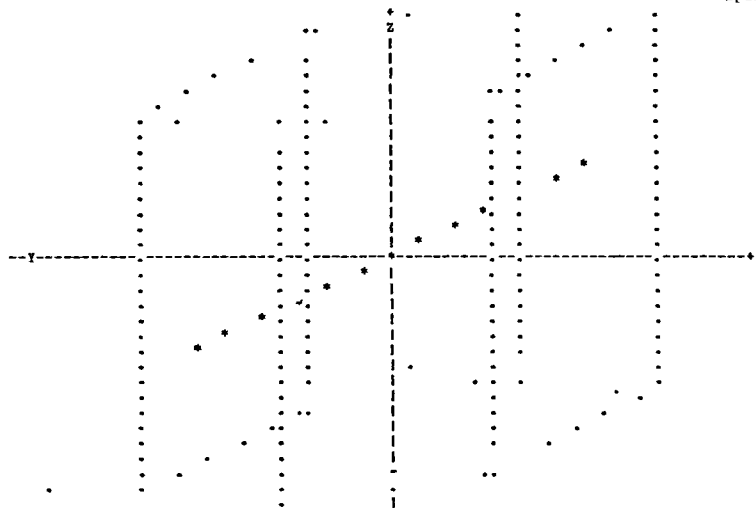
THE CONVERSION FACTOR FOR VIEWPLOT IS :

23.0214080811

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(6.5029 10.7253)	-----	(6.5029 -14.9206)
(6.5029 10.7253)	-----	(18.0000 16.4318)
(6.5029 10.7253)	-----	(-8.6229 8.5430)
(6.5029 -14.9206)	-----	(18.0000 -9.2141)
(6.5029 -14.9206)	-----	(-8.6229 -17.1028)
(18.0000 16.4318)	-----	(18.0000 -9.2141)
(18.0000 16.4318)	-----	(8.6229 17.1028)
(18.0000 -9.2141)	-----	(8.6229 -8.5430)
(-6.5029 14.9206)	-----	(-6.5029 -10.7253)
(-6.5029 14.9206)	-----	(-18.0000 9.2141)
(-6.5029 14.9206)	-----	(8.6229 17.1028)
(-6.5029 -10.7253)	-----	(-18.0000 -16.4318)
(-6.5029 -10.7253)	-----	(8.6229 -8.5430)
(-18.0000 9.2141)	-----	(-18.0000 -16.4318)
(-18.0000 9.2141)	-----	(-8.6229 8.5430)
(-18.0000 -16.4318)	-----	(-8.6229 -17.1028)
(-8.6229 8.5430)	-----	(-8.6229 -17.1028)
(8.6229 17.1028)	-----	(8.6229 -8.5430)

CRYSTAL SHAPE:



MICROCLINE 2 : ROGERS, 1937, P. 431

TRICLINIC SYSTEM, A:B:C= 0.6614: 1.0000: 0.5570 ALPHA= 90.6500 , BETA= 90.6500 , GAMMA= 115.9222

POPA(S).

NUMBER OF FACES OR MILLER INDICES =

18

MILLER INDICES :

0	1	0
0	-1	0
1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	0	1
0	0	-1
2	0	-1
-2	0	1
0	2	-1
0	-2	-1
0	-2	1
1	1	-1
1	-1	-1
-1	1	-1
-1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

0.0	X +	2.2241	Y +	0.0	Z =	1
0.0	X +	-2.2241	Y +	0.0	Z =	1
1.0000	X +	1.2111	Y +	0.0	Z =	1
-1.0000	X +	0.2111	Y +	0.0	Z =	1
-1.0000	X +	-1.2111	Y +	0.0	Z =	1

```

1.0000 X + -0.2512 Y + 0.0 Z = 1
0.0204 X + 0.0326 Y + 1.7453 Z = 1
-0.0204 X + -0.0326 Y + -1.7453 Z = 1
1.0012 X + 0.4794 Y + -0.5494 Z = 1
-1.0012 X + 0.0449 Y + 0.5494 Z = 1
0.0113 X + 1.2517 Y + 0.4474 Z = 1
-0.0113 X + 1.2175 Y + -0.4474 Z = 1
-0.0111 X + -1.2537 Y + -0.4474 Z = 1
0.0113 X + -1.2175 Y + 0.4474 Z = 1
0.0287 X + 1.0042 Y + -0.4474 Z = 1
0.0287 X + -0.2274 Y + -0.4474 Z = 1
-0.0287 X + 0.2274 Y + 0.4474 Z = 1
-0.0287 X + -1.0042 Y + 0.4474 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :
( 0.4427 0.4496 0.4324 )
( 0.4427 0.4496 -0.1803 )
( -0.8800 0.4496 0.4437 )
( -0.8800 0.4496 -0.4437 )
( -0.8667 0.4496 0.1800 )
( -0.5493 0.4496 0.4437 )
( 0.1120 0.4496 -0.4550 )
( -0.4427 -0.4496 -0.4124 )
( -0.4427 -0.4496 0.1803 )
( 0.8800 -0.4496 0.4437 )
( 0.8800 -0.4496 -0.1689 )
( 0.5493 -0.4496 -0.4437 )
( -0.1120 -0.4496 0.4550 )
( 0.9920 0.0 0.5457 )
( 0.9920 0.0 -0.0113 )
( 0.5526 0.3597 0.5442 )
( 0.8272 0.1349 -0.1789 )
( -0.9920 0.0 -0.5457 )
( -0.9920 0.0 0.0113 )
( -0.9024 0.3597 -0.5533 )
( -0.5526 -0.3597 -0.5442 )
( -0.8962 -0.0784 0.1787 )
( 0.9024 -0.3597 0.5533 )
( 0.9584 -0.1349 -0.1755 )
( -0.4395 0.3597 0.5555 )
( -0.0896 -0.3597 0.5645 )
( -0.5291 0.0 0.5630 )
( 0.0896 0.3597 -0.5645 )
( 0.4395 -0.3597 -0.5555 )
( 0.5291 0.0 -0.5630 )
( 0.7936 0.0 -0.3432 )
( -0.7936 0.0 0.3432 )

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.4427 0.4496 0.4324 )----- ( 0.4427 0.4496 -0.1803 )
( 0.4427 0.4496 0.4324 )----- ( -0.5493 0.4496 0.4437 )
( 0.4427 0.4496 0.4324 )----- ( 0.5526 0.3597 0.5442 )
( 0.4427 0.4496 -0.1803 )----- ( 0.1120 0.4496 -0.4550 )
( 0.4427 0.4496 -0.1803 )----- ( 0.8272 0.1349 -0.1789 )
( -0.8800 0.4496 0.1577 )----- ( -0.8800 0.4496 0.4437 )
( -0.8800 0.4496 0.1577 )----- ( -0.8667 0.4496 0.1800 )
( -0.8800 0.4496 0.1577 )----- ( -0.9920 0.0 0.0113 )
( -0.8800 0.4496 -0.4438 )----- ( 0.1120 0.4496 -0.4550 )
( -0.8800 0.4496 -0.4438 )----- ( -0.9024 0.3597 -0.5533 )
( -0.8667 0.4496 0.1800 )----- ( -0.5493 0.4496 0.4437 )
( -0.8667 0.4496 0.1800 )----- ( -0.7936 0.0 0.3432 )
( -0.5493 0.4496 0.4437 )----- ( -0.4395 0.3597 0.5555 )
( 0.1120 0.4496 -0.4550 )----- ( 0.0896 0.3597 -0.5645 )
( -0.4427 -0.4496 -0.4324 )----- ( -0.4427 -0.4496 0.1803 )

```

```

( -0.4427 -0.4496 -0.4324 )----- ( 0.5493 -0.4496 -0.4437 )
( -0.4427 -0.4496 -0.4324 )----- ( -0.5526 -0.3597 -0.5442 )
( -0.4427 -0.4496 0.1803 )----- ( -0.1120 -0.4496 0.4550 )
( -0.4427 -0.4496 0.1803 )----- ( -0.8962 -0.0784 0.1787 )
( 0.8800 -0.4496 0.4438 )----- ( 0.8800 -0.4496 -0.1689 )
( 0.8800 -0.4496 0.4438 )----- ( -0.1120 -0.4496 0.4550 )
( 0.8800 -0.4496 0.4438 )----- ( 0.9024 -0.3597 0.5533 )
( 0.8800 -0.4496 -0.1689 )----- ( 0.5493 -0.4496 -0.4437 )
( 0.8800 -0.4496 -0.1689 )----- ( 0.9584 -0.1349 -0.1755 )
( 0.5493 -0.4496 -0.4437 )----- ( 0.4395 -0.3597 -0.5555 )
( -0.1120 -0.4496 0.4550 )----- ( -0.0896 -0.3597 0.5645 )
( 0.9920 0.0 0.5457 )----- ( 0.9920 0.0 -0.0113 )
( 0.9920 0.0 0.5457 )----- ( 0.5526 0.3597 0.5442 )
( 0.9920 0.0 0.5457 )----- ( 0.9024 -0.3597 0.5533 )
( 0.9920 0.0 -0.0113 )----- ( 0.8272 0.1349 -0.1789 )
( 0.9920 0.0 -0.0113 )----- ( 0.9584 -0.1349 -0.1755 )
( 0.5526 0.3597 0.5442 )----- ( -0.4395 0.3597 0.5555 )
( 0.8272 0.1349 -0.1789 )----- ( 0.7936 0.0 -0.3432 )
( -0.9920 0.0 -0.5457 )----- ( -0.9920 0.0 0.0113 )
( -0.9920 0.0 -0.5457 )----- ( -0.9024 0.3597 -0.5533 )
( -0.9920 0.0 -0.5457 )----- ( -0.5526 -0.3597 -0.5442 )
( -0.9920 0.0 0.0113 )----- ( -0.8962 -0.0784 0.1787 )
( -0.9024 0.3597 -0.5533 )----- ( 0.0896 0.3597 -0.5645 )
( -0.8962 -0.0784 0.1787 )----- ( 0.4395 -0.3597 -0.5555 )
( -0.9024 -0.3597 0.5533 )----- ( -0.7936 0.0 0.3432 )
( 0.9024 -0.3597 0.5533 )----- ( -0.0896 -0.3597 0.5645 )
( 0.9584 -0.1349 -0.1755 )----- ( 0.7936 0.0 -0.3432 )
( -0.4395 0.3597 0.5555 )----- ( -0.5291 0.0 0.5630 )
( -0.0896 -0.3597 0.5645 )----- ( -0.5291 0.0 0.5630 )
( -0.5291 0.0 0.5630 )----- ( -0.7936 0.0 0.3432 )
( 0.0896 0.3597 -0.5645 )----- ( 0.5291 0.0 -0.5630 )
( 0.4395 -0.3597 -0.5555 )----- ( 0.5291 0.0 -0.5630 )
( 0.5291 0.0 -0.5630 )----- ( 0.7936 0.0 -0.3432 )

THE MAXIMUM IS: 0.9920 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS: 907.2281

VERTICES
401.6343 407.9065 392.3074
401.6343 407.9065 -163.5475
-798.3652 407.9067 143.0848
-798.3652 407.9065 -402.5984
-786.2874 407.9067 161.2929
-498.3625 407.9065 402.5181
101.6308 407.9065 -412.8093
-401.6343 -407.9065 -392.3074
-401.6343 -407.9065 163.5475
798.3652 -407.9065 402.5984
798.3652 -407.9065 -153.2572
498.3625 -407.9065 -402.5181
-101.6308 -407.9065 412.8093
899.9995 0.0 495.1125
899.9998 0.0 -10.2117
501.3059 326.3262 493.7185
750.4922 122.3702 -162.1286
-899.9995 0.0 -495.1121
-899.9998 0.0 10.2117
-818.6921 326.3262 -501.9521
-501.3059 -326.3262 -493.7185
-813.0840 -71.1393 162.1091
818.6921 -326.3262 501.9521
869.5103 -122.3685 -159.2408
-398.6417 326.3262 501.9521
-81.3088 -326.3262 512.1116
-47.9993 0.0 518.7658

```

81.3048 326.3252 -512.1616
 398.6917 -126.3259 -503.9211
 479.9471 0.0 -510.7698
 720.0019 0.0 -311.1567
 -720.0019 0.0 311.3567

EDGES

1 2
 1 6
 1 16
 2 7
 2 17
 3 4
 3 5
 3 19
 4 7
 4 20
 5 6
 5 32
 6 25
 7 28
 8 9
 8 12
 8 21
 9 13
 9 22
 10 11
 10 13
 10 23
 11 12
 11 24
 12 29
 13 26
 14 15
 14 16
 14 23
 15 17
 15 24
 16 25
 17 31
 18 19
 18 20
 18 21
 19 22
 20 28
 21 29
 22 32
 23 26
 24 31
 25 27
 26 27
 27 32
 28 30
 29 30
 30 31

FACES

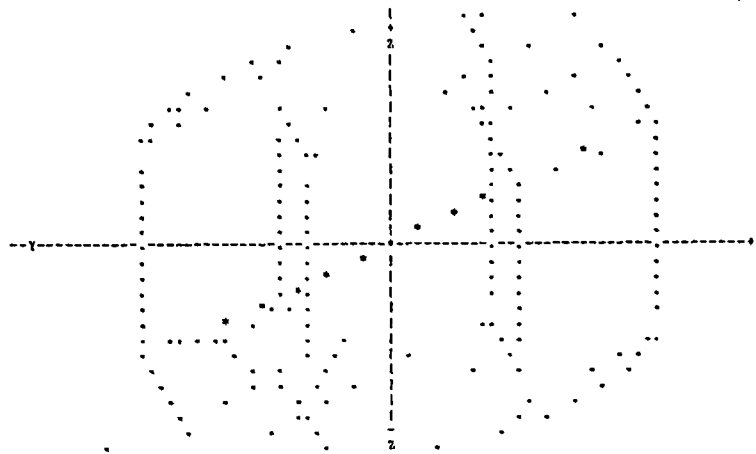
1 2 7 4 3 5 6
 8 9 13 10 11 12
 1 2 17 15 14 16
 3 4 20 18 19
 8 9 22 19 18 21
 10 11 24 15 14 23
 14 16 25 27 26 23

18 20 28 30 29 21
 15 17 31 24
 3 5 32 22 19
 1 6 25 16
 4 7 28 20
 8 12 29 21
 10 13 26 23
 2 7 28 30 31 17
 11 12 29 30 31 24
 5 6 25 27 32
 9 13 26 27 32 22

THE MAXIMUM IS: 0.7818808556 THE CONVERSION FACTOR FOR VIEWPLOT IS : 23.0214080811

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
 (6.5029 8.1608)----- (6.5029 -5.9444)
 (6.5029 8.1608)----- (15.1257 12.4406)
 (6.5029 8.1608)----- (3.4778 10.2888)
 (6.5029 -5.9444)----- (9.3772 -10.9293)
 (6.5029 -5.9444)----- (-4.0852 -7.4720)
 (18.0000 7.1976)----- (18.0000 -6.6495)
 (18.0000 7.1976)----- (17.8843 7.6564)
 (18.0000 7.1976)----- (8.6229 4.2799)
 (18.0000 -6.6495)----- (9.3772 -10.9293)
 (18.0000 -6.6495)----- (16.1246 -9.0798)
 (17.8843 7.6564)----- (15.1257 12.4406)
 (17.8843 7.6564)----- (6.9983 11.1175)
 (15.1257 12.4406)----- (12.1006 14.5687)
 (9.3772 -10.9293)----- (7.5017 -13.3597)
 (-6.5029 -8.1608)----- (-6.5029 5.9444)
 (-6.5029 -8.1608)----- (-15.1257 -12.4406)
 (-6.5029 -8.1608)----- (-3.4778 -10.2888)
 (-6.5029 5.9444)----- (-9.3772 10.9293)
 (-6.5029 5.9444)----- (5.9849 7.7461)
 (-18.0000 6.6495)----- (-18.0000 -7.4557)
 (-18.0000 6.6495)----- (-9.3772 10.9293)
 (-18.0000 6.6495)----- (-16.1246 -9.0798)
 (-18.0000 -7.4557)----- (-15.1257 -12.4406)
 (-18.0000 -7.4557)----- (-11.4359 -7.9254)
 (-15.1257 -12.4406)----- (-12.1006 14.5687)
 (-9.3772 -10.9293)----- (-7.5017 -13.3597)
 (-8.6229 8.5830)----- (-8.6229 -4.2799)
 (-8.6229 8.5830)----- (3.4778 10.2888)
 (-8.6229 8.5830)----- (16.1246 -9.0798)
 (-8.6229 -4.2799)----- (-4.0852 -7.4720)
 (-8.6229 -4.2799)----- (-11.4359 -7.9254)
 (3.4778 10.2888)----- (12.1006 14.5687)
 (-4.0852 -7.4720)----- (-6.9983 -11.1175)
 (8.6229 -8.5830)----- (8.6229 4.2799)
 (8.6229 -8.5830)----- (16.1246 -9.0798)
 (8.6229 -8.5830)----- (3.4778 -10.2888)
 (8.6229 4.2799)----- (5.9849 7.7461)
 (16.1246 -9.0798)----- (7.5017 -13.3597)
 (-3.4778 -10.2888)----- (-12.1006 -14.5687)
 (5.9849 7.7461)----- (6.9983 11.1175)
 (-16.1246 -9.0798)----- (-7.5017 -13.3597)
 (-11.4359 -7.9254)----- (-6.9983 -11.1175)
 (12.1006 14.5687)----- (4.5988 15.1055)
 (-7.5017 -13.3597)----- (4.5988 15.1055)
 (4.5988 15.1055)----- (6.9983 11.1175)
 (7.5017 -13.3597)----- (-4.5988 -15.1055)
 (-12.1006 -14.5687)----- (-4.5988 -15.1055)
 (-4.5988 -15.1055)----- (-6.9983 -11.1175)

CRYSTAL SHAPE:



MONTICELLITE : DEPP HOWIE AND ZUSSMAN, 1967, P. 10
 ORTHORHOMBIC SYSTEM : A:B:C= 0.4345: 1.0000: 0.5749 , ALPHA=BETA=GA*HA=90, , 7 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 34
 MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	1
0	1	-1
0	-1	1
0	-1	-1
1	2	0
-1	2	0
-1	-2	0
1	-2	0
0	2	1
0	2	-1
0	-2	1
0	-2	-1
0	1	0
0	-1	0
1	1	1
1	1	-1
1	-1	-1
1	-1	1
-1	1	1
-1	1	-1
-1	-1	-1
-1	-1	1
1	2	1
1	2	-1

1	-2	-1
1	-2	1
-1	2	1
-1	2	-1
-1	-2	-1
-1	-2	1

THE GAUSSIAN EQUATIONS OF THE CRYSTAL FACES ARE :

2.3015 X +	1.0000 Y +	0.0 Z =	1
-2.3015 X +	1.0000 Y +	0.0 Z =	1
-2.3015 X +	-1.0000 Y +	0.0 Z =	1
2.3015 X +	-1.0000 Y +	0.0 Z =	1
0.0 X +	1.0000 Y +	1.7394 Z =	1
0.0 X +	1.0000 Y +	-1.7394 Z =	1
0.0 X +	-1.0000 Y +	1.7394 Z =	1
0.0 X +	-1.0000 Y +	-1.7394 Z =	1
1.7704 X +	1.5385 Y +	0.0 Z =	1
-1.7704 X +	1.5385 Y +	0.0 Z =	1
-1.7704 X +	-1.5385 Y +	0.0 Z =	1
1.7704 X +	-1.5385 Y +	0.0 Z =	1
0.0 X +	1.5385 Y +	1.3380 Z =	1
0.0 X +	1.5385 Y +	-1.3380 Z =	1
0.0 X +	-1.5385 Y +	1.3380 Z =	1
0.0 X +	-1.5385 Y +	-1.3380 Z =	1
0.0 X +	2.0000 Y +	0.0 Z =	1
0.0 X +	-2.0000 Y +	0.0 Z =	1
1.7704 X +	0.7692 Y +	1.3380 Z =	1
1.7704 X +	0.7692 Y +	-1.3380 Z =	1
1.7704 X +	-0.7692 Y +	-1.3380 Z =	1
1.7704 X +	-0.7692 Y +	1.3380 Z =	1
-1.7704 X +	0.7692 Y +	1.3380 Z =	1
-1.7704 X +	0.7692 Y +	-1.3380 Z =	1
-1.7704 X +	-0.7692 Y +	-1.3380 Z =	1
-1.7704 X +	-0.7692 Y +	1.3380 Z =	1
1.4384 X +	1.2500 Y +	1.0871 Z =	1
1.4384 X +	1.2500 Y +	-1.0871 Z =	1
1.4384 X +	-1.2500 Y +	-1.0871 Z =	1
1.4384 X +	-1.2500 Y +	1.0871 Z =	1
-1.4384 X +	1.2500 Y +	1.0871 Z =	1
-1.4384 X +	1.2500 Y +	-1.0871 Z =	1
-1.4384 X +	-1.2500 Y +	-1.0871 Z =	1
-1.4384 X +	-1.2500 Y +	1.0871 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.4345	0.0	0.1725	)
(	0.4345	0.0	-0.1725	)
(	0.3042	0.3000	0.1725	)
(	0.3042	0.3000	-0.1725	)
(	-0.4345	0.0	0.1725	)
(	-0.4345	0.0	-0.1725	)
(	-0.3042	0.3000	0.1725	)
(	-0.3042	0.3000	-0.1725	)
(	-0.3042	-0.3000	0.1725	)
(	-0.3042	-0.3000	-0.1725	)
(	0.3042	-0.3000	0.1725	)
(	0.3042	-0.3000	-0.1725	)
(	0.1303	0.0	0.5749	)
(	-0.1303	0.0	0.5749	)
(	0.1303	0.1000	0.4024	)
(	-0.1303	0.1000	0.4024	)
(	0.1303	0.0	-0.5749	)
(	-0.1303	0.0	-0.5749	)
(	0.1303	0.1000	-0.4024	)
(	-0.1303	0.1000	-0.4024	)

```

(      0.1303      -0.3000      0.0024      )
(      -0.1303      -0.3000      0.4024      )
(      0.1301      -0.3000      -0.4014      )
(      -0.1303      -0.3000      -0.4024      )
(      0.1304      0.5000      0.1725      )
(      0.1304      0.5000      -0.1725      )
(      -0.1304      0.5000      0.1725      )
(      -0.1304      0.5000      -0.1725      )
(      -0.1304      -0.5000      0.1725      )
(      -0.1304      -0.5000      -0.1725      )
(      0.1304      -0.5000      0.1725      )
(      0.1304      -0.5000      -0.1725      )
( THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.4345 0.0 0.1725 )----- ( 0.4345 0.0 -0.1725 )
( 0.4345 0.0 0.1725 )----- ( 0.3042 0.3000 0.1725 )
( 0.4345 0.0 0.1725 )----- ( 0.3042 -0.3000 0.1725 )
( 0.4345 0.0 0.1725 )----- ( 0.1103 0.0 0.5749 )
( 0.4345 0.0 -0.1725 )----- ( 0.3042 0.3000 -0.1725 )
( 0.4345 0.0 -0.1725 )----- ( 0.1042 -0.3000 -0.1725 )
( 0.4345 0.0 -0.1725 )----- ( 0.1303 0.0 -0.5749 )
( 0.3042 0.3000 0.1725 )----- ( 0.1042 0.3000 -0.1725 )
( 0.3042 0.3000 0.1725 )----- ( 0.1303 0.3000 0.4024 )
( 0.3042 0.3000 0.1725 )----- ( 0.1104 0.5000 0.1725 )
( 0.3042 0.3000 -0.1725 )----- ( 0.1303 0.3000 -0.4024 )
( 0.3042 0.3000 -0.1725 )----- ( 0.1304 0.5000 -0.1725 )
( -0.4345 0.0 0.1725 )----- ( -0.4345 0.0 -0.1725 )
( -0.4345 0.0 0.1725 )----- ( -0.3042 0.3000 0.1725 )
( -0.4345 0.0 0.1725 )----- ( -0.3042 -0.3000 0.1725 )
( -0.4345 0.0 0.1725 )----- ( -0.1303 0.5749 )
( -0.4345 0.0 -0.1725 )----- ( -0.3042 0.3000 -0.1725 )
( -0.4345 0.0 -0.1725 )----- ( -0.3042 -0.3000 -0.1725 )
( -0.4345 0.0 -0.1725 )----- ( -0.1303 0.0 -0.5749 )
( -0.3042 0.3000 0.1725 )----- ( -0.3042 0.3000 -0.1725 )
( -0.3042 0.3000 0.1725 )----- ( -0.1303 0.3000 0.4024 )
( -0.3042 0.3000 0.1725 )----- ( -0.1104 0.5000 0.1725 )
( -0.3042 0.3000 -0.1725 )----- ( -0.1303 0.3000 -0.4024 )
( -0.3042 0.3000 -0.1725 )----- ( -0.1304 0.5000 0.1725 )
( -0.3042 -0.3000 0.1725 )----- ( -0.3042 -0.3000 -0.1725 )
( -0.3042 -0.3000 0.1725 )----- ( -0.1303 -0.3000 0.4024 )
( -0.3042 -0.3000 0.1725 )----- ( -0.1304 -0.5000 0.1725 )
( -0.3042 -0.3000 0.1725 )----- ( 0.1303 -0.3000 -0.4024 )
( -0.3042 -0.3000 0.1725 )----- ( 0.1304 -0.5000 -0.1725 )
( -0.3042 -0.3000 0.1725 )----- ( 0.1303 -0.3000 0.4024 )
( -0.3042 -0.3000 0.1725 )----- ( 0.1304 -0.5000 0.1725 )
( -0.1303 0.0 0.5749 )----- ( -0.1303 0.0 -0.5749 )
( -0.1303 0.0 0.5749 )----- ( 0.1303 0.3000 0.4024 )
( -0.1303 0.0 0.5749 )----- ( 0.1303 -0.3000 0.4024 )
( -0.1303 0.0 0.5749 )----- ( -0.1303 0.3000 -0.4024 )
( -0.1303 0.0 0.5749 )----- ( -0.1103 0.3000 -0.4024 )
( -0.1303 0.3000 0.4024 )----- ( -0.1303 0.3000 0.4024 )
( -0.1303 0.3000 0.4024 )----- ( 0.1304 0.5000 0.1725 )
( -0.1303 0.3000 0.4024 )----- ( -0.1304 0.5000 0.1725 )
( -0.1303 0.0 -0.5749 )----- ( -0.1303 0.0 -0.5749 )
( -0.1303 0.0 -0.5749 )----- ( 0.1303 0.3000 -0.4024 )
( -0.1303 0.0 -0.5749 )----- ( 0.1303 -0.3000 -0.4024 )
( -0.1303 0.0 -0.5749 )----- ( -0.1303 0.3000 -0.4024 )
( -0.1303 0.3000 -0.4024 )----- ( -0.1303 0.3000 -0.4024 )
( -0.1303 0.3000 -0.4024 )----- ( 0.1304 0.5000 0.1725 )

```

	(	-0.1303	0.3000	-0.4024	)	-0.1304	0.5000	-0.1725	)
	(	0.1303	-0.3000	0.4024	)	-0.1303	-0.3000	0.4024	)
	(	0.1303	-0.3000	0.4024	)	0.1304	-0.5000	0.1725	)
	(	-0.1303	-0.3000	0.4024	)	-0.1304	-0.5000	0.1725	)
	(	0.1303	-0.3000	-0.4024	)	-0.1303	-0.3000	-0.4024	)
	(	0.1303	-0.3000	-0.4024	)	0.1304	-0.5000	-0.1725	)
	(	-0.1303	-0.3000	-0.4024	)	-0.1304	-0.5000	-0.1725	)
	(	0.1304	0.5000	0.1725	)	-0.1304	0.5000	-0.1725	)
	(	0.1304	0.5000	0.1725	)	-0.1304	0.5000	0.1725	)
	(	0.1304	0.5000	-0.1725	)	-0.1304	0.5000	-0.1725	)
	(	-0.1304	0.5000	0.1725	)	-0.1304	0.5000	-0.1725	)
	(	-0.1304	-0.5000	0.1725	)	-0.1304	-0.5000	-0.1725	)
	(	-0.1304	-0.5000	0.1725	)	0.1304	-0.5000	0.1725	)
	(	-0.1304	-0.5000	-0.1725	)	0.1304	-0.5000	-0.1725	)
	(	0.1304	-0.5000	0.1725	)	0.1304	-0.5000	-0.1725	)

THE MAXIMUM IS: U.5749 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 1565.4888

```

VERTICES
680.2051      0.0      269.9990
680.2051      0.0     -269.9990
476.1436    469.6460    269.9990
476.1436    469.6460   -269.9990
-680.2051      0.0      269.9990
-680.2051      0.0     -269.9990
-476.1436    469.6460    269.9990
-476.1436    469.6460   -269.9990
-476.1436   -469.6460   -269.9990
-476.1436   -469.6460    269.9990
476.1436   -469.6460   -269.9990
476.1436   -469.6460    269.9990
204.0605      0.0      899.9998
-204.0605      0.0     -899.9998
204.0609    469.6460    630.0002
-204.0609    469.6460   -630.0002
204.0605      0.0     -899.9998
-204.0605      0.0      899.9998
204.0609    469.6460   -630.0002
-204.0609    469.6460    630.0002
204.0609   -469.6460    630.0002
-204.0609   -469.6460   -630.0002
204.0615    782.7441    269.9995
-204.0615    782.7441   -269.9995
204.0615    782.7441   -269.9995
-204.0615    782.7441    269.9995
204.0615   -782.7441   -269.9995
-204.0615   -782.7441    269.9995
204.0615   -782.7441   -269.9995
EDGFS
1      2
1      3
1     12
1     13
2      4
2     11
2     17
3      4
3     15
3     25
4     19
4     26

```

```

5 6
5 7
5 10
5 14
6 8
6 9
6 18
7 8
7 16
7 27
8 20
8 28
9 10
9 24
9 30
10 22
10 29
11 12
11 23
11 32
12 21
12 31
13 14
13 15
13 21
14 16
14 22
15 16
15 25
16 27
17 18
17 19
17 23
18 20
18 24
19 20
19 26
20 28
21 22
21 31
22 29
23 24
23 32
24 30
25 26
25 27
26 28
27 28
29 30
29 31
30 32
31 32
FACES
1 2 4 3
5 6 8 7
5 6 9 10
1 2 11 12
13 14 16 15
17 18 20 19
13 14 22 21
17 18 24 23
3 4 26 25

```

```

7 8 28 27
9 10 29 30
11 12 31 32
15 16 27 25
19 20 28 26
21 22 29 31
23 24 30 32
25 26 28 27
29 30 32 31
1 3 15 13
2 4 19 17
2 11 23 17
1 12 21 13
5 7 16 14
6 8 20 18
6 9 24 18
5 10 22 14
3 15 25
4 19 26
11 23 32
12 21 31
7 16 27
8 20 28
9 24 30
10 22 29
THE MAXIMUM IS: 0.5978488922 THE CONVESSION FACTOR FOR VIEWPLOT IS : 30.1079406738
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( -4.9393 2.8896 )----- ( -4.9393 -7.4958 )
( -4.9393 2.8896 )----- ( 5.5749 3.5905 )
( -4.9393 2.8896 )----- ( -12.4899 3.5905 )
( -4.9393 2.8896 )----- ( -1.4818 16.6181 )
( -4.9393 -7.4958 )----- ( 5.5749 -6.8049 )
( -4.9393 -7.4958 )----- ( -12.4899 -6.8049 )
( -4.9393 -7.4958 )----- ( -1.4818 -18.0900 )
( 5.5749 3.5905 )----- ( 5.5749 -6.8049 )
( 5.5749 3.5905 )----- ( 7.5506 11.4254 )
( 5.5749 3.5905 )----- ( 13.5722 4.5018 )
( 5.5749 -6.8049 )----- ( 7.5506 -12.8073 )
( 5.5749 -6.8049 )----- ( 11.5722 -5.8937 )
( 4.9393 7.4958 )----- ( 4.9393 -2.8896 )
( 4.9393 7.4958 )----- ( 12.4899 6.8049 )
( 4.9393 7.4958 )----- ( -5.5749 6.8049 )
( 4.9393 7.4958 )----- ( 1.4818 18.0900 )
( 4.9393 -2.8896 )----- ( 12.4899 -3.5905 )
( 4.9393 -2.8896 )----- ( -5.5749 -3.5905 )
( 4.9393 -2.8896 )----- ( 1.4818 -16.6181 )
( 12.4899 6.8049 )----- ( 12.4899 -3.5905 )
( 12.4899 6.8049 )----- ( 10.5141 12.8073 )
( 12.4899 6.8049 )----- ( 16.5157 5.8937 )
( 12.4899 -3.5905 )----- ( 10.5141 -11.4254 )
( 12.4899 -3.5905 )----- ( 16.5157 -4.5018 )
( -5.5749 -3.5905 )----- ( -5.5749 6.8049 )
( -5.5749 -3.5905 )----- ( -7.5506 -11.4254 )
( -5.5749 -3.5905 )----- ( -13.5722 -4.5018 )
( -5.5749 6.8049 )----- ( -7.5506 12.8073 )
( -5.5749 6.8049 )----- ( -11.5722 5.8937 )
( -12.4899 -6.8049 )----- ( -12.4899 3.5905 )
( -12.4899 -6.8049 )----- ( -10.5141 -12.8073 )
( -12.4899 -6.8049 )----- ( -16.5157 -5.8937 )
( -12.4899 3.5905 )----- ( -10.5141 12.8073 )
( -12.4899 3.5905 )----- ( -16.5157 4.5018 )
( -1.4818 16.6181 )----- ( 1.4818 18.0900 )

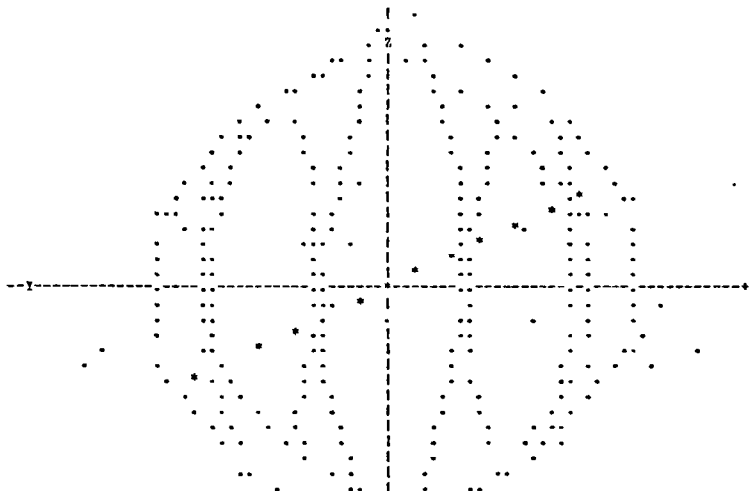
```

```

( -1.4818 16.6181 )----- ( 7.5506 11.4254 )
( -1.4818 16.6181 )----- ( -10.5141 11.4254 )
( 1.4818 18.0000 )----- ( 10.5141 12.8073 )
( 1.4818 18.0000 )----- ( -7.5506 12.8073 )
( 7.5506 11.4254 )----- ( 10.5141 12.8073 )
( 7.5506 11.4254 )----- ( 13.5722 4.5018 )
( 10.5141 12.8073 )----- ( 16.5357 4.5018 )
( -1.4818 -18.0000 )----- ( 1.4818 -16.6181 )
( -1.4818 -18.0000 )----- ( 7.5506 -12.8073 )
( -1.4818 -18.0000 )----- ( -10.5141 -12.8073 )
( 1.4818 -16.6181 )----- ( 10.5141 -11.4254 )
( 1.4818 -16.6181 )----- ( -7.5506 -11.4254 )
( 7.5506 -11.4254 )----- ( 10.5141 -12.8073 )
( 7.5506 -12.8073 )----- ( 13.5722 -5.8837 )
( 10.5141 -12.8073 )----- ( 16.5357 -4.5018 )
( -10.5141 11.4254 )----- ( -7.5506 12.8073 )
( -10.5141 11.4254 )----- ( -16.5357 4.5018 )
( -7.5506 12.8073 )----- ( -13.5722 5.8837 )
( -10.5141 -12.8073 )----- ( -7.5506 -11.4254 )
( -10.5141 -12.8073 )----- ( -16.5357 -5.8837 )
( -7.5506 -11.4254 )----- ( -13.5722 -4.5018 )
( 13.5722 4.5018 )----- ( 13.5722 -5.8837 )
( 13.5722 4.5018 )----- ( 16.5357 5.8837 )
( 13.5722 -5.8837 )----- ( 16.5357 -4.5018 )
( 16.5357 5.8837 )----- ( 16.5357 -4.5018 )
( -13.5722 5.8837 )----- ( -13.5722 -4.5018 )
( -13.5722 5.8837 )----- ( -16.5357 4.5018 )
( -13.5722 -4.5018 )----- ( -16.5357 -5.8837 )
( -16.5357 4.5018 )----- ( -16.5357 -5.8837 )

```

CRYSTAL SHAPE:



MULLITE : DEER HOWIE AND ZUSSMAN, 1967, p. 37
 ORTHORHOMBIC SYSTEM : A:B:C = 0.9818: 1.0000: 0.3753 , ALPHA=BETA=90 , 2 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 6
 MILLER INDICES :

```

0 0 1
0 0 -1
1 1 0
-1 1 0
-1 -1 0
1 -1 0

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

0.0 X + 0.0 Y + 0.5329 Z = 1
0.0 X + 0.0 Y + -0.5329 Z = 1
1.0185 Y + 1.0000 Y + 0.0 Z = 1
-1.0185 X + 1.0000 Y + 0.0 Z = 1
-1.0185 X + -1.0000 Y + 0.0 Z = 1
1.0185 X + -1.0000 Y + 0.0 Z = 1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 0.0 1.0000 1.8765 )
( 0.9818 0.0 1.8765 )
( -0.9818 0.0 1.8765 )
( 0.0 -1.0000 1.8765 )
( 0.0 1.0000 -1.8765 )
( 0.9818 0.0 -1.8765 )
( -0.9818 0.0 -1.8765 )
( 0.0 -1.0000 -1.8765 )

```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 0.0 1.0000 1.8765 )----- ( 0.9818 0.0 1.8765 )
( 0.0 1.0000 1.8765 )----- ( -0.9818 0.0 1.8765 )
( 0.0 1.0000 1.8765 )----- ( 0.0 1.0000 -1.8765 )
( 0.9818 0.0 1.8765 )----- ( 0.0 -1.0000 1.8765 )
( 0.9818 0.0 1.8765 )----- ( 0.9818 0.0 -1.8765 )
( -0.9818 0.0 1.8765 )----- ( 0.0 -1.0000 1.8765 )
( -0.9818 0.0 1.8765 )----- ( -0.9818 0.0 -1.8765 )
( 0.0 -1.0000 1.8765 )----- ( 0.0 -1.0000 -1.8765 )
( 0.0 -1.0000 1.8765 )----- ( 0.9818 0.0 -1.8765 )
( 0.0 1.0000 -1.8765 )----- ( -0.9818 0.0 -1.8765 )
( 0.9818 0.0 -1.8765 )----- ( 0.0 -1.0000 -1.8765 )
( -0.9818 0.0 -1.8765 )----- ( 0.0 -1.0000 -1.8765 )

```

THE MAXIMUM IS:

```

VERTICES
0.0 479.6162 899.9998
470.8875 0.0 899.9998
-470.8875 0.0 899.9998
0.0 -479.6162 899.9998
0.0 479.6162 -899.9998
470.8875 0.0 -899.9998
-470.8875 0.0 -899.9998
0.0 -479.6162 -899.9998

```

EDGES

```

1 2
1 3
1 5
2 4
2 6
3 4
3 7
4 8

```

THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :

479.6162

5 6
5 7
6 8
7 8
FACES
1 2 4 3
5 6 8 7
1 2 6 5
1 3 7 5
3 4 8 7
2 4 8 6

THE MAXIMUM IS:

2.0493507385

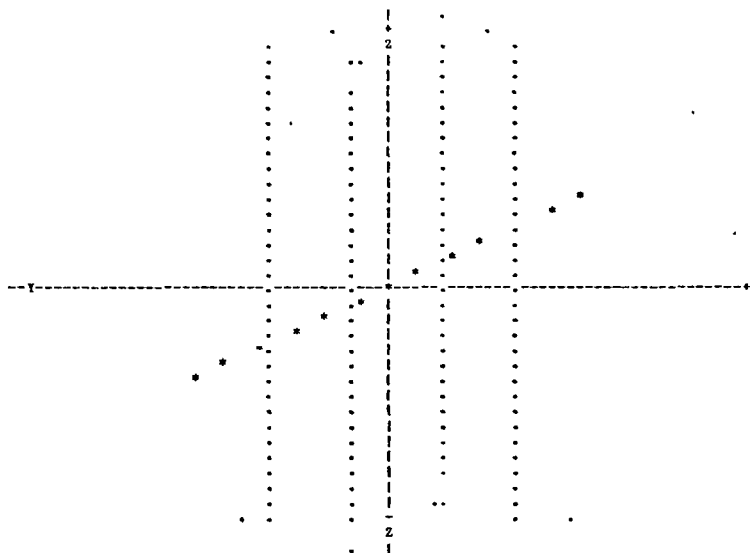
THE CONVERSION FACTOR FOR VIEWPLOT IS :

0.7032689285

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

```
( 8.7833 16.4818 )-----(-3.2559 14.9636 )
( 8.7833 16.4818 )-----(-3.2559 18.0000 )
( 8.7833 16.4818 )-----(-8.7833 -16.4818 )
(-3.2559 14.9636 )-----(-8.7833 16.4818 )
(-3.2559 14.9636 )-----(-3.2559 -18.0000 )
( 3.2559 18.0000 )-----(-8.7833 16.4818 )
( 3.2559 18.0000 )-----(-3.2559 -14.9636 )
(-8.7833 16.4818 )-----(-8.7833 -16.4818 )
( 8.7833 -16.4818 )-----(-3.2559 -18.0000 )
( 8.7833 -16.4818 )-----(-3.2559 -14.9636 )
(-3.2559 -18.0000 )-----(-8.7833 -16.4818 )
( 3.2559 -14.9636 )-----(-8.7833 -16.4818 )
```

CRYSTAL SHAPE:



Apdx. 2-b, p. 176

MUSCOVITE : AXIAL RATIOS : MASON AND BERRY , 1968, P. 449

FORMS : DEFR HOWIE AND ZUSSMAN, 1967, P. 201

MONOCLINIC SYSTEM : A:B:C= 0.5750: 1.0000: 2.2200 , ALPHA=90, BETA= 95.5000 , 3 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 8
MILLER INDICES :

```
1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 1 0
0 -1 0
0 0 1
0 0 -1
```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```
1.7472 X + 1.0000 Y + 0.0 Z = 1
-1.7472 X + 1.0000 Y + 0.0 Z = 1
-1.7472 X + -1.0000 Y + 0.0 Z = 1
1.7472 X + -1.0000 Y + 0.0 Z = 1
0.0 X + 1.6667 Y + 0.0 Z = 1
0.0 X + -1.6667 Y + 0.0 Z = 1
0.4337 X + 0.0 Y + 4.5045 Z = 1
-0.4337 X + 0.0 Y + -4.5045 Z = 1
```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```
( 0.5724 0.0 0.1669 )
( 0.5724 0.0 -0.2771 )
( 0.2289 0.6000 0.2000 )
( 0.2289 0.6000 -0.2440 )
( -0.5724 0.0 0.1669 )
( -0.5724 0.0 -0.2771 )
( -0.2289 0.6000 0.2440 )
( -0.2289 0.6000 -0.2000 )
( -0.2289 -0.6000 0.2440 )
( -0.2289 -0.6000 -0.2000 )
( 0.2289 -0.6000 0.2000 )
( 0.2289 -0.6000 -0.2440 )
```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```
( 0.5724 0.0 0.1669 )-----(-0.5724 0.0 -0.2771 )
( 0.5724 0.0 0.1669 )-----(-0.2289 0.6000 0.2000 )
( 0.5724 0.0 0.1669 )-----(-0.2289 -0.6000 0.2000 )
( 0.5724 0.0 -0.2771 )-----(-0.2289 0.6000 -0.2440 )
( 0.5724 0.0 -0.2771 )-----(-0.2289 -0.6000 -0.2440 )
( 0.2289 0.6000 0.2000 )-----(-0.2289 0.6000 -0.2440 )
( 0.2289 0.6000 0.2000 )-----(-0.2289 -0.6000 -0.2440 )
( 0.2289 0.6000 -0.2440 )-----(-0.2289 0.6000 -0.2000 )
( 0.2289 0.6000 -0.2440 )-----(-0.2289 -0.6000 -0.2000 )
( -0.5724 0.0 0.1669 )-----(-0.5724 0.0 -0.2771 )
( -0.5724 0.0 0.1669 )-----(-0.2289 0.6000 0.2000 )
( -0.5724 0.0 0.1669 )-----(-0.2289 -0.6000 0.2000 )
( -0.5724 0.0 -0.2771 )-----(-0.2289 0.6000 -0.2440 )
( -0.5724 0.0 -0.2771 )-----(-0.2289 -0.6000 -0.2440 )
( -0.2289 0.6000 0.2000 )-----(-0.2289 0.6000 -0.2440 )
( -0.2289 0.6000 0.2000 )-----(-0.2289 -0.6000 -0.2440 )
( -0.2289 -0.6000 0.2440 )-----(-0.2289 0.6000 -0.2000 )
( -0.2289 -0.6000 0.2440 )-----(-0.2289 -0.6000 -0.2000 )
( -0.2289 -0.6000 -0.2000 )-----(-0.2289 0.6000 -0.2440 )
( -0.2289 -0.6000 -0.2000 )-----(-0.2289 -0.6000 -0.2440 )
( 0.2289 -0.6000 0.2000 )-----(-0.2289 0.6000 -0.2440 )
( 0.2289 -0.6000 0.2000 )-----(-0.2289 -0.6000 -0.2440 )
```

THE MAXIMUM IS:

0.6000

THE CONVERSION FACTOR FOR THE PLOT GRAPH IS :

1499.9993

VERTICES

```
858.5291 0.0 250.3115
858.5291 0.0 -415.6672
383.4114 899.9998 229.4321
383.4114 899.9998 -186.0664
-858.5291 0.0 415.6672
-858.5291 0.0 -250.3115
```


-343.4114 899.9998 366.0664
 -343.4114 899.9998 -299.9121
 -343.4114 -899.9998 366.0664
 -343.4114 -899.9998 -299.9121
 343.4114 899.9998 299.9121
 343.4114 -899.9998 -366.0664

EDGES

1 2
 1 3
 1 11
 2 4
 2 12
 3 4
 3 7
 4 8
 5 6
 5 7
 5 9
 6 8
 6 10
 7 8
 9 10
 9 11
 10 12
 11 12

FACES

1 2 4 3
 5 6 8 7
 5 6 10 9
 1 2 12 11
 3 4 8 7
 9 10 12 11
 1 3 7 5
 2 4 8 6

THE MAXIMUM IS:

0.686402294

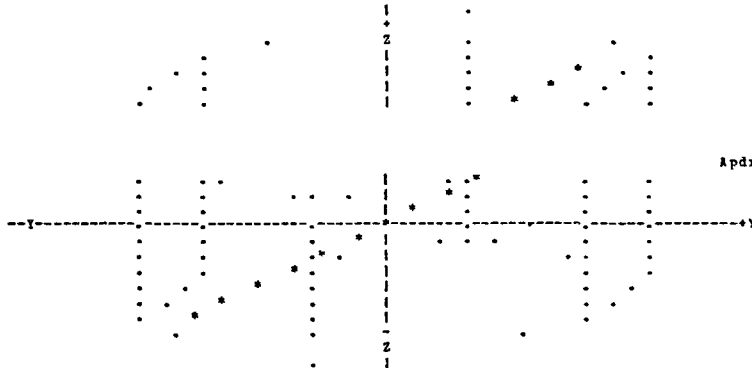
THE CONVERSION FACTOR FOR VIEWPLOT IS :

26.2222290039

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(-5.6666	1.7339	)------	(-5.6666	-9.9088	)
(-5.6666	1.7339	)------	(13.4667	4.1863	)
(-5.6666	1.7339	)------	(-18.0000	4.1863	)
(-5.6666	-9.9088	)------	(13.4667	-7.4563	)
(-5.6666	-9.9088	)------	(-18.0000	-7.4563	)
(13.4667	4.1863	)------	(13.4667	-7.4563	)
(13.4667	4.1863	)------	(18.0000	7.4563	)
(13.4667	-7.4563	)------	(18.0000	-4.1863	)
(5.6666	9.9088	)------	(5.6666	-1.7339	)
(5.6666	9.9088	)------	(18.0000	7.4563	)
(5.6666	9.9088	)------	(-13.4667	7.4563	)
(5.6666	-1.7339	)------	(18.0000	-4.1863	)
(5.6666	-1.7339	)------	(-13.4667	-4.1863	)
(18.0000	7.4563	)------	(18.0000	-4.1863	)
(-13.4667	7.4563	)------	(-13.4667	-4.1863	)
(-13.4667	-7.4563	)------	(-18.0000	4.1863	)
(-13.4667	-7.4563	)------	(-18.0000	-7.4563	)
(-18.0000	4.1863	)------	(-18.0000	-7.4563	)

CRYSTAL SHAPE:



Apdx. 2-b, p. 178

NEPHELINE • POGERS, 1937, P. 440
 HEXAGONAL SYSTEM : A1:A2:A3:C=1:1:1: 0.8400 , ALPHA=BETA=GAMMA=90 , 2 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

1	0	-1	0
0	1	-1	0
-1	1	0	0
-1	0	1	0
0	-1	1	0
1	-1	0	0
0	0	0	1
0	0	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.1547 X +	0.0	Y +	0.0	Z =	1	
0.5773 X +	1.0000	Y +	0.0	Z =	1	
-0.5773 X +	1.0000	Y +	0.0	Z =	1	
-1.1547 X +	0.0	Y +	0.0	Z =	1	
-0.5773 X +	-1.0000	Y +	0.0	Z =	1	
0.5773 X +	-1.0000	Y +	0.0	Z =	1	
0.0	X +	0.0	Y +	0.7937	Z =	1
0.0	X +	0.0	Y +	-0.7937	Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(0.8660	0.5000	0.5000	1.2600	)
(0.8660	0.5000	-0.5000	-1.2600	)
(0.8660	-0.5000	0.5000	1.2600	)
(0.8660	-0.5000	-0.5000	-1.2600	)
(0.0	1.0000	0.0000	1.2600	)
(0.0	1.0000	0.0000	-1.2600	)
(-0.8660	0.5000	0.5000	1.2600	)
(-0.8660	0.5000	-0.5000	-1.2600	)
(-0.8660	-0.5000	0.5000	1.2600	)
(-0.8660	-0.5000	-0.5000	-1.2600	)
(0.0	-1.0000	0.0000	1.2600	)
(0.0	-1.0000	0.0000	-1.2600	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(0.8660	-0.5000	1.2600	)------	(0.8660	0.5000	-1.2600	)
(0.8660	0.5000	1.2600	)------	(0.8660	-0.5000	1.2600	)
(0.8660	0.5000	1.2600	)------	(0.0	1.0000	1.2600	)
(0.8660	0.5000	-1.2600	)------	(0.8660	-0.5000	-1.2600	)
(0.8660	-0.5000	1.2600	)------	(0.0	1.0000	-1.2600	)
(0.8660	-0.5000	1.2600	)------	(0.8660	-0.5000	-1.2600	)
(0.8660	-0.5000	-1.2600	)------	(0.0	-1.0000	1.2600	)
(0.8660	-0.5000	-1.2600	)------	(0.0	-1.0000	-1.2600	)
(0.0	1.0000	1.2600	)------	(-0.8660	0.5000	1.2600	)
(0.0	1.0000	-1.2600	)------	(-0.8660	0.5000	-1.2600	)
(-0.8660	0.5000	1.2600	)------	(-0.8660	0.5000	-1.2600	)
(-0.8660	0.5000	1.2600	)------	(-0.8660	-0.5000	1.2600	)
(-0.8660	0.5000	-1.2600	)------	(-0.8660	-0.5000	-1.2600	)

Apdx. 2-b, p. 179

(-0.8660	-0.5000	1.2600	-----	(-0.8660	-0.5000	-1.2600	)
(-0.8660	-0.5000	1.2600	-----	(0.0	-1.0000	1.2600	)
(-0.8660	-0.5000	-1.2600	-----	(0.0	-1.0000	-1.2600	)
(0.0	-1.0000	1.2600	-----	(0.0	-1.0000	-1.2600	)

THE MAXIMUM IS: 1.2600 THE CONVERSION FACTOR FOR THE PINTER GRAPH IS : 714.2859

VERTICES

618.5718	357.1631	899.9995
618.5718	357.1631	-899.9995
618.5718	-357.1631	899.9995
618.5718	-357.1631	-899.9995
0.0	714.2859	899.9995
0.0	714.2859	-899.9995
-618.5718	357.1631	899.9995
-618.5718	357.1631	-899.9995
-618.5718	-357.1631	899.9995
-618.5718	-357.1631	-899.9995
0.0	-714.2859	899.9995
0.0	-714.2859	-899.9995

EDGES

1	2
1	3
1	5
2	4
2	6
3	4
3	11
4	12
5	6
5	7
6	8
7	8
7	9
8	10
9	10
9	11
10	12
11	12

FACES

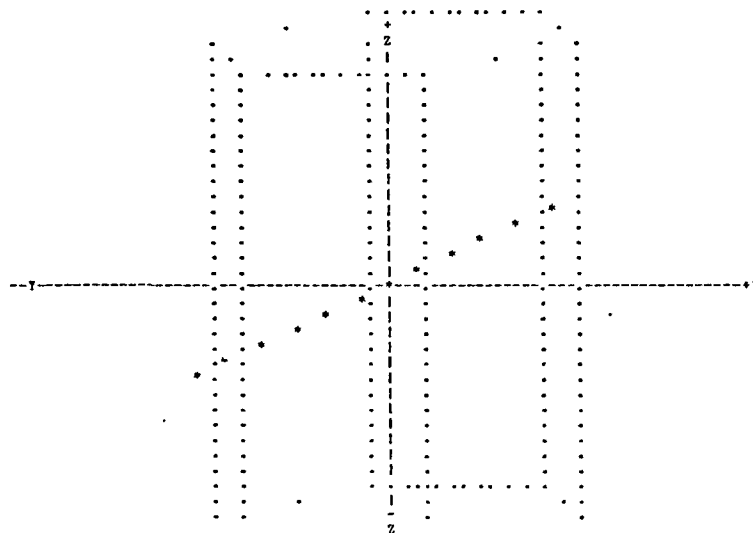
1	2	4	3
1	2	6	5
5	6	8	7
7	8	10	9
9	10	12	11
3	4	12	11
1	3	11	9
2	4	12	10
		8	6

THE MAXIMUM IS: 1.4124622345 THE CONVERSION FACTOR FOR VIEWPLOT IS : 12.7437028985

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(2.2054	14.1141	-----	(2.2054	-18.0000	)
(2.2054	14.1141	-----	(-10.5390	14.1141	)
(2.2054	14.1141	-----	(12.7437	16.0571	)
(2.2054	-18.0000	-----	(-10.5390	-18.0000	)
(2.2054	-18.0000	-----	(12.7437	-16.0571	)
(-10.5390	14.1141	-----	(-10.5390	-18.0000	)
(-10.5390	14.1141	-----	(-12.7437	16.0571	)
(-10.5390	-18.0000	-----	(-12.7437	-16.0571	)
(12.7437	16.0571	-----	(12.7437	-16.0571	)
(12.7437	16.0571	-----	(10.5390	18.0000	)
(12.7437	-16.0571	-----	(10.5390	-14.1141	)
(10.5390	18.0000	-----	(10.5390	-14.1141	)
(10.5390	18.0000	-----	(-2.2054	18.0000	)
(10.5390	-14.1141	-----	(-2.2054	-14.1141	)

CRYSTAL SHAPE:



Apdx. 2-b, p. 180

OLIGOCLASE ANDERSONITE : ROGEPS, 1937, P. 435, 436

TRICLINIC SYSTEM, A:B:C= 0.6369: 1.0000: 0.5599 ALPHA= 94.2660 , BETA= 116.5990 , GAMMA= 87.6666

FORM(S) =

NUMBER OF FACES OR MILLER INDICES = 10

MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	0
0	-1	0
0	0	1
0	0	-1
-1	0	1
1	0	-1

THE CARTESIAN COORDINATES OF THE CRYSTAL FACES ARE :

1.7559 X +	0.9842 Y +	0.0	Z = 1
-1.7559 X +	1.0174 Y +	0.0	Z = 1
-1.7559 X +	-0.9812 Y +	0.0	Z = 1
1.7559 X +	-1.0174 Y +	0.0	Z = 1
0.0 X +	2.0056 Y +	0.0	Z = 1

```

0.0      Y +      -2.0056 Y +      0.0      Z =      1
0.5695 X +      0.0134 Y +      1.1907 Z =      1
-0.5695 X +      -0.0134 Y +      -1.1907 Z =      1
-0.5068 X +      0.0      Y +      1.0506 Z =      1
0.5068 X +      -0.0126 Y +      -1.0506 Z =      1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :
(      0.5695      0.0      0.5547 )
(      0.5695      0.0      -0.6771 )
(      0.2889      0.4986      0.6601 )
(      0.2889      0.4986      -0.8517 )
(      -0.5695      0.0      -0.5547 )
(      -0.5695      0.0      0.6771 )
(      -0.2806      0.4986      -0.7345 )
(      -0.2806      0.4986      0.8165 )
(      -0.2889      -0.4986      -0.6601 )
(      -0.2889      -0.4986      0.8125 )
(      0.2806      -0.4986      0.7345 )
(      0.2806      -0.4986      -0.7773 )
(      -0.1496      0.4986      0.8797 )
(      0.1180      0.4986      -0.9341 )
(      -0.0782      -0.4986      0.9141 )
(      0.1098      -0.4986      -0.8597 )

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :
(      0.5695      0.0      0.5547 )----- (      0.5695      0.0      -0.6771 )
(      0.5695      0.0      0.5547 )----- (      0.2889      0.4986      0.6601 )
(      0.5695      0.0      0.5547 )----- (      0.2889      0.4986      -0.8517 )
(      0.5695      0.0      -0.6771 )----- (      0.2889      0.4986      0.6601 )
(      0.5695      0.0      -0.6771 )----- (      0.2889      0.4986      -0.8517 )
(      0.2889      0.4986      0.6601 )----- (      -0.1496      0.4986      0.8797 )
(      0.2889      0.4986      0.6601 )----- (      -0.1496      0.4986      -0.9341 )
(      -0.5695      0.0      -0.5547 )----- (      -0.5695      0.0      0.6771 )
(      -0.5695      0.0      -0.5547 )----- (      -0.2806      0.4986      -0.7345 )
(      -0.5695      0.0      0.6771 )----- (      -0.2806      0.4986      0.8165 )
(      -0.5695      0.0      0.6771 )----- (      -0.2889      -0.4986      0.8125 )
(      -0.2806      0.4986      -0.7345 )----- (      -0.2806      0.4986      0.8165 )
(      -0.2806      0.4986      -0.7345 )----- (      0.1180      0.4986      -0.9341 )
(      -0.2806      0.4986      0.8165 )----- (      -0.1496      0.4986      0.8797 )
(      -0.2889      -0.4986      -0.6601 )----- (      -0.2889      -0.4986      0.8125 )
(      -0.2889      -0.4986      -0.6601 )----- (      0.1098      -0.4986      -0.8597 )
(      -0.2889      -0.4986      0.8125 )----- (      -0.0782      -0.4986      0.9141 )
(      0.2806      -0.4986      0.7345 )----- (      0.2806      -0.4986      -0.7773 )
(      0.2806      -0.4986      0.7345 )----- (      -0.0782      -0.4986      0.9141 )
(      0.2806      -0.4986      -0.7773 )----- (      -0.0782      -0.4986      -0.8597 )
(      -0.1496      0.4986      0.8797 )----- (      0.1098      -0.4986      -0.8597 )
(      0.1180      0.4986      -0.9341 )----- (      0.1098      -0.4986      -0.8597 )

THE MAXIMUM IS:      0.9341      THE CONVERSION FACTOR FOR THE PAPER GRAPH IS :      963.5186

VERTICES
548.7166      0.0      534.4465
548.7163      0.0      -652.3955
278.3523      480.4082      635.9924
278.3523      480.4082      -820.5864
-548.7168      0.0      -534.4465
-548.7166      0.0      652.3958
-270.3660      480.4082      -707.6646
-270.3660      480.4082      766.6768
-278.3523      -480.4082      -635.9924
-278.3523      -480.4082      782.8242
270.3660      -480.4082      707.6646
270.3660      -480.4082      -748.9143
-144.1591      480.4082      847.5605

```

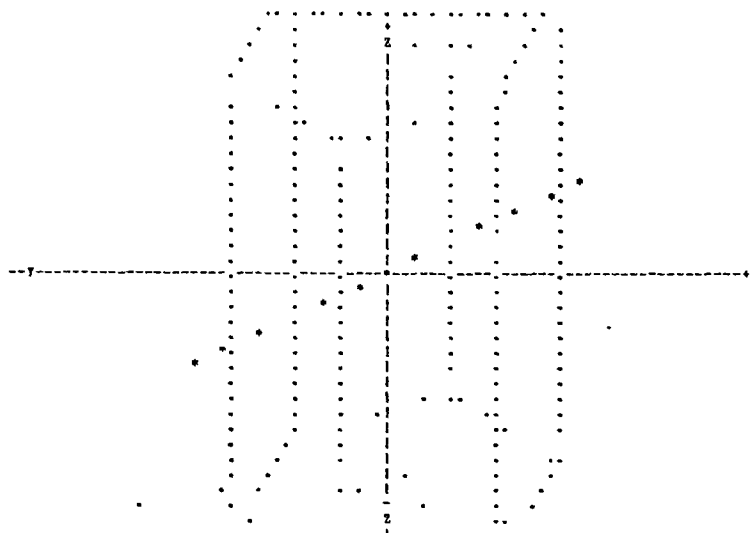
```

113.7359 480.4082 -899.9998
-75.3265 -480.4082 880.7666
105.7498 -480.4082 -828.3274
EDGES
1 2
1 3
1 11
2 4
2 12
3 4
3 13
4 14
5 6
5 7
5 9
6 8
6 10
7 8
7 14
8 13
9 10
9 16
10 15
11 12
11 15
12 16
13 15
14 16
FACES
1 2 4 3
5 6 8 7
5 6 10 9
1 2 12 11
3 4 14 7 8 13
9 10 15 11 12 16
1 3 13 15 11
5 7 14 16 9
6 8 13 15 10
2 4 14 16 12
THE MAXIMUM IS: 0.9548582435 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.8509521484
THP 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( -4.0533 8.5663 )----- ( -4.0533 -14.6540 )
( -4.0533 8.5663 )----- ( 7.3429 11.4842 )
( -4.0533 8.5663 )----- ( -11.3962 12.9140 )
( -4.0533 -14.6540 )----- ( 7.3429 -17.0133 )
( -4.0533 -14.6540 )----- ( -11.3962 -15.5836 )
( 7.3429 11.4842 )----- ( 7.3429 -17.0133 )
( 7.3429 11.4842 )----- ( 10.4639 17.0780 )
( 7.3429 -17.0133 )----- ( 8.5589 -18.0000 )
( 4.0533 -8.5663 )----- ( 4.0533 14.6540 )
( 4.0533 -8.5663 )----- ( 11.3962 -12.9140 )
( 4.0533 -8.5663 )----- ( -7.3429 -11.4842 )
( 4.0533 14.6540 )----- ( 11.3962 16.3274 )
( 4.0533 14.6540 )----- ( -7.3429 16.3274 )
( 11.3962 -12.9140 )----- ( 11.3962 16.3274 )
( 11.3962 -12.9140 )----- ( 8.5589 -18.0000 )
( 11.3962 16.3274 )----- ( 10.4639 17.0780 )
( -7.3429 11.4842 )----- ( -7.3429 16.3274 )
( -7.3429 11.4842 )----- ( -10.4639 -17.0780 )
( -7.3429 16.3274 )----- ( -8.5589 18.0000 )
( -11.3962 12.9140 )----- ( -11.3962 -15.5836 )
( -11.3962 12.9140 )----- ( -8.5589 18.0000 )

```

CRYSTAL SHAPE:

```
( -11.3962 -15.5836 )-----(-10.1807 -16.5702 )
( 10.4639 17.0708 )-----(-8.8426 17.4914 )
( 8.5589 -18.0000 )-----(-10.1802 -16.5702 )
```



ORTHOCLASE 1 : ROGERS , 1937, P. 428
 MONOCLINIC SYSTEM : A:B:C= 0.6580: 1.0000: 0.5550 ,ALPHA=GAMMA=90, BETA= 116.0500 , 3 FORM(S)-
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

```
0      1      0
0     -1      0
1      1      0
-1     -1      0
-1     -1      0
1     -1      0
0      0      1
0      0     -1
```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```
0.0 X + 2.0000 Y + 0.0 Z = 1
0.0 X + -2.0000 Y + 0.0 Z = 1
1.1277 X + 0.6667 Y + 0.0 Z = 1
-1.1277 X + 0.6667 Y + 0.0 Z = 1
-1.1277 X + -0.6667 Y + 0.0 Z = 1
1.1277 X + -0.6667 Y + 0.0 Z = 1
0.8867 X + 0.0 Y + 1.8018 Z = 1
-0.8867 X + 0.0 Y + -1.8018 Z = 1
```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```
( 0.5912 0.5000 0.2660 )
```

```
( 0.5912 0.5000 -0.8440 )
( -0.5912 0.5000 0.8440 )
( -0.5912 0.5000 -0.2660 )
( -0.5912 -0.5000 0.8440 )
( -0.5912 -0.5000 -0.2660 )
( 0.5912 -0.5000 0.2660 )
( 0.5912 -0.5000 -0.8440 )
( 0.8867 0.0 0.1216 )
( 0.8867 0.0 -0.9884 )
( -0.8867 0.0 0.9884 )
( -0.8867 0.0 -0.1216 )
```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```
( 0.5912 0.5000 0.2660 )-----(-0.5912 0.5000 -0.8440 )
( 0.5912 0.5000 0.2660 )-----(-0.5912 0.5000 0.8440 )
( 0.5912 0.5000 0.2660 )-----(-0.8867 0.0 0.1216 )
( 0.5912 0.5000 -0.8440 )-----(-0.5912 0.5000 -0.2660 )
( 0.5912 0.5000 -0.8440 )-----(-0.8867 0.0 -0.9884 )
( -0.5912 0.5000 0.8440 )-----(-0.5912 0.5000 -0.2660 )
( -0.5912 0.5000 0.8440 )-----(-0.8867 0.0 0.9884 )
( -0.5912 0.5000 -0.2660 )-----(-0.8867 0.0 -0.1216 )
( -0.5912 -0.5000 0.8440 )-----(-0.5912 -0.5000 -0.2660 )
( -0.5912 -0.5000 0.8440 )-----(-0.5912 -0.5000 0.2660 )
( -0.5912 -0.5000 0.8440 )-----(-0.8867 0.0 0.9884 )
( -0.5912 -0.5000 -0.2660 )-----(-0.5912 -0.5000 -0.8440 )
( -0.5912 -0.5000 -0.2660 )-----(-0.8867 0.0 -0.1216 )
( 0.5912 -0.5000 0.2660 )-----(-0.5912 -0.5000 -0.8440 )
( 0.5912 -0.5000 0.2660 )-----(-0.8867 0.0 0.1216 )
( 0.5912 -0.5000 -0.8440 )-----(-0.8867 0.0 -0.9884 )
( -0.8867 0.0 0.1216 )-----(-0.8867 0.0 -0.9884 )
( -0.8867 0.0 0.9884 )-----(-0.8867 0.0 -0.1216 )
```

THE MAXIMUM IS:

0.9884

THE CONVERSION FACTOR FOR THE PINTER GRAPH IS :

910.5186

VERTICES

```
538.2576 455.2593 242.2298
538.2576 455.2593 -768.4453
-538.2576 455.2593 768.4453
-538.2576 455.2593 -242.2298
538.2576 -455.2593 768.4453
-538.2576 -455.2593 -242.2298
538.2576 -455.2593 242.2298
538.2576 -455.2593 -768.4453
807.3862 0.0 110.6760
807.3862 0.0 -899.9574
-807.3862 0.0 899.9574
-807.3862 0.0 -110.6760
```

EDGES

```
1 2
1 3
1 9
2 4
2 10
3 4
3 11
4 12
5 6
5 7
5 11
6 8
6 12
7 8
7 9
8 10
9 10
```

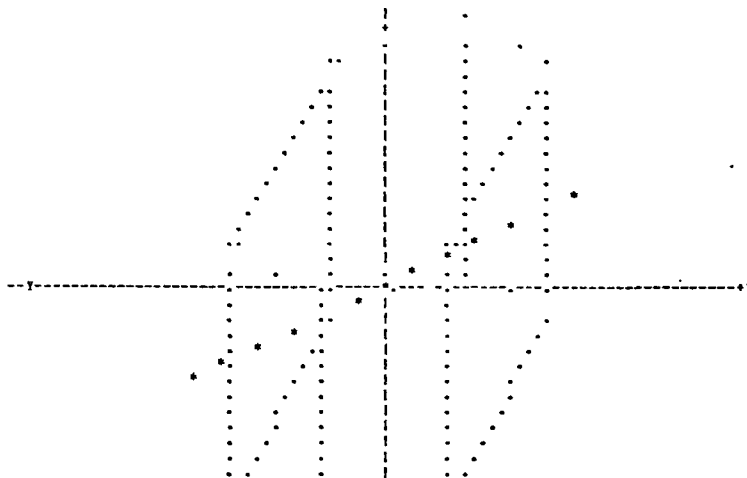
11 12
 FACES 2 4 3
 1 2 4 3
 5 6 8 7
 1 2 10 9
 3 4 12 11
 5 6 12 11
 7 8 10 9
 1 3 11 5 7 9
 2 4 12 6 8 10
 THE MAXIMUM IS: 1.1445608139

THE CONVERSION FACTOR FOR VIEWPLOT IS: 15.7265558243

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS:

(4.3531 2.5471)	-----	(4.3531 -14.9094)
(4.3531 2.5471)	-----	(11.3734 14.9094)
(4.3531 2.5471)	-----	(-5.2652 -0.5435)
(4.3531 -14.9094)	-----	(11.3734 -2.5471)
(4.3531 -14.9094)	-----	(-5.2652 -18.0000)
(11.3734 14.9094)	-----	(11.3734 -2.5471)
(11.3734 14.9094)	-----	(5.2652 18.0000)
(11.3734 -2.5471)	-----	(5.2652 0.5435)
(-4.3531 14.9094)	-----	(-4.3531 -2.5471)
(-4.3531 14.9094)	-----	(-11.3734 2.5471)
(-4.3531 14.9094)	-----	(5.2652 18.0000)
(-4.3531 -2.5471)	-----	(-11.3734 -14.9094)
(-4.3531 -2.5471)	-----	(5.2652 0.5435)
(-11.3734 2.5471)	-----	(-11.3734 -18.9094)
(-11.3734 2.5471)	-----	(-5.2652 -0.5435)
(-11.3734 -14.9094)	-----	(-5.2652 -18.0000)
(-5.2652 -0.5435)	-----	(-5.2652 -18.0000)
(5.2652 18.0000)	-----	(5.2652 0.5435)

CRYSTAL SHAPE:



Apdx. 2-b, p. 186

ORTHOCLASE 2 : ROGERS, 1937, P. 428
 MONOCLINIC SYSTEM : A:B:C= 0.6580: 1.0000: 0.5550 , ALPHA=90, BETA= 116.0500 , 4 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 10
 MILLER INDICES :

0	1	0
0	-1	0
1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	0	1
0	0	-1
-2	0	-1
-2	0	1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

0.0	X +	2.0000	Y +	0.0	Z =	1
0.0	X +	-2.0000	Y +	0.0	Z =	1
1.1277	X +	0.6667	Y +	0.0	Z =	1
-1.1277	X +	0.6667	Y +	0.0	Z =	1
-1.1277	X +	-0.6667	Y +	0.0	Z =	1
1.1277	X +	-0.6667	Y +	0.0	Z =	1
0.8807	X +	0.0	Y +	1.8018	Z =	1
-0.8807	X +	0.0	Y +	-1.8018	Z =	1
0.8342	X +	0.0	Y +	-0.6006	Z =	1
-0.8342	X +	0.0	Y +	0.6006	Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(0.5912 0.5000 0.2660)	-----	(0.5912 0.5000 -0.8440)
(0.5912 0.5000 0.2660)	-----	(-0.5912 0.5000 0.8440)
(-0.5912 0.5000 0.2660)	-----	(-0.5912 0.5000 -0.8440)
(-0.5912 0.5000 0.2660)	-----	(0.5912 0.5000 0.8440)
(-0.5912 0.5000 -0.2660)	-----	(-0.5912 0.5000 -0.8440)
(-0.5912 0.5000 -0.2660)	-----	(0.5912 -0.5000 -0.8440)
(0.5912 0.5000 -0.2660)	-----	(0.5912 -0.5000 0.8440)
(0.5912 0.5000 -0.2660)	-----	(-0.5912 -0.5000 0.8440)
(0.5912 0.5000 0.2660)	-----	(0.5912 0.5000 0.8440)
(0.5912 0.5000 0.2660)	-----	(-0.5912 0.5000 -0.8440)
(0.5912 0.5000 0.2660)	-----	(-0.5912 0.5000 0.8440)
(0.5912 0.5000 0.2660)	-----	(0.5912 -0.5000 -0.8440)
(0.5912 0.5000 0.2660)	-----	(0.5912 -0.5000 0.8440)
(0.5912 0.5000 0.2660)	-----	(-0.5912 -0.5000 0.8440)
(0.5912 0.5000 0.2660)	-----	(-0.5912 -0.5000 -0.8440)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(0.5912 0.5000 0.2660)	-----	(0.5912 0.5000 -0.8440)
(0.5912 0.5000 0.2660)	-----	(-0.5912 0.5000 0.8440)
(0.5912 0.5000 0.2660)	-----	(-0.5912 0.5000 -0.8440)
(0.5912 0.5000 -0.8440)	-----	(0.5912 0.5000 0.8440)
(0.5912 0.5000 -0.8440)	-----	(-0.5912 0.5000 -0.8440)
(0.5912 0.5000 -0.8440)	-----	(-0.5912 0.5000 0.8440)
(0.5912 0.5000 -0.8440)	-----	(0.5912 -0.5000 -0.8440)
(0.5912 0.5000 -0.8440)	-----	(0.5912 -0.5000 0.8440)
(0.5912 0.5000 -0.8440)	-----	(-0.5912 -0.5000 0.8440)
(0.5912 0.5000 -0.8440)	-----	(-0.5912 -0.5000 -0.8440)
(0.5912 0.5000 -0.8440)	-----	(0.5912 0.5000 0.8440)
(0.5912 0.5000 -0.8440)	-----	(0.5912 0.5000 -0.8440)
(0.5912 0.5000 -0.8440)	-----	(-0.5912 0.5000 0.8440)
(0.5912 0.5000 -0.8440)	-----	(-0.5912 0.5000 -0.8440)
(0.5912 0.5000 -0.8440)	-----	(0.5912 -0.5000 -0.8440)
(0.5912 0.5000 -0.8440)	-----	(0.5912 -0.5000 0.8440)
(0.5912 0.5000 -0.8440)	-----	(-0.5912 -0.5000 0.8440)
(0.5912 0.5000 -0.8440)	-----	(-0.5912 -0.5000 -0.8440)

THE MAXIMUM IS: 0.8867 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 1014.9619

VERTICES
599.9998 507.4810 270.0154
599.9995 507.4810 -856.5903
-599.9998 507.4810 -270.0154
-599.9995 507.4810 856.5903
599.9998 -507.4810 -270.0154
-599.9995 -507.4810 856.5903
599.9998 -507.4810 270.0154
599.9995 -507.4810 -856.5903
899.9998 0.0 123.3714
899.9993 0.0 -439.9299
-899.9998 0.0 -123.3714
-899.9993 0.0 439.9299

EDGES
1 2
1 4
1 9
2 3
2 8
2 10
3 4
3 11
4 6
4 12
5 6
5 8
5 11
6 7
6 12
7 8
7 9
8 10
9 10
11 12

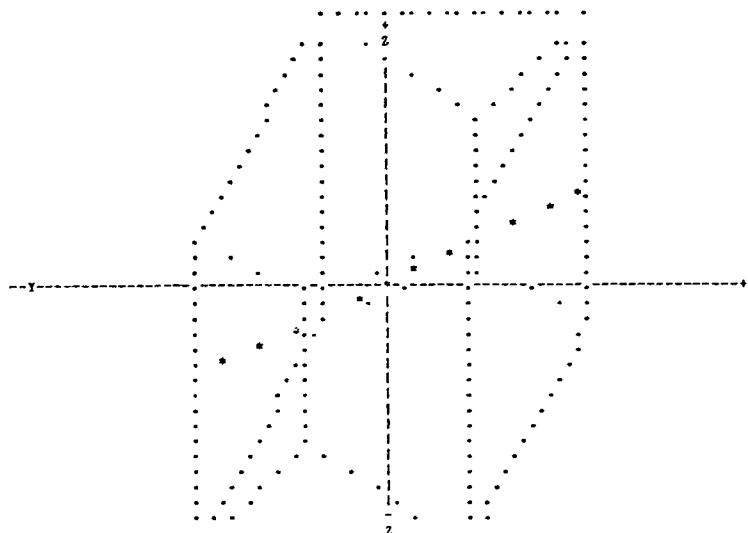
FACES
1 2 3 4
5 6 7 8
1 2 10 9
3 4 12 11
5 6 12 11
7 8 10 9
1 4 6 7 9
2 3 11 5 8
2 8 10
4 6 12

THE MAXIMUM IS: 0.9480389953 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.9865570068

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
(5.2555 3.0750)----- (5.2555 -18.0000)
(5.2555 3.0750)----- (13.7311 18.0000)
(5.2555 3.0750)----- (-6.3567 -0.6562)
(5.2555 -18.0000)----- (13.7311 -3.0750)
(5.2555 -18.0000)----- (-13.7311 18.0000)
(5.2555 -18.0000)----- (-6.3567 -11.1937)
(13.7311 -3.0750)----- (13.7311 18.0000)
(13.7311 -3.0750)----- (6.3567 0.6562)
(13.7311 18.0000)----- (-5.2555 18.0000)
(13.7311 18.0000)----- (6.3567 11.1937)
(-5.2555 -3.0750)----- (-5.2555 18.0000)
(-5.2555 -3.0750)----- (-13.7311 -18.0000)

(-5.2555 -3.0750)----- (6.3567 0.6562)
(-5.2555 18.0000)----- (-13.7311 3.0750)
(-5.2555 18.0000)----- (6.3567 11.1937)
(-13.7311 3.0750)----- (-13.7311 -18.0000)
(-13.7311 3.0750)----- (-6.3567 -0.6562)
(-13.7311 -18.0000)----- (-6.3567 -11.1937)
(-6.3567 -0.6562)----- (-6.3567 -11.1937)
(6.3567 0.6562)----- (6.3567 11.1937)

CRYSTAL SHAPE:



OPHTHOCLASE 3 : ROGERS, 1937, P. 428
MONOCLINIC SYSTEM : A:B:C= 0.6580: 1.0000: 0.5550 , ALPHA=90, BETA= 116.0500 , 6 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 18
MILLER INDICES :

0 1 0
0 -1 0
1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 0 1
0 0 -1
2 0 -1
-2 0 1
0 2 1
0 2 -1
0 -2 -1

```

      0      -2      1
      1      1      -1
      1      -1      -1
      -1      -1      1
      -1      -1      1
THE CARTESIAN COORDINATES OF THE CRYSTAL FACES ARE :
0.0 X + 2.0000 Y + 0.0 Z = 1
0.0 X + -2.0000 Y + 0.0 Z = 1
1.1277 X + 0.6667 Y + 0.0 Z = 1
-1.1277 X + 0.6667 Y + 0.0 Z = 1
-1.1277 X + -0.6667 Y + 0.0 Z = 1
1.1277 X + -0.6667 Y + 0.0 Z = 1
0.8867 X + 0.0 Y + 1.8018 Z = 1
-0.8867 X + 0.0 Y + -1.8018 Z = 1
0.8342 X + 0.0 Y + -0.6006 Z = 1
-0.8342 X + 0.0 Y + 0.6006 Z = 1
0.4843 X + 1.1111 Y + 1.0010 Z = 1
-0.4843 X + 1.1111 Y + -1.0010 Z = 1
-0.4843 X + -1.1111 Y + -1.0010 Z = 1
0.4843 X + -1.1111 Y + 1.0010 Z = 1
0.4505 X + 0.5556 Y + -1.0010 Z = 1
0.4505 X + -0.5556 Y + -1.0010 Z = 1
-0.4505 X + 0.5556 Y + 1.0010 Z = 1
-0.4505 X + -0.5556 Y + 1.0010 Z = 1

```

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :
( 0.5912 0.5000 0.1550 )
( 0.5912 0.5000 -0.4555 )
( -0.5912 0.5000 -0.1550 )
( -0.5912 0.5000 0.4555 )
( -0.2956 0.5000 0.5885 )
( 0.2956 0.5000 -0.5885 )
( -0.5912 -0.5000 -0.1550 )
( -0.5912 -0.5000 0.4555 )
( 0.5912 -0.5000 0.1550 )
( 0.5912 -0.5000 -0.4555 )
( 0.2956 -0.5000 -0.5885 )
( -0.2956 -0.5000 0.5885 )
( 0.8867 0.0 0.1216 )
( 0.8867 0.0 -0.4334 )
( 0.6503 0.4000 0.2371 )
( 0.7981 0.1500 -0.5566 )
( -0.8867 0.0 -0.1216 )
( -0.8867 0.0 0.4334 )
( -0.6503 0.4000 -0.2371 )
( -0.7981 0.1500 0.5566 )
( -0.6503 -0.4000 -0.2371 )
( -0.7981 -0.1500 0.5566 )
( -0.2365 0.4000 0.6706 )
( -0.2365 -0.4000 0.6706 )
( -0.4729 0.0 0.7862 )
( 0.2365 0.4000 -0.6706 )
( 0.2365 -0.4000 -0.6706 )
( 0.4729 0.0 -0.7862 )
( 0.7094 0.0 -0.6798 )
( -0.7094 0.0 0.6798 )

```

```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.5912 0.5000 0.1550 )----- ( 0.5912 0.5000 -0.4555 )
( 0.5912 0.5000 0.1550 )----- ( -0.2956 0.5000 0.5885 )
( 0.5912 0.5000 0.1550 )----- ( 0.6503 0.4000 0.2371 )
( 0.5912 0.5000 -0.4555 )----- ( 0.2956 0.5000 -0.5885 )

```

```

( 0.5912 0.5000 -0.4555 )----- ( 0.7981 0.1500 -0.5566 )
( -0.5912 0.5000 -0.1550 )----- ( -0.5912 0.5000 0.4555 )
( -0.5912 0.5000 -0.1550 )----- ( 0.2956 0.5000 -0.5885 )
( -0.5912 0.5000 -0.1550 )----- ( -0.6503 0.4000 -0.2371 )
( -0.5912 0.5000 0.4555 )----- ( -0.2956 0.5000 0.5885 )
( -0.5912 0.5000 0.4555 )----- ( 0.7981 0.1500 0.5566 )
( -0.2956 0.5000 0.5885 )----- ( -0.2365 0.4000 0.6706 )
( 0.2956 0.5000 -0.5885 )----- ( 0.2365 0.4000 -0.6706 )
( -0.5912 -0.5000 -0.1550 )----- ( -0.5912 -0.5000 0.4555 )
( -0.5912 -0.5000 -0.1550 )----- ( 0.2956 -0.5000 -0.5885 )
( -0.5912 -0.5000 -0.1550 )----- ( -0.6503 -0.4000 -0.2371 )
( -0.5912 -0.5000 0.4555 )----- ( -0.2956 -0.5000 0.5885 )
( -0.5912 -0.5000 0.4555 )----- ( 0.7981 -0.1500 0.5566 )
( 0.5912 -0.5000 0.1550 )----- ( 0.5912 -0.5000 -0.4555 )
( 0.5912 -0.5000 0.1550 )----- ( -0.2956 -0.5000 0.5885 )
( 0.5912 -0.5000 0.1550 )----- ( 0.6503 -0.4000 0.2371 )
( 0.5912 -0.5000 -0.4555 )----- ( 0.2956 -0.5000 -0.5885 )
( 0.5912 -0.5000 -0.4555 )----- ( 0.7981 -0.1500 -0.5566 )
( 0.2956 -0.5000 -0.5885 )----- ( 0.2365 -0.4000 -0.6706 )
( -0.2956 -0.5000 0.5885 )----- ( -0.2365 -0.4000 0.6706 )
( 0.8867 0.0 0.1216 )----- ( 0.8867 0.0 -0.4334 )
( 0.8867 0.0 0.1216 )----- ( 0.6503 0.4000 0.2371 )
( 0.8867 0.0 0.1216 )----- ( 0.6503 -0.4000 0.2371 )
( 0.8867 0.0 -0.4334 )----- ( 0.7981 0.1500 -0.5566 )
( 0.8867 0.0 -0.4334 )----- ( 0.7981 -0.1500 0.5566 )
( 0.6503 0.4000 0.2371 )----- ( -0.2365 0.4000 0.6706 )
( 0.7981 0.1500 -0.5566 )----- ( 0.7094 0.0 -0.6798 )
( -0.8867 0.0 -0.1216 )----- ( -0.8867 0.0 0.4334 )
( -0.8867 0.0 -0.1216 )----- ( -0.6503 0.4000 -0.2371 )
( -0.8867 0.0 -0.1216 )----- ( -0.6503 -0.4000 -0.2371 )
( -0.8867 0.0 0.4334 )----- ( -0.7981 0.1500 0.5566 )
( -0.8867 0.0 0.4334 )----- ( -0.7981 -0.1500 0.5566 )
( -0.6503 0.4000 -0.2371 )----- ( 0.2365 0.4000 -0.6706 )
( -0.7981 0.1500 0.5566 )----- ( 0.7094 0.0 -0.6798 )
( -0.6503 -0.4000 -0.2371 )----- ( 0.2365 -0.4000 0.6706 )
( -0.7981 -0.1500 0.5566 )----- ( 0.7094 0.0 0.6798 )
( -0.2365 0.4000 0.6706 )----- ( -0.4729 0.0 0.7862 )
( -0.2365 -0.4000 0.6706 )----- ( -0.4729 0.0 -0.7862 )
( -0.4729 0.0 0.7862 )----- ( -0.7094 0.0 0.6798 )
( 0.2365 0.4000 -0.6706 )----- ( 0.4729 0.0 -0.7862 )
( 0.2365 -0.4000 -0.6706 )----- ( 0.4729 0.0 0.7862 )
( 0.4729 0.0 -0.7862 )----- ( 0.7094 0.0 -0.6798 )

```

THE MAXIMUM IS:

0.8867

THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :

1014.9619

VERTICES

```

599.9995 507.4810 157.3545
599.9995 507.4810 -462.2766
-599.9995 507.4810 -157.3545
-599.9995 507.4810 462.2766
-299.9978 507.4810 597.2864
299.9978 507.4810 -597.2864
-599.9995 -507.4810 -157.3545
-599.9995 -507.4810 462.2766
599.9995 -507.4810 157.3545
599.9995 -507.4810 -462.2766
299.9978 -507.4810 -597.2864
-299.9978 -507.4810 597.2864
899.9995 0.0 121.3714
899.9995 0.0 -433.4219
699.9995 405.9846 240.6116
810.0000 152.2434 -564.1272

```

```

-899.4998 0.0 -123.3714
-899.4993 0.0 439.9299
-659.4998 405.9846 -240.6866
-810.0000 152.2434 564.9272
-659.4998 -405.9846 -240.6866
-810.0000 -152.2434 564.9272
659.4998 -405.9846 240.6866
810.0000 152.2434 -564.9272
-239.9989 405.9846 680.6187
-239.9989 -405.9846 680.6187
-479.9988 0.0 797.9333
239.9989 405.9846 -680.6187
239.9989 -405.9846 -680.6187
479.9988 0.0 -797.9333
720.0007 0.0 -689.9243
-720.0007 0.0 689.9243

```

EDGES

```

1 2
1 5
1 15
2 6
2 16
3 4
3 6
3 19
4 5
4 20
5 25
6 28
7 8
7 11
7 21
8 12
8 22
9 10
9 12
9 23
10 11
10 24
11 29
12 26
13 14
13 15
13 23
14 16
14 24
15 25
16 31
17 18
17 19
17 21
18 20
18 22
19 28
20 32
21 29
22 32
23 26
24 31
25 27
26 27
27 32

```

```

28 30
29 30
30 31

```

FACES

```

1 2 6 3 4 5
7 8 12 9 10 11
1 2 16 14 13 15
3 4 20 18 17 19
7 8 22 18 17 21
9 10 24 14 13 23
13 15 25 27 26 23
17 19 28 30 29 21
14 16 31 24
18 20 32 22
1 5 25 15
3 6 28 19
7 11 29 21
9 12 26 23
2 6 28 30 31 16
10 11 29 30 31 24
4 5 25 27 32 20
8 12 26 27 32 22

```

THE MAXIMUM IS:

0.8694310784

THE CONVERSION FACTOR FOR VIEWPLOT IS :

20.7031860352

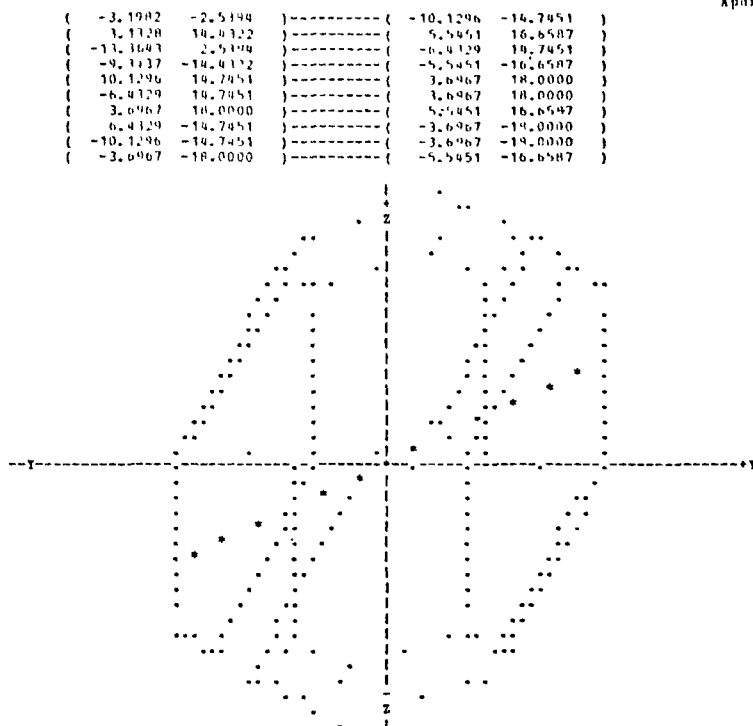
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 5.7307 1.0550 )----- ( 5.7307 -11.5842 )
( 5.7307 1.0550 )----- ( 12.6620 13.2608 )
( 5.7307 1.0550 )----- ( 3.1982 2.5394 )
( 5.7307 -11.5842 )----- ( 8.0411 -13.2608 )
( 5.7307 -11.5842 )----- ( -3.1328 -14.4322 )
( 14.9725 -1.0550 )----- ( 14.9725 11.5842 )
( 14.9725 -1.0550 )----- ( 8.0411 -13.2608 )
( 14.9725 -1.0550 )----- ( 13.3643 -2.5394 )
( 14.9725 11.5842 )----- ( 12.6620 13.2608 )
( 14.9725 11.5842 )----- ( 9.3437 14.4322 )
( 12.6620 13.2608 )----- ( 10.1296 14.7451 )
( 8.0411 -13.2608 )----- ( 6.4329 -14.7451 )
( -5.7307 -1.0550 )----- ( -5.7307 11.5842 )
( -5.7307 -1.0550 )----- ( -12.6620 -13.2608 )
( -5.7307 -1.0550 )----- ( -3.1982 -2.5394 )
( -5.7307 11.5842 )----- ( -8.0411 13.2608 )
( -5.7307 11.5842 )----- ( 3.1328 14.4322 )
( -14.9725 1.0550 )----- ( -14.9725 -11.5842 )
( -14.9725 1.0550 )----- ( -8.0411 13.2608 )
( -14.9725 1.0550 )----- ( -13.3643 2.5394 )
( -14.9725 -11.5842 )----- ( -12.6620 -13.2608 )
( -14.9725 -11.5842 )----- ( -9.3437 -14.4322 )
( -12.6620 -13.2608 )----- ( -10.1296 -14.7451 )
( -8.0411 13.2608 )----- ( -6.4329 14.7451 )
( -6.9314 -0.7155 )----- ( -6.9314 12.2057 )
( -6.9314 -0.7155 )----- ( 3.1982 2.5394 )
( -6.9314 -0.7155 )----- ( 13.3643 2.5394 )
( -6.9314 -12.2057 )----- ( -3.1328 -14.4322 )
( -6.9314 -12.2057 )----- ( -9.3437 -14.4322 )
( 3.1982 2.5394 )----- ( 10.1296 14.7451 )
( -3.1328 -14.4322 )----- ( -5.7307 -11.5842 )
( 6.9314 0.7155 )----- ( 6.9314 12.2057 )
( 6.9314 0.7155 )----- ( 13.3643 2.5394 )
( 6.9314 0.7155 )----- ( 3.1982 -2.5394 )
( 6.9314 12.2057 )----- ( 9.3437 14.4322 )
( 6.9314 12.2057 )----- ( 3.1328 14.4322 )
( 13.3643 -2.5394 )----- ( 6.4329 -14.7451 )
( 9.3437 14.4322 )----- ( 5.7307 11.5842 )

```


CRYSTAL SHAPE:



ORTHOCLASE 4 : ROGERS, 1937, P. 428
 MONOCLINIC SYSTEM : A:B:C= 0.6580: 1.0000: 0.5550 , ALPHA=90, BETA= 116.0500 , 5 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 14
 MILLER INDICES :

0	1	0
0	-1	0
1	1	0
-1	1	0
-1	-1	0
1	-1	0
1	3	0
-1	3	0
-1	-3	0
1	-3	0
1	0	-1

Apdx. 2-b, p. 194

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACTS ARE :

0.0	X +	2.0000	Y +	0.0	Z =	1
0.0	X +	-2.0000	Y +	0.0	Z =	1
1.1277	X +	0.6667	Y +	0.0	Z =	1
-1.1277	X +	0.6667	Y +	0.0	Z =	1
-1.1277	X +	-0.6667	Y +	0.0	Z =	1
1.1277	X +	-0.6667	Y +	0.0	Z =	1
0.7048	X +	1.2500	Y +	0.0	Z =	1
-0.7048	X +	1.2500	Y +	0.0	Z =	1
-0.7048	X +	-1.2500	Y +	0.0	Z =	1
0.7048	X +	-1.2500	Y +	0.0	Z =	1
0.4505	X +	0.0	Y +	-1.0010	Z =	1
-0.4505	X +	0.0	Y +	1.0010	Z =	1
0.5872	X +	0.0	Y +	1.2012	Z =	1
-0.5872	X +	0.0	Y +	-1.2012	Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5320	0.5000	-0.7596	)
(	0.5320	0.5000	0.5724	)
(	-0.5320	0.5000	0.7596	)
(	-0.5320	0.5000	-0.5724	)
(	0.1773	0.5000	-0.9192	)
(	-0.1773	0.5000	0.9192	)
(	0.5320	-0.5000	0.7596	)
(	-0.5320	-0.5000	-0.5724	)
(	0.5320	-0.5000	-0.7596	)
(	-0.5320	-0.5000	0.5724	)
(	0.1773	-0.5000	-0.9192	)
(	-0.1773	-0.5000	0.9192	)
(	0.8867	0.0	-0.5999	)
(	0.8867	0.0	0.3991	)
(	0.6207	0.4500	-0.7197	)
(	0.6207	0.4500	0.5291	)
(	-0.8867	0.0	0.5999	)
(	-0.8867	0.0	-0.3991	)
(	-0.6207	0.4500	0.7197	)
(	-0.6207	0.4500	-0.5291	)
(	-0.6207	-0.4500	0.7197	)
(	-0.6207	-0.4500	-0.5291	)
(	0.6207	-0.4500	-0.7197	)
(	0.6207	-0.4500	0.5291	)

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :

(	0.5320	0.5000	-0.7596	)	-----	(	0.5320	0.5000	0.5724	)
(	0.5320	0.5000	-0.7596	)	-----	(	0.1773	0.5000	-0.9192	)
(	0.5320	0.5000	-0.7596	)	-----	(	0.6207	0.4500	-0.7197	)
(	0.5320	0.5000	0.5724	)	-----	(	-0.1773	0.5000	0.9192	)
(	0.5320	0.5000	0.5724	)	-----	(	0.6207	0.4500	0.5291	)
(	-0.5320	0.5000	0.7596	)	-----	(	-0.5320	0.5000	-0.5724	)
(	-0.5320	0.5000	0.7596	)	-----	(	-0.1773	0.5000	0.9192	)
(	-0.5320	0.5000	-0.7596	)	-----	(	-0.6207	0.4500	0.7197	)
(	-0.5320	0.5000	-0.7596	)	-----	(	-0.1773	0.5000	-0.9192	)
(	-0.5320	0.5000	-0.5724	)	-----	(	-0.6207	0.4500	-0.5291	)
(	-0.5320	0.5000	-0.5724	)	-----	(	0.1773	-0.5000	-0.9192	)
(	-0.5320	0.5000	0.9192	)	-----	(	0.1773	-0.5000	0.9192	)
(	-0.5320	0.5000	0.9192	)	-----	(	-0.5320	-0.5000	-0.5724	)
(	-0.5320	0.5000	0.7197	)	-----	(	-0.1773	-0.5000	0.9192	)
(	-0.5320	0.5000	0.7197	)	-----	(	-0.6207	-0.4500	0.5291	)
(	-0.5320	0.5000	0.5291	)	-----	(	-0.1773	-0.5000	-0.9192	)
(	-0.5320	0.5000	0.5291	)	-----	(	-0.6207	-0.4500	-0.7197	)
(	0.5320	-0.5000	-0.7596	)	-----	(	0.5320	-0.5000	0.5724	)

```

( 0.5320 -0.5000 -0.7596 )----- ( 0.1771 -0.5000 -0.9192 )
( 0.5320 -0.5000 -0.7596 )----- ( 0.6207 -0.4500 -0.7197 )
( 0.5320 -0.5000 -0.5724 )----- ( -0.1773 -0.5000 -0.9192 )
( 0.5320 -0.5000 -0.5724 )----- ( 0.6207 -0.4500 -0.5291 )
( 0.8867 0.0 -0.5999 )----- ( 0.8867 0.0 -0.3191 )
( 0.8867 0.0 -0.5999 )----- ( 0.6207 0.4500 -0.7197 )
( 0.8867 0.0 -0.5999 )----- ( 0.6207 -0.4500 -0.7197 )
( 0.8867 0.0 0.3991 )----- ( 0.6207 0.4500 0.5291 )
( 0.8867 0.0 0.3991 )----- ( 0.6207 -0.4500 0.5291 )
( 0.6207 0.4500 -0.7197 )----- ( 0.6207 0.4500 0.5291 )
( -0.8867 0.0 0.5999 )----- ( -0.8867 0.0 -0.3191 )
( -0.8867 0.0 0.5999 )----- ( -0.6207 0.4500 0.7197 )
( -0.8867 0.0 0.5999 )----- ( -0.6207 -0.4500 -0.7197 )
( -0.8867 0.0 -0.3991 )----- ( -0.6207 0.4500 -0.5291 )
( -0.8867 0.0 -0.3991 )----- ( -0.6207 -0.4500 -0.5291 )
( -0.6207 0.4500 0.7197 )----- ( -0.6207 0.4500 -0.5291 )
( -0.6207 -0.4500 0.7197 )----- ( -0.6207 -0.4500 -0.5291 )
( 0.6207 -0.4500 -0.7197 )----- ( 0.6207 -0.4500 0.5291 )
THE MAXIMUM IS: 0.9192 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS : 979.1235

```

```

VERTICES
520.9319 489.5618 -743.7087
520.9319 489.5618 560.4819
-520.9319 489.5618 743.7087
-520.9319 489.5618 -560.4819
173.6426 489.5618 -899.9998
-173.6426 489.5618 899.9998
-520.9319 -489.5618 743.7087
-520.9319 -489.5618 -560.4819
520.9319 -489.5618 -743.7087
520.9319 -489.5618 560.4819
173.6426 -489.5618 -899.9998
-173.6426 -489.5618 899.9998
868.2207 0.0 -587.4189
868.2202 0.0 390.7219
607.7549 440.6052 -704.6365
607.7549 440.6045 518.0417
-868.2207 0.0 587.4189
-868.2202 0.0 -390.7219
-607.7549 440.6052 704.6365
-607.7549 440.6045 -518.0417
-607.7549 -440.6052 704.6365
-607.7549 -440.6045 -518.0417
607.7549 -440.6052 -704.6365
607.7549 -440.6045 518.0417
EDGES
1 2
1 5
1 15
2 6
2 16
3 4
3 6
3 19
4 5
4 20
5 11
6 12
7 8
7 12
7 21
8 11
8 22

```

```

9 10
9 11
9 23
10 12
10 24
13 14
13 15
13 23
14 16
14 24
15 16
17 18
17 19
17 21
18 20
18 22
19 20
21 22
23 24
FACES
1 2 6 3 4 5
7 8 11 9 10 12
13 14 16 15
17 18 20 19
17 18 22 21
13 14 24 23
1 2 16 15
3 4 20 19
7 8 22 21
9 10 24 23
1 5 11 9 23 13 15
3 6 12 7 21 17 19
2 6 12 10 24 14 16
4 5 11 8 22 18 20

```

```

THE MAXIMUM IS: 0.9504116774 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.9391479492
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 5.6651 -16.1595 )----- ( 5.6651 9.0674 )
( 5.6651 -16.1595 )----- ( 8.2014 -18.0000 )
( 5.6651 -16.1595 )----- ( 4.0840 -15.6994 )
( 5.6651 9.0674 )----- ( 10.7377 18.0000 )
( 5.6651 9.0674 )----- ( 4.0840 7.9508 )
( 13.2741 16.1595 )----- ( 13.2741 -9.0674 )
( 13.2741 16.1595 )----- ( 10.7377 18.0000 )
( 13.2741 16.1595 )----- ( 12.9612 15.6994 )
( 13.2741 -9.0674 )----- ( 8.2014 -18.0000 )
( 13.2741 -9.0674 )----- ( 12.9612 -7.9508 )
( 8.2014 -18.0000 )----- ( -10.7377 -18.0000 )
( 10.7377 18.0000 )----- ( -8.2014 18.0000 )
( -5.6651 16.1595 )----- ( -5.6651 -9.0674 )
( -5.6651 16.1595 )----- ( -8.2014 18.0000 )
( -5.6651 16.1595 )----- ( -4.0840 15.6994 )
( -5.6651 -9.0674 )----- ( -10.7377 -18.0000 )
( -5.6651 -9.0674 )----- ( -4.0840 -7.9508 )
( -13.2741 -16.1595 )----- ( -13.2741 9.0674 )
( -13.2741 -16.1595 )----- ( -10.7377 -18.0000 )
( -13.2741 -16.1595 )----- ( -12.9612 -15.6994 )
( -13.2741 9.0674 )----- ( -8.2014 18.0000 )
( -13.2741 9.0674 )----- ( -12.9612 7.9508 )
( -6.1400 -14.3191 )----- ( -6.1400 4.6011 )
( -6.1400 -14.3191 )----- ( 4.0840 -15.6994 )
( -6.1400 -14.3191 )----- ( -12.9612 -15.6994 )
( 7.3594 4.6011 )----- ( 4.0840 7.9508 )

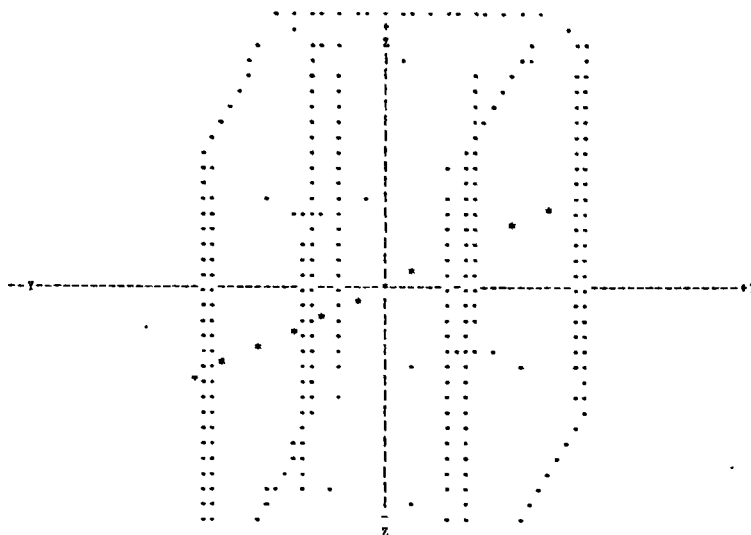
```

CRYSTAL SHAPE:

```

( -6.3408  4.6011 )----- ( -12.9612  7.9508 )
(  4.0840 -15.6994 )----- (  4.0840  7.9508 )
(  6.3408 14.3191 )----- (  6.3408 -4.6011 )
(  6.3408 14.3191 )----- ( 12.9612 15.6994 )
(  6.3408 14.3191 )----- ( -4.0840 15.6994 )
(  6.3408 -4.6011 )----- ( 12.9612 -7.9508 )
(  6.3408 -4.6011 )----- ( -4.0840 -7.9508 )
( 12.9612 15.6994 )----- ( 12.9612 -7.9508 )
( -4.0840 15.6994 )----- ( -4.0840 -7.9508 )
( -12.9612 -15.6994 )----- ( -12.9612  7.9508 )

```



PERICLASE : MASON AND BERRY, 1968, P. 27
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 1 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

```

      1      1      1
     -1      1      1
     -1     -1      1
      1     -1      1
     -1      1     -1
     -1      1     -1
     -1     -1     -1
      1     -1     -1

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :
 1.0000 X + 1.0000 Y + 1.0000 Z = 1
 -1.0000 X + 1.0000 Y + 1.0000 Z = 1

Apdx. 2-b, p. 198

```

-1.0000 X + -1.0000 Y + 1.0000 Z = 1
 1.0000 X + -1.0000 Y + 1.0000 Z = 1
 1.0000 X + 1.0000 Y + -1.0000 Z = 1
-1.0000 X + 1.0000 Y + -1.0000 Z = 1
-1.0000 X + -1.0000 Y + -1.0000 Z = 1
 1.0000 X + -1.0000 Y + -1.0000 Z = 1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 0.0 0.0 1.0000 )
( 0.0 1.0000 0.0 )
( 1.0000 0.0 0.0 )
( -1.0000 0.0 0.0 )
( 0.0 -1.0000 0.0 )
( 0.0 0.0 -1.0000 )

```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 0.0 0.0 1.0000 )----- ( 0.0 1.0000 0.0 )
( 0.0 0.0 1.0000 )----- ( 1.0000 0.0 0.0 )
( 0.0 0.0 1.0000 )----- ( -1.0000 0.0 0.0 )
( 0.0 0.0 1.0000 )----- ( 0.0 -1.0000 0.0 )
( 0.0 1.0000 0.0 )----- ( 1.0000 0.0 0.0 )
( 0.0 1.0000 0.0 )----- ( -1.0000 0.0 0.0 )
( 0.0 1.0000 0.0 )----- ( 0.0 0.0 -1.0000 )
( 1.0000 0.0 0.0 )----- ( 0.0 0.0 -1.0000 )
( 1.0000 0.0 0.0 )----- ( 0.0 -1.0000 0.0 )
( -1.0000 0.0 0.0 )----- ( 0.0 -1.0000 0.0 )
( -1.0000 0.0 0.0 )----- ( 0.0 0.0 -1.0000 )
( 0.0 -1.0000 0.0 )----- ( 0.0 0.0 -1.0000 )
( 0.0 -1.0000 0.0 )----- ( 0.0 0.0 -1.0000 )

```

THE MAXIMUM IS:

```

VERTICES
0.0 0.0 900.0000
0.0 900.0000 0.0
900.0000 0.0 0.0
-900.0000 0.0 0.0
0.0 -900.0000 0.0
0.0 0.0 -900.0000

```

EDGES

```

1 2
1 3
1 4
1 5
2 3
2 4
2 6
3 5
3 6
4 5
4 6
5 6

```

FACES

```

1 2 3
1 2 4
1 4 5
1 3 5
2 3 6
2 4 6
4 5 6
3 5 6

```

THE MAXIMUM IS:

1.0000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.0000000000

```

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.0 18.0000 )----- ( 18.0000 0.0 )
( 0.0 18.0000 )----- ( -6.7962 -3.1600 )
( 0.0 18.0000 )----- ( 6.7962 3.1600 )
( 0.0 18.0000 )----- ( -18.0000 0.0 )

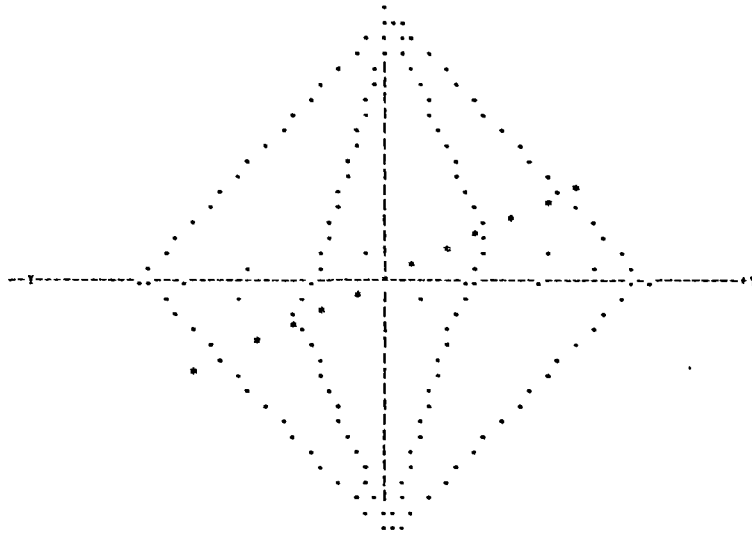
```

```

( 18.0000 0.0 )-----(-6.7962 -3.1690 )
( 18.0000 0.0 )-----(-6.7962 -3.1690 )
( 18.0000 0.0 )-----(-6.7962 -3.1690 )
( -6.7962 -3.1690 )-----(-18.0000 0.0 )
( -6.7962 -3.1690 )-----(-18.0000 0.0 )
( 6.7962 3.1690 )-----(-18.0000 0.0 )
( 6.7962 3.1690 )-----(-18.0000 0.0 )
( -18.0000 0.0 )-----(-18.0000 0.0 )

```

CRYSTAL SHAPE:



PHLOGOPITE BIOTITE : MASON AND BERRY, 1968, P. 451
 MONOCLINIC SYSTEM : a:b:c= 0.5750: 1.0000: 2.2480 , ALPHA=GA=90, BETA= 100.8000 , 3 FOPH(S) .
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

```

1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 1 0
0 -1 0
0 0 1
0 0 -1

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

1.7705 X + 1.0000 Y + 0.0 Z = 1
-1.7705 X + 1.0000 Y + 0.0 Z = 1
-1.7705 X + -1.0000 Y + 0.0 Z = 1
1.7705 X + -1.0000 Y + 0.0 Z = 1

```

```

0.0 X + 1.6667 Y + 0.0 Z = 1
0.0 X + -1.6667 Y + 0.0 Z = 1
0.8486 X + 0.0 Y + 4.4488 Z = 1
-0.8486 X + 0.0 Y + -4.4488 Z = 1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 0.5648 0.0 0.1171 )
( 0.5648 0.0 -0.3325 )
( 0.2259 0.6000 0.1817 )
( 0.2259 0.6000 -0.2679 )
( -0.5648 0.0 0.3325 )
( -0.5648 0.0 -0.1171 )
( -0.2259 0.6000 0.2679 )
( -0.2259 0.6000 -0.1817 )
( -0.2259 -0.6000 0.2679 )
( -0.2259 -0.6000 -0.1817 )
( 0.2259 -0.6000 0.1817 )
( 0.2259 -0.6000 -0.2679 )

```

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :

```

( 0.5648 0.0 0.1171 )-----(-0.5648 0.0 -0.3325 )
( 0.5648 0.0 0.1171 )-----(-0.2259 0.6000 0.1817 )
( 0.5648 0.0 0.1171 )-----(-0.2259 -0.6000 0.1817 )
( 0.5648 0.0 -0.3325 )-----(-0.2259 0.6000 -0.2679 )
( 0.5648 0.0 -0.3325 )-----(-0.2259 -0.6000 -0.2679 )
( 0.2259 0.6000 0.1817 )-----(-0.2259 0.6000 -0.2679 )
( 0.2259 0.6000 0.1817 )-----(-0.2259 0.6000 0.2679 )
( 0.2259 0.6000 -0.2679 )-----(-0.2259 0.6000 -0.1817 )
( 0.2259 0.6000 -0.2679 )-----(-0.5648 0.0 -0.1171 )
( -0.5648 0.0 0.3325 )-----(-0.2259 0.6000 0.2679 )
( -0.5648 0.0 0.3325 )-----(-0.2259 -0.6000 0.2679 )
( -0.5648 0.0 -0.1171 )-----(-0.2259 0.6000 -0.1817 )
( -0.5648 0.0 -0.1171 )-----(-0.2259 -0.6000 -0.1817 )
( -0.2259 -0.6000 0.2679 )-----(-0.2259 0.6000 -0.1817 )
( -0.2259 -0.6000 0.2679 )-----(-0.2259 -0.6000 -0.1817 )
( -0.2259 -0.6000 -0.1817 )-----(-0.2259 -0.6000 0.1817 )
( -0.2259 -0.6000 -0.1817 )-----(-0.2259 -0.6000 -0.2679 )
( 0.2259 -0.6000 0.1817 )-----(-0.2259 -0.6000 -0.2679 )

```

THE MAXIMUM IS: 0.6000 THE CONVERSION FACTOR FOR THE PPRINTER GRAPH IS : 1499.9993

VERTICES

```

847.2227 0.0 175.5827
847.2227 0.0 -498.8162
338.8887 899.9998 272.5527
338.8887 899.9998 -401.8459
-847.2227 0.0 498.8162
-847.2227 0.0 -175.5827
-338.8887 899.9998 401.8459
-338.8887 899.9998 -272.5527
-338.8887 -899.9998 401.8459
-338.8887 -899.9998 -272.5527
338.8887 -899.9998 272.5527
338.8887 -899.9998 -401.8459

```

EDGES

```

1 2
1 3
1 11
2 4
2 12
3 4
3 7
4 8
5 6
5 7
5 9

```

```

6 8
7 10
7 8
9 10
9 11
10 12
11 12
FACES
1 2 4 3
5 6 8 7
5 6 10 9
1 2 12 11
3 4 8 7
9 10 12 11
1 3 7 5
2 4 8 6
9 11
10 12
THE MAXIMUM IS: 0.6853017A07

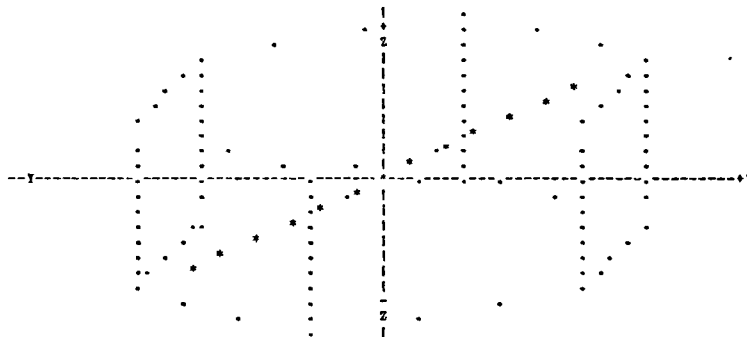
```

THE CONVERSION FACTOR FOR VIEWPLOT IS : 26.2657928467

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(-5.6013 0.4627)	-----	(-5.6013 -11.3464)
(-5.6013 0.4627)	-----	(13.5190 3.7278)
(-5.6013 0.4627)	-----	(-18.0000 3.7278)
(-5.6013 -11.3464)	-----	(13.5190 -8.0813)
(-5.6013 -11.3464)	-----	(-18.0000 -8.0813)
(13.5190 3.7278)	-----	(13.5190 -8.0813)
(13.5190 3.7278)	-----	(18.0000 8.0813)
(13.5190 -8.0813)	-----	(18.0000 -3.7278)
(5.6013 11.3464)	-----	(5.6013 -0.4627)
(5.6013 11.3464)	-----	(18.0000 8.0813)
(5.6013 11.3464)	-----	(-13.5190 8.0813)
(5.6013 -0.4627)	-----	(18.0000 -3.7278)
(5.6013 -0.4627)	-----	(-13.5190 -3.7278)
(18.0000 8.0813)	-----	(18.0000 -3.7278)
(-13.5190 8.0813)	-----	(-13.5190 -3.7278)
(-13.5190 8.0813)	-----	(-18.0000 3.7278)
(-13.5190 -3.7278)	-----	(-18.0000 -8.0813)
(-18.0000 3.7278)	-----	(-18.0000 -8.0813)

CRYSTAL SHAPE:



PYRITE 1 : ROGERS, 1937, v. 291
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 1 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 6

MILLER INDICES :

```

1 0 0
-1 0 0
0 1 0
0 -1 0
0 0 1
0 0 -1

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

1.0000 X + 0.0 Y + 0.0 Z = 1
-1.0000 X + 0.0 Y + 0.0 Z = -1
0.0 X + 1.0000 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + 0.0 Z = -1
0.0 X + 0.0 Y + 1.0000 Z = 1
0.0 X + 0.0 Y + -1.0000 Z = -1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 1.0000 1.0000 1.0000 )
( 1.0000 1.0000 -1.0000 )
( 1.0000 -1.0000 1.0000 )
( 1.0000 -1.0000 -1.0000 )
( -1.0000 1.0000 1.0000 )
( -1.0000 1.0000 -1.0000 )
( -1.0000 -1.0000 1.0000 )
( -1.0000 -1.0000 -1.0000 )

```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 1.0000 1.0000 1.0000 )----- ( 1.0000 1.0000 -1.0000 )
( 1.0000 1.0000 1.0000 )----- ( 1.0000 -1.0000 1.0000 )
( 1.0000 1.0000 1.0000 )----- ( -1.0000 1.0000 1.0000 )
( 1.0000 1.0000 -1.0000 )----- ( 1.0000 -1.0000 -1.0000 )
( 1.0000 1.0000 -1.0000 )----- ( -1.0000 1.0000 -1.0000 )
( 1.0000 -1.0000 1.0000 )----- ( 1.0000 -1.0000 -1.0000 )
( 1.0000 -1.0000 1.0000 )----- ( -1.0000 -1.0000 1.0000 )
( 1.0000 -1.0000 -1.0000 )----- ( -1.0000 -1.0000 -1.0000 )
( -1.0000 1.0000 1.0000 )----- ( -1.0000 1.0000 -1.0000 )
( -1.0000 1.0000 1.0000 )----- ( -1.0000 -1.0000 1.0000 )
( -1.0000 1.0000 -1.0000 )----- ( -1.0000 -1.0000 -1.0000 )
( -1.0000 -1.0000 1.0000 )----- ( -1.0000 -1.0000 -1.0000 )

```

THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PRINTED GRAPH IS : 900.0000

VERTICES
 900.0000 900.0000 900.0000
 900.0000 900.0000 -900.0000
 900.0000 -900.0000 900.0000
 900.0000 -900.0000 -900.0000
 -900.0000 900.0000 900.0000
 -900.0000 900.0000 -900.0000
 -900.0000 -900.0000 900.0000
 -900.0000 -900.0000 -900.0000

EDGES

```

1 2
1 3
1 5
2 4
2 6
3 4
3 7
4 8
5 6
5 7
6 8
7 8
FACES
1 2 4 3
5 6 8 7

```



```

( -0.3333 -0.3333 0.3333 )-----(-0.2500 -0.5000 0.0 )
( -0.3333 -0.3333 0.3333 )-----(-0.0 -0.2500 0.5000 )
( -0.3333 -0.3333 -0.3333 )-----(-0.2500 -0.5000 0.0 )
( -0.3333 -0.3333 -0.3333 )-----(-0.0 -0.2500 -0.5000 )
( 0.0 0.2500 0.5000 )-----(-0.0 -0.2500 0.5000 )
( 0.0 0.2500 -0.5000 )-----(-0.0 -0.2500 -0.5000 )

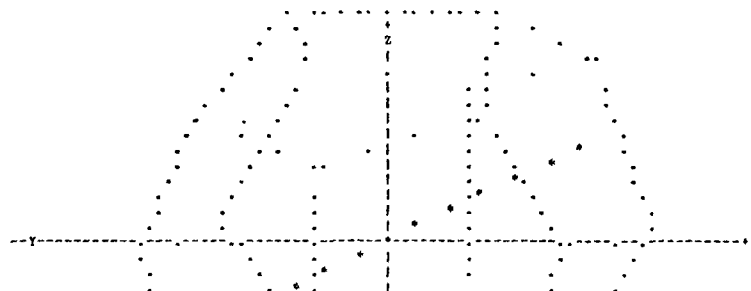
THE MAXIMUM IS: 0.5000 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS : 1800.0000
VERICES
900.0000 0.0 450.0000
900.0000 0.0 -450.0000
599.9998 -599.9998 599.9998
599.9998 -599.9998 -599.9998
450.0000 -900.0000 0.0
599.9998 599.9998 599.9998
599.9998 599.9998 -599.9998
450.0000 900.0000 0.0
-900.0000 0.0 450.0000
-900.0000 0.0 -450.0000
-599.9998 599.9998 599.9998
-599.9998 599.9998 -599.9998
-450.0000 900.0000 0.0
-599.9998 -599.9998 599.9998
-599.9998 -599.9998 -599.9998
-450.0000 -900.0000 0.0
0.0 450.0000 900.0000
0.0 -450.0000 900.0000
0.0 450.0000 -900.0000
0.0 -450.0000 -900.0000
EDGES
1 2
1 3
1 6
2 4
2 7
3 5
3 18
4 5
4 20
5 16
6 8
6 17
7 8
7 19
8 13
9 10
9 11
9 14
10 12
10 15
11 13
11 17
12 13
12 19
14 16
14 18
15 16
15 20
17 18
19 20
FACES
1 2 4 5 3
1 2 7 8 6

```

```

9 10 12 13 11
9 10 15 16 14
1 3 18 17 6
9 11 17 18 14
2 4 20 19 7
10 12 19 20 15
6 8 13 11 17
7 8 13 12 19
3 5 16 14 18
4 5 16 15 20
THE MAXIMUM IS: 0.5943911076 THE CONVERSION FACTOR FOR VIEWPLOT IS : 30.2830810547
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( -5.7169 4.9050 )-----(-5.7169 -10.2365 )
( -5.7169 4.9050 )-----(-13.9056 8.3172 )
( -5.7169 4.9050 )-----(-6.2831 8.3172 )
( -5.7169 -10.2365 )-----(-13.9056 -11.8715 )
( -5.7169 -10.2365 )-----(-6.2831 -11.8715 )
( -13.9056 8.3172 )-----(-18.0000 -1.3329 )
( -13.9056 8.3172 )-----(-7.5708 15.1415 )
( -13.9056 -11.8715 )-----(-18.0000 -1.3329 )
( -13.9056 -11.8715 )-----(-7.5708 -15.1415 )
( -18.0000 -1.3329 )-----(-12.2831 1.3329 )
( 6.2831 8.3172 )-----(-12.2831 -1.3329 )
( 6.2831 8.3172 )-----(-7.5708 15.1415 )
( 6.2831 -11.8715 )-----(-12.2831 -1.3329 )
( 6.2831 -11.8715 )-----(-7.5708 -15.1415 )
( 12.2831 -1.3329 )-----(-18.0000 1.3329 )
( 5.7169 10.2365 )-----(-5.7169 -4.9050 )
( 5.7169 10.2365 )-----(-13.9056 11.8715 )
( 5.7169 10.2365 )-----(-6.2831 11.8715 )
( 5.7169 -4.9050 )-----(-13.9056 -8.1172 )
( 5.7169 -4.9050 )-----(-6.2831 -8.1172 )
( 13.9056 11.8715 )-----(-18.0000 1.3329 )
( 13.9056 11.8715 )-----(-7.5708 15.1415 )
( 13.9056 -8.3172 )-----(-18.0000 -1.3329 )
( 13.9056 -8.3172 )-----(-7.5708 -15.1415 )
( -6.2831 11.8715 )-----(-12.2831 1.3329 )
( -6.2831 11.8715 )-----(-7.5708 15.1415 )
( -6.2831 -8.3172 )-----(-12.2831 -1.3329 )
( -6.2831 -8.3172 )-----(-7.5708 -15.1415 )
( 7.5708 15.1415 )-----(-7.5708 15.1415 )
( 7.5708 -15.1415 )-----(-7.5708 -15.1415 )
CRYSTAL SHAPE:

```



1	0	0
0	1	0
0	0	-1
0	-1	0
0	0	1
0	0	-1
2	-1	0
2	1	0
-2	1	0
-2	-1	0
1	0	2
-1	0	2
1	0	-2
-1	0	-2
0	2	1
0	2	-1
0	-2	1
0	-2	-1

2.2222	X	+	0.0	Y	+	0.0	Z	=	1
0.0	X	+	2.2222	Y	+	0.0	Z	=	1
0.0	X	+	0.0	Y	+	-2.2222	Z	=	1
0.0	X	+	-2.2222	Y	+	0.0	Z	=	1
0.0	X	+	0.0	Y	+	2.2222	Z	=	1
0.0	X	+	0.0	Y	+	-2.2222	Z	=	1
2.0000	X	+	-1.0000	Y	+	0.0	Z	=	1
2.0000	X	+	1.0000	Y	+	0.0	Z	=	1
-2.0000	X	+	1.0000	Y	+	0.0	Z	=	1
-2.0000	Y	+	-1.0000	X	+	0.0	Z	=	1
1.0000	X	+	0.0	Y	+	2.0000	Z	=	1
-1.0000	X	+	0.0	Y	+	2.0000	Z	=	1
1.0000	X	+	0.0	Y	+	-2.0000	Z	=	1
-1.0000	X	+	0.0	Y	+	-2.0000	Z	=	1
0.0	X	+	2.0000	Y	+	1.0000	Z	=	1
0.0	X	+	2.0000	Y	+	-1.0000	Z	=	1
0.0	X	+	-2.0000	Y	+	1.0000	Z	=	1
0.0	Y	+	-2.0000	X	+	-1.0000	Z	=	1

(	0.4500	-0.1000	0.2750
(	0.4500	-0.1000	-0.2750
(	0.4500	0.1000	0.2750
(	0.4500	0.1000	-0.2750
(	0.2750	0.4500	0.1000
(	0.2750	0.4500	-0.1000
(	-0.2750	0.4500	0.1000
(	-0.2750	0.4500	-0.1000
(	0.1000	0.2750	-0.4500

(	0.1000	-0.2750	-0.4500
(	-0.1000	0.2750	-0.4500
(	-0.1000	-0.2750	-0.4500
(	0.2750	-0.4500	0.1000
(	0.2750	-0.4500	-0.1000
(	-0.2750	-0.4500	0.1000
(	-0.2750	-0.4500	-0.1000
(	0.1000	0.2750	0.4500
(	0.1000	-0.2750	0.4500
(	-0.1000	0.2750	0.4500
(	-0.1000	-0.2750	0.4500
(	0.3333	-0.3333	0.3333
(	0.3333	-0.3333	-0.3333
(	0.3333	0.3333	0.3333
(	0.3333	0.3333	-0.3333
(	-0.5000	0.0	0.2500
(	-0.5000	0.0	-0.2500
(	-0.3333	0.3333	0.3333
(	-0.3333	0.3333	-0.3333
(	-0.3333	-0.3333	0.3333
(	-0.3333	-0.3333	-0.3333

(	0.4500	-0.1000	0.2750	)	(	0.4500	-0.1000	-0.2750	)
(	0.4500	-0.1000	0.2750	)	(	0.4500	0.1000	0.2750	)
(	0.4500	-0.1000	0.2750	)	(	0.3333	-0.3333	0.3333	)
(	0.4500	-0.1000	-0.2750	)	(	0.4500	0.1000	-0.2750	)
(	0.4500	-0.1000	-0.2750	)	(	0.3333	-0.3333	-0.3333	)
(	0.4500	0.1000	0.2750	)	(	0.4500	0.1000	-0.2750	)
(	0.4500	0.1000	0.2750	)	(	0.3333	0.3333	0.3333	)
(	0.4500	0.1000	-0.2750	)	(	0.3333	0.3333	-0.3333	)
(	0.2750	0.4500	0.1000	)	(	0.2750	0.4500	-0.1000	)
(	0.2750	0.4500	0.1000	)	(	-0.2750	0.4500	0.1000	)
(	0.2750	0.4500	0.1000	)	(	0.3333	0.3333	0.3333	)
(	0.2750	0.4500	-0.1000	)	(	-0.2750	0.4500	-0.1000	)
(	0.2750	0.4500	-0.1000	)	(	0.3333	0.4500	-0.1000	)
(	-0.2750	0.4500	0.1000	)	(	-0.2750	0.4500	-0.1000	)
(	-0.2750	0.4500	0.1000	)	(	-0.3333	0.3333	-0.3333	)
(	-0.2750	0.4500	-0.1000	)	(	-0.3333	0.3333	-0.3333	)
(	0.1000	0.2750	-0.4500	)	(	0.1000	-0.2750	-0.4500	)
(	0.1000	0.2750	-0.4500	)	(	0.1000	-0.2750	-0.4500	)
(	0.1000	0.2750	-0.4500	)	(	0.1000	-0.2750	-0.4500	)
(	0.1000	0.2750	-0.4500	)	(	0.1000	0.2750	-0.4500	)
(	0.1000	0.2750	-0.4500	)	(	-0.1000	0.2750	-0.4500	)
(	0.1000	0.2750	-0.4500	)	(	-0.1000	0.2750	-0.4500	)
(	0.1000	0.2750	-0.4500	)	(	-0.1000	-0.2750	-0.4500	)
(	0.1000	0.2750	-0.4500	)	(	0.3333	0.3333	-0.3333	)
(	0.1000	-0.2750	-0.4500	)	(	-0.1000	0.2750	-0.4500	)
(	0.1000	-0.2750	-0.4500	)	(	-0.1000	-0.2750	-0.4500	)
(	0.1000	-0.2750	-0.4500	)	(	-0.1000	-0.2750	-0.4500	)
(	0.1000	-0.2750	-0.4500	)	(	-0.1000	-0.2750	-0.4500	)
(	0.1000	-0.2750	-0.4500	)	(	-0.1111	-0.3333	-0.3333	)
(	-0.1000	0.2750	-0.4500	)	(	-0.1000	-0.2750	-0.4500	)
(	-0.1000	0.2750	-0.4500	)	(	-0.1000	-0.2750	-0.4500	)
(	-0.1000	0.2750	-0.4500	)	(	-0.1000	-0.2750	-0.4500	)
(	-0.1000	0.2750	-0.4500	)	(	-0.1111	0.3333	0.3333	)
(	-0.1000	0.2750	-0.4500	)	(	-0.1111	0.3333	-0.3333	)
(	0.2750	-0.4500	0.1000	)	(	0.2750	-0.4500	-0.1000	)
(	0.2750	-0.4500	0.1000	)	(	-0.2750	-0.4500	0.1000	)
(	0.2750	-0.4500	0.1000	)	(	-0.1111	-0.3333	0.3333	)
(	0.2750	-0.4500	0.1000	)	(	-0.2750	-0.4500	-0.1000	)
(	0.2750	-0.4500	0.1000	)	(	-0.1111	-0.3333	-0.3333	)
(	-0.2750	-0.4500	0.1000	)	(	-0.2750	-0.4500	-0.1000	)
(	-0.2750	-0.4500	0.1000	)	(	-0.1111	-0.3333	-0.3333	)
(	-0.2750	-0.4500	0.1000	)	(	-0.2750	-0.4500	-0.1000	)
(	-0.2750	-0.4500	0.1000	)	(	-0.1111	-0.3333	-0.3333	)
(	-0.2750	-0.4500	0.1000	)	(	-0.2750	-0.4500	-0.1000	)

(	-0.2750	-0.4500	0.1000	)	-----	(	-0.1111	-0.3333	0.3333	)
(	-0.2750	-0.4500	-0.1000	)	-----	(	-0.1111	-0.3333	-0.3333	)
(	0.1000	0.2750	0.4500	)	-----	(	0.1000	-0.2750	0.4500	)
(	0.1000	0.2750	0.4500	)	-----	(	-0.1000	0.2750	0.4500	)
(	0.1000	0.2750	0.4500	)	-----	(	0.1111	0.3333	0.3333	)
(	0.1000	-0.2750	0.4500	)	-----	(	-0.1000	-0.2750	0.4500	)
(	0.1000	-0.2750	0.4500	)	-----	(	0.1111	-0.3333	0.3333	)
(	-0.1000	0.2750	0.4500	)	-----	(	-0.1000	-0.2750	0.4500	)
(	-0.1000	0.2750	0.4500	)	-----	(	-0.1111	0.3333	0.3333	)
(	-0.1000	-0.2750	0.4500	)	-----	(	-0.1111	-0.3333	0.3333	)
(	-0.5000	0.0	0.2500	)	-----	(	-0.5000	0.0	-0.2500	)
(	-0.5000	0.0	0.2500	)	-----	(	-0.1111	0.3333	0.3333	)
(	-0.5000	0.0	0.2500	)	-----	(	-0.1111	-0.3333	0.3333	)
(	-0.5000	0.0	-0.2500	)	-----	(	-0.1111	0.3333	-0.3333	)
(	-0.5000	0.0	-0.2500	)	-----	(	-0.1111	-0.3333	-0.3333	)

THE MAXIMUM IS: 0.5000 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 1800.0000

VERTICES

810.0002	-179.9993	494.9995
810.0002	-179.9993	-494.9995
810.0002	179.9993	494.9995
810.0002	179.9993	-494.9995
494.9995	810.0002	179.9993
494.9995	810.0002	-179.9993
-494.9995	810.0002	179.9993
-494.9995	810.0002	-179.9993
179.9993	494.9995	810.0002
179.9993	494.9995	-810.0002
-179.9993	494.9995	810.0002
-179.9993	494.9995	-810.0002
494.9995	-810.0002	179.9993
494.9995	-810.0002	-179.9993
-494.9995	-810.0002	179.9993
-494.9995	-810.0002	-179.9993
179.9993	494.9995	810.0002
179.9993	494.9995	-810.0002
-179.9993	494.9995	810.0002
-179.9993	494.9995	-810.0002
599.9998	-599.9998	599.9998
599.9998	-599.9998	-599.9998
599.9998	599.9998	599.9998
599.9998	599.9998	-599.9998
-900.0000	0.0	450.0000
-900.0000	0.0	-450.0000
-599.9998	599.9998	599.9998
-599.9998	599.9998	-599.9998
-599.9998	-599.9998	599.9998
-599.9998	-599.9998	-599.9998

EDGES

1	2
1	3
1	21
2	4
2	22
3	4
3	23
4	24
5	6
5	7
5	23
6	8
6	24
7	8

7	27
8	28
9	10
9	10
9	11
9	11
9	11
9	12
9	24
10	11
10	12
10	12
10	12
10	22
11	12
11	12
11	12
11	28
12	30
13	14
13	15
13	21
14	16
14	22
15	16
15	29
16	30
17	18
17	19
17	23
18	20
18	21
19	20
19	27
20	29
25	26
25	27
25	29
26	28
26	30

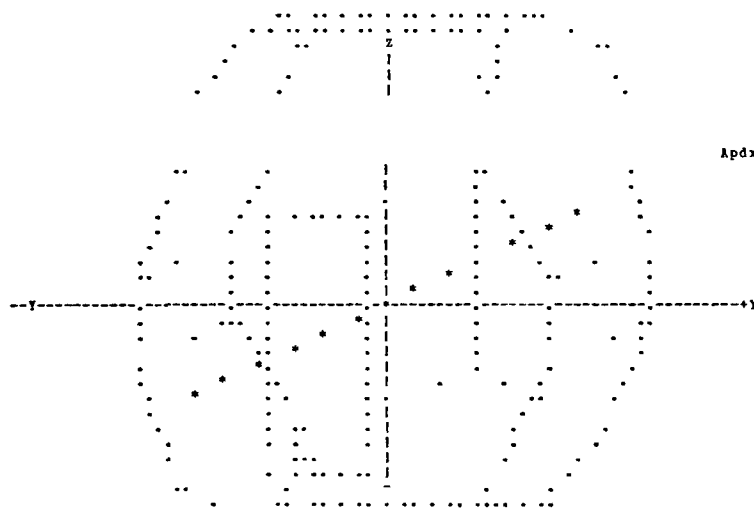
FACES

1	2	4	3
5	6	8	7
9	10	11	12
13	14	16	15
17	18	20	19
9	10	11	12
1	2	22	14
3	4	24	6
7	8	28	26
15	16	30	26
1	3	23	17
19	20	29	25
2	4	24	9
11	12	30	26
5	7	27	14
6	8	28	11
11	17	29	20
10	12	30	16

THE MAXIMUM IS: 0.553030226 THE CONVERSION FACTOR FOR VIEWPIOT IS : 32.5009155273

THE 2D EDGES ARE DESCRIBED BY THE FOLLOWING POINTS :

CRYSTAL SHAPE:



PYRITE 4 : ROGERS, 1937, P. 291
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 2 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 20
 MILLER INDICES :

2	-1	0
2	1	0
-2	1	0
-2	-1	0
1	0	2
-1	0	2
1	0	-2
-1	0	-2
0	2	1
0	2	-1
0	-2	1
0	-2	-1
1	1	1
-1	1	1
-1	-1	1
1	-1	1
1	1	-1
-1	1	-1
-1	-1	-1
1	-1	-1

THE CAPTFSIAM EQUATIONS OF THE CRYSTAL FACES ARE :

2.0000	X	-1.0000	Y	0.0	Z	=	1
2.0000	X	1.0000	Y	0.0	Z	=	1
-2.0000	X	1.0000	Y	0.0	Z	=	1
-2.0000	X	-1.0000	Y	0.0	Z	=	1
1.0000	X	0.0	Y	2.0000	Z	=	1
-1.0000	X	0.0	Y	2.0000	Z	=	1
1.0000	X	0.0	Y	-2.0000	Z	=	1
-1.0000	X	0.0	Y	-2.0000	Z	=	1
0.0	X	2.0000	Y	-1.0000	Z	=	1
0.0	X	-2.0000	Y	-1.0000	Z	=	1
0.0	X	2.0000	Y	1.0000	Z	=	1
0.0	X	-2.0000	Y	1.0000	Z	=	1
1.3333	X	1.3333	Y	1.3333	Z	=	1

```

-1.3333 X + 1.3333 Y + 1.3333 Z = 1
-1.3333 X + -1.3333 Y + 1.3333 Z = 1
1.3333 X + -1.3333 Y + 1.3333 Z = 1
1.3333 X + 1.3333 Y + -1.3333 Z = 1
-1.3333 X + 1.3333 Y + -1.3333 Z = 1
-1.3333 X + -1.3333 Y + -1.3333 Z = 1
1.3333 X + -1.3333 Y + -1.3333 Z = 1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 0.5000 0.0 0.7500 )
( 0.5000 0.0 -0.2500 )
( 0.2500 -0.5000 0.0 )
( 0.2500 0.5000 0.0 )
( -0.5000 0.0 0.2500 )
( -0.5000 0.0 -0.7500 )
( -0.2500 0.5000 0.0 )
( -0.2500 -0.5000 0.0 )
( 0.0 0.2500 0.5000 )
( 0.0 -0.2500 0.5000 )
( 0.0 0.2500 -0.5000 )
( 0.0 -0.2500 -0.5000 )

```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```

( 0.5000 0.0 0.2500 )----- ( 0.5000 0.0 -0.2500 )
( 0.5000 0.0 0.2500 )----- ( 0.2500 -0.5000 0.0 )
( 0.5000 0.0 0.2500 )----- ( 0.2500 0.5000 0.0 )
( 0.5000 0.0 0.2500 )----- ( 0.0 0.2500 0.5000 )
( 0.5000 0.0 0.2500 )----- ( 0.0 -0.2500 0.5000 )
( 0.5000 0.0 -0.2500 )----- ( 0.2500 -0.5000 0.0 )
( 0.5000 0.0 -0.2500 )----- ( 0.2500 0.5000 0.0 )
( 0.5000 0.0 -0.2500 )----- ( 0.0 0.2500 -0.5000 )
( 0.5000 0.0 -0.2500 )----- ( 0.0 -0.2500 -0.5000 )
( 0.2500 -0.5000 0.0 )----- ( -0.2500 -0.5000 0.0 )
( 0.2500 -0.5000 0.0 )----- ( 0.0 -0.2500 0.5000 )
( 0.2500 -0.5000 0.0 )----- ( 0.0 -0.2500 -0.5000 )
( 0.2500 0.5000 0.0 )----- ( -0.2500 0.5000 0.0 )
( 0.2500 0.5000 0.0 )----- ( 0.0 0.2500 0.5000 )
( 0.2500 0.5000 0.0 )----- ( 0.0 0.2500 -0.5000 )
( -0.5000 0.0 0.2500 )----- ( -0.5000 0.0 -0.2500 )
( -0.5000 0.0 0.2500 )----- ( -0.2500 0.5000 0.0 )
( -0.5000 0.0 0.2500 )----- ( -0.2500 -0.5000 0.0 )
( -0.5000 0.0 -0.2500 )----- ( 0.0 0.2500 -0.5000 )
( -0.5000 0.0 -0.2500 )----- ( 0.0 -0.2500 -0.5000 )
( -0.2500 0.5000 0.0 )----- ( 0.0 0.2500 0.5000 )
( -0.2500 0.5000 0.0 )----- ( 0.0 0.2500 -0.5000 )
( -0.2500 -0.5000 0.0 )----- ( 0.0 -0.2500 0.5000 )
( -0.2500 -0.5000 0.0 )----- ( 0.0 -0.2500 -0.5000 )
( 0.0 0.2500 0.5000 )----- ( 0.0 -0.2500 0.5000 )
( 0.0 0.2500 -0.5000 )----- ( 0.0 -0.2500 -0.5000 )

```

THE MAXIMUM IS:

0.5000

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :

1800.0000

```

VERTICES
900.0000 0.0 450.0000
900.0000 0.0 -450.0000
450.0000 -900.0000 0.0
450.0000 900.0000 0.0
-900.0000 0.0 450.0000
-900.0000 0.0 -450.0000
-450.0000 900.0000 0.0
-450.0000 -900.0000 0.0
0.0 450.0000 900.0000

```

```

0.0 -450.0000 900.0000
0.0 450.0000 -900.0000
0.0 -450.0000 -900.0000

```

EDGES

```

1 2
1 3
1 4
1 9
1 10
2 3
2 4
2 11
2 12
3 8
3 10
3 12
4 7
4 9
4 11
5 6
5 7
5 8
5 9
5 10
6 7
6 8
6 11
6 12
7 9
7 11
8 10
8 12
9 10
11 12

```

FACES

```

1 2 3
1 2 4
5 6 7
5 6 8
1 9 10
5 9 10
2 11 12
6 11 12
4 7 9
4 7 11
3 8 10
3 8 12
1 4 9
5 7 9
5 8 10
1 3 10
2 4 11
6 7 11
6 8 12
2 3 12

```

THE MAXIMUM IS:

0.5943911076

THE CONVERSION FACTOR FOR VIEWPLOT IS :

30.280810547

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

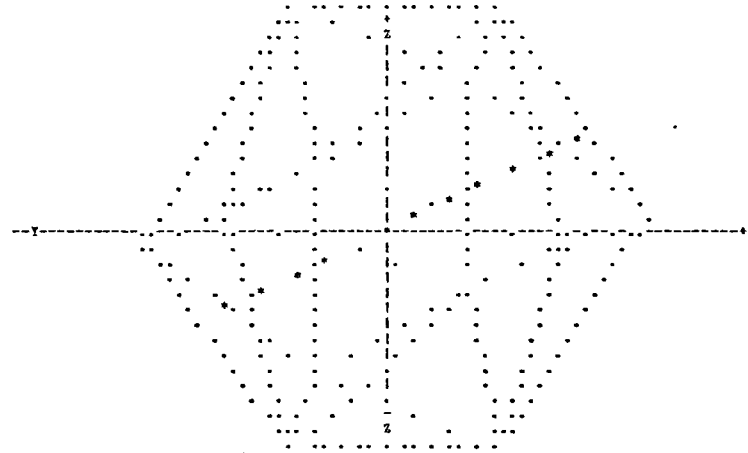
```

( -5.7169 4.9050 )----- ( -5.7169 -10.2365 )
( -5.7169 4.9050 )----- ( -18.0000 -1.1329 )
( -5.7169 4.9050 )----- ( 12.2711 -1.1329 )
( -5.7169 4.9050 )----- ( 7.5708 15.1415 )
( -5.7169 4.9050 )----- ( -7.5708 15.1415 )

```

CRYSTAL SHAPE:

(	-5.7169	-10.2365	)	-----	(	-18.0000	-1.3329	)
(	-5.7169	-10.2365	)	-----	(	12.2831	-1.3329	)
(	-5.7169	-10.2365	)	-----	(	7.5708	-15.1415	)
(	-5.7169	-10.2365	)	-----	(	-7.5708	-15.1415	)
(	-18.0000	-1.3329	)	-----	(	-12.2831	1.3329	)
(	-18.0000	-1.3329	)	-----	(	-7.5708	15.1415	)
(	-18.0000	-1.3329	)	-----	(	-7.5708	-15.1415	)
(	12.2831	-1.3329	)	-----	(	18.0000	1.3329	)
(	12.2831	-1.3329	)	-----	(	7.5708	15.1415	)
(	12.2831	-1.3329	)	-----	(	7.5708	-15.1415	)
(	5.7169	10.2365	)	-----	(	5.7169	-4.9050	)
(	5.7169	10.2365	)	-----	(	18.0000	1.3329	)
(	5.7169	10.2365	)	-----	(	-12.2831	1.3329	)
(	5.7169	10.2365	)	-----	(	7.5708	15.1415	)
(	5.7169	10.2365	)	-----	(	-7.5708	15.1415	)
(	5.7169	-4.9050	)	-----	(	18.0000	1.3329	)
(	5.7169	-4.9050	)	-----	(	-12.2831	1.3329	)
(	5.7169	-4.9050	)	-----	(	7.5708	-15.1415	)
(	5.7169	-4.9050	)	-----	(	-7.5708	-15.1415	)
(	18.0000	1.3329	)	-----	(	7.5708	15.1415	)
(	18.0000	1.3329	)	-----	(	7.5708	-15.1415	)
(	-12.2831	1.3329	)	-----	(	-7.5708	15.1415	)
(	-12.2831	1.3329	)	-----	(	-7.5708	-15.1415	)
(	7.5708	15.1415	)	-----	(	-7.5708	15.1415	)
(	7.5708	-15.1415	)	-----	(	-7.5708	-15.1415	)



PYRITE 5 : ROGERS, 1937, p. 291
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 1 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 24
 MILLER INDICES :

-3	2	1
-3	2	-1

Apdx. 2-b, p. 216

-3	-2	-1
-3	-2	1
3	2	1
3	2	-1
3	-2	-1
3	-2	1
2	-1	3
-2	-1	3
-2	1	3
-2	1	-3
-2	-1	-3
2	-1	-3
2	1	3
2	1	-3
-1	3	2
-1	3	2
-1	3	-2
-1	3	-2
1	-3	-2
1	-3	-2
1	-3	2
-1	-3	2

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

-3.0000 X +	2.0000 Y +	1.0000 Z =	1
-3.0000 X +	2.0000 Y +	-1.0000 Z =	1
-3.0000 X +	-2.0000 Y +	-1.0000 Z =	1
-3.0000 X +	-2.0000 Y +	1.0000 Z =	1
3.0000 X +	2.0000 Y +	1.0000 Z =	1
3.0000 X +	2.0000 Y +	-1.0000 Z =	1
3.0000 X +	-2.0000 Y +	-1.0000 Z =	1
3.0000 X +	-2.0000 Y +	1.0000 Z =	1
2.0000 X +	-1.0000 Y +	3.0000 Z =	1
-2.0000 X +	-1.0000 Y +	3.0000 Z =	1
-2.0000 X +	1.0000 Y +	3.0000 Z =	1
-2.0000 X +	1.0000 Y +	-3.0000 Z =	1
-2.0000 Y +	-1.0000 Y +	-3.0000 Z =	1
2.0000 X +	-1.0000 Y +	-3.0000 Z =	1
2.0000 X +	1.0000 Y +	-3.0000 Z =	1
2.0000 X +	1.0000 Y +	3.0000 Z =	1
-1.0000 X +	3.0000 Y +	2.0000 Z =	1
1.0000 X +	3.0000 Y +	2.0000 Z =	1
-1.0000 X +	3.0000 Y +	-2.0000 Z =	1
1.0000 X +	3.0000 Y +	-2.0000 Z =	1
-1.0000 X +	-3.0000 Y +	-2.0000 Z =	1
1.0000 X +	-3.0000 Y +	-2.0000 Z =	1
1.0000 X +	-3.0000 Y +	2.0000 Z =	1
-1.0000 X +	-3.0000 Y +	2.0000 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	-0.3333	0.0	0.0	)
(	-0.1429	0.2857	0.0	)
(	-0.2857	0.0	0.1429	)
(	-0.1667	0.1667	0.1667	)
(	-0.2857	0.0	-0.1429	)
(	-0.1667	0.1667	-0.1667	)
(	-0.1429	-0.2857	0.0	)
(	-0.1667	-0.1667	-0.1667	)
(	-0.1667	-0.1667	0.1667	)
(	0.3333	0.0	0.0	)
(	0.1429	0.2857	0.0	)
(	0.2857	0.0	0.1429	)
(	0.1667	0.1667	0.1667	)
(	0.2857	0.0	-0.1429	)
(	0.1667	0.1667	-0.1667	)

(	-0.3333	0.0	0.0	)	----	(	-0.1429	0.2857	0.0	)
(	-0.3333	0.0	0.0	)	----	(	-0.2857	0.0	0.1429	)
(	-0.3333	0.0	0.0	)	----	(	-0.2857	0.0	-0.1429	)
(	-0.3333	0.0	0.0	)	----	(	-0.1429	-0.2857	0.0	)
(	-0.1429	0.2857	0.0	)	----	(	-0.1667	0.1667	0.1667	)
(	-0.1429	0.2857	0.0	)	----	(	-0.1667	0.1667	-0.1667	)
(	-0.1429	0.2857	0.0	)	----	(	0.0	0.3333	0.0	)
(	-0.2857	0.0	0.1429	)	----	(	-0.1667	0.1667	0.1667	)
(	-0.2857	0.0	0.1429	)	----	(	-0.1667	-0.1667	0.1667	)
(	-0.2857	0.0	0.1429	)	----	(	0.0	0.0	0.3333	)
(	-0.1667	0.1667	0.1667	)	----	(	0.0	0.1429	0.2857	)
(	-0.2857	0.0	-0.1429	)	----	(	-0.1667	0.1667	-0.1667	)
(	-0.2857	0.0	-0.1429	)	----	(	-0.1667	-0.1667	-0.1667	)
(	-0.2857	0.0	-0.1429	)	----	(	0.0	0.0	-0.3333	)
(	-0.1667	0.1667	-0.1667	)	----	(	0.0	0.1429	-0.2857	)
(	-0.1429	-0.2857	0.0	)	----	(	-0.1667	-0.1667	-0.1667	)
(	-0.1429	-0.2857	0.0	)	----	(	-0.1667	0.1667	0.1667	)
(	-0.1429	-0.2857	0.0	)	----	(	0.0	-0.3333	0.0	)
(	-0.1667	-0.1667	-0.1667	)	----	(	0.0	-0.1429	-0.2857	)
(	-0.1667	-0.1667	0.1667	)	----	(	0.0	0.1429	0.2857	)
(	0.3333	0.0	0.0	)	----	(	0.1429	0.2857	0.0	)
(	0.3333	0.0	0.0	)	----	(	0.2857	0.0	0.1429	)
(	0.3333	0.0	0.0	)	----	(	0.2857	0.0	-0.1429	)
(	0.3333	0.0	0.0	)	----	(	0.1429	-0.2857	0.0	)
(	0.1429	0.2857	0.0	)	----	(	0.1667	0.1667	0.1667	)
(	0.1429	0.2857	0.0	)	----	(	0.1667	0.1667	-0.1667	)
(	0.1429	0.2857	0.0	)	----	(	0.0	0.3333	0.0	)
(	0.2857	0.0	0.1429	)	----	(	0.1667	0.1667	0.1667	)
(	0.2857	0.0	0.1429	)	----	(	0.1667	-0.1667	0.1667	)
(	0.2857	0.0	0.1429	)	----	(	0.0	0.0	0.3333	)
(	0.1667	0.1667	0.1667	)	----	(	0.0	0.1429	0.2857	)
(	0.2857	0.0	-0.1429	)	----	(	0.1667	0.1667	-0.1667	)
(	0.2857	0.0	-0.1429	)	----	(	0.1667	-0.1667	-0.1667	)
(	0.2857	0.0	-0.1429	)	----	(	0.0	0.0	-0.3333	)
(	0.1667	0.1667	-0.1667	)	----	(	0.0	0.1429	-0.2857	)
(	0.1429	-0.2857	0.0	)	----	(	-0.1667	-0.1667	-0.1667	)
(	0.1429	-0.2857	0.0	)	----	(	-0.1667	0.1667	0.1667	)
(	0.1429	-0.2857	0.0	)	----	(	0.0	-0.3333	0.0	)
(	0.1667	-0.1667	-0.1667	)	----	(	0.0	-0.1429	-0.2857	)
(	0.1667	-0.1667	0.1667	)	----	(	0.0	0.1429	0.2857	)
(	0.0	0.0	0.3333	)	----	(	0.0	-0.1429	0.2857	)
(	0.0	0.0	0.3333	)	----	(	0.0	0.1429	0.2857	)
(	0.0	-0.1429	0.2857	)	----	(	0.0	-0.3333	0.0	)
(	0.0	0.1429	0.2857	)	----	(	0.0	0.3333	0.0	)
(	0.0	0.0	-0.3333	)	----	(	0.0	0.1429	-0.2857	)
(	0.0	0.0	-0.3							

0.3333

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :

2700.0000

VERTICES		
-899.9998	0.0	0.0
-385.7141	771.4285	0.0
-771.4285	0.0	385.7141
-449.9998	449.9998	449.9998
-771.4285	0.0	-385.7141
-449.9998	449.9998	-449.9998
-385.7141	-771.4285	0.0
-449.9998	-449.9998	-449.9998
-449.9998	-449.9998	449.9998
899.9998	0.0	0.0
385.7141	771.4285	0.0
771.4285	0.0	385.7141
449.9998	449.9998	449.9998
771.4285	0.0	-385.7141
449.9998	449.9998	-449.9998
385.7141	-771.4285	0.0
449.9998	-449.9998	-449.9998
449.9998	-449.9998	449.9998
0.0	0.0	899.9998
0.0	-385.7141	771.4285
0.0	385.7141	771.4285
0.0	0.0	-899.9998
0.0	385.7141	-771.4285
0.0	-385.7141	-771.4285
0.0	899.9998	0.0
0.0	-899.9998	0.0

EDGES

1	2
1	3
1	5
1	7
2	4
2	6
2	25
3	4
3	9
3	19
4	21
5	6
5	8
5	22
6	23
7	8
7	9
7	26
8	24
9	20
10	11
10	12
10	14
10	16
11	13
11	15
11	25
12	13
12	18
12	19
13	21
14	15
14	17
14	22

15 23
16 17
16 18
16 26
17 24
18 20
19 20
19 21
20 26
21 25
22 23
22 24
23 25
24 26
FACES
1 2 4 3
1 2 6 5
1 5 8 7
1 3 9 7
10 11 13 12
10 11 15 14
10 14 17 16
10 12 18 16
12 18 20 19
3 9 20 19
3 4 21 19
5 6 23 22
5 8 24 22
14 17 24 22
12 13 21 19
14 15 23 22
2 4 21 25
11 13 21 25
2 6 23 25
11 15 23 25
7 8 24 26
16 17 24 26
16 18 20 26
7 9 20 26

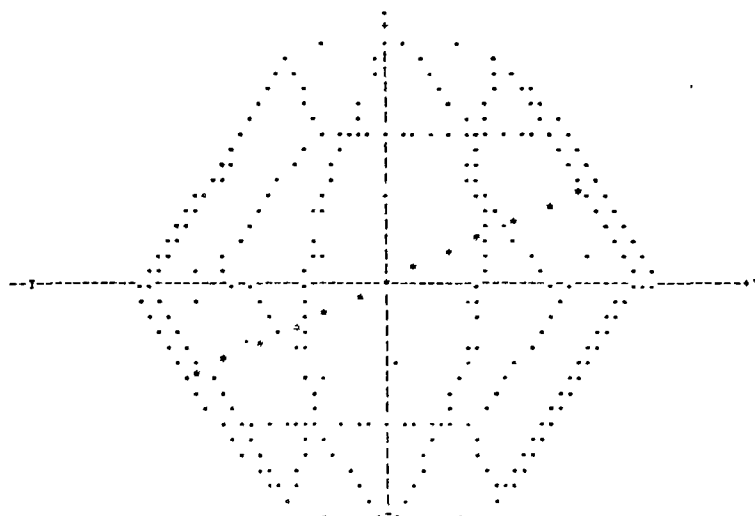
THE MAXIMUM IS: 0.3396520019 THE CONVERSION FACTOR FOR VIEWPLOT IS : 52.9954071045

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(6.6697 3.1100)	-----	(18.0000 1.3329)
(6.6697 3.1100)	-----	(5.7169 10.2365)
(6.6697 3.1100)	-----	(5.7169 -4.9050)
(6.6697 3.1100)	-----	(-12.2831 1.3329)
(18.0000 1.3329)	-----	(12.1674 10.3876)
(18.0000 1.3329)	-----	(12.1674 -7.2775)
(18.0000 1.3329)	-----	(17.6651 0.0)
(5.7169 10.2365)	-----	(12.1674 10.3876)
(5.7169 10.2365)	-----	(-5.4977 10.3876)
(5.7169 10.2365)	-----	(0.0 17.6651)
(12.1674 10.3876)	-----	(7.5708 15.1415)
(5.7169 -4.9050)	-----	(12.1674 -7.2775)
(5.7169 -4.9050)	-----	(-5.4977 -7.2775)
(5.7169 -4.9050)	-----	(0.0 -17.6651)
(12.1674 -7.2775)	-----	(7.5708 -15.1415)
(-12.2831 1.3329)	-----	(-5.4977 -7.2775)
(-12.2831 1.3329)	-----	(-5.4977 10.3876)
(-12.2831 1.3329)	-----	(-17.6651 0.0)
(-5.4977 -7.2775)	-----	(-7.5708 -15.1415)
(-5.4977 10.3876)	-----	(-7.5708 15.1415)
(-6.6697 -3.1100)	-----	(12.2831 -1.3329)

(-6.6697 -3.1100)	-----	(-5.7169 4.9050)
(-6.6697 -3.1100)	-----	(-5.7169 -10.2365)
(-6.6697 -3.1100)	-----	(-18.0000 -1.3329)
(12.2831 -1.3329)	-----	(-5.4977 7.2775)
(12.2831 -1.3329)	-----	(5.4977 -10.3876)
(12.2831 -1.3329)	-----	(17.6651 0.0)
(-5.7169 4.9050)	-----	(5.4977 7.2775)
(-5.7169 4.9050)	-----	(-12.1674 7.2775)
(-5.7169 4.9050)	-----	(0.0 17.6651)
(5.4977 7.2775)	-----	(7.5708 15.1415)
(-5.7169 -10.2365)	-----	(5.4977 -10.3876)
(-5.7169 -10.2365)	-----	(-12.1674 -10.3876)
(-5.7169 -10.2365)	-----	(0.0 -17.6651)
(5.4977 -10.3876)	-----	(7.5708 -15.1415)
(-18.0000 -1.3329)	-----	(-12.1674 -10.3876)
(-18.0000 -1.3329)	-----	(-12.1674 7.2775)
(-18.0000 -1.3329)	-----	(-17.6651 0.0)
(-12.1674 -10.3876)	-----	(-7.5708 -15.1415)
(-12.1674 7.2775)	-----	(-7.5708 15.1415)
(0.0 17.6651)	-----	(-7.5708 15.1415)
(0.0 17.6651)	-----	(7.5708 15.1415)
(-7.5708 15.1415)	-----	(-17.6651 0.0)
(7.5708 15.1415)	-----	(17.6651 0.0)
(0.0 -17.6651)	-----	(7.5708 -15.1415)
(0.0 -17.6651)	-----	(-7.5708 -15.1415)
(7.5708 -15.1415)	-----	(17.6651 0.0)
(-7.5708 -15.1415)	-----	(-17.6651 0.0)

CRYSTAL SHAPE:



7
 PYROPHYLLITE TALC : DEFR HOWE AND ZUSMAN, 1967, p. 225
 MONOCLINIC SYSTEM : A:B:C= 0.5700 1.0000 2.0670 ,ALPHA-GAMMA=90, BETA= 100.0000 , 3 FORM(S).
 NUMBER OF FACETS OR MILLER INDICES = 8
 MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	0
0	-1	0
0	0	1
0	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACETS ARE :

1.7568 X +	1.0000 Y +	0.0 Z =	1
-1.7568 X +	1.0000 Y +	0.0 Z =	1
-1.7568 X +	-1.0000 Y +	0.0 Z =	1
1.7568 X +	-1.0000 Y +	0.0 Z =	1
0.0 X +	1.6667 Y +	0.0 Z =	1
0.0 X +	-1.6667 Y +	0.0 Z =	1
0.8531 X +	0.0 Y +	4.8379 Z =	1
-0.8531 X +	0.0 Y +	-4.8379 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5692	0.0	0.1063	)
(	0.5692	0.0	-0.3071	)
(	0.2277	0.6000	0.1666	)
(	0.2277	0.6000	-0.2468	)
(	-0.5692	0.0	0.3071	)
(	-0.5692	0.0	-0.1063	)
(	-0.2277	0.6000	0.2468	)
(	-0.2277	0.6000	-0.1666	)
(	-0.2277	-0.6000	0.2468	)
(	-0.2277	-0.6000	-0.1666	)
(	0.2277	-0.6000	0.1666	)
(	0.2277	-0.6000	-0.2468	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.5692	0.0	0.1063	)	-----	(	0.5692	0.0	-0.3071	)
(	0.5692	0.0	0.1063	)	-----	(	0.2277	0.6000	0.1666	)
(	0.5692	0.0	0.1063	)	-----	(	0.2277	-0.6000	0.1666	)
(	0.5692	0.0	-0.3071	)	-----	(	0.2277	0.6000	-0.2468	)
(	0.5692	0.0	-0.3071	)	-----	(	0.2277	-0.6000	-0.2468	)
(	0.2277	0.6000	0.1666	)	-----	(	0.2277	0.6000	-0.2468	)
(	0.2277	0.6000	0.1666	)	-----	(	-0.2277	0.6000	0.2468	)
(	0.2277	0.6000	-0.2468	)	-----	(	-0.2277	0.6000	-0.1666	)
(	-0.5692	0.0	0.3071	)	-----	(	-0.5692	0.0	-0.1063	)
(	-0.5692	0.0	0.3071	)	-----	(	-0.2277	0.6000	0.2468	)
(	-0.5692	0.0	-0.1063	)	-----	(	-0.2277	-0.6000	-0.1666	)
(	-0.5692	0.0	-0.1063	)	-----	(	-0.2277	-0.6000	-0.1666	)
(	-0.2277	0.6000	0.2468	)	-----	(	-0.2277	0.6000	-0.1666	)
(	-0.2277	-0.6000	0.2468	)	-----	(	-0.2277	-0.6000	-0.1666	)
(	-0.2277	-0.6000	0.2468	)	-----	(	0.2277	-0.6000	0.1666	)
(	-0.2277	-0.6000	-0.1666	)	-----	(	0.2277	-0.6000	-0.2468	)
(	0.2277	-0.6000	0.1666	)	-----	(	0.2277	-0.6000	-0.2468	)

THE MAXIMUM IS:

0.6000

THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :

1499.9993

VERTICES
 853.8289 0.0 159.4964
 853.8289 0.0 -460.6030
 341.5310 899.9998 249.8283
 341.5310 899.9998 -370.2708
 -853.8289 0.0 460.6030

Apdx. 2-b, p. 222

-853.8289 0.0 -159.4964
 -341.5310 899.9998 370.2708
 -341.5310 899.9998 -249.8283
 -341.5310 -899.9998 370.2708
 -341.5310 -899.9998 -249.8283
 341.5310 -899.9998 249.8283
 341.5310 -899.9998 -370.2708

EDGES

1	2
1	3
1	11
2	4
2	12
3	4
3	7
4	8
5	6
5	7
5	9
6	8
6	10
7	8
9	10
9	11
10	12
11	12

FACES

1	2	4	3
5	6	8	7
5	6	10	9
1	2	12	11
3	4	8	7
9	10	12	11
1	3	7	5
2	4	8	6

THE MAXIMUM IS:

0.6059669089

THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :

26.2403259277

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(	-5.6395	0.1605	)	-----	(	-5.6395	-10.6872	)
(	-5.6395	0.1605	)	-----	(	13.4884	3.3185	)
(	-5.6395	0.1605	)	-----	(	-18.0000	3.3185	)
(	-5.6395	-10.6872	)	-----	(	13.4884	-7.5292	)
(	-5.6395	-10.6872	)	-----	(	-18.0000	-7.5292	)
(	13.4884	3.3185	)	-----	(	13.4884	-7.5292	)
(	13.4884	3.3185	)	-----	(	18.0000	7.5292	)
(	13.4884	-7.5292	)	-----	(	18.0000	-3.3185	)
(	5.6395	10.6872	)	-----	(	5.6395	-0.1605	)
(	5.6395	10.6872	)	-----	(	18.0000	7.5292	)
(	5.6395	10.6872	)	-----	(	-13.4884	7.5292	)
(	5.6395	-0.1605	)	-----	(	18.0000	-3.3185	)
(	5.6395	-0.1605	)	-----	(	-13.4884	-3.3185	)
(	18.0000	7.5292	)	-----	(	18.0000	-3.3185	)
(	-13.4884	7.5292	)	-----	(	-13.4884	-3.3185	)
(	-13.4884	7.5292	)	-----	(	-18.0000	3.3185	)
(	-13.4884	-3.3185	)	-----	(	-18.0000	-7.5292	)
(	-18.0000	3.3185	)	-----	(	-18.0000	-7.5292	)

CRYSTAL SHAPE:

1

2

3

4

5

6

7

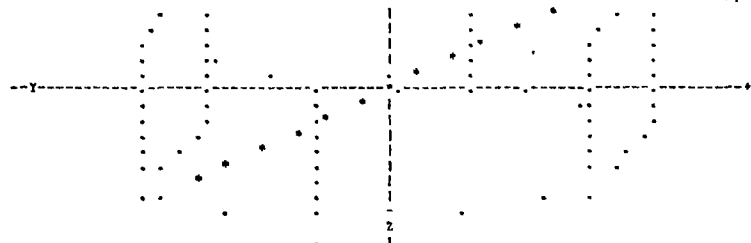
8

9

10

11

12



PYRRHOTITE : MASON AND FREY, 1960, p. 242
 HEXAGONAL SYSTEM : A1:A2:A3:C=1:1:1: 1.6692 , ALPHA=BETA=GAMMA=90, , 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 20
 MILLER INDICES :

1	0	-1	0
0	1	-1	0
-1	1	0	0
-1	0	1	0
0	-1	1	0
1	-1	0	0
0	0	0	-1
0	0	0	1
1	0	-1	2
0	1	-1	2
-1	1	0	2
-1	0	1	2
0	-1	1	2
1	-1	0	2
1	0	-1	-2
-1	1	-1	-2
-1	0	1	-2
0	-1	1	-2
1	-1	0	-2

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.1547 X +	0.0 Y +	0.0 Z =	1
0.5773 X +	1.0000 Y +	0.0 Z =	1
-0.5773 X +	1.0000 Y +	0.0 Z =	1
-1.1547 X +	0.0 Y +	0.0 Z =	1
-0.5773 X +	-1.0000 Y +	0.0 Z =	1
0.5773 X +	-1.0000 Y +	0.0 Z =	1
0.0 X +	0.0 Y +	-1.1982 Z =	1
0.0 X +	0.0 Y +	1.1982 Z =	1
0.6415 X +	0.0 Y +	0.6657 Z =	1
0.3207 X +	0.5556 Y +	0.6657 Z =	1
-0.3207 X +	0.5556 Y +	0.6657 Z =	1
-0.6415 X +	0.0 Y +	0.6657 Z =	1
-0.3207 X +	-0.5556 Y +	0.6657 Z =	1
0.3207 X +	-0.5556 Y +	0.6657 Z =	1
0.6415 X +	0.0 Y +	-0.6657 Z =	1
0.3207 X +	0.5556 Y +	-0.6657 Z =	1
-0.3207 X +	0.5556 Y +	-0.6657 Z =	1
-0.6415 X +	0.0 Y +	-0.6657 Z =	1
-0.3207 X +	-0.5556 Y +	-0.6657 Z =	1
0.3207 X +	-0.5556 Y +	-0.6657 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.8660	0.5000	0.6677	)
(	0.8660	0.5000	-0.6677	)
(	0.8660	-0.5000	0.6677	)
(	0.8660	-0.5000	-0.6677	)
(	0.0	1.0000	0.6677	)
(	0.0	1.0000	-0.6677	)
(	-0.8660	0.5000	0.6677	)
(	-0.8660	0.5000	-0.6677	)
(	-0.8660	-0.5000	0.6677	)
(	-0.8660	-0.5000	-0.6677	)
(	0.0	-1.0000	0.6677	)
(	0.0	-1.0000	-0.6677	)
(	0.6928	0.4000	-0.8346	)
(	0.6928	-0.4000	-0.8346	)
(	0.0	0.8000	-0.8346	)
(	-0.6928	0.4000	-0.8346	)
(	-0.6928	-0.4000	-0.8346	)
(	0.0	-0.8000	-0.8346	)
(	0.6928	0.4000	0.8346	)
(	0.6928	-0.4000	0.8346	)
(	0.0	0.8000	0.8346	)
(	-0.6928	0.4000	0.8346	)
(	-0.6928	-0.4000	0.8346	)
(	0.0	-0.8000	0.8346	)

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :

(	0.8660	0.5000	0.6677	)	-----	(	0.8660	0.5000	-0.6677	)
(	0.8660	0.5000	0.6677	)	-----	(	0.8660	-0.5000	0.6677	)
(	0.8660	0.5000	0.6677	)	-----	(	0.0	1.0000	0.6677	)
(	0.8660	0.5000	0.6677	)	-----	(	0.6928	0.4000	0.8346	)
(	0.8660	0.5000	-0.6677	)	-----	(	0.8660	-0.5000	-0.6677	)
(	0.8660	0.5000	-0.6677	)	-----	(	0.0	1.0000	-0.6677	)
(	0.8660	0.5000	-0.6677	)	-----	(	0.6928	0.4000	-0.8346	)
(	0.8660	-0.5000	0.6677	)	-----	(	0.8660	-0.5000	0.6677	)
(	0.8660	-0.5000	0.6677	)	-----	(	0.0	-1.0000	0.6677	)
(	0.8660	-0.5000	0.6677	)	-----	(	0.6928	-0.4000	0.8346	)
(	0.8660	-0.5000	-0.6677	)	-----	(	0.0	-1.0000	-0.6677	)
(	0.8660	-0.5000	-0.6677	)	-----	(	0.6928	-0.4000	-0.8346	)
(	0.0	1.0000	0.6677	)	-----	(	0.0	1.0000	-0.6677	)
(	0.0	1.0000	0.6677	)	-----	(	-0.8660	0.5000	0.6677	)
(	0.0	1.0000	0.6677	)	-----	(	0.0	0.0000	0.8346	)
(	0.0	1.0000	-0.6677	)	-----	(	-0.8660	0.5000	-0.6677	)
(	0.0	1.0000	-0.6677	)	-----	(	0.0	0.0000	-0.8346	)
(	-0.8660	0.5000	0.6677	)	-----	(	-0.8660	0.5000	-0.6677	)
(	-0.8660	0.5000	0.6677	)	-----	(	-0.8660	-0.5000	0.6677	)
(	-0.8660	0.5000	0.6677	)	-----	(	-0.8660	-0.5000	-0.6677	)
(	-0.8660	0.5000	-0.6677	)	-----	(	-0.8660	-0.5000	0.6677	)
(	-0.8660	0.5000	-0.6677	)	-----	(	-0.8660	-0.5000	-0.6677	)
(	-0.8660	-0.5000	0.6677	)	-----	(	0.0	-1.0000	0.6677	)
(	-0.8660	-0.5000	0.6677	)	-----	(	-0.6928	-0.4000	0.8346	)
(	-0.8660	-0.5000	-0.6677	)	-----	(	0.0	-1.0000	-0.6677	)
(	-0.8660	-0.5000	-0.6677	)	-----	(	-0.6928	-0.4000	-0.8346	)
(	0.0	-1.0000	0.6677	)	-----	(	0.0	-1.0000	-0.6677	)
(	0.0	-1.0000	0.6677	)	-----	(	0.0	-0.8000	0.8346	)
(	0.0	-1.0000	-0.6677	)	-----	(	0.0	-0.8000	-0.8346	)
(	0.6928	0.4000	-0.8346	)	-----	(	0.6928	0.4000	-0.8346	)
(	0.6928	0.4000	-0.8346	)	-----	(	0.0	0.8000	-0.8346	)
(	0.6928	-0.4000	-0.8346	)	-----	(	0.0	0.8000	0.8346	)
(	0.6928	-0.4000	-0.8346	)	-----	(	-0.6928	0.4000	-0.8346	)
(	-0.6928	0.4000	-0.8346	)	-----	(	-0.6928	0.4000	-0.8346	)
(	-0.6928	0.4000	-0.8346	)	-----	(	0.0	-0.8000	-0.8346	)
(	-0.6928	-0.4000	-0.8346	)	-----	(	0.0	-0.8000	0.8346	)


```

      ( 0.6928 0.4000 0.8346 )----- ( 0.0 0.0000 0.8346 )
      ( 0.6928 -0.4000 0.8346 )----- ( 0.0 -0.8000 0.8346 )
      ( 0.0 0.8000 0.8346 )----- ( -0.6928 0.4000 0.8346 )
      ( -0.6928 0.4000 0.8346 )----- ( -0.6928 -0.4000 0.8346 )
      ( -0.6928 -0.4000 0.8346 )----- ( 0.0 -0.8000 0.8346 )
THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS : 900.0000

```

```

VERTICES
779.4004 450.0254 600.9106
779.4004 450.0254 -600.9106
779.4004 -450.0254 600.9106
779.4004 -450.0254 -600.9106
0.0 900.0000 600.9114
0.0 900.0000 -600.9114
-779.4004 450.0254 600.9104
-779.4004 450.0254 -600.9104
-779.4004 -450.0254 600.9106
-779.4004 -450.0254 -600.9106
0.0 -900.0000 600.9114
0.0 -900.0000 -600.9114
623.5190 360.0200 -751.1401
623.5190 -360.0200 -751.1401
0.0 719.9990 -751.1401
-623.5190 360.0200 -751.1401
-623.5190 -360.0200 -751.1401
0.0 -719.9990 -751.1401
623.5190 360.0200 751.1401
623.5190 -360.0200 751.1401
0.0 719.9990 751.1401
-623.5190 360.0200 751.1401
-623.5190 -360.0200 751.1401
0.0 -719.9990 751.1401

```

```

EDGES
1 2
1 3
1 5
1 19
2 4
2 6
2 13
3 4
3 11
3 20
4 12
4 14
5 6
5 7
5 21
6 8
6 15
7 8
7 9
7 22
8 10
8 16
9 10
9 11
9 23
10 12
10 17
11 12
11 24
12 18

```

```

13 14
13 15
14 18
15 16
16 17
17 18
19 20
19 21
20 24
21 22
22 23
23 24
FACES
1 2 4 3
1 2 6 5
5 6 8 7
7 8 10 9
9 10 12 11
3 4 12 11
13 14 18 17 16 15
19 20 24 23 22 21
1 3 20 19
1 5 21 19
5 7 22 21
7 9 23 22
9 11 24 23
3 11 24 20
2 4 14 13
2 6 15 13
6 8 16 15
8 10 17 16
10 12 18 17
4 12 18 14

```

```

THE MAXIMUM IS: 1.0000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.0000000000

```

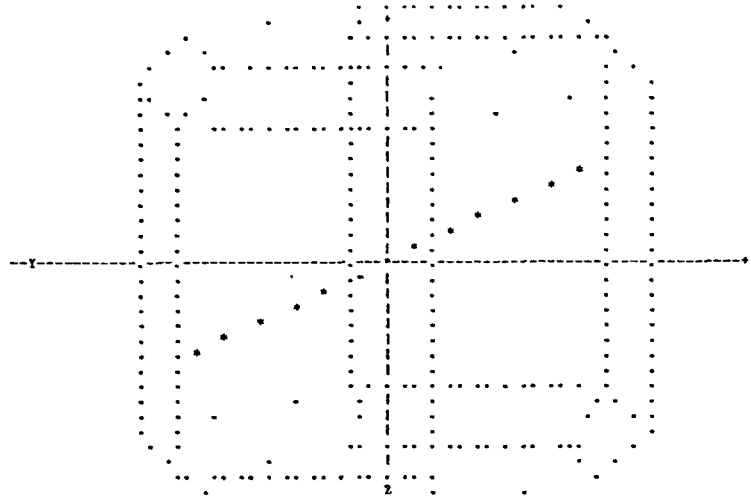
```

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 3.1150 9.2739 )----- ( 3.1150 -14.7626 )
( 3.1150 9.2739 )----- ( -14.8860 9.2739 )
( 3.1150 9.2739 )----- ( 18.0000 12.0182 )
( 3.1150 9.2739 )----- ( 2.4920 12.8273 )
( 3.1150 -14.7626 )----- ( -14.8860 -14.7626 )
( 3.1150 -14.7626 )----- ( 18.0000 -12.0182 )
( 3.1150 -14.7626 )----- ( 2.4920 -17.2183 )
( -14.8860 9.2739 )----- ( -14.8860 -14.7626 )
( -14.8860 9.2739 )----- ( -18.0000 12.0182 )
( -14.8860 9.2739 )----- ( -11.9998 12.0273 )
( -14.8860 -14.7626 )----- ( -18.0000 -12.0182 )
( -14.8860 -14.7626 )----- ( -11.9998 -17.2183 )
( 18.0000 12.0182 )----- ( 18.0000 -12.0182 )
( 18.0000 12.0182 )----- ( 14.4000 14.7626 )
( 18.0000 12.0182 )----- ( 14.4000 15.0228 )
( 18.0000 -12.0182 )----- ( 14.4000 -9.2739 )
( 18.0000 -12.0182 )----- ( 14.4000 -15.0228 )
( 14.4000 14.7626 )----- ( 14.4000 -9.2739 )
( 14.4000 14.7626 )----- ( -3.1150 14.7626 )
( 14.4000 14.7626 )----- ( 11.9998 17.2183 )
( 14.4000 -9.2739 )----- ( -3.1150 -9.2739 )
( 14.4000 -9.2739 )----- ( 11.9998 -17.2183 )
( -3.1150 14.7626 )----- ( -3.1150 -9.2739 )
( -3.1150 14.7626 )----- ( -11.9998 17.2183 )
( -3.1150 14.7626 )----- ( -2.4920 17.2183 )
( -3.1150 -9.2739 )----- ( -3.1150 -17.2183 )
( -3.1150 -9.2739 )----- ( -2.4920 -17.2183 )

```

```
( -18.0000 12.0182 )-----(-18.0000 -12.0182 )
( -18.0000 12.0182 )-----(-14.4000 15.0228 )
( -18.0000 -12.0182 )-----(-14.4000 -15.0228 )
( 2.4920 -17.2183 )-----(-11.9088 -17.2183 )
( 2.4920 -17.2183 )-----(-14.4000 -15.0228 )
( -11.9088 -17.2183 )-----(-14.4000 -15.0228 )
( 14.4000 -15.0228 )-----(-11.9088 -17.2183 )
( 11.9088 -17.2183 )-----(-2.4920 -17.2183 )
( -2.4920 -17.2183 )-----(-14.4000 -15.0228 )
( 2.4920 12.0182 )-----(-11.9088 12.0182 )
( 2.4920 12.0182 )-----(-14.4000 15.0228 )
( -11.9088 12.0182 )-----(-14.4000 15.0228 )
( 14.4000 15.0228 )-----(-11.9088 17.2183 )
( 11.9088 17.2183 )-----(-2.4920 17.2183 )
( -2.4920 17.2183 )-----(-14.4000 15.0228 )
```

CRYSTAL SHAPE:



LOW QUARTZ 1 : MASON AND BERRY, 1968, P. 409
 HEXAGONAL SYSTEM : A1:A2:A3:C=1:1:1: 1.1000 , ALPHA=BETA=GAMMA=90, , 2 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 18
 MILLER INDICES :

1	0	-1	1
0	1	-1	1
-1	1	0	1
-1	0	1	1
0	-1	1	1
1	-1	0	1
1	0	-1	-1
0	1	-1	-1

-1	1	0	-1
-1	0	1	-1
0	-1	1	-1
1	-1	0	-1
1	0	-1	0
0	1	-1	0
-1	1	0	0
-1	0	1	0
0	-1	1	0
1	-1	0	0

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```
0.7698 X + 0.0 Y + 0.6061 Z = 1
-0.3849 X + 0.6667 Y + 0.6061 Z = 1
-0.3849 X + 0.6667 Y + 0.6061 Z = 1
-0.7698 X + 0.0 Y + 0.6061 Z = 1
-0.3849 X + -0.6667 Y + 0.6061 Z = 1
0.3849 X + -0.6667 Y + 0.6061 Z = 1
0.7698 X + 0.0 Y + -0.6061 Z = 1
0.3849 X + 0.6667 Y + -0.6061 Z = 1
-0.3849 X + 0.6667 Y + -0.6061 Z = 1
-0.7698 X + 0.0 Y + -0.6061 Z = 1
-0.3849 X + -0.6667 Y + -0.6061 Z = 1
0.3849 X + -0.6667 Y + -0.6061 Z = 1
1.4434 X + 0.0 Y + 0.0 Z = 1
0.7217 X + 1.2500 Y + 0.0 Z = 1
-0.7217 X + 1.2500 Y + 0.0 Z = 1
-1.4434 X + 0.0 Y + 0.0 Z = 1
-0.7217 X + -1.2500 Y + 0.0 Z = 1
0.7217 X + -1.2500 Y + 0.0 Z = 1
```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```
( 0.0 0.0000 1.6500 )
( 0.6928 0.4000 0.7700 )
( 0.6928 -0.4000 0.7700 )
( 0.0000 0.8000 0.7700 )
( -0.6928 0.4000 0.7700 )
( -0.6928 -0.4000 0.7700 )
( -0.0000 -0.8000 0.7700 )
( 0.0 0.0000 -1.6500 )
( 0.6928 0.4000 -0.7700 )
( 0.6928 -0.4000 -0.7700 )
( 0.0000 0.8000 -0.7700 )
( -0.6928 0.4000 -0.7700 )
( -0.6928 -0.4000 -0.7700 )
( -0.0000 -0.8000 -0.7700 )
```

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

```
( 0.0 0.0000 1.6500 )-----(-0.6928 0.4000 0.7700 )
( 0.0 0.0000 1.6500 )-----(-0.6928 -0.4000 0.7700 )
( 0.0 0.0000 1.6500 )-----(-0.0000 0.8000 0.7700 )
( 0.0 0.0000 1.6500 )-----(-0.6928 0.4000 0.7700 )
( 0.0 0.0000 1.6500 )-----(-0.6928 -0.4000 0.7700 )
( 0.0 0.0000 1.6500 )-----(-0.0000 -0.8000 0.7700 )
( 0.6928 0.4000 0.7700 )-----(-0.6928 0.4000 0.7700 )
( 0.6928 0.4000 0.7700 )-----(-0.0000 0.8000 0.7700 )
( 0.6928 0.4000 0.7700 )-----(-0.6928 -0.4000 0.7700 )
( 0.6928 -0.4000 0.7700 )-----(-0.6928 0.4000 0.7700 )
( 0.6928 -0.4000 0.7700 )-----(-0.0000 -0.8000 0.7700 )
( 0.0000 0.8000 0.7700 )-----(-0.6928 0.4000 0.7700 )
( 0.0000 0.8000 0.7700 )-----(-0.6928 -0.4000 0.7700 )
( 0.0000 0.8000 0.7700 )-----(-0.0000 -0.8000 0.7700 )
( -0.6928 0.4000 0.7700 )-----(-0.6928 0.4000 0.7700 )
( -0.6928 0.4000 0.7700 )-----(-0.0000 0.8000 0.7700 )
( -0.6928 -0.4000 0.7700 )-----(-0.6928 -0.4000 0.7700 )
( -0.6928 -0.4000 0.7700 )-----(-0.0000 -0.8000 0.7700 )
( -0.0000 -0.8000 0.7700 )-----(-0.6928 0.4000 0.7700 )
( -0.0000 -0.8000 0.7700 )-----(-0.6928 -0.4000 0.7700 )
( -0.0000 -0.8000 0.7700 )-----(-0.0000 -0.8000 0.7700 )
```

```

( -0.0000 -0.0000 0.7700 )----- ( -0.0000 -0.0000 -0.7700 )
( 0.0 0.0000 -1.6500 )----- ( 0.6928 0.4000 -0.7700 )
( 0.0 0.0000 -1.6500 )----- ( 0.6928 0.4000 -0.7700 )
( 0.0 0.0000 -1.6500 )----- ( 0.0000 0.4000 -0.7700 )
( 0.0 0.0000 -1.6500 )----- ( -0.6928 0.4000 -0.7700 )
( 0.0 0.0000 -1.6500 )----- ( -0.6928 0.4000 -0.7700 )
( 0.0 0.0000 -1.6500 )----- ( -0.6928 0.4000 -0.7700 )
( 0.6928 0.4000 -0.7700 )----- ( 0.6928 0.4000 -0.7700 )
( 0.6928 0.4000 -0.7700 )----- ( 0.0000 0.4000 -0.7700 )
( 0.6928 0.4000 -0.7700 )----- ( -0.6928 0.4000 -0.7700 )
( 0.0000 0.4000 -0.7700 )----- ( -0.6928 0.4000 -0.7700 )
( -0.6928 0.4000 -0.7700 )----- ( -0.6928 0.4000 -0.7700 )
( -0.6928 0.4000 -0.7700 )----- ( -0.6928 0.4000 -0.7700 )

```

THE MAXIMUM IS: 1.6500 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS : 545.4548

VERTICES

0.0	0.0001	899.9995
377.8911	218.1944	419.9995
377.8911	-218.1944	419.9995
0.0001	436.3638	420.0000
-377.8909	218.1945	420.0000
-377.8911	-218.1944	419.9995
-0.0001	-436.3638	420.0000
0.0	0.0001	899.9995
377.8911	218.1944	419.9995
377.8911	-218.1944	419.9995
0.0001	436.3638	420.0000
-377.8909	218.1945	420.0000
-377.8911	-218.1944	419.9995
-0.0001	-436.3638	420.0000

EDGES

1	2
1	3
1	4
1	5
1	6
1	7
2	3
2	4
2	9
3	7
3	10
4	5
4	11
5	6
5	12
6	7
6	13
7	14
8	9
8	10
8	11
8	12
8	13
8	14
9	10
9	11
10	14
11	12
12	13
13	14

FACES

1	2	3

1	2	4
1	4	5
1	5	6
1	6	7
1	3	7
8	9	10
8	9	11
8	11	12
8	12	13
8	13	14
8	10	14
2	3	10
2	4	11
4	5	12
5	6	13
6	7	14
3	7	14

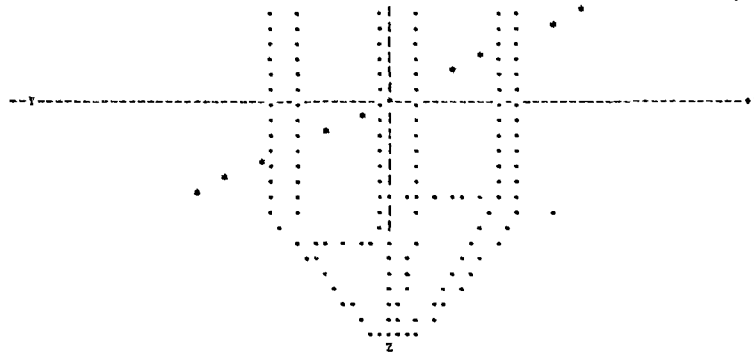
THE MAXIMUM IS: 1.6499986649 THE CONVERSION FACTOR FOR VIEWPLOT IS : 10.9090995789

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(0.0000 18.0000)	-----	(1.5103 7.0694)
(0.0000 18.0000)	-----	(-7.2175 7.0694)
(0.0000 18.0000)	-----	(8.7273 8.4000)
(0.0000 18.0000)	-----	(7.2175 9.7305)
(0.0000 18.0000)	-----	(-1.5103 9.7306)
(0.0000 18.0000)	-----	(-8.7273 8.4000)
(1.5103 7.0694)	-----	(-7.2175 7.0694)
(1.5103 7.0694)	-----	(8.7273 8.4000)
(1.5103 7.0694)	-----	(1.5103 -9.7306)
(-7.2175 7.0694)	-----	(-8.7273 8.4000)
(-7.2175 7.0694)	-----	(-7.2175 -9.7305)
(8.7273 8.4000)	-----	(7.2175 9.7305)
(8.7273 8.4000)	-----	(8.7273 -8.4000)
(7.2175 9.7306)	-----	(-1.5103 9.7306)
(7.2175 9.7306)	-----	(7.2175 -7.0694)
(-1.5103 9.7306)	-----	(-8.7273 8.4000)
(-1.5103 9.7306)	-----	(-1.5103 -7.0694)
(-8.7273 8.4000)	-----	(-8.7273 -8.4000)
(0.0000 -18.0000)	-----	(1.5103 -9.7306)
(0.0000 -18.0000)	-----	(-7.2175 -9.7305)
(0.0000 -18.0000)	-----	(8.7273 -8.4000)
(0.0000 -18.0000)	-----	(7.2175 -7.0694)
(0.0000 -18.0000)	-----	(-1.5103 -7.0694)
(0.0000 -18.0000)	-----	(-8.7273 -8.4000)
(1.5103 -9.7306)	-----	(-7.2175 -9.7305)
(1.5103 -9.7306)	-----	(8.7273 -8.4000)
(-7.2175 -9.7306)	-----	(-8.7273 -8.4000)
(8.7273 -8.4000)	-----	(7.2175 -7.0694)
(7.2175 -7.0694)	-----	(-1.5103 -7.0694)
(-1.5103 -7.0694)	-----	(-8.7273 -8.4000)

CRYSTAL SHAPE:





RUTILE : MASON AND BERRY, 1968, P. 300
 TETRAGONAL SYSTEM: A:B:C=1:1: 0.6439 ALPHA=BETA=GAMMA=90, , & FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 24
 MILLER INDICES :

1	0	0
-1	0	0
0	1	0
0	-1	0
1	1	0
-1	1	0
-1	-1	0
1	-1	0
1	0	1
0	1	1
-1	0	1
0	-1	1
1	0	-1
0	1	-1
-1	0	-1
0	-1	-1
1	1	1
-1	1	1
-1	-1	1
1	-1	1
1	1	-1
-1	1	-1
-1	-1	-1
1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X +	0.0	Y +	0.0	Z =	1
-1.0000 X +	0.0	Y +	0.0	Z =	1
0.0 X +	1.0000	Y +	0.0	Z =	1
0.0 X +	-1.0000	Y +	0.0	Z =	1
0.7143 X +	0.7143	Y +	0.0	Z =	1
-0.7143 X +	0.7143	Y +	0.0	Z =	1
-0.7143 X +	-0.7143	Y +	0.0	Z =	1
0.7143 X +	-0.7143	Y +	0.0	Z =	1
0.4000 X +	0.0	Y +	0.6212	Z =	1

0.0 X +	0.4000	Y +	0.6212	Z =	1
-0.4000 X +	0.0	Y +	0.6212	Z =	1
0.0 X +	-0.4000	Y +	0.6212	Z =	1
0.4000 X +	0.0	Y +	-0.6212	Z =	1
0.0 X +	0.4000	Y +	-0.6212	Z =	1
-0.4000 X +	0.0	Y +	-0.6212	Z =	1
0.0 X +	-0.4000	Y +	-0.6212	Z =	1
0.3704 X +	0.3704	Y +	0.5752	Z =	1
-0.3704 X +	0.3704	Y +	0.5752	Z =	1
-0.3704 X +	-0.3704	Y +	0.5752	Z =	1
0.3704 X +	-0.3704	Y +	0.5752	Z =	1
0.3704 X +	0.3704	Y +	-0.5752	Z =	1
-0.3704 X +	0.3704	Y +	-0.5752	Z =	1
-0.3704 X +	-0.3704	Y +	-0.5752	Z =	1
0.3704 X +	-0.3704	Y +	-0.5752	Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	1.0000	0.4000	0.8371	)
(	1.0000	0.4000	-0.8371	)
(	1.0000	-0.4000	0.8371	)
(	1.0000	-0.4000	-0.8371	)
(	1.0000	0.2000	0.9659	)
(	1.0000	-0.2000	0.9659	)
(	1.0000	0.2000	-0.9659	)
(	1.0000	-0.2000	-0.9659	)
(	-1.0000	0.4000	0.8371	)
(	-1.0000	0.4000	-0.8371	)
(	-1.0000	-0.4000	0.8371	)
(	-1.0000	-0.4000	-0.8371	)
(	-1.0000	0.2000	0.9659	)
(	-1.0000	-0.2000	0.9659	)
(	-1.0000	0.2000	-0.9659	)
(	-1.0000	-0.2000	-0.9659	)
(	0.4000	1.0000	0.8371	)
(	0.4000	1.0000	-0.8371	)
(	-0.4000	1.0000	0.8371	)
(	-0.4000	1.0000	-0.8371	)
(	0.2000	1.0000	0.9659	)
(	-0.2000	1.0000	0.9659	)
(	0.2000	1.0000	-0.9659	)
(	-0.2000	1.0000	-0.9659	)
(	-0.4000	-1.0000	0.8371	)
(	-0.4000	-1.0000	-0.8371	)
(	0.4000	-1.0000	0.8371	)
(	0.4000	-1.0000	-0.8371	)
(	-0.2000	-1.0000	0.9659	)
(	0.2000	-1.0000	0.9659	)
(	-0.2000	-1.0000	-0.9659	)
(	0.2000	-1.0000	-0.9659	)
(	0.0	0.0	1.6097	)
(	0.2000	0.2000	1.4810	)
(	0.2000	-0.2000	1.4810	)
(	-0.2000	0.2000	1.4810	)
(	-0.2000	-0.2000	1.4810	)
(	0.0	0.0	-1.6097	)
(	0.2000	0.2000	-1.4810	)
(	0.2000	-0.2000	-1.4810	)
(	-0.2000	0.2000	-1.4810	)
(	-0.2000	-0.2000	-1.4810	)

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :

(	1.0000	0.4000	0.8371	)	-----	(	1.0000	0.4000	-0.8371	)
(	1.0000	0.4000	0.8371	)	-----	(	1.0000	0.2000	0.9659	)
(	1.0000	0.4000	0.8371	)	-----	(	0.4000	1.0000	0.8371	)

(	1.0000	0.4000	-0.8371	)	-----	(	1.0000	0.2000	-0.9659	)
(	1.0000	0.4000	-0.8371	)	-----	(	0.4000	1.0000	-0.8371	)
(	1.0000	-0.4000	0.8371	)	-----	(	1.0000	-0.4000	-0.8371	)
(	1.0000	-0.4000	0.8371	)	-----	(	1.0000	-0.2000	0.9659	)
(	1.0000	-0.4000	0.8371	)	-----	(	0.4000	-1.0000	0.8371	)
(	1.0000	-0.4000	-0.8371	)	-----	(	1.0000	-0.2000	-0.9659	)
(	1.0000	-0.4000	-0.8371	)	-----	(	0.4000	-1.0000	-0.8371	)
(	1.0000	0.2000	0.9659	)	-----	(	1.0000	-0.2000	0.9659	)
(	1.0000	0.2000	0.9659	)	-----	(	0.2000	0.2000	1.4810	)
(	1.0000	-0.2000	0.9659	)	-----	(	0.2000	-0.2000	1.4810	)
(	1.0000	-0.2000	-0.9659	)	-----	(	1.0000	-0.2000	-0.9659	)
(	1.0000	0.2000	-0.9659	)	-----	(	0.2000	0.2000	-1.4810	)
(	1.0000	-0.2000	-0.9659	)	-----	(	0.2000	-0.2000	-1.4810	)
(	-1.0000	0.4000	0.8371	)	-----	(	-1.0000	0.4000	-0.8371	)
(	-1.0000	0.4000	0.8371	)	-----	(	-1.0000	0.2000	0.9659	)
(	-1.0000	0.4000	0.8371	)	-----	(	-0.4000	1.0000	0.8371	)
(	-1.0000	0.4000	-0.8371	)	-----	(	-1.0000	0.2000	-0.9659	)
(	-1.0000	0.4000	-0.8371	)	-----	(	-0.4000	1.0000	-0.8371	)
(	-1.0000	0.4000	0.8371	)	-----	(	-1.0000	-0.4000	-0.8371	)
(	-1.0000	-0.4000	0.8371	)	-----	(	-1.0000	-0.2000	0.9659	)
(	-1.0000	-0.4000	0.8371	)	-----	(	-0.4000	-1.0000	0.8371	)
(	-1.0000	-0.4000	-0.8371	)	-----	(	-1.0000	-0.2000	-0.9659	)
(	-1.0000	-0.4000	-0.8371	)	-----	(	-0.4000	-1.0000	-0.8371	)
(	-1.0000	0.2000	0.9659	)	-----	(	-1.0000	-0.2000	0.9659	)
(	-1.0000	0.2000	0.9659	)	-----	(	-0.2000	0.2000	1.4810	)
(	-1.0000	-0.2000	0.9659	)	-----	(	-0.2000	-0.2000	1.4810	)
(	-1.0000	-0.2000	-0.9659	)	-----	(	-1.0000	-0.2000	-0.9659	)
(	-1.0000	0.2000	-0.9659	)	-----	(	-0.2000	0.2000	-1.4810	)
(	-1.0000	-0.2000	-0.9659	)	-----	(	-0.2000	-0.2000	-1.4810	)
(	0.4000	1.0000	0.8371	)	-----	(	0.4000	1.0000	-0.8371	)
(	0.4000	1.0000	0.8371	)	-----	(	0.2000	1.0000	0.9659	)
(	0.4000	1.0000	-0.8371	)	-----	(	0.2000	1.0000	-0.9659	)
(	-0.4000	1.0000	0.8371	)	-----	(	-0.4000	1.0000	-0.8371	)
(	-0.4000	1.0000	0.8371	)	-----	(	-0.2000	1.0000	0.9659	)
(	-0.4000	1.0000	-0.8371	)	-----	(	-0.2000	1.0000	-0.9659	)
(	0.2000	1.0000	0.9659	)	-----	(	0.2000	1.0000	0.9659	)
(	0.2000	1.0000	0.9659	)	-----	(	0.2000	0.2000	1.4810	)
(	0.2000	1.0000	-0.9659	)	-----	(	-0.2000	0.2000	1.4810	)
(	0.2000	1.0000	-0.9659	)	-----	(	-0.2000	1.0000	-0.9659	)
(	-0.2000	1.0000	0.9659	)	-----	(	0.2000	0.2000	-1.4810	)
(	-0.2000	1.0000	0.9659	)	-----	(	-0.4000	-1.0000	-0.8371	)
(	-0.4000	-1.0000	0.8371	)	-----	(	-0.2000	-1.0000	0.9659	)
(	-0.4000	-1.0000	-0.8371	)	-----	(	-0.2000	-1.0000	-0.9659	)
(	0.4000	-1.0000	0.8371	)	-----	(	0.4000	-1.0000	-0.8371	)
(	0.4000	-1.0000	0.8371	)	-----	(	0.2000	-1.0000	0.9659	)
(	0.4000	-1.0000	-0.8371	)	-----	(	0.2000	-1.0000	-0.9659	)
(	-0.2000	-1.0000	0.9659	)	-----	(	0.2000	-1.0000	0.9659	)
(	-0.2000	-1.0000	0.9659	)	-----	(	-0.2000	-0.2000	1.4810	)
(	-0.2000	-1.0000	-0.9659	)	-----	(	0.2000	-0.2000	1.4810	)
(	-0.2000	-1.0000	-0.9659	)	-----	(	0.2000	0.2000	-1.4810	)
(	0.0	0.0	1.6097	)	-----	(	0.2000	0.2000	1.4810	)
(	0.0	0.0	1.6097	)	-----	(	0.2000	-0.2000	1.4810	)
(	0.0	0.0	1.6097	)	-----	(	-0.2000	0.2000	1.4810	)
(	0.0	0.0	1.6097	)	-----	(	-0.2000	-0.2000	1.4810	)
(	0.0	0.0	-1.6097	)	-----	(	0.2000	0.2000	-1.4810	)
(	0.0	0.0	-1.6097	)	-----	(	0.2000	-0.2000	-1.4810	)
(	0.0	0.0	-1.6097	)	-----	(	-0.2000	0.2000	-1.4810	)
(	0.0	0.0	-1.6097	)	-----	(	-0.2000	-0.2000	-1.4810	)

THE MAXIMUM IS: 1.6097 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 559.0930

VERTICES

559.0930	223.6371	467.9998
559.0930	223.6371	-467.9998
559.0930	-223.6371	467.9998
559.0930	-223.6371	-467.9998
559.0930	111.8182	540.0000
559.0930	-111.8182	540.0000
559.0930	111.8182	-540.0000
559.0930	-111.8182	-540.0000
-559.0930	223.6371	467.9998
-559.0930	223.6371	-467.9998
-559.0930	-223.6371	467.9998
-559.0930	-223.6371	-467.9998
-559.0930	111.8182	540.0000
-559.0930	-111.8182	540.0000
-559.0930	111.8182	-540.0000
-559.0930	-111.8182	-540.0000
223.6371	559.0930	467.9998
223.6371	559.0930	-467.9998
-223.6371	559.0930	467.9998
-223.6371	559.0930	-467.9998
111.8182	559.0930	540.0000
-111.8182	559.0930	540.0000
111.8182	559.0930	-540.0000
-111.8182	559.0930	-540.0000
223.6371	-559.0930	467.9998
223.6371	-559.0930	-467.9998
-223.6371	-559.0930	467.9998
-223.6371	-559.0930	-467.9998
111.8182	-559.0930	540.0000
-111.8182	-559.0930	540.0000
111.8182	-559.0930	-540.0000
-111.8182	-559.0930	-540.0000
0.0	0.0	899.9998
111.8182	111.8182	828.0007
111.8182	-111.8182	828.0007
-111.8182	111.8182	828.0007
-111.8182	-111.8182	828.0007
0.0	0.0	-819.9998
111.8182	111.8182	-828.0007
111.8182	-111.8182	-828.0007
-111.8182	111.8182	-828.0007
-111.8182	-111.8182	-828.0007

EDGES

1	2
1	5
1	7
2	16
3	4
3	6
3	27
4	8
4	28
5	6
5	34
6	35
7	8
7	14
8	40
9	10
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 38 42

FACES
 1 2 7 8 4 3 6 5
 9 10 15 16 12 11 14 13
 17 18 23 24 20 19 22 21
 25 26 31 32 28 27 30 29
 1 2 18 17
 9 10 20 19
 11 12 26 25
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 5 6 35 33 34
 21 22 36 33 34
 13 14 37 33 36
 29 30 35 33 37
 7 8 40 38 39
 23 24 41 38 39
 15 16 42 38 41

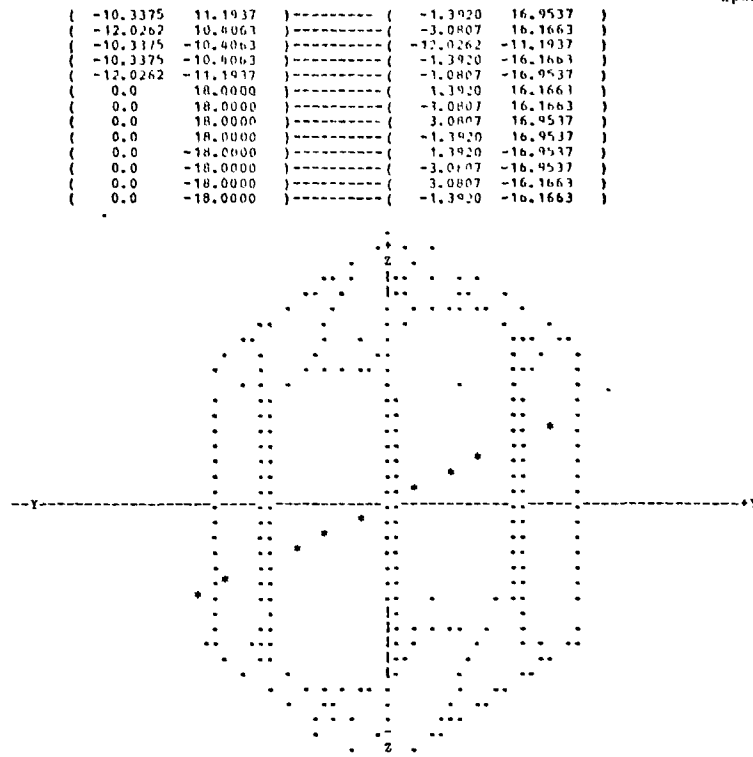
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 9 13 36 22 19
 11 14 37 29 25
 3 6 35 30 27
 2 7 39 23 18
 10 15 41 24 20
 12 16 42 31 26
 4 8 40 32 28

THE MAXIMUM IS: 1.6097497940 THE CONVERSION FACTOR FOR VIEWPLOT IS : 11.1818618774

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(0.2509 7.3914)	-----	(0.2509 -11.3286)
(0.2509 7.3914)	-----	(-1.9855 8.8314)
(0.2509 7.3914)	-----	(9.4931 8.5725)
(0.2509 -11.3286)	-----	(-1.9855 -12.7686)
(0.2509 -11.3286)	-----	(9.4931 -10.1474)
(-8.6946 7.3914)	-----	(-8.6946 -11.3286)
(-8.6946 7.3914)	-----	(-6.4582 8.8314)
(-8.6946 7.3914)	-----	(-12.8706 8.5725)
(-8.6946 -11.3286)	-----	(-6.4582 -12.7686)
(-8.6946 -11.3286)	-----	(-12.8706 -10.1474)
(-1.9855 8.8314)	-----	(-6.4582 8.8314)
(-1.9855 8.8314)	-----	(1.3920 16.1663)
(-6.4582 8.8314)	-----	(-3.0807 16.1663)
(-1.9855 -12.7686)	-----	(-6.4582 -12.7686)
(-1.9855 -12.7686)	-----	(1.3920 -16.9537)
(-6.4582 -12.7686)	-----	(-3.0807 -16.9537)
(8.6946 11.3286)	-----	(8.6946 -7.3914)
(8.6946 11.3286)	-----	(6.4582 12.7686)
(8.6946 11.3286)	-----	(12.8706 10.1474)
(8.6946 -7.3914)	-----	(6.4582 -8.8314)
(8.6946 -7.3914)	-----	(12.8706 -8.5725)
(-0.2509 11.3286)	-----	(-0.2509 -7.3914)
(-0.2509 11.3286)	-----	(1.9855 -12.7686)
(-0.2509 11.3286)	-----	(9.4931 10.1474)
(-0.2509 -7.3914)	-----	(1.9855 -8.8314)
(-0.2509 -7.3914)	-----	(-9.4931 -8.5725)
(6.4582 12.7686)	-----	(1.9855 12.7686)
(6.4582 12.7686)	-----	(3.0807 16.9537)
(1.9855 12.7686)	-----	(-1.3920 16.9537)
(6.4582 -8.8314)	-----	(1.9855 -8.8314)
(6.4582 -8.8314)	-----	(3.0807 -16.1663)
(1.9855 -8.8314)	-----	(-1.3920 -16.1663)
(9.4931 8.5725)	-----	(9.4931 -10.1474)
(9.4931 8.5725)	-----	(10.3375 10.4063)
(9.4931 -10.1474)	-----	(10.3375 -11.1937)
(12.8706 10.1474)	-----	(12.8706 -8.5725)
(12.8706 10.1474)	-----	(12.0262 11.1937)
(12.8706 -8.5725)	-----	(12.0262 -10.4063)
(10.3375 10.4063)	-----	(12.0262 11.1937)
(10.3375 10.4063)	-----	(1.3920 16.1663)
(12.0262 11.1937)	-----	(3.0807 16.9537)
(10.3375 -11.1937)	-----	(1.3920 -16.1663)
(12.0262 -10.4063)	-----	(3.0807 -16.9537)
(-9.4931 10.1474)	-----	(-9.4931 -8.5725)
(-9.4931 10.1474)	-----	(-10.3375 11.1937)
(-9.4931 -8.5725)	-----	(-10.3375 -10.4063)
(-12.8706 8.5725)	-----	(-12.8706 -10.1474)
(-12.8706 8.5725)	-----	(-12.0262 10.4063)
(-12.8706 -10.1474)	-----	(-12.0262 -11.1937)
(-10.3375 11.1937)	-----	(-12.0262 10.4063)

CRISTAL SHAPE:



SCAPOLITE : ROGERS, 1937, P. 468
 TETRAGONAL SYSTEM: A:B:C=1:1: 0.6290 ALPHA=BETA=GAMMA=90, , 4 FORM(S) .
 NUMBER OF FACES OR MILLER INDICES = 16
 MILLER INDICES :

1	0	0
-1	0	0
0	1	0
0	-1	0
1	1	0
-1	1	0
-1	-1	0
1	-1	0

Apdx. 2-b, p. 238

1	1	1
-1	1	1
-1	-1	1
1	-1	1
1	1	-1
-1	1	-1
-1	-1	-1
1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X + 0.0 Y + 0.0 Z = 1
-1.0000 X + 0.0 Y + 0.0 Z = 1
0.0 X + 1.0000 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + 0.0 Z = 1
0.6667 X + 0.6667 Y + 0.0 Z = 1
-0.6667 X + 0.6667 Y + 0.0 Z = 1
-0.6667 X + -0.6667 Y + 0.0 Z = 1
0.6667 X + -0.6667 Y + 0.0 Z = 1
0.3333 X + 0.3333 Y + 0.5299 Z = 1
-0.3333 X + 0.3333 Y + 0.5299 Z = 1
-0.3333 X + -0.3333 Y + 0.5299 Z = 1
0.3333 X + -0.3333 Y + 0.5299 Z = 1
0.3333 X + 0.3333 Y + -0.5299 Z = 1
-0.3333 X + 0.3333 Y + -0.5299 Z = 1
-0.3333 X + -0.3333 Y + -0.5299 Z = 1
0.3333 X + -0.3333 Y + -0.5299 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

1.0000	0.5000	0.9435
1.0000	0.5000	-0.9435
1.0000	-0.5000	0.9435
1.0000	-0.5000	-0.9435
1.0000	0.0	1.2500
1.0000	0.0	-1.2500
-1.0000	0.5000	0.9435
-1.0000	0.5000	-0.9435
-1.0000	-0.5000	0.9435
-1.0000	-0.5000	-0.9435
-1.0000	0.0	1.2500
-1.0000	0.0	-1.2500
0.5000	1.0000	0.9435
0.5000	1.0000	-0.9435
-0.5000	1.0000	0.9435
-0.5000	1.0000	-0.9435
0.0	1.0000	1.2500
0.0	1.0000	-1.2500
-0.5000	-1.0000	0.9435
-0.5000	-1.0000	-0.9435
0.5000	-1.0000	0.9435
0.5000	-1.0000	-0.9435
0.0	-1.0000	1.2500
0.0	-1.0000	-1.2500
-0.0000	0.0	1.0000
-0.0000	0.0	-1.0000

THE 3D EDGES OF THE CRYSTAL ARE DIFFERENTIATED BY THE FOLLOWING POINTS :

1.0000	0.5000	0.9435	1.0000	0.5000	-0.9435
1.0000	0.5000	0.9435	1.0000	0.0	1.2500
1.0000	0.5000	0.9435	0.5000	1.0000	0.9435
1.0000	0.5000	-0.9435	1.0000	0.0	-1.2500
1.0000	0.5000	-0.9435	0.5000	1.0000	-0.9435
1.0000	-0.5000	0.9435	1.0000	-0.5000	-0.9435
1.0000	-0.5000	0.9435	1.0000	0.0	1.2500
1.0000	-0.5000	0.9435	0.5000	-1.0000	0.9435
1.0000	-0.5000	-0.9435	1.0000	0.0	-1.2500

(	1.0000	-0.5000	-0.9435	)	-----	(	0.5000	-1.0000	-0.9435	)
(	1.0000	0.0	1.2580	)	-----	(	-0.0000	0.0	1.8870	)
(	1.0000	0.0	-1.2580	)	-----	(	-0.0000	0.0	-1.8870	)
(	-1.0000	0.5000	0.9435	)	-----	(	-1.0000	0.5000	-0.9435	)
(	-1.0000	0.5000	0.9435	)	-----	(	-1.0000	0.0	1.2580	)
(	-1.0000	0.5000	0.9435	)	-----	(	-0.5000	1.0000	0.9435	)
(	-1.0000	0.5000	-0.9435	)	-----	(	-1.0000	0.0	-1.2580	)
(	-1.0000	0.5000	-0.9435	)	-----	(	-0.5000	1.0000	-0.9435	)
(	-1.0000	-0.5000	0.9435	)	-----	(	-1.0000	0.0	1.2580	)
(	-1.0000	-0.5000	0.9435	)	-----	(	-0.5000	-1.0000	0.9435	)
(	-1.0000	-0.5000	-0.9435	)	-----	(	-1.0000	0.0	-1.2580	)
(	-1.0000	-0.5000	-0.9435	)	-----	(	-0.5000	-1.0000	-0.9435	)
(	-1.0000	0.0	1.2580	)	-----	(	-0.0000	0.0	1.8870	)
(	-1.0000	0.0	-1.2580	)	-----	(	-0.0000	0.0	-1.8870	)
(	0.5000	1.0000	0.9435	)	-----	(	0.5000	1.0000	-0.9435	)
(	0.5000	1.0000	0.9435	)	-----	(	0.0	1.0000	1.2580	)
(	0.5000	1.0000	-0.9435	)	-----	(	0.0	1.0000	-1.2580	)
(	-0.5000	1.0000	0.9435	)	-----	(	-0.5000	1.0000	-0.9435	)
(	-0.5000	1.0000	0.9435	)	-----	(	0.0	1.0000	1.2580	)
(	-0.5000	1.0000	-0.9435	)	-----	(	0.0	1.0000	-1.2580	)
(	0.0	1.0000	1.2580	)	-----	(	-0.0000	0.0	1.8870	)
(	0.0	1.0000	-1.2580	)	-----	(	-0.0000	0.0	-1.8870	)
(	-0.5000	-1.0000	0.9435	)	-----	(	-0.5000	-1.0000	-0.9435	)
(	-0.5000	-1.0000	0.9435	)	-----	(	0.0	-1.0000	1.2580	)
(	-0.5000	-1.0000	-0.9435	)	-----	(	0.0	-1.0000	-1.2580	)
(	0.5000	-1.0000	0.9435	)	-----	(	0.5000	-1.0000	-0.9435	)
(	0.5000	-1.0000	0.9435	)	-----	(	0.0	-1.0000	1.2580	)
(	0.5000	-1.0000	-0.9435	)	-----	(	0.0	-1.0000	-1.2580	)
(	0.0	-1.0000	1.2580	)	-----	(	-0.0000	0.0	1.8870	)
(	0.0	-1.0000	-1.2580	)	-----	(	-0.0000	0.0	-1.8870	)

THE MAXIMUM IS: 1.8870 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS: 476.9478

VERTICES

476.9478	238.4740	450.0000
476.9478	238.4740	-450.0000
476.9478	-238.4740	450.0000
476.9478	-238.4740	-450.0000
476.9478	0.0	599.9998
476.9478	0.0	-599.9998
-476.9478	238.4740	450.0000
-476.9478	238.4740	-450.0000
-476.9478	-238.4740	450.0000
-476.9478	-238.4740	-450.0000
-476.9478	0.0	599.9998
-476.9478	0.0	-599.9998
238.4740	476.9478	450.0000
238.4740	476.9478	-450.0000
-238.4740	476.9478	450.0000
-238.4740	476.9478	-450.0000
0.0	476.9478	599.9998
0.0	476.9478	-599.9998
-238.4740	-476.9478	450.0000
-238.4740	-476.9478	-450.0000
238.4740	-476.9478	450.0000
238.4740	-476.9478	-450.0000
0.0	-476.9478	599.9998
0.0	-476.9478	-599.9998
-0.0001	0.0	899.9998
-0.0001	0.0	-899.9998

EDGES

1	2
1	5

1	13
2	6
2	14
3	8
3	5
3	21
4	6
4	22
5	25
6	26
7	8
7	11
7	15
8	12
8	16
9	10
9	11
9	19
10	12
10	20
11	25
12	26
13	14
13	17
14	18
15	16
15	17
16	18
17	25
18	26
19	20
19	23
20	24
21	22
21	23
22	24
23	25
24	26

FACES

1	2	6	4	3	5
7	8	12	10	9	11
13	14	18	16	15	17
19	20	24	22	21	23
1	2	14	13		
7	8	16	15		
9	10	20	19		
3	4	22	21		
1	5	25	17	13	
7	11	25	17	15	
9	11	25	23	19	
3	5	25	23	21	
2	6	26	18	14	
8	12	26	18	16	
10	12	26	24	20	
4	6	26	24	22	

THE MAXIMUM IS: 1.8869991302 THE CONVERSION FACTOR FOR VIEWPLOT IS: 4.5389547348

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS:

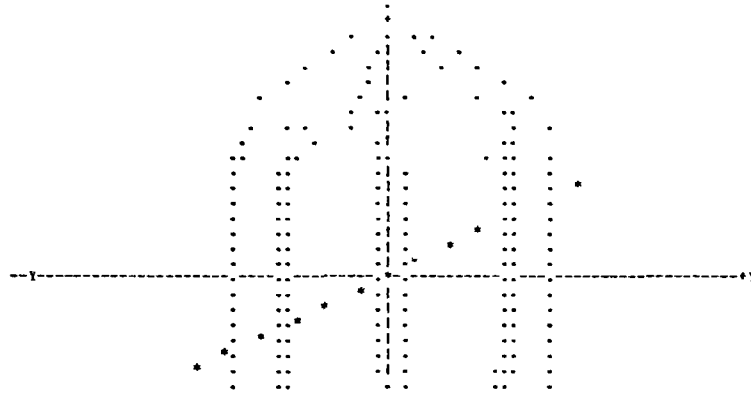
(	1.1679	7.3206	)	-----	(	1.1679	-10.6794	)
(	1.1679	7.3206	)	-----	(	-3.6016	10.3206	)
(	1.1679	7.3206	)	-----	(	7.7887	8.1603	)
(	1.1679	-10.6794	)	-----	(	-3.6016	-13.6794	)
(	1.1679	-10.6794	)	-----	(	7.7887	-9.8197	)


```

( -8.3710 7.3206 )-----(-8.1710 -10.6794 )
( -8.3710 7.3206 )-----(-3.6016 10.3206 )
( -8.3710 7.3206 )-----(-11.3397 8.1603 )
( -8.3710 -10.6794 )-----(-3.6016 -11.6794 )
( -8.3710 -10.6794 )-----(-11.3397 -9.8397 )
( -3.6016 10.3206 )-----(-0.0000 18.0000 )
( -3.6016 -10.3206 )-----(-0.0000 -18.0000 )
( 8.3710 10.6794 )-----(-3.6016 11.6794 )
( 8.3710 10.6794 )-----(-11.3397 9.8397 )
( 8.3710 -10.6794 )-----(-3.6016 -10.3206 )
( 8.3710 -10.6794 )-----(-11.3397 -8.1603 )
( -1.1679 10.6794 )-----(-1.1679 -7.3206 )
( -1.1679 10.6794 )-----(-3.6016 13.6794 )
( -1.1679 10.6794 )-----(-7.7382 9.8397 )
( -1.1679 -7.3206 )-----(-3.6016 -10.3206 )
( -1.1679 -7.3206 )-----(-7.7382 -8.1603 )
( 3.6016 11.6794 )-----(-0.0000 18.0000 )
( 3.6016 -10.3206 )-----(-0.0000 -18.0000 )
( 7.7382 8.1603 )-----(-7.7382 -9.8397 )
( 7.7382 8.1603 )-----(-9.5390 12.0000 )
( 7.7382 -9.8397 )-----(-9.5390 -12.0000 )
( 11.3397 9.8397 )-----(-11.3397 -8.1603 )
( 11.3397 9.8397 )-----(-9.5390 12.0000 )
( 11.3397 -8.1603 )-----(-9.5390 -12.0000 )
( 9.5390 12.0000 )-----(-0.0000 18.0000 )
( 9.5390 -12.0000 )-----(-0.0000 -18.0000 )
( -7.7382 9.8397 )-----(-7.7382 -9.1603 )
( -7.7382 9.8397 )-----(-9.5390 12.0000 )
( -7.7382 -8.1603 )-----(-9.5390 -12.0000 )
( -11.3397 8.1603 )-----(-11.3397 -9.8397 )
( -11.3397 8.1603 )-----(-9.5390 12.0000 )
( -11.3397 -9.8397 )-----(-9.5390 -12.0000 )
( -9.5390 12.0000 )-----(-0.0000 18.0000 )
( -9.5390 -12.0000 )-----(-0.0000 -18.0000 )

```

CRYSTAL SHAPE:



SILLIMANITE : DEER HOWIE AND ZUSSMAN, 1967, P.34
 TRICLINIC SYSTEM : A:B:C= 0.9802: 1.0000: 0.7575 , ALPHA=90, , 3 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 8
 MILLER INDICES :

```

1 1 0
-1 1 0
-1 -1 0
1 -1 0
0 1 0
0 -1 0
0 0 1
0 0 -1

```

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

```

1.0202 X + 1.0000 Y + 0.0 Z = 1
-1.0202 X + 1.0000 Y + 0.0 Z = -1
-1.0202 X + -1.0000 Y + 0.0 Z = -1
1.0202 X + -1.0000 Y + 0.0 Z = 1
0.0 X + 1.2500 Y + 0.0 Z = 1
0.0 X + -1.2500 Y + 0.0 Z = -1
0.0 X + 0.0 Y + 0.5281 Z = 1
0.0 X + 0.0 Y + -0.5281 Z = -1

```

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

```

( 0.9802 0.0 1.8938 )
( 0.9802 0.0 -1.8938 )
( 0.1960 0.8000 1.8937 )
( 0.1960 0.8000 -1.8937 )
( -0.9802 0.0 1.8938 )
( -0.9802 0.0 -1.8938 )
( -0.1960 0.8000 1.8937 )
( -0.1960 0.8000 -1.8937 )
( -0.1960 -0.8000 1.8937 )
( -0.1960 -0.8000 -1.8937 )
( 0.1960 -0.8000 1.8937 )
( 0.1960 -0.8000 -1.8937 )

```

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :

```

( 0.9802 0.0 1.8938 )-----(-0.9802 0.0 -1.8938 )
( 0.9802 0.0 1.8938 )-----(-0.1960 0.8000 1.8937 )
( 0.9802 0.0 1.8938 )-----(-0.1960 -0.8000 1.8937 )
( 0.9802 0.0 -1.8938 )-----(-0.1960 0.8000 -1.8937 )
( 0.9802 0.0 -1.8938 )-----(-0.1960 -0.8000 -1.8937 )
( 0.1960 0.8000 1.8937 )-----(-0.1960 0.8000 -1.8937 )
( 0.1960 0.8000 1.8937 )-----(-0.1960 -0.8000 1.8937 )
( 0.1960 0.8000 1.8937 )-----(-0.1960 -0.8000 -1.8937 )
( -0.9802 0.0 1.8938 )-----(-0.9802 0.0 -1.8938 )
( -0.9802 0.0 1.8938 )-----(-0.1960 0.8000 1.8937 )
( -0.9802 0.0 1.8938 )-----(-0.1960 -0.8000 1.8937 )
( -0.9802 0.0 -1.8938 )-----(-0.1960 0.8000 -1.8937 )
( -0.9802 0.0 -1.8938 )-----(-0.1960 -0.8000 -1.8937 )
( -0.1960 0.8000 1.8937 )-----(-0.1960 0.8000 -1.8937 )
( -0.1960 0.8000 1.8937 )-----(-0.1960 -0.8000 1.8937 )
( -0.1960 0.8000 1.8937 )-----(-0.1960 -0.8000 -1.8937 )
( -0.1960 -0.8000 1.8937 )-----(-0.1960 -0.8000 -1.8937 )
( -0.1960 -0.8000 1.8937 )-----(-0.1960 0.8000 1.8937 )
( -0.1960 -0.8000 1.8937 )-----(-0.1960 0.8000 -1.8937 )

```

Apdx. 2-b, p. 243

THE MAXIMUM IS: (0.1960 -0.0000 1.0000)----- (0.1960 -0.0000 -1.0000)
 1.0000 THE CONVERSION FACTOR FOR THE PPIETER GRAPH IS : 475.2473

VERTICES
 465.0374 0.0 -899.9995
 465.0374 0.0 -899.9995
 93.1675 380.1978 -899.9990
 93.1675 380.1978 -899.9990
 -465.0374 0.0 -899.9995
 -465.0374 0.0 -899.9995
 -93.1675 380.1978 -899.9990
 -93.1675 380.1978 -899.9990
 -93.1675 -380.1978 -899.9990
 -93.1675 -380.1978 -899.9990
 93.1675 -380.1978 -899.9990
 93.1675 -380.1978 -899.9990

EDGES
 1 2
 1 3
 1 11
 2 4
 2 12
 3 4
 3 7
 4 8
 5 6
 5 7
 5 9
 6 8
 6 10
 7 8
 9 10
 9 11
 10 12
 11 12

FACES
 1 2 4 3
 5 6 8 7
 5 6 10 9
 1 2 12 11
 3 4 8 7
 9 10 12 11
 1 3 7 5
 2 4 8 6

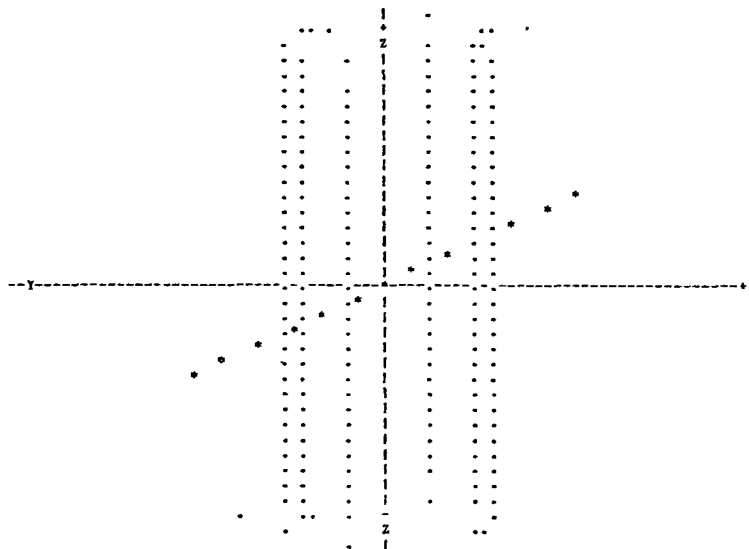
THE MAXIMUM IS: 2.0663194656 THE CONVERSION FACTOR FOR VIEWPIOT IS : 8.7111406326

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
 (-3.2239 14.9934)----- (-3.2239 -18.0000)
 (-3.2239 14.9934)----- (6.3241 16.1960)
 (-3.2239 14.9934)----- (-7.6137 16.1960)
 (-3.2239 -18.0000)----- (6.3241 -16.7974)
 (-3.2239 -18.0000)----- (-7.6137 -16.7974)
 (6.3241 16.1960)----- (6.3241 -16.7974)
 (6.3241 16.1960)----- (7.6137 16.7974)
 (6.3241 -16.7974)----- (7.6137 -16.1960)
 (3.2239 18.0000)----- (3.2239 -14.9934)
 (3.2239 18.0000)----- (7.6137 16.7974)
 (3.2239 18.0000)----- (-6.3241 16.7974)
 (3.2239 -14.9934)----- (7.6137 -16.1960)
 (3.2239 -14.9934)----- (-6.3241 -16.1960)
 (7.6137 16.7974)----- (7.6137 -16.1960)
 (-6.3241 16.7974)----- (-6.3241 -16.1960)
 (-6.3241 16.7974)----- (-7.6137 16.1960)
 (-6.3241 -16.1960)----- (-7.6137 -16.7974)

CRYSTAL SHAPE:

(-7.6137 16.1960)----- (-7.6137 -16.7974)

Apdx. 2-b, p. 244



SODALITE : ROGERS, 1937, p. 441
 ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 1 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 12
 MILLER INDICES :

0	1	1
1	0	1
1	1	0
0	-1	1
-1	0	1
-1	1	0
0	1	-1
1	0	-1
1	-1	0
0	-1	-1
-1	0	-1
-1	-1	0

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

0.0	X +	1.0000	Y +	1.0000	Z =	1
1.0000	X +	0.0	Y +	1.0000	Z =	1
1.0000	X +	1.0000	Y +	0.0	Z =	1
0.0	Y +	-1.0000	Y +	1.0000	Z =	1
-1.0000	X +	0.0	Y +	1.0000	Z =	1
-1.0000	Y +	1.0000	Y +	0.0	Z =	1
0.0	Y +	1.0000	Y +	-1.0000	Z =	1

```

1.0000 X + 0.0 Y + -1.0000 Z = 1
1.0000 X + -1.0000 Y + 0.0 Z = 1
0.0 X + -1.0000 Y + -1.0000 Z = 1
-1.0000 X + 0.0 Y + -1.0000 Z = 1
-1.0000 X + -1.0000 Y + 0.0 Z = 1
THE POSITIONS OF THE CRYSTAL VERTICES ARE :
( 0.5000 0.5000 0.5000 )
( 0.0 0.0 1.0000 )
( 0.0 1.0000 0.0 )
( -0.5000 0.5000 0.5000 )
( 1.0000 0.0 0.0 )
( 0.5000 -0.5000 0.5000 )
( 0.5000 0.5000 -0.5000 )
( -0.5000 -0.5000 0.5000 )
( 0.0 -1.0000 0.0 )
( -1.0000 0.0 0.0 )
( -0.5000 0.5000 -0.5000 )
( 0.0 0.0 -1.0000 )
( 0.5000 -0.5000 -0.5000 )
( -0.5000 -0.5000 -0.5000 )
THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.5000 0.5000 0.5000 )----- ( 0.0 0.0 1.0000 )
( 0.5000 0.5000 0.5000 )----- ( 0.0 1.0000 0.0 )
( 0.5000 0.5000 0.5000 )----- ( 1.0000 0.0 0.0 )
( 0.0 0.0 1.0000 )----- ( -0.5000 0.5000 0.5000 )
( 0.0 0.0 1.0000 )----- ( 0.5000 -0.5000 0.5000 )
( 0.0 1.0000 0.0 )----- ( -0.5000 0.5000 0.5000 )
( 0.0 1.0000 0.0 )----- ( -0.5000 0.5000 -0.5000 )
( 0.0 1.0000 0.0 )----- ( 0.5000 0.5000 -0.5000 )
( -0.5000 0.5000 0.5000 )----- ( -1.0000 0.0 0.0 )
( 1.0000 0.0 0.0 )----- ( 0.5000 -0.5000 0.5000 )
( 1.0000 0.0 0.0 )----- ( 0.5000 0.5000 -0.5000 )
( 1.0000 0.0 0.0 )----- ( 0.5000 -0.5000 -0.5000 )
( 0.5000 -0.5000 0.5000 )----- ( 0.0 -1.0000 0.0 )
( 0.5000 0.5000 -0.5000 )----- ( 0.0 0.0 -1.0000 )
( -0.5000 -0.5000 0.5000 )----- ( 0.0 -1.0000 0.0 )
( -0.5000 -0.5000 0.5000 )----- ( -1.0000 0.0 0.0 )
( 0.0 -1.0000 0.0 )----- ( 0.5000 -0.5000 -0.5000 )
( 0.0 -1.0000 0.0 )----- ( -0.5000 0.5000 -0.5000 )
( -1.0000 0.0 0.0 )----- ( -0.5000 0.5000 -0.5000 )
( -1.0000 0.0 0.0 )----- ( -0.5000 -0.5000 -0.5000 )
( -0.5000 0.5000 -0.5000 )----- ( 0.0 0.0 -1.0000 )
( 0.0 0.0 -1.0000 )----- ( 0.5000 -0.5000 -0.5000 )
( 0.0 0.0 -1.0000 )----- ( -0.5000 -0.5000 -0.5000 )
THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PINTER GRAPH IS : 900.0000
VERTICES
450.0000 450.0000 450.0000
0.0 0.0 900.0000
0.0 900.0000 0.0
-450.0000 450.0000 450.0000
900.0000 0.0 0.0
450.0000 -450.0000 450.0000
450.0000 450.0000 -450.0000
-450.0000 -450.0000 450.0000
0.0 -900.0000 0.0
-900.0000 0.0 0.0
-450.0000 450.0000 -450.0000
0.0 0.0 -900.0000
450.0000 -450.0000 -450.0000
-450.0000 -450.0000 -450.0000
EDGES

```

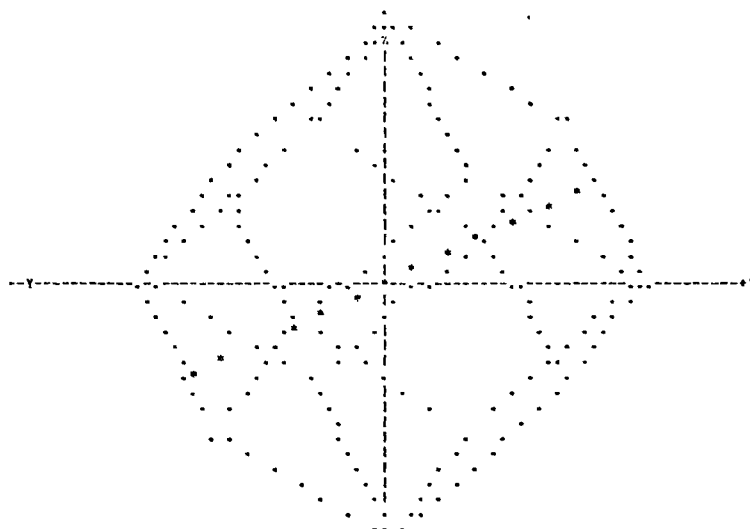
```

1 2
1 3
1 5
2 4
2 6
2 8
3 4
3 7
3 11
4 10
5 6
5 7
5 13
6 9
7 12
8 9
8 10
9 13
9 14
10 11
10 14
11 12
12 13
12 14
FACES
1 2 4 3
1 2 6 5
1 3 7 5
2 6 9 8
2 4 10 8
3 4 10 11
3 7 12 11
5 7 12 13
5 6 9 13
9 13 12 14
10 11 12 14
8 9 14 10
THE MAXIMUM IS: 1.0000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.0000000000
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 5.6019 7.4155 )----- ( 0.0 18.0000 )
( 5.6019 7.4155 )----- ( 18.0000 0.0 )
( 5.6019 7.4155 )----- ( -6.7962 -3.1690 )
( 0.0 18.0000 )----- ( 12.3981 10.5845 )
( 0.0 18.0000 )----- ( -12.3981 7.4155 )
( 0.0 18.0000 )----- ( -5.6019 10.5845 )
( 18.0000 0.0 )----- ( 12.3981 10.5845 )
( 18.0000 0.0 )----- ( 5.6019 -10.5845 )
( 18.0000 0.0 )----- ( 12.3981 -7.4155 )
( 12.3981 10.5845 )----- ( 6.7962 3.1690 )
( -6.7962 -3.1690 )----- ( -12.3981 7.4155 )
( -6.7962 -3.1690 )----- ( 5.6019 -10.5845 )
( -6.7962 -3.1690 )----- ( -12.3981 -10.5845 )
( -12.3981 7.4155 )----- ( -18.0000 0.0 )
( 5.6019 -10.5845 )----- ( 0.0 -18.0000 )
( -5.6019 10.5845 )----- ( -18.0000 0.0 )
( -5.6019 10.5845 )----- ( 6.7962 3.1690 )
( -18.0000 0.0 )----- ( -12.3981 -10.5845 )
( -18.0000 0.0 )----- ( -5.6019 -7.4155 )
( 6.7962 3.1690 )----- ( 12.3981 -7.4155 )
( 6.7962 3.1690 )----- ( 5.6019 -7.4155 )
( 12.3981 -7.4155 )----- ( 0.0 -18.0000 )
( 0.0 -18.0000 )----- ( -12.3981 -10.5845 )

```

CRYSTAL SHAPE:

(0.0 -14.0000)----- (-5.6019 -7.4114)



SPHENF : MASON AND BERRY , 1968, P. 507
 MONOCLINIC SYSTEM : A:B:C= 0.7530: 1.0000: 0.8540 , ALPHA=GAMMA=90, BETA= 119.6600 , 3 FOR*(S).
 NUMBER OF FACES OR MILLER INDICES = 10
 MILLER INDICES :

1	1	1
-1	1	-1
-1	-1	-1
1	-1	1
1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	0	1
0	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

2.1951 X +	1.0000 Y +	1.1710 Z =	1
-2.1951 X +	1.0000 Y +	-1.1710 Z =	1
-2.1951 X +	-1.0000 Y +	-1.1710 Z =	1
2.1951 X +	-1.0000 Y +	1.1710 Z =	1
1.5283 X +	1.0000 Y +	0.0 Z =	1
-1.5283 X +	1.0000 Y +	0.0 Z =	1
-1.5283 X +	-1.0000 Y +	0.0 Z =	1
1.5283 X +	-1.0000 Y +	0.0 Z =	1
1.1114 X +	0.0 Y +	1.9516 Z =	1

Apdx. 2-b, p. 248

-1.1114 X + 0.0 Y + -1.9516 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.0	1.0000	0.0	)
(	0.6543	0.0000	-0.3726	)
(	0.2617	0.0000	0.3633	)
(	-0.1963	0.7000	0.6242	)
(	-0.6543	0.0000	0.3726	)
(	-0.2617	0.0000	-0.3633	)
(	0.1963	0.7000	-0.6242	)
(	0.0	-1.0000	0.0	)
(	0.1963	-0.7000	-0.6242	)
(	-0.1963	-0.7000	0.6242	)
(	0.6543	0.0	-0.8850	)
(	-0.6543	0.0	0.8850	)

THE 3D EDGES OF THE CRYSTAL ARE DEFINED BY THE FOLLOWING POINTS :

(	0.0	1.0000	0.0	)	-----	(	0.6543	0.0000	-0.3726	)
(	0.0	1.0000	0.0	)	-----	(	-0.1963	0.7000	0.6242	)
(	0.0	1.0000	0.0	)	-----	(	-0.6543	0.0000	0.3726	)
(	0.0	1.0000	0.0	)	-----	(	0.1963	0.7000	-0.6242	)
(	0.6543	0.0000	-0.3726	)	-----	(	0.2617	0.0000	0.3633	)
(	0.6543	0.0000	-0.3726	)	-----	(	0.0	-1.0000	0.0	)
(	0.6543	0.0000	-0.3726	)	-----	(	0.6543	0.0	-0.8850	)
(	0.2617	0.0000	0.3633	)	-----	(	-0.1963	0.7000	0.6242	)
(	0.2617	0.0000	0.3633	)	-----	(	-0.1963	-0.7000	0.6242	)
(	-0.1963	0.7000	0.6242	)	-----	(	-0.6543	0.0	0.8850	)
(	-0.6543	0.0000	0.3726	)	-----	(	-0.2617	0.0000	-0.3633	)
(	-0.6543	0.0000	0.3726	)	-----	(	0.0	-1.0000	0.0	)
(	-0.6543	0.0000	0.3726	)	-----	(	-0.6543	0.0	0.8850	)
(	-0.2617	0.0000	-0.3633	)	-----	(	0.1963	0.7000	-0.6242	)
(	-0.2617	0.0000	-0.3633	)	-----	(	0.1963	-0.7000	-0.6242	)
(	0.1963	0.7000	-0.6242	)	-----	(	0.6543	0.0	-0.8850	)
(	0.0	-1.0000	0.0	)	-----	(	-0.1963	-0.7000	0.6242	)
(	0.0	-1.0000	0.0	)	-----	(	-0.1963	-0.7000	0.6242	)
(	0.1963	-0.7000	-0.6242	)	-----	(	0.6543	0.0	-0.8850	)
(	-0.1963	-0.7000	0.6242	)	-----	(	-0.6543	0.0	0.8850	)

THE MAXIMUM IS:

1.0000

THE CONVERSION FACTOR FOR THE P-INT: GRAPH IS :

900.0000

VERTICES

0.0	900.0000	0.0
508.9065	0.0000	-335.3567
235.5641	0.0001	327.0144
-176.6723	629.9993	561.7686
-508.9065	0.0000	335.3567
-235.5641	0.0001	-327.0144
176.6723	629.9993	-561.7686
0.0	-900.0000	0.0
176.6723	-629.9993	-561.7686
-176.6723	-629.9993	561.7686
508.9065	0.0	-796.5215
-508.9065	0.0	796.5215

EDGES

1	2
1	4
1	5
1	7
2	3
2	8
2	11
3	4
3	10
4	12
5	6
5	8

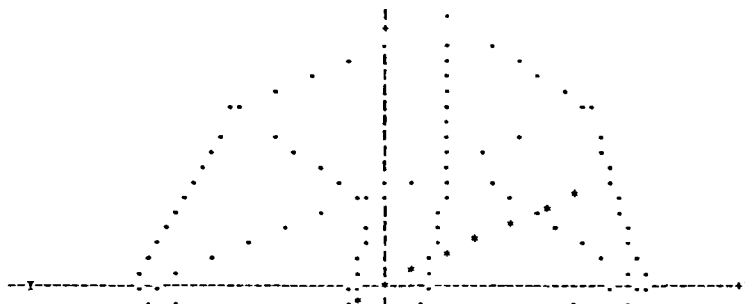
5 12
6 7
6 9
7 11
8 9
8 10
9 11
10 12
FACES
1 2 3 4
1 5 6 7
5 6 9 8
2 3 10 8
1 2 11 7
1 4 12 5
5 8 10 12
2 8 9 11
3 4 12 10
6 7 11 9

THE MAXIMUM IS: 1.0002231598 THE CONVERSION FACTOR FOR WILFLOT IS : 17.9959/16797

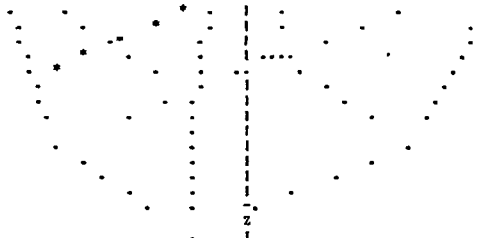
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(17.9960 0.0)	-----	(-4.4460 -8.7788)
(17.9960 0.0)	-----	(13.9310 11.8548)
(17.9960 0.0)	-----	(4.4460 8.7788)
(17.9960 0.0)	-----	(11.2634 -11.8548)
(-4.4460 -8.7788)	-----	(-1.7784 5.7096)
(-4.4460 -8.7788)	-----	(-17.9960 0.0)
(-4.4460 -8.7788)	-----	(-4.4460 -18.0000)
(-1.7784 5.7096)	-----	(13.9310 11.8548)
(-1.7784 5.7096)	-----	(-11.2634 11.8548)
(13.9310 11.8548)	-----	(4.4460 18.0000)
(4.4460 8.7788)	-----	(1.7784 -5.7096)
(4.4460 8.7788)	-----	(-17.9960 0.0)
(4.4460 8.7788)	-----	(4.4460 18.0000)
(1.7784 -5.7096)	-----	(11.2634 -11.8548)
(1.7784 -5.7096)	-----	(13.9310 -11.8548)
(11.2634 -11.8548)	-----	(-4.4460 -18.0000)
(-17.9960 0.0)	-----	(-13.9310 -11.8548)
(-17.9960 0.0)	-----	(-11.2634 11.8548)
(-13.9310 -11.8548)	-----	(-4.4460 18.0000)
(-11.2634 11.8548)	-----	(4.4460 18.0000)

CRYSTAL SHAPE:



Apdx. 2-b, p. 250



SPINEL MAGNETITE CHROMITE FRANKLINITE : MASON AND BERRY, 1968, p. 281,282,285
ISOMETRIC SYSTEM: A=B=C, ALPHA=BETA=GAMMA=90, 1 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 8
MILLER INDICES :

1	1	1
-1	1	1
-1	-1	1
1	-1	1
1	1	-1
-1	1	-1
-1	-1	-1
1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X +	1.0000 Y +	1.0000 Z = 1
-1.0000 X +	1.0000 Y +	1.0000 Z = 1
-1.0000 X +	-1.0000 Y +	1.0000 Z = 1
1.0000 X +	-1.0000 Y +	1.0000 Z = 1
1.0000 X +	1.0000 Y +	-1.0000 Z = 1
-1.0000 X +	1.0000 Y +	-1.0000 Z = 1
-1.0000 X +	-1.0000 Y +	-1.0000 Z = 1
1.0000 Y +	-1.0000 Y +	-1.0000 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(0.0 0.0 1.0000)
(0.0 1.0000 0.0)
(1.0000 0.0 0.0)
(-1.0000 0.0 0.0)
(0.0 -1.0000 0.0)
(0.0 0.0 -1.0000)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(0.0 0.0 1.0000)	-----	(0.0 1.0000 0.0)
(0.0 0.0 1.0000)	-----	(1.0000 0.0 0.0)
(0.0 0.0 1.0000)	-----	(-1.0000 0.0 0.0)
(0.0 0.0 1.0000)	-----	(0.0 -1.0000 0.0)
(0.0 1.0000 0.0)	-----	(1.0000 0.0 0.0)
(0.0 1.0000 0.0)	-----	(-1.0000 0.0 0.0)
(0.0 1.0000 0.0)	-----	(0.0 0.0 -1.0000)
(1.0000 0.0 0.0)	-----	(0.0 0.0 -1.0000)
(-1.0000 0.0 0.0)	-----	(0.0 0.0 -1.0000)
(-1.0000 0.0 0.0)	-----	(0.0 0.0 1.0000)
(-1.0000 0.0 0.0)	-----	(0.0 0.0 1.0000)

THE MAXIMUM IS: 1.0000 THE CONVERSION FACTOR FOR THE PRINTED GRAPH IS : 900.0000

VERTICALS
0.0 0.0 900.0000
0.0 900.0000 0.0
900.0000 0.0 0.0

-900.0000 0.0 0.0
0.0 -900.0000 0.0
0.0 0.0 -900.0000

FACES

1 2
1 3
1 4
1 5
2 3
2 4
2 5
3 5
3 6
4 5
4 6
5 6

FACES

1 2 3
1 2 4
1 4 5
1 3 5
2 3 6
2 4 6
4 5 6
3 5 6

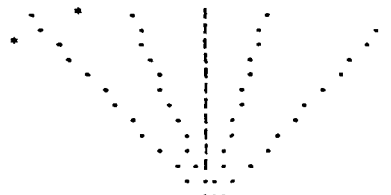
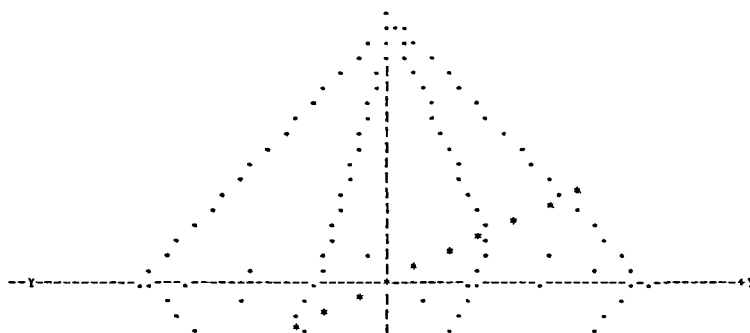
THE MAXIMUM IS:

1.0000000000 THE CONVERSION FACTOR FOR VIEWPLOT IS : 18.0000000000

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS -

(0.0 18.0000)	-----	(18.0000 0.0)
(0.0 18.0000)	-----	(-6.7962 -3.1690)
(0.0 18.0000)	-----	(6.7962 3.1690)
(0.0 18.0000)	-----	(-18.0000 0.0)
(18.0000 0.0)	-----	(-6.7962 -3.1690)
(18.0000 0.0)	-----	(6.7962 3.1690)
(18.0000 0.0)	-----	(0.0 -18.0000)
(-6.7962 -3.1690)	-----	(-18.0000 0.0)
(-6.7962 -3.1690)	-----	(0.0 -18.0000)
(6.7962 3.1690)	-----	(-18.0000 0.0)
(6.7962 3.1690)	-----	(0.0 -18.0000)
(-18.0000 0.0)	-----	(0.0 -18.0000)

CRYSTAL SHAPE:



SPODUMENE : AXIAL RATIOS : MASOV AND DEFRY, 1968, P. 474
FORMS : DEER HOWIE AND ZUSSMAN, 1967, P. 136
MONOCLINIC SYSTEM : A:B:C= 1.1440: 1.0000: 0.6310, ALPHA=97.999, BETA= 110.3333, 6 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 18
MILLER INDICES :

1	0	0
-1	0	0
0	1	0
0	-1	0
1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	0	1
0	0	-1
0	2	1
0	-2	1
0	2	-1
0	-2	-1
-2	2	1
-2	-2	1
2	2	-1
2	-2	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

-0.9322 X +	0.0 Y +	0.0 Z =	1
-0.9322 X +	0.0 Y +	0.0 Z =	1
0.0 X +	1.0000 Y +	0.0 Z =	1
0.0 X +	-1.0000 Y +	0.0 Z =	1
0.5826 X +	0.6250 Y +	0.0 Z =	1
-0.5826 X +	0.6250 Y +	0.0 Z =	1
-0.5826 X +	-0.6250 Y +	0.0 Z =	1
0.5826 X +	-0.6250 Y +	0.0 Z =	1
0.1958 X +	0.0 Y +	0.5283 Z =	1
-0.1958 X +	0.0 Y +	-0.5283 Z =	1
0.1468 X +	0.5000 Y +	0.3962 Z =	1
0.1468 X +	-0.5000 Y +	0.3962 Z =	1
-0.1468 X +	0.5000 Y +	-0.3962 Z =	1
-0.1468 X +	-0.5000 Y +	-0.3962 Z =	1
-0.2838 X +	0.4444 Y +	0.3572 Z =	1
-0.2838 X +	-0.4444 Y +	0.3572 Z =	1
0.2838 X +	0.4444 Y +	-0.3572 Z =	1
0.2838 X +	-0.4444 Y +	-0.3572 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(1.0727	0.0000	1.3693
(1.0727	0.0000	-1.2178
(1.0727	-0.6000	1.3693
(1.0727	-0.6000	-1.2178
(1.0727	0.6000	1.3693

(	1.0727	-0.5000	1.4955	)
(	1.0727	0.0	-1.9750	)
(	-1.0727	0.6000	-1.3693	)
(	-1.0727	0.6000	1.2178	)
(	-1.0727	-0.6000	-1.3693	)
(	-1.0727	-0.6000	1.2178	)
(	-1.0727	0.5000	-1.4955	)
(	-1.0727	-0.5000	-1.4955	)
(	-1.0727	0.0	1.9750	)
(	0.6436	1.0000	1.0235	)
(	0.6436	1.0000	-1.0588	)
(	-0.6436	1.0000	-1.0235	)
(	-0.6436	1.0000	1.0588	)
(	-0.2682	1.0000	1.3614	)
(	-0.2682	-1.0000	-1.3614	)
(	-0.6436	-1.0000	-1.0235	)
(	-0.6436	-1.0000	1.0588	)
(	0.6436	-1.0000	1.0235	)
(	0.6436	-1.0000	-1.0588	)
(	-0.2682	-1.0000	1.3614	)
(	-0.2682	-1.0000	-1.3614	)
(	-0.2682	0.5000	1.9924	)
(	-0.2682	-0.5000	1.9924	)
(	-0.8045	0.0	2.1911	)
(	0.2682	0.5000	-1.9924	)
(	0.2682	-0.5000	-1.9924	)
(	0.8045	0.0	-2.1911	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	1.0727	0.6000	1.3693	)	-----	(	1.0727	0.6000	-1.2178	)
(	1.0727	0.6000	1.3693	)	-----	(	1.0727	0.5000	1.4955	)
(	1.0727	0.6000	1.3693	)	-----	(	0.6436	1.0000	1.0235	)
(	1.0727	0.6000	-1.2178	)	-----	(	1.0727	0.0	-1.9750	)
(	1.0727	0.6000	-1.2178	)	-----	(	0.6436	1.0000	-1.0588	)
(	1.0727	-0.6000	1.3693	)	-----	(	1.0727	-0.5000	-1.2178	)
(	1.0727	-0.6000	1.3693	)	-----	(	1.0727	-0.5000	1.4955	)
(	1.0727	-0.6000	1.3693	)	-----	(	0.6436	-1.0000	1.0235	)
(	1.0727	-0.6000	-1.2178	)	-----	(	1.0727	0.0	-1.9750	)
(	1.0727	-0.6000	-1.2178	)	-----	(	0.6436	-1.0000	-1.0588	)
(	1.0727	0.5000	1.4955	)	-----	(	1.0727	-0.5000	1.4955	)
(	1.0727	0.5000	1.4955	)	-----	(	-0.2682	0.5000	1.9924	)
(	1.0727	-0.5000	1.4955	)	-----	(	-0.2682	-0.5000	1.9924	)
(	1.0727	0.0	-1.9750	)	-----	(	0.8045	0.0	-2.1911	)
(	-1.0727	0.6000	-1.3693	)	-----	(	-1.0727	0.6000	1.2178	)
(	-1.0727	0.6000	-1.3693	)	-----	(	-1.0727	0.5000	-1.4955	)
(	-1.0727	0.6000	-1.3693	)	-----	(	-0.6436	1.0000	-1.0235	)
(	-1.0727	0.6000	1.2178	)	-----	(	-1.0727	0.0	1.9750	)
(	-1.0727	0.6000	1.2178	)	-----	(	-0.6436	1.0000	1.0588	)
(	-1.0727	-0.6000	-1.3693	)	-----	(	-1.0727	-0.6000	1.2178	)
(	-1.0727	-0.6000	-1.3693	)	-----	(	-1.0727	-0.5000	-1.4955	)
(	-1.0727	-0.6000	-1.3693	)	-----	(	-0.6436	-1.0000	-1.0235	)
(	-1.0727	-0.6000	1.2178	)	-----	(	-1.0727	0.0	1.9750	)
(	-1.0727	-0.6000	1.2178	)	-----	(	-0.6436	-1.0000	1.0588	)
(	-1.0727	0.5000	1.4955	)	-----	(	-1.0727	-0.5000	-1.4955	)
(	-1.0727	0.5000	-1.4955	)	-----	(	0.2682	0.5000	-1.9924	)
(	-1.0727	-0.5000	-1.4955	)	-----	(	0.2682	-0.5000	-1.9924	)
(	-1.0727	0.0	1.9750	)	-----	(	-0.8045	0.0	2.1911	)
(	0.6436	1.0000	1.0235	)	-----	(	0.6436	1.0000	-1.0588	)
(	0.6436	1.0000	1.0235	)	-----	(	-0.2682	1.0000	1.3614	)
(	0.6436	1.0000	-1.0588	)	-----	(	0.2682	1.0000	-1.3614	)
(	-0.6436	1.0000	-1.0235	)	-----	(	-0.6436	1.0000	1.0588	)
(	-0.6436	1.0000	-1.0235	)	-----	(	0.2682	1.0000	-1.3614	)
(	-0.6436	1.0000	1.0588	)	-----	(	-0.2682	1.0000	1.3614	)

(	-0.2682	1.0000	1.3614	)	-----	(	-0.2682	0.5000	1.9924	)
(	0.2682	1.0000	-1.3614	)	-----	(	0.2682	0.5000	-1.9924	)
(	-0.6436	-1.0000	-1.0235	)	-----	(	-0.6436	-1.0000	1.0588	)
(	-0.6436	-1.0000	-1.0235	)	-----	(	0.2682	-1.0000	-1.3614	)
(	-0.6436	-1.0000	1.0588	)	-----	(	-0.2682	-1.0000	1.3614	)
(	0.6436	-1.0000	1.0235	)	-----	(	0.6436	-1.0000	-1.0588	)
(	0.6436	-1.0000	1.0235	)	-----	(	-0.2682	-1.0000	1.3614	)
(	0.6436	-1.0000	-1.0588	)	-----	(	0.2682	-1.0000	-1.3614	)
(	-0.2682	-1.0000	1.3614	)	-----	(	-0.2682	-0.5000	1.9924	)
(	-0.2682	-1.0000	1.3614	)	-----	(	0.2682	-0.5000	-1.9924	)
(	-0.2682	0.5000	1.9924	)	-----	(	-0.8045	0.0	2.1911	)
(	-0.2682	0.5000	1.9924	)	-----	(	-0.8045	0.0	-2.1911	)
(	0.2682	0.5000	-1.9924	)	-----	(	0.8045	0.0	-2.1911	)
(	0.2682	-0.5000	-1.9924	)	-----	(	0.8045	0.0	2.1911	)

THE MAXIMUM IS:

2.1911

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS :

410.7454

VERTICES

440.6118	246.4471	562.4260
440.6118	246.4471	-500.2124
440.6118	-246.4471	562.4260
440.6118	-246.4471	-500.2124
440.6118	205.3727	614.2620
440.6118	-205.3727	614.2620
440.6118	0.0	-811.2288
-440.6118	246.4471	-562.4260
-440.6118	246.4471	500.2124
-440.6118	-246.4471	-562.4260
-440.6118	-246.4471	500.2124
-440.6118	205.3727	-614.2620
-440.6118	-205.3727	-614.2620
-440.6118	0.0	811.2288
264.3669	410.7454	420.3933
264.3669	410.7454	-434.9014
-264.3669	410.7454	-420.3933
-264.3669	410.7454	434.9014
-110.1530	410.7454	559.1802
110.1530	410.7454	-559.1802
-264.3669	-410.7454	-420.3933
-264.3669	-410.7454	434.9014
264.3669	-410.7454	420.3933
264.3669	-410.7454	-434.9014
-110.1530	-410.7454	559.1802
110.1530	-410.7454	-559.1802
-110.1529	205.3727	818.3604
-110.1529	-205.3727	818.3604
-330.4507	0.0	899.9998
110.1529	205.3727	-818.3604
110.1529	-205.3727	-818.3604
330.4507	0.0	-899.9998

EDGES

1	2
1	5
1	15
2	7
2	16
3	4
3	6
3	23
4	7
4	24
5	6
5	27
6	28

7 32
8 9
8 12
8 17
9 14
9 18
10 11
10 13
10 21
11 14
11 22
12 13
12 30
13 31
14 29
15 16
15 19
16 20
17 18
17 20
18 19
19 27
20 30
21 22
21 26
22 25
23 24
23 25
24 26
25 28
26 31
27 29
28 29
30 32
31 32

FACES

1	2	7	4	3	6	5
8	9	14	11	10	13	12
15	16	20	17	18	19	
21	22	25	23	24	26	
1	2	16	15			
8	9	18	17			
10	11	22	21			
3	4	24	23			
5	6	28	29	27		
12	13	31	32	30		
1	5	27	19	15		
3	6	28	25	23		
8	12	30	20	17		
10	13	31	26	21		
9	14	29	27	19	18	
11	14	29	28	25	22	
2	7	32	30	20	16	
4	7	32	31	26	24	

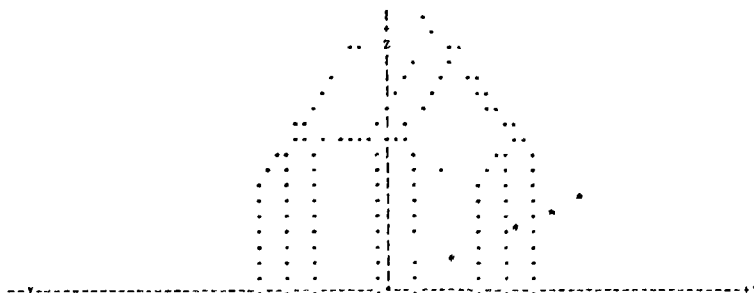
THE MAXIMUM IS: 2.3327798843 THE CONVERSION FACTOR FOR VIEWPLOT IS : 7.7161149979

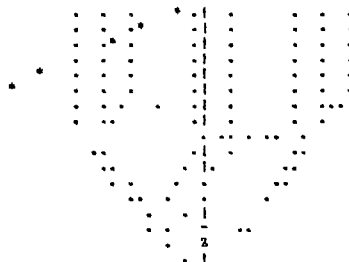
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(1.5045	9.1083	)-----	(1.5045	-10.8540	)
(1.5045	9.1083	)-----	(0.7329	10.0821	)
(1.5045	9.1083	)-----	(5.8410	7.0230	)
(1.5045	-10.8540	)-----	(-3.1252	-16.6967	)
(1.5045	-10.8540	)-----	(5.8410	-9.0442	)
(-7.7548	9.1083	)-----	(-7.7548	-10.8540	)

(-7.7548	9.1083	)-----	(-6.9832	10.0821	)
(-7.7548	9.1083	)-----	(-9.5912	7.0230	)
(-7.7548	-10.8540	)-----	(-3.1252	-16.6967	)
(-7.7548	-10.8540	)-----	(-9.5912	-9.0442	)
(0.7329	10.0821	)-----	(-6.9832	10.0821	)
(0.7329	10.0821	)-----	(4.6393	15.7377	)
(-6.9832	10.0821	)-----	(-3.0768	15.7377	)
(-3.1252	-16.6967	)-----	(-2.3439	-18.0000	)
(7.7548	-9.1083	)-----	(7.7548	10.8540	)
(7.7548	-9.1083	)-----	(6.9832	-10.0821	)
(7.7548	-9.1083	)-----	(9.5912	-7.0230	)
(7.7548	10.8540	)-----	(3.1252	16.6967	)
(7.7548	10.8540	)-----	(9.5912	9.0442	)
(-1.5045	-9.1083	)-----	(-1.5045	10.8540	)
(-1.5045	-9.1083	)-----	(-0.7329	-10.0821	)
(-1.5045	-9.1083	)-----	(-5.8410	-7.0230	)
(-1.5045	10.8540	)-----	(3.1252	16.6967	)
(-1.5045	10.8540	)-----	(-5.8410	9.0442	)
(6.9832	-10.0821	)-----	(-0.7329	-10.0821	)
(6.9832	-10.0821	)-----	(3.0768	-15.7377	)
(-0.7329	-10.0821	)-----	(-4.6393	-15.7377	)
(3.1252	16.6967	)-----	(2.3439	18.0000	)
(5.8410	7.0230	)-----	(5.8410	-9.0442	)
(5.8410	7.0230	)-----	(8.4974	10.8689	)
(5.8410	-9.0442	)-----	(6.9348	-10.8689	)
(9.5912	-7.0230	)-----	(9.5912	9.0442	)
(9.5912	-7.0230	)-----	(6.9348	-10.8689	)
(9.5912	9.0442	)-----	(8.4974	10.8689	)
(8.4974	10.8689	)-----	(4.6393	15.7377	)
(6.9348	-10.8689	)-----	(3.0768	-15.7377	)
(-5.8410	-7.0230	)-----	(-5.8410	9.0442	)
(-5.8410	-7.0230	)-----	(-8.4974	-10.8689	)
(-5.8410	9.0442	)-----	(-6.9348	10.8689	)
(-9.5912	7.0230	)-----	(-9.5912	-9.0442	)
(-9.5912	7.0230	)-----	(-6.9348	10.8689	)
(-9.5912	-9.0442	)-----	(-8.4974	-10.8689	)
(-6.9348	10.8689	)-----	(-3.0768	15.7377	)
(-8.4974	-10.8689	)-----	(-4.6393	-15.7377	)
(4.6393	15.7377	)-----	(2.3439	18.0000	)
(-3.0768	-15.7377	)-----	(-2.3439	-18.0000	)
(3.0768	-15.7377	)-----	(-2.3439	-18.0000	)
(-4.6393	-15.7377	)-----	(-2.3439	-18.0000	)

CRYSTAL SHAPE:





STAURILITE - DFER FOWIE AND ZUSSMAN, 1967, P. 49
 ORTHORHOMBIC SYSTEM : A:B:C = 0.4730: 1.0000: G.3353, ALPHA=BETA=GAMMA=90, , 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 8
 MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	0
0	-1	0
0	0	1
0	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

2.1142	X +	1.0000	Y +	0.0	Z =	1
-2.1142	X +	1.0000	Y +	0.0	Z =	1
-2.1142	X +	-1.0000	Y +	0.0	Z =	1
2.1142	X +	-1.0000	Y +	0.0	Z =	1
0.0	X +	1.5385	Y +	0.0	Z =	1
0.0	X +	-1.5385	Y +	0.0	Z =	1
0.0	X +	0.0	Y +	1.4912	Z =	1
0.0	X +	0.0	Y +	-1.4912	Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.4730	0.0	0.6706	)
(	0.4730	0.0	-0.6706	)
(	0.1655	0.6500	0.6706	)
(	0.1655	0.6500	-0.6706	)
(	-0.4730	0.0	0.6706	)
(	-0.4730	0.0	-0.6706	)
(	-0.1655	0.6500	0.6706	)
(	-0.1655	0.6500	-0.6706	)
(	-0.1655	-0.6500	0.6706	)
(	-0.1655	-0.6500	-0.6706	)
(	0.1655	-0.6500	0.6706	)
(	0.1655	-0.6500	-0.6706	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.4730	0.0	0.6706	)	-----	(	0.4730	0.0	-0.6706	)
(	0.4730	0.0	0.6706	)	-----	(	0.1655	0.6500	0.6706	)
(	0.4730	0.0	0.6706	)	-----	(	0.1655	-0.6500	0.6706	)
(	0.4730	0.0	-0.6706	)	-----	(	0.1655	0.6500	-0.6706	)
(	0.4730	0.0	-0.6706	)	-----	(	0.1655	-0.6500	-0.6706	)
(	0.1655	0.6500	0.6706	)	-----	(	0.1655	0.6500	-0.6706	)
(	0.1655	0.6500	0.6706	)	-----	(	-0.1655	0.6500	0.6706	)
(	0.1655	0.6500	-0.6706	)	-----	(	-0.1655	0.6500	-0.6706	)
(	-0.4730	0.0	0.6706	)	-----	(	-0.4730	0.0	-0.6706	)
(	-0.4730	0.0	0.6706	)	-----	(	-0.1655	0.6500	0.6706	)

Apdx. 2-b, p. 258

(	-0.4730	0.0	0.6706	)	-----	(	-0.1655	-0.6500	0.6706	)
(	-0.4730	0.0	-0.6706	)	-----	(	-0.1655	0.6500	-0.6706	)
(	-0.4730	0.0	-0.6706	)	-----	(	-0.1655	-0.6500	-0.6706	)
(	-0.1655	0.6500	0.6706	)	-----	(	-0.1655	0.6500	-0.6706	)
(	-0.1655	-0.6500	0.6706	)	-----	(	-0.1655	-0.6500	-0.6706	)
(	-0.1655	-0.6500	0.6706	)	-----	(	0.1655	-0.6500	0.6706	)
(	-0.1655	-0.6500	-0.6706	)	-----	(	0.1655	-0.6500	-0.6706	)
(	0.1655	-0.6500	0.6706	)	-----	(	0.1655	-0.6500	-0.6706	)

THE MAXIMUM IS:

VERTICES
 634.8044 0.0 899.9998
 634.8044 0.0 -899.9998
 222.1811 872.3530 899.9998
 222.1811 872.3530 -899.9998
 -634.8044 0.0 899.9998
 -634.8044 0.0 -899.9998
 -222.1811 872.3530 899.9998
 -222.1811 872.3530 -899.9998
 -222.1811 -872.3530 899.9998
 -222.1811 -872.3530 -899.9998
 222.1811 -872.3530 899.9998
 222.1811 -872.3530 -899.9998

EDGES

1 2
 1 3
 1 11
 2 4
 2 12
 3 4
 3 7
 4 8
 5 6
 5 7
 5 9
 6 8
 6 10
 7 8
 9 10
 9 11
 10 12
 11 12

FACES

1 2 4 3
 5 6 8 7
 5 6 10 9
 1 2 12 11
 3 4 8 7
 9 10 12 11
 1 3 7 5
 2 4 8 6
 9 11
 10 12

THE MAXIMUM IS:

0.7538744211

THE CONVERSION FACTOR FOR VIEWPLOT IS :

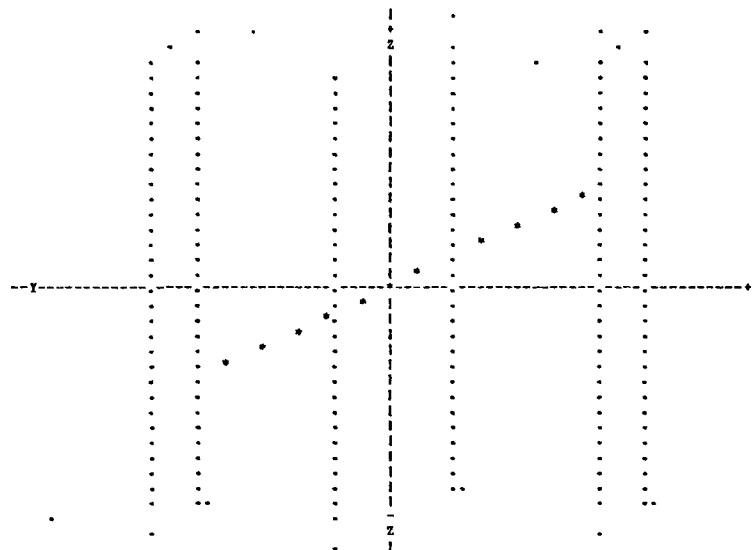
23.8766479492

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(	-4.2641	14.0234	)	-----	(	-4.2641	-10.0000	)
(	-4.2641	14.0234	)	-----	(	14.0274	15.3158	)
(	-4.2641	14.0234	)	-----	(	-17.0123	15.3158	)
(	-4.2641	-10.0000	)	-----	(	14.0274	-16.7076	)
(	-4.2641	-10.0000	)	-----	(	-17.0123	-16.7076	)
(	14.0274	15.3158	)	-----	(	14.0274	-16.7076	)
(	14.0274	15.3158	)	-----	(	17.0123	16.7076	)
(	14.0274	-16.7076	)	-----	(	17.0123	-16.7076	)
(	4.2641	10.0000	)	-----	(	17.0123	16.7076	)
(	4.2641	10.0000	)	-----	(	17.0123	-16.7076	)

CRYSTAL SHAPE:

(4.2641	-18.0000	)-----	(-14.0774	16.7076	)
(4.2641	-14.0774	)-----	(17.0123	-15.1158	)
(4.2641	-14.0234	)-----	(-14.0274	-15.1158	)
(17.0123	16.7076	)-----	(17.0123	-15.1158	)
(-14.0274	16.7076	)-----	(-14.0274	-15.1158	)
(-14.0274	16.7076	)-----	(-17.0123	15.1158	)
(-14.0774	-15.1158	)-----	(-17.0123	-16.7076	)
(-17.0123	15.1158	)-----	(-17.0123	-16.7076	)



TEFFROITE : DEER HOFER AND ZUSSMAN, 1967, p. 9
 (OLIVINE GROUP).
 ORTHORHOMBIC SYSTEM : A:B:C= 0.4622: 1.0000: 0.5896 , ALPHA=BETA=GAMMA=90 , 5 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 22
 MILLER INDICES :

1	2	0
-1	2	0
-1	-2	0
1	-2	0
1	3	0
-1	3	0
1	-3	0
1	-3	0
0	1	0
0	-1	0
0	1	1
0	-1	1

0	-1	-1
0	1	-1
1	1	1
1	-1	1
1	-1	-1
1	1	-1
-1	1	1
-1	-1	1
-1	-1	-1
-1	1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

2.1636 X +	2.0000 Y +	0.0 Z =	1
-2.1636 X +	2.0000 Y +	0.0 Z =	1
-2.1636 X +	-2.0000 Y +	0.0 Z =	1
2.1636 X +	-2.0000 Y +	0.0 Z =	1
1.6643 X +	2.3077 Y +	0.0 Z =	1
-1.6643 X +	2.3077 Y +	0.0 Z =	1
-1.6643 X +	-2.3077 Y +	0.0 Z =	1
1.6643 X +	-2.3077 Y +	0.0 Z =	1
0.0 X +	2.6316 Y +	0.0 Z =	1
0.0 X +	-2.6316 Y +	0.0 Z =	1
0.0 X +	1.0000 Y +	1.6961 Z =	1
0.0 X +	-1.0000 Y +	1.6961 Z =	1
0.0 X +	-1.0000 Y +	-1.6961 Z =	1
0.0 X +	1.0000 Y +	-1.6961 Z =	1
1.7309 X +	0.8000 Y +	1.3569 Z =	1
1.7309 X +	-0.8000 Y +	1.3569 Z =	1
1.7309 X +	-0.8000 Y +	-1.3569 Z =	1
1.7309 X +	0.8000 Y +	-1.3569 Z =	1
-1.7309 X +	0.8000 Y +	1.3569 Z =	1
-1.7309 X +	-0.8000 Y +	1.3569 Z =	1
-1.7309 X +	-0.8000 Y +	-1.3569 Z =	1
-1.7309 X +	0.8000 Y +	-1.3569 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(0.4622	0.0	0.1474	)
(0.4622	0.0	-0.1474	)
(0.1849	0.3000	0.3243	)
(0.1849	0.3000	-0.3243	)
(-0.4622	0.0	0.1474	)
(-0.4622	0.0	-0.1474	)
(-0.1849	0.3000	0.3243	)
(-0.1849	0.3000	-0.3243	)
(-0.1849	-0.3000	0.3243	)
(-0.1849	-0.3000	-0.3243	)
(0.1849	-0.3000	0.3243	)
(0.1849	-0.3000	-0.3243	)
(0.0740	0.3000	0.3656	)
(0.0740	0.3000	-0.3656	)
(0.1156	0.3500	0.3412	)
(0.1156	0.3500	-0.3412	)
(-0.0740	0.3000	0.3656	)
(-0.0740	0.3000	-0.3656	)
(-0.1156	0.3500	0.3412	)
(-0.1156	0.3500	-0.3412	)
(-0.0740	-0.3000	0.3656	)
(-0.0740	-0.3000	-0.3656	)
(-0.1156	-0.3500	0.3412	)
(-0.1156	-0.3500	-0.3412	)
(0.0740	-0.3000	0.3656	)
(0.0740	-0.3000	-0.3656	)
(0.1156	-0.3500	0.3412	)
(0.1156	-0.3500	-0.3412	)

-0.1155		0.0		0.0		0.0	
THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :				THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :			
0.4622	0.0	0.1474	-----	0.4622	0.0	-0.1474	-----
0.4622	0.0	0.1474	-----	0.1849	0.3000	0.3243	-----
0.4622	0.0	0.1474	-----	0.1949	-0.3000	0.3243	-----
0.4622	0.0	0.1474	-----	0.1155	0.0	0.5896	-----
0.4622	0.0	-0.1474	-----	0.1149	0.3000	-0.1241	-----
0.4622	0.0	-0.1474	-----	0.1849	-0.3000	-0.3243	-----
0.4622	0.0	-0.1474	-----	0.1155	0.0	-0.5896	-----
0.1849	0.3000	0.3243	-----	0.1149	0.3000	-0.1241	-----
0.1849	0.3000	0.3243	-----	0.1156	0.3500	0.3832	-----
0.1849	0.3000	-0.1243	-----	0.1156	0.3500	-0.3832	-----
-0.4622	0.0	0.1474	-----	-0.4622	0.0	-0.1474	-----
-0.4622	0.0	0.1474	-----	-0.1149	0.3000	0.3243	-----
-0.4622	0.0	0.1474	-----	-0.1949	-0.3000	0.3243	-----
-0.4622	0.0	0.1474	-----	-0.1155	0.0	0.5896	-----
-0.4622	0.0	-0.1474	-----	-0.1149	0.3000	-0.3243	-----
-0.4622	0.0	-0.1474	-----	-0.1849	-0.3000	-0.3243	-----
-0.1849	0.3000	0.3243	-----	-0.1155	0.0	0.5896	-----
-0.1849	0.3000	0.3243	-----	-0.1849	0.3000	-0.1241	-----
-0.1849	0.3000	-0.1243	-----	-0.1156	0.3500	0.3832	-----
-0.1849	0.3000	-0.3243	-----	-0.1156	0.3500	-0.3832	-----
-0.1849	-0.3000	0.3243	-----	-0.1149	-0.3000	-0.3243	-----
-0.1849	-0.3000	0.3243	-----	-0.1156	-0.3500	0.3832	-----
-0.1849	-0.3000	-0.3243	-----	-0.1156	-0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	0.0740	0.3800	-0.3656	-----
0.0740	0.3800	0.3656	-----	0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.0740	0.3800	0.3656	-----
0.0740	0.3800	0.3656	-----	0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.0740	0.3800	-0.3656	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	0.3832	-----
0.0740	0.3800	0.3656	-----	-0.1156	0.3500	-0.3832	-----
0.0740	0.3800						

```

THE MAXIMUM IS:                                0.
VERTICES
705.5293      0.0      224.9995
705.5293      0.0      -224.9995
282.2122  457.9363  494.9980

```

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 1526.4583

EDGES	1	2
	1	3
	1	11
	1	29
	2	4
	2	12
	2	31
	3	4
	3	15
	4	16
	5	6
	5	7
	5	9
	5	30
	6	8
	6	10
	6	32
	7	8
	7	19
	8	20
	9	10
	9	23
	10	24
	11	12
	11	27
	12	28
	13	14
	13	15
	13	17
	14	16
	14	18
	15	29

```

16 31
17 18
17 19
18 20
19 30
20 32
21 22
21 23
21 25
22 24
22 26
23 30
24 32
25 26
25 27
26 28
27 29
28 31
29 30
31 32
FACES
1 2 4 3
5 6 8 7
5 6 10 9
1 2 12 11
3 4 16 14 13 15
7 8 20 18 17 19
9 10 24 22 21 23
11 12 28 26 25 27
13 14 18 17
21 22 26 25
13 15 29 30 19 17
21 23 30 29 27 25
22 24 32 31 28 26
14 16 31 32 20 18
1 3 15 29
1 11 27 29
2 12 28 31
2 4 16 31
5 7 19 30
5 9 23 30
6 10 24 32
6 8 20 32

```

THE MAXIMUM IS: 0.6099432111 THE CONVERSION FACTOR FOR VIEWPLOT IS : 29.5109405518

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

```

( -5.1500 1.9485 )----- ( -5.1500 -6.7513 )
( -5.1500 1.9485 )----- ( 6.7933 8.6092 )
( -5.1500 1.9485 )----- ( -10.9133 8.6092 )
( -5.1500 1.9485 )----- ( -1.2875 16.7993 )
( -5.1500 -6.7513 )----- ( 6.7933 -10.5303 )
( -5.1500 -6.7513 )----- ( -10.9133 -10.5303 )
( -5.1500 -6.7513 )----- ( -1.2875 -18.0000 )
( 6.7933 8.6092 )----- ( 6.7933 -10.5303 )
( 6.7933 8.6092 )----- ( 9.0413 10.7094 )
( 6.7933 -10.5303 )----- ( 9.0413 -11.9101 )
( 5.1500 6.7513 )----- ( 5.1500 -1.9485 )
( 5.1500 6.7513 )----- ( 10.9133 10.5303 )
( 5.1500 6.7513 )----- ( -6.7933 10.5303 )
( 5.1500 6.7513 )----- ( 1.2875 18.0000 )
( 5.1500 -1.9485 )----- ( 10.9133 -8.6092 )
( 5.1500 -1.9485 )----- ( -6.7933 -8.6092 )
( 5.1500 -1.9485 )----- ( 1.2875 -16.7993 )

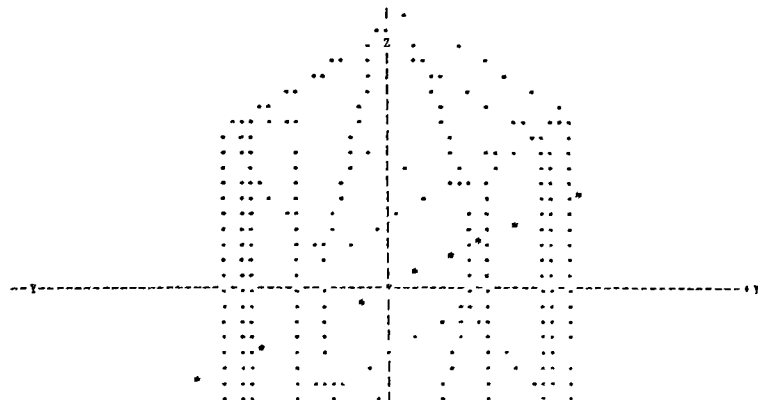
```

```

( 10.9133 10.5303 )----- ( 10.9133 -8.6092 )
( 10.9133 10.5303 )----- ( 11.6163 11.9101 )
( 10.9133 -8.6092 )----- ( 11.6163 -10.7094 )
( -6.7933 10.5303 )----- ( -6.7933 -8.6092 )
( -6.7933 10.5303 )----- ( -9.0413 11.9101 )
( -6.7933 -8.6092 )----- ( -9.0413 -10.7094 )
( -10.9133 8.6092 )----- ( -10.9133 -10.5303 )
( -10.9133 8.6092 )----- ( -11.6163 10.7094 )
( -10.9133 -10.5303 )----- ( -11.6163 -11.9101 )
( 10.3902 10.4036 )----- ( 10.3902 -11.1720 )
( 10.3902 10.4036 )----- ( 9.0413 10.7094 )
( 10.3902 10.4036 )----- ( 12.0381 11.1720 )
( 10.3902 -11.1720 )----- ( 9.0413 -11.9101 )
( 10.3902 -11.1720 )----- ( 12.0381 -10.4036 )
( 9.0413 10.7094 )----- ( -1.2875 16.7993 )
( 9.0413 -11.9101 )----- ( -1.2875 -18.0000 )
( 12.0381 11.1720 )----- ( 12.0381 -10.4036 )
( 12.0381 11.1720 )----- ( 11.6163 11.9101 )
( 12.0381 -10.4036 )----- ( 11.6163 -10.7094 )
( 11.6163 11.9101 )----- ( 1.2875 18.0000 )
( 11.6163 -10.7094 )----- ( 1.2875 -16.7993 )
( -10.3902 11.1720 )----- ( -10.3902 -10.4036 )
( -10.3902 11.1720 )----- ( -9.0413 11.9101 )
( -10.3902 11.1720 )----- ( -12.0381 10.4036 )
( -10.3902 -10.4036 )----- ( -9.0413 -10.7094 )
( -10.3902 -10.4036 )----- ( -12.0381 -11.1720 )
( -9.0413 11.9101 )----- ( 1.2875 18.0000 )
( -9.0413 -10.7094 )----- ( 1.2875 -16.7993 )
( -12.0381 10.4036 )----- ( -12.0381 -11.1720 )
( -12.0381 10.4036 )----- ( -11.6163 10.7094 )
( -12.0381 -11.1720 )----- ( -11.6163 -11.9101 )
( -11.6163 10.7094 )----- ( -1.2875 16.7993 )
( -11.6163 -11.9101 )----- ( -1.2875 -18.0000 )
( -1.2875 16.7993 )----- ( 1.2875 18.0000 )
( -1.2075 -18.0000 )----- ( 1.2875 -16.7993 )

```

CRYSTAL SHAPE:



TOPAZ : DEER HOWIE AND ZUSSMAN, 1967, P. 45
 ORTHORHOMBIC SYSTEM : A:B:C = 0.5284 : 1.0000 : 0.9538 , ALPHA=BETA=GAMMA=90 , 4 FORM(S).
 NUMBER OF FACES OF MILLER INDICES = 20
 MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
1	2	0
-1	2	0
-1	-2	0
1	-2	0
0	2	1
0	-2	1
0	2	-1
0	-2	-1
1	1	1
-1	1	1
-1	-1	1
1	-1	1
1	1	-1
-1	1	-1
-1	-1	-1
1	-1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.8925 X +	1.0000 Y +	0.0 Z =	1
-1.8925 X +	1.0000 Y +	0.0 Z =	1
-1.8925 X +	-1.0000 Y +	0.0 Z =	1
1.8925 X +	-1.0000 Y +	0.0 Z =	1
1.5140 X +	1.6000 Y +	0.0 Z =	1
-1.5140 X +	1.6000 Y +	0.0 Z =	1
-1.5140 X +	-1.6000 Y +	0.0 Z =	1
1.5140 X +	-1.6000 Y +	0.0 Z =	1
0.0 X +	0.6667 Y +	0.3495 Z =	1
0.0 X +	-0.6667 Y +	0.3495 Z =	1
0.0 X +	0.6667 Y +	-0.3495 Z =	1
0.0 X +	-0.6667 Y +	-0.3495 Z =	1
0.5735 X +	0.3030 Y +	0.3177 Z =	1
-0.5735 X +	0.3030 Y +	0.3177 Z =	1
-0.5735 X +	-0.3030 Y +	0.3177 Z =	1
0.5735 X +	-0.3030 Y +	0.3177 Z =	1
0.5735 X +	0.3030 Y +	-0.3177 Z =	1
-0.5735 X +	0.3030 Y +	-0.3177 Z =	1
-0.5735 X +	-0.3030 Y +	-0.3177 Z =	1
0.5735 X +	-0.3030 Y +	-0.3177 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5284	0.0	2.1937	)
(	0.5284	0.0	-2.1937	)
(	0.3963	0.2500	2.1937	)
(	0.3963	0.2500	-2.1937	)
(	-0.5284	0.0	2.1937	)
(	-0.5284	0.0	-2.1937	)

Apdx. 2-b, p. 266

(	-0.3963	0.2500	2.1937	)
(	-0.3963	0.2500	-2.1937	)
(	-0.3963	-0.2500	2.1937	)
(	-0.3963	-0.2500	-2.1937	)
(	0.3963	-0.2500	2.1937	)
(	0.3963	-0.2500	-2.1937	)
(	0.0	0.6250	1.6691	)
(	0.0	0.6250	-1.6691	)
(	0.3258	0.3167	2.2573	)
(	0.3258	0.3167	-2.2573	)
(	-0.3258	0.3167	2.2573	)
(	-0.3258	0.3167	-2.2573	)
(	0.0	-0.6250	1.6691	)
(	0.0	-0.6250	-1.6691	)
(	-0.3258	-0.3167	2.2573	)
(	-0.3258	-0.3167	-2.2573	)
(	0.3258	-0.3167	2.2573	)
(	0.3258	-0.3167	-2.2573	)
(	0.1585	0.0	2.8614	)
(	-0.1585	0.0	2.8614	)
(	0.1585	0.0	-2.8614	)
(	-0.1585	0.0	-2.8614	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.5284	0.0	2.1937	)	-----	(	0.5284	0.0	-2.1937	)
(	0.5284	0.0	2.1937	)	-----	(	0.3963	0.2500	2.1937	)
(	0.5284	0.0	2.1937	)	-----	(	0.3963	-0.2500	2.1937	)
(	0.5284	0.0	2.1937	)	-----	(	0.1585	0.0	2.8614	)
(	0.5284	0.0	-2.1937	)	-----	(	0.3963	0.2500	-2.1937	)
(	0.5284	0.0	-2.1937	)	-----	(	0.3963	-0.2500	-2.1937	)
(	0.5284	0.0	-2.1937	)	-----	(	0.1585	0.0	-2.8614	)
(	0.3963	0.2500	2.1937	)	-----	(	0.3963	0.2500	-2.1937	)
(	0.3963	0.2500	2.1937	)	-----	(	0.3258	0.3167	2.2573	)
(	0.3963	0.2500	-2.1937	)	-----	(	0.3258	0.3167	-2.2573	)
(	-0.5284	0.0	2.1937	)	-----	(	-0.5284	0.0	-2.1937	)
(	-0.5284	0.0	2.1937	)	-----	(	-0.3963	0.2500	2.1937	)
(	-0.5284	0.0	2.1937	)	-----	(	-0.3963	-0.2500	2.1937	)
(	-0.5284	0.0	-2.1937	)	-----	(	-0.1585	0.0	2.8614	)
(	-0.5284	0.0	-2.1937	)	-----	(	-0.3963	0.2500	-2.1937	)
(	-0.5284	0.0	-2.1937	)	-----	(	-0.3963	-0.2500	-2.1937	)
(	-0.3963	0.2500	2.1937	)	-----	(	-0.3963	0.2500	-2.1937	)
(	-0.3963	0.2500	2.1937	)	-----	(	-0.3258	0.3167	2.2573	)
(	-0.3963	0.2500	-2.1937	)	-----	(	-0.3258	0.3167	-2.2573	)
(	-0.3963	0.2500	-2.1937	)	-----	(	-0.1585	0.0	2.8614	)
(	0.3963	-0.2500	2.1937	)	-----	(	0.3963	-0.2500	-2.1937	)
(	0.3963	-0.2500	2.1937	)	-----	(	0.3258	-0.3167	2.2573	)
(	0.3963	-0.2500	-2.1937	)	-----	(	0.3258	-0.3167	-2.2573	)
(	0.0	0.6250	1.6691	)	-----	(	0.0	0.6250	-1.6691	)
(	0.0	0.6250	1.6691	)	-----	(	0.3258	0.3167	2.2573	)
(	0.0	0.6250	1.6691	)	-----	(	0.3258	0.3167	-2.2573	)
(	0.0	0.6250	-1.6691	)	-----	(	0.3258	0.3167	-2.2573	)
(	0.0	0.6250	-1.6691	)	-----	(	-0.3258	0.3167	2.2573	)
(	0.3258	0.3167	2.2573	)	-----	(	0.1585	0.0	2.8614	)
(	0.3258	0.3167	2.2573	)	-----	(	0.1585	0.0	-2.8614	)
(	-0.3258	0.3167	2.2573	)	-----	(	-0.1585	0.0	2.8614	)
(	-0.3258	0.3167	2.2573	)	-----	(	-0.1585	0.0	-2.8614	)
(	0.0	-0.6250	1.6691	)	-----	(	0.0	-0.6250	1.6691	)
(	0.0	-0.6250	1.6691	)	-----	(	0.3258	0.3167	2.2573	)
(	0.0	-0.6250	1.6691	)	-----	(	0.3258	0.3167	-2.2573	)
(	0.0	-0.6250	-1.6691	)	-----	(	0.1258	0.3167	2.2573	)
(	0.0	-0.6250	-1.6691	)	-----	(	-0.3258	-0.3167	-2.2573	)

(	0.0	-0.6250	-1.6691	)	-----	(	0.3250	-0.1167	-2.2573	)
(	-0.3250	-0.3167	-2.2573	)	-----	(	-0.1585	0.0	-2.8614	)
(	-0.3250	-0.3167	-2.2573	)	-----	(	-0.1585	0.0	-2.8614	)
(	0.3250	-0.3167	-2.2573	)	-----	(	0.1585	0.0	-2.8614	)
(	0.3250	-0.3167	-2.2573	)	-----	(	0.1585	0.0	-2.8614	)
(	0.1585	0.0	-2.8614	)	-----	(	-0.1585	0.0	-2.8614	)
(	0.1585	0.0	-2.8614	)	-----	(	-0.1585	0.0	-2.8614	)

THE MAXIMUM IS: 2.8614 THE CONVERSION FACTOR FOR THE PRINTED GRAPH IS: 314.5313

VERTICES

166.1983	0.0	689.9993
166.1983	0.0	-689.9993
124.6486	78.6330	689.9976
124.6486	78.6330	-689.9976
-166.1983	0.0	689.9993
-166.1983	0.0	-689.9993
-124.6486	78.6330	689.9976
-124.6486	78.6330	-689.9976
-124.6486	-78.6330	689.9976
-124.6486	-78.6330	-689.9976
124.6486	-78.6330	689.9976
124.6486	-78.6330	-689.9976
0.0	196.5821	524.9995
0.0	196.5821	-524.9995
102.4889	99.6016	709.9983
102.4889	99.6016	-709.9983
-102.4889	99.6016	709.9983
-102.4889	99.6016	-709.9983
0.0	-196.5821	524.9995
0.0	-196.5821	-524.9995
-102.4889	-99.6016	709.9983
-102.4889	-99.6016	-709.9983
102.4889	-99.6016	709.9983
102.4889	-99.6016	-709.9983
49.8595	0.0	899.9995
-49.8595	0.0	899.9995
49.8595	0.0	-899.9995
-49.8595	0.0	-899.9995

EDGES

1	2
1	3
1	11
1	25
2	4
2	12
2	27
3	4
3	15
4	16
5	6
5	7
5	9
5	26
6	8
6	10
6	28
7	8
7	17
8	18
9	10
9	21
10	22
11	12

11	23
12	24
13	14
13	15
13	17
14	16
14	25
15	25
16	27
17	26
18	28
19	20
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20	22
20	24
21	26
22	28
23	25
24	27
25	26
27	28

FACES

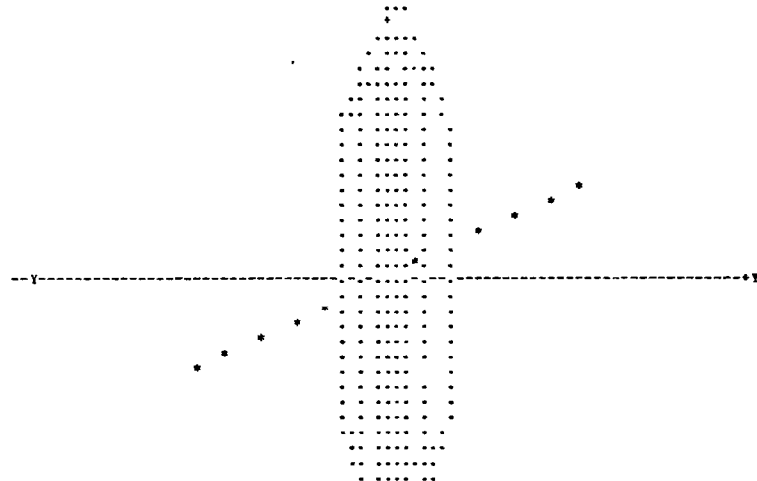
1	2	4	3
5	6	8	7
5	6	10	9
1	2	12	11
3	4	16	14
7	8	18	14
9	10	22	20
11	12	24	20
13	15	25	26
19	21	26	25
14	16	27	28
20	22	28	27
1	3	15	25
5	7	17	26
5	9	21	26
1	11	23	25
2	4	16	27
6	8	18	28
6	10	22	28
2	12	24	27

THE MAXIMUM IS: 2.8693070221 THE CONVERSION FACTOR FOR VIEWPLOT IS: 6.2298669815

THE 2D PDGFS ARE DETERMINED BY THE FOLLOWING POINTS:

(	-1.2429	13.0871	)	-----	(	-1.2429	-14.2462	)
(	-1.2429	13.0871	)	-----	(	0.6253	13.2320	)
(	-1.2429	13.0871	)	-----	(	-2.4896	13.2320	)
(	-1.2429	13.0871	)	-----	(	-0.3729	17.6523	)
(	-1.2429	-14.2462	)	-----	(	0.6253	-14.1013	)
(	-1.2429	-14.2462	)	-----	(	-2.4896	-14.1013	)
(	-1.2429	-14.2462	)	-----	(	-0.3729	-18.0000	)
(	0.6253	13.2320	)	-----	(	0.6253	-14.1013	)
(	0.6253	13.2320	)	-----	(	1.2063	13.7054	)
(	0.6253	-14.1013	)	-----	(	1.2063	-14.4202	)
(	1.2429	14.2462	)	-----	(	1.2429	-11.0871	)
(	1.2429	14.2462	)	-----	(	2.4896	14.1013	)
(	1.2429	14.2462	)	-----	(	-0.6253	14.1013	)
(	1.2429	14.2462	)	-----	(	0.1729	18.0000	)
(	1.2429	-11.0871	)	-----	(	2.4896	-11.2320	)
(	1.2429	-11.0871	)	-----	(	-0.6253	-11.2320	)
(	1.2429	-11.0871	)	-----	(	0.3729	-17.6523	)

CRYSTAL SHAPE:



TOURMALINE : MASON AND BERRY, 1968, P. 481
 HEXAGONAL SYSTEM : A1:A2:A3:C=1:1:1: 0.4480 , ALPHA=BETA=GAMMA=90. , 3 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 15
 MILLER INDICES :

1	1	-2	0
2	-1	-1	0
1	-2	1	0
-1	-1	2	0
-2	1	1	0
-1	2	-1	0
1	-1	0	0
0	1	-1	0
-1	0	1	0
1	0	-1	1
-1	1	0	1
0	-1	1	1
0	1	-1	-1
-1	0	1	-1
1	-1	0	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.7321 X +	1.0000 Y +	0.0	Z = 1
1.7321 X +	-1.0000 Y +	0.0	Z = 1
0.0 X +	-2.0000 Y +	0.0	Z = 1
-1.7321 X +	-1.0000 Y +	0.0	Z = 1
-1.7321 X +	1.0000 Y +	0.0	Z = 1
0.0 X +	2.0000 Y +	0.0	Z = 1
1.1547 X +	-2.0000 Y +	0.0	Z = 1
1.1547 X +	2.0000 Y +	0.0	Z = 1
-2.3095 X +	0.0 Y +	0.0	Z = 1
0.3849 X +	0.0 Y +	0.7440	Z = 1
-0.1924 X +	0.3333 Y +	0.7440	Z = 1
-0.1924 X +	-0.3333 Y +	0.7440	Z = 1
0.1924 X +	0.3333 Y +	-0.7440	Z = 1
-0.3849 X +	0.0 Y +	-0.7440	Z = 1
0.1924 X +	-0.3333 Y +	-0.7440	Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5774	0.0	1.0453	)
(	0.5774	0.0	-1.1947	)
(	0.4330	0.2500	1.1200	)
(	0.4330	0.2500	-1.1200	)
(	0.4330	-0.2500	1.1200	)
(	0.4330	-0.2500	-1.1200	)
(	-0.2887	-0.5000	1.0453	)
(	-0.2887	-0.5000	-1.1947	)
(	0.0	-0.5000	1.1200	)
(	0.0	-0.5000	-1.1200	)
(	-0.4330	-0.2500	1.1200	)
(	-0.4330	-0.2500	-1.1200	)
(	-0.2887	0.5000	1.0453	)
(	-0.2887	0.5000	-1.1947	)
(	-0.4330	0.2500	1.1200	)
(	-0.4330	0.2500	-1.1200	)
(	0.0	0.5000	1.1200	)
(	0.0	0.5000	-1.1200	)
(	0.2165	-0.3750	1.2120	)
(	0.2165	0.3750	1.2120	)
(	-0.4330	0.0	1.2120	)
(	-0.0000	0.0	1.3440	)

```

      0.0      0.0      -1.3440
      ( THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS : )
      ( 0.5774 0.0 1.0453 )----- ( 0.5774 0.0 -1.1947 )
      ( 0.5774 0.0 1.0453 )----- ( 0.4330 0.2500 1.1200 )
      ( 0.5774 0.0 1.0453 )----- ( 0.4330 -0.2500 1.1200 )
      ( 0.5774 0.0 -1.1947 )----- ( 0.4330 0.2500 -1.1200 )
      ( 0.5774 0.0 -1.1947 )----- ( 0.4330 0.0 1.1200 )
      ( 0.4330 0.2500 1.1200 )----- ( 0.4330 0.2500 -1.1200 )
      ( 0.4330 0.2500 -1.1200 )----- ( 0.2165 0.3750 1.2320 )
      ( 0.4330 0.2500 -1.1200 )----- ( 0.0 0.5000 1.1200 )
      ( 0.4330 -0.2500 1.1200 )----- ( 0.4330 -0.2500 -1.1200 )
      ( 0.4330 -0.2500 1.1200 )----- ( 0.2165 -0.3750 1.2320 )
      ( 0.4330 -0.2500 -1.1200 )----- ( 0.0 -0.5000 1.1200 )
      ( -0.2887 -0.5000 1.0453 )----- ( -0.2887 -0.5000 -1.1947 )
      ( -0.2887 -0.5000 1.0453 )----- ( 0.0 -0.5000 1.1200 )
      ( -0.2887 -0.5000 1.0453 )----- ( -0.4330 -0.2500 1.1200 )
      ( -0.2887 -0.5000 -1.1947 )----- ( 0.0 -0.5000 -1.1200 )
      ( -0.2887 -0.5000 -1.1947 )----- ( -0.4330 -0.2500 -1.1200 )
      ( 0.0 -0.5000 1.1200 )----- ( 0.0 0.0 -1.3440 )
      ( 0.0 -0.5000 1.1200 )----- ( 0.0 -0.5000 -1.1200 )
      ( -0.4330 -0.2500 1.1200 )----- ( 0.2165 -0.3750 1.2320 )
      ( -0.4330 -0.2500 1.1200 )----- ( -0.4330 -0.2500 -1.1200 )
      ( -0.4330 -0.2500 -1.1200 )----- ( -0.4330 0.0 1.2320 )
      ( -0.2887 0.5000 1.0453 )----- ( -0.2887 0.5000 -1.1947 )
      ( -0.2887 0.5000 1.0453 )----- ( -0.4330 0.2500 1.1200 )
      ( -0.2887 0.5000 1.0453 )----- ( 0.0 0.5000 1.1200 )
      ( -0.2887 0.5000 -1.1947 )----- ( -0.4330 0.2500 -1.1200 )
      ( -0.2887 0.5000 -1.1947 )----- ( 0.0 0.5000 -1.1200 )
      ( -0.4330 0.2500 1.1200 )----- ( -0.4330 0.2500 -1.1200 )
      ( -0.4330 0.2500 1.1200 )----- ( -0.4330 0.0 1.2320 )
      ( 0.0 0.5000 1.1200 )----- ( 0.0 0.5000 -1.1200 )
      ( 0.0 0.5000 1.1200 )----- ( 0.2165 0.3750 1.2320 )
      ( 0.2165 -0.3750 1.2320 )----- ( -0.0000 0.0 1.3440 )
      ( 0.2165 0.3750 1.2320 )----- ( -0.0000 0.0 1.3440 )
      ( -0.4330 0.0 1.2320 )----- ( -0.0000 0.0 1.3440 )
  
```

THE MAXIMUM IS: 1.3440 THE CONVERSION FACTOR FOR THE PRINTED GRAPH IS: 669.6428

```

VERTICES
386.6184 0.0 699.9939
386.6184 0.0 -800.0024
289.9597 167.4176 749.9973
289.9597 167.4176 -749.9990
289.9597 -167.4176 749.9973
289.9597 -167.4176 -749.9990
-193.3093 -334.8213 700.0007
-193.3093 -334.8213 -799.9968
0.0 -334.8213 749.9990
0.0 -334.8213 -749.9998
-289.9553 -167.4255 749.9973
-289.9553 -167.4255 -749.9998
-193.3092 334.8210 700.0002
-193.3092 334.8210 -799.9973
-289.9553 167.4255 749.9973
-289.9553 167.4255 -749.9998
0.0 334.8213 749.9990
0.0 334.8213 -749.9998
144.9818 -251.1185 824.9968
144.9818 251.1185 824.9968
-289.9553 0.0 825.0039
-0.0001 0.0 899.9998
  
```

```

0.0      0.0      -899.9998
EDGES
1 2
1 3
1 5
2 4
2 6
2 23
3 4
3 20
4 18
5 6
5 19
6 10
7 8
7 9
7 11
8 10
8 12
8 23
9 10
9 19
11 12
11 21
12 16
13 14
13 15
13 17
14 16
14 18
14 23
15 16
15 21
17 18
17 20
19 22
20 22
21 22
FACES
1 2 4 3
1 2 6 5
7 8 10 9
7 8 12 11
13 14 16 15
13 14 18 17
5 6 10 9 19
3 4 18 17 20
11 12 16 15 21
1 3 20 22 19 5
13 15 21 22 20 17
7 9 19 22 21 11
2 4 18 14 23
8 12 16 14 23
2 6 10 8 23
  
```

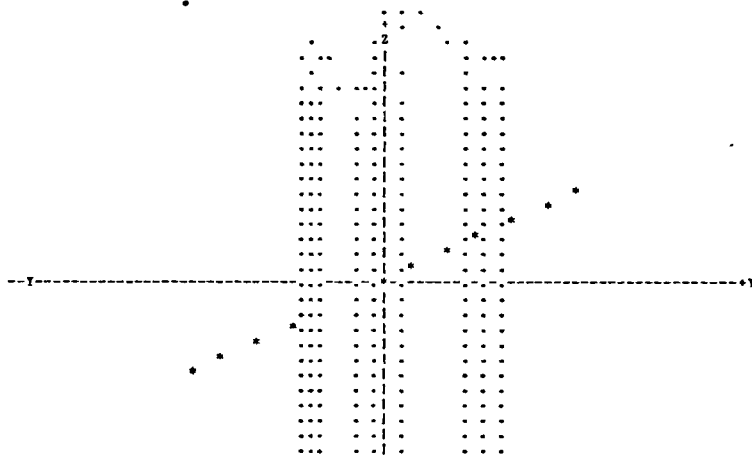
THE MAXIMUM IS: 1.3439998627 THE CONVERSION FACTOR FOR VIEWPLOT IS: 13.1928585052

```

      THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
      ( -2.9195 12.6186 )----- ( -2.9195 -17.3614 )
      ( -2.9195 12.6186 )----- ( 1.1548 11.9790 )
      ( -2.9195 12.6186 )----- ( -5.5177 11.9790 )
      ( -2.9195 -17.3614 )----- ( 1.1548 -16.0210 )
      ( -2.9195 -17.3614 )----- ( -5.5177 -16.0210 )
      ( -2.9195 -17.3614 )----- ( 0.0 -18.0000 )
  
```


(	1.1588	13.9790	)	-----	(	1.1588	-16.0210	)
(	1.1588	13.9790	)	-----	(	3.9276	15.9894	)
(	1.1588	-16.0210	)	-----	(	6.6964	-15.0000	)
(	-5.5379	13.9790	)	-----	(	-5.5379	-16.0210	)
(	-5.5379	13.9790	)	-----	(	-6.1172	15.9894	)
(	-5.5379	-16.0210	)	-----	(	-6.6964	-15.0000	)
(	-5.2367	14.6407	)	-----	(	-5.2367	-15.1193	)
(	-5.2367	14.6407	)	-----	(	-6.6964	15.0000	)
(	-5.2367	14.6407	)	-----	(	-1.1590	16.0209	)
(	-5.2367	-15.3193	)	-----	(	-6.6964	-15.0000	)
(	-5.2367	-15.3193	)	-----	(	-1.1590	-13.9790	)
(	-5.2367	-15.3193	)	-----	(	0.0	-18.0000	)
(	-6.6964	15.0000	)	-----	(	-6.6964	-15.0000	)
(	-6.6964	15.0000	)	-----	(	-6.1172	15.9894	)
(	-1.1590	16.0209	)	-----	(	-1.1590	-13.9790	)
(	-1.1590	16.0209	)	-----	(	2.1895	17.5210	)
(	-1.1590	-13.9790	)	-----	(	5.5380	-13.9790	)
(	8.1562	14.6407	)	-----	(	8.1562	-15.3193	)
(	8.1562	14.6407	)	-----	(	5.5380	16.0209	)
(	8.1562	14.6407	)	-----	(	6.6964	15.0000	)
(	8.1562	-15.3193	)	-----	(	5.5380	-13.9790	)
(	8.1562	-15.3193	)	-----	(	6.6964	-15.0000	)
(	8.1562	-15.3193	)	-----	(	0.0	-18.0000	)
(	5.5380	16.0209	)	-----	(	5.5380	-13.9790	)
(	5.5380	16.0209	)	-----	(	2.1895	17.5210	)
(	6.6964	15.0000	)	-----	(	6.6964	-15.0000	)
(	6.6964	15.0000	)	-----	(	3.9276	15.9894	)
(	-6.1172	15.9894	)	-----	(	0.0000	18.0000	)
(	3.9276	15.9894	)	-----	(	0.0000	18.0000	)
(	2.1895	17.5210	)	-----	(	0.0000	18.0000	)

CRYSTAL SHAPE:



TREMOLITE FERROACTINOLITE : MASON AND BEPPY, 1969, P. 863
 MONOCLINIC SYSTEM : A:B:C= 0.5450: 1.0000: 0.2930 , ALPHA=GAMMA=90, BETA= 104.7000 , 3 POPH(S).
 NUMBER OF FACES OR MILLER INDICES = 10
 MILLER INDICES :

1	1	0
-1	1	0
-1	-1	0
1	-1	0
0	1	0
0	-1	0
0	1	1
0	-1	1
0	-1	-1
0	1	-1

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.8970 X +	1.0000 Y +	0.0 Z =	1
-1.8970 Y +	1.0000 Y +	0.0 Z =	1
-1.8970 X +	-1.0000 Y +	0.0 Z =	1
1.8970 X +	-1.0000 Y +	0.0 Z =	1
0.0 X +	2.0000 Y +	0.0 Z =	1
0.0 X +	-2.0000 Y +	0.0 Z =	1
0.2238 X +	0.2500 Y +	0.8532 Z =	1
0.2238 X +	-0.2500 Y +	0.8532 Z =	1
-0.2238 X +	-0.2500 Y +	-0.8532 Z =	1
-0.2238 X +	0.2500 Y +	-0.8532 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.5272	0.0	1.0337	)
(	0.5272	0.0	-1.3103	)
(	0.2636	0.5000	0.9564	)
(	0.2636	0.5000	-1.0946	)
(	-0.5272	0.0	1.3103	)
(	-0.5272	0.0	-1.0337	)
(	-0.2636	0.5000	1.0946	)
(	-0.2636	0.5000	-0.9564	)
(	-0.2636	-0.5000	1.0946	)
(	-0.2636	-0.5000	-0.9564	)
(	0.2636	-0.5000	0.9564	)
(	0.2636	-0.5000	-1.0946	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.5272	0.0	1.0337	)	-----	(	0.5272	0.0	-1.3103	)
(	0.5272	0.0	1.0337	)	-----	(	0.2636	0.5000	0.9564	)
(	0.5272	0.0	1.0337	)	-----	(	-0.5272	0.0	1.3103	)
(	0.5272	0.0	1.0337	)	-----	(	0.2636	-0.5000	0.9564	)
(	0.5272	0.0	-1.3103	)	-----	(	0.2636	0.5000	-1.0946	)
(	0.5272	0.0	-1.3103	)	-----	(	-0.5272	0.0	-1.0337	)
(	0.5272	0.0	-1.3103	)	-----	(	0.2636	-0.5000	-1.0946	)
(	0.2636	0.5000	0.9564	)	-----	(	0.2636	0.5000	1.0946	)
(	0.2636	0.5000	-1.0946	)	-----	(	-0.2636	0.5000	-0.9564	)
(	-0.5272	0.0	1.3103	)	-----	(	-0.5272	0.0	-1.0337	)
(	-0.5272	0.0	1.3103	)	-----	(	-0.2636	0.5000	1.0946	)
(	-0.5272	0.0	1.3103	)	-----	(	-0.2636	-0.5000	1.0946	)
(	-0.5272	0.0	-1.0337	)	-----	(	-0.2636	0.5000	-0.9564	)
(	-0.5272	0.0	-1.0337	)	-----	(	-0.2636	-0.5000	-0.9564	)
(	-0.2636	0.5000	1.0946	)	-----	(	-0.2636	0.5000	0.9564	)
(	-0.2636	0.5000	1.0946	)	-----	(	0.2636	-0.5000	0.9564	)
(	-0.2636	-0.5000	1.0946	)	-----	(	0.2636	-0.5000	-1.0946	)

THE MAXIMUM IS: { -0.2636 -0.5000 -0.9564 }-----{ 0.2636 -0.5000 -1.0946 }
 { 0.2636 -0.5000 -0.9564 }-----{ 0.2636 -0.5000 -1.0946 }
 1.3103 THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS : 686.8665

VERTICES
 362.0891 0.0 710.0137
 362.0891 0.0 -899.9995
 181.0446 343.4331 656.8853
 181.0446 343.4331 -751.8777
 -362.0891 0.0 899.9995
 -362.0891 0.0 -710.0137
 -181.0446 343.4331 751.8777
 -181.0446 343.4331 -656.8853
 -181.0446 -343.4331 751.8777
 -181.0446 -343.4331 -656.8853
 181.0446 -343.4331 656.8853
 181.0446 -343.4331 -751.8777

EDGES

1 2
 1 3
 1 5
 1 11
 2 4
 2 6
 2 12
 3 4
 3 7
 4 8
 5 6
 5 7
 5 9
 6 8
 6 10
 7 8
 9 10
 9 11
 10 12
 11 12

FACES

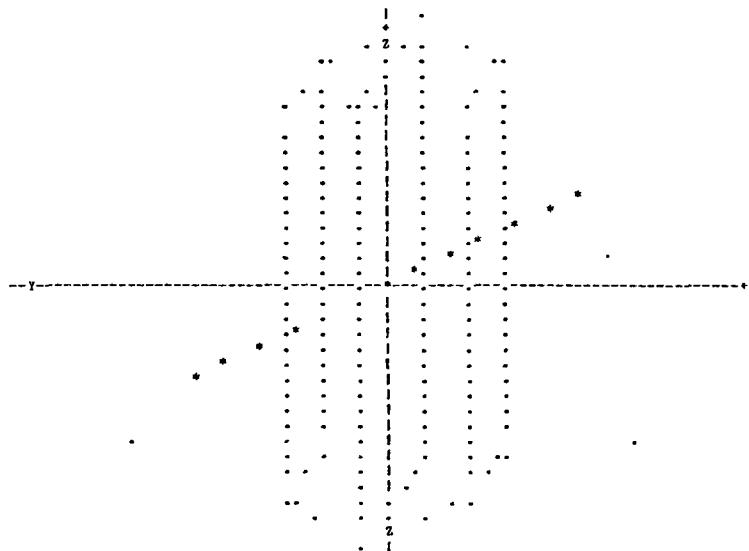
1 2 4 3
 5 6 8 7
 5 6 10 9
 1 2 12 11
 3 4 8 7
 9 10 12 11
 1 3 7 5
 1 5 9 11
 2 6 10 12
 2 4 8 6

THE MAXIMUM IS: 1.4031066895 THE CONVERSION FACTOR FOR VIEWPLOT IS : 12.8286743164

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
 { -2.5534 12.0704 }-----{ -2.5534 -18.0000 }
 { -2.5534 12.0704 }-----{ 5.1376 11.6734 }
 { -2.5534 12.0704 }-----{ 2.5534 18.0000 }
 { -2.5534 12.0704 }-----{ -7.6910 11.6734 }
 { -2.5534 -18.0000 }-----{ 5.1376 -14.6382 }
 { -2.5534 -18.0000 }-----{ 2.5534 -12.0704 }
 { -2.5534 -18.0000 }-----{ -7.6910 -14.6382 }
 { 5.1376 11.6734 }-----{ 5.1376 -14.6382 }
 { 5.1376 11.6734 }-----{ 7.6910 14.6382 }
 { 5.1376 -14.6382 }-----{ 7.6910 -11.6734 }
 { 2.5534 18.0000 }-----{ 2.5534 -12.0704 }
 { 2.5534 18.0000 }-----{ 7.6910 14.6382 }

{ 2.5534 18.0000 }-----{ -5.1376 14.6382 }
 { 2.5534 -12.0704 }-----{ 7.6910 -11.6734 }
 { 2.5534 -12.0704 }-----{ -5.1376 -11.6734 }
 { 7.6910 14.6382 }-----{ 7.6910 -11.6734 }
 { -5.1376 14.6382 }-----{ -5.1376 -11.6734 }
 { -5.1376 14.6382 }-----{ -7.6910 11.6734 }
 { -5.1376 -11.6734 }-----{ -7.6910 -14.6382 }
 { -7.6910 11.6734 }-----{ -7.6910 -14.6382 }

CRYSTAL SHAPE:



VESUVIANITE 1 : ROGERS, 1937, P. 470
 TETRAGONAL SYSTEM: A:B:C=1:1: 0.7564 ALPHA=BETA=GAMMA=90, 3 POPE(S).
 NUMBER OF FACES OF MILLER INDICES = 14
 MILLER INDICES :

1 1 0
 -1 1 0
 1 -1 0
 -1 -1 0
 1 1 1
 -1 1 1
 1 -1 1
 -1 -1 1
 1 1 -1
 -1 1 -1
 1 -1 -1
 -1 -1 -1
 0 0 1

0 0 -1
THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X +	1.0000 Y +	0.0 Z =	1
-1.0000 X +	1.0000 Y +	0.0 Z =	1
1.0000 X +	-1.0000 Y +	0.0 Z =	1
-1.0000 X +	-1.0000 Y +	0.0 Z =	1
0.6250 X +	0.6250 Y +	0.8263 Z =	1
-0.6250 X +	0.6250 Y +	0.8263 Z =	1
0.6250 X +	-0.6250 Y +	0.8263 Z =	1
-0.6250 X +	-0.6250 Y +	0.8263 Z =	1
0.6250 X +	0.6250 Y +	-0.8263 Z =	1
-0.6250 X +	0.6250 Y +	-0.8263 Z =	1
0.6250 X +	-0.6250 Y +	-0.8263 Z =	1
-0.6250 X +	-0.6250 Y +	-0.8263 Z =	1
0.6250 X +	0.0 Y +	0.9443 Z =	1
0.0 X +	0.0 Y +	-0.9443 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.0	1.0000	0.4538	)
(	0.0	1.0000	-0.4538	)
(	1.0000	0.0	0.4538	)
(	1.0000	0.0	-0.4538	)
(	-1.0000	0.0	0.4538	)
(	-1.0000	0.0	-0.4538	)
(	0.0	-1.0000	0.4538	)
(	0.0	-1.0000	-0.4538	)
(	0.0000	0.2000	1.0590	)
(	0.2000	0.0000	1.0590	)
(	-0.2000	0.0000	1.0590	)
(	0.0000	-0.2000	1.0590	)
(	0.0000	0.2000	-1.0590	)
(	0.2000	0.0000	-1.0590	)
(	-0.2000	0.0000	-1.0590	)
(	-0.0000	-0.2000	-1.0590	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.0	1.0000	0.4538	)	-----	(	0.0	1.0000	-0.4538	)
(	0.0	1.0000	0.4538	)	-----	(	1.0000	0.0	0.4538	)
(	0.0	1.0000	0.4538	)	-----	(	-1.0000	0.0	0.4538	)
(	0.0	1.0000	0.4538	)	-----	(	0.0000	0.2000	1.0590	)
(	0.0	1.0000	-0.4538	)	-----	(	1.0000	0.0	-0.4538	)
(	0.0	1.0000	-0.4538	)	-----	(	-1.0000	0.0	-0.4538	)
(	0.0	1.0000	-0.4538	)	-----	(	0.0000	0.2000	-1.0590	)
(	1.0000	0.0	0.4538	)	-----	(	1.0000	0.0	-0.4538	)
(	1.0000	0.0	0.4538	)	-----	(	0.0	-1.0000	0.4538	)
(	1.0000	0.0	0.4538	)	-----	(	0.2000	0.0000	1.0590	)
(	1.0000	0.0	-0.4538	)	-----	(	0.0	-1.0000	-0.4538	)
(	1.0000	0.0	-0.4538	)	-----	(	0.2000	0.0000	-1.0590	)
(	-1.0000	0.0	0.4538	)	-----	(	-1.0000	0.0	-0.4538	)
(	-1.0000	0.0	0.4538	)	-----	(	0.0	-1.0000	0.4538	)
(	-1.0000	0.0	0.4538	)	-----	(	-0.2000	0.0000	1.0590	)
(	-1.0000	0.0	-0.4538	)	-----	(	0.0	-1.0000	-0.4538	)
(	-1.0000	0.0	-0.4538	)	-----	(	-0.2000	0.0000	-1.0590	)
(	0.0	-1.0000	0.4538	)	-----	(	0.0	-1.0000	-0.4538	)
(	0.0	-1.0000	0.4538	)	-----	(	0.0000	-0.2000	1.0590	)
(	0.0	-1.0000	-0.4538	)	-----	(	-0.0000	-0.2000	-1.0590	)
(	0.0000	0.2000	1.0590	)	-----	(	0.2000	0.0000	1.0590	)
(	0.0000	0.2000	1.0590	)	-----	(	-0.2000	0.0000	1.0590	)
(	0.2000	0.0000	1.0590	)	-----	(	0.0000	-0.2000	1.0590	)
(	-0.2000	0.0000	1.0590	)	-----	(	0.0000	-0.2000	-1.0590	)
(	0.0000	0.2000	-1.0590	)	-----	(	0.2000	0.0000	-1.0590	)
(	0.0000	0.2000	-1.0590	)	-----	(	-0.2000	0.0000	-1.0590	)
(	0.2000	0.0000	-1.0590	)	-----	(	-0.0000	-0.2000	-1.0590	)
(	-0.2000	0.0000	-1.0590	)	-----	(	-0.0000	-0.2000	-1.0590	)

THE MAXIMUM IS: 1.0590

THE CONVERSION FACTOR FOR THE PRINTER GRAPH IS -

VERTICES

0.0	849.8911	385.7139
0.0	849.8911	-385.7139
849.8911	0.0	385.7139
849.8911	0.0	-385.7139
-849.8911	0.0	385.7139
-849.8911	0.0	-385.7139
0.0	-849.8911	385.7139
0.0	-849.8911	-385.7139
0.0001	169.9788	899.9998
169.9788	0.0001	899.9998
-169.9788	0.0001	899.9998
0.0001	-169.9788	899.9998
0.0001	169.9788	-899.9998
169.9788	0.0001	-899.9998
-169.9788	0.0001	-899.9998
-0.0001	-169.9788	-899.9998

EDGES

1	2
1	3
1	5
1	9
2	4
2	6
2	13
3	4
3	7
3	10
4	8
4	14
5	6
5	7
5	11
6	8
6	15
7	8
7	12
8	16
9	10
9	11
10	12
11	12
13	14
13	15
14	16
15	16

FACES

1	2	4	3
1	2	6	5
3	4	8	7
5	6	8	7
1	3	10	9
1	5	11	9
3	7	12	10
5	7	12	11
2	4	14	13
2	6	15	13
6	8	16	15
4	8	16	14
9	10	12	11
13	14	16	15

THE MAXIMUM IS:

1.094164616/

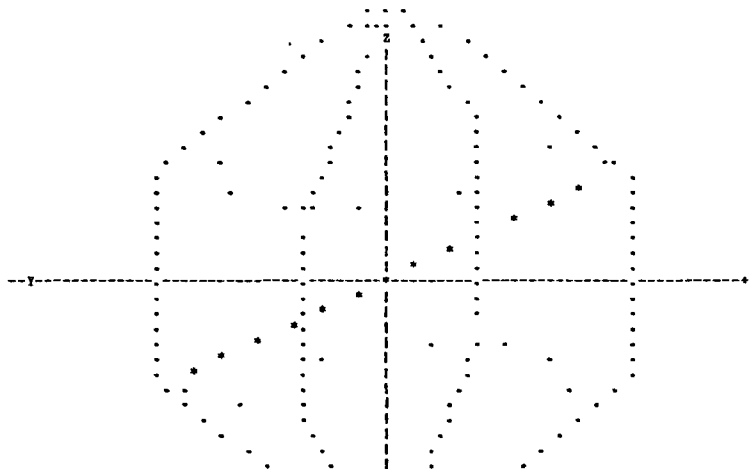
THE CONVERSION FACTOR FOR VIEWPLOT IS :

16.4508209229

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(16.4508	7.4660	)-----	(16.4508	-7.4660	)
(16.4508	7.4660	)-----	(-6.2112	4.5698	)
(16.4508	7.4660	)-----	(6.2112	10.3623	)
(16.4508	7.4660	)-----	(3.2902	17.4207	)
(16.4508	-7.4660	)-----	(-6.2112	-10.3623	)
(16.4508	-7.4660	)-----	(6.2112	-4.5698	)
(16.4508	-7.4660	)-----	(3.2902	-17.4207	)
(-6.2112	4.5698	)-----	(-6.2112	-10.3623	)
(-6.2112	4.5698	)-----	(-16.4508	7.4660	)
(-6.2112	4.5698	)-----	(-1.2423	16.8415	)
(-6.2112	-10.3623	)-----	(-16.4508	-7.4660	)
(-6.2112	-10.3623	)-----	(-1.2423	-18.0000	)
(6.2112	10.3623	)-----	(6.2112	-4.5698	)
(6.2112	10.3623	)-----	(-16.4508	7.4660	)
(6.2112	10.3623	)-----	(1.2423	18.0000	)
(6.2112	-4.5698	)-----	(-16.4508	-7.4660	)
(6.2112	-4.5698	)-----	(1.2423	-16.8415	)
(-16.4508	7.4660	)-----	(-16.4508	-7.4660	)
(-16.4508	7.4660	)-----	(-3.2902	17.4207	)
(-16.4508	-7.4660	)-----	(-3.2902	-17.4207	)
(3.2902	17.4207	)-----	(-1.2423	16.8415	)
(3.2902	17.4207	)-----	(1.2423	18.0000	)
(-1.2423	16.8415	)-----	(-3.2902	17.4207	)
(1.2423	18.0000	)-----	(-3.2902	-17.4207	)
(3.2902	-17.4207	)-----	(-1.2423	-18.0000	)
(3.2902	-17.4207	)-----	(1.2423	-16.8415	)
(-1.2423	-18.0000	)-----	(-3.2902	-17.4207	)
(1.2423	-16.8415	)-----	(-3.2902	-17.4207	)

CRYSTAL SHAPE:



Apdx. 2-b, p. 280

VESUVIANITE 2 : ROGERS, 1937, P. 470
TETRAGONAL SYSTEM: A:B:C=1:1: 0.7564 ALPHA=BETA=GAMMA=90, , 5 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 18
MILLER INDICES :

1	1	0
-1	1	0
1	-1	0
-1	-1	0
1	1	1
-1	1	1
1	-1	1
-1	-1	1
1	1	-1
-1	1	-1
1	-1	-1
-1	-1	-1
1	-1	-1
0	0	1
0	0	-1
1	0	0
-1	0	0
0	1	0
0	-1	0

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X +	1.0000 Y +	0.0 Z =	1
-1.0000 X +	1.0000 Y +	0.0 Z =	1
1.0000 X +	-1.0000 Y +	0.0 Z =	1
-1.0000 X +	-1.0000 Y +	0.0 Z =	1
0.6250 X +	0.6250 Y +	0.8263 Z =	1
-0.6250 X +	0.6250 Y +	0.8263 Z =	1
0.6250 X +	-0.6250 Y +	0.8263 Z =	1
-0.6250 X +	-0.6250 Y +	0.8263 Z =	1
0.6250 X +	0.6250 Y +	-0.8263 Z =	1
-0.6250 X +	0.6250 Y +	-0.8263 Z =	1
0.6250 X +	-0.6250 Y +	-0.8263 Z =	1
-0.6250 X +	-0.6250 Y +	-0.8263 Z =	1
0.0 X +	0.0 Y +	0.9118 Z =	1
0.0 X +	0.0 Y +	-0.9118 Z =	1
1.4286 X +	0.0 Y +	0.0 Z =	1
-1.4286 X +	0.0 Y +	0.0 Z =	1
0.0 X +	1.4286 Y +	0.0 Z =	1
0.0 X +	-1.4286 Y +	0.0 Z =	1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(0.7000	0.3000	0.4538	)
(0.7000	0.7000	0.4538	)
(0.7000	0.3000	-0.4538	)
(0.7000	0.7000	-0.4538	)
(-0.7000	0.3000	0.4538	)
(-0.7000	0.7000	0.4538	)
(-0.7000	0.3000	-0.4538	)
(-0.7000	0.7000	-0.4538	)
(0.7000	-0.3000	0.4538	)
(0.7000	-0.7000	0.4538	)
(0.7000	-0.3000	-0.4538	)
(0.7000	-0.7000	-0.4538	)
(-0.7000	-0.3000	0.4538	)
(-0.7000	-0.7000	0.4538	)
(-0.7000	-0.3000	-0.4538	)
(-0.7000	-0.7000	-0.4538	)

(	-0.1000	-0.7000	-0.4518	)
(	0.0	0.1500	1.0968	)
(	-0.0000	0.7000	0.6808	)
(	0.1500	0.0	1.0968	)
(	0.7000	-0.0000	0.6808	)
(	-0.1500	0.0	1.0968	)
(	-0.7000	-0.0000	0.6808	)
(	0.0	-0.1500	1.0968	)
(	-0.0000	-0.7000	0.6808	)
(	0.0	0.1500	-1.0968	)
(	-0.0000	0.7000	-0.6808	)
(	0.1500	0.0	-1.0968	)
(	0.7000	-0.0000	-0.6808	)
(	-0.1500	0.0	-1.0968	)
(	-0.7000	-0.0000	-0.6808	)
(	0.0	-0.1500	-1.0968	)
(	0.0000	-0.7000	-0.6808	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.7000	0.3000	0.4538	)	-----	(	0.3000	0.7000	0.4538	)
(	0.7000	0.1000	0.4538	)	-----	(	0.7000	0.3000	-0.4538	)
(	0.7000	0.3000	0.4538	)	-----	(	0.7000	-0.0000	0.6808	)
(	0.3000	0.7000	0.4538	)	-----	(	0.3000	0.7000	-0.4538	)
(	0.3000	0.7000	0.4538	)	-----	(	-0.0000	0.7000	0.6808	)
(	0.7000	0.3000	-0.4538	)	-----	(	0.3000	0.7000	-0.4538	)
(	0.7000	0.3000	-0.4538	)	-----	(	0.7000	-0.0000	-0.6808	)
(	0.3000	0.7000	-0.4538	)	-----	(	-0.0000	0.7000	-0.6808	)
(	-0.7000	0.3000	0.4538	)	-----	(	-0.3000	0.7000	0.4538	)
(	-0.7000	0.3000	0.4538	)	-----	(	-0.7000	0.3000	-0.4538	)
(	-0.7000	0.3000	0.4538	)	-----	(	-0.7000	-0.0000	0.6808	)
(	-0.3000	0.7000	0.4538	)	-----	(	-0.3000	0.7000	-0.4538	)
(	-0.3000	0.7000	0.4538	)	-----	(	-0.0000	0.7000	0.6808	)
(	-0.7000	0.3000	-0.4538	)	-----	(	-0.3000	0.7000	-0.4538	)
(	-0.7000	0.3000	-0.4538	)	-----	(	-0.7000	-0.0000	-0.6808	)
(	-0.3000	0.7000	-0.4538	)	-----	(	-0.0000	0.7000	-0.6808	)
(	0.7000	-0.3000	0.4538	)	-----	(	0.3000	-0.7000	0.4538	)
(	0.7000	-0.3000	0.4538	)	-----	(	0.7000	-0.0000	0.6808	)
(	0.7000	-0.3000	0.4538	)	-----	(	0.7000	-0.0000	0.6808	)
(	0.3000	-0.7000	0.4538	)	-----	(	0.3000	-0.7000	-0.4538	)
(	0.3000	-0.7000	0.4538	)	-----	(	-0.0000	-0.7000	0.6808	)
(	0.7000	-0.3000	-0.4538	)	-----	(	0.3000	-0.7000	-0.4538	)
(	0.7000	-0.3000	-0.4538	)	-----	(	0.7000	-0.0000	-0.6808	)
(	0.3000	-0.7000	-0.4538	)	-----	(	0.0000	-0.7000	-0.6808	)
(	-0.7000	-0.3000	0.4538	)	-----	(	-0.3000	-0.7000	0.4538	)
(	-0.7000	-0.3000	0.4538	)	-----	(	-0.7000	-0.3000	-0.4538	)
(	-0.7000	-0.3000	0.4538	)	-----	(	-0.7000	-0.0000	0.6808	)
(	-0.3000	-0.7000	0.4538	)	-----	(	-0.3000	-0.7000	-0.4538	)
(	-0.3000	-0.7000	0.4538	)	-----	(	-0.0000	-0.7000	0.6808	)
(	-0.7000	-0.3000	-0.4538	)	-----	(	-0.3000	-0.7000	-0.4538	)
(	-0.7000	-0.3000	-0.4538	)	-----	(	-0.7000	-0.0000	-0.6808	)
(	-0.3000	-0.7000	-0.4538	)	-----	(	-0.0000	-0.7000	-0.6808	)
(	0.0	0.1500	1.0968	)	-----	(	0.0	0.1500	1.0968	)
(	0.0	0.1500	1.0968	)	-----	(	0.1500	0.0	1.0968	)
(	0.1500	0.0	1.0968	)	-----	(	0.7000	-0.0000	0.6808	)
(	-0.1500	0.0	1.0968	)	-----	(	0.0	-0.1500	1.0968	)
(	-0.1500	0.0	1.0968	)	-----	(	-0.7000	-0.0000	0.6808	)
(	0.0	-0.1500	1.0968	)	-----	(	0.0	-0.1500	1.0968	)
(	0.0	0.1500	-1.0968	)	-----	(	-0.0000	-0.7000	0.6808	)
(	0.0	0.1500	-1.0968	)	-----	(	0.1500	0.0	-1.0968	)
(	0.0	0.1500	-1.0968	)	-----	(	-0.1500	0.0	-1.0968	)
(	0.1500	0.0	-1.0968	)	-----	(	0.7000	-0.0000	-0.6808	)

(	0.1500	0.0	-1.0968	)	-----	(	0.0	-0.1500	-1.0968	)
(	-0.1500	0.0	-1.0968	)	-----	(	-0.7000	-0.0000	-0.6808	)
(	-0.1500	0.0	-1.0968	)	-----	(	0.0	-0.1500	-1.0968	)
(	0.0	-0.1500	-1.0968	)	-----	(	0.0000	-0.7000	-0.6808	)

THE MAXIMUM IS: 1.0968 THE CONVERSION FACTOR FOR THE PRINTING GRAPH IS: 820.5840

VERTICES

574.4092	246.1746	372.4136
246.1746	574.4092	372.4136
574.4092	246.1746	-372.4136
246.1746	574.4092	-372.4136
-574.4092	246.1746	372.4136
-246.1746	574.4092	372.4136
-574.4092	246.1746	-372.4136
-246.1746	574.4092	-372.4136
574.4092	-246.1746	372.4136
246.1746	-574.4092	372.4136
574.4092	-246.1746	-372.4136
246.1746	-574.4092	-372.4136
-574.4092	-246.1746	372.4136
-246.1746	-574.4092	372.4136
-574.4092	-246.1746	-372.4136
-246.1746	-574.4092	-372.4136
0.0	123.0872	899.9998
-0.0003	574.4089	558.6201
123.0872	0.0	899.9998
574.4089	-0.0003	558.6201
-123.0872	0.0	899.9998
-574.4089	-0.0003	558.6201
0.0	-123.0872	899.9998
-0.0003	-574.4089	558.6201
0.0	123.0872	-899.9998
-0.0003	574.4089	-558.6201
123.0872	0.0	-899.9998
574.4089	-0.0003	-558.6201
-123.0872	0.0	-899.9998
-574.4089	-0.0003	-558.6201
0.0	-123.0872	-899.9998
0.0003	-574.4089	-558.6201

EDGES

1	2
1	3
1	20
2	4
2	18
3	4
3	28
4	26
5	6
5	7
5	22
6	8
6	10
7	8
7	30
8	26
9	10
9	11
9	20
10	12
10	24
11	12
11	28

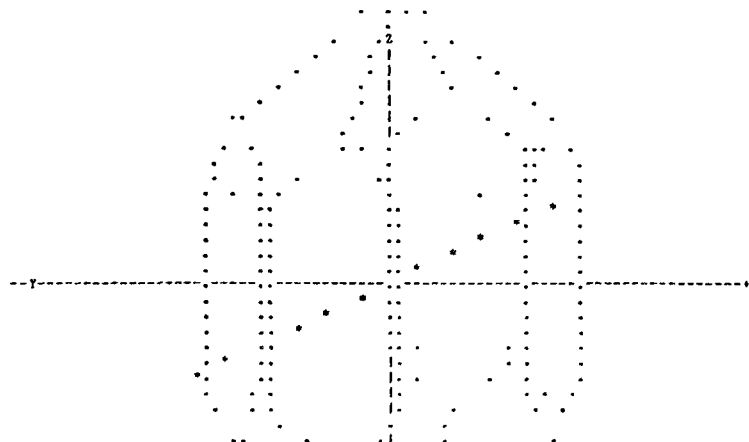
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12 37
13 14
13 15
13 22
14 16
14 24
15 16
15 30
16 32
17 18
17 19
17 21
19 20
19 23
21 22
21 23
23 24
25 26
25 27
25 29
27 28
27 31
29 30
29 31
31 32
FACES
1 2 4 3
5 6 8 7
9 10 12 11
13 14 16 15
1 2 18 17 19 20
5 6 18 17 21 22
9 10 24 23 19 20
13 14 24 23 21 22
3 4 26 25 27 28
7 8 26 25 29 30
15 16 32 31 29 30
11 12 32 31 27 28
17 19 23 21
25 27 31 29
1 3 28 11 9 20
5 7 30 15 13 22
2 4 26 8 6 18
10 12 32 16 14 24
THE MAXIMUM IS: 1.1231870651 THE CONVERSION FACTOR FOR VIEWPLOT IS : 16.0258178711
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.5722 5.2982 )----- ( 9.4029 6.4267 )
( 0.5722 5.2982 )----- ( 0.5722 -9.2482 )
( 0.5722 5.2982 )----- ( -4.2356 8.9347 )
( 9.4029 6.4267 )----- ( 9.4029 -8.1196 )
( 9.4029 6.4267 )----- ( 11.2181 10.9097 )
( 0.5722 -9.2482 )----- ( 9.4029 -8.1196 )
( 0.5722 -9.2482 )----- ( -4.2356 -12.8847 )
( 9.4029 -8.1196 )----- ( 11.2181 -10.9097 )
( 9.0433 9.2482 )----- ( 13.0333 8.1196 )
( 9.0433 9.2482 )----- ( 9.0433 -5.2982 )
( 9.0433 9.2482 )----- ( 4.2355 12.8847 )
( 13.0333 8.1196 )----- ( 13.0333 -6.4267 )
( 13.0333 8.1196 )----- ( 11.2181 10.9097 )
( 9.0433 -5.2982 )----- ( 13.0333 -6.4267 )
( 9.0433 -5.2982 )----- ( 4.2355 -8.9347 )
( 13.0333 -6.4267 )----- ( 11.2181 -10.9097 )

```

(	-9.0433	5.2982	)	-----	(	-13.0333	6.4267	)
(	-9.0433	5.2982	)	-----	(	-9.0433	-9.7482	)
(	-9.0433	5.2982	)	-----	(	-4.2356	8.9347	)
(	-13.0333	6.4267	)	-----	(	-13.0333	-8.1196	)
(	-13.0333	6.4267	)	-----	(	-11.2181	10.9097	)
(	-9.0433	-9.2482	)	-----	(	-13.0333	-8.1196	)
(	-9.0433	-9.2482	)	-----	(	-4.2356	-12.8847	)
(	-13.0333	-8.1196	)	-----	(	-11.2181	-10.9097	)
(	-0.5722	9.2482	)	-----	(	-9.4029	8.1196	)
(	-0.5722	9.2482	)	-----	(	-0.5722	-5.2982	)
(	-0.5722	9.2482	)	-----	(	4.2355	12.8847	)
(	-9.4029	8.1196	)	-----	(	-9.4029	-6.4267	)
(	-9.4029	8.1196	)	-----	(	-11.2181	10.9097	)
(	-0.5722	-5.2982	)	-----	(	-9.4029	-6.4267	)
(	-0.5722	-5.2982	)	-----	(	4.2355	-8.9347	)
(	-9.4029	-6.4267	)	-----	(	-11.2181	-10.9097	)
(	2.4039	17.5768	)	-----	(	11.2181	10.9097	)
(	2.4039	17.5768	)	-----	(	-0.9076	17.1536	)
(	2.4039	17.5768	)	-----	(	0.9076	18.0000	)
(	-0.9076	17.1536	)	-----	(	-4.2356	8.9347	)
(	-0.9076	17.1536	)	-----	(	-2.4039	17.5768	)
(	0.9076	18.0000	)	-----	(	4.2355	12.8847	)
(	0.9076	18.0000	)	-----	(	-2.4039	17.5768	)
(	-2.4039	17.5768	)	-----	(	-11.2181	10.9097	)
(	2.4039	-17.5768	)	-----	(	11.2181	-10.9097	)
(	2.4039	-17.5768	)	-----	(	-0.9076	-18.0000	)
(	2.4039	-17.5768	)	-----	(	0.9076	-17.1536	)
(	-0.9076	-18.0000	)	-----	(	-4.2356	-12.8847	)
(	-0.9076	-18.0000	)	-----	(	-2.4039	-17.5768	)
(	0.9076	-17.1536	)	-----	(	4.2355	-8.9347	)
(	0.9076	-17.1536	)	-----	(	-2.4039	-17.5768	)
(	-2.4039	-17.5768	)	-----	(	-11.2181	-10.9097	)

CRYSTAL SHAPE:



EIRCON 1 : ROGERS, 1937, P. 471
 TETRAGONAL SYSTEM: A:B:C=1:1: 0.9060 ALPHA=BETA=GAMMA=90, , 2 FORM(S).
 NUMBER OF FACES OR MILLER INDICES = 12
 MILLER INDICES :

1 1 1
 1 1 -1
 1 -1 -1
 1 -1 1
 -1 1 1
 -1 1 -1
 -1 -1 -1
 -1 -1 1
 1 1 0
 1 -1 0
 -1 1 0
 -1 -1 0

THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :

1.0000 X + 1.0000 Y + 1.1033 Z = 1
 1.0000 X + 1.0000 Y + -1.1033 Z = 1
 1.0000 X + -1.0000 Y + -1.1033 Z = 1
 1.0000 X + -1.0000 Y + 1.1033 Z = 1
 -1.0000 X + 1.0000 Y + 1.1033 Z = 1
 -1.0000 X + 1.0000 Y + -1.1033 Z = 1
 -1.0000 X + -1.0000 Y + -1.1033 Z = 1
 -1.0000 X + -1.0000 Y + 1.1033 Z = 1
 1.1111 X + 1.1111 Y + 0.0 Z = 1
 1.1111 X + -1.1111 Y + 0.0 Z = 1
 -1.1111 X + 1.1111 Y + 0.0 Z = 1
 -1.1111 X + -1.1111 Y + 0.0 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(0.0 0.0 0.9060)
 (0.9000 -0.0000 0.0906)
 (-0.0000 0.9000 0.0906)
 (0.0 0.0 -0.9060)
 (0.9000 -0.0000 -0.0906)
 (-0.0000 0.9000 -0.0906)
 (-0.0000 -0.9000 -0.0906)
 (-0.0000 -0.9000 0.0906)
 (-0.9000 -0.0000 0.0906)
 (-0.9000 -0.0000 -0.0906)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(0.0 0.0 0.9060)----- (0.9000 -0.0000 0.0906)
 (0.0 0.0 0.9060)----- (-0.0000 0.9000 0.0906)
 (0.0 0.0 0.9060)----- (-0.0000 -0.9000 0.0906)
 (0.0 0.0 0.9060)----- (-0.9000 -0.0000 0.0906)
 (0.9000 -0.0000 0.0906)----- (-0.0000 0.9000 0.0906)
 (0.9000 -0.0000 0.0906)----- (-0.0000 -0.9000 -0.0906)
 (0.9000 -0.0000 0.0906)----- (-0.0000 -0.9000 0.0906)
 (-0.0000 0.9000 0.0906)----- (-0.0000 0.9000 -0.0906)
 (-0.0000 0.9000 0.0906)----- (-0.9000 -0.0000 0.0906)
 (0.0 0.0 -0.9060)----- (0.9000 -0.0000 -0.0906)
 (0.0 0.0 -0.9060)----- (-0.0000 0.9000 -0.0906)
 (0.0 0.0 -0.9060)----- (-0.0000 -0.9000 -0.0906)
 (0.0 0.0 -0.9060)----- (-0.9000 -0.0000 -0.0906)
 (0.9000 -0.0000 -0.0906)----- (-0.0000 0.9000 -0.0906)

Apdx. 2-b, p. 286

(0.9000 -0.0000 -0.0906)----- (-0.0000 -0.9000 -0.0906)
 (-0.0000 0.9000 -0.0906)----- (-0.9000 -0.0000 -0.0906)
 (-0.0000 -0.9000 -0.0906)----- (-0.0000 -0.9000 0.0906)
 (-0.0000 -0.9000 -0.0906)----- (-0.9000 -0.0000 -0.0906)
 (-0.0000 -0.9000 0.0906)----- (-0.9000 -0.0000 0.0906)
 (-0.9000 -0.0000 0.0906)----- (-0.9000 -0.0000 -0.0906)

THE MAXIMUM IS:

0.9060 THE CONVERSION FACTOR FOR THE PLOTTER GRAPH IS :

993.3767

VERTICES

0.0 0.0 899.9998
 894.0396 -0.0004 89.9996
 -0.0004 894.0396 89.9996
 0.0 0.0 -899.9998
 894.0396 -0.0004 -89.9996
 -0.0004 894.0396 -89.9996
 -0.0004 -894.0396 -89.9996
 -0.0004 -894.0396 89.9996
 -894.0396 -0.0004 89.9996
 -894.0396 -0.0004 -89.9996

EDGES

1 2
 1 3
 1 8
 1 9
 2 3
 2 5
 2 8
 3 6
 3 9
 4 5
 4 6
 4 7
 4 10
 5 6
 5 7
 6 10
 7 8
 7 10
 8 9
 9 10

FACES

1 2 3
 4 5 6
 4 5 7
 1 2 8
 1 3 9
 4 6 10
 4 7 10
 1 8 9
 2 3 6 5
 2 5 7 8
 3 6 10 9
 7 8 9 10

THE MAXIMUM IS:

0.9060004950

THE CONVERSION FACTOR FOR VIEWPLOT IS :

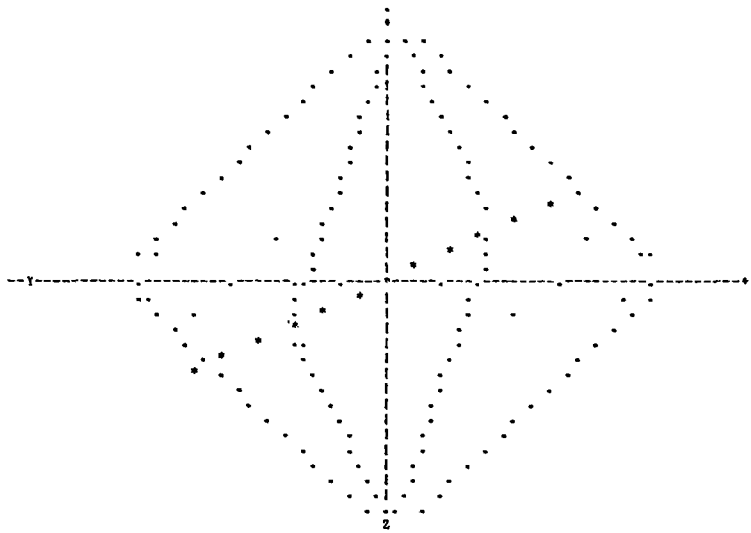
19.8675388521

THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :

(0.0 18.0000)----- (-6.7512 -1.3480)
 (0.0 18.0000)----- (17.8008 1.0000)
 (0.0 18.0000)----- (-17.8008 1.0000)
 (0.0 18.0000)----- (6.7511 4.7440)
 (-6.7512 -1.3480)----- (17.8008 1.0000)
 (-6.7512 -1.3480)----- (-6.7512 -4.7440)
 (-6.7512 -1.3480)----- (-17.8008 1.0000)
 (17.8008 1.0000)----- (17.8008 -1.0000)

```
( 17.8808 1.8000 )----- ( 6.7511 4.9480 )
( 0.0 -18.0000 )----- ( -6.7512 -4.9480 )
( 0.0 -18.0000 )----- ( 17.8808 -1.8000 )
( 0.0 -18.0000 )----- ( -17.8808 -1.8000 )
( 0.0 -18.0000 )----- ( 6.7511 1.3480 )
( -6.7512 -4.9480 )----- ( 17.8808 -1.8000 )
( -6.7512 -4.9480 )----- ( -17.8808 -1.8000 )
( 17.8808 -1.8000 )----- ( 6.7511 1.3480 )
( -17.8808 -1.8000 )----- ( -17.8808 1.8000 )
( -17.8808 -1.8000 )----- ( 6.7511 1.3480 )
( -17.8808 1.8000 )----- ( 6.7511 4.9480 )
( 6.7511 4.9480 )----- ( 6.7511 1.3480 )
```

CRYSTAL SHAPE:



ZIRCON 2 : ROGERS, 1937, P. 471
TETRAGONAL SYSTEM: A:B:C=1:1: 0.9060 ALPHA-BETA=90, , 2 FORM(S).
NUMBER OF FACES OR MILLER INDICES = 12
MILLER INDICES :

```
1 1 1
1 1 -1
1 -1 -1
1 -1 1
-1 1 1
-1 1 -1
-1 -1 -1
-1 -1 1
1 1 0
```

```
1 -1 0
-1 1 0
-1 -1 0
THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :
1.0000 X + 1.0000 Y + 1.1038 Z = 1
1.0000 X + 1.0000 Y + -1.1038 Z = 1
1.0000 Y + -1.0000 Y + -1.1038 Z = 1
1.0000 X + -1.0000 Y + 1.1038 Z = 1
-1.0000 X + 1.0000 Y + 1.1038 Z = 1
-1.0000 X + 1.0000 Y + -1.1038 Z = 1
-1.0000 X + -1.0000 Y + -1.1038 Z = 1
-1.0000 X + -1.0000 Y + 1.1038 Z = 1
3.3333 X + 3.3333 Y + 0.0 Z = 1
3.3333 X + -3.3333 Y + 0.0 Z = 1
-3.3333 X + 3.3333 Y + 0.0 Z = 1
-3.3333 X + -3.3333 Y + 0.0 Z = 1
```

```
THE POSITIONS OF THE CRYSTAL VERTICES ARE :
( 0.0 0.0 0.9060 )
( 0.3000 0.0 0.6342 )
( 0.0 0.3000 0.6342 )
( 0.0 0.0 -0.9060 )
( 0.3000 0.0 -0.6342 )
( 0.0 0.3000 -0.6342 )
( 0.0 0.0 0.3000 )
( 0.0 -0.3000 0.6342 )
( -0.3000 0.0 0.6342 )
( -0.3000 0.0 -0.6342 )
```

```
THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.0 0.0 0.9060 )----- ( 0.3000 0.0 0.6342 )
( 0.0 0.0 0.9060 )----- ( 0.0 0.3000 0.6342 )
( 0.0 0.0 0.9060 )----- ( 0.0 -0.3000 0.6342 )
( 0.0 0.0 0.9060 )----- ( -0.3000 0.0 0.6342 )
( 0.3000 0.0 0.6342 )----- ( 0.0 0.3000 0.6342 )
( 0.3000 0.0 0.6342 )----- ( 0.0 -0.3000 0.6342 )
( 0.3000 0.0 0.6342 )----- ( -0.3000 0.0 0.6342 )
( 0.3000 0.0 0.6342 )----- ( -0.3000 0.0 -0.6342 )
( 0.0 0.3000 0.6342 )----- ( 0.0 0.3000 -0.6342 )
( 0.0 0.3000 0.6342 )----- ( 0.0 -0.3000 0.6342 )
( 0.0 0.3000 0.6342 )----- ( 0.0 -0.3000 -0.6342 )
( 0.0 0.3000 0.6342 )----- ( -0.3000 0.0 0.6342 )
( 0.0 0.3000 0.6342 )----- ( -0.3000 0.0 -0.6342 )
( 0.0 0.0 -0.9060 )----- ( 0.0 0.3000 -0.6342 )
( 0.0 0.0 -0.9060 )----- ( 0.0 -0.3000 -0.6342 )
( 0.0 0.0 -0.9060 )----- ( -0.3000 0.0 -0.6342 )
( 0.0 0.0 -0.9060 )----- ( -0.3000 0.0 0.6342 )
( 0.3000 0.0 -0.6342 )----- ( 0.0 0.3000 -0.6342 )
( 0.3000 0.0 -0.6342 )----- ( 0.0 -0.3000 -0.6342 )
( 0.3000 0.0 -0.6342 )----- ( -0.3000 0.0 -0.6342 )
( 0.3000 0.0 -0.6342 )----- ( -0.3000 0.0 0.6342 )
( 0.0 -0.3000 -0.6342 )----- ( 0.0 -0.3000 0.6342 )
( 0.0 -0.3000 -0.6342 )----- ( 0.0 0.3000 0.6342 )
( 0.0 -0.3000 -0.6342 )----- ( -0.3000 0.0 0.6342 )
( 0.0 -0.3000 -0.6342 )----- ( -0.3000 0.0 -0.6342 )
( -0.3000 0.0 0.6342 )----- ( -0.3000 0.0 -0.6342 )
```

THE MAXIMUM IS: 0.9060 THE CONVERSION FACTOR FOR THE PRINTING GRAPH IS : 993.3767

```
VERTICES
0.0 0.0 699.9998
298.0129 0.0 679.9998
0.0 298.0129 629.9998
0.0 0.0 -899.9998
298.0129 0.0 -679.9998
0.0 298.0129 -629.9998
0.0 -298.0129 -629.9998
0.0 -298.0129 629.9998
-298.0129 0.0 629.9998
-298.0129 0.0 -629.9998
EDGES
1 2
```



```

1 3
1 8
1 9
2 3
2 5
2 8
3 6
3 9
4 5
4 6
4 7
5 6
5 7
6 10
7 8
7 10
8 9
9 10
FACES
1 2 3
4 5 6
4 5 7
1 2 8
1 3 9
4 6 10
4 7 10
1 8 9
2 3 6 5
2 5 7 8
3 6 10 9
7 8 9 10
THE MAXIMUM IS: 0.9060004950 THE COMPRESSION FACTOR FOR VIEWPLOT IS : 19.8675384521
THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.0 18.0000 )-----(-2.2504 11.5507 )
( 0.0 18.0000 )-----(-5.9603 12.6000 )
( 0.0 18.0000 )-----(-5.9603 12.6000 )
( 0.0 18.0000 )-----(-2.2504 13.6493 )
( -2.2504 11.5507 )-----(-5.9603 12.6000 )
( -2.2504 11.5507 )-----(-2.2504 -13.6493 )
( -2.2504 11.5507 )-----(-5.9603 12.6000 )
( 5.9603 12.6000 )-----(-5.9603 12.6000 )
( 5.9603 12.6000 )-----(-2.2504 13.6493 )
( 0.0 -18.0000 )-----(-2.2504 -13.6493 )
( 0.0 -18.0000 )-----(-5.9603 12.6000 )
( 0.0 -18.0000 )-----(-5.9603 12.6000 )
( 0.0 -18.0000 )-----(-2.2504 -11.5507 )
( -2.2504 -13.6493 )-----(-5.9603 12.6000 )
( -2.2504 -13.6493 )-----(-5.9603 12.6000 )
( 5.9603 -12.6000 )-----(-2.2504 -11.5507 )
( -5.9603 -12.6000 )-----(-5.9603 12.6000 )
( -5.9603 -12.6000 )-----(-2.2504 -11.5507 )
( -5.9603 12.6000 )-----(-2.2504 11.5507 )
( 2.2504 13.6493 )-----(-2.2504 -11.5507 )
CRYSTAL SHAPE:

```



```

ZIPCON 3 : ROGERS, 1937, P. 471
TETRAGONAL SYSTEM: A:B:C=1:1:1 0.9060 ALPHA=BETA=GAMMA=90, , 3 FORM(S).
NUMBER OF FACES OF MILLER INDICES = 16
MILLER INDICES :
1 1 1
-1 1 1
-1 -1 1
1 -1 1
1 1 -1
-1 1 -1
-1 -1 -1
1 -1 -1
1 1 0
1 -1 0
-1 1 0
-1 -1 0
1 0 0
0 1 0
-1 0 0
0 -1 0
THE CARTESIAN EQUATIONS OF THE CRYSTAL FACES ARE :
1.0000 X + 1.0000 Y + 1.1038 Z = 1
-1.0000 X + 1.0000 Y + 1.1038 Z = 1
-1.0000 X + -1.0000 Y + 1.1038 Z = 1
1.0000 X + -1.0000 Y + 1.1038 Z = 1
1.0000 X + 1.0000 Y + -1.1038 Z = 1
-1.0000 X + 1.0000 Y + -1.1038 Z = 1
-1.0000 X + -1.0000 Y + -1.1038 Z = 1
1.0000 X + -1.0000 Y + -1.1038 Z = 1
3.3333 X + 3.3333 Y + 0.0 Z = 1
3.3333 X + -3.3333 Y + 0.0 Z = 1
-3.3333 X + 3.3333 Y + 0.0 Z = 1
-3.3333 X + -3.3333 Y + 0.0 Z = 1

```

5.0000 X + 0.0 Y + 0.0 Z = 1
 0.0 X + 5.0000 Y + 0.0 Z = 1
 -5.0000 X + 0.0 Y + 0.0 Z = 1
 0.0 X + -5.0000 Y + 0.0 Z = 1

THE POSITIONS OF THE CRYSTAL VERTICES ARE :

(	0.0	0.0	0.9060	)
(	0.0	0.2000	0.7248	)
(	0.2000	0.0	0.7248	)
(	0.2000	0.1000	0.6342	)
(	0.1000	0.2000	0.6342	)
(	-0.2000	0.0	0.7248	)
(	-0.1000	0.2000	0.6342	)
(	-0.2000	0.1000	0.6342	)
(	0.0	-0.2000	0.7248	)
(	-0.2000	-0.1000	0.6342	)
(	-0.1000	-0.2000	0.6342	)
(	0.2000	-0.1000	0.6342	)
(	0.1000	-0.2000	0.6342	)
(	0.0	0.0	-0.9060	)
(	0.0	0.2000	-0.7248	)
(	0.2000	0.0	-0.7248	)
(	0.2000	0.1000	-0.6342	)
(	0.1000	0.2000	-0.6342	)
(	-0.2000	0.0	-0.7248	)
(	-0.1000	0.2000	-0.6342	)
(	-0.2000	0.1000	-0.6342	)
(	0.0	-0.2000	-0.7248	)
(	-0.2000	-0.1000	-0.6342	)
(	-0.1000	-0.2000	-0.6342	)
(	0.2000	-0.1000	-0.6342	)
(	0.1000	-0.2000	-0.6342	)

THE 3D EDGES OF THE CRYSTAL ARE DETERMINED BY THE FOLLOWING POINTS :

(	0.0	0.0	0.9060	)	-----	(	0.0	0.2000	0.7248	)
(	0.0	0.0	0.9060	)	-----	(	0.2000	0.0	0.7248	)
(	0.0	0.0	0.9060	)	-----	(	-0.2000	0.0	0.7248	)
(	0.0	0.0	0.9060	)	-----	(	0.0	-0.2000	0.7248	)
(	0.0	0.2000	0.7248	)	-----	(	0.1000	0.2000	0.6342	)
(	0.0	0.2000	0.7248	)	-----	(	-0.1000	0.2000	0.6342	)
(	0.2000	0.0	0.7248	)	-----	(	0.2000	0.1000	0.6342	)
(	0.2000	0.0	0.7248	)	-----	(	0.2000	-0.1000	0.6342	)
(	0.2000	0.1000	0.6342	)	-----	(	0.1000	0.2000	0.6342	)
(	0.2000	0.1000	0.6342	)	-----	(	0.1000	-0.2000	0.6342	)
(	0.1000	0.2000	0.6342	)	-----	(	0.1000	0.1000	-0.6342	)
(	-0.2000	0.0	0.7248	)	-----	(	-0.2000	0.1000	0.6342	)
(	-0.2000	0.0	0.7248	)	-----	(	-0.2000	-0.1000	0.6342	)
(	-0.1000	0.2000	0.6342	)	-----	(	-0.2000	0.1000	0.6342	)
(	-0.1000	0.2000	0.6342	)	-----	(	-0.1000	0.2000	-0.6342	)
(	-0.2000	0.1000	0.6342	)	-----	(	-0.2000	0.1000	-0.6342	)
(	0.0	-0.2000	0.7248	)	-----	(	-0.1000	-0.2000	0.6342	)
(	0.0	-0.2000	0.7248	)	-----	(	0.1000	-0.2000	0.6342	)
(	-0.2000	-0.1000	0.6342	)	-----	(	-0.1000	-0.2000	0.6342	)
(	-0.2000	-0.1000	0.6342	)	-----	(	-0.2000	-0.1000	-0.6342	)
(	-0.1000	-0.2000	0.6342	)	-----	(	-0.1000	-0.2000	-0.6342	)
(	0.2000	-0.1000	0.6342	)	-----	(	0.1000	-0.2000	0.6342	)
(	0.2000	-0.1000	0.6342	)	-----	(	0.2000	-0.1000	-0.6342	)
(	0.1000	-0.2000	0.6342	)	-----	(	0.1000	-0.2000	-0.6342	)
(	0.0	0.0	-0.9060	)	-----	(	0.0	0.2000	-0.7248	)
(	0.0	0.0	-0.9060	)	-----	(	0.2000	0.0	-0.7248	)
(	0.0	0.0	-0.9060	)	-----	(	-0.2000	0.0	-0.7248	)
(	0.0	0.0	-0.9060	)	-----	(	0.0	-0.2000	-0.7248	)
(	0.0	0.2000	-0.7248	)	-----	(	0.1000	0.2000	-0.6342	)
(	0.0	0.2000	-0.7248	)	-----	(	-0.1000	0.2000	-0.6342	)

(	0.2000	0.0	-0.7248	)	-----	(	0.2000	0.1000	-0.6342	)
(	0.2000	0.0	-0.7248	)	-----	(	0.2000	-0.1000	-0.6342	)
(	0.2000	0.1000	-0.6342	)	-----	(	0.1000	0.2000	-0.6342	)
(	-0.2000	0.0	-0.7248	)	-----	(	-0.2000	0.1000	-0.6342	)
(	-0.2000	0.0	-0.7248	)	-----	(	-0.2000	-0.1000	-0.6342	)
(	-0.1000	0.2000	-0.6342	)	-----	(	-0.2000	0.1000	-0.6342	)
(	0.0	-0.2000	-0.7248	)	-----	(	-0.1000	-0.2000	-0.6342	)
(	0.0	-0.2000	-0.7248	)	-----	(	0.1000	-0.2000	-0.6342	)
(	-0.2000	-0.1000	-0.6342	)	-----	(	-0.1000	-0.2000	-0.6342	)
(	-0.2000	-0.1000	-0.6342	)	-----	(	0.1000	-0.2000	-0.6342	)
(	0.2000	-0.1000	-0.6342	)	-----	(	0.2000	-0.1000	-0.6342	)
(	0.1000	-0.2000	-0.6342	)	-----	(	0.1000	-0.2000	-0.6342	)
(	0.0	0.0	-0.9060	)	-----	(	0.0	0.2000	-0.7248	)
(	0.0	0.0	-0.9060	)	-----	(	0.2000	0.0	-0.7248	)
(	0.0	0.0	-0.9060	)	-----	(	-0.2000	0.0	-0.7248	)
(	0.0	0.2000	-0.7248	)	-----	(	0.1000	0.2000	-0.6342	)
(	0.0	0.2000	-0.7248	)	-----	(	-0.1000	0.2000	-0.6342	)

THE MAXIMUM IS: 0.9060 THE CONVERSION FACTOR FOR THE PINTER GRAPH IS : 993.3767

VERTICES

0.0	0.0	899.9998
0.0	198.6753	719.9998
198.6753	0.0	719.9998
198.6755	99.3378	630.0000
99.3378	198.6755	630.0000
-198.6753	0.0	719.9998
-99.3378	198.6755	630.0000
-198.6755	99.3378	630.0000
0.0	-198.6753	719.9998
-198.6755	-99.3378	630.0000
-99.3378	-198.6755	630.0000
198.6755	-99.3378	630.0000
99.3378	-198.6755	630.0000
0.0	0.0	-899.9998
0.0	198.6753	-719.9998
198.6753	0.0	-719.9998
198.6755	99.3378	-630.0000
99.3378	198.6755	-630.0000
-198.6753	0.0	-719.9998
-99.3378	198.6755	-630.0000
-198.6755	99.3378	-630.0000
0.0	-198.6753	-719.9998
-198.6755	-99.3378	-630.0000
-99.3378	-198.6755	-630.0000
198.6755	-99.3378	-630.0000
99.3378	-198.6755	-630.0000

EDGES

1	2
1	3
1	6
1	9
2	5
2	7
3	4
3	12
4	5
4	17
5	10
6	8
6	10
7	8
7	20
8	21
9	11
9	13
10	11
10	23
11	24
12	13

```

13 26
14 15
14 16
14 19
14 22
15 18
15 20
16 17
16 25
17 18
19 21
19 23
20 21
22 24
22 26
23 24
25 26
FACES
1 2 5 4 3
1 2 7 8 6
1 6 10 11 9
1 3 12 13 9
14 15 18 17 16
14 15 20 21 19
14 19 23 24 22
14 16 25 26 22
4 5 18 17
12 13 26 25
7 8 21 20
10 11 24 23
3 4 17 16 25 12
2 5 18 15 20 7
6 8 21 19 23 10
9 11 24 22 26 13
THE MAXIMUM IS: 0.9060004950 THE CONVERSION FACTOR FOR VIEWPLOT IS : 19.8675384521

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THE 2D EDGES ARE DETERMINED BY THE FOLLOWING POINTS :
( 0.0 18.0000 )----- ( 3.9735 14.4000 )
( 0.0 18.0000 )----- ( -1.5003 13.7004 )
( 0.0 18.0000 )----- ( 1.5003 15.0996 )
( 0.0 18.0000 )----- ( -3.9735 14.4000 )
( 3.9735 14.4000 )----- ( 3.2234 12.2502 )
( 3.9735 14.4000 )----- ( 4.7236 12.9498 )
( -1.5003 13.7004 )----- ( 0.4865 11.9004 )
( -1.5003 13.7004 )----- ( -3.4870 11.9004 )
( 0.4865 11.9004 )----- ( 3.2234 12.2502 )
( 0.4865 11.9004 )----- ( 0.4865 -13.2996 )
( 3.2234 12.2502 )----- ( 3.2234 -12.9498 )
( 1.5003 15.0996 )----- ( 3.4870 13.2996 )
( 1.5003 15.0996 )----- ( -0.4865 13.2996 )
( 4.7236 12.9498 )----- ( 3.4870 13.2996 )
( 4.7236 12.9498 )----- ( 4.7236 -12.2502 )
( 3.4870 13.2996 )----- ( 3.4870 -11.9004 )
( -3.9735 14.4000 )----- ( -3.2234 12.2502 )
( -3.9735 14.4000 )----- ( -4.7236 12.2502 )
( -0.4865 13.2996 )----- ( -3.2234 12.9498 )
( -0.4865 13.2996 )----- ( -0.4865 -11.9004 )
( -3.2234 12.9498 )----- ( -3.2234 -12.2502 )
( -3.4870 11.9004 )----- ( -4.7236 12.2502 )
( -3.4870 11.9004 )----- ( -3.4870 -13.2996 )
( -4.7236 12.2502 )----- ( -4.7236 -12.9498 )
( 0.0 -18.0000 )----- ( 3.9735 -14.4000 )
( 0.0 -18.0000 )----- ( -1.5003 -15.0996 )

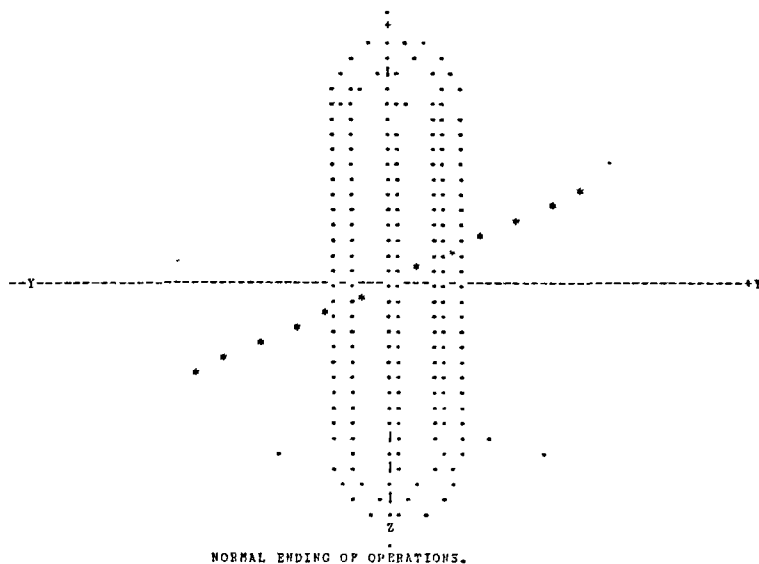
```

```

( 0.0 -18.0000 )----- ( 1.5003 -13.7004 )
( 0.0 -18.0000 )----- ( -3.9735 -14.4000 )
( 3.9735 -14.4000 )----- ( 3.2234 -12.9498 )
( 3.9735 -14.4000 )----- ( 4.7236 -12.2502 )
( -1.5003 -15.0996 )----- ( 0.4865 -13.2996 )
( -1.5003 -15.0996 )----- ( -3.4870 -13.2996 )
( 0.4865 -13.2996 )----- ( 3.2234 -12.9498 )
( 1.5003 -13.7004 )----- ( 3.4870 -11.9004 )
( 1.5003 -13.7004 )----- ( -0.4865 -11.9004 )
( 4.7236 -12.2502 )----- ( 3.4870 -11.9004 )
( -3.9735 -14.4000 )----- ( -3.2234 -12.2502 )
( -3.9735 -14.4000 )----- ( -4.7236 -12.9498 )
( -0.4865 -11.9004 )----- ( -3.2234 -12.2502 )
( -3.4870 -13.2996 )----- ( -4.7236 -12.9498 )

```

CRYSTAL SHAPE:



Appendix A.1

The following is a list of the Fortran statements making up Module 1, a program designed to simulate the growth of single crystals. Module 2 also contains the subroutines required to analyze the position lost due to the use of object lattices as a mean of storing the intermediate phases of the simulation.

```

C
C      BEGINNING OF MAIN .
C
      DIMENSION HEADER(2,80)
      COMMON /NCUBE/ SPACE
      COMMON /NOUT/ IS
      COMMON /XANALY/ FRMIN(50),FRMAX(50),XMIN(50),XMAX(50),VOL(50),VOL1
1(50),XMINH(50),XMAXH(50),AREA(50),TOTALE(50)
      COMMON /FOAT/ X(50),Y(50),Z(50),A(50),XINCR
      COMMON /CNTL/ I4,N,II,INDI3,NCO,JIII
      INTGFR*2 IS(20),SPACE(39,39,39)
      XYZ=9876.5
      READ(1,20) ((HEADER(I,J),I=1,2),J=1,80)
20  FORMAT(80A1)
      INDI3=0
      WRITE(3,7)
      WRITE(3,21) ((HEADER(I,J),I=1,2),J=1,80)
21  FORMAT('0',/,25X,80A1)
      READ(1,8) I4,I2,NTYPE,XINCR,(IS(I),I=1,20)
      DO 1 I=1,I4
      READ(1,9) X(I),Y(I),Z(I)
1  CONTINUE
      IF (IS(1).NE.1) GO TO 2
      WRITE(3,10)
      WRITE(3,11) (X(I),Y(I),Z(I),I=1,I4)
2  N=20
      CALL ADTRAN
      IF (IS(2).NE.1) GO TO 3
      WRITE(3,12) N,N,N
      WRITE(3,13) (X(I),Y(I),Z(I),A(I),I=1,I4)
      INDI3=0
3  DO 5 I=1,I2
      CALL RESET
      IF (I1.EQ.1) GO TO 4
      IF (NTYPE.EQ.1) CALL GROW1
4  CALL SCID
      IF (INDI3.EQ.1.AND.IS(19).EQ.1) GO TO 6
      CALL THNEAS
      CALL PFFCI
      CALL MATEXP
      CALL DETRAN
      CALL VEPTI
      CALL AFEVOL
5  CONTINUE
      CALL PTOTAN (I2)
      CALL CTOTAN (I2)
      WRITE(3,14)
      WRITE(8,15) XYZ,XYZ,XYZ,XYZ
      STOP
6  I2=I1-1
      CALL PTOTAN (I2)
      CALL CTOTAN (I2)
      WRITE(3,14)
      WRITE(8,15) XYZ,XYZ,XYZ,XYZ
      STOP

```

Apdx. J, p. 2

```

C
7  FORMAT ('0',50X,'BEGINNING OF OPERATIONS.')
8  FORMAT (3I4,F10.4,20I2)
9  FORMAT (3F10.4)
10  FORMAT ('0',/,10X,'STANDARD CRYSTAL'S FACES EQUATIONS ( WITH CE
11  WRITE AT 0,0,0 ) ARE :')
12  FORMAT ('0',10X,F10.4,' X + ',F10.4,' Y + ',F10.4,' Z = 1.0')
12  FORMAT ('0',/,10X,'TRANSPPOSED CRYSTAL'S FACES EQUATIONS ( WITH
13  CENTRE AT ',I4,' ',I4,' ',I4,' ) ARE :')
13  FORMAT ('0',10X,F10.4,' X + ',F10.4,' Y + ',F10.4,' Z = ',F10.4)
14  FORMAT ('0',20(/),46X,'NORMAL ENDING OF OPERATIONS.')
15  FORMAT(4F10.4)
      END
      B 64-

C
C      SUBROUTINE ADTRAN .
C
      SUBROUTINE ADTRAN
      COMMON /EQNT/ X(50),Y(50),Z(50),A(50),XINCR
      COMMON /CNTL/ I4,N,II,INDI3,NCO,JIII
      DO 1 I=1,I4
      A(I) = ((X(I)*(-N)) + (Y(I)*(-N)) + (Z(I)*(-N)) - 1.0)
1  CONTINUE
      RETURN
      END
      B 6-

C
C      SUBROUTINE RESET .
C
      SUBROUTINE RESET
      COMMON /NCUBE/ SPACE
      INTEGER*2 SPACE(39,39,39),BLANK/' ',BOPDER/'+'
      I1=39
      DO 1 I=1,39
      DO 1 J=1,39
      DO 1 K=1,39
      SPACE(I,J,K)=BLANK
      IF (I.EQ.1.OR.I.EQ.I1.OR.J.EQ.1.OR.J.EQ.I1.OR.K.EQ.1.OR.K.EQ.I1) S
1  SPACE(I,J,K)=BOPDER
      CONTINUE
      RETURN
      END
      C 13-

C
C      SUBROUTINE GROW1 .
C
      SUBROUTINE GROW1
      COMMON /EQNT/ X(50),Y(50),Z(50),A(50),XINCR
      COMMON /CNTL/ I4,N,II,INDI3,NCO,JIII
      FFAL DIS(50),I6(2)
      II (I1.NF.2) GO TO 2
      DO 1 I=1,I4
      DIS(I) = ((ABS(((X(I)*N) + (Y(I)*N) + (Z(I)*N) - (A(I)))/(SQRT((X(I)**2) + (
1  Y(I)**2) + (Z(I)**2)))))*XINCR)
      CONTINUE
2  DO 9 I=1,I4
      I2 = SQRT((X(I)**2) + (Y(I)**2) + (Z(I)**2))
      X3 = ((X(I)*N) + (Y(I)*N) + (Z(I)*N))
      X6(1) = ((DIS(I)*X2)*FLOAT(II)) - (X3)
      X6(2) = ((-DIS(I)*X2)*FLOAT(II)) - (X3)
      DO 7 J=1,2
      IF (X(I).NE.0.0) GO TO 3
      IF (Y(I).NE.0.0) GO TO 4
      IF (Z(I).NE.0.0) GO TO 5

```



```

21)
31  FORMAT('0',10X,'MAXIMUM ABSOLUTE ERROR UNDEFINED DUE TO CRYSTAL PA F 177
    IDIUS = 0.0 UNITS.') F 178
32  FORMAT('0',10X,'MAXIMUM ABSOLUTE ERROR = +-',F10.4,' UNITS.') F 179
33  FORMAT('0',5X,'MINIMUM ABSOLUTE ERROR UNDEFINED DUE TO CRYSTAL RAD F 181
    IUS = 0.0 UNITS.') F 182
34  FORMAT('0',5X,'MINIMUM ABSOLUTE ERROR =+-',F10.4,' UNITS.') F 183
35  FORMAT('0',///,39X,' FREQUENCY DISTRIBUTION OF SURFACE COORDINAT F 184
    IS SHIFT.') F 185
36  FORMAT('0',11X,'FREQUENCY',//) F 186
37  FORMAT(' ',9X,' 100X') F 187
38  FORMAT(' ',9X,' 75X') F 188
39  FORMAT(' ',9X,' 50X') F 189
40  FORMAT(' ',9X,' 25X') F 190
41  FORMAT(' ',9X,' 0X') F 191
42  FORMAT(' ') F 192
43  FORMAT(' ',14X,100A1) F 193
44  FORMAT('0',15X,'0',6X,'0.1',5X,'0.2',5X,'0.3',5X,'0.4',5X,'0.5',5 F 194
    1X,'0.6',5X,'0.7',5X,'0.8',5X,'0.9',5X,'1.0', ' GT.1.',3X,'ABSOLUTE F 195
    2 SHIFT',//) F 196
51  FORMAT(4F10.4) F 197
52  FORMAT(3I4) F 198
53  FORMAT(16) F 199
    END F 200-

C
C      SUBROUTINE MATEXP .
C
SUBROUTINE MATEXP
COMMON /NCUBE/ SPACE
COMMON /NOUT/ IS
INTEGER*2 SPACE(39,39,39),V(39),IS(20)
DO 1 I=1,39
J=40-I
V(I)=J
CONTINUE
WRITE(3,4)
WRITE(3,5)
WRITE(3,6)
WRITE(3,7)
DO 3 I1=1,39
I2=20
WRITE(3,8) (SPACE(I1,K,I2),K=1,39)
WRITE(3,9) (SPACE((V(K)),I2,(V(I1))),K=1,39)
WRITE(3,10) (SPACE(I2,K,(V(I1))),K=1,39)
CONTINUE
RETURN
C
C
C      FORMAT('1',///,39X,'ORTHOGONAL INTERCEPT PLANES THROUGH SPACE AND G 23
CRYSTAL CENTRE :') G 24
5  FORMAT(' ',///,17X,'X-Y PLANE :',29X,'X-Z PLANE :',30X,'Y-Z PLANE G 25
    1 :') G 26
6  FORMAT(' ',///,14X,'LOOKING DOWN +Z',26X,'LOOKING DOWN -Y',26X,'LOO G 27
    KING DOWN +X') G 28
7  FORMAT(' ',///,14X,'-X TOP, -Y LEFT',26X,'+Z TOP, -X LEFT',26X,'+Z G 29
    1TOP, -Y LEFT',//) G 30
8  FORMAT(' ',1X,40A1) G 31
9  FORMAT(' ',42X,40A1) G 32
10 FORMAT(' ',83X,40A1) G 33
    END G 34-

```

```

C
C      SUBROUTINE THREEAS .
C
SUBROUTINE THREEAS
COMMON /EONT/ X(50),Y(50),Z(50),A(50),XINCR H 1
COMMON /CNTL/ I4,N,II,INDI3,NCO,IIIX H 2
COMMON /XANALY/ PRMIN(50),PRMAX(50),XMIN(50),XMAX(50),VOL(50),VOL1 H 4
1(50),XMINTH(50),XMAXTH(50),AREA(50),TOTARE(50) H 5
RADMIN=999999.9 H 6
RADMAX=999999.9 H 7
DO 1 I=1,I4 H 8
DIST=(ABS(((X(I)*N)+(Y(I)*N)+(Z(I)*N)-A(I)))/(SQRT((X(I)**2)+(Y(I)* H 9
1*2)+(Z(I)**2)))) H 10
IF (DIST.GT.RADMAX) RADMAX=DIST H 11
IF (DIST.LT.RADMIN) RADMIN=DIST H 12
CONTINUE H 13
XMINTH(II)=RADMIN H 14
XMAXTH(II)=RADMAX H 15
RETURN H 16
END H 17

C
C      SUBROUTINE PTOTAN .
C
SUBROUTINE PTOTAN (I2)
COMMON /NOUT/ IS
COMMON /XANALY/ PRMIN(50),PRMAX(50),F(50),G(50),E(50),VOL1(50),XMI I 18
1NTH(50),XMAXTH(50),AREA(50),TOTARE(50) I 19
INTEGER I2 I 20
INTGEP*2 BL/' ',VER/'1',P1/' ',UN/'U',P2/'*'/ I 21
0,OV/'O',DOM(100)/100*-'',NT(30,100)/3000*-'',P6/'6'/ I 22
INTGEP*2 IS(20),NX1(50),NX2(50),NX5(50) I 23
REAL XA1/0.0/,XA2/0.0/,XA3/0.0/,XA4/0.0/,XA5/0.0/,XA6/0.0/ I 24
IF (I5(11).NE.1) RETURN I 25
DO 1 I=1,I2 I 26
IF (E(I).LT.0.0001) E(I)=1000.0 I 27
XA1=AMAX1(PRMIN(I),XA1) I 28
XA2=AMAX1(PRMAX(I),XA2) I 29
XA3=AMAX1(F(I),XA3) I 30
XA4=AMAX1(G(I),XA4) I 31
XA5=AMAX1(E(I),XA5) I 32
XA6=AMAX1(AREA(I),XA6) I 33
CONTINUE I 34
IF (XA1.LT.XA2) XA1=XA2 I 35
IF (XA1.LT.0.0001) GO TO 2 I 36
ICFA1=30.0/XA1 I 37
GO TO 3 I 38
ICFA1=0.0 I 39
IF (XA3.LT.0.0001) GO TO 4 I 40
ICFA3=100.0/XA3 I 41
GO TO 5 I 42
ICFA3=0.0 I 43
IF (XA4.LT.0.0001) GO TO 6 I 44
ICFA4=100.0/XA4 I 45
GO TO 7 I 46
ICFA4=0.0 I 47
IF (XA5.LT.0.0001) GO TO 8 I 48
ICFA5=100.0/XA5 I 49
GO TO 9 I 50
ICFA5=0.0 I 51
IF (XA6.LT.0.0001) GO TO 10 I 52
ICFA6=100.0/XA6 I 53

```

```

10 GO TO 11 I 37
11 XCPA6=0.0 I 38
DO 12 I=1,I2 I 39
  NK1(I)=IFIX((PRM1(I)*XCPA1)+0.5) I 40
  NK2(I)=IFIX((PRM2(I)*XCPA1)+0.5) I 41
12 CONTINUE I 42
DO 13 I=1,I2 I 43
  WRITE (3,47) IKJ I 44
  WRITE (3,48) I 45
DO 13 I=1,I2 I 46
  DO 13 J=1,100 I 47
    NT(I,J)=BL I 48
13 CONTINUE I 49
  IF (IKJ.EQ.1) GO TO 16 I 50
  IF (IKJ.EQ.2) GO TO 18 I 51
  IF (IKJ.EQ.4) GO TO 14 I 52
  IF (IKJ.EQ.3) GO TO 20 I 53
14 DO 15 I=1,I2 I 54
  NK5(I)=IFIX((P(I)*XCPA5)+0.5) I 55
15 CONTINUE I 56
GO TO 22 I 57
16 DO 17 I=1,I2 I 58
  NK5(I)=IFIX((F(I)*XCPA3)+0.5) I 59
17 CONTINUE I 60
GO TO 22 I 61
18 DO 19 I=1,I2 I 62
  NK5(I)=IFIX((G(I)*XCPA4)+0.5) I 63
19 CONTINUE I 64
GO TO 22 I 65
20 DO 21 I=1,I2 I 66
  NK5(I)=IFIX((AREA(I)*XCPA6)+0.5) I 67
21 CONTINUE I 68
22 DO 30 I=1,I2 I 69
  IF (NK5(I).LT.0) GO TO 23 I 70
  IF (NK5(I).EQ.0) NK5(I)=1 I 71
  IF ((NK1(I).LT.0)) GO TO 25 I 72
  IF (NK1(I).EQ.0) NK1(I)=1 I 73
  IF ((NT((NK1(I)), (NK5(I)))) .NE. BL) GO TO 26 I 74
  NT((NK1(I)), (NK5(I)))=P1 I 75
GO TO 27 I 76
23 DO 24 J=1,30 I 77
  NT(J,1)=00 I 78
24 CONTINUE I 79
GO TO 30 I 80
25 NT(1), (NK5(I))=P6 I 81
GO TO 27 I 82
26 NT((NK1(I)), (NK5(I)))=00 I 83
IF (NK2(I).LT.0) GO TO 29 I 84
IF (NK2(I).EQ.0) NK2(I)=1 I 85
IF ((NT((NK2(I)), (NK5(I)))) .NE. BL) GO TO 28 I 86
NT((NK2(I)), (NK5(I)))=P2 I 87
GO TO 30 I 88
28 NT((NK2(I)), (NK5(I)))=00 I 89
GO TO 30 I 90
29 NT(1), (NK5(I))=P6 I 91
30 CONTINUE I 92
XDUM1=XA1*0.25 I 93
XDUM2=XA1*0.50 I 94
XDUM3=XA1*0.75 I 95
XDUM4=0.0 I 96
DO 36 I=1,30 I 97

```

```

IF (I.EQ.1) GO TO 31 I 98
IF (I.EQ.7) GO TO 32 I 99
IF (I.EQ.15) GO TO 33 I 100
IF (I.EQ.23) GO TO 34 I 101
IF (I.EQ.30) GO TO 35 I 102
WRITE (3,49) (NT(I,J),J=1,100) I 103
GO TO 36 I 104
31 WRITE (3,50) XDUM4, (NT(I,J),J=1,100) I 105
GO TO 36 I 106
32 WRITE (3,51) XDUM1, (NT(I,J),J=1,100) I 107
GO TO 36 I 108
33 WRITE (3,51) XDUM2, (NT(I,J),J=1,100) I 109
GO TO 36 I 110
34 WRITE (3,51) XDUM3, (NT(I,J),J=1,100) I 111
GO TO 36 I 112
35 WRITE (3,51) XA1, (NT(I,J),J=1,100) I 113
36 CONTINUE I 114
DUM(1)=VER I 115
DO 37 I=25,100,25 I 116
  DUM(I)=VER I 117
37 CONTINUE I 118
  WRITE (3,52) (DUM(J),J=1,100) I 119
  IF (IKJ.EQ.4) GO TO 38 I 120
GO TO 39 I 121
38 XX1=XA5*0.25 I 122
  XX2=XA5*0.50 I 123
  XX3=XA5*0.75 I 124
  WRITE (3,53) XX1,XX2,XX3,XA5 I 125
39 IF (IKJ.EQ.1) GO TO 40 I 126
GO TO 41 I 127
40 XX1=XA3*0.25 I 128
  XX2=XA3*0.50 I 129
  XX3=XA3*0.75 I 130
  WRITE (3,54) XX1,XX2,XX3,XA3 I 131
41 IF (IKJ.EQ.2) GO TO 42 I 132
GO TO 43 I 133
42 XX1=XA4*0.25 I 134
  XX2=XA4*0.50 I 135
  XX3=XA4*0.75 I 136
  WRITE (3,55) XX1,XX2,XX3,XA4 I 137
43 IF (IKJ.EQ.3) GO TO 44 I 138
GO TO 45 I 139
44 XX1=XA6*0.25 I 140
  XX2=XA6*0.50 I 141
  XX3=XA6*0.75 I 142
  WRITE (3,56) XX1,XX2,XX3,XA6 I 143
45 IF (IKJ.FQ.1) WRITE (3,57) I 144
  IF (IKJ.FQ.1) WRITE (3,58) I 145
  IF (IKJ.FQ.2) WRITE (3,59) I 146
  IF (IKJ.FQ.2) WRITE (3,60) I 147
  IF (IKJ.FQ.4) WRITE (3,61) I 148
  IF (IKJ.FQ.4) WRITE (3,62) I 149
  IF (IKJ.FQ.3) WRITE (3,63) I 150
  IF (IKJ.FQ.3) WRITE (3,64) I 151
  WRITE (3,65) I 152
  WRITE (3,66) I 153
  WRITE (3,67) I 154
46 CONTINUE I 155
RETURN I 156
C I 157
47 FORMAT ('1',//,30X,' VARIATION OF PRECISION ANALYSIS NO : ',I2) I 158

```



```

48  FORMAT ('0',//,' ABSOLUTE ERROR.') I 159
49  FORMAT (' ',9X,'(1,100A1) I 160
50  FORMAT (' ',9X,'(1,100A1) I 161
51  FORMAT (' ',9X,'(1,100A1) I 162
52  FORMAT (' ',9X,'(1,100A1) I 163
53  FORMAT (' ',5X,' 0.0 ',10X,F9.3,16X,F9.3,16X,F9.3,16X,F9.3,' : M I 164
10.PTS.) I 165
54  FORMAT (' ',5X,' 0.0 ',18X,F9.3,16X,F9.3,16X,F9.3,16X,F9.3,' : M I 166
11RAD.) I 167
55  FORMAT (' ',5X,' 0.0 ',18X,F9.3,16X,F9.3,16X,F9.3,16X,F9.3,' : M I 168
11RAD.) I 169
56  FORMAT (' ',5X,' 0.0 ',18X,F9.3,16X,F9.3,16X,F9.3,16X,F9.3,' : M I 170
10.PTS.) I 171
57  FORMAT ('0',//,15X,'* : GRAPH OF MINIMUM ABSOLUTE ERROR VS. MINIMUM I 172
11 RADIUS OF THE SIMULATED CRYSTAL.') I 173
58  FORMAT ('0',//,15X,'* : GRAPH OF MAXIMUM ABSOLUTE ERROR VS. MINIMUM I 174
11 RADIUS OF THE SIMULATED CRYSTAL.') I 175
59  FORMAT ('0',//,15X,'* : GRAPH OF MINIMUM ABSOLUTE ERROR VS. MAXIMUM I 176
11 RADIUS OF THE SIMULATED CRYSTAL.') I 177
60  FORMAT ('0',//,15X,'* : GRAPH OF MAXIMUM ABSOLUTE ERROR VS. MAXIMUM I 178
11 RADIUS OF THE SIMULATED CRYSTAL.') I 179
61  FORMAT ('0',//,15X,'* : GRAPH OF MINIMUM ABSOLUTE ERROR VS. TOTAL N I 180
11 NUMBER OF POINTS (SURFACE + INTERNAL) OF SIMULATED CRYSTAL.') I 181
62  FORMAT ('0',//,15X,'* : GRAPH OF MAXIMUM ABSOLUTE ERROR VS. TOTAL N I 182
11 NUMBER OF POINTS (SURFACE + INTERNAL) OF SIMULATED CRYSTAL.') I 183
63  FORMAT ('0',//,15X,'* : GRAPH OF MINIMUM ABSOLUTE ERROR VS. NUMBER I 184
11 OF SURFACE POINTS OF THE SIMULATED CRYSTAL.') I 185
64  FORMAT ('0',//,15X,'* : GRAPH OF MAXIMUM ABSOLUTE ERROR VS. NUMBER I 186
11 OF SURFACE POINTS OF THE SIMULATED CRYSTAL.') I 187
65  FORMAT ('0',//,15X,'0 : UNDIFFERENTIATED OVERLAP OF GRAPHS . AND *' I 188
11) I 189
66  FORMAT ('0',//,15X,'U : PRECISION UNDEFINED DUE TO THE CRYSTAL NUMB I 190
11 ER OF POINTS = 0.') I 191
67  FORMAT ('0',//,15X,'* : PRECISION UNDEFINED DUE TO THE CRYSTAL MIN I 192
11 IUM AND/OR MAXIMUM RADIUS = 0.') I 193
END I 194-
C
C      SUBROUTINE CPTOTAN .
C
      SUBROUTINE CTOTAN (I2) J 1
      COMMON /XANALY/ PPMIN(50),PPMAX(50),XMIN(50),XMAX(50),VOL(50),VOL1 J 2
      (50),XMINTH(50),XMAXTH(50),AREA(50),TOTARE(50) J 3
      COMMON /BCOUT/ I5 J 4
      INTEGER I2 J 5
      REAL X1/0.0/,X2/0.0/,X3/0.0/,X4/0.0/,X5/0.0/,X6/0.0/,X7/0.0/ J 6A
      ,X8/0.0/ J 6B
      @ INTEGER*2 DUB(100)/100*'-'//,VER/'/'//, WT(30,100),BL/' ' J 7A
      @ P1/'/'//,OV/'0'//,P2/'-'//,IND(4)/4*0/ J 7B
      INTEGER*2 I5(20),NX1(50),NX2(50),NX5(50) J 7C
      IF (I5(12).NE.1) RETURN J 8
      DO 1 I=1,22 J 9
      X1=AMAX1(XMIN(I),X1) J 10
      X2=AMAX1(XMAX(I),X2) J 11
      X3=AMAX1(VOL(I),X3) J 12
      X4=AMAX1(XMINTH(I),X4) J 13
      X5=AMAX1(XMAXTH(I),X5) J 14
      X6=AMAX1(VOL1(I),X6) J 15
      X7=AMAX1(AREA(I),X7) J 16
      X8=AMAX1(TOTARE(I),X8) J 17
1  CONTINUE J 18
      IF (X4.GT.X1) GO TO 2 J 19

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```

      IF (X5.GT.X2) GO TO 3 J 20
      IF (X6.GT.X3) GO TO 4 J 21
      IF (X8.GT.X7) GO TO 5 J 22
      GO TO 6 J 23
2  X1=X4 J 24
      IND(1)=1 J 25
      GO TO 6 J 26
3  X2=X5 J 27
      IND(2)=1 J 28
      GO TO 6 J 29
4  X3=X6 J 30
      IND(4)=1 J 31
      GO TO 6 J 32
5  IND(3)=1 J 33
      X7=X8 J 34
      X1=X1 J 35
      YY1=100.0/X1 J 36
      YY2=100.0/X2 J 37
      YY3=100.0/X3 J 38
      YY4=30.0/(FLOAT(I2)) J 39
      YY5=100.0/X7 J 40
      DO 7 I=1,12 J 41
      NX1(I)=IFIX(((XMINTH(I))*YY4)+0.5) J 42
      CONTINUE J 43
      DO 37 IKJ=1,4 J 44
      WRITE (3,38) IKJ J 45
      WRITE (3,39) J 46
      DO 8 I=1,30 J 47
      DO 8 J=1,100 J 48
      NT(I,J)=BL J 49
8  CONTINUE J 50
      IF (IKJ.EQ.1) GO TO 9 J 51
      IF (IKJ.EQ.2) GO TO 11 J 52
      IF (IKJ.EQ.4) GO TO 13 J 53
      IF (IKJ.EQ.3) GO TO 15 J 54
9  DO 10 I=1,12 J 55
      NY2(I)=(IFIX(((XMINTH(I))*YY1)+0.5)) J 56
      NX5(I)=(IFIX(((XMIN(I))*YY1)+0.5)) J 57
      CONTINUE J 58
      DO 12 I=1,12 J 59
      NX2(I)=(IFIX(((XMAXTH(I))*YY2)+0.5)) J 60
      NX5(I)=(IFIX(((XMAX(I))*YY2)+0.5)) J 61
      CONTINUE J 62
      DO 14 I=1,12 J 63
      NX5(I)=(IFIX(((VOL(I))*YY3)+0.5)) J 64
      NX2(I)=(IFIX(((VOL1(I))*YY3)+0.5)) J 65
      CONTINUE J 66
      GO TO 17 J 67
14  DO 16 I=1,12 J 68
      NX5(I)=(IFIX(((AREA(I))*YY5)+0.5)) J 69
      NX2(I)=(IFIX(((TOTARE(I))*YY5)+0.5)) J 70
      CONTINUE J 71
      DO 21 I=1,12 J 72
      IF (NX5(I).EQ.0) NX5(I)=1 J 73
      IF (NX1(I).EQ.0) NX1(I)=1 J 74
      IF (NX2(I).EQ.0) NX2(I)=1 J 75
      IF ((NT((NX1(I)),NX2(I))),.NE.BL) GO TO 18 J 76
      NT((NX1(I)),NX2(I))=P2 J 77
      GO TO 19 J 78
18  NT((NX1(I)),NX2(I))=OV J 79
19  NT((NX1(I)),NX2(I))=OV J 80

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```

19 IF ((INT((HX1(I)), (HX5(I))))-NE,BL) GO TO 20
   NT ((XK1(I)), (NX5(I))) * P1
   GO TO 21
20 NT ((XK1(I)), (NX5(I))) * OV
21 CONTINUE
   XDUM1=(FLOAT(I2))+0.25
   XDUM2=(FLOAT(I2))+0.50
   XDUM3=(FLOAT(I2))+0.75
   XDUM4=0.0
   XA1=(FLOAT(I2))
   DO 27 I=1,30
     IF (I.EQ.1) GO TO 22
     IF (I.EQ.7) GO TO 23
     IF (I.EQ.15) GO TO 24
     IF (I.EQ.23) GO TO 25
     IF (I.EQ.30) GO TO 26
     WRITE (3,40) (NT(I,J),J=1,100)
     GO TO 27
22 WRITE (3,41) XDUM4, (NT(I,J),J=1,100)
   GO TO 27
23 WRITE (3,42) XDUM1, (NT(I,J),J=1,100)
   GO TO 27
24 WRITE (3,42) XDUM2, (NT(I,J),J=1,100)
   GO TO 27
25 WRITE (3,42) XDUM3, (NT(I,J),J=1,100)
   GO TO 27
26 WRITE (3,42) XA1, (NT(I,J),J=1,100)
27 CONTINUE
   DUM(1)=VER
   DO 78 I=25,100,25
     DUM(I)=VER
28 CONTINUE
   WRITE (3,43) (DUM(J),J=1,100)
   IF (IKJ.EQ.1) GO TO 29
   GO TO 30
29 XX1=X1*0.25
   XX2=X1*0.50
   XX3=X1*0.75
   WRITE (3,44) XX1,XX2,XX3,X1
30 IF (IKJ.EQ.2) GO TO 31
   GO TO 32
31 XX1=X2*0.25
   XX2=X2*0.50
   XX3=X2*0.75
   WRITE (3,45) XX1,XX2,XX3,X2
32 IF (IKJ.EQ.4) GO TO 33
   GO TO 34
33 XX1=X3*0.25
   XX2=X3*0.50
   XX3=X3*0.75
   WRITE (3,46) XX1,XX2,XX3,X3
34 IF (IKJ.EQ.3) GO TO 35
   GO TO 36
35 XX1=X7*0.25
   XX2=X7*0.50
   XX3=X7*0.75
   WRITE (3,47) XX1,XX2,XX3,X7
36 IF (IKJ.EQ.1) WRITE (3,48)
   IF (IKJ.EQ.1) WRITE (3,49)
   IF (IKJ.EQ.2) WRITE (3,50)
   IF (IKJ.EQ.2) WRITE (3,51)

      IF (IKJ.EQ.3) WRITE (3,52)
      IF (IKJ.EQ.3) WRITE (3,53)
      IF (IKJ.EQ.4) WRITE (3,54)
      IF (IKJ.EQ.4) WRITE (3,55)
      WRITE (3,56)
      IF ((IND(IKJ)).EQ.1) WRITE (3,57)
37 CONTINUE
   RETURN
C
38 FORMAT ('1',///,4EX,' GROWTH ANALYSIS NO : ',I2)
39 FORMAT ('0',///,6X,' EVENTS.')
40 FORMAT (' ',5X,'1',100A1)
41 FORMAT (' ',5X,'1',F5.2,1X,'-',100A1)
42 FORMAT (' ',5X,'1',F5.2,1X,'-',100A1)
43 FORMAT (' ',5X,'1',100A1)
44 FORMAT (' ',5X,' 0.0 ',18X,F9.3,16X,F9.3,16X,F9.3,16X,F
1INPAD.)
45 FORMAT (' ',5X,' 0.0 ',18X,F9.3,16X,F9.3,16X,F9.3,16X,F
1AXPAD.)
46 FORMAT (' ',5X,' 0.0 ',18X,F9.3,16X,F9.3,16X,F9.3,16X,F
1EPAD.)
47 FORMAT (' ',5X,' 0.0 ',18X,F9.3,16X,F9.3,16X,F9.3,16X,F
1OLUME.)
48 FORMAT ('0',/,15X,'* : GRAPH OF EVENTS VS MINIMUM RADII
1TED CPYSTAL.')
49 FORMAT ('0',/,15X,'* : GRAPH OF EVENTS VS MINIMUM RADII
1TICAL CPYSTAL.')
50 FORMAT ('0',/,15X,** GRAPH OF EVENTS VS MAXIMUM RADII
1TED CPYSTAL.')
51 FORMAT ('0',/,15X,* - GRAPH OF EVENTS VS MAXIMUM RADII
1TICAL CPYSTAL.')
52 FORMAT ('0',/,15X,'* : GRAPH OF EVENTS VS NUMBER OF SUPP
1OF THE SIMULATED CPYSTAL.')
53 FORMAT ('0',/,15X,'* : GRAPH OF EVENTS VS CALCULATED SUPP
1OF THEORETICALLY CPYSTAL.')
54 FORMAT ('0',/,15X,'* : GRAPH OF EVENTS VS TOTAL NUMBER OF
1SURFACE + INTERNAL OF THE SIMULATED CPYSTAL.')
55 FORMAT ('0',/,15X,'* : GRAPH OF EVENTS VS CALCULATED VOLU
1ORITICAL CPYSTAL.')
56 FORMAT ('0',/,15X,'O - UNDIFFERENTIATED OFFFLAP OF GRAPHS
1)
57 FORMAT ('0',///,10X,'***** WARNING : GRAPHIC COORDINA
1M VALUE IS THE THEORETICALLY CALCULATED ONE. *****')
END
C
C SUBROUTINE DETRAN .
C
SUBROUTINE DETRAN
COMMON /EQMT/ X(50),Y(50),Z(50),A(50),XIMCR
COMMON /LQMS/ APX(50),APY(50),APZ(50),APD(50)
COMMON /CNTL/ IQ,N,I1,I2NDIS,HCO,JIT
DO 1 I=1,I4
APX(I)=X(I)
APY(I)=Y(I)
APZ(I)=Z(I)
APD(I)=(-((X(I)*N)+(Y(I)*H)+(Z(I)*H))-A(I))
1 CONTINUE
RETURN
END
C
C SUBROUTINE VERTI .

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C      SUBROUTINE VPPT1
COMMON /CNT1/ PN,N,NCKXY,INDI3,NCO,JII
COMMON /FQNT/ X(50),Y(50),Z(50),A(50)
COMMON /VIR/ I4(100),I5(100),I6(100),I7(100)
REAL Y1(100),Y2(100),X1(100),X2(100),X3(100)
INTEGER O,P,Q,R,S,T,PN
I1=1
J1=1
JII=1
KI=PN-2
DO 28 O=1,KL
A1=X(O)
B1=Y(O)
C1=Z(O)
D1=A(O)
P=PN-1
Q=O+1
DO 27 R=Q,P
A2=X(R)
B2=Y(R)
C2=Z(R)
D2=A(R)
S=R+1
DO 26 T=S,PN
A3=X(T)
B3=Y(T)
C3=Z(T)
D3=A(T)
DET=((A1*(B2*C3-C2*B3)-(A1*(B2*C3-C2*B3)+(C1*(A2*B3-B2*A3))
IF (ABS(DET).LT.0.0001) GO TO 26
X1(III)=(D1*(B2*C3-C2*B3)-B1*(D2*C3-C2*D3)+C1*(D2*B3-B2*D3))/DET
X2(III)=(D1*(D2*C3-C2*D3)-D1*(A2*C3-C2*A3)+C1*(A2*D3-D2*A3))/DET
X3(III)=(A1*(B2*D3-D2*B3)-B1*(A2*D3-D2*A3)+D1*(A2*B3-B2*A3))/DET
*****
** VERIFICATION OF THE REALITY OF THE VERTICES POSITIONS **
** I.E., ONLY THOSE OF THE INNER MOST SHAPE ARE RETAINED. **
*****
DO 21 I=1,PN
IF (X1(III)*X(I)+X2(III)*Y(I)+X3(III)*Z(I)).GT.((X(I)+0.0001)) GO
TO 24
CONTINUE
IF (III.EQ.1) GO TO 23
JB=J1-1
*****
** FILTERING OF VERTICES TO AVOID REPETITIONS. **
*****
DO 22 II=1,JB
IF ((ABS(X1(III)-Y1(II)).LT.0.0001.AND.(ABS(X2(III)-Y2(II)).LT.0
1.0001.AND.(ABS(X3(III)-Y3(II)).LT.0.0001)) GO TO 25
CONTINUE
X4(JII)=X1(III)
X5(JII)=X2(III)
X6(JII)=X3(III)
JII=JII+1
Y1(JI)=X1(III)
Y2(JI)=X2(III)
Y3(JI)=X3(III)
JII=JII+1
I1=I1+1
I1=I1+1
CONTINUE
24

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```

25 CONTINUE
26 CONTINUE
27 CONTINUE
28 CONTINUE
RETURN
END
L 61
L 62
L 63
L 64
L 65
L 66-

C      SUBROUTINE AREVOL
C
C      SUBROUTINE AREVOL
COMMON /CNT1/ PN,N,NZCYZ,INDI3,NCO,JIII
COMMON /EQNS/ APY(50),APY(50),APZ(50),APD(50)
COMMON /VEPT/ VX(100),VY(100),VZ(100)
COMMON /XPNALY/ PPMIN(50),PPMAX(50),XMIN(50),XMAX(50),VOL(50),VOL1
1(50),XMINTH(50),XMAXTH(50),PREA(50),TOTARE(50)
INTEGER PN
REAL X1(500),X2(500),X3(500)
INTEGER*2 X4(500),X8(500),AY(500),LISVER(50,20)
NS=JIII-1
N1=1
N2=1
N3=NS-1
N4=1
N5=PN-1
DO 5 I1=N2,N3
H6=I1+1
DO 4 I2=N6,N5
DO 3 I3=N4,N5
N7=I3+1
DO 2 I4=N7,PN
IF (ABS(VX(I1)*APX(I3)+VY(I1)*APY(I3)+VZ(I1)*APZ(I3)-APD(I3)).LT.0
1.0001.AND.(ABS(VX(I1)*APX(I4)+VY(I1)*APY(I4)+VZ(I1)*APZ(I4)-APD(I4))
2).LT.0.0001.AND.(ABS(VX(I2)*APX(I3)+VY(I2)*APY(I3)+VZ(I2)*APZ(I3)-A
3PD(I3)).LT.0.0001.AND.(ABS(VX(I2)*APX(I4)+VY(I2)*APY(I4)+VZ(I2)*APZ
4(I4)-APD(I4)).LT.0.0001)) GO TO 1
GO TO 2
X1(N1)=VX(I1)
X2(N1)=VY(I1)
X3(N1)=VZ(I1)
X4(N1)=I1
N1=N1+1
X1(N1)=VX(I2)
X2(N1)=VY(I2)
X3(N1)=VZ(I2)
X4(N1)=I2
N1=N1+1
CONTINUE
CONTINUE
CONTINUE
CONTINUE
N=N1-1
KK=1
DO 15 I=1,PN
KK=1
DO 7 K=1,N
IF (ABS(AY(I)*VX(K)+APY(K)+APZ(I)*VZ(K)-APD(I)).LT.0.0001)
1GO TO 6
GO TO 7
X8(KK)=K
KK=KK+1
CONTINUE

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```

      1L=KK-1
      2AY(1)=XU(1)
      3X8(1)=0
      4JJ=1
      5I=2
      6CONTINUE
      7DO 10 JK=1,M,2
      8IF (AY(JJ).EQ.X4(JK).AND.X8(II).EQ.X4(JK+1).OR.AY(JJ).EQ.X4(JK+1).
10 1AND.X8(II).EQ.X4(JK)) GO TO 13
11 2CONTINUE
      3II=II+1
      4IF (II.GT.LL) GO TO 12
      5IF (X8(II).EQ.0) GO TO 11
      6GO TO 9
12 7WRITE(3,21)
13 8JJ=JJ+1
      9AY(JJ)=X8(II)
     10X8(II)=0
     11IF (JJ.LT.LL) GO TO 8
     12*****
     13LISVER MATRIX CONTAINS IN EACH ROW : THE INDEX OF THE ROW IS THE
     14CORRESPONDING INDEX OF THE PLANE.
     151 : THE NUMBER OF ORDERED VERTICES FOR THAT PLANE.
     162: THE LIST OF THESE ORDERED VERTICES INDICES.
     17*****
     18LISVER(I,1)=LL
     19N34=LL+1
     20DO 14 N35=1,LL
     21N36=N35+1
     22LISVER(I,N36)=AY(N35)
14 23CONTINUE
15 24CONTINUE
     25FLAREA=0.0
     26VOL10=0.0
     27*****
     28DETERMINATION OF UNIT PYRAMID HEIGHT XDST.
     29DETERMINATION OF THE CENTROID OF AREA FOR EACH CRYSTAL'S FACES.
     30*****
     31DO 18 I=1,PN
     32XDST=ABS(-(APD(I))/(SQRT(( (APX(I))**2)+( (APY(I))**2)+( (APZ(I))**2
33 3))))
     34IF (LISVER(I,1).LT.3) GO TO 19
     35N20=((LISVER(I,1))+1)
     36N30=(LISVER(I,1))
     37APEA11=0.0
     38VOL11=0.0
     39F=0.0
     40B=0.0
     41C=0.0
     42DO 16 J=2,N20
     43A=A+(VX(LISVER(I,J)))
     44B=B+(VY(LISVER(I,J)))
     45C=C+(VZ(LISVER(I,J)))
16 46CONTINUE
     47A=A/(FLOAT(N30))
     48B=B/(FLOAT(N30))
     49C=C/(FLOAT(N30))
     50N21=N20+1
     51LISVER(I,N21)=(LISVER(I,2))
     52DO 17 J=2,N20
     53K1=(LISVER(I,J))

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```

A1=(VX(K1)-A)      M 114
J2=(VY(K1)-B)      M 115
A3=(VZ(K1)-C)      M 116
K=J+1              M 117
K2=(LISVER(I,K))    M 118
B1=(VX(K2)-A)      M 119
B2=(VY(K2)-B)      M 120
B3=(VZ(K2)-C)      M 121
*****            M 122
DETERMINATION OF THE AREA OF THE INDIVIDUAL FACE TRIANGULAR M 123
SUBDIVISIONS.      M 124
*****            M 125
AREA12=0.0         M 126
AREA12=((SQRT(((A2*B3)-(A3*B2))*2)+((A3*B1)-(A1*B3))*2)+((A1*B M 127
2*B2)-(A2*B1))*2))/2.0)
AREA11=AREA11+AREA12 M 128
*****            M 129
DETERMINATION OF UNIT PYRAMID VOLUME VOL12 M 130
*****            M 131
VOL12=0.0          M 132
VOL12=((AREA12)*(KDIST))/3.0) M 133
VOL11=VOL11+VOL12 M 134
CONTINUE           M 135
*****            M 136
DETERMINATION OF THE TOTAL AREA OF EACH CRYSTAL FACES PLAREA M 137
DETERMINATION OF CRYSTAL TOTAL VOLUME VOLTO. M 138
*****            M 139
PLAAREA=PLAAREA+AREA11 M 140
VOLTO=VOLTO+VOL11 M 141
CONTINUE           M 142
VOL1(NZXCYZ)=VOLTO M 143
TOTAPE(NZXCYZ)=PLAREA M 144
WRITE(3,3000) TOTAPE(NZXCYZ),VOL1(NZXCYZ) M 145
3000 FORMAT(' ',6X,'THEORETICAL CRYSTAL AREA = ',F10.4,' SQUARE M 146
UNITS,',F10.4,' THEORETICAL CRYSTAL VOLUME = ',F10.4,' CUBIC M 147
UNITS.')
GO TO 20           M 148
WRITE(3,22)        M 149
WRITE(3,23) I,LISVER(I,1) M 150
RETURN             M 151
*****            M 152
FORMAT('0.0',' ERROR : ONE OF THE CRYSTAL'S FACES IS DETERMINED M 153
BY ONE POINT ONLY, PROB. ERROR IN THE MILLER INDICES.')
FORMAT('0.0',' ERROR :ABNORMAL TERMINATION DURING AREA DETERMINATI M 154
ON.')
FORMAT('0.0',' ERROR :',I4,' TH CRYSTAL FACE DETERMINED BY :',I4,' M 155
VECTICES ONLY I.E. LESS THAN POSSIBLE MINIMUM OF 3.')
END                M 156
END OF PROGRAM .   M 157

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      BEGINNING OF OPERATIONS.
      FLUORITE : MASON AND BLPRY, 1968, P. 323
STANDARD CRYSTAL'S FACES EQUATIONS ( WITH CENTRE AT 0,0,0 ) ARE :
      1.0000 X +      0.0 Y +      0.0 Z = 1.0
     -1.0000 X +      0.0 Y +      0.0 Z = 1.0
      0.0 X +      1.0000 Y +      0.0 Z = 1.0
      0.0 X +     -1.0000 Y +      0.0 Z = 1.0
      0.0 X +      0.0 Y +     1.0000 Z = 1.0
      0.0 X +      0.0 Y +    -1.0000 Z = 1.0
TRANSFERRED CRYSTAL'S FACES EQUATIONS ( WITH CENTRE AT 20 , 20 , 20 ) ARE :
      1.0000 X +      0.0 Y +      0.0 Z = 21.0000
     -1.0000 X +      0.0 Y +      0.0 Z = -19.0000
      0.0 X +      1.0000 Y +      0.0 Z = 21.0000
      0.0 X +     -1.0000 Y +      0.0 Z = -19.0000
      0.0 X +      0.0 Y +     1.0000 Z = 21.0000
      0.0 X +      0.0 Y +    -1.0000 Z = -19.0000
      1 TH SPACIAL DIFFERENTIATION COMPLETED USING      27 MATRIX POINTS.
INTERFACIAL SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY      26 SURFACE AND      1 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 :      0.0395
MAXIMUM SHIFT = 0.0 UNITS, MINIMUM SHIFT = 0.0 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 1.7321 UNITS.
MINIMUM RADIUS OF THERMODYNAMIC CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF THERMODYNAMIC CRYSTAL = 1.0000 UNITS.
MAXIMUM ABSOLUTE ERROR = +- 0.0 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

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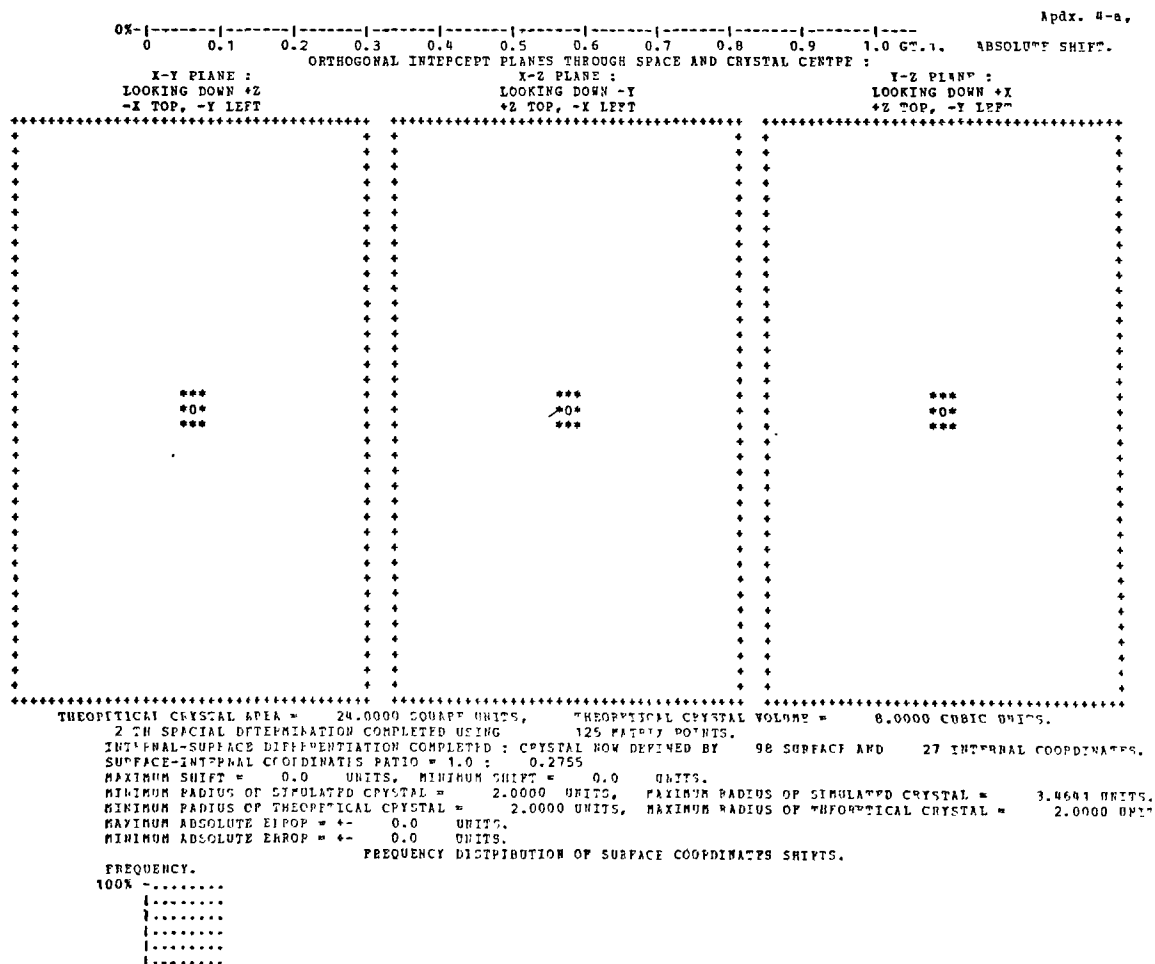
FREQUENCY.

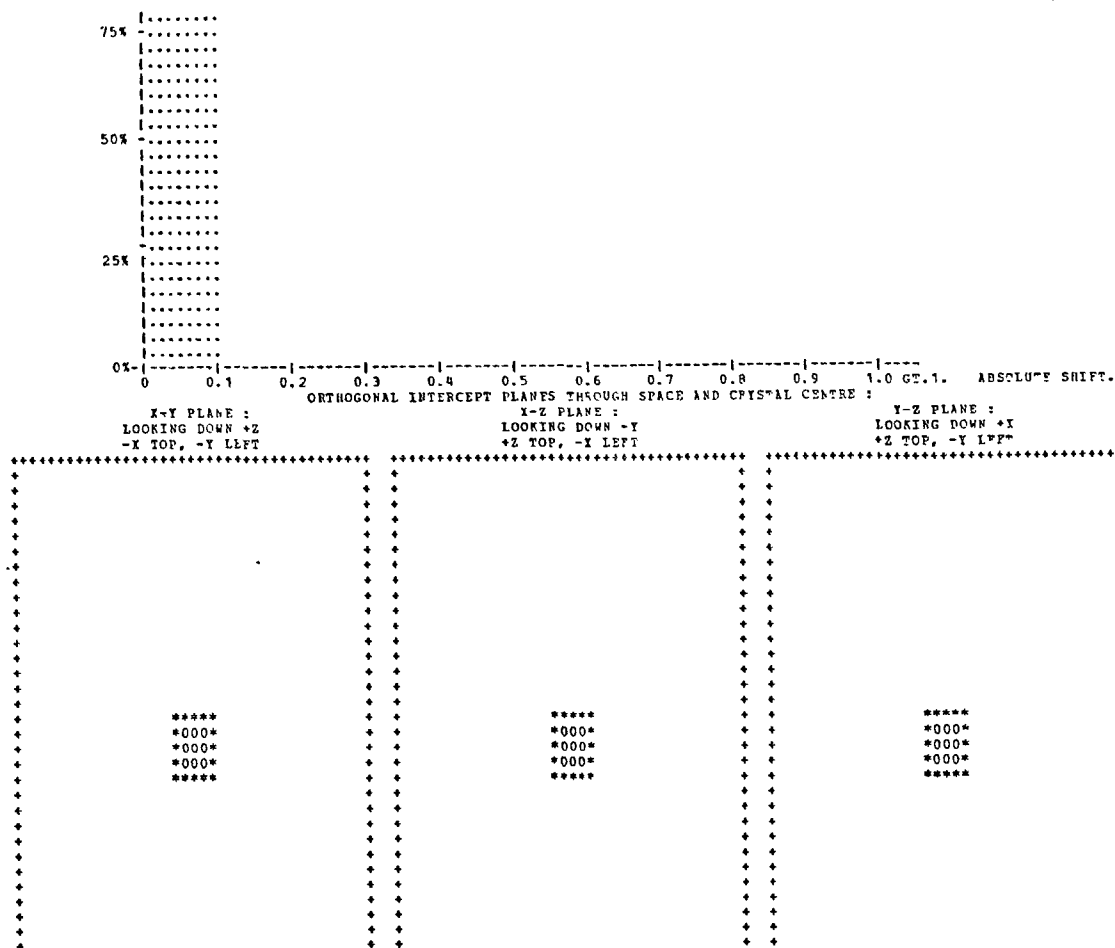
100% —

75% —

50% —

25% —

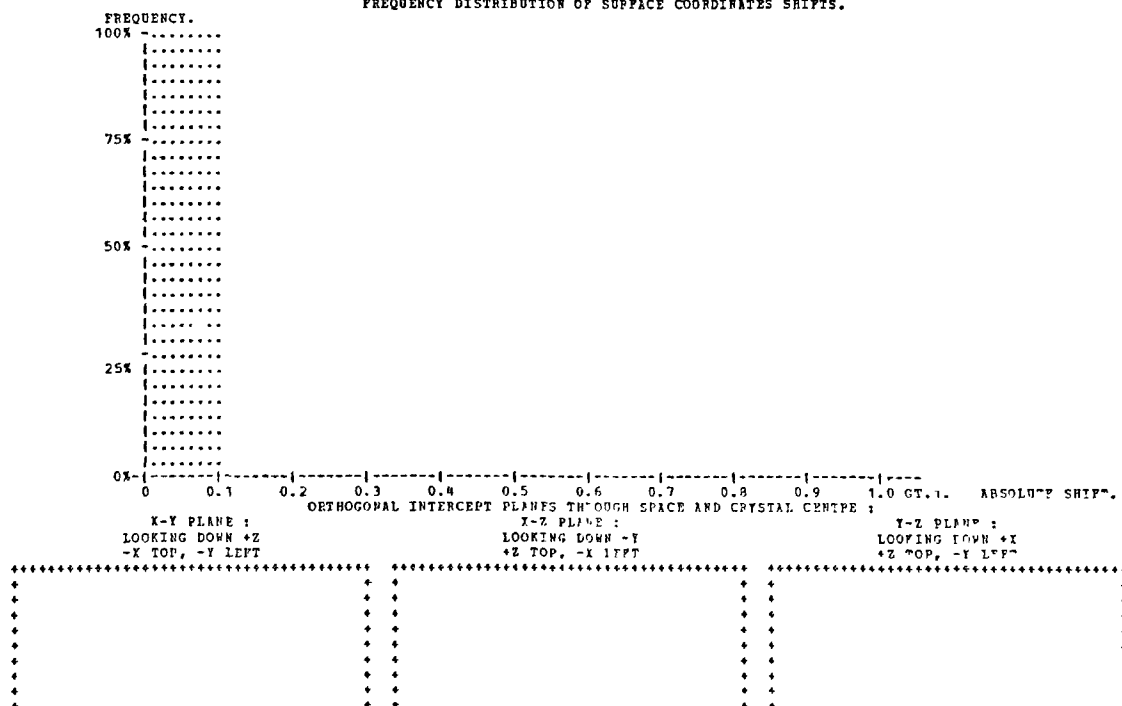




Apdx. 9-B,

THEORETICAL CRYSTAL AREA = 96.0000 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 64.0000 CUBIC UNITS.
3 CH SPACIAL DETERMINATION COMPLETED USING 343 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 218 SURFACE AND 125 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.5734
MAXIMUM SHIFT = 0.0 UNITS, MINIMUM SHIFT = 0.0 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 3.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 5.1962 UNITS
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 3.0000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 3.0000 UNITS
MAXIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.
MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



[illegible]

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

100%
75%
50%

25% |
 |
 |
 |
 |
 0% |

Apdx. 4-a. 1

0% ————— 1.0 G^m.1. ABSOLUTE SHIFT.

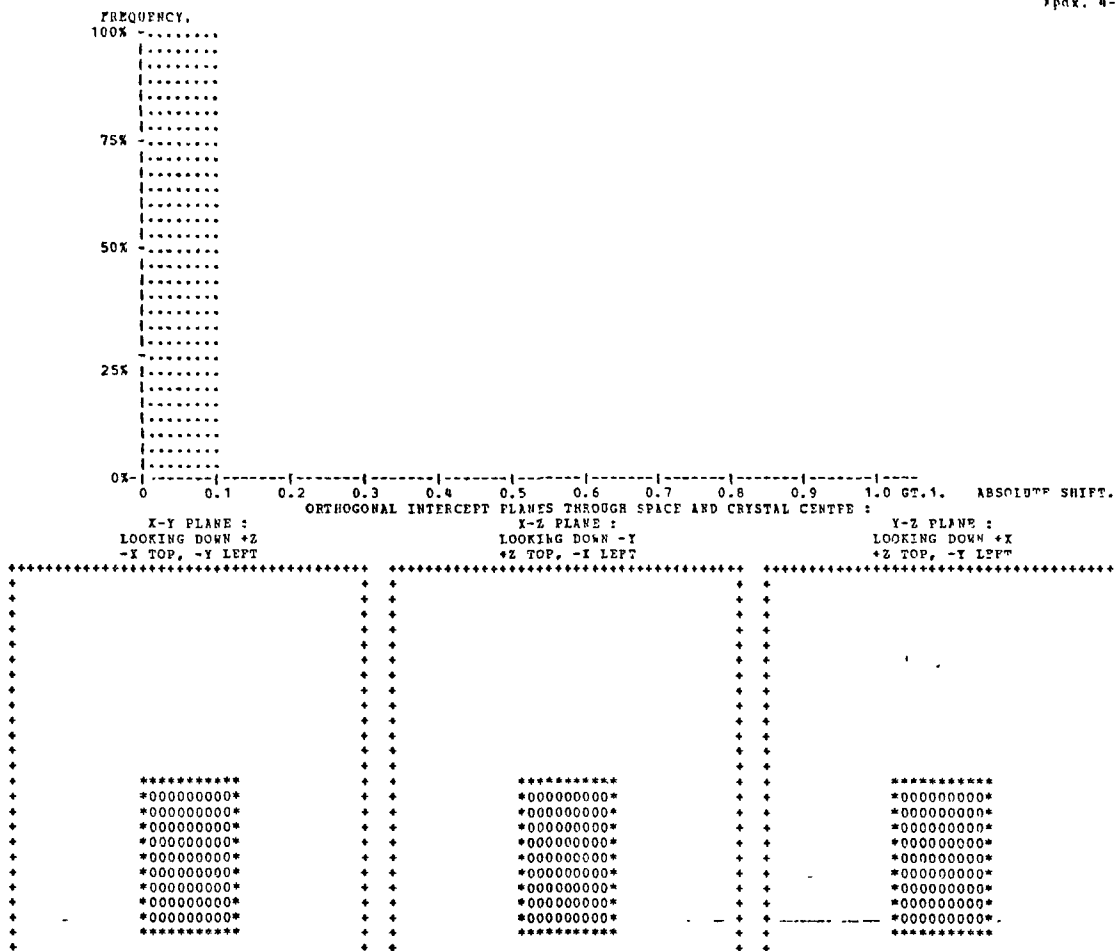
X-Y PLANE :
LOOKING DOWN +Z
-X TOP, -Y LEFT

X-Z PLANE :
LOOKING DOWN -Y
+Z TOP, -X LEFT

Y-Z PLANE :
LOOKING DOWN +X
+Z TOP, -Y LEFT

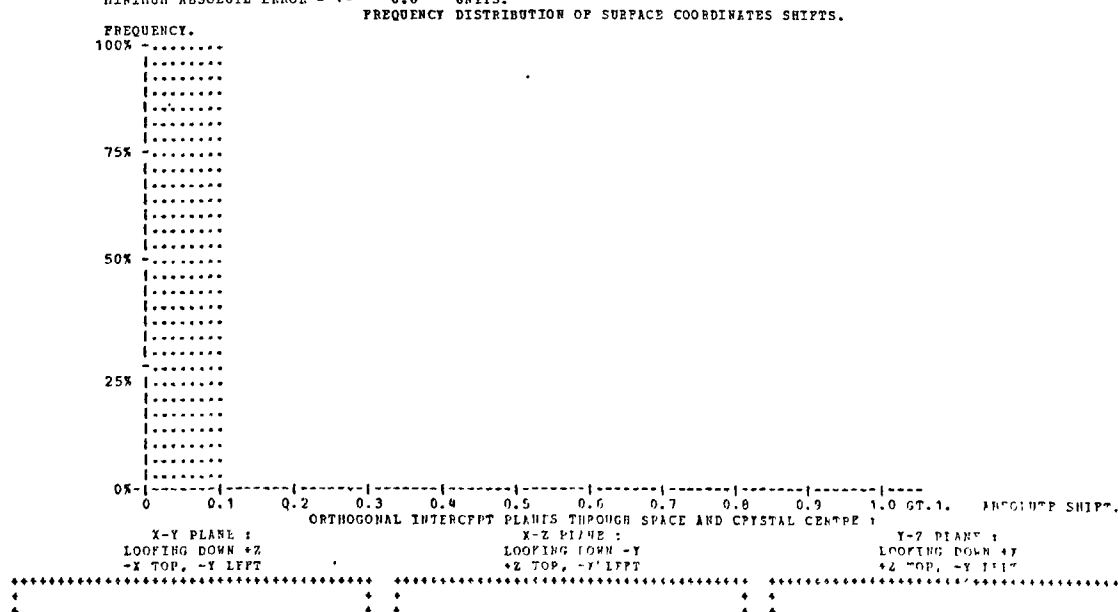
[illegible]

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES CHPTS.

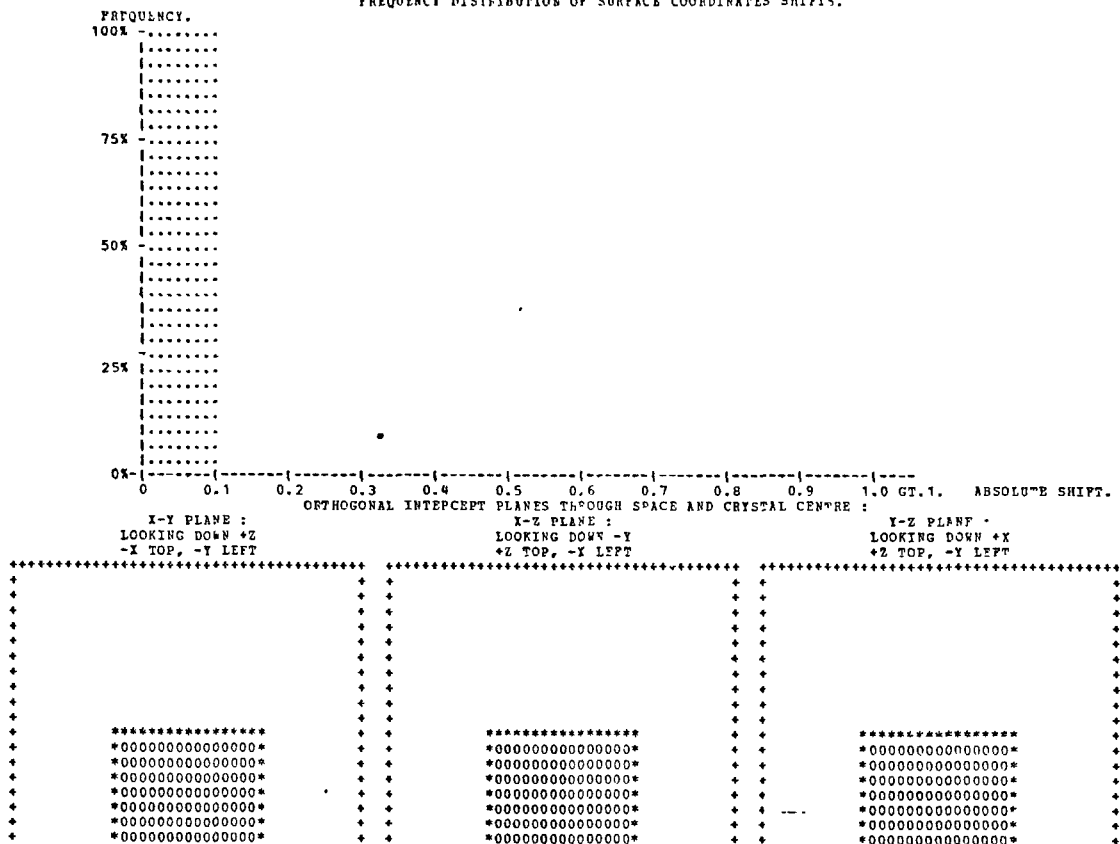


Apdx. 4-a,

THEORETICAL CRYSTAL AREA = 600.0000 SQUARE UNITS. THEORETICAL CRYSTAL VOLUME = 999.9993 CUBIC UNITS.
6 TH SPACIAL DETERMINATION COMPLETED USING 2197 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 866 SURFACE AND 1331 INTERNAL COORDINATES
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.5370
MAXIMUM SHIFT = 0.0 UNITS, MINIMUM SHIFT = 0.0 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 6.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 10.3923 UNIT
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 6.0000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL 6.0000 UN
MAXIMUM ABSOLUTE ERROR = +- 0.0 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

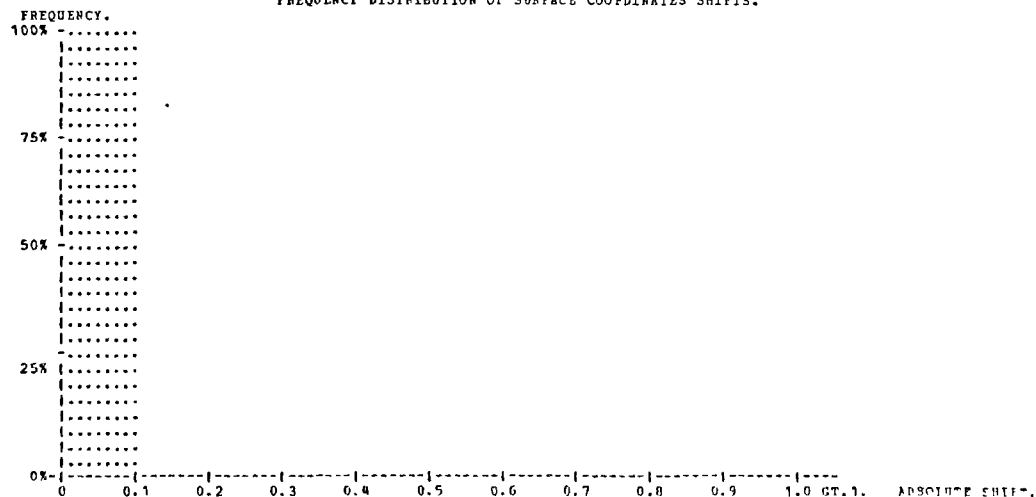


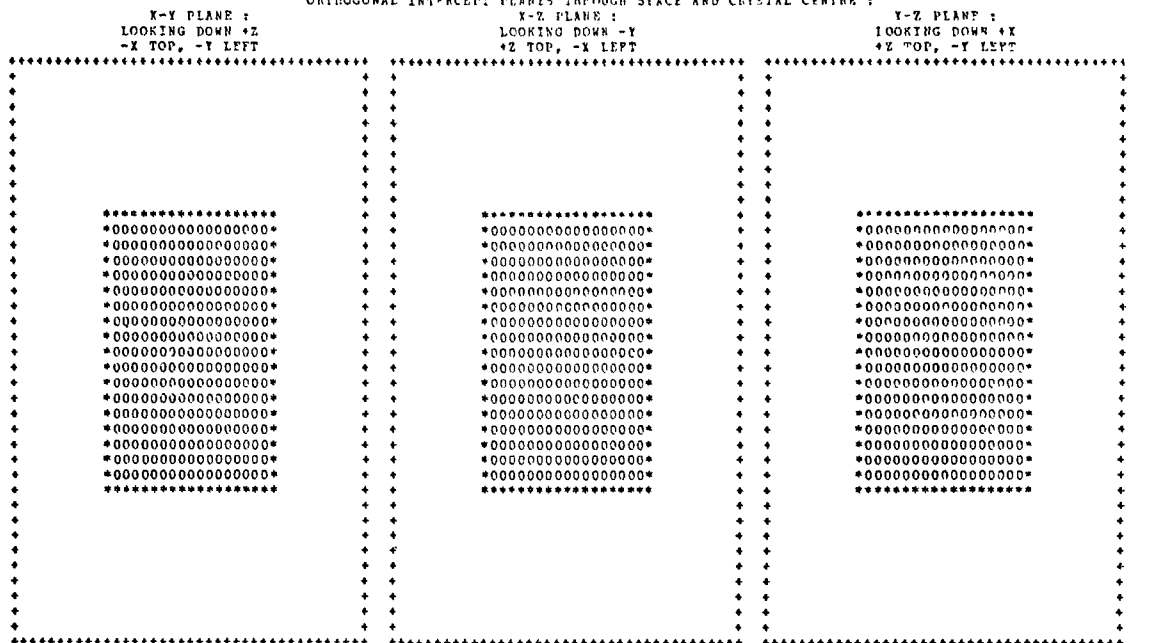
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

[illegible]

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THEORETICAL CRYSTAL AREA = 1536.0000 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 4095.9976 CUBIC UNITS.
9 TH SPICIAL DETERMINATION COMPLETED USING 6859 ATOMIC POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 1946 SURFACE AND 4913 INTERNAL COORDINATES
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 2.5247
MAXIMUM SHIFT = 0.0 UNITS, MINIMUM SHIFT = 0.0 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 9.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 15.5885 UNITS
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 9.0000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 9.0000 UNITS
MAXIMUM ABSOLUTE ERROR = 0.0 UNITS
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FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.





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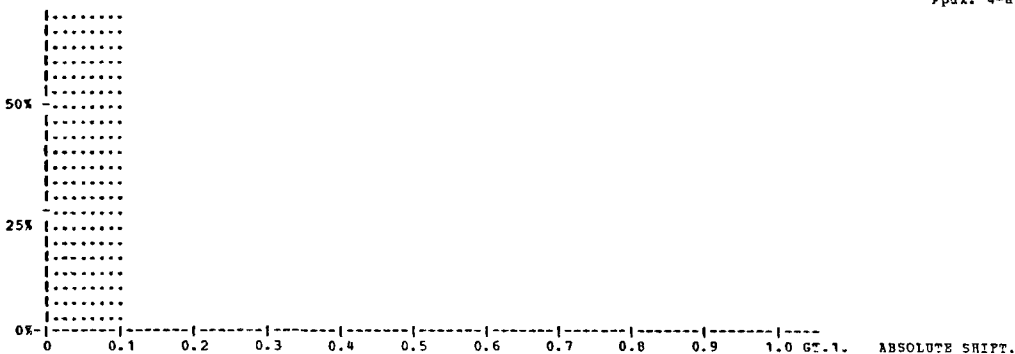
THEORETICAL CRYSTAL AREA = 1944.0000 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 5832.0000 CUBIC UNITS.
10 TH SPACIAL DETERMINATION COMPLETED USING 9261 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 2402 SURFACE AND 6859 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 2.8555
MAXIMUM SHIFT = 0.0 UNITS, MINIMUM SHIFT = 0.0 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 10.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 17.3205 UNITS.
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 10.0000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 10.0000 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

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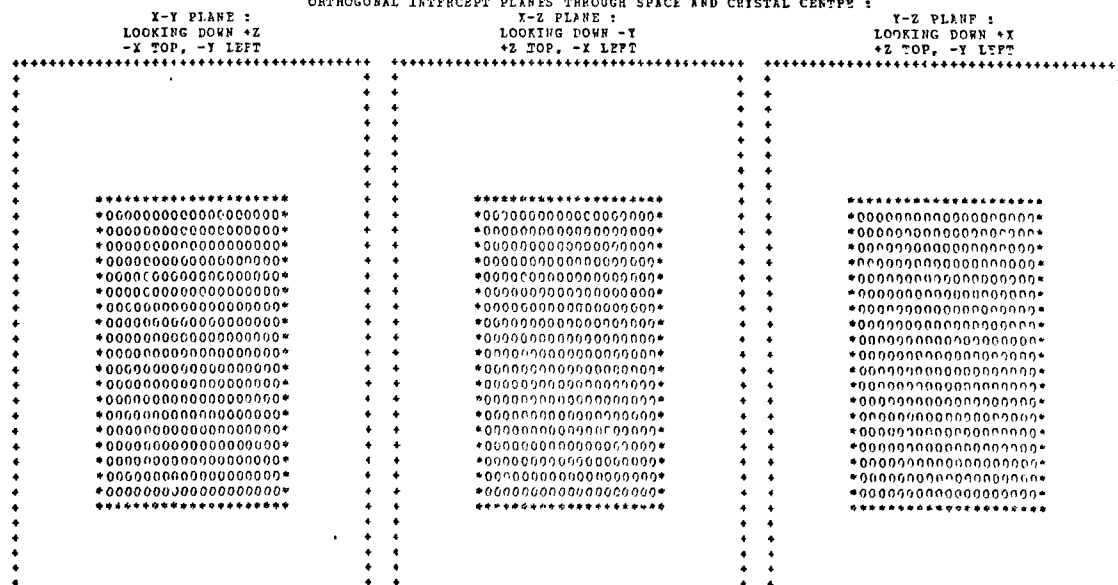
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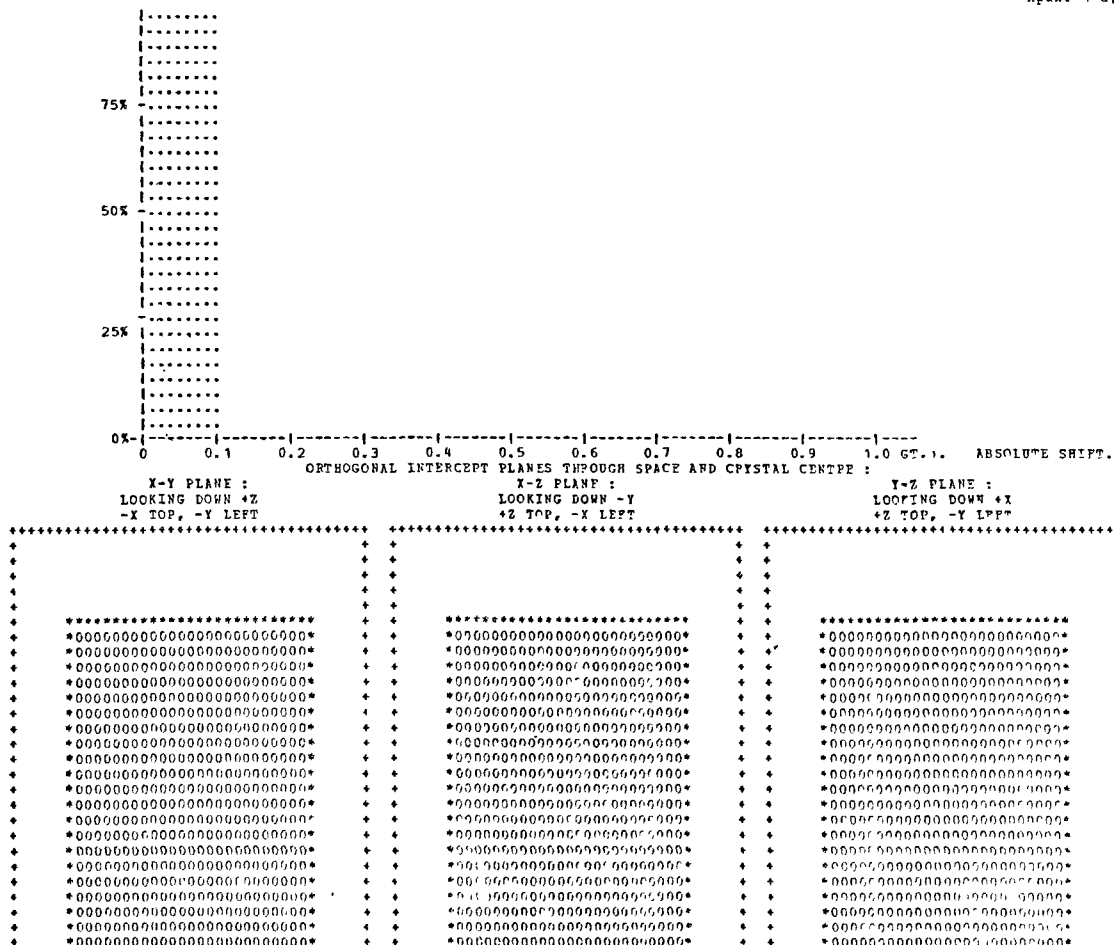
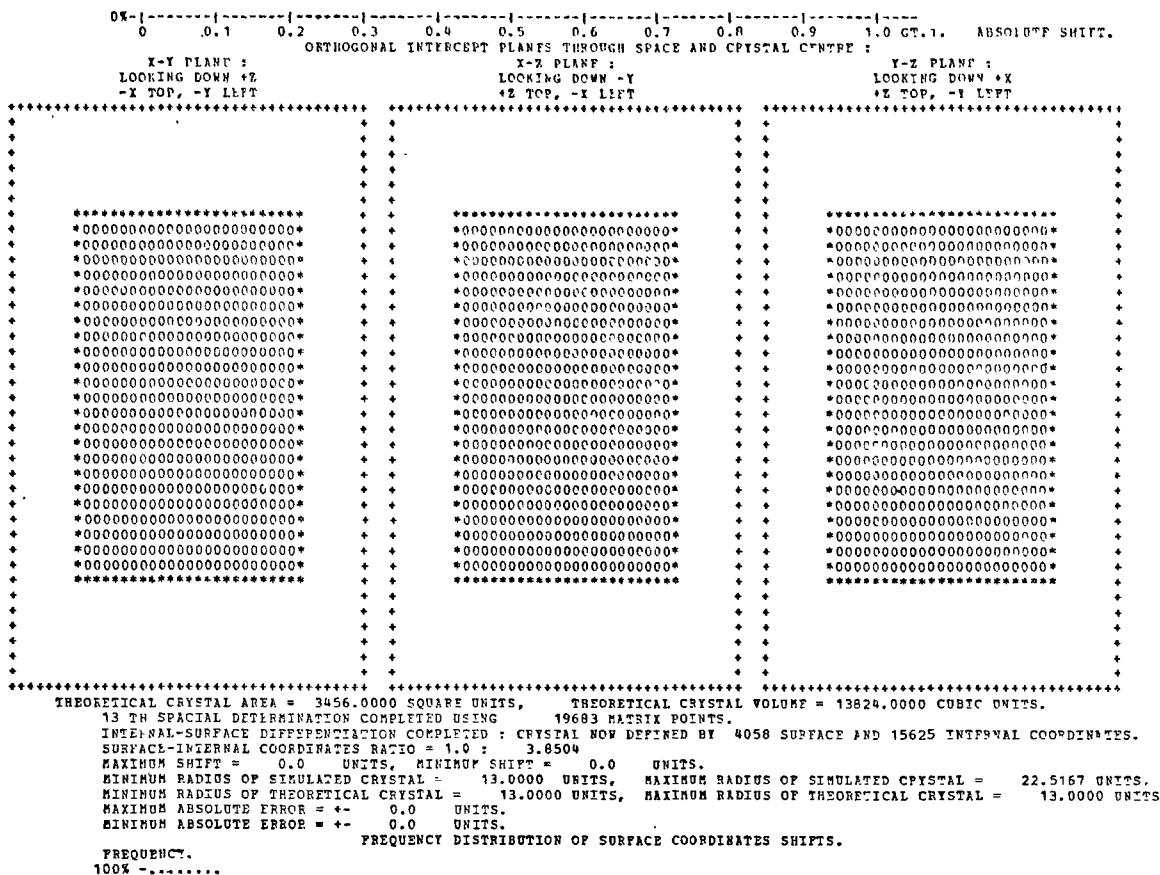
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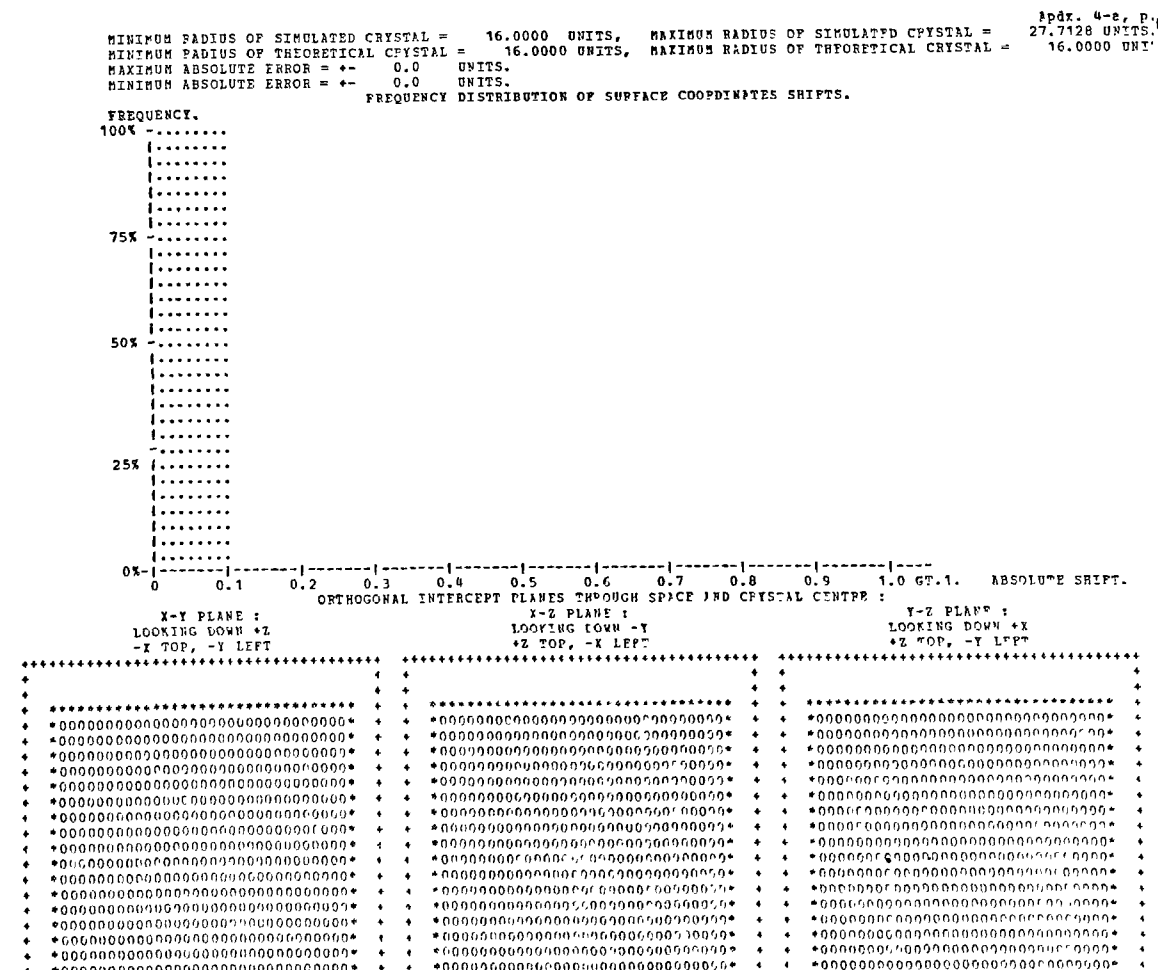
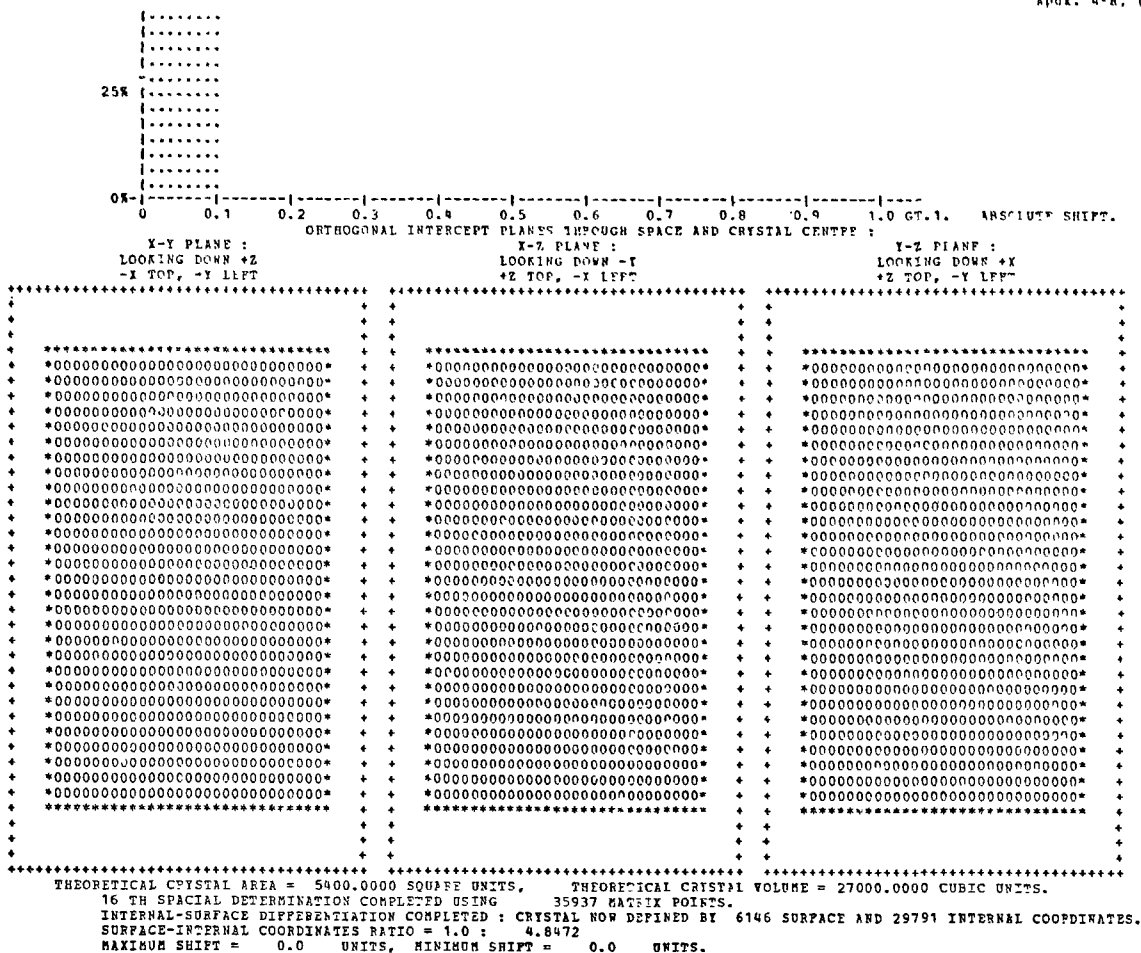
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

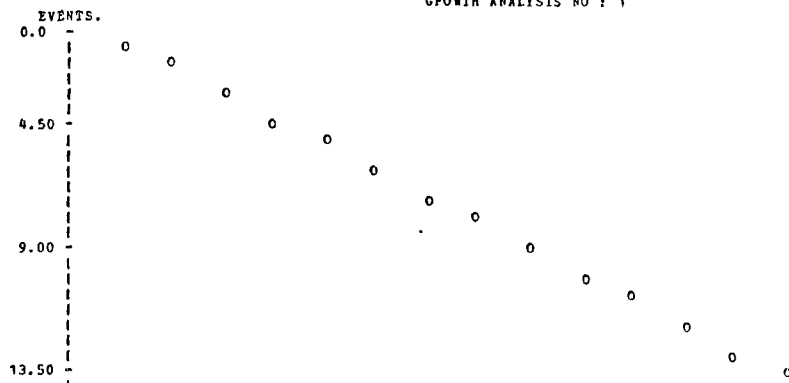
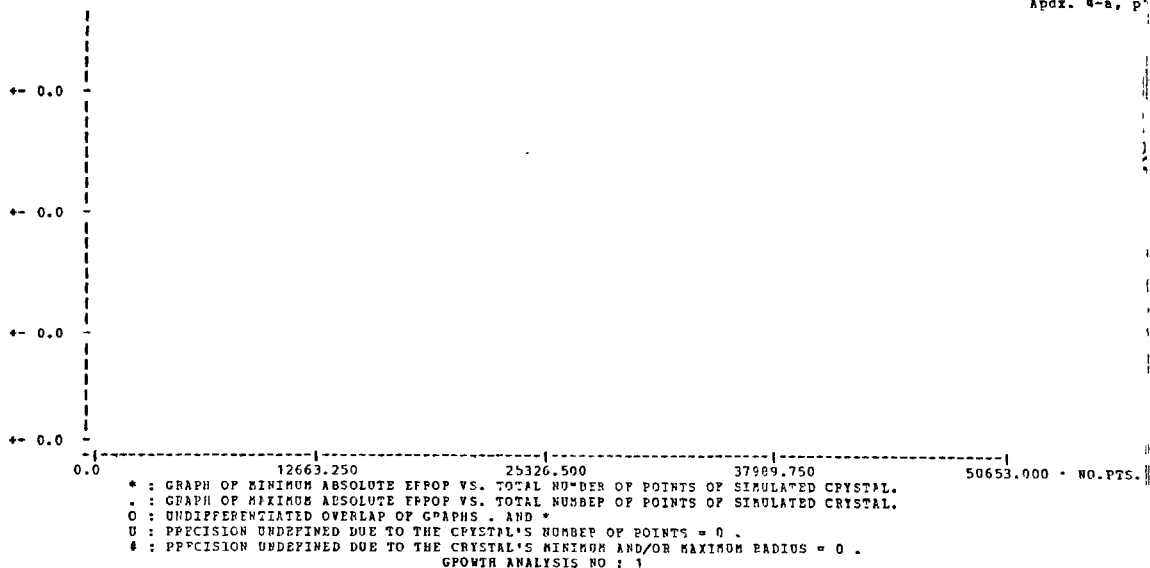
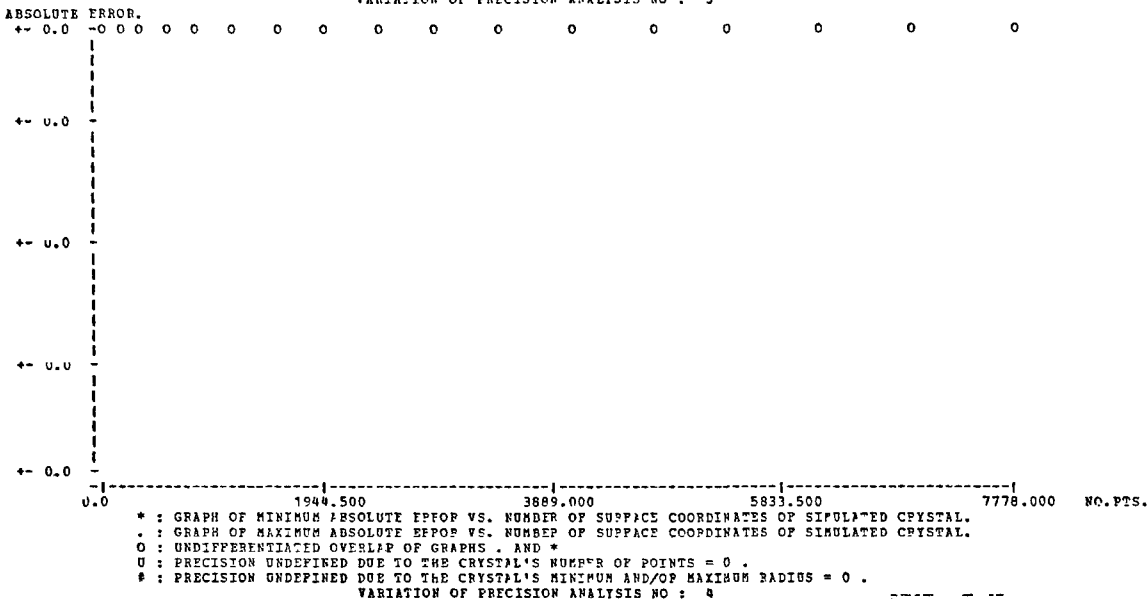
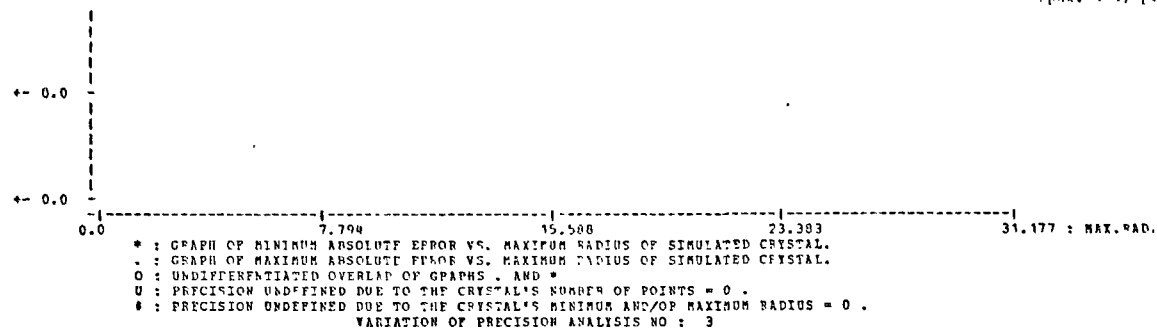


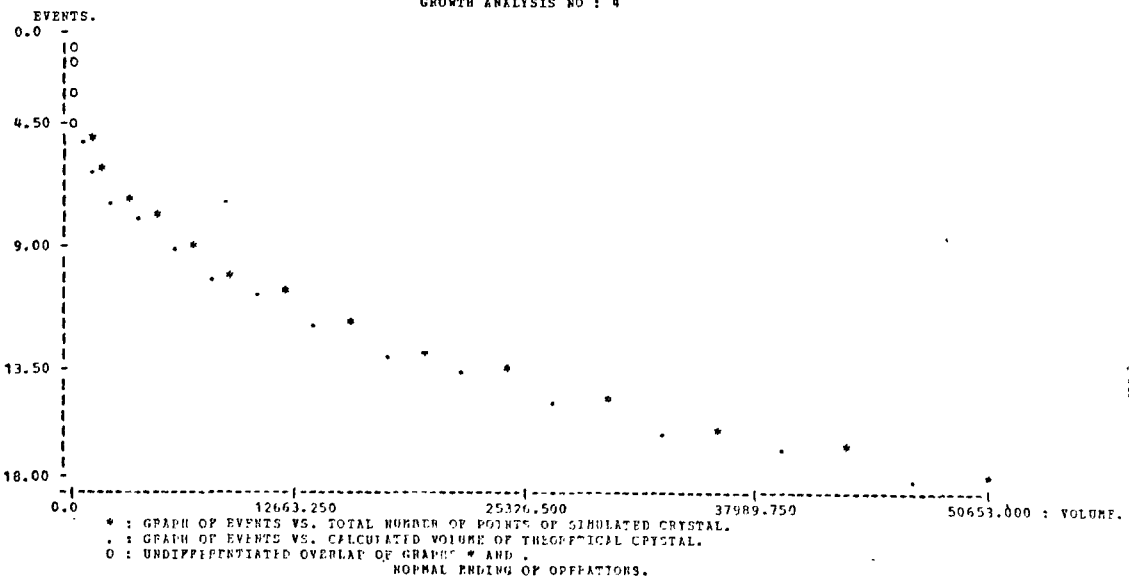
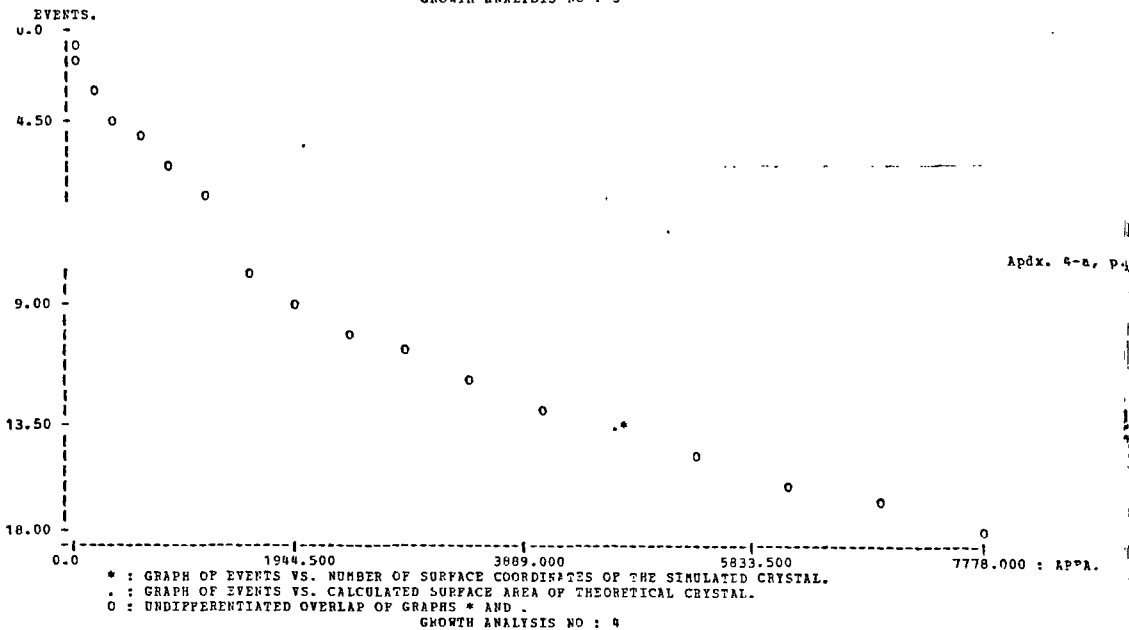
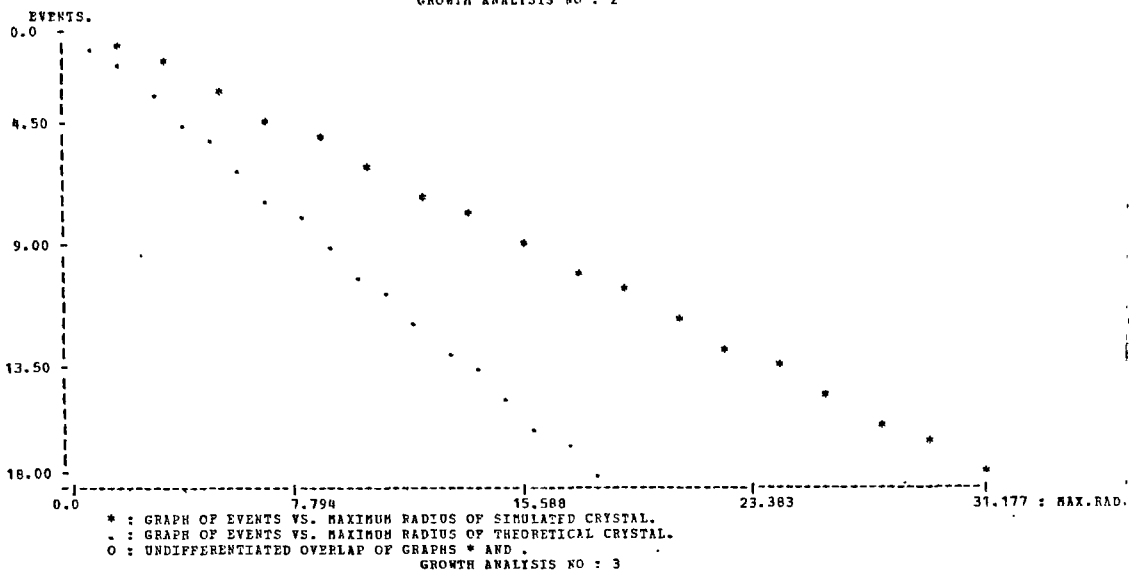
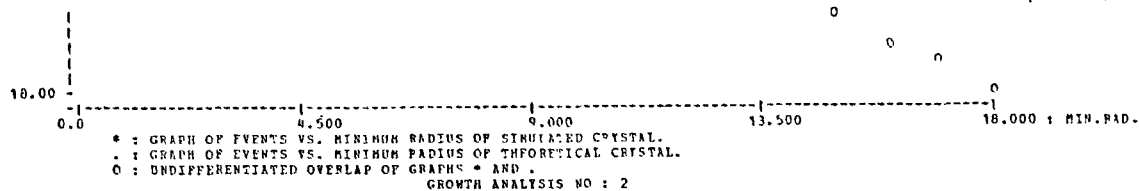
Index. 4-a, p. 1











The following is the simulation of the growth of a rutile crystal, as performed by Module 2. Three orthogonal intersecting planes, passing through the centre of the crystal, and the frequency distribution of the surface coordinates are presented, along with relevant information, after each growth increment. Near the end of the document, eight graphs illustrate the behaviour of the precision obtained during the simulated growth.

BEGINNING OF OPERATIONS.
RUTILE : MASON AND BERRY, 1960, P. 300.
STANDARD CRYSTAL'S FACETS EQUATIONS (WITH CENTRE AT 0,0,0) ARE :

1.0000 X +	0.0 Y +	0.0 Z =	1.0
-1.0000 X +	0.0 Y +	0.0 Z =	1.0
0.0 X +	1.0000 Y +	0.0 Z =	1.0
0.0 X +	-1.0000 Y +	0.0 Z =	1.0
0.7143 X +	0.7143 Y +	0.0 Z =	1.0
-0.7143 X +	0.7143 Y +	0.0 Z =	1.0
-0.7143 X +	-0.7143 Y +	0.0 Z =	1.0
0.7143 X +	-0.7143 Y +	0.0 Z =	1.0
0.4000 X +	0.0 Y +	0.6212 Z =	1.0
0.0 X +	0.4000 Y +	0.6212 Z =	1.0
-0.4000 X +	0.0 Y +	0.6212 Z =	1.0
0.0 X +	-0.4000 Y +	0.6212 Z =	1.0
0.4000 X +	0.0 Y +	-0.6212 Z =	1.0
0.0 X +	0.4000 Y +	-0.6212 Z =	1.0
-0.4000 X +	0.0 Y +	-0.6212 Z =	1.0
0.0 X +	-0.4000 Y +	-0.6212 Z =	1.0
0.3704 X +	0.3704 Y +	0.5752 Z =	1.0
-0.3704 X +	0.3704 Y +	0.5752 Z =	1.0
-0.3704 X +	-0.3704 Y +	0.5752 Z =	1.0
0.3704 X +	-0.3704 Y +	0.5752 Z =	1.0
0.3704 X +	0.3704 Y +	-0.5752 Z =	1.0
-0.3704 X +	0.3704 Y +	-0.5752 Z =	1.0
-0.3704 X +	-0.3704 Y +	-0.5752 Z =	1.0
0.3704 X +	-0.3704 Y +	-0.5752 Z =	1.0

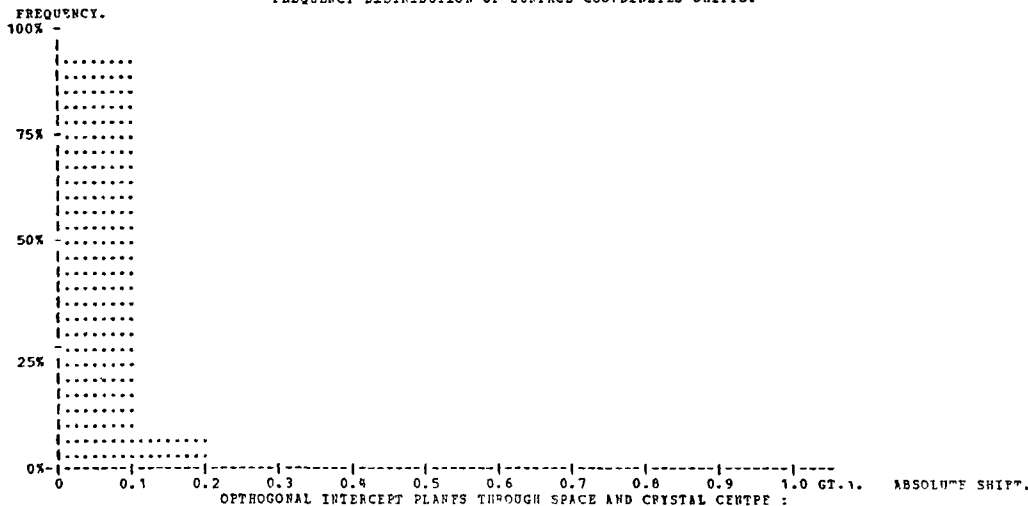
TRANSPOSED CRYSTAL'S FACETS EQUATIONS (WITH CENTRE AT 20 , 20 , 20) ARE :

1.0000 X +	0.0 Y +	0.0 Z =	21.0000
-1.0000 X +	0.0 Y +	0.0 Z =	-19.0000
0.0 X +	1.0000 Y +	0.0 Z =	21.0000
0.0 X +	-1.0000 Y +	0.0 Z =	-19.0000
0.7143 X +	0.7143 Y +	0.0 Z =	29.5720
-0.7143 X +	0.7143 Y +	0.0 Z =	1.0000
-0.7143 X +	-0.7143 Y +	0.0 Z =	-27.5720
0.7143 X +	-0.7143 Y +	0.0 Z =	1.0000
0.4000 X +	0.0 Y +	0.6212 Z =	21.4240
0.0 X +	0.4000 Y +	0.6212 Z =	21.4240
-0.4000 X +	0.0 Y +	0.6212 Z =	5.4240
0.0 X +	-0.4000 Y +	0.6212 Z =	5.4240
0.4000 X +	0.0 Y +	-0.6212 Z =	-3.4240
0.0 X +	0.4000 Y +	-0.6212 Z =	-3.4240
-0.4000 X +	0.0 Y +	-0.6212 Z =	-19.4240
0.0 X +	-0.4000 Y +	-0.6212 Z =	-19.4240
0.3704 X +	0.3704 Y +	0.5752 Z =	27.3200
-0.3704 X +	0.3704 Y +	0.5752 Z =	12.5040
-0.3704 X +	-0.3704 Y +	0.5752 Z =	-2.3120
0.3704 X +	-0.3704 Y +	0.5752 Z =	12.5040
0.3704 X +	0.3704 Y +	-0.5752 Z =	4.3120
-0.3704 X +	0.3704 Y +	-0.5752 Z =	-10.5040
-0.3704 X +	-0.3704 Y +	-0.5752 Z =	-25.3200
0.3704 X +	-0.3704 Y +	-0.5752 Z =	-10.5040

1 TH SPACIAL DETERMINATION COMPLETED USING 29 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 26 SURFACE AND 3 INTERNAL COORDINATES
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.1154

MAXIMUM SHIFT = 0.1933 UNITS, MINIMUM SHIFT = 0.0 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 2.0000 UNITS
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 0.9899 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 1.3535 UNITS
MAXIMUM ABSOLUTE ERROR = + 0.0967 UNITS.
MINIMUM ABSOLUTE ERROR = - 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

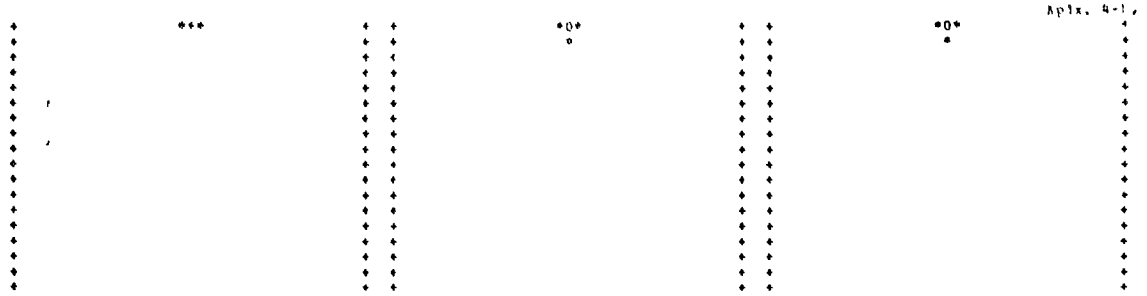


X-Y PLANE :
LOOKING DOWN +Z
-X TOP, -Y LEFT

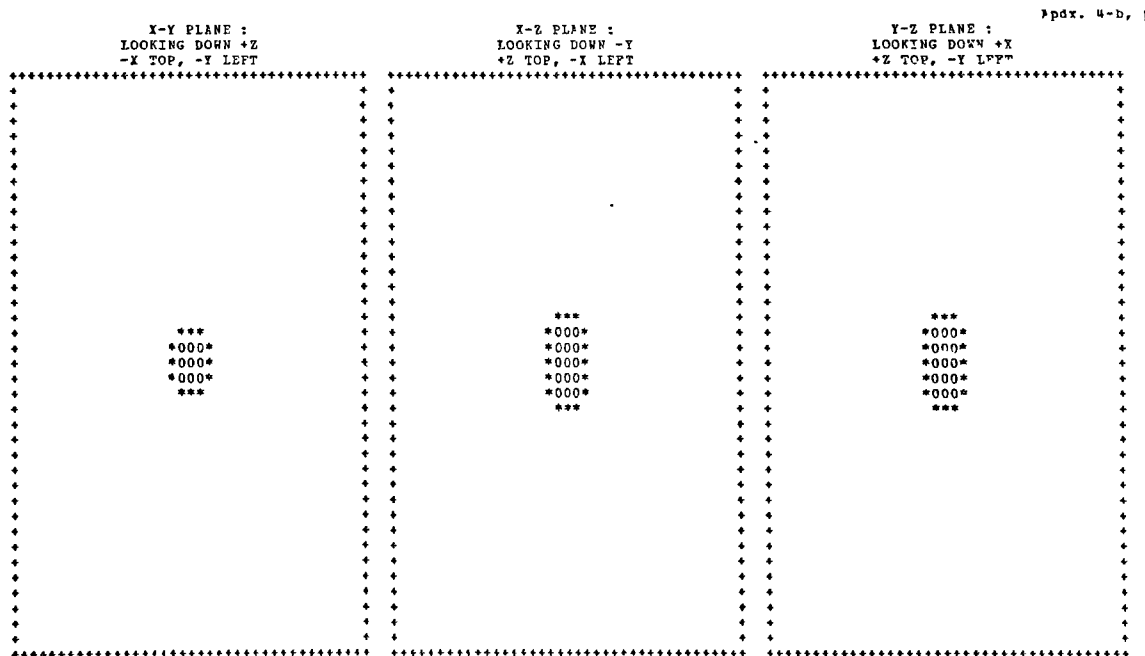
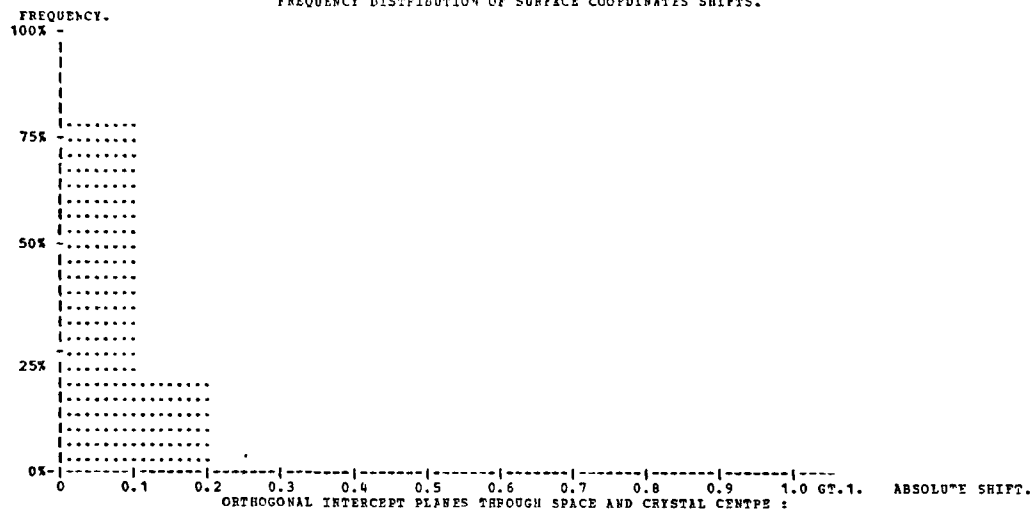
X-Z PLANE :
LOOKING DOWN -Y
+Z TOP, -X LEFT

Y-Z PLANE :
LOOKING DOWN +X
+Z TOP, -Y LEFT

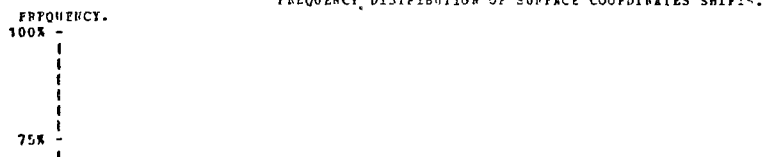


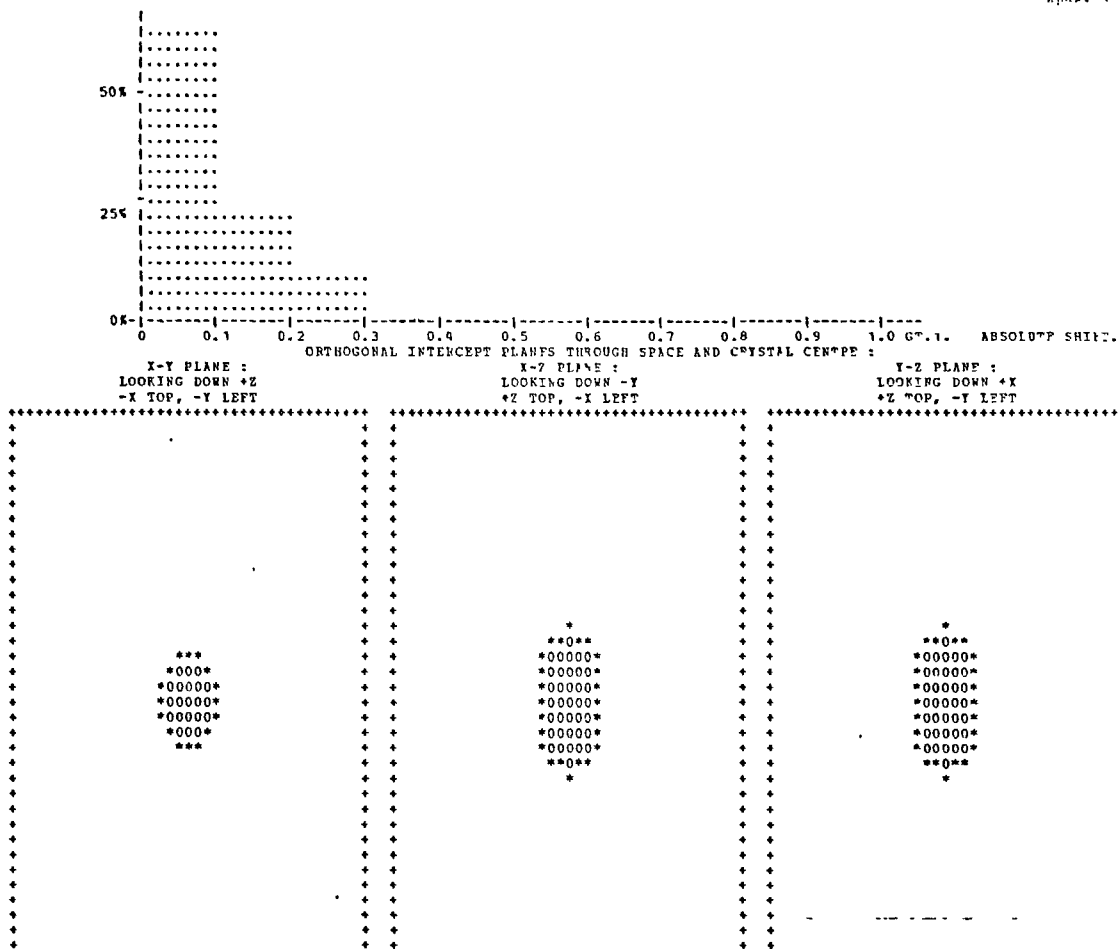


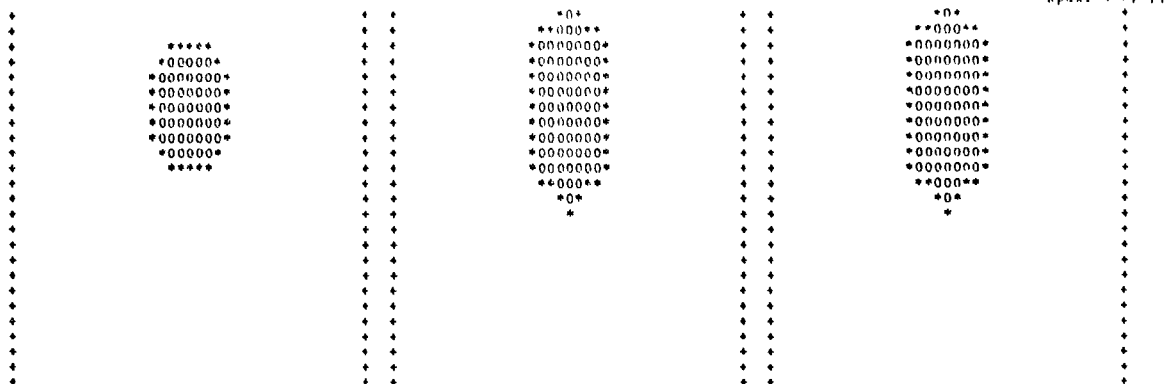
THEORETICAL CRYSTAL AREA = 20.0597 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 7.5445 CUBIC UNITS.
 2 TH SPACIAL DIFFERENTIATION COMPLETED USING 115 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED - CRYSTAL NOW DEFINED BY 78 SURFACE AND 37 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.4794
 MAXIMUM SHIFT = 0.1066 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 4.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 3.1623 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 1.4798 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 2.7069 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.0615 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.



THEORETICAL CRYSTAL AREA = 80.2396 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 60.3560 CUBIC UNITS.
 3 TH SPACIAL DIFFERENTIATION COMPLETED USING 287 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED - CRYSTAL NOW DEFINED BY 154 SURFACE AND 133 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.8636
 MAXIMUM SHIFT = 0.2098 UNITS, MINIMUM SHIFT = 0.0 UNITS
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 2.8284 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 5.0000 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 2.9698 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 4.0604 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.0561 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.



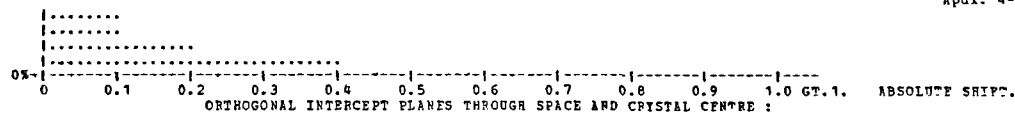
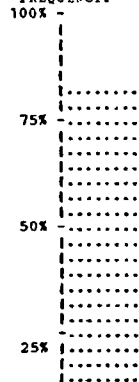




THEORETICAL CRYSTAL AREA = 320.9543 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 462.8479 CUBIC UNITS.
 5 TH SPACIAL DETERMINATION COMPLETED USING 1193 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 414 SURFACE AND 779 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.8816
 MAXIMUM SHIFT = 0.3897 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 5.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 8.0000 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 4.9496 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 6.7673 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.0535 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

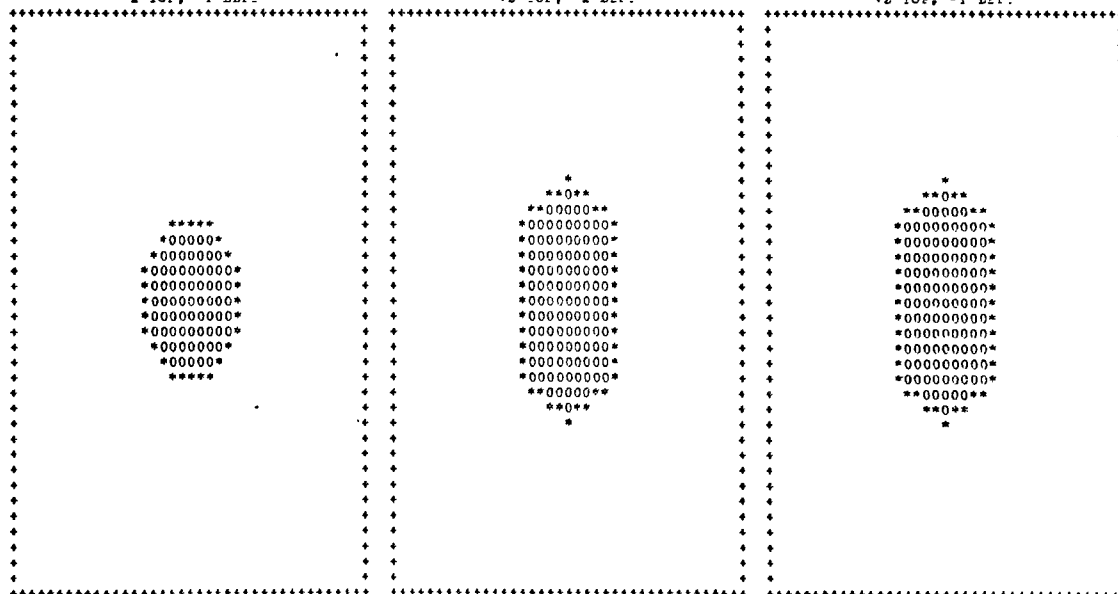
FREQUENCY.



X-Y PLANE :
 LOOKING DOWN +Z
 -X TOP, -Y LEFT

X-Z PLANE :
 LOOKING DOWN -Y
 +Z TOP, -X LEFT

Y-Z PLANE :
 LOOKING DOWN +X
 +Z TOP, -Y LEFT

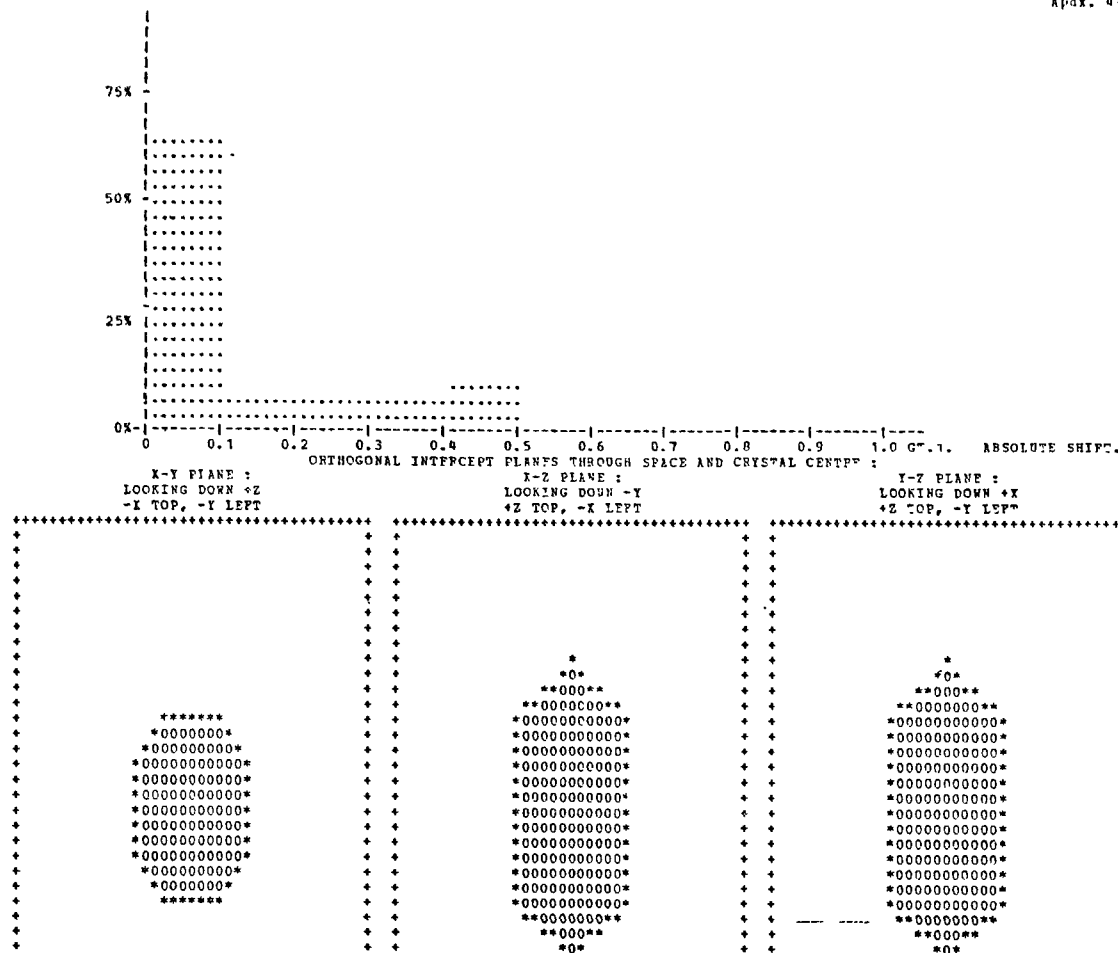


THEORETICAL CRYSTAL AREA = 501.4917 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 943.0640 CUBIC UNITS.
 6 TH SPACIAL DETERMINATION COMPLETED USING 2069 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 638 SURFACE AND 1431 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 2.2429
 MAXIMUM SHIFT = 0.4244 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 6.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 10.0000 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 5.9396 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 8.1208 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.0663 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

FREQUENCY.

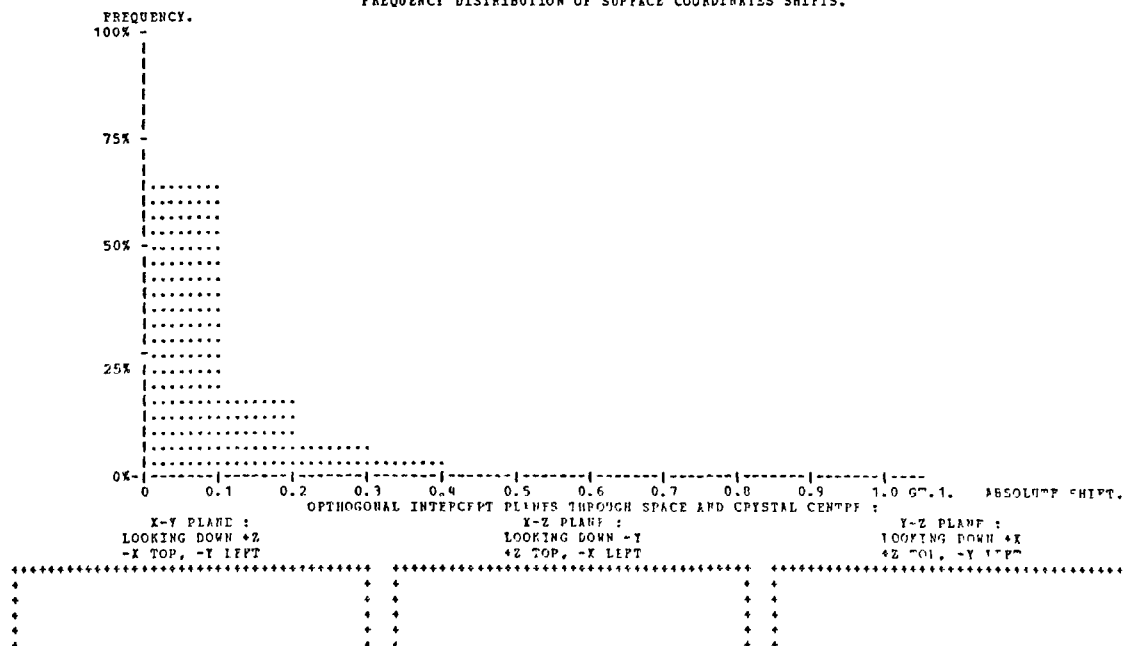


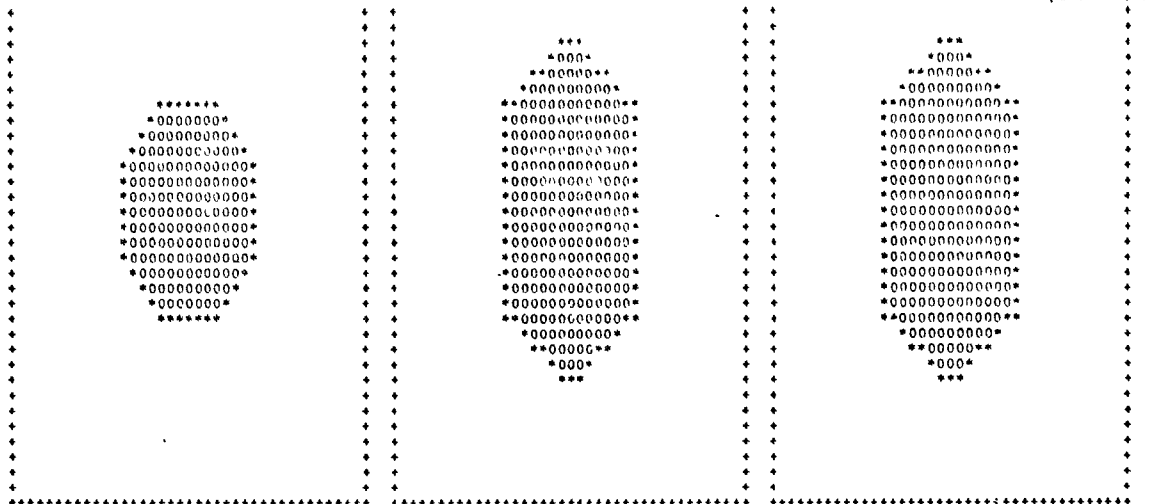


Apdx. a-b, p

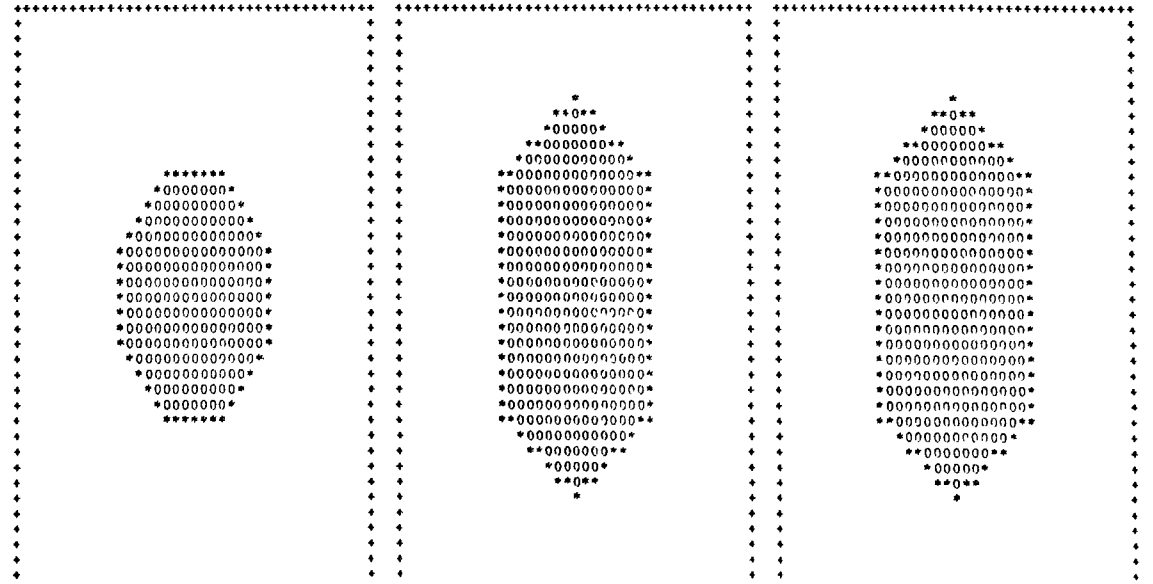
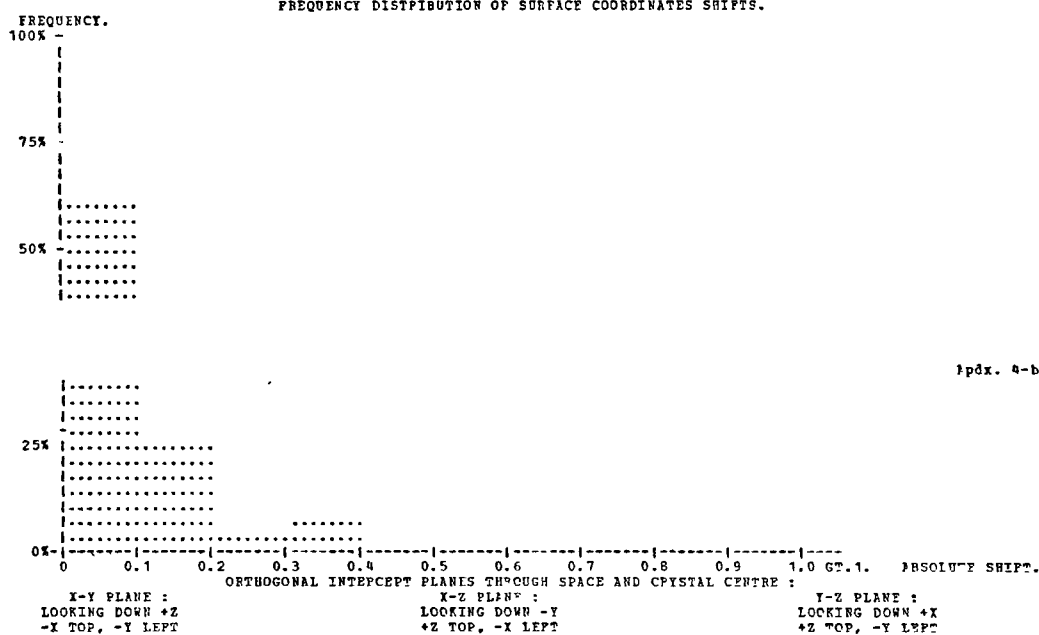
THEORETICAL CRYSTAL AREA = 722.1479 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 1629.6172 CUBIC UNITS.
 7 TH SPACIAL DETERMINATION COMPLETED USING 3111 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 850 SURFACE AND 2261 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 2.6600
 MAXIMUM SHIFT = 0.4628 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 7.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 11.0905 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 6.9295 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 9.4743 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.0488 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.





THEORETICAL CRYSTAL AREA = 982.9241 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 2587.7749 CUBIC UNITS.
 8 TH SPACIAL DETERMINATION COMPLETED USING 4439 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 1070 SURFACE AND 3369 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 3.1486
 MINIMUM SHIFT = 0.3928 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 7.8102 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 13.0000 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 7.9194 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 10.8277 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.0368 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

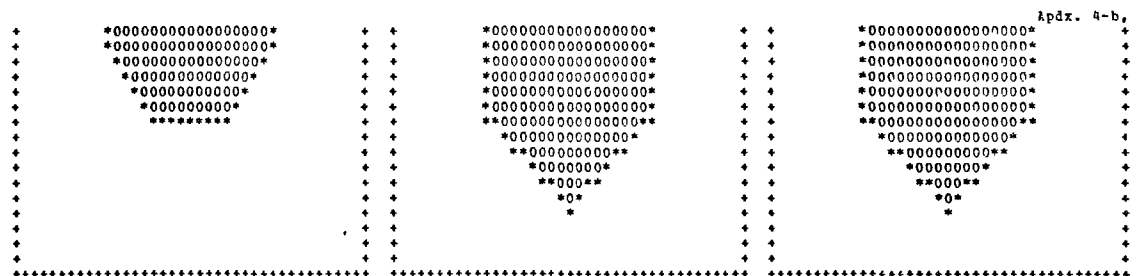
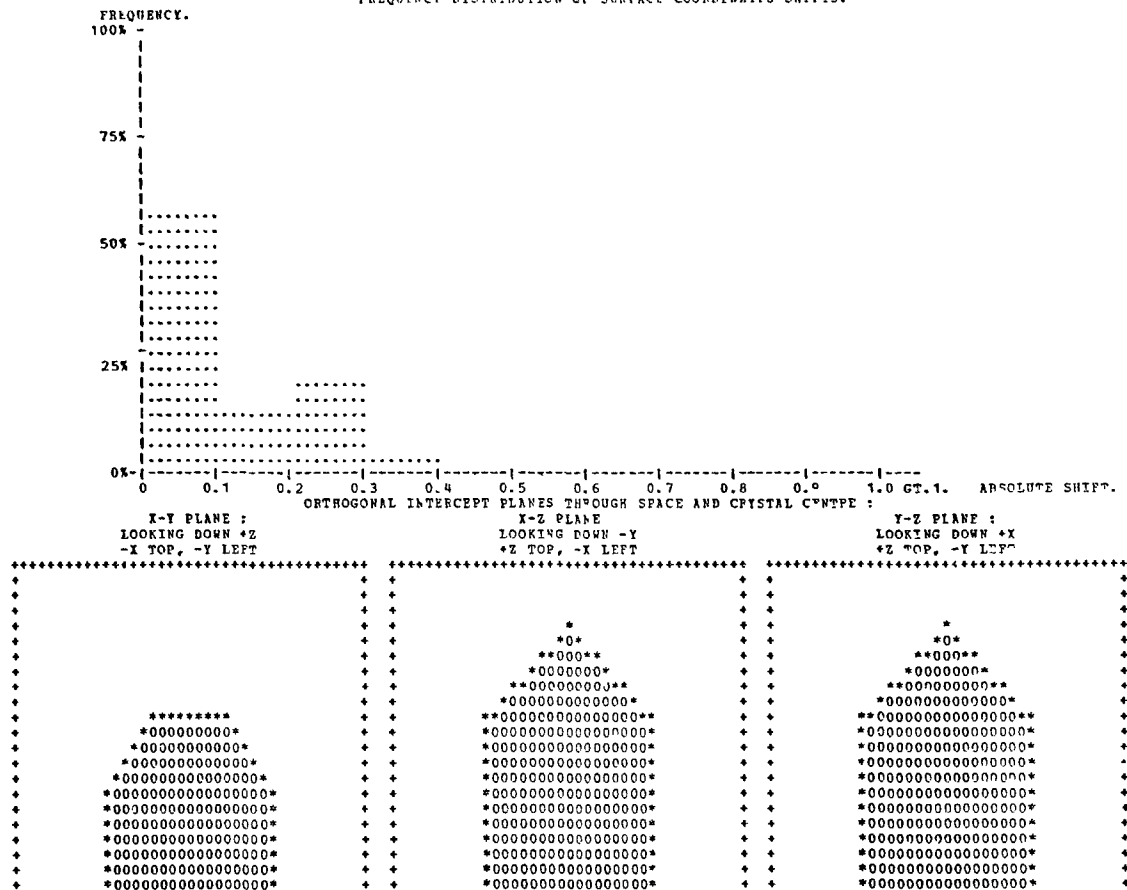


THEORETICAL CRYSTAL AREA = 1.01.8198 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 3052.8042 CUBIC UNITS.
 9 TH SPACIAL DETERMINATION COMPLETED USING 6463 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 1374 SURFACE AND 5029 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 3.6601
 MAXIMUM SHIFT = 0.4304 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 9.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 15.0000 UNITS.

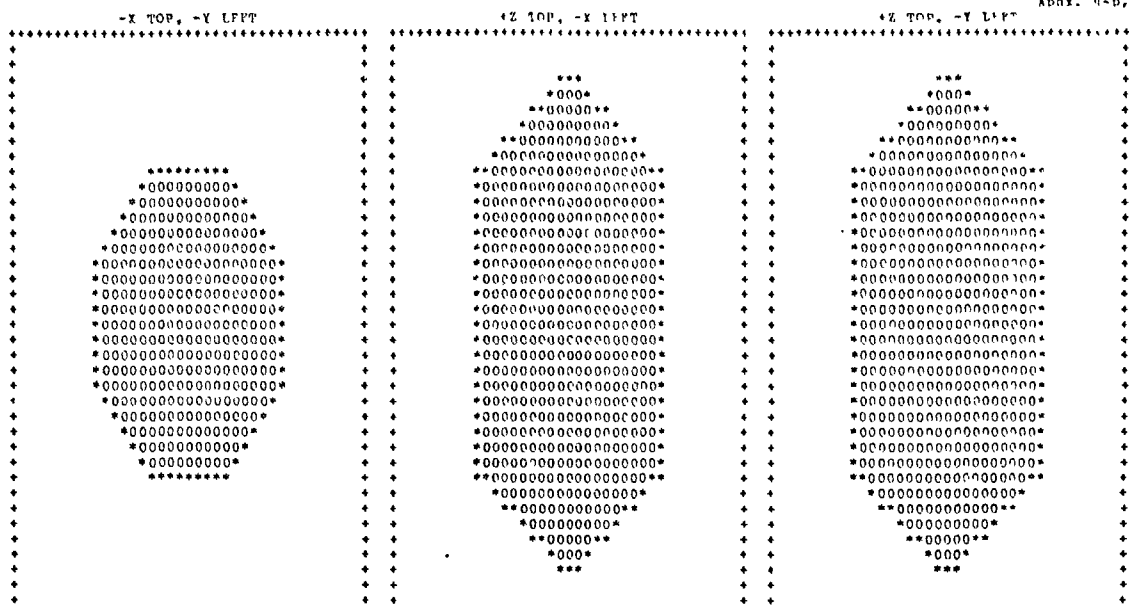
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 8.9094 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 12.1012 UNITS
 MAXIMUM ABSOLUTE ERROR = +/- 0.0107 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.

Apdx. 4-1, 1
 12.1012 UNITS

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

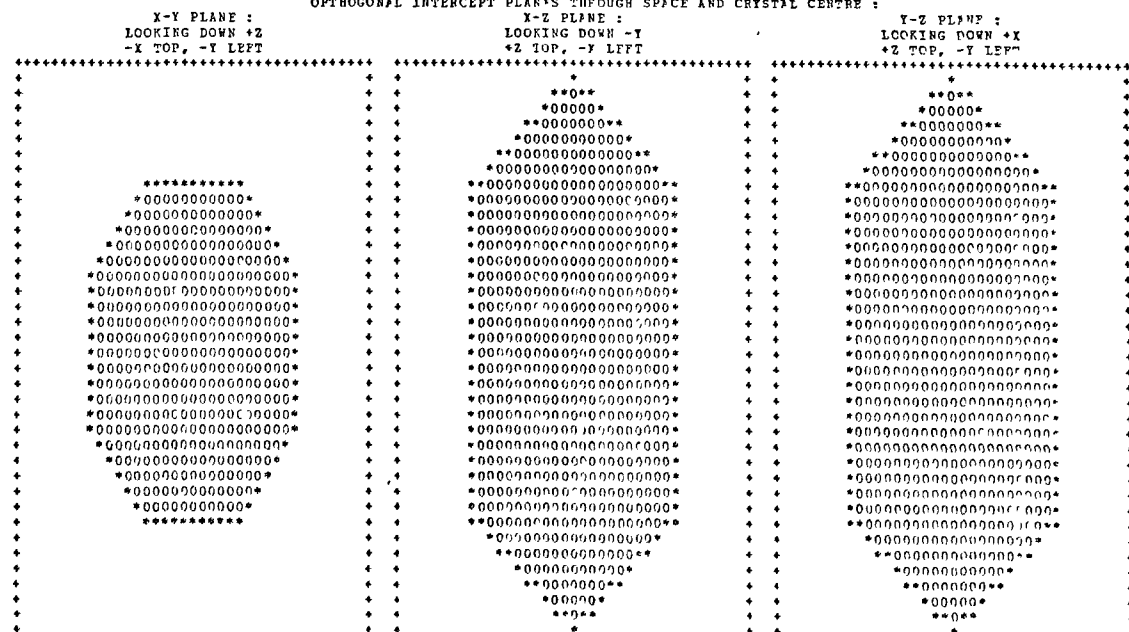
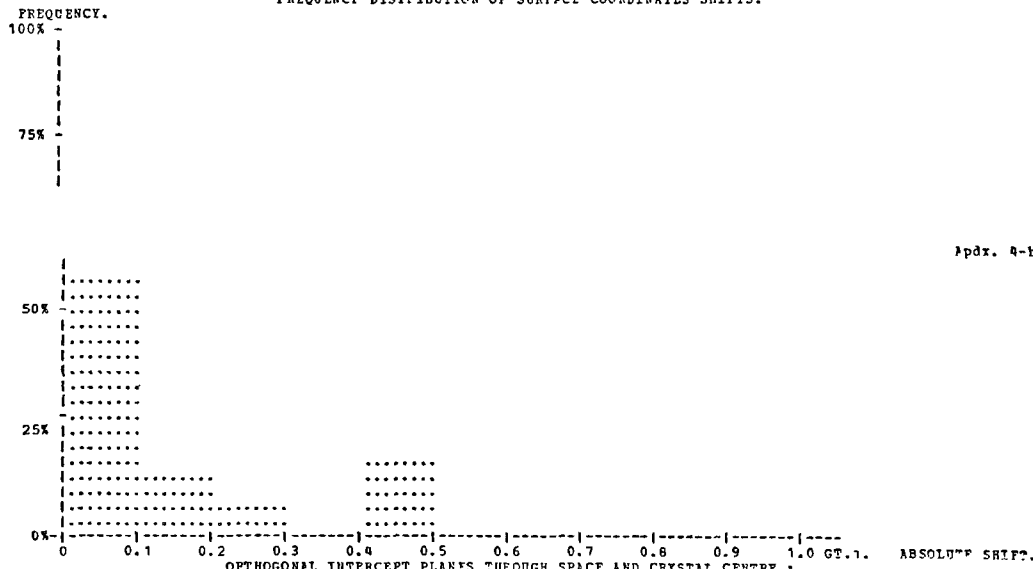


Apdx. 4-b,

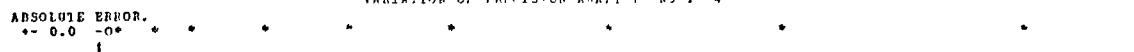
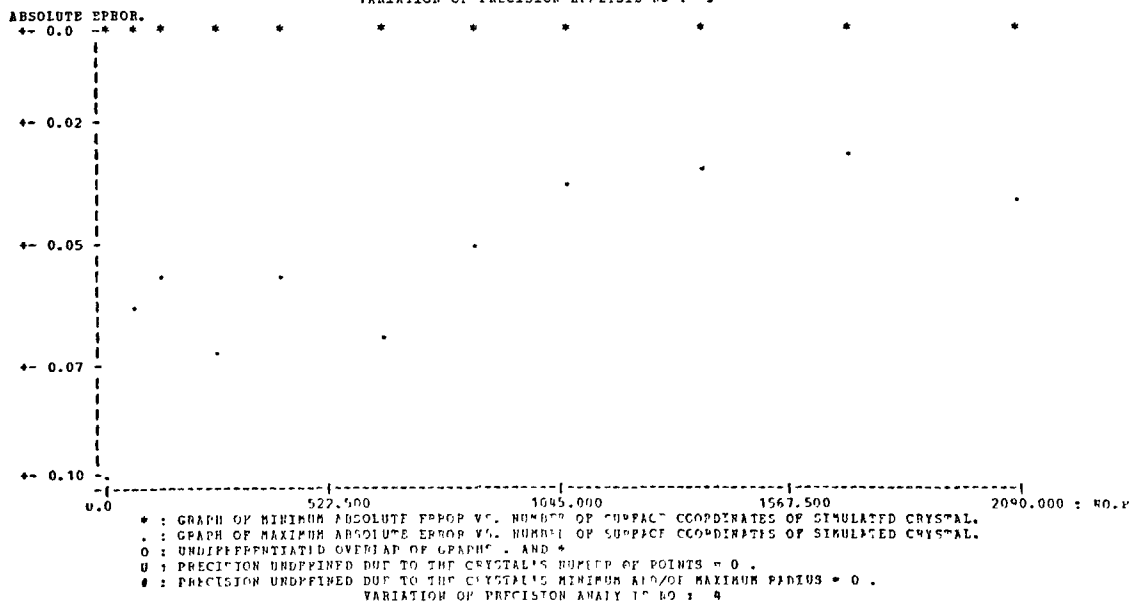
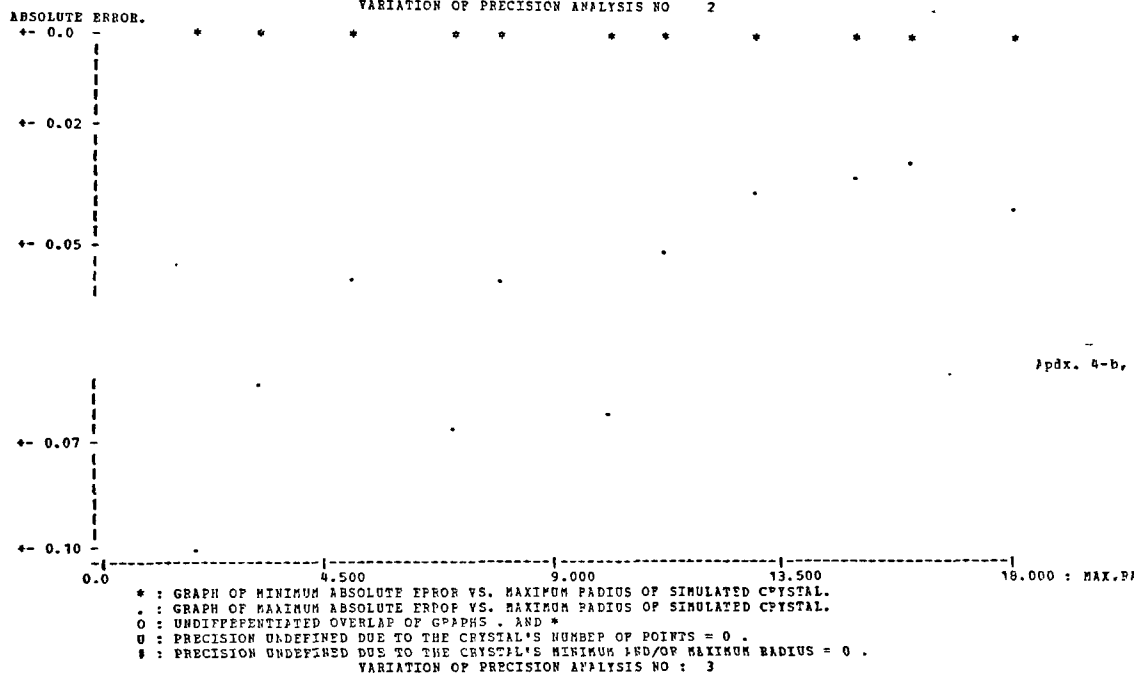
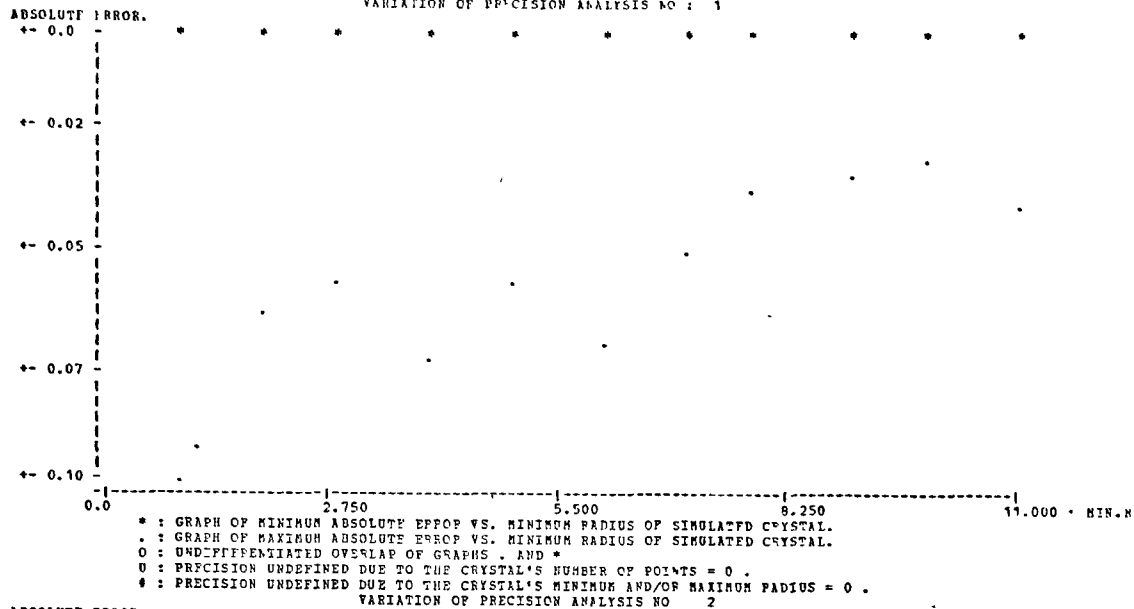


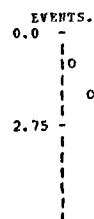
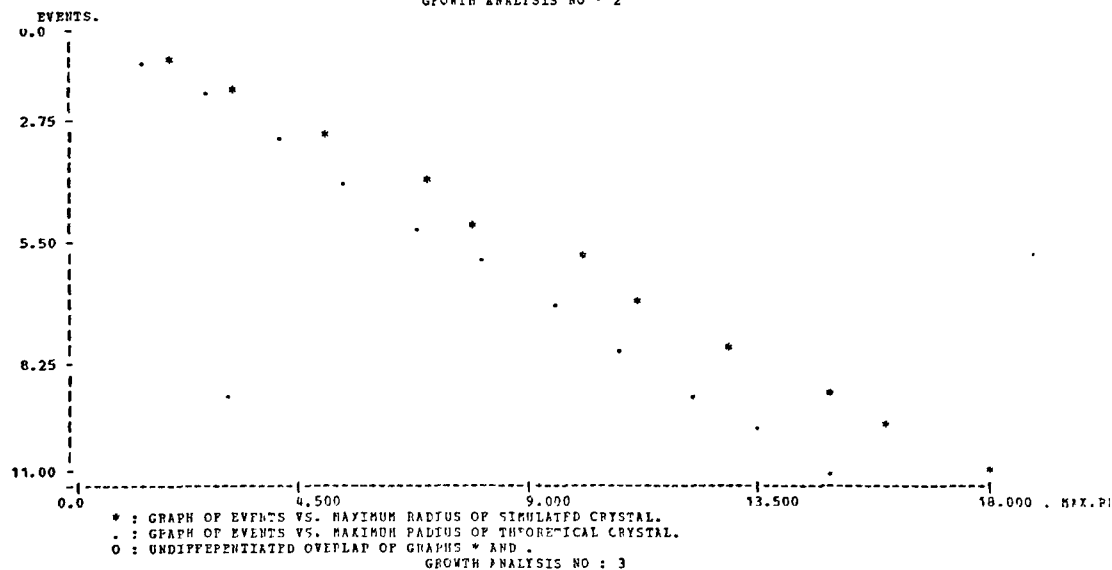
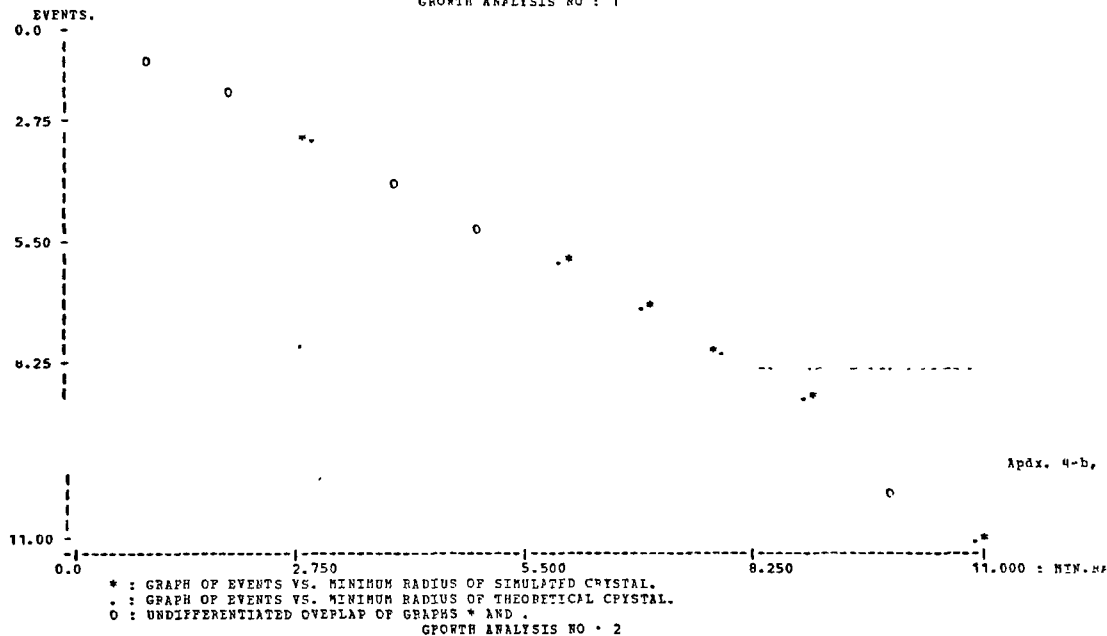
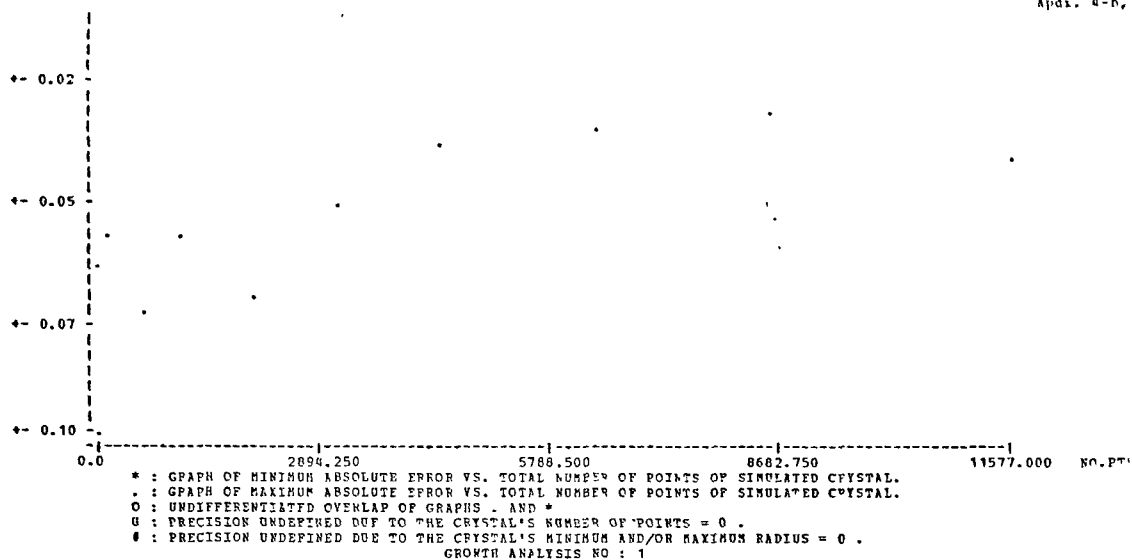
THEORETICAL CRYSTAL AREA = 2005.9717 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 7544.5039 CUBIC UNITS.
 11 TH SPATIAL DETERMINATION COMPLETED USING 11577 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED - CRYSTAL NOW DEFINED BY 2090 SURFACE AND 9487 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 4.5392
 MAXIMUM SHIFT = 0.4878 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 11.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 18.0000 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 10.8892 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 14.8881 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.0375 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

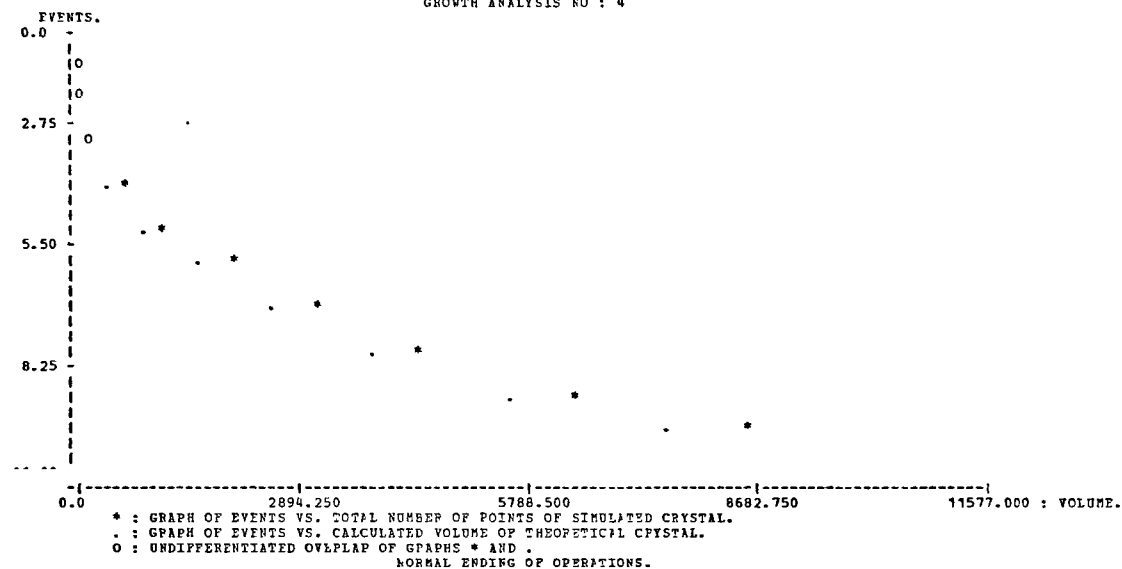
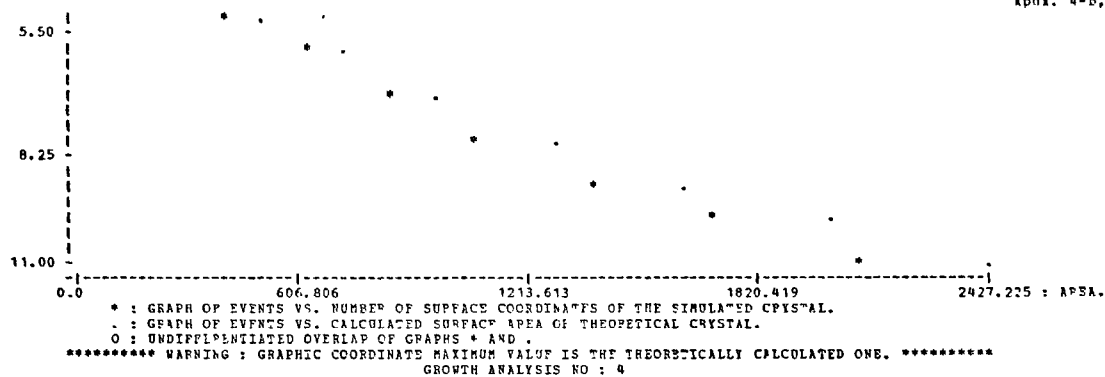
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



***** Andx. 4-b *****
 THEORETICAL CRYSTAL AREA = 2427.2211 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 10041.7461 CUBIC UNITS.
 TERMINATION ON THE 12 TH ITERATION : CRYSTAL TOO BIG FOR ALLOWED SPACE, DEFECT COORDINATE 19 19 1 BELONGS TO "HYP" V
 VARIATION OF PRECISION ANALYSIS NO : 1







The following is the simulation of the growth of a fayalite crystal, as performed by Module 2. Three orthogonal intersecting planes, passing through the centre of the crystal, and the frequency distribution of the surface coordinates are presented, along with relevant information, after each growth increment. Near the end of the document, eight graphs illustrate the behaviour of the precision obtained during the simulated growth.

0

BEGINNING OF OPERATIONS.

FAYALITE : DEER HORN AND ZUSCHMAN, 1967, p. 1.

STANDARD CRYSTAL'S FACTS EQUATIONS (WITH CENTRE AT 0,0,0) ARE :

```

2.1753 X + 1.0000 Y + 0.0 Z = 1.0
-2.1753 X + 1.0000 Y + 0.0 Z = 1.0
-2.1753 X + -1.0000 Y + 0.0 Z = 1.0
2.1753 X + -1.0000 Y + 0.0 Z = 1.0
1.6733 X + 1.5385 Y + 0.0 Z = 1.0
-1.6733 X + 1.5385 Y + 0.0 Z = 1.0
-1.6733 X + -1.5385 Y + 0.0 Z = 1.0
1.6733 X + -1.5385 Y + 0.0 Z = 1.0
0.0 X + 2.0000 Y + 0.0 Z = 1.0
0.0 X + -2.0000 Y + 0.0 Z = 1.0
0.0 X + 1.3333 Y + 1.1441 Z = 1.0
0.0 X + 1.3333 Y + -1.1441 Z = 1.0
0.0 X + -1.3333 Y + 1.1441 Z = 1.0
0.0 X + -1.3333 Y + -1.1441 Z = 1.0
0.0 X + 0.0 Y + 1.3729 Z = 1.0
0.0 X + 0.0 Y + -1.3729 Z = 1.0
1.1156 X + 0.0 Y + 0.8801 Z = 1.0
1.1156 X + 0.0 Y + -0.8801 Z = 1.0
-1.1156 X + 0.0 Y + 0.8801 Z = 1.0
-1.1156 X + 0.0 Y + -0.8801 Z = 1.0
1.0877 X + 0.5000 Y + 0.8581 Z = 1.0
1.0877 X + -0.5000 Y + 0.8581 Z = 1.0
1.0877 X + 0.5000 Y + -0.8581 Z = 1.0
1.0877 X + -0.5000 Y + -0.8581 Z = 1.0
-1.0877 X + 0.5000 Y + 0.8581 Z = 1.0
-1.0877 X + -0.5000 Y + 0.8581 Z = 1.0
-1.0877 X + 0.5000 Y + -0.8581 Z = 1.0
-1.0877 X + -0.5000 Y + -0.8581 Z = 1.0

```

TRANSPOSED CRYSTAL'S FACTS EQUATIONS (WITH CENTRE AT 20 , 20 , 20) ARE :

```

2.1753 X + 1.0000 Y + 0.0 Z = 64.5060
-2.1753 X + 1.0000 Y + 0.0 Z = -22.5060
-2.1753 X + -1.0000 Y + 0.0 Z = -62.5060
2.1753 X + -1.0000 Y + 0.0 Z = 24.5060
1.6733 X + 1.5385 Y + 0.0 Z = 65.2360
-1.6733 X + 1.5385 Y + 0.0 Z = -1.6860
-1.6733 X + -1.5385 Y + 0.0 Z = -63.2360
1.6733 X + -1.5385 Y + 0.0 Z = 3.6960
0.0 X + 2.0000 Y + 0.0 Z = 41.0000
0.0 X + -2.0000 Y + 0.0 Z = -39.0000
0.0 X + 1.3333 Y + 1.1441 Z = 50.5480
0.0 X + 1.3333 Y + -1.1441 Z = 4.7840
0.0 X + -1.3333 Y + 1.1441 Z = -2.7840
0.0 X + -1.3333 Y + -1.1441 Z = -48.5480
0.0 X + 0.0 Y + 1.3729 Z = 28.4580
0.0 X + 0.0 Y + -1.3729 Z = -26.4580
1.1156 X + 0.0 Y + 0.8801 Z = 40.9140
1.1156 X + 0.0 Y + -0.8801 Z = 5.7100
-1.1156 X + 0.0 Y + 0.8801 Z = -38.9140
-1.1156 X + 0.0 Y + -0.8801 Z = -3.7100
1.0877 X + 0.5000 Y + 0.8581 Z = 49.9160
1.0877 X + -0.5000 Y + 0.8581 Z = 29.9160
1.0877 X + 0.5000 Y + -0.8581 Z = 15.5920

```

APP. 4-c,

```

1.0877 X + -0.5000 Y + -0.8581 Z = -4.4080
-1.0877 X + 0.5000 Y + 0.8581 Z = 6.4080
-1.0877 X + -0.5000 Y + 0.8581 Z = -13.5920
-1.0877 X + 0.5000 Y + -0.8581 Z = -27.9160
-1.0877 X + -0.5000 Y + -0.8581 Z = -47.9160

```

1 TH SPACIAL DETERMINATION COMPLETED USING 7 MATRIX POINTS.

INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 6 SURFACE AND 1 INTERNAL COORDINATES

SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.1667

MAXIMUM SHIFT = 0.0820 UNITS, MINIMUM SHIFT = 0.0 UNITS.

MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNIT

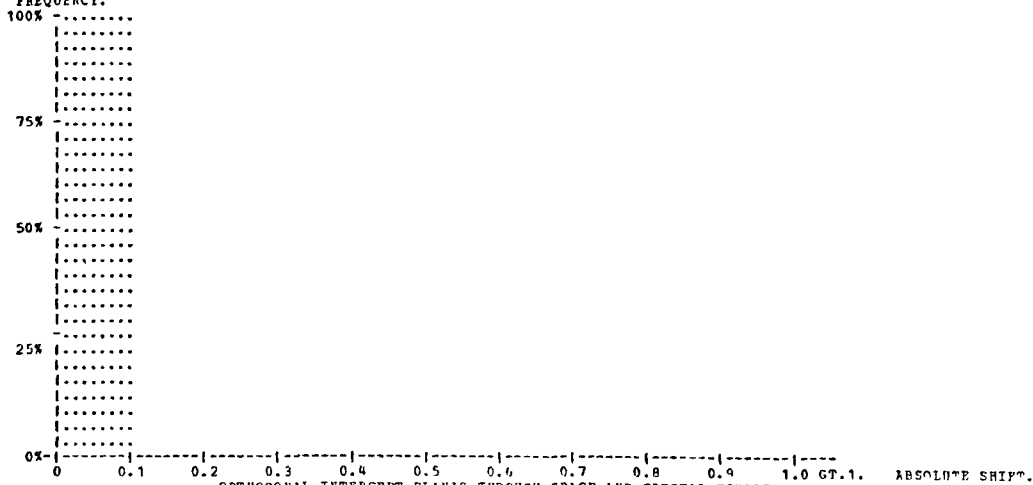
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 0.4177 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 0.7284 UN

MAXIMUM ABSOLUTE ERROR = +- 0.0820 UNITS.

MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

FREQUENCY.



X-Y PLANE :

LOOKING DOWN +Z

-X TOP, -Y LEFT

X-Z PLANE :

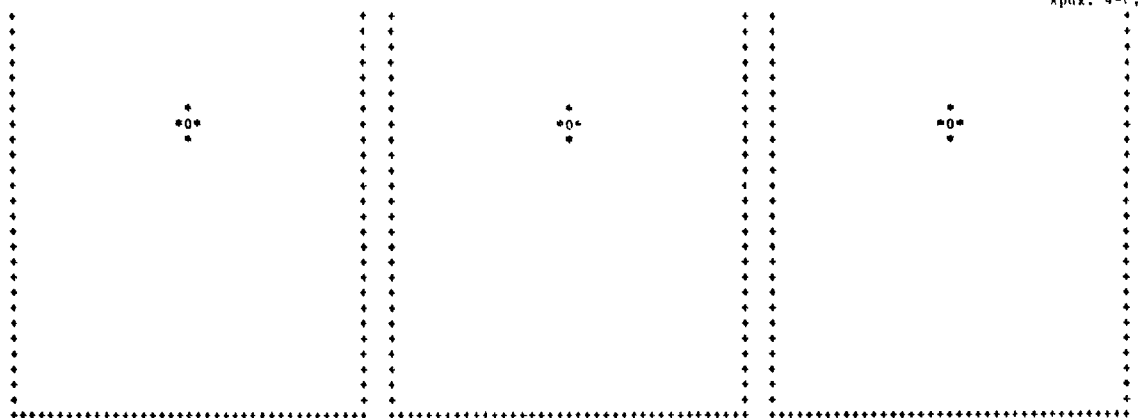
LOOKING DOWN -Y

+Z TOP, -X LEFT

Y-Z PLANE :

LOOKING DOWN +Y

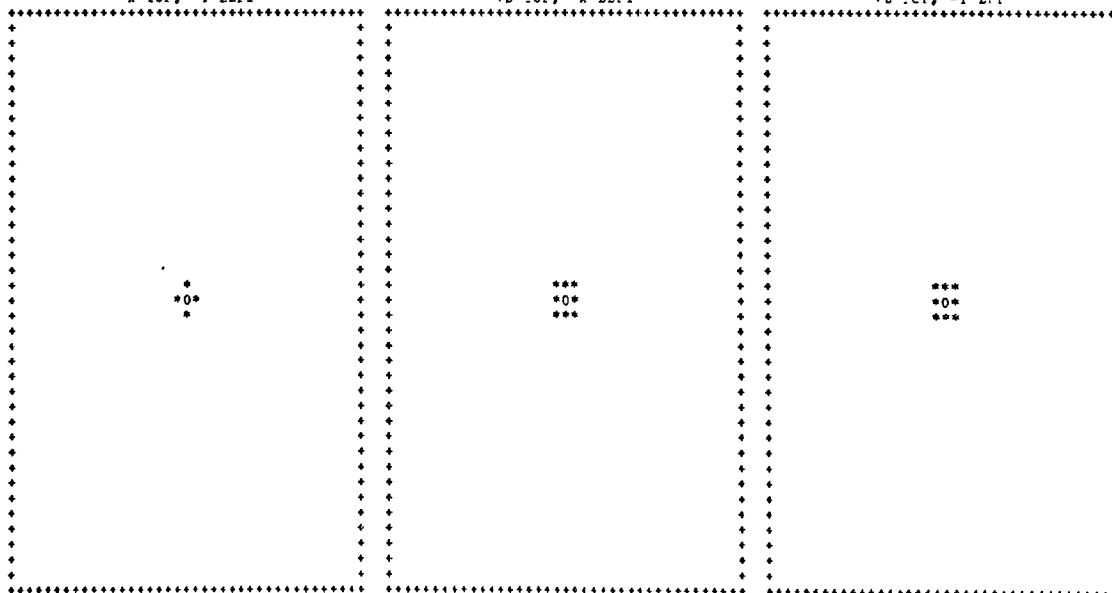
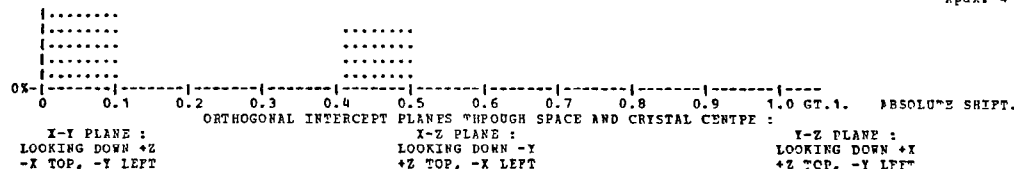
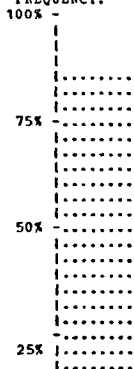
+Z TOP, -Y LEFT



THEORETICAL CRYSTAL AREA = 4.5928 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 0.7771 CUBIC UNITS.
 2 TH SPACIAL DIFFERENTIATION COMPLETED USING 15 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 14 SURFACE AND 1 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 - 0.0714
 MAXIMUM SHIFT = 0.4568 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 1.4142 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 0.8354 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 1.4568 UNI
 MAXIMUM ABSOLUTE ERROR = +- 0.4568 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

FREQUENCY.

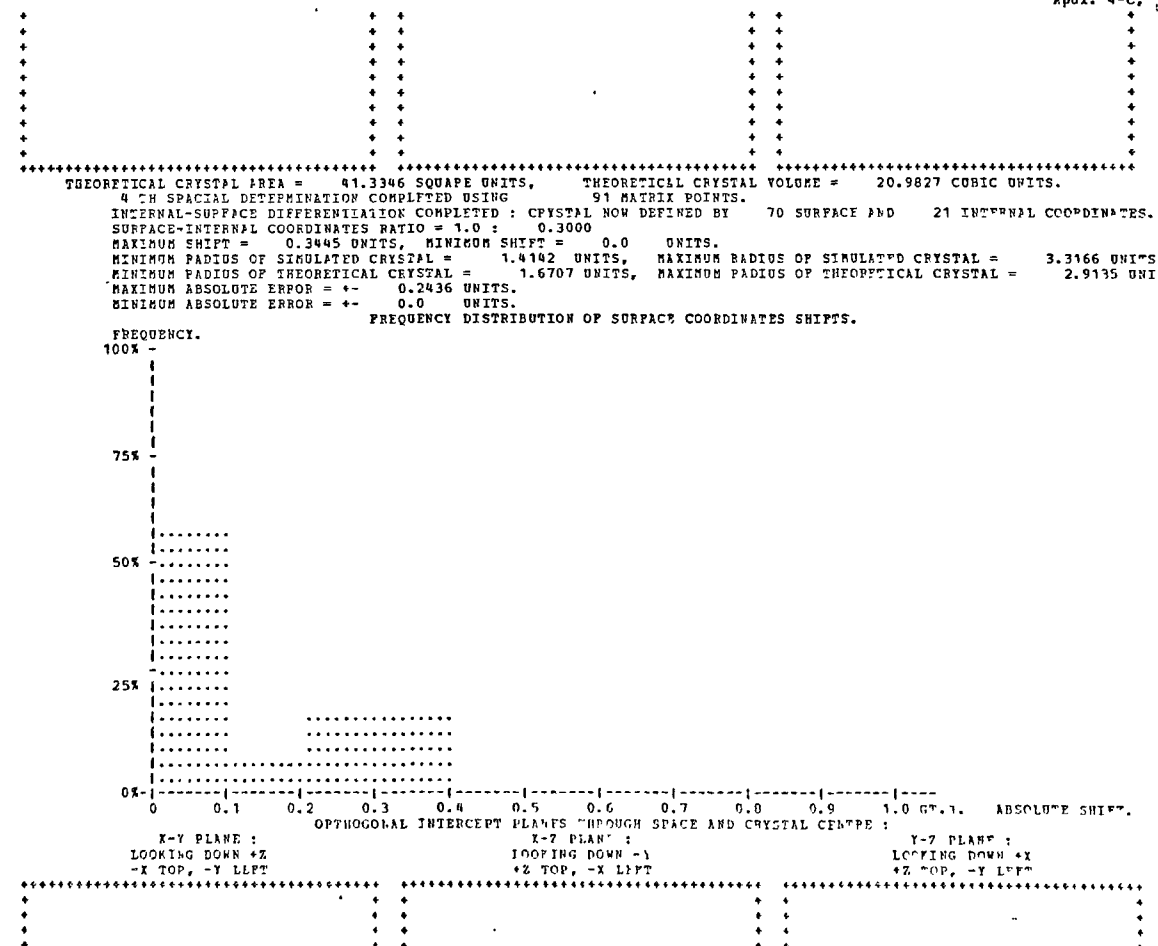
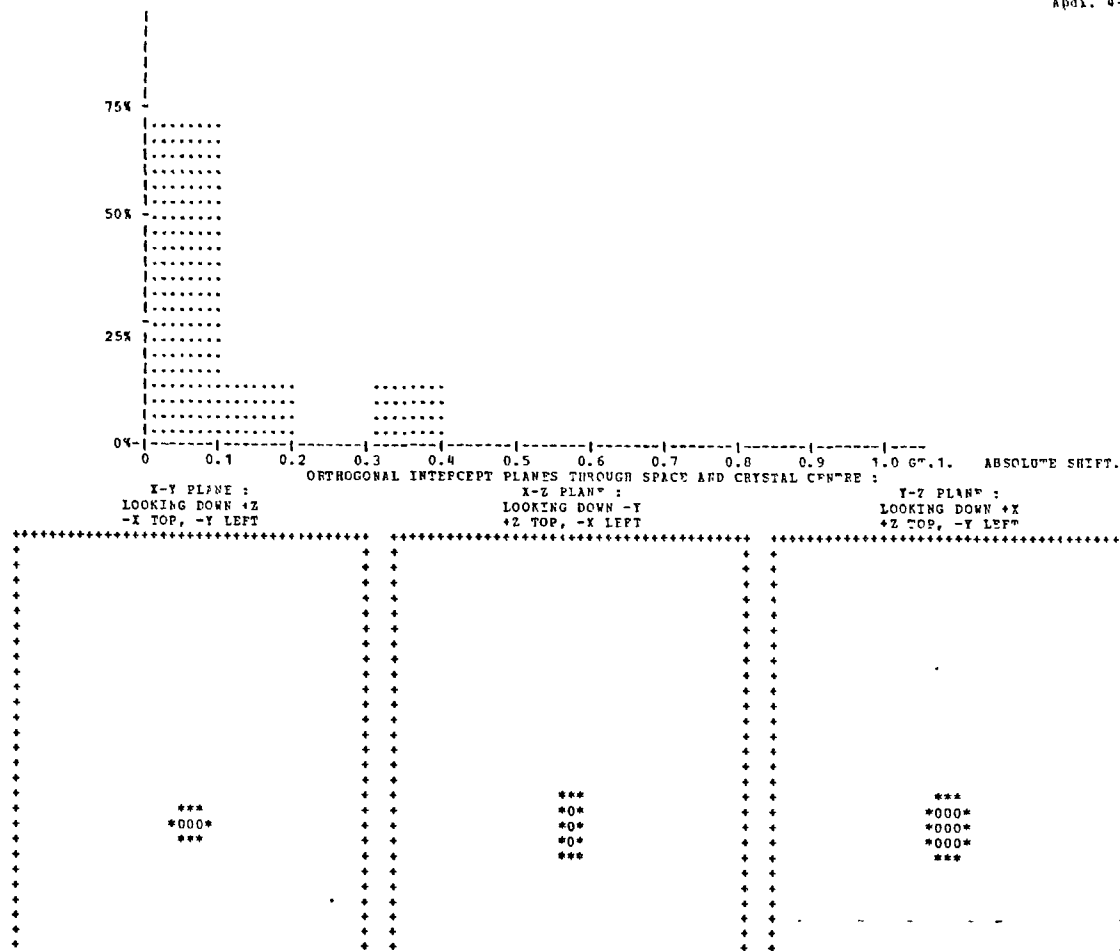


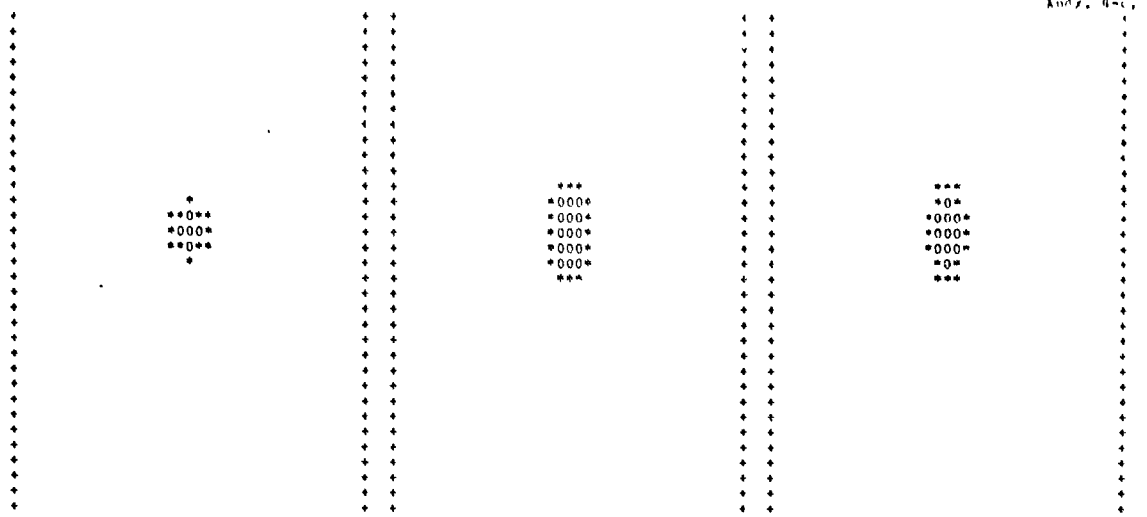
THEORETICAL CRYSTAL AREA = 10.3709 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 6.2171 CUBIC UNITS.
 3 TH SPACIAL DIFFERENTIATION COMPLETED USING 51 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 42 SURFACE AND 9 INTERNAL COORDINATES
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 - 0.2143
 MAXIMUM SHIFT = 0.3445 UNITS, MINIMUM SHIFT = 0.0339 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 2.4495 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 1.2531 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 2.4952 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.3445 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0151 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

FREQUENCY.

100% -

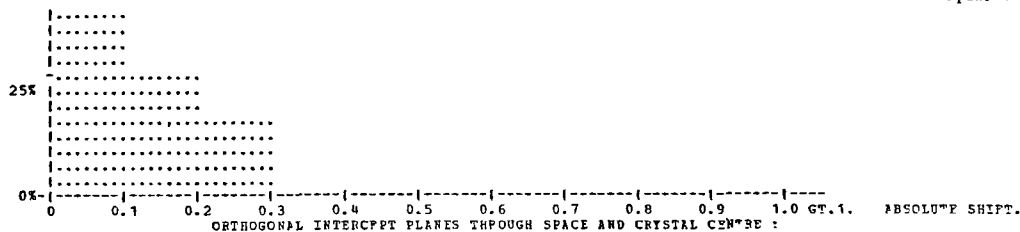
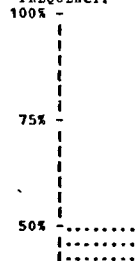




THEORETICAL CRYSTAL AREA = 73.4839 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 49.7370 CUBIC UNITS.
 5 TH SPACIAL DETERMINATION COMPLETED USING 147 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 90 SURFACE AND 57 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.6333
 MAXIMUM SHIFT = 0.2712 UNITS, MINIMUM SHIFT = 0.0257 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 2.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 4.1231 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 2.0884 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 3.6419 UNIT
 MAXIMUM ABSOLUTE ERROR = +- 0.1356 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0086 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

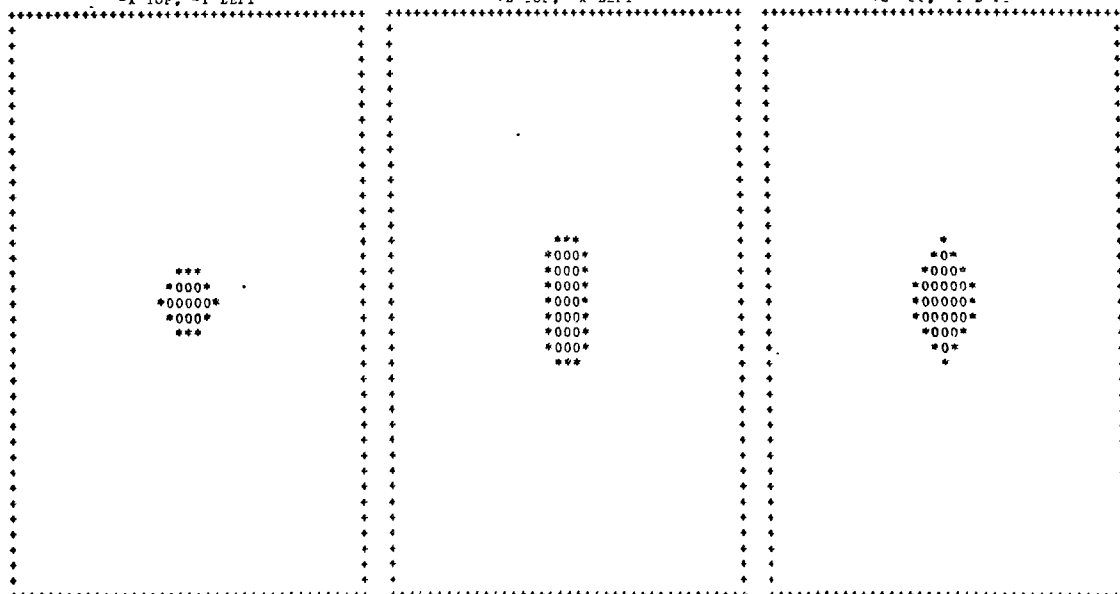
FREQUENCY.



X-Y PLANE :
 LOOKING DOWN +Z
 -X TOP, -Y LEFT

X-Z PLANE :
 LOOKING DOWN -Y
 +Z TOP, -X LEFT

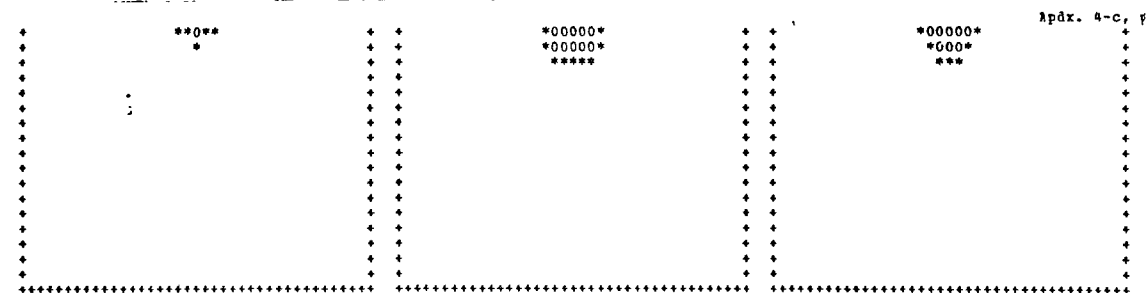
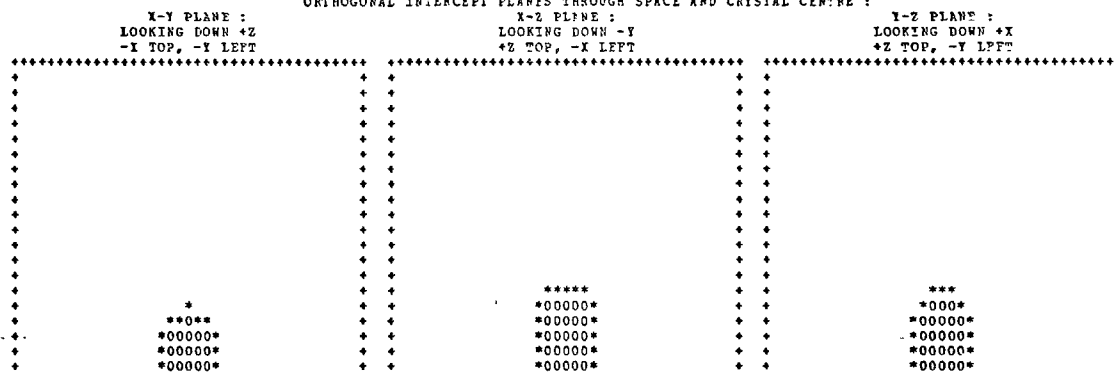
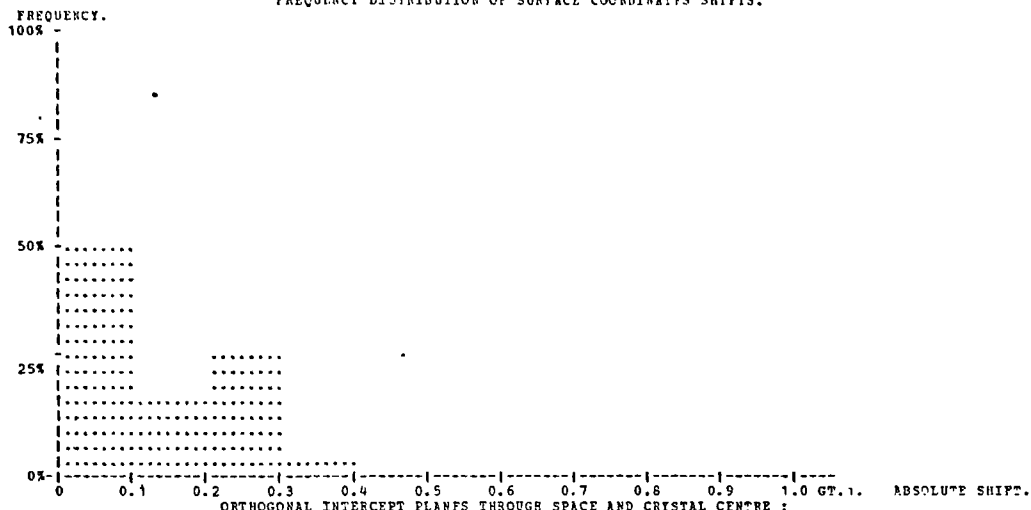
Y-Z PLANE :
 LOOKING DOWN +X
 +Z TOP, -Y LEFT



THEORETICAL CRYSTAL AREA = 114.8168 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 97.1429 CUBIC UNITS.
 6 TH SPACIAL DETERMINATION COMPLETED USING 249 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 142 SURFACE AND 107 INTERNAL COORDINATES
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.7535
 MAXIMUM SHIFT = 0.3701 UNITS, MINIMUM SHIFT = 0.0 UNITS.

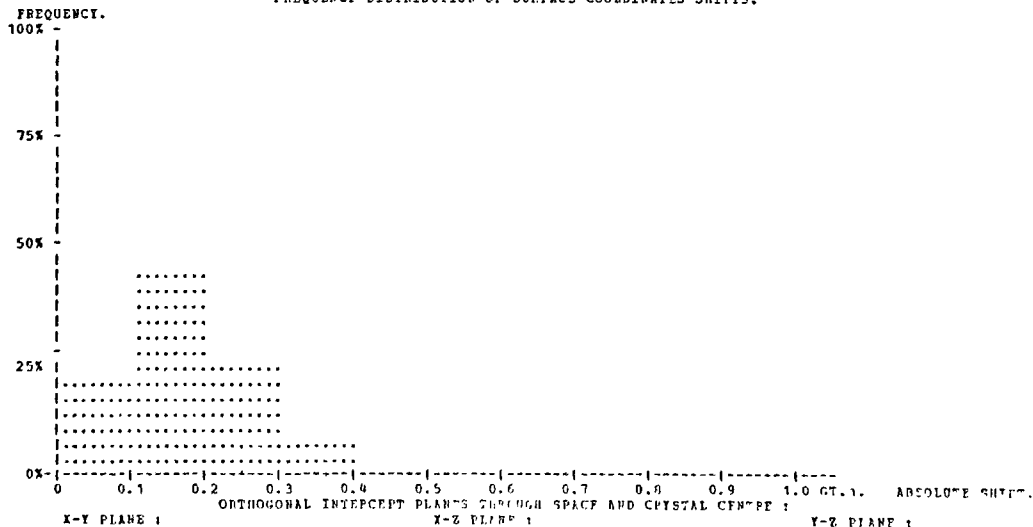
MINIMUM RADIUS OF SIMULATED CRYSTAL = 2.2361 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 2.5061 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 4.5026 UNITS
 MINIMUM ABSOLUTE ERROR = +/- 0.1213 UNITS, MAXIMUM ABSOLUTE ERROR = +/- 0.0 UNITS, MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS
 Apdx. 4-c, 4.5026 UNITS
 4.3703 UNITS

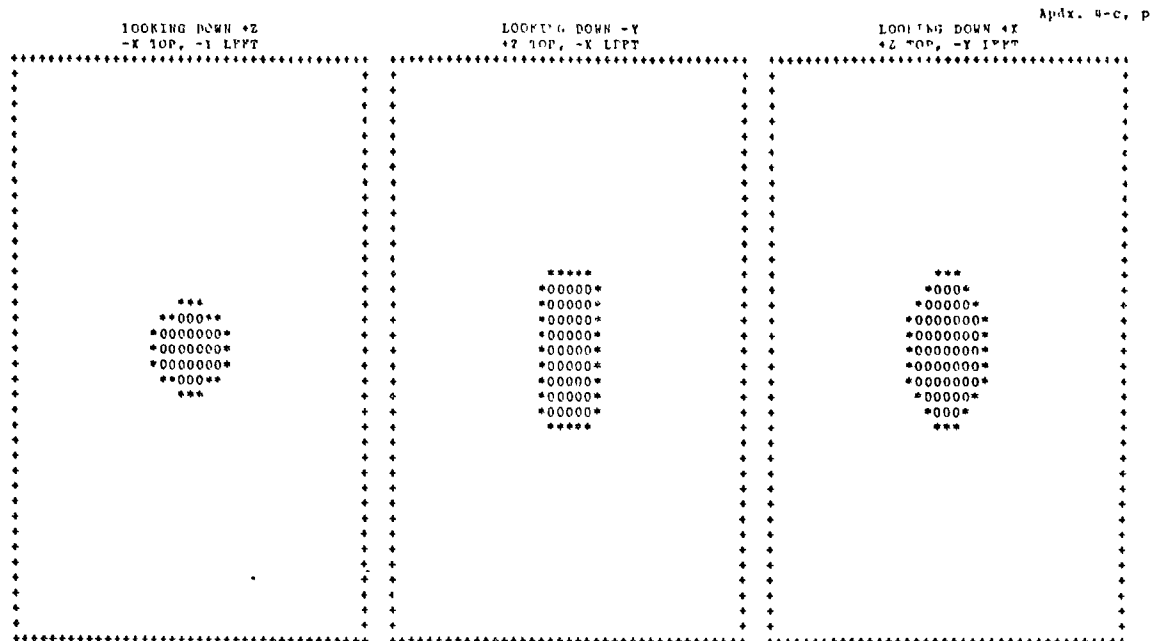
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



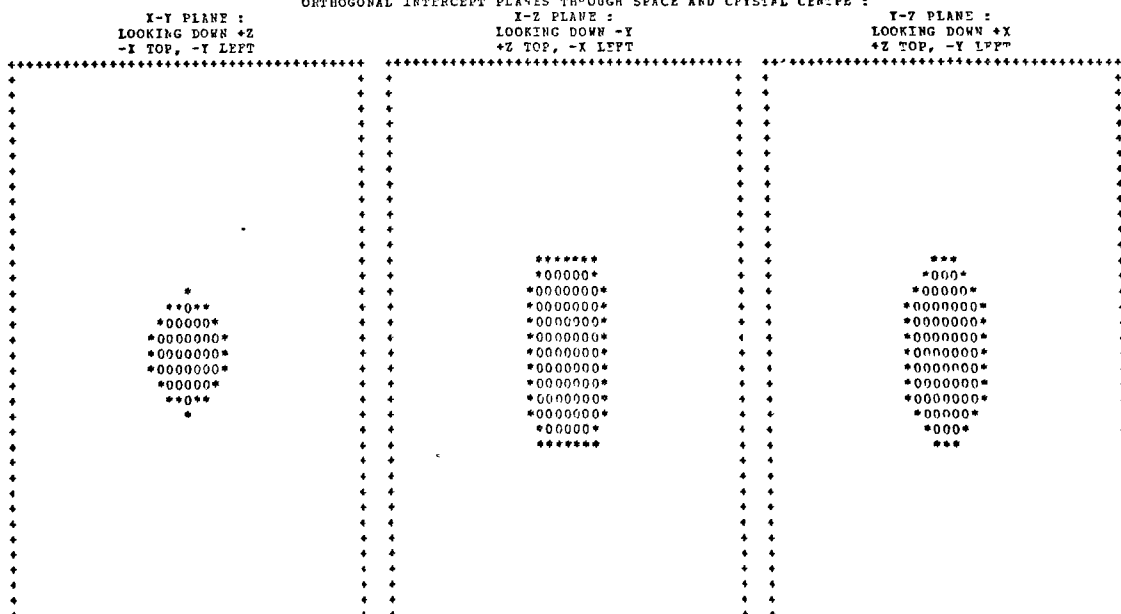
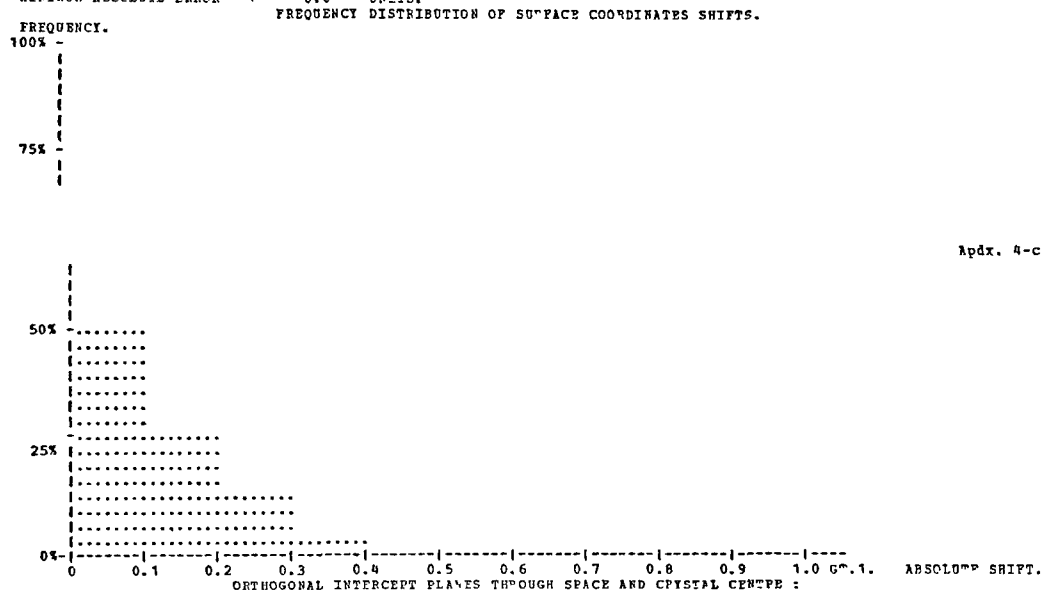
THEORETICAL CRYSTAL AREA = 165.3392 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 167.8632 CUBIC UNITS.
 7 IN SPACIAL DETERMINATION COMPLETED USING 409 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 202 SURFACE AND 207 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.0248
 MAXIMUM SHIFT = 0.3722 UNITS, MINIMUM SHIFT = 0.0231 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 2.8284 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 5.4772 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 2.9238 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 5.0997 UNITS
 MAXIMUM ABSOLUTE ERROR = +/- 0.0930 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0042 UNITS.
 Apdx. 4-c, 5

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

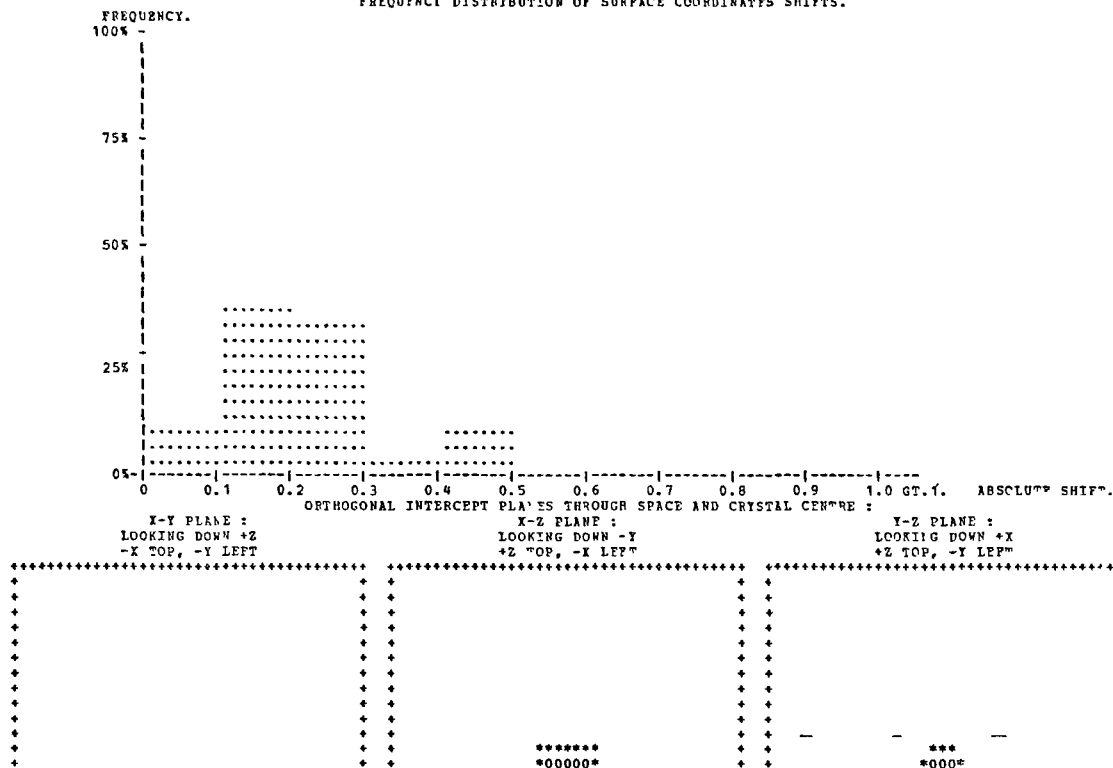




THEORETICAL CRYSTAL AREA = 225.0452 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 266.5596 CUBIC UNITS.
 8 TH SPACIAL DETERMINATION COMPLETED USING 569 MATEIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 254 SURFACE AND 315 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.2402
 MAXIMUM SHIFT = 0.3280 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 3.1623 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 6.7082 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 3.3415 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 5.8271 UNIT
 MAXIMUM ABSOLUTE ERROR = +- 0.0732 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

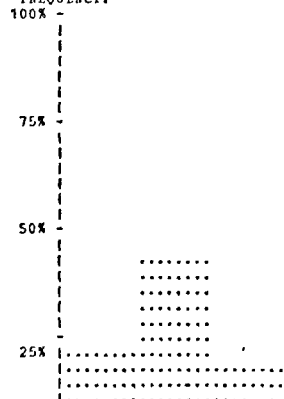


THEORETICAL CRYSTAL AREA = 333.9140 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 397.8960 CUBIC UNITS.
 9 TH SPECIAL DIFFERENTIATION COMPLETED USING 1023 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 338 SURFACE AND 471 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.3935
 MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0250 UNITS
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 3.6056 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 7.6159 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 3.7592 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 6.5555 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.1000 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0047 UNITS.
 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



THEORETICAL CRYSTAL AREA = 372.0120 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 566.5369 CUBIC UNITS.
 10 TH SPECIAL DIFFERENTIATION COMPLETED USING 1023 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 414 SURFACE AND 609 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.4710
 MAXIMUM SHIFT = 0.4921 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 4.1231 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 8.0623 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 4.1769 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 7.2819 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.0734 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.
 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

FREQUENCY.

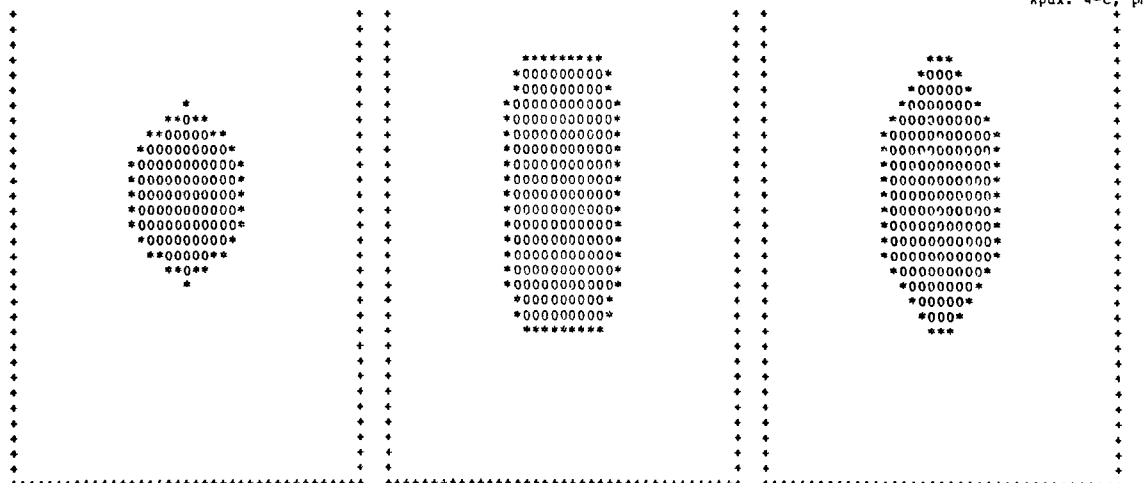
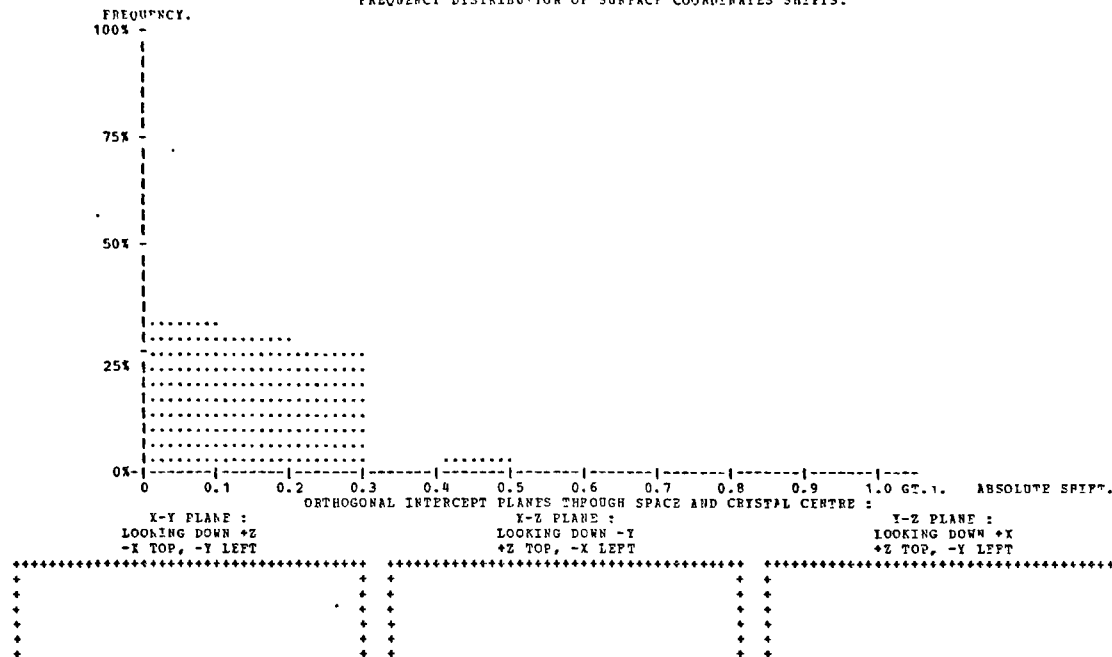



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THEORETICAL CRYSTAL AREA = 550.7209 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 1034.3792 CUBIC UNITS.
12 TH SPACIAL DIFFRACTION COMPLETED USING 1747 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 574 SURFACE AND 1173 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 2.0436
MAXIMUM SHIFT = 0.4393 UNITS, MINIMUM SHIFT = 0.0 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 5.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 9.8995 UNITS.
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 5.0122 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 8.7806 UNITS.
MAXIMUM ABSOLUTE ERROR = +- 0.0732 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

```

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

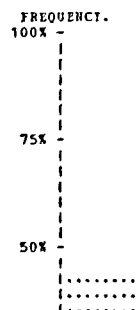


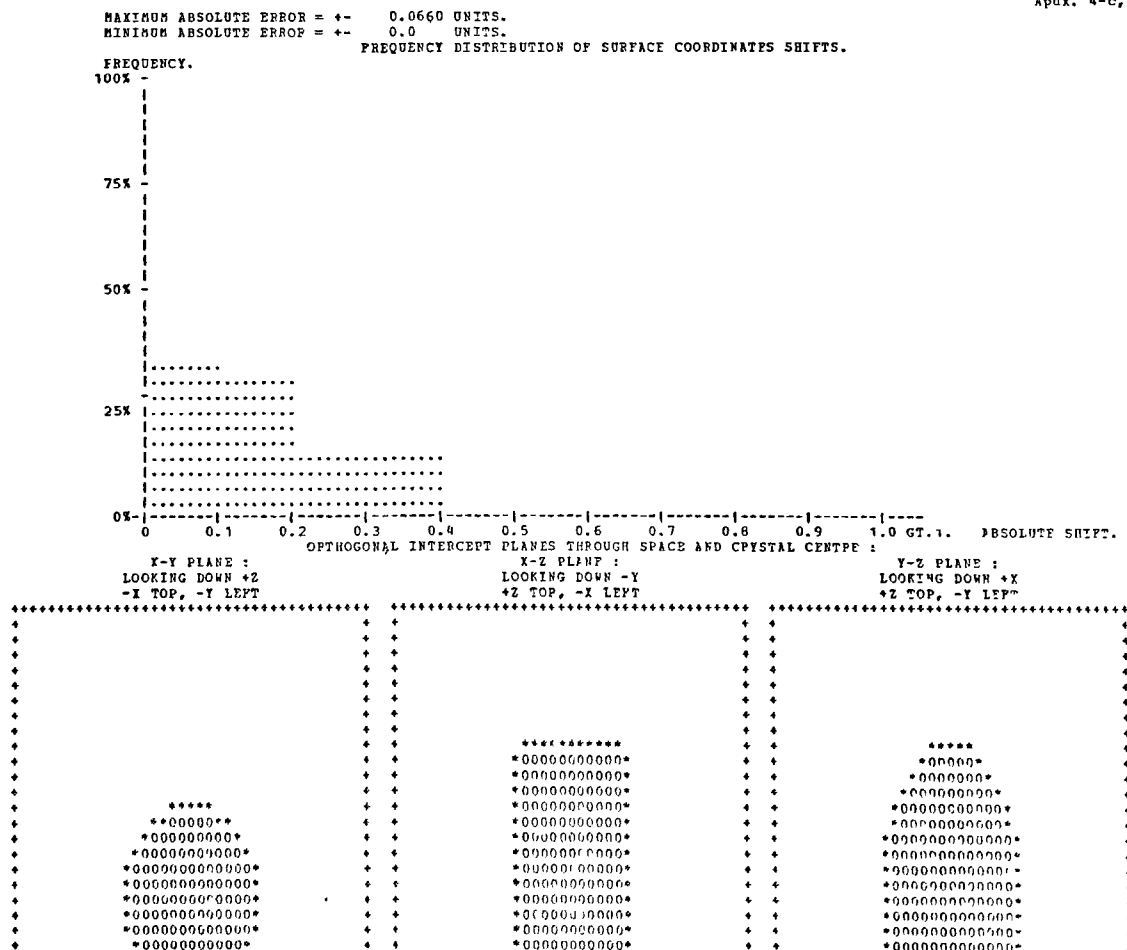
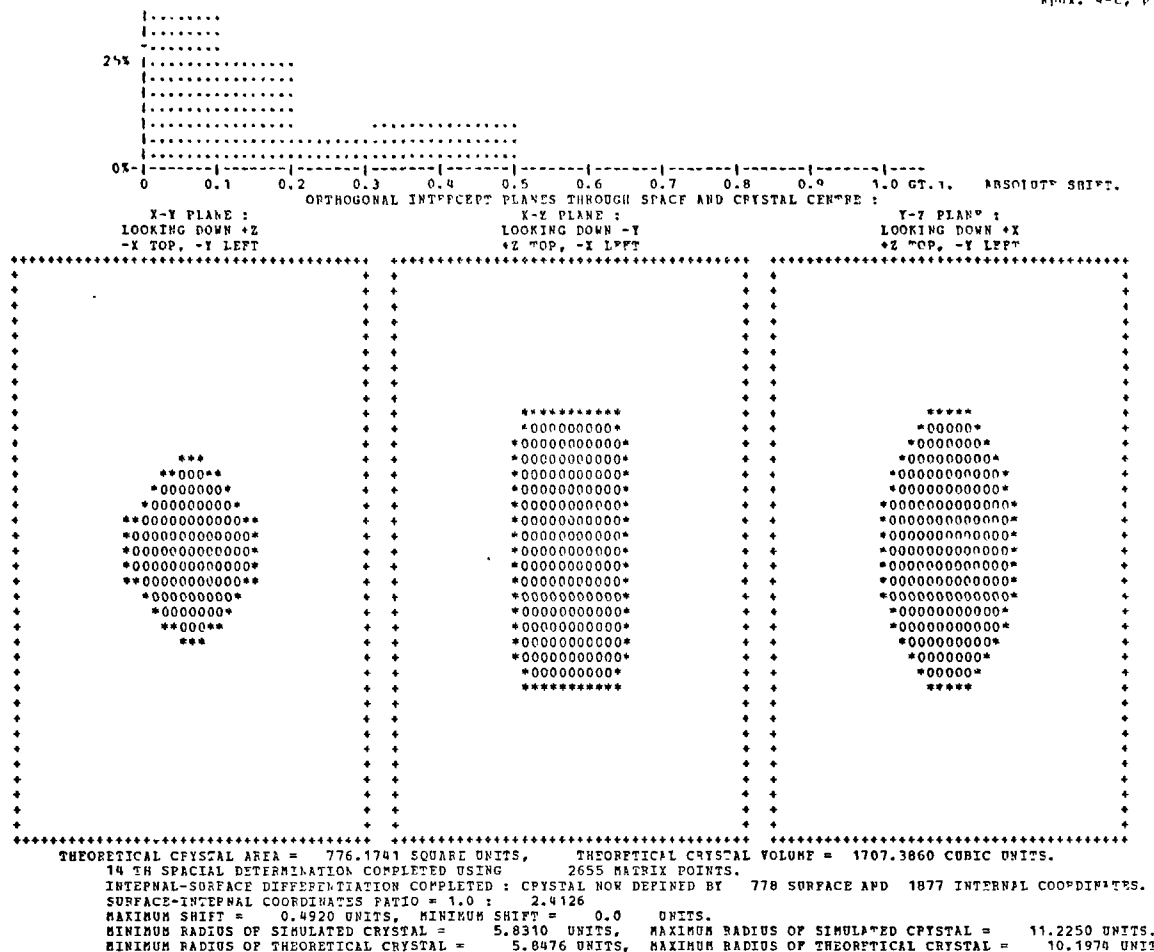
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THEORETICAL CRYSTAL AREA = 661.3555 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 1342.9050 CUBIC UNITS.
13 TH SPACIAL DIFFRACTION COMPLETED USING 2125 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 666 SURFACE AND 1459 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 2.1907
MAXIMUM SHIFT = 0.5900 UNITS, MINIMUM SHIFT = 0.0079 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 5.3852 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 10.3441 UNITS.
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 5.4299 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 9.4690 UNITS.
MAXIMUM ABSOLUTE ERROR = +- 0.0714 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0009 UNITS.

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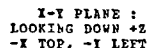
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.





Ap 1x. 4 c, p

FREQUENCY DISTRIBUTION OF SURFACE COORDINATE'S SHIFTS.

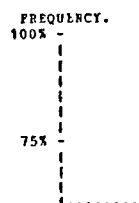


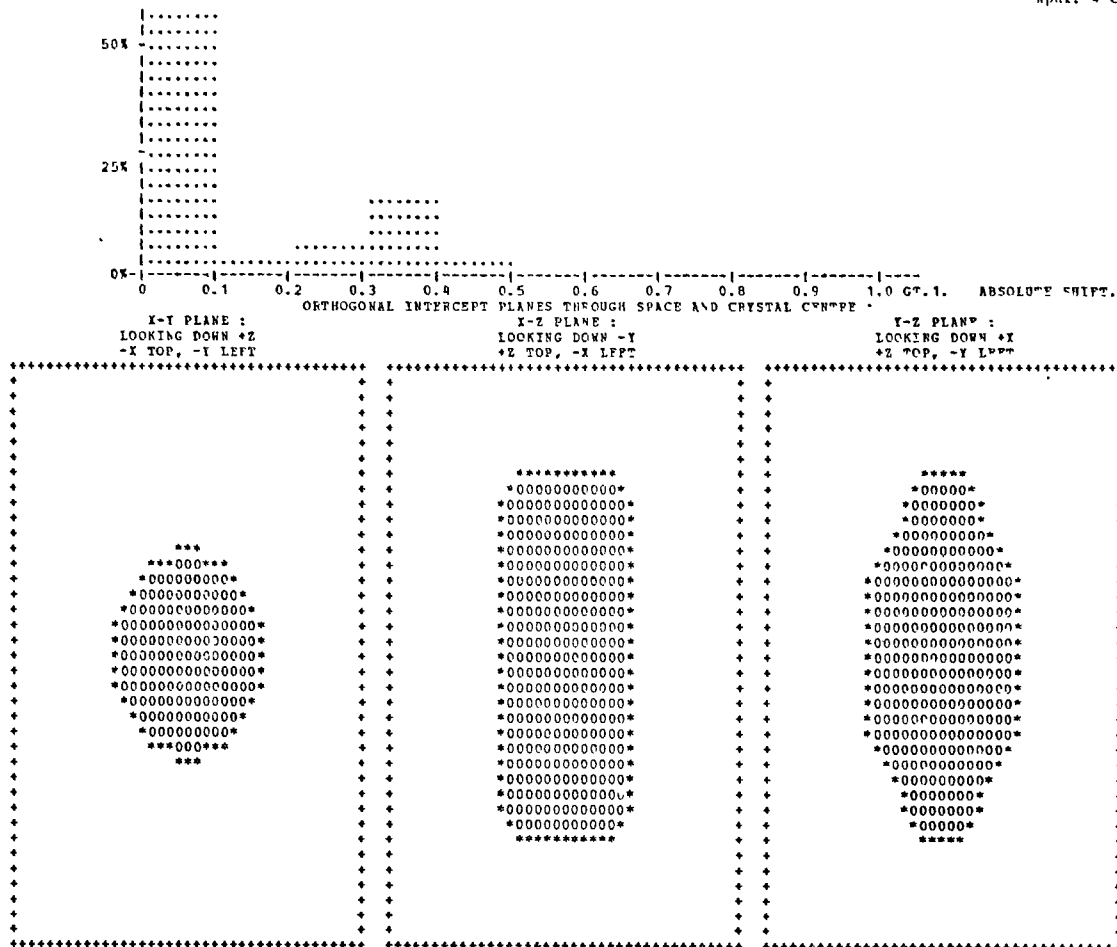
PLANTS THROUGH :
X-Z PLANE :
LOOKING DOWN -Y
+Z TOP. -Y LEFT

Y-Z PLANE :
LOOKING DOWN +)
42 TOP -Y LEFT

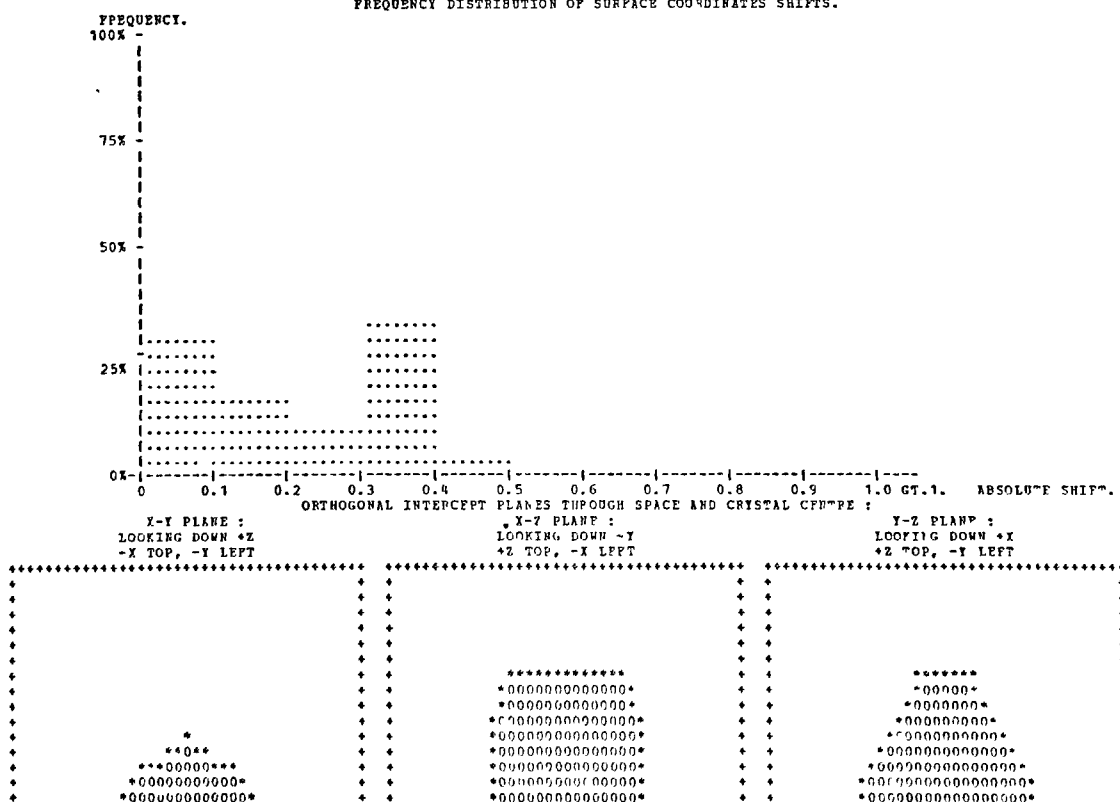
Appx. 4-C. P

FREQUENCY DISTRIBUTION OF SURFACZ COORDINATES SHIFTS.





Apdx. 4-c, D.
THEORETICAL CRYSTAL AREA = 1175.7441 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 3183.1870 CUBIC UNITS.
17 TH SPACIAL DETERMINATION COMPLETED USING 4495 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED - CRYSTAL NOW DEFINED BY 1154 SURFACE AND 3341 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 2.8951
MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0208 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 6.7082 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 13.4536 UNITS
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 7.1007 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 12.3825 UNITS
MAXIMUM ABSOLUTE ERROR = +/- 0.0590 UNITS.
MINIMUM ABSOLUTE ERROR = +/- 0.0017 UNITS.
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



Л. 18. 4-с, р

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

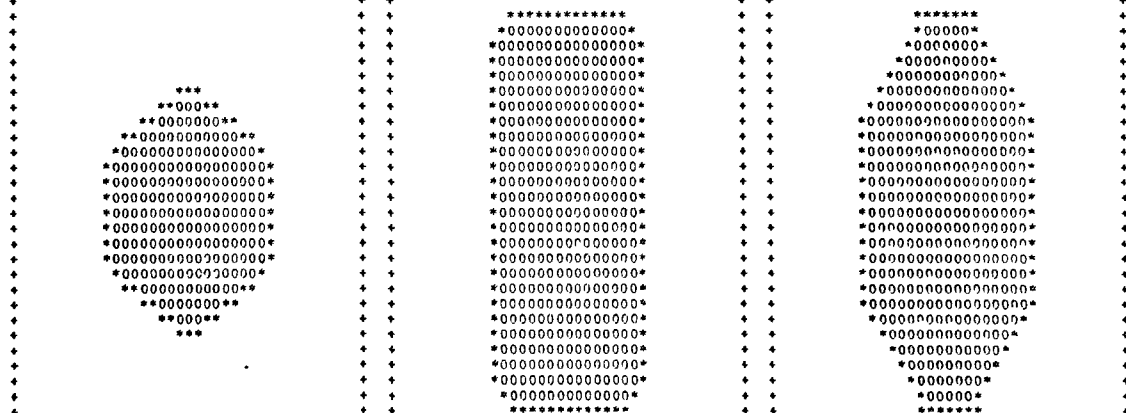
1005 -



0%-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----
 | 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 Gm. i. ABSOLUTE SHIP".

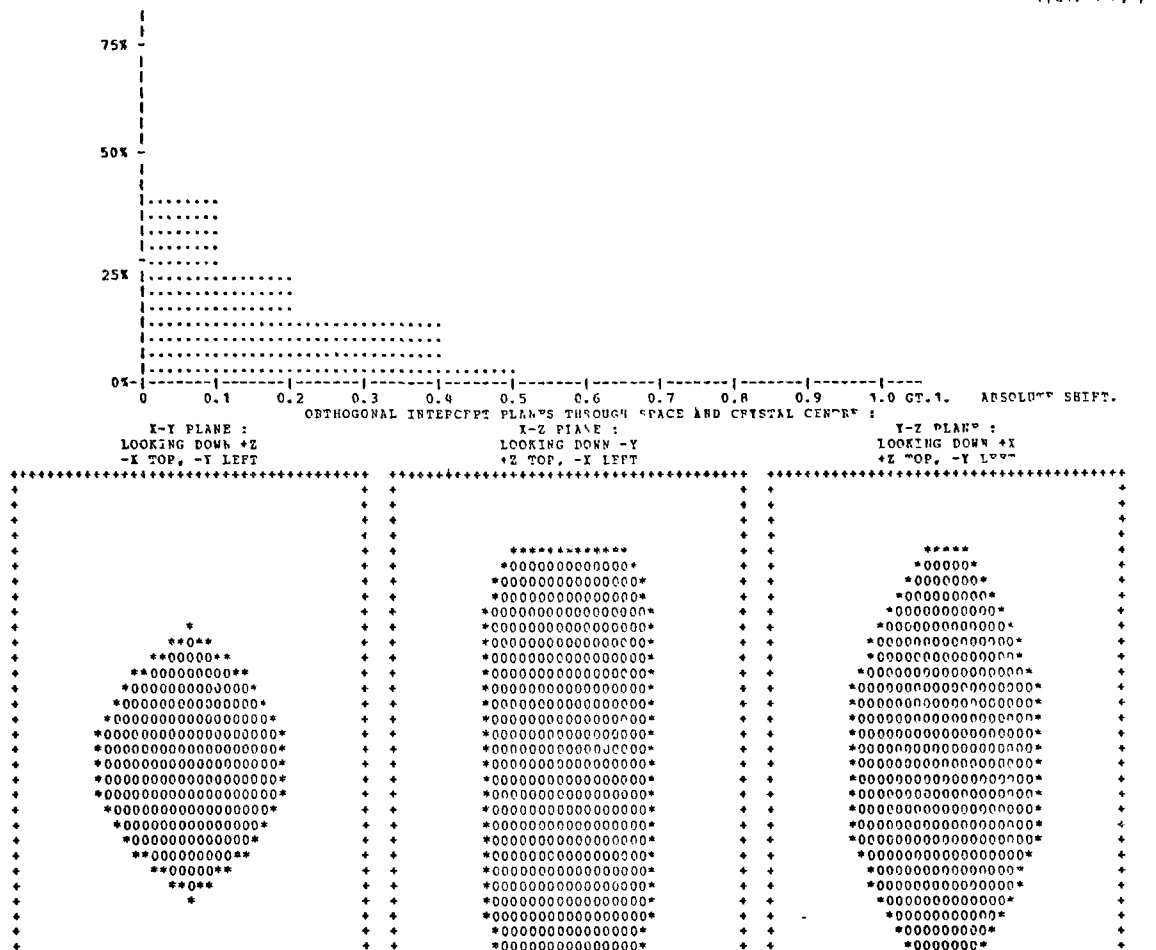
ORTHOGONAL INTERCEPT PLANS THROUGH SPACE AND CRYSTAL COMPOSE :

I-Y PLANE : LOOKING DOWN +Z -I TOP, -Y LEFT	X-Z PLANE : LOOKING DOWN -Y +Z TOP, -X LEFT	Y-Z PLANE : LOOKING DOWN +X +Z TOP, -Y LEFT



PRECEDENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS

100% -



THEORETICAL CRYSTAL AREA = 1657.9839 SQUARE UNITS. THEORETICAL CRYSTAL VOLUME = 5330.4141 CUBIC UNITS.

20 TH SPACIAL DIFFRACTION COMPLETED USING 7201 MATRIX POINTS.

INTERNAL-SURFACE DIFFRACTION COMPLETED: CRYSTAL NOW DEFINED BY 1566 SURFACE AND 5635 INTERNAL COORDINATES.

SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 3.5983

MAXIMUM SHIFT = 0.4406 UNITS. MINIMUM SHIFT = 0.0 UNITS.

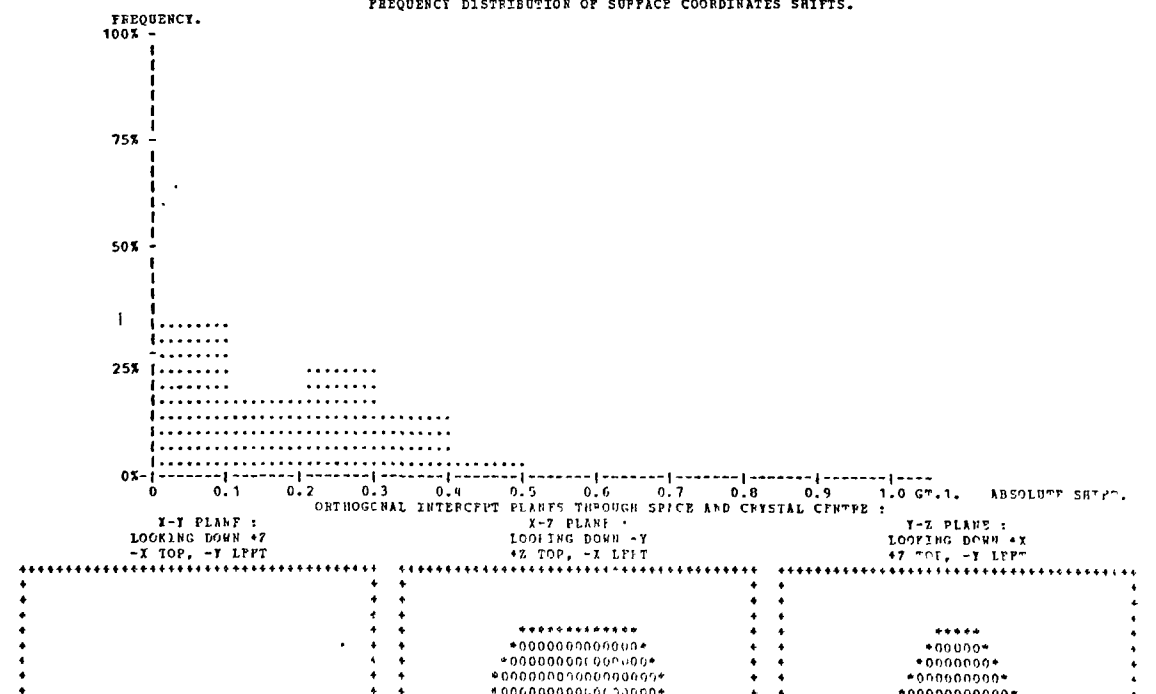
MINIMUM RADIUS OF SIMULATED CRYSTAL = 8.0623 UNITS. MAXIMUM RADIUS OF SIMULATED CRYSTAL = 16.2788 UNITS

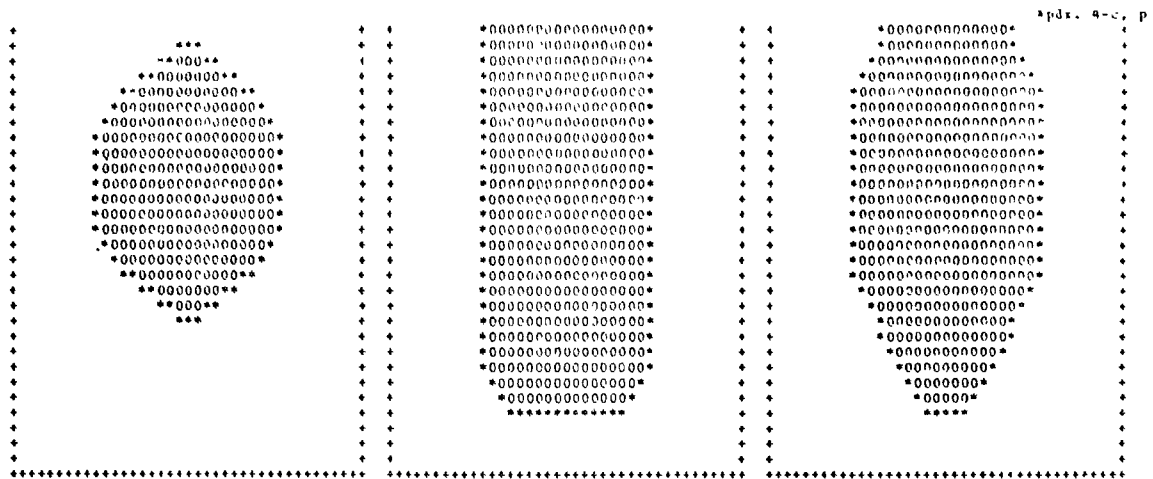
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 8.3537 UNITS. MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 16.5677 UNITS

MAXIMUM ABSOLUTE ERROR = +/- 0.0400 UNITS.

MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



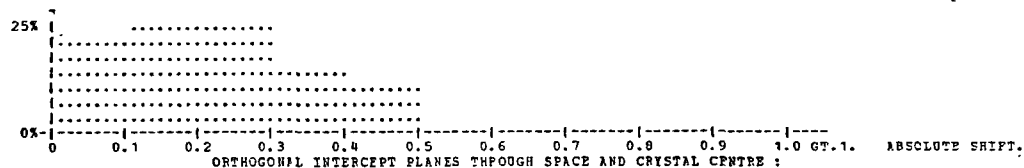


THEORETICAL CRYSTAL AREA = 1837.1019 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 6217.1367 CUBIC UNITS.
 21 IN SPACIAL DIFFRACTION COMPLETED USING 8205 MATRIX POINTS.
 INTERNAL-SURFACE DIFFRACTION COMPLETED : CRYSTAL NOW DEFINED BY 1746 SURFACE AND 6459 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 3.6993
 MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0008 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 8.5840 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 16.6733 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 8.7714 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 15.2961 UNIT.
 MAXIMUM ABSOLUTE ERROR = +- 0.0455 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0001 UNITS.

FREQUENCY.



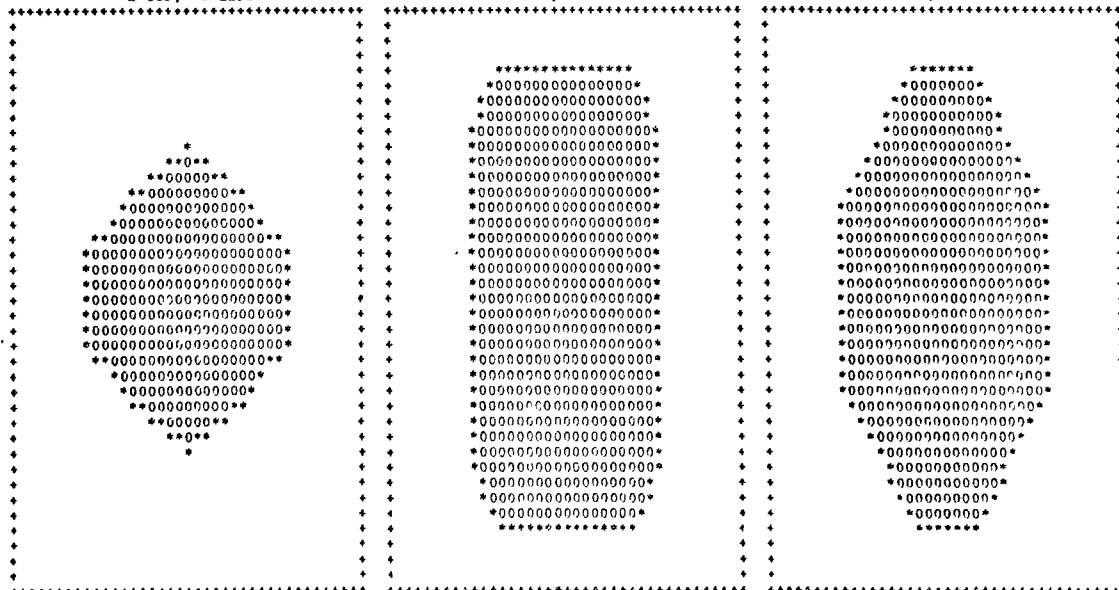
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



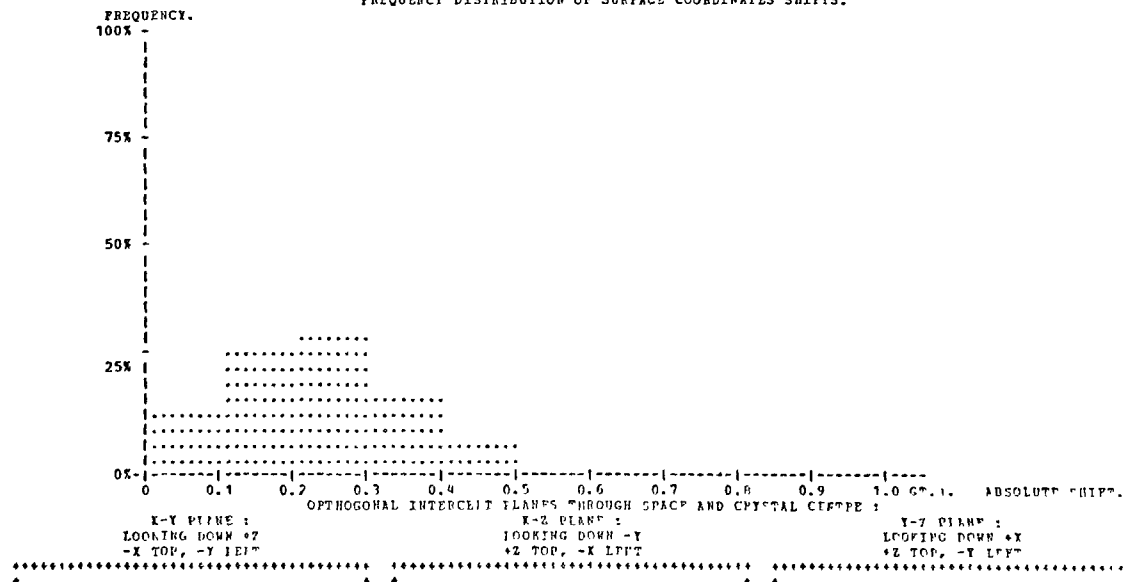
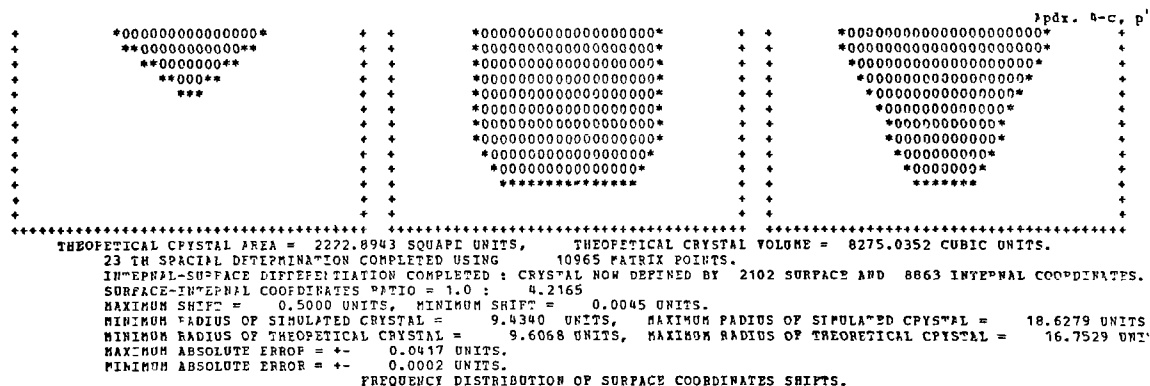
X-Y PLANE :
LOOKING DOWN +Z
-Y TOP, -Y LEFT

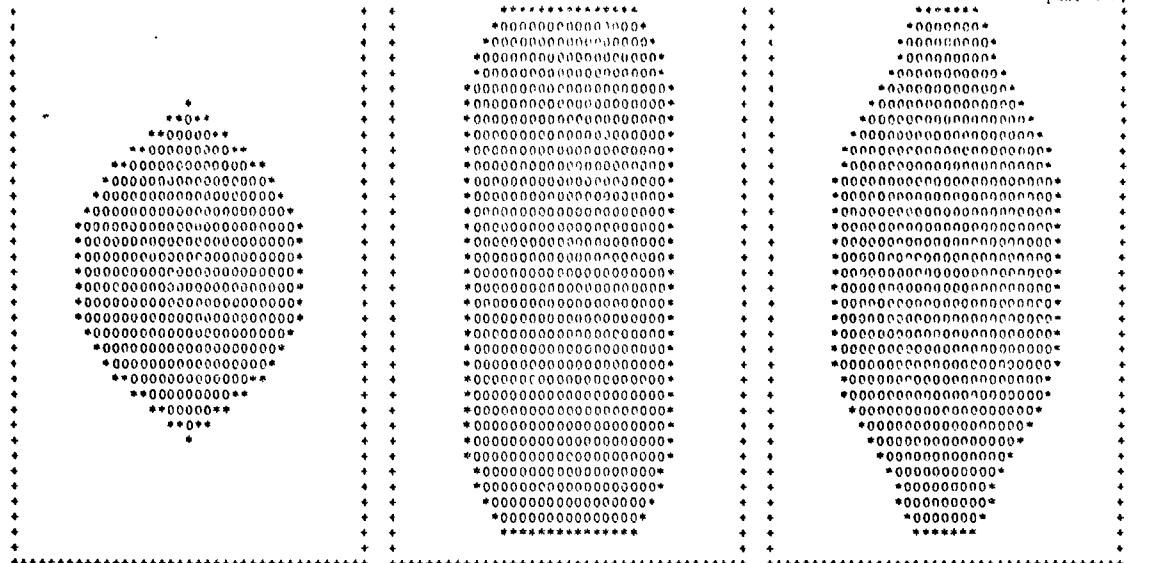
X-Z PLANE :
LOOKING DOWN -Y
+Z TOP, -X LEFT

Y-Z PLANE :
LOOKING DOWN +X
+Z TOP, -Y LEFT



THEORETICAL CRYSTAL AREA = 2025.4093 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 7197.1172 CUBIC UNITS.
 22 IN SPACIAL DIFFRACTION COMPLETED USING 9439 MATRIX POINTS.
 INTERNAL-SURFACE DIFFRACTION COMPLETED : CRYSTAL NOW DEFINED BY 1082 SURFACE AND 7557 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 4.0154
 MAXIMUM SHIFT = 0.4970 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 8.9443 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 17.5784 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 9.1891 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 16.9145 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.0150 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.





THEORETICAL CRYSTAL AREA = 2429.5671 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 9455.4961 CUBIC UNITS.
 24 TH SPACIAL DETERMINATION COMPLETED USING 11909 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 2222 SURFACE AND 9687 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 4.3596
 MAXIMUM SHIFT = 0.4812 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 9.8489 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 18.8944 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 10.0245 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 17.4812 UNIT
 MAXIMUM ABSOLUTE ERROR = +/- 0.0351 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

FREQUENCY.

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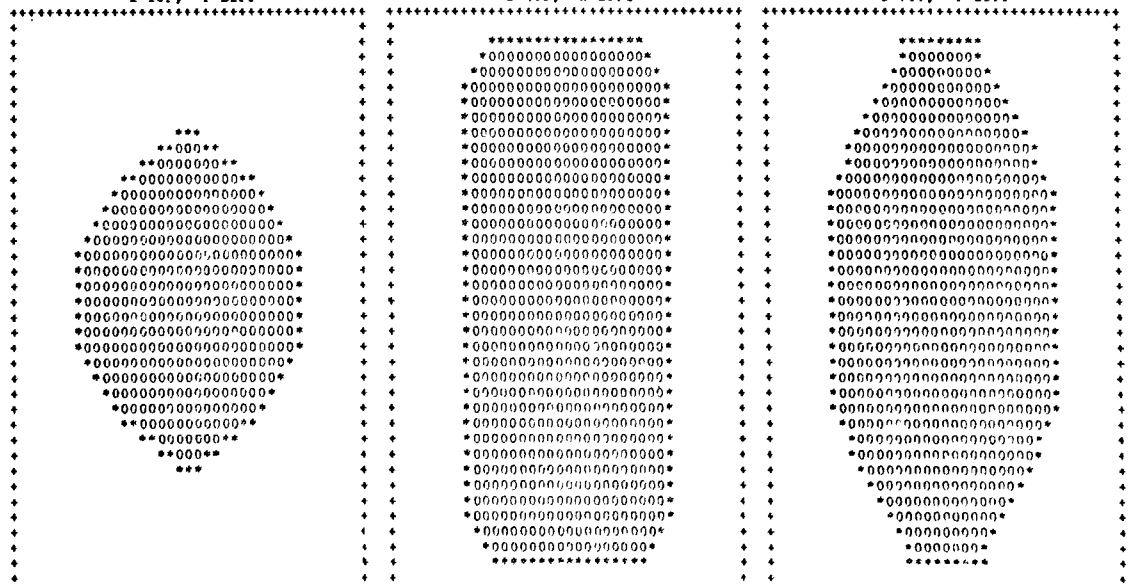
0%

X-Y PLANE :
LOOKING DOWN +Z
-X TOP, -Y LEFT

X-Z PLANE :
LOOKING DOWN -Y
+Z TOP, -X LEFT

Y-Z PLANE :
LOOKING DOWN +X
+Z TOP, -Y LEFT

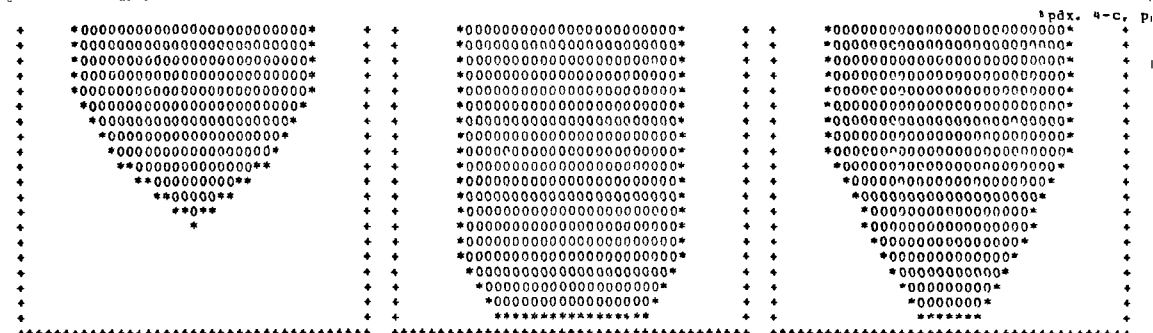
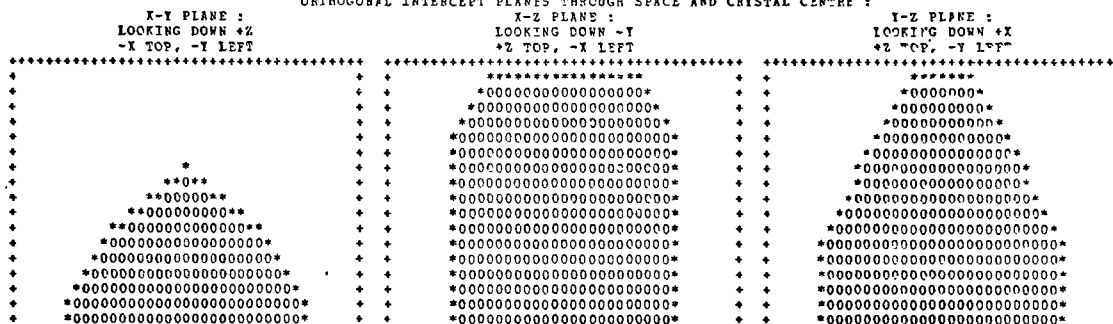
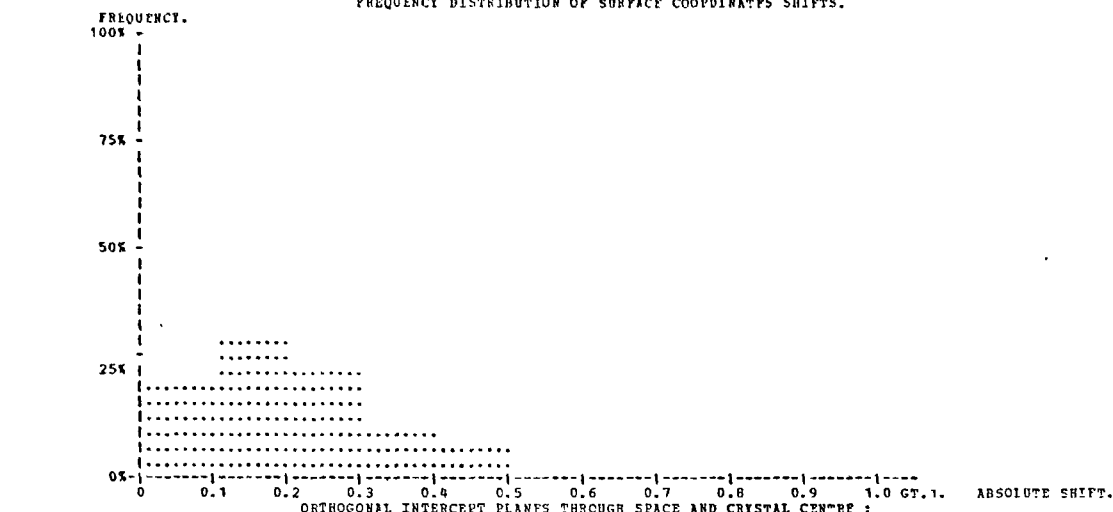
ORTHOGONAL INTERCEPT PLANES THROUGH SPACE AND CRYSTAL CENTRE :



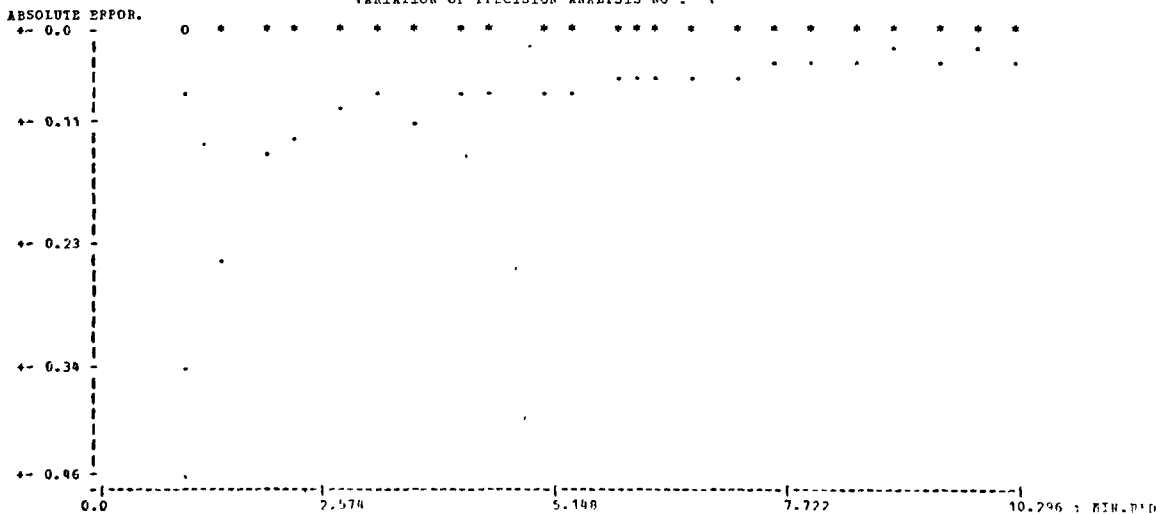
THEORETICAL CRYSTAL AREA = 2645.4247 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 10743.2305 CUBIC UNITS.
 25 TH SPACIAL DETERMINATION COMPLETED USING 11695 MATRIX POINTS.

INTERNAL-SURFACE DIFFERENTIATION COMPILED: CRYSTAL NOW DEFINED BY 2406 SURFACE AND 11209 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 4.6920
 MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0015 UNITS.
 MAXIMUM RADIUS OF SIMULATED CRYSTAL = 10.2956 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 10.9249 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 10.4421 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 10.2096 UNITS
 MAXIMUM ABSOLUTE ERROR = +/- 0.0105 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0001 UNITS.

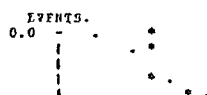
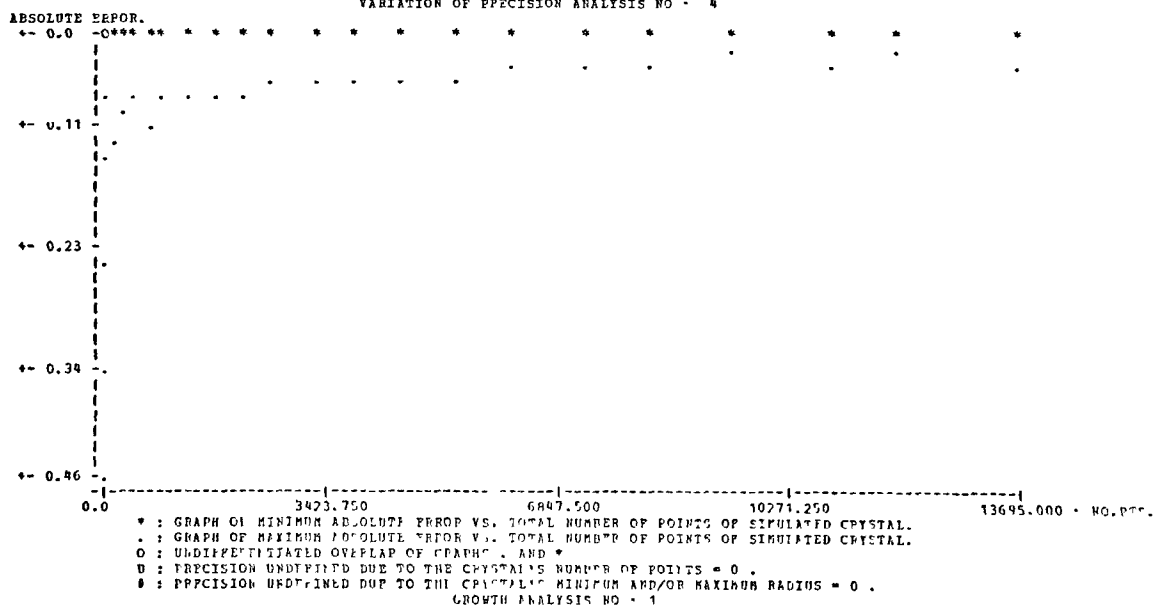
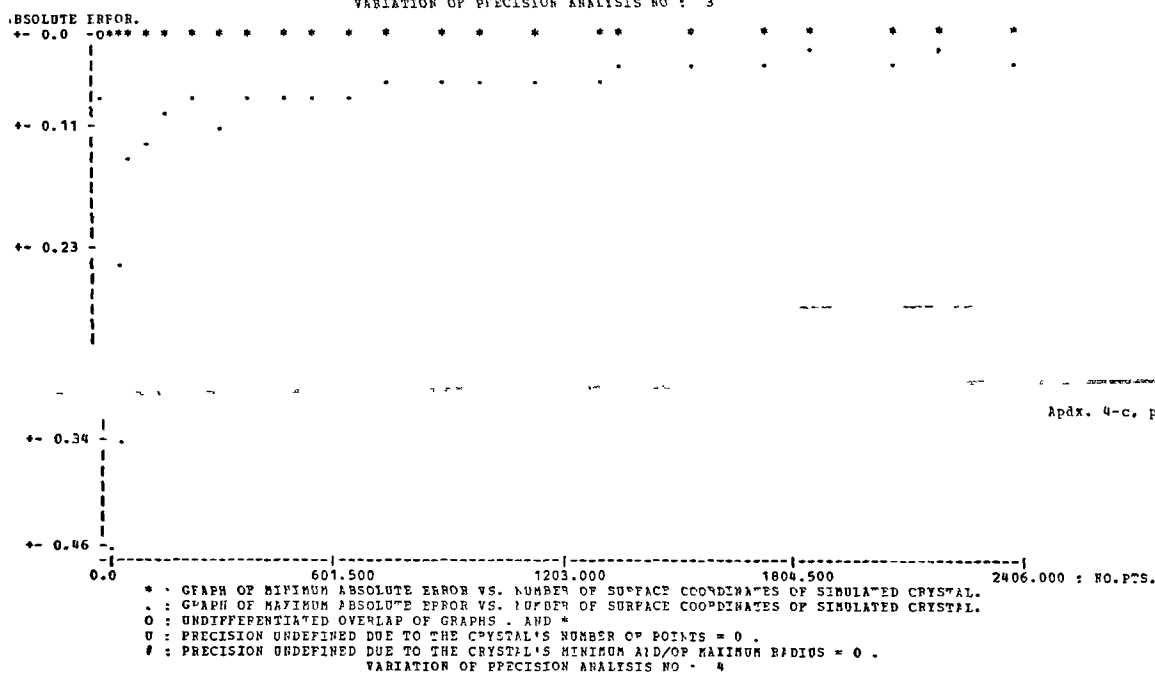
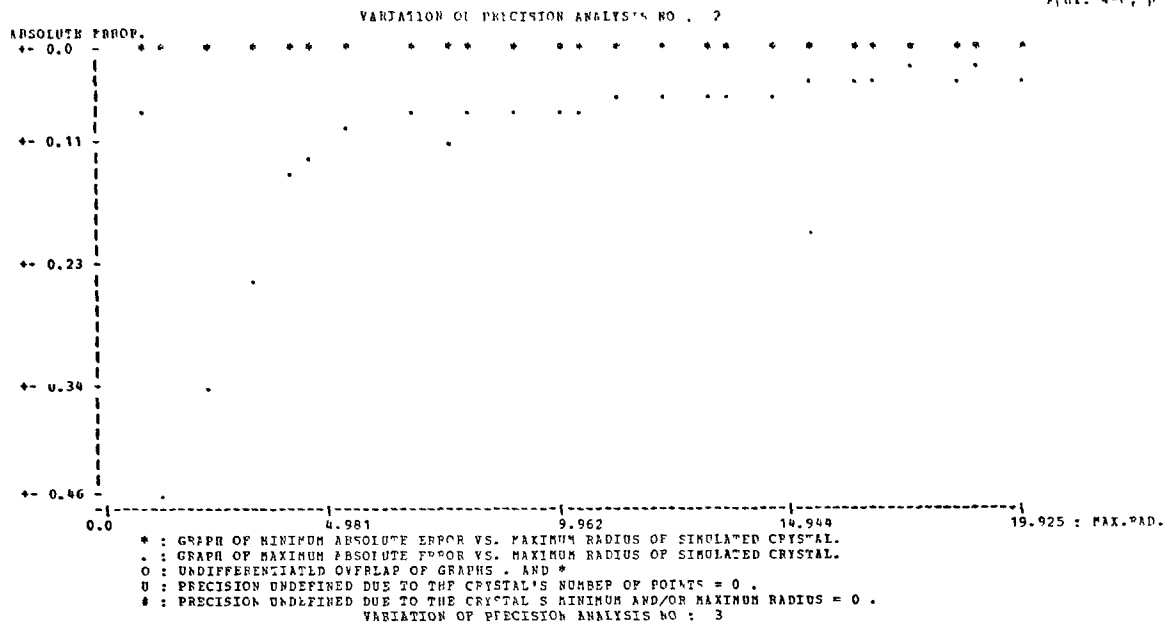
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

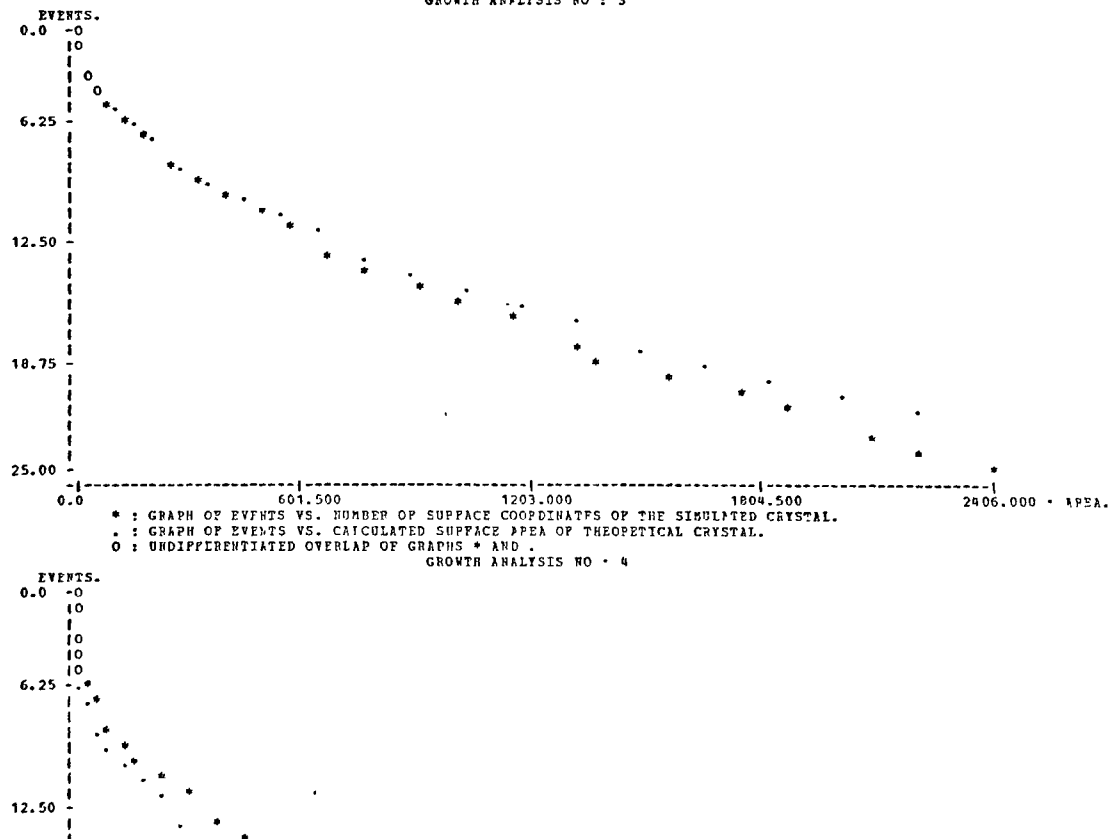
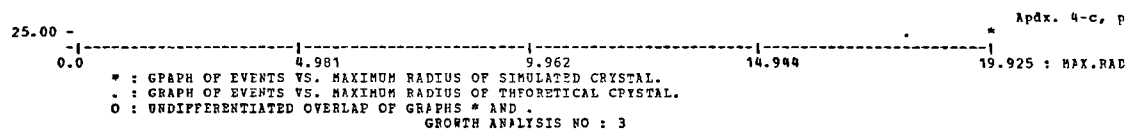
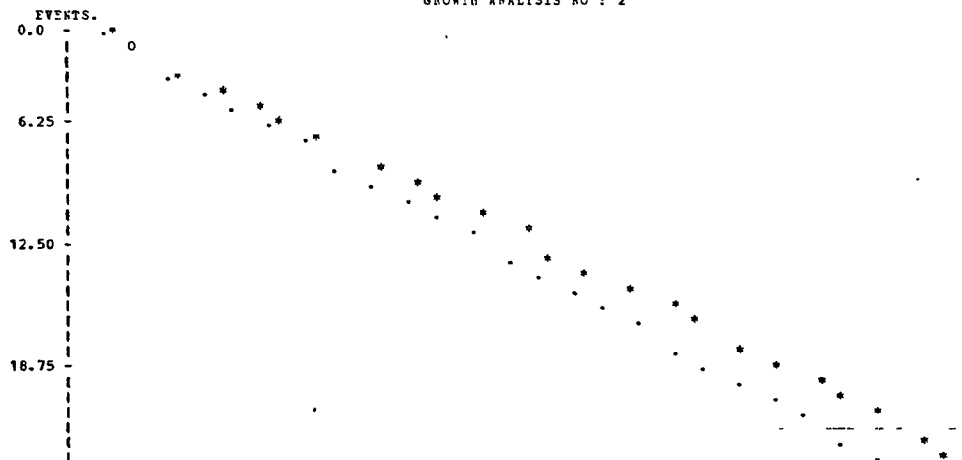
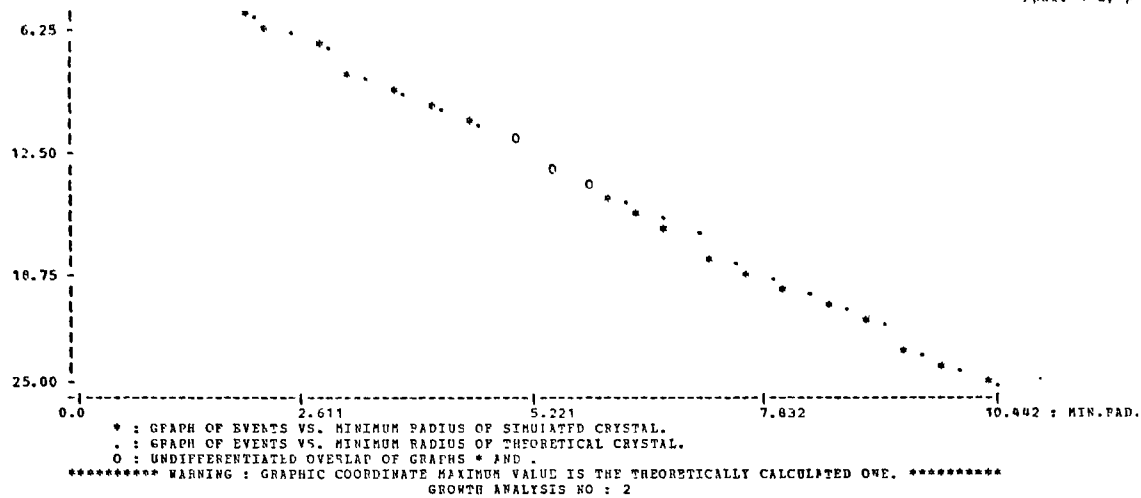


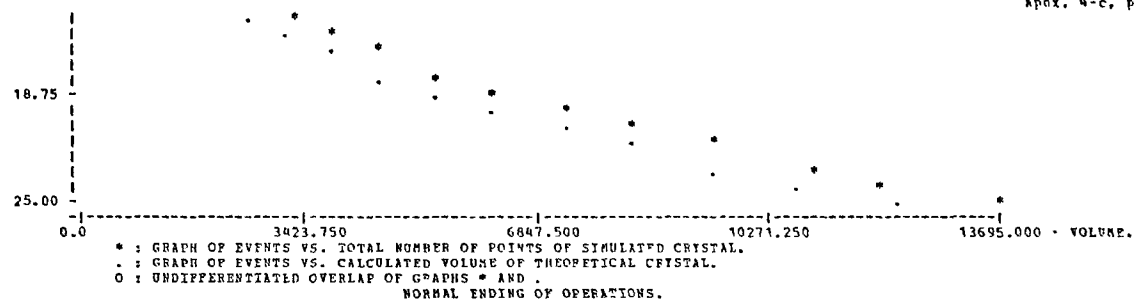
THEORETICAL CRYSTAL AREA = 2870.4758 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 12142.8398 CUBIC UNITS.
 TERMINATION ON THE 26 TH ITERATION: CRYSTAL TOO BIG FOR ALLOWED SPACE, BORDER COORDINATE 12 17 1 BELONGS TO "HYP INCP"
 VARIATION OF PRECISION ANALYSIS NO: 1



* : GRAPH OF MINIMUM ABSOLUTE ERROR VS. MINIMUM RADIUS OF SIMULATED CRYSTAL.
 . : GRAPH OF MAXIMUM ABSOLUTE ERROR VS. MINIMUM RADIUS OF SIMULATED CRYSTAL.
 O : UNDIFFERENTIATED OVERLAP OF GRAPHS. AND *
 U : PRECISION UNOBTAINED DUE TO THE CRYSTAL'S NUMBER OF POINTS = 0.
 I : PRECISION UNOBTAINED DUE TO THE CRYSTAL'S MINIMUM AND/OR MAXIMUM RADIUS = 0.



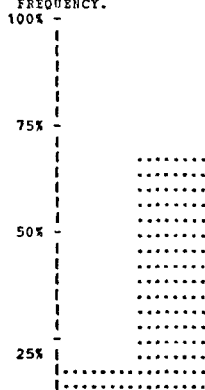




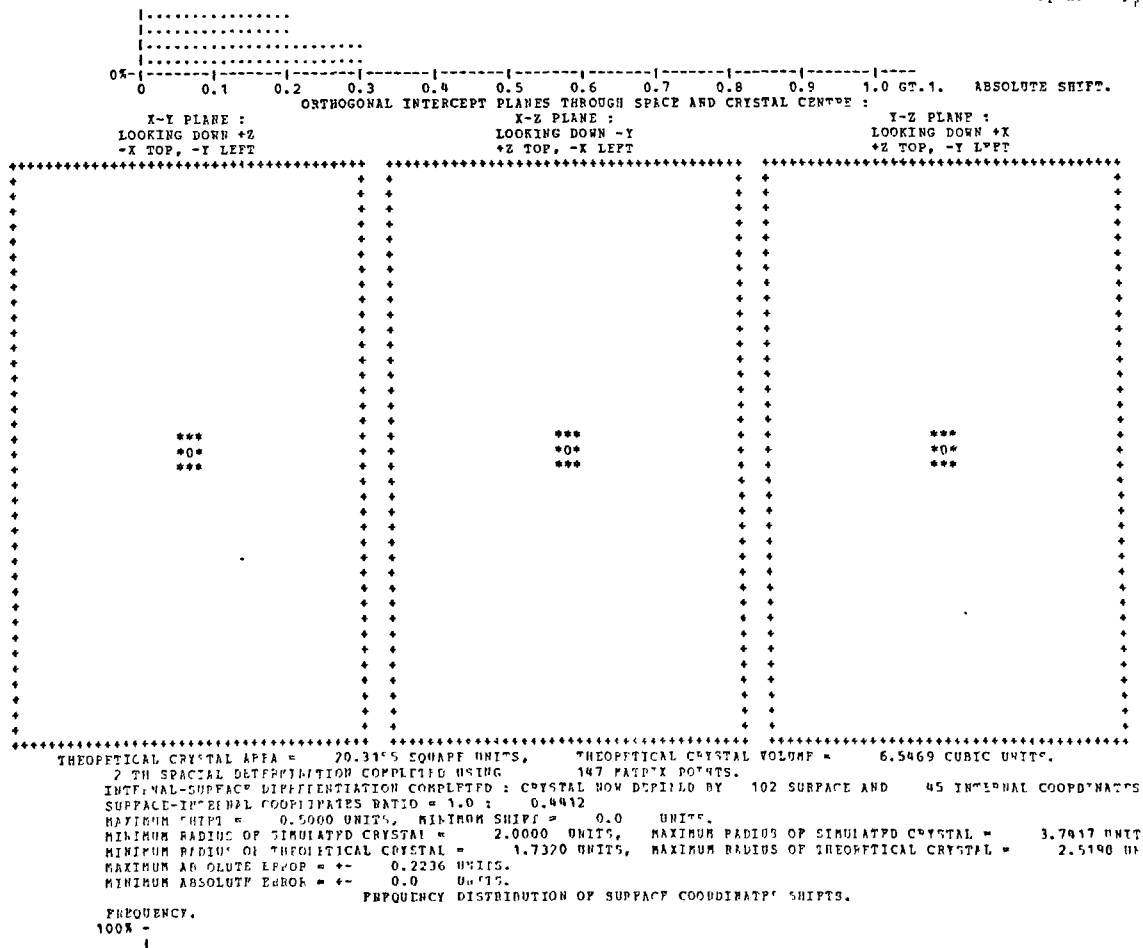
The following is the simulation of the growth of a nepheline crystal, as performed by Module 2. Three orthogonal intersecting planes, passing through the center of the crystal, and the frequency distribution of the surface coordinates shift is presented, along with relevant information, after each growth increment. Near the end of the document, eight graphs illustrate the behaviour of the procedure obtained during the simulated growth.

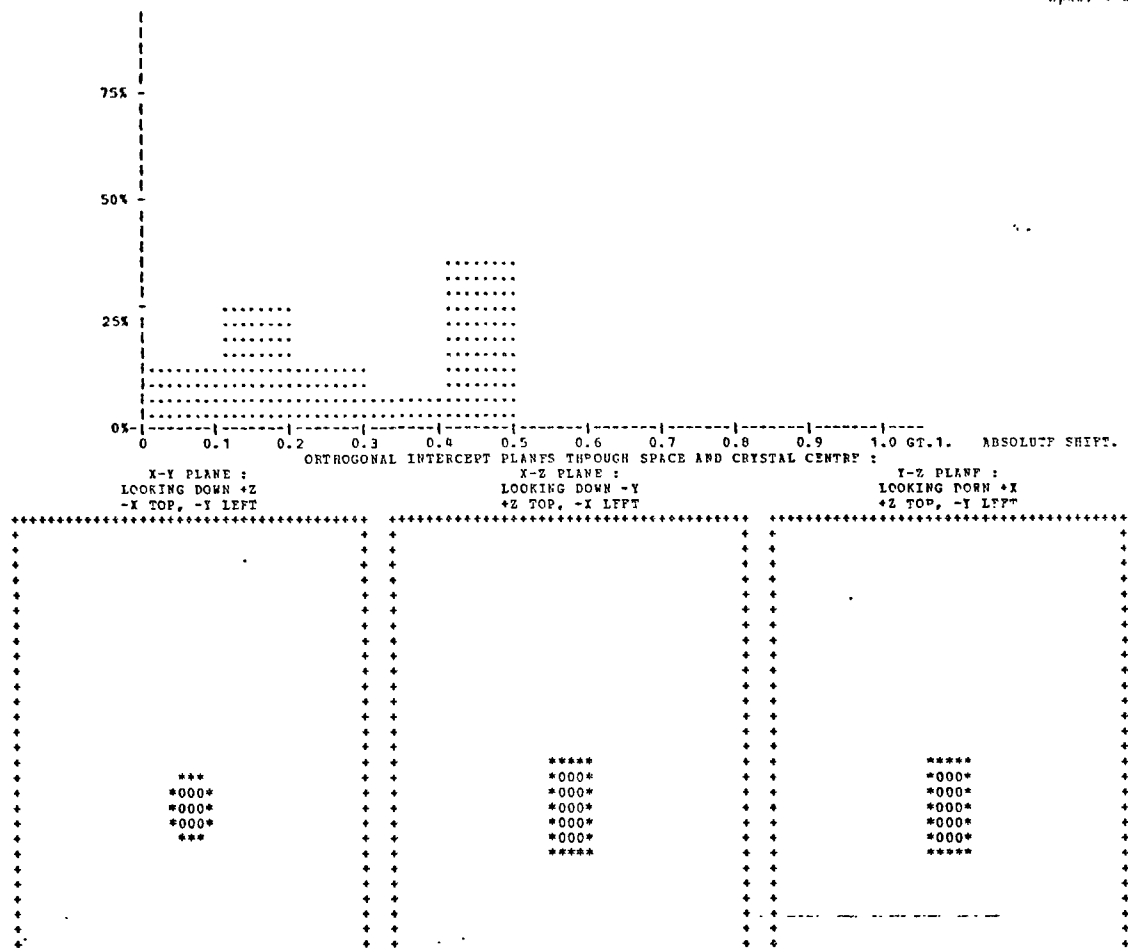
BEGINNING OF OPERATIONS.
 REFERENCE: ROGERS, 1937, P. 440
 STANDARD CRYSTAL'S FACIES EQUATIONS (WITH CENTRE AT 0,0,0) ARE :
 1.1547 X + 0.0 Y + 0.0 Z = 1.0
 0.5773 X + 1.0000 Y + 0.0 Z = 1.0
 -0.5773 X + 1.0000 Y + 0.0 Z = 1.0
 -1.1547 X + 0.0 Y + 0.0 Z = 1.0
 -0.5773 X + -1.0000 Y + 0.0 Z = 1.0
 0.5773 X + -1.0000 Y + 0.0 Z = 1.0
 0.0 X + 0.0 Y + 0.7937 Z = 1.0
 0.0 X + 0.0 Y + -0.7937 Z = 1.0
 TRANSPOSED CRYSTAL'S FACIES EQUATIONS (WITH CENTRE AT 20 , 20 , 20) ARE :
 1.1547 X + 0.0 Y + 0.0 Z = 24.0940
 0.5773 X + 1.0000 Y + 0.0 Z = 32.5460
 -0.5773 X + 1.0000 Y + 0.0 Z = 9.4540
 -1.1547 X + 0.0 Y + 0.0 Z = -22.0940
 -0.5773 X + -1.0000 Y + 0.0 Z = -30.5460
 0.5773 X + -1.0000 Y + 0.0 Z = -7.4540
 0.0 X + 0.0 Y + 0.7937 Z = 16.8740
 0.0 X + 0.0 Y + -0.7937 Z = -14.8740
 1 TH SPACIAL DETERMINATION COMPLETED USING 27 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 26 SURFACE AND 1 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.0385
 MAXIMUM SHIFT = 0.2599 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 1.7321 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 0.8660 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 1.2599 UNITS
 MAXIMUM ABSOLUTE ERROR = +/- 0.2599 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.

FREQUENCY. FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



Append. 4-8, 1

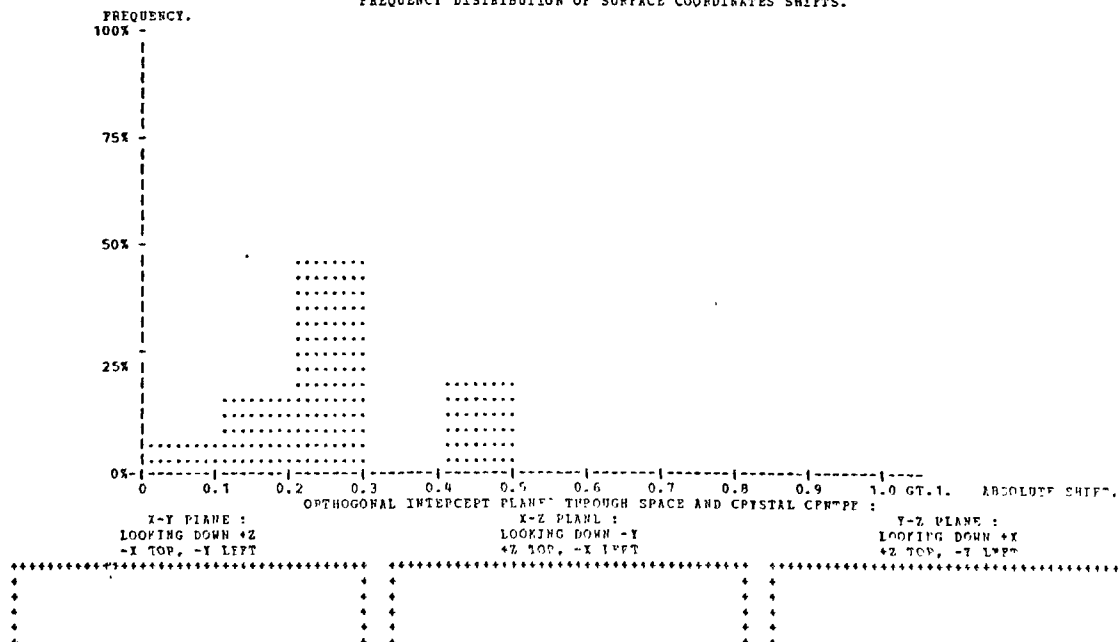




Apdx. 4-d, /

THEORETICAL CRYSTAL AREA = 81.2616 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 52.3748 CUBIC UNITS.
 3 TH SPACIAL DIFFERENTIATION COMPLETED USING 333 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 186 SURFACE AND 147 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.7903
 MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 2.8204 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 5.0990 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 2.5981 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 3.7798 UNI
 MAXIMUM ABSOLUTE ERROR = +- 0.1581 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



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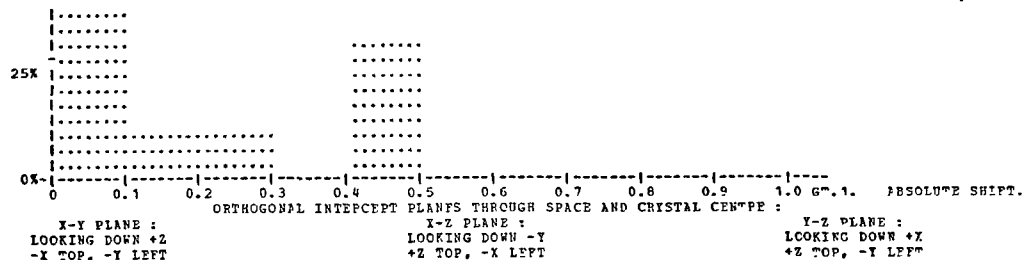
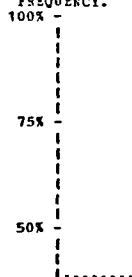
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 THEORETICAL CRYSTAL AREA = 182.8390 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 176.7657 CUBIC UNITS.
 4 TH SPACIAL DETERMINATION COMPLETED USING 561 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 282 SURFACE AND 279 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.9894
 MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 3.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 6.4807 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 3.4641 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 5.0397 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.1547 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

FREQUENCY.



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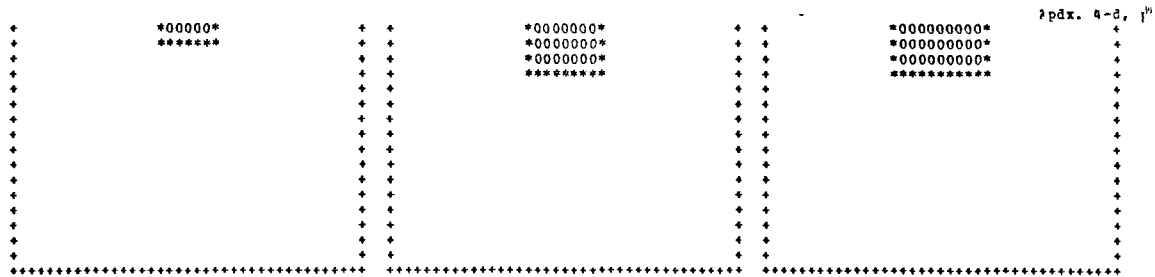
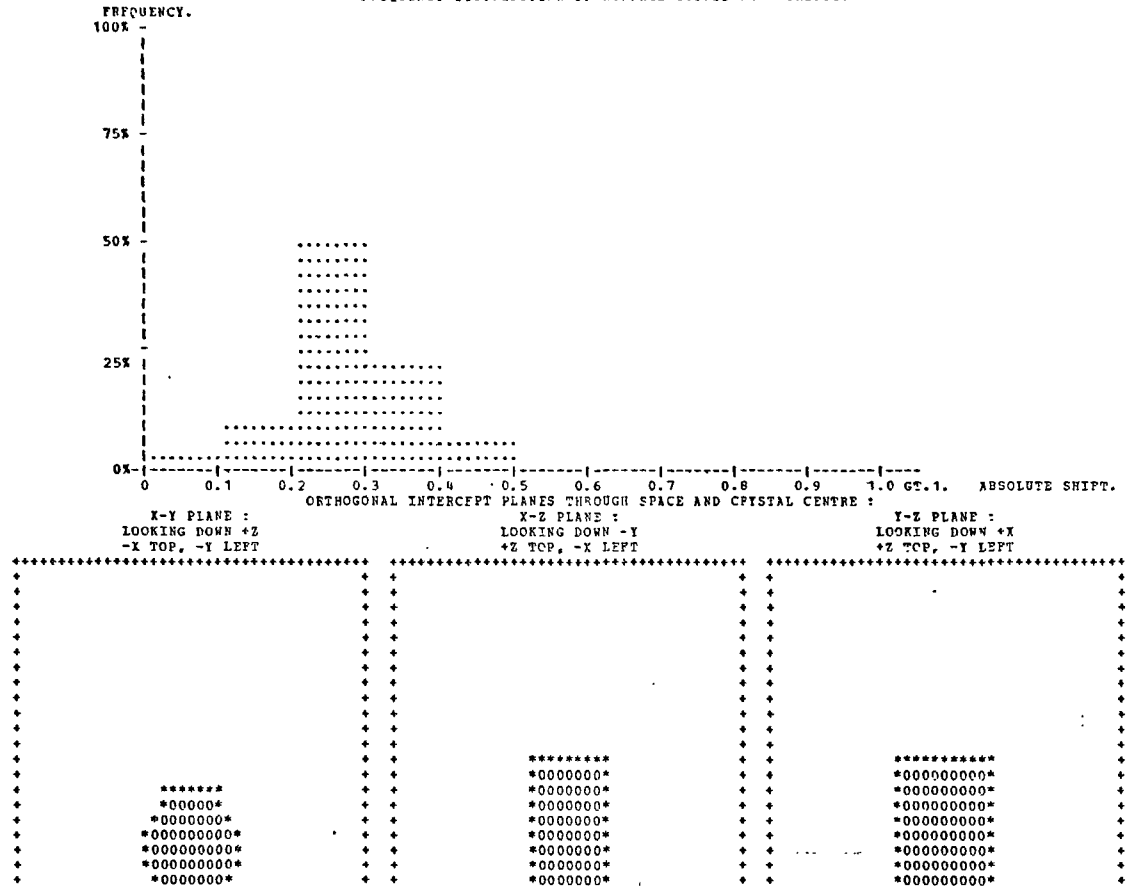
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 THEORETICAL CRYSTAL AREA = 325.0460 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 418.7998 CUBIC UNITS.
 5 TH SPACIAL DETERMINATION COMPLETED USING 1027 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 466 SURFACE AND 561 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.039
 MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 4.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 7.8740 UNITS.

MINIMUM RADIUS OF THEORETICAL CRYSTAL = 4.3301 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 6.2996 UN
 MAXIMUM ABSOLUTE ERROR = +/- 0.0901 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.

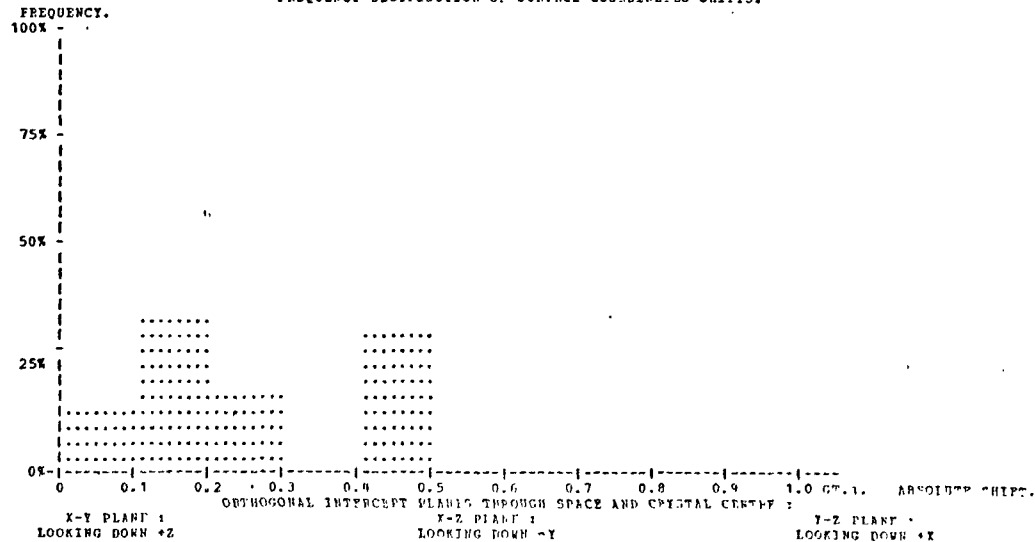
Andx. 4-7.
 6.2996 UN

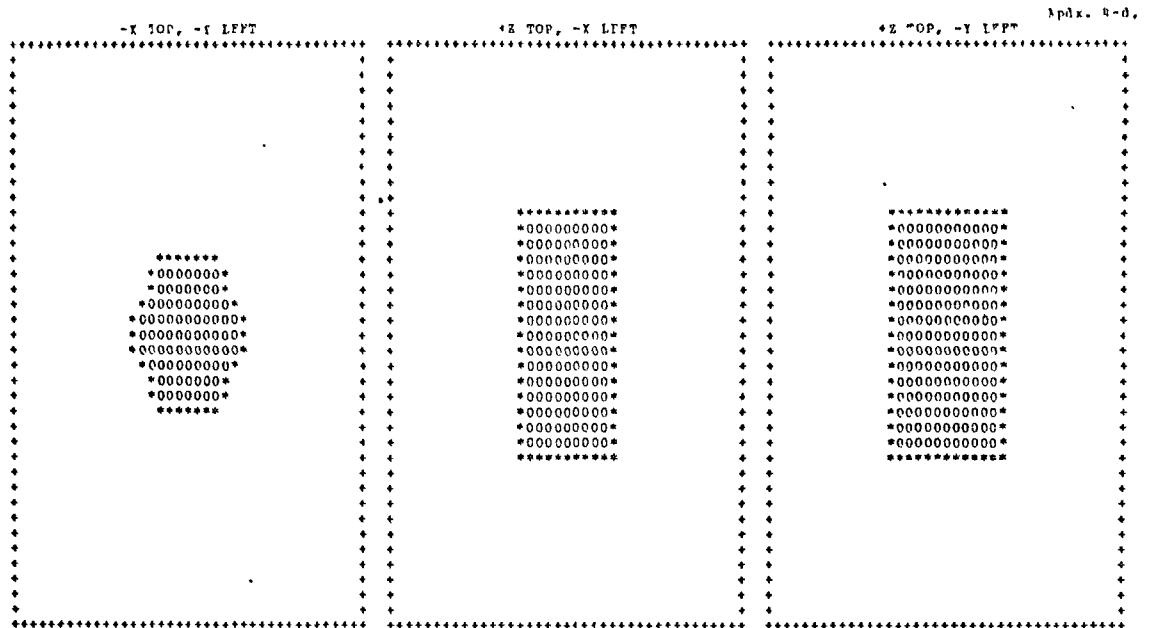
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



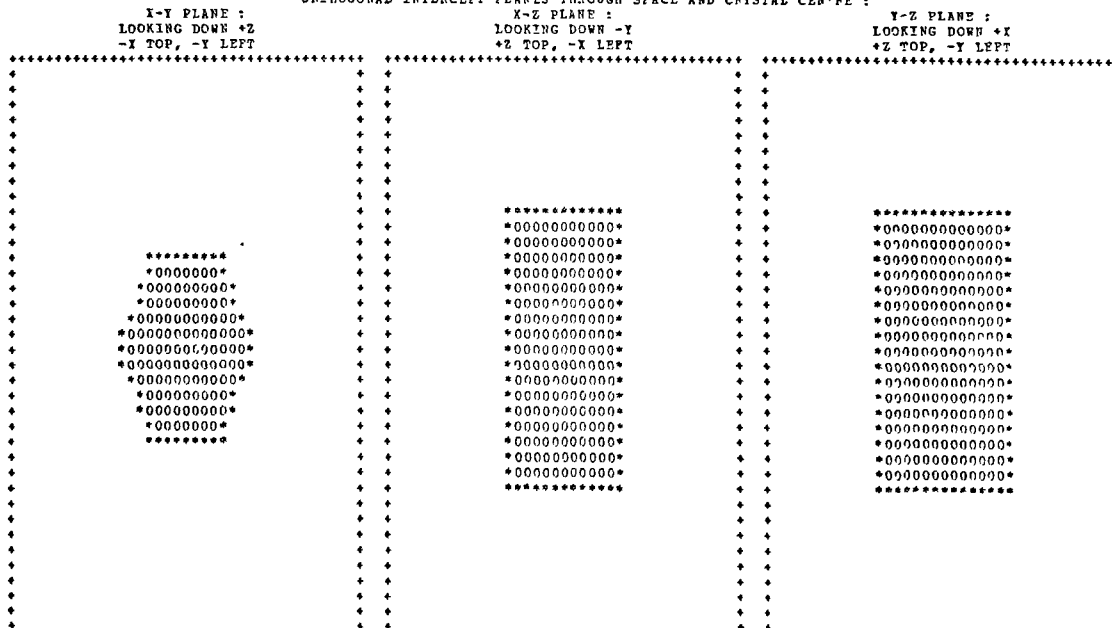
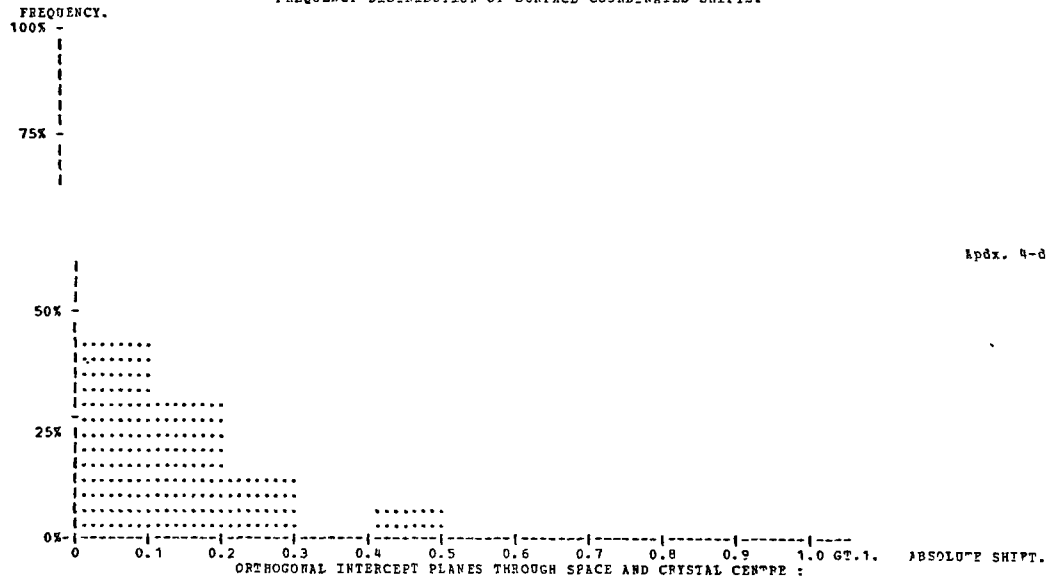
THEORETICAL CRYSTAL AREA = 507.8862 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 818.3606 CUBIC UNITS.
 6 TH SPACIAL DETERMINATION COMPLETED USING 1887 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 702 SURFACE AND 1185 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.6880
 MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 5.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 10.0499 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 5.1961 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 7.5595 UNITS
 MAXIMUM ABSOLUTE ERROR = +/- 0.0822 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



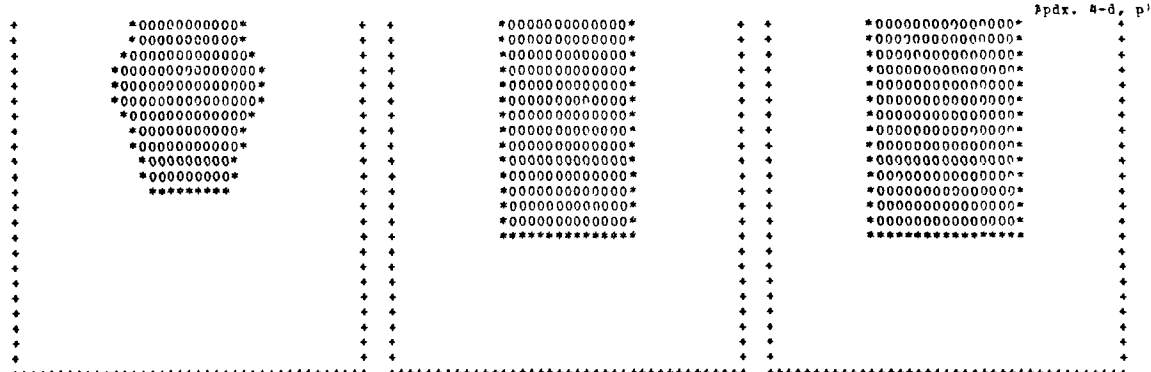
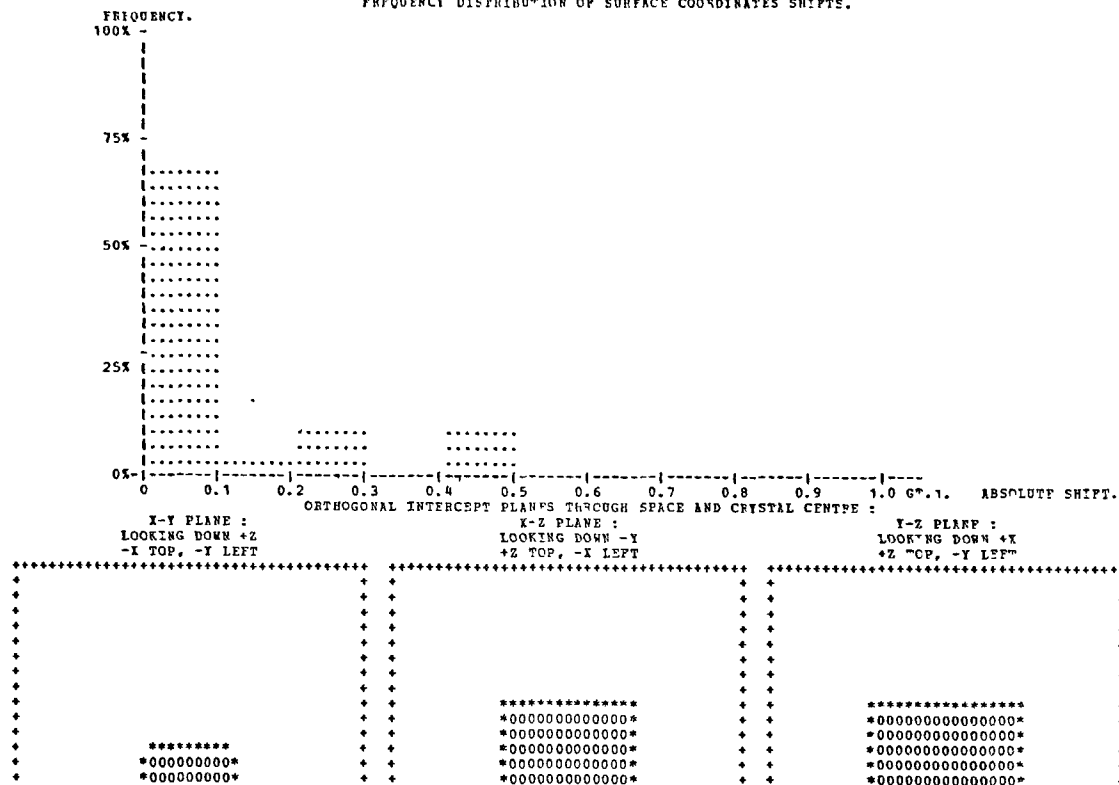


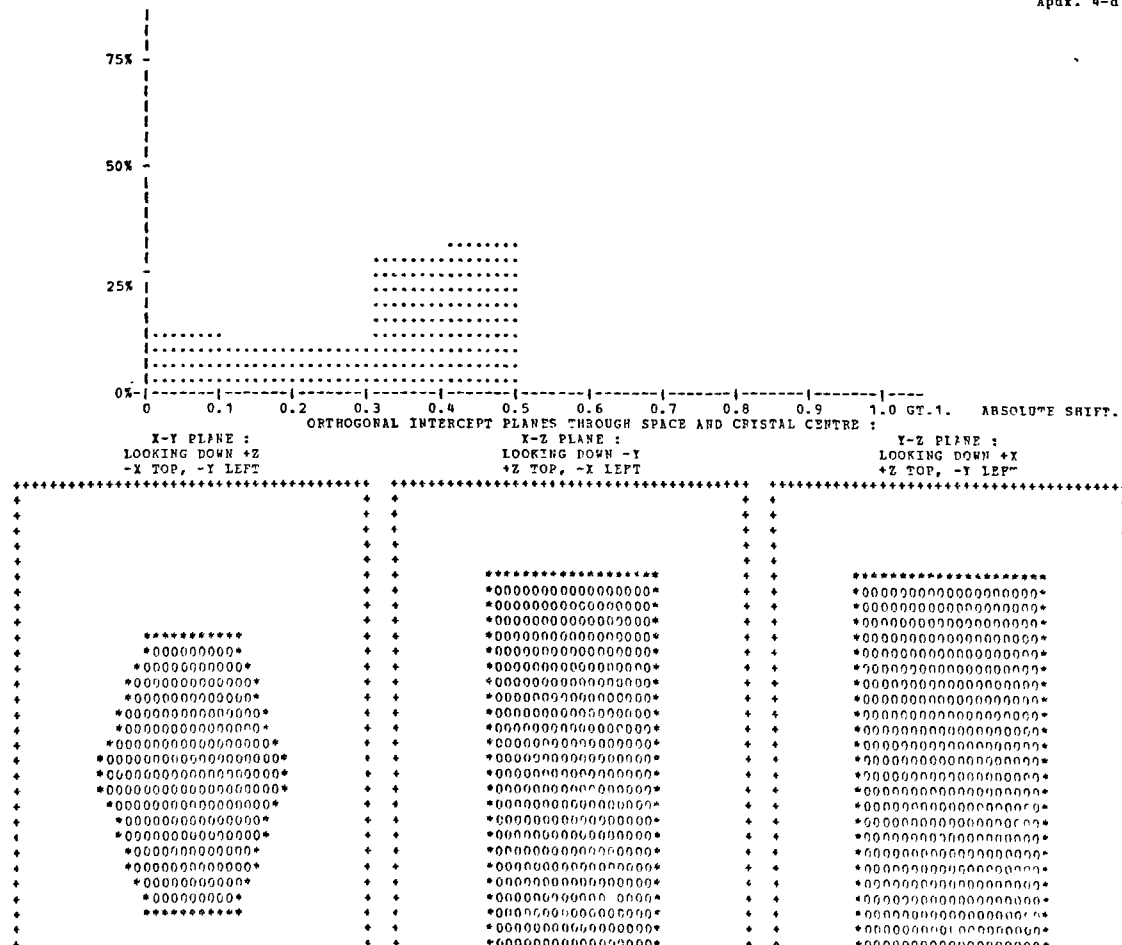
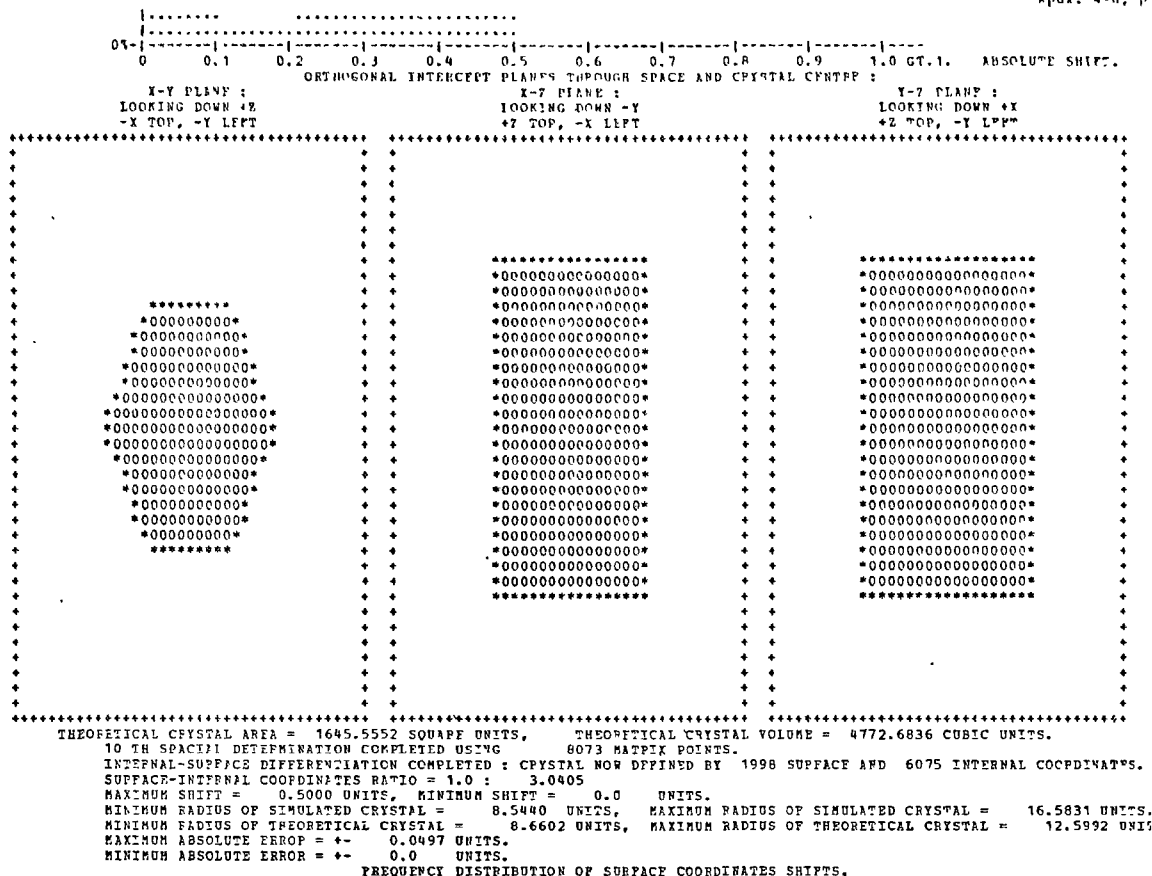
THEORETICAL CRYSTAL AREA = 731.356⁹ SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 1414.1274 CUBIC UNITS.
 7 TH SPACIAL DIFFRACTION COMPLETED USING 2869 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 982 SURFACE AND 1887 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.9216
 MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 5.8310 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 11.5326 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 6.0622 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 8.8194 UNIT
 MINIMUM ABSOLUTE ERROR = +/- 0.0707 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.
 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

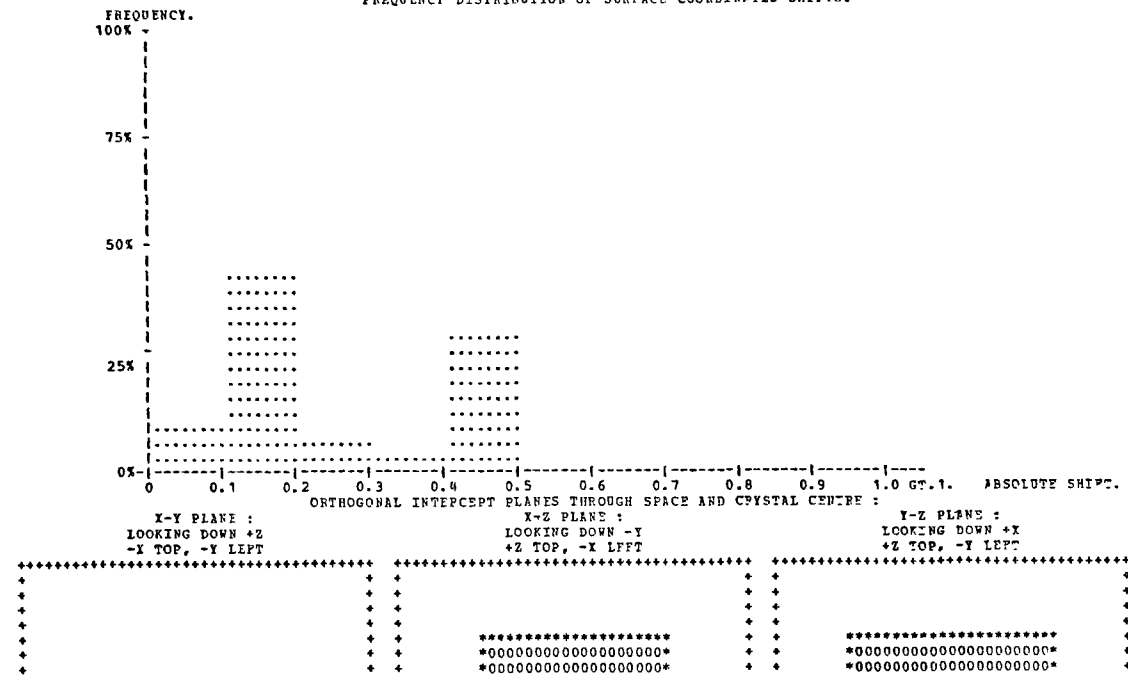


THEORETICAL CRYSTAL AREA = 295.4505 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 2245.4850 CUBIC UNITS.
 8 TH SURFACE DIFFERENTIATION COMPLETED USING 4945 MAXIMUM POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 1226 SURFACE AND 2869 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 2.3401
 MAXIMUM SHIFT = 0.0000 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 6.7082 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 17.8452 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 6.9282 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 10.0794 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.0620 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



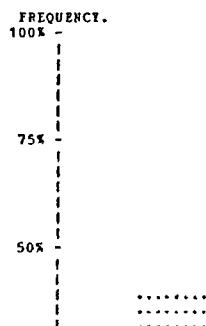


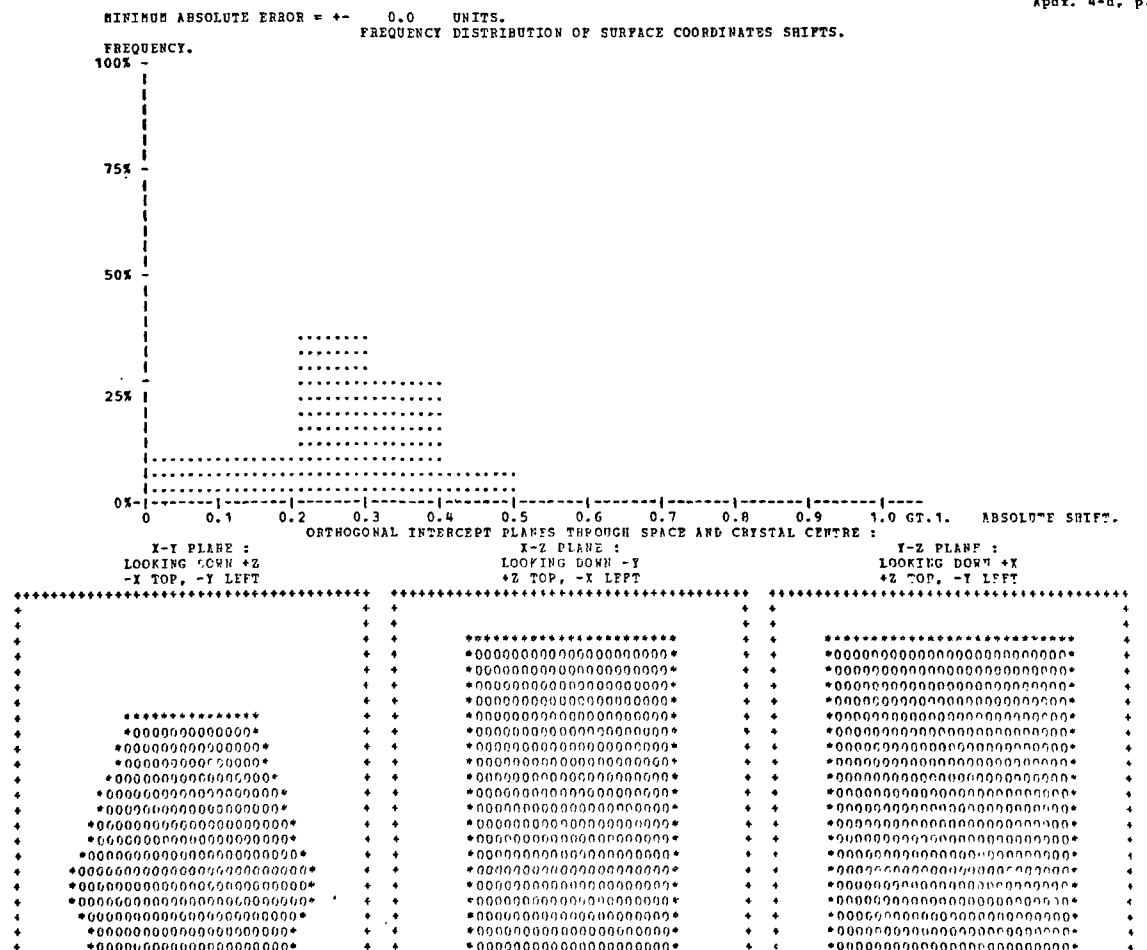
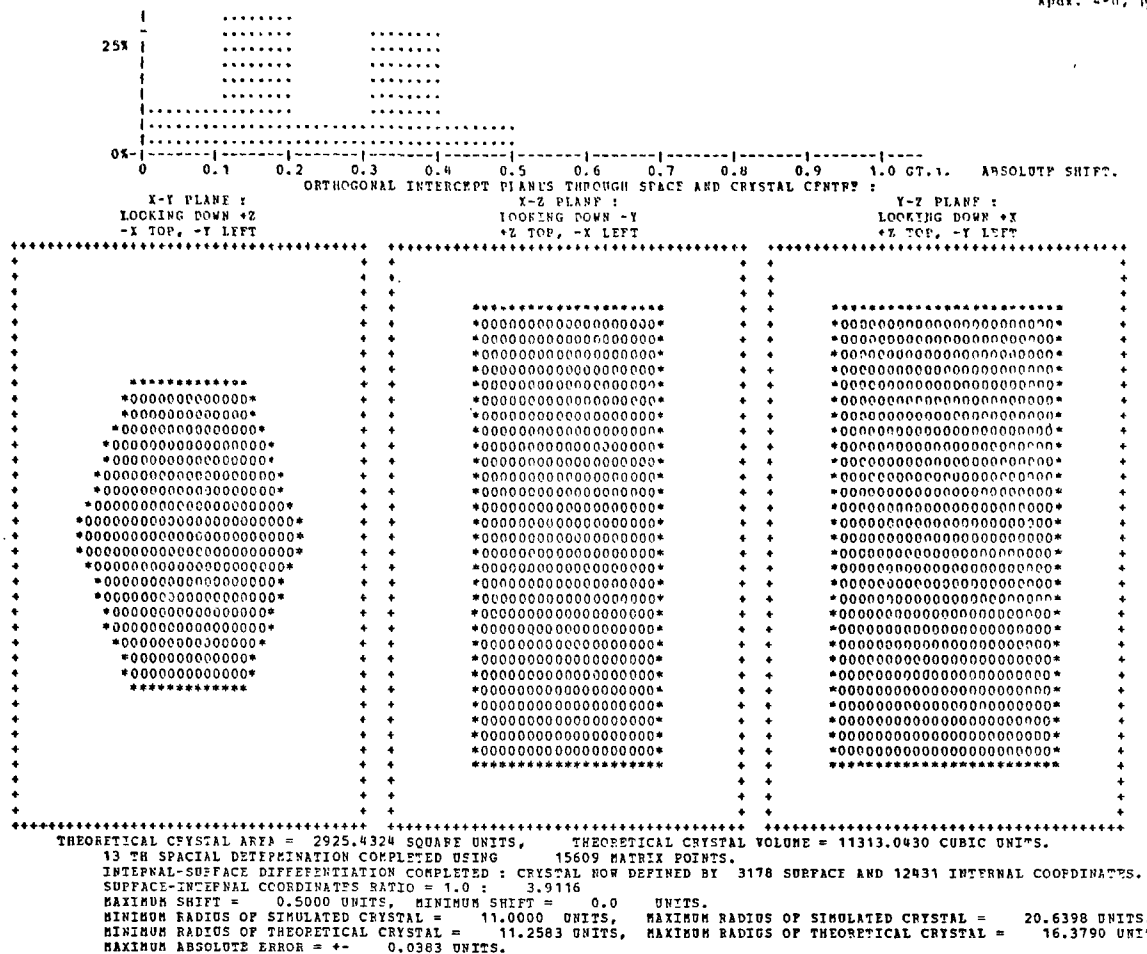
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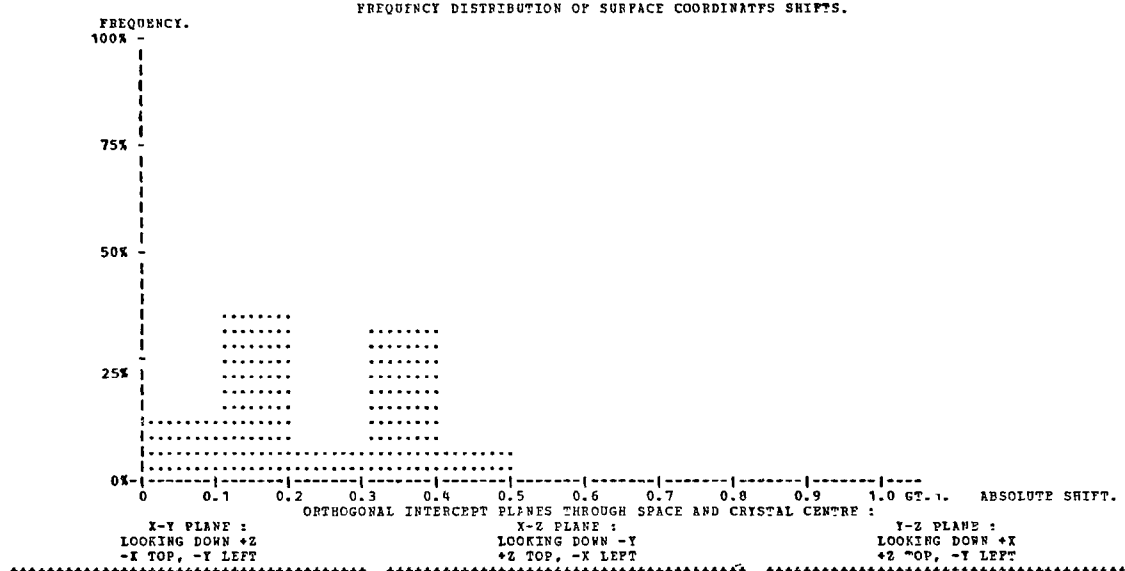
THEORETICAL CRYSTAL AREA = 2458.1750 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 8713.9141 COBIC UNITS.
12 TH SPATIAL DIFFRACTION COMPLETED USING 12431 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 2658 SURFACE AND 9773 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 3.6768
MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0 UNITS.
MINIMUM RADII OF SIMULATED CRYSTAL = 10.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 19.2354 UNITS.
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 10.3923 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 15.1191 UNITS.
MAXIMUM ABSOLUTE ERROR = - 0.0415 UNITS.
MINIMUM ABSOLUTE ERROR = - 0.0 UNITS.

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THEORETICAL CRYSTAL AREA = 3433.3179 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 14383.5234 CUBIC UNITS.
14 TH SPACIAL DETERMINATION COMPLETED USING 20313 HATRIK POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED - CRYSTAL NOW DEFINED BY 3758 SURFACE AND 16555 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 4.4053
MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 12.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 22.8258 UNITS
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 12.1244 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 17.6389 UNITS
MAXIMUM ABSOLUTE ERROR = + 0.0356 UNITS.
MINIMUM ABSOLUTE ERROR = - 0.0 UNITS.

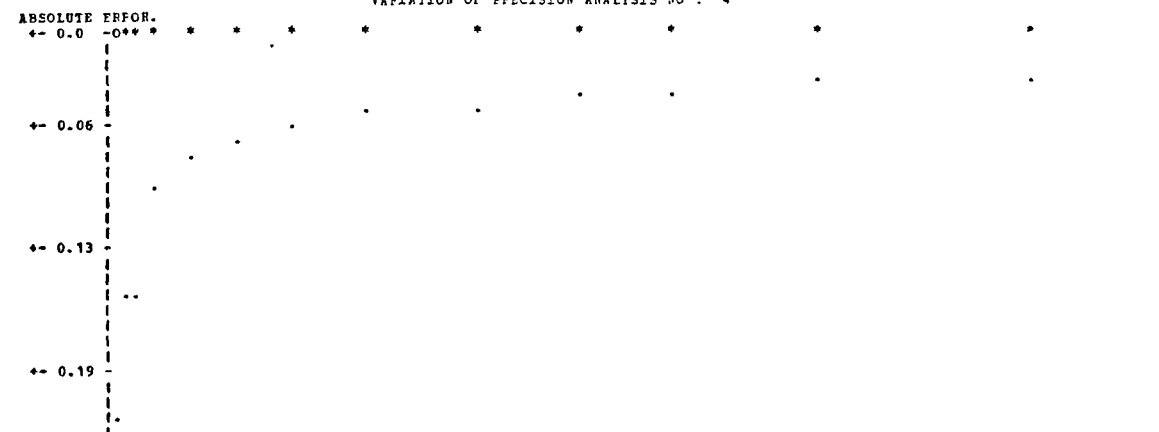
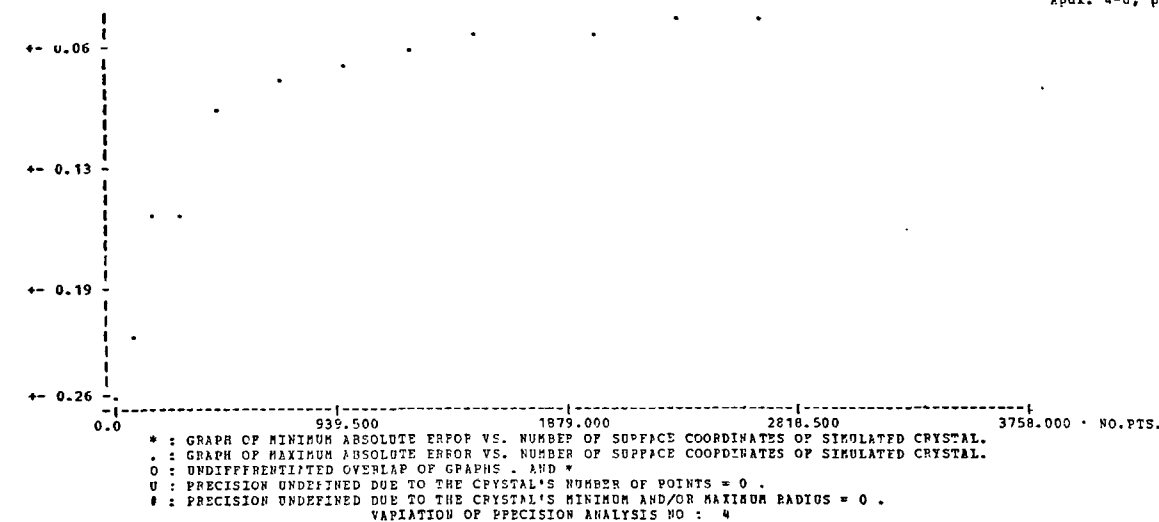
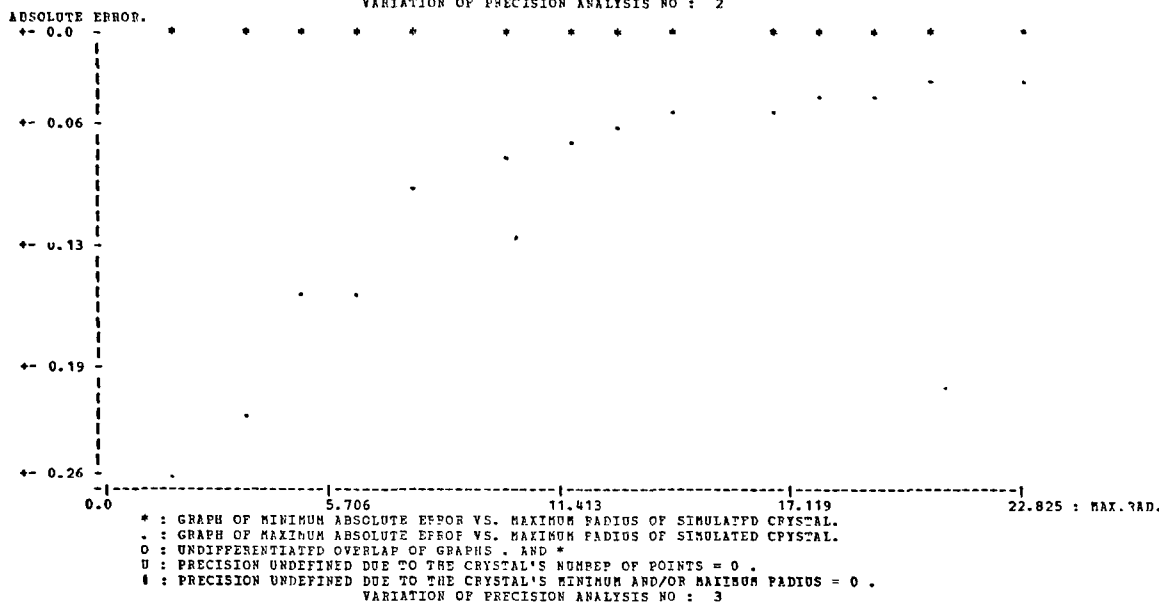
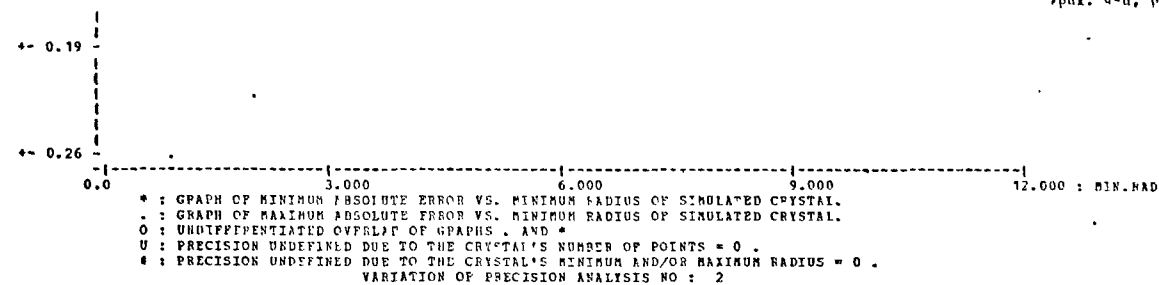
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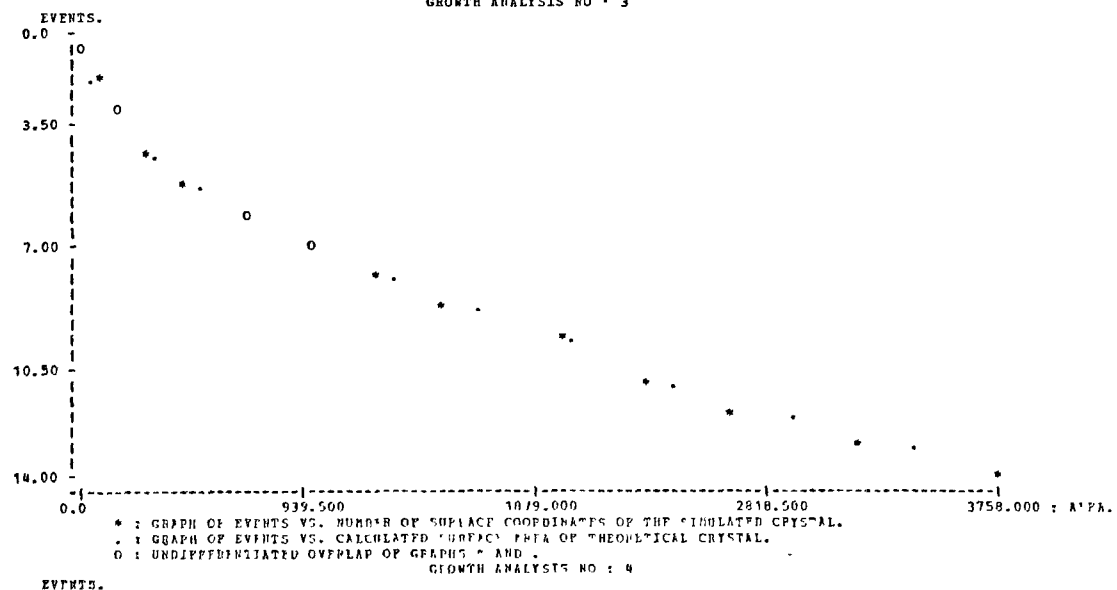
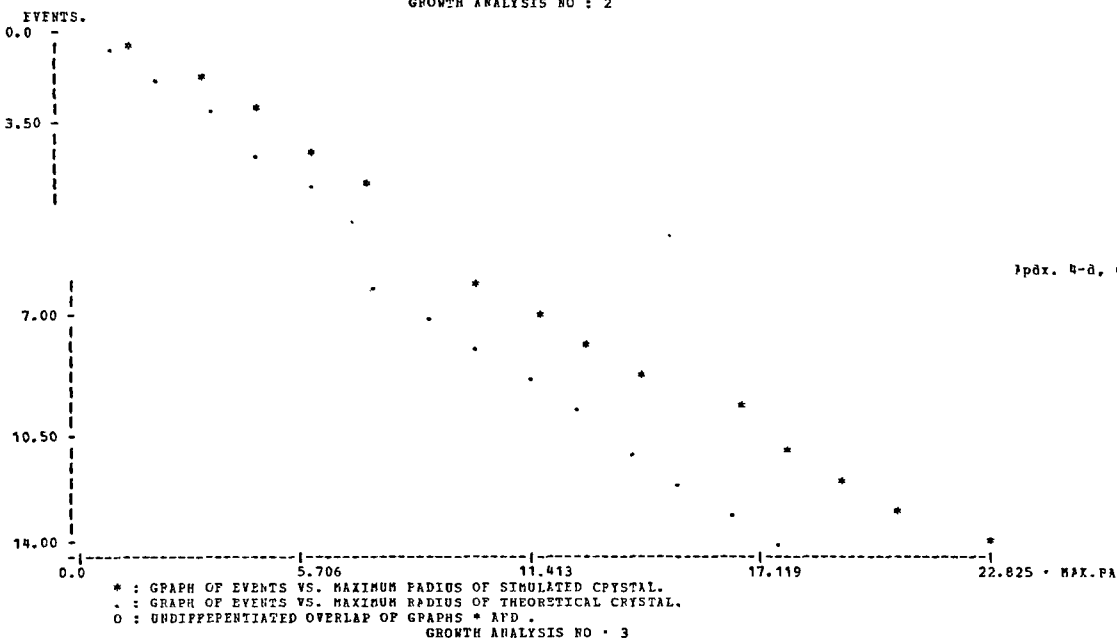
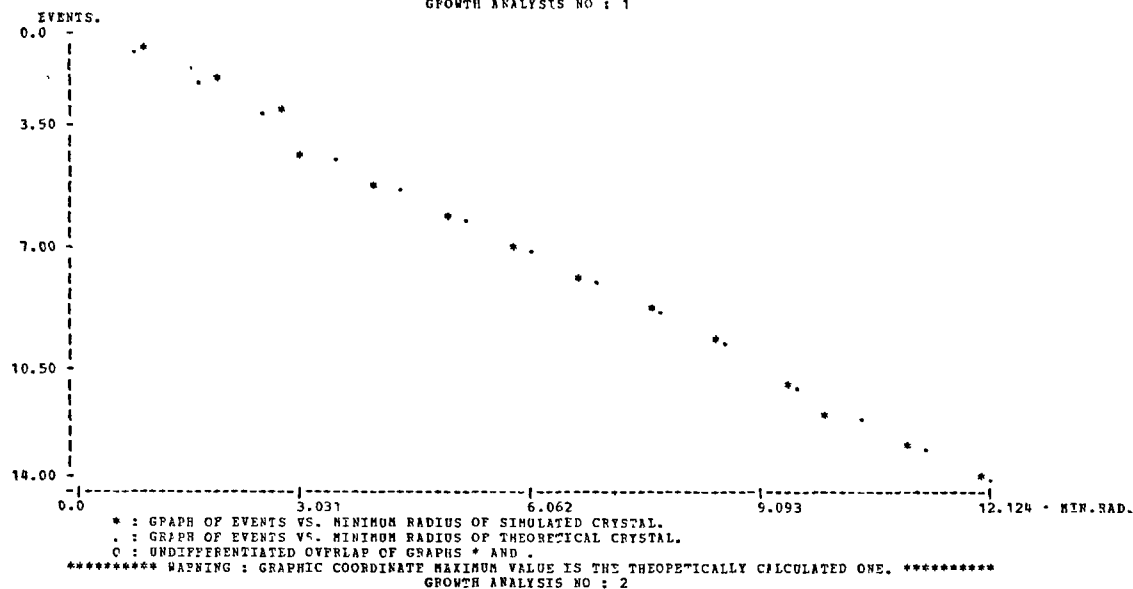
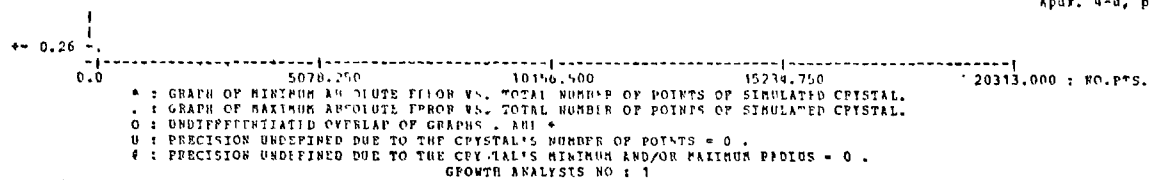
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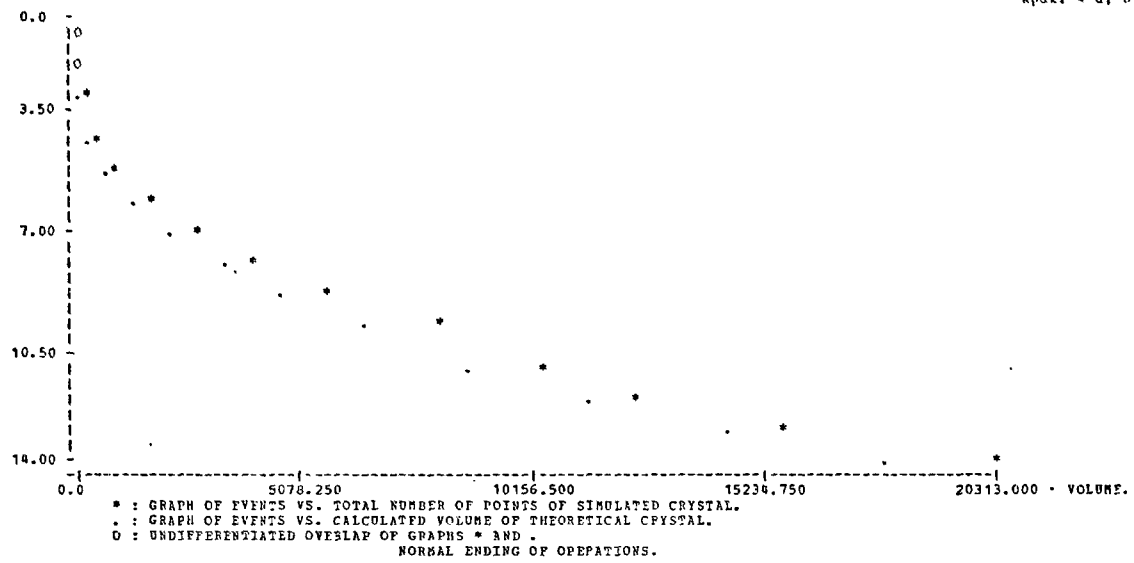
*****
THEORETICAL CRYSTAL AREA = 3981.8369 SQUARE UNITS.    THEORETICAL CRYSTAL VOLUME = 17964.6875 CUBIC UNITS.
TERMINATION ON THE 15 TH ITERATION : CRYSTAL TOO BIG FOR ALLOWED SPACE, BORDER COORDINATE 7 12 1 BELONGS TO THE IN
VARIATION OF PRECISION ANALYSIS NO : 1
ABSOLUTE ERROR.
+- 0.0 - * * * * *

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The following is the simulation of the growth of a sapphire crystal, as performed by Module 2. Three orthogonal intersecting planes, passing through the centre of the crystal, and the frequency distribution of the surface coordinates shift are presented, along with relevant information, after each growth increment. Near the end of the document, eight graphs illustrate the behaviour of the precision obtained during the simulated growth.

BEGINNING OF OPERATIONS.
 AZEIRINE : FORMS : DIER HOWEL AND ZUSSMAN, 1967, P. 132,
 AXIAL RATIOS : MASON AND BEIRI, 1968, P. 472
 STANDARD CRYSTAL'S FACTS EQUATIONS (WITH CENTRE AT 0,0,0) ARE :

1.9011 X +	0.0 Y +	0.0 Z = 1.0
-1.9011 X +	0.0 Y +	0.0 Z = 1.0
0.0 X +	2.0000 Y +	0.0 Z = 1.0
0.0 X +	-2.0000 Y +	0.0 Z = 1.0
1.3580 X +	1.4286 Y +	0.0 Z = 1.0
-1.3580 X +	1.4286 Y +	0.0 Z = 1.0
-1.3580 X +	-1.4286 Y +	0.0 Z = 1.0
1.3580 X +	-1.4286 Y +	0.0 Z = 1.0
1.0763 X +	1.5000 Y +	0.4160 Z = 1.0
-0.8248 X +	1.5000 Y +	0.4160 Z = 1.0
-0.8248 X +	-1.5000 Y +	0.4160 Z = 1.0
1.0763 X +	-1.5000 Y +	0.4160 Z = 1.0
0.8248 X +	1.5000 Y +	-0.4160 Z = 1.0
-1.0763 X +	1.5000 Y +	-0.4160 Z = 1.0
-1.0763 X +	-1.5000 Y +	-0.4160 Z = 1.0
0.8248 X +	-1.5000 Y +	-0.4160 Z = 1.0
0.4845 X +	0.3333 Y +	0.5546 Z = 1.0
-0.1492 X +	0.3333 Y +	0.5546 Z = 1.0
-0.1492 X +	-0.3333 Y +	0.5546 Z = 1.0
0.4845 X +	-0.3333 Y +	0.5546 Z = 1.0
0.1492 X +	0.3333 Y +	-0.5546 Z = 1.0
-0.4845 X +	0.3333 Y +	-0.5546 Z = 1.0
-0.4845 X +	-0.3333 Y +	-0.5546 Z = 1.0
0.1492 X +	-0.3333 Y +	-0.5546 Z = 1.0

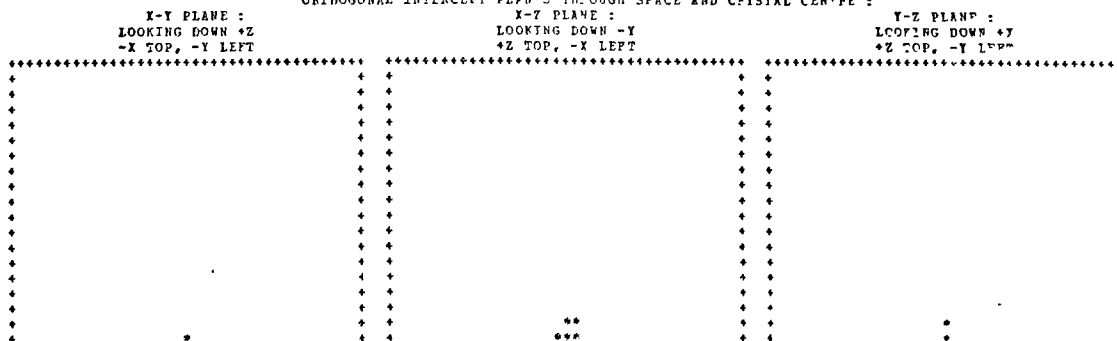
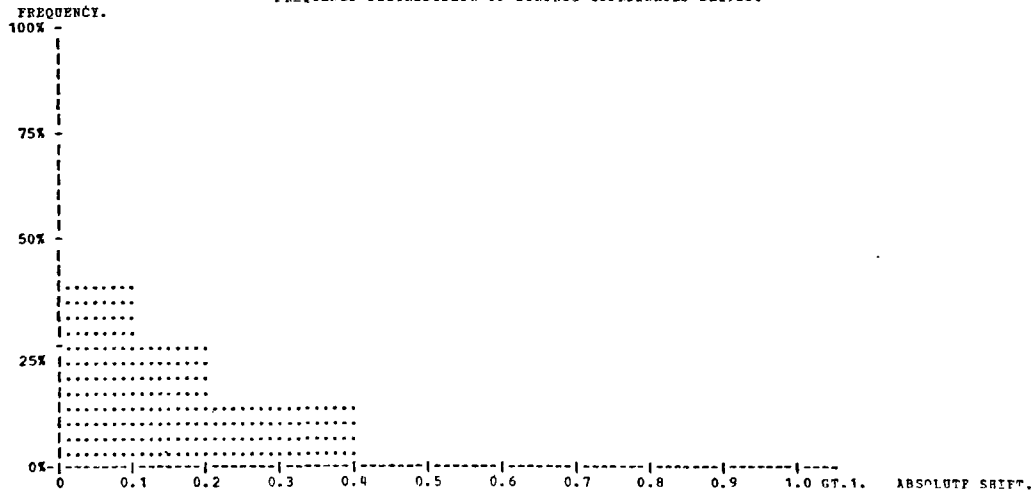
TRANSPOSED CRYSTAL'S FACTS EQUATIONS (WITH CENTRE AT 20 , 20 , 20) ARE :

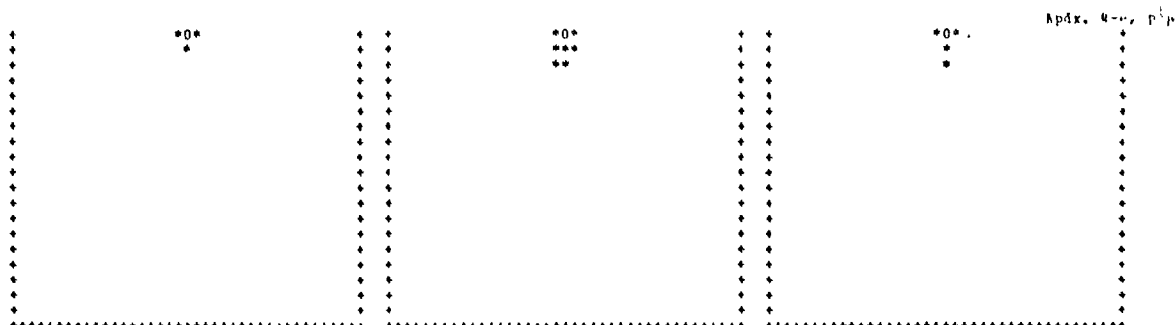
1.9011 X +	0.0 Y +	0.0 Z = 39.0220
-1.9011 X +	0.0 Y +	0.0 Z = -37.0220
0.0 X +	2.0000 Y +	0.0 Z = 41.0000
0.0 X +	-2.0000 Y +	0.0 Z = -39.0000
1.3580 X +	1.4286 Y +	0.0 Z = 56.7320
-1.3580 X +	1.4286 Y +	0.0 Z = 2.4120
-1.3580 X +	-1.4286 Y +	0.0 Z = -54.7320
1.3580 X +	-1.4286 Y +	0.0 Z = -0.4120
1.0763 X +	1.5000 Y +	0.4160 Z = 60.8460
-0.8248 X +	1.5000 Y +	0.4160 Z = 22.8240
-0.8248 X +	-1.5000 Y +	0.4160 Z = -37.1760
1.0763 X +	-1.5000 Y +	0.4160 Z = 0.8460
0.8248 X +	1.5000 Y +	-0.4160 Z = 39.1760
-1.0763 X +	1.5000 Y +	-0.4160 Z = 1.1540
-1.0763 X +	-1.5000 Y +	-0.4160 Z = -58.8460
0.8248 X +	-1.5000 Y +	-0.4160 Z = -20.8240
0.4845 X +	0.3333 Y +	0.5546 Z = 28.4480
-0.1492 X +	0.3333 Y +	0.5546 Z = 15.7740
-0.1492 X +	-0.3333 Y +	0.5546 Z = 2.4420
0.4845 X +	-0.3333 Y +	0.5546 Z = 15.1160
0.1492 X +	0.3333 Y +	-0.5546 Z = -0.4420
-0.4845 X +	0.3333 Y +	-0.5546 Z = -13.1160
-0.4845 X +	-0.3333 Y +	-0.5546 Z = -26.4480
0.1492 X +	-0.3333 Y +	-0.5546 Z = -13.7740

1 TH SPACIAL DETERMINATION COMPLETED USING 15 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 10 SURFACE AND 1 INTERNAL COORDINATES.

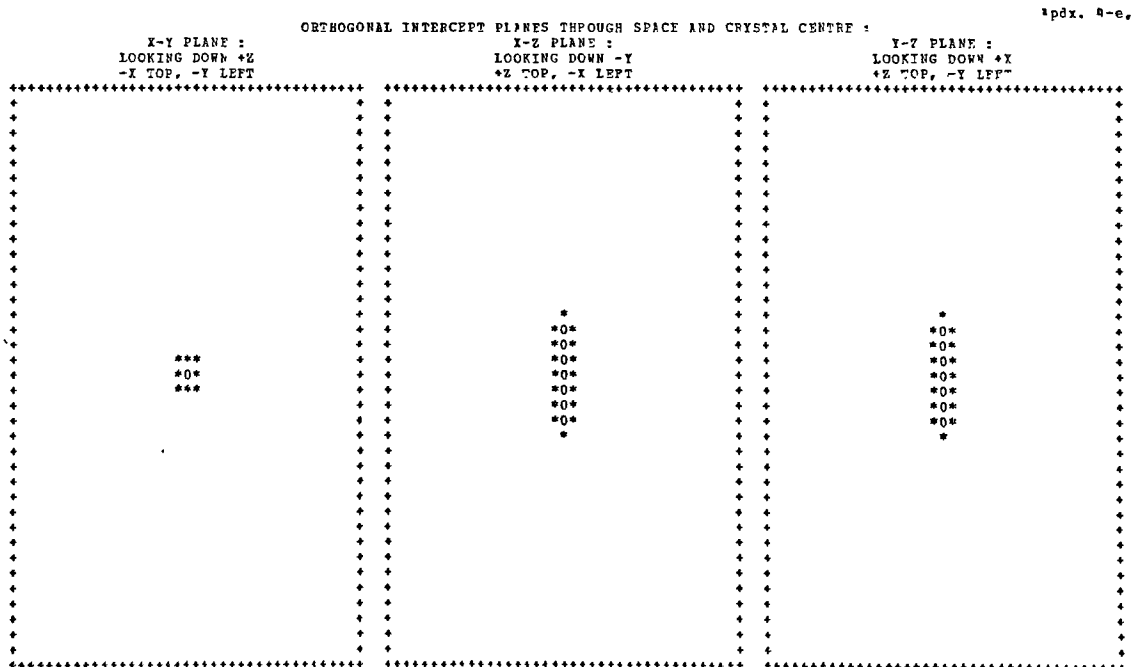
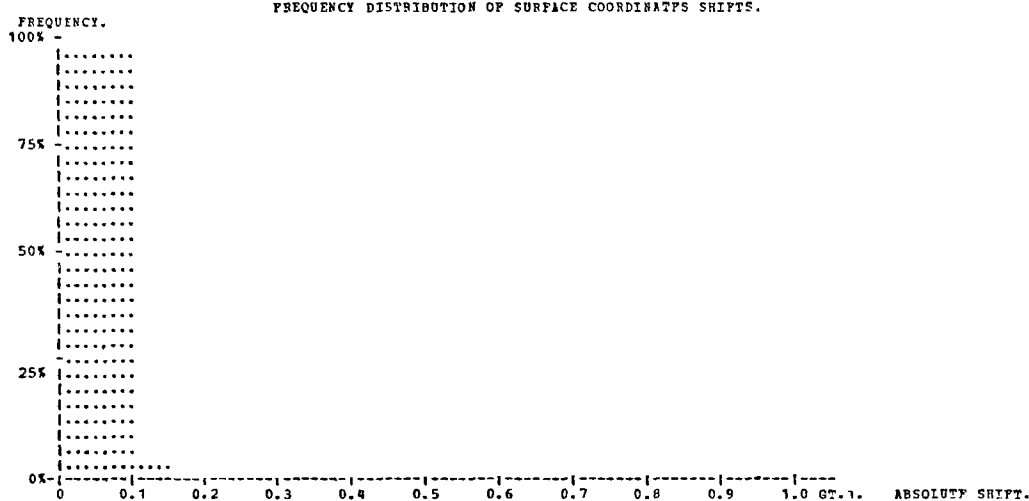
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.0714
 MAXIMUM SHIFT = 0.3086 UNITS, MINIMUM SHIFT = 0.0403 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 2.2361 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 0.5000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 1.5060 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.3086 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0342 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

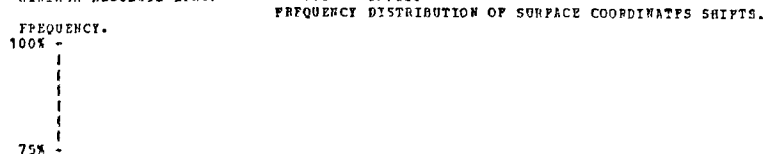


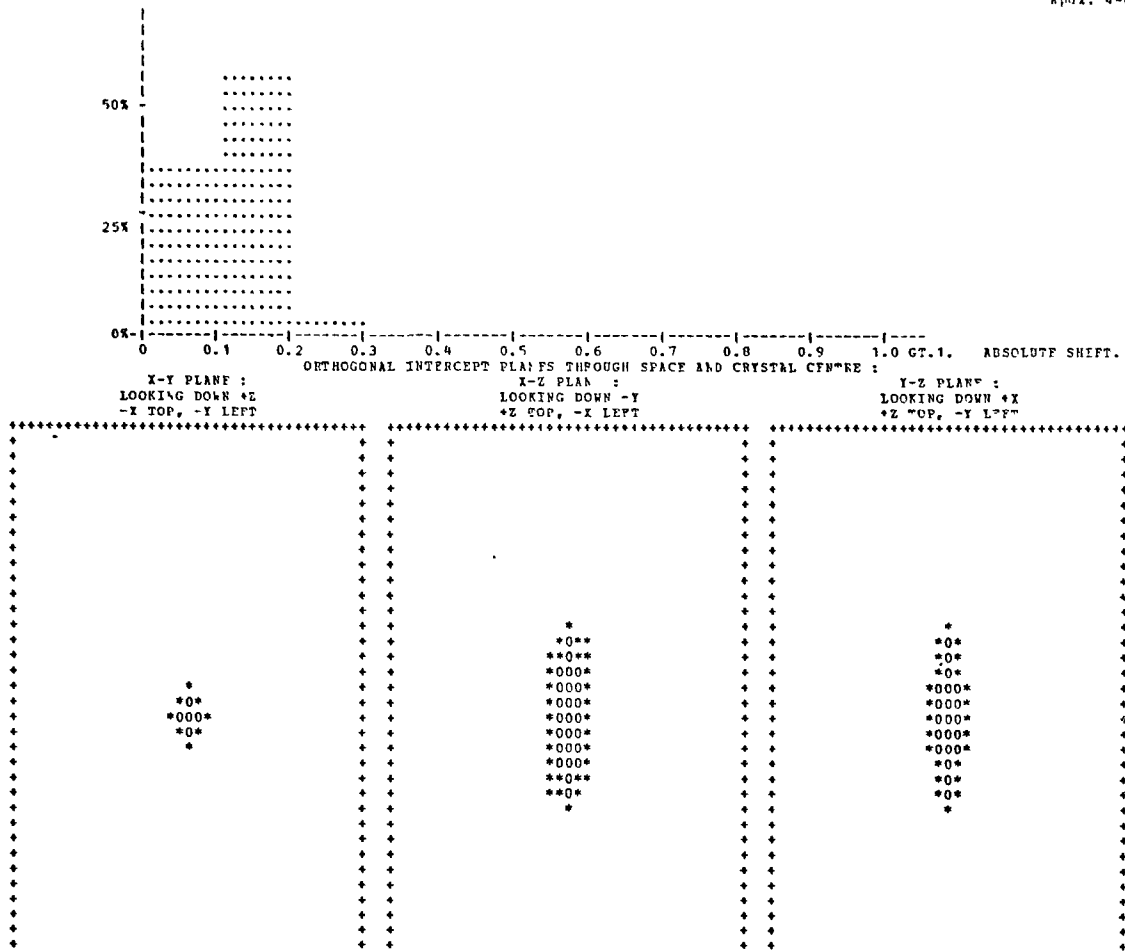


THEORETICAL CRYSTAL AREA = 9.7181 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 1.8405 CUBIC UNITS.
 2 TH SPACIAL DIFFRACTION COMPLETED USING 45 MATRIX POINTS.
 INTERNAL-SURFACE DIFFRACTION COMPLETED : CRYSTAL NOW DEFINED BY 38 SURFACE AND 7 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.1842
 MAXIMUM SHIFT = 0.1775 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 4.0000 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 3.0119 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.0520 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.



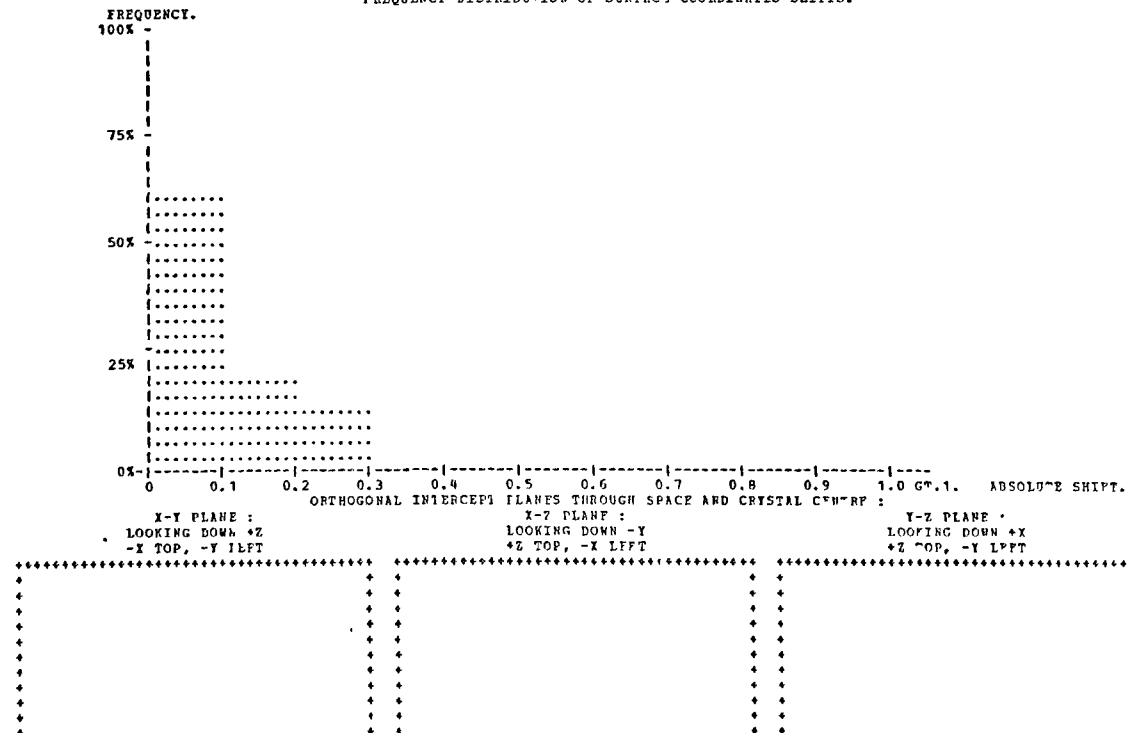
THEORETICAL CRYSTAL AREA = 39.8723 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 14.7240 CUBIC UNITS.
 3 TH SPACIAL DIFFRACTION COMPLETED USING 115 MATRIX POINTS.
 INTERNAL-SURFACE DIFFRACTION COMPLETED : CRYSTAL NOW DEFINED BY 80 SURFACE AND 35 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.4375
 MAXIMUM SHIFT = 0.2902 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.4142 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 6.0000 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 1.5000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 4.5179 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.0766 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

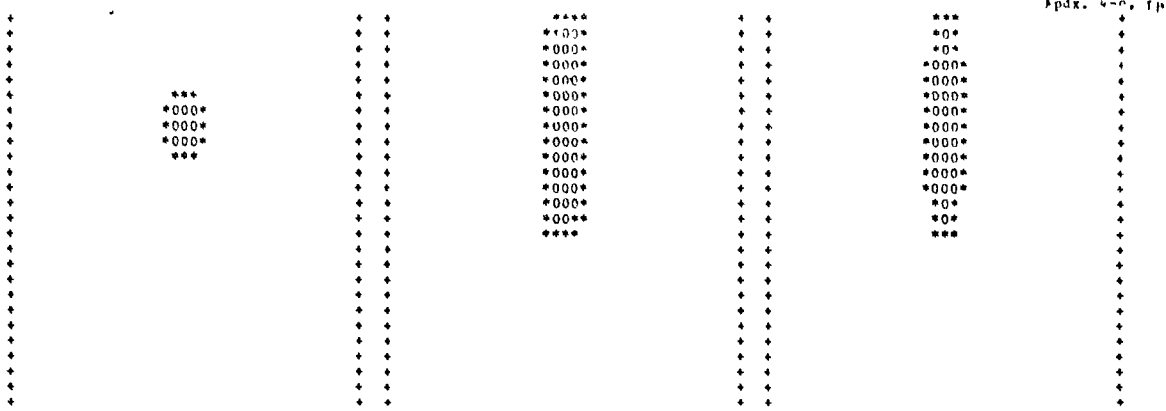




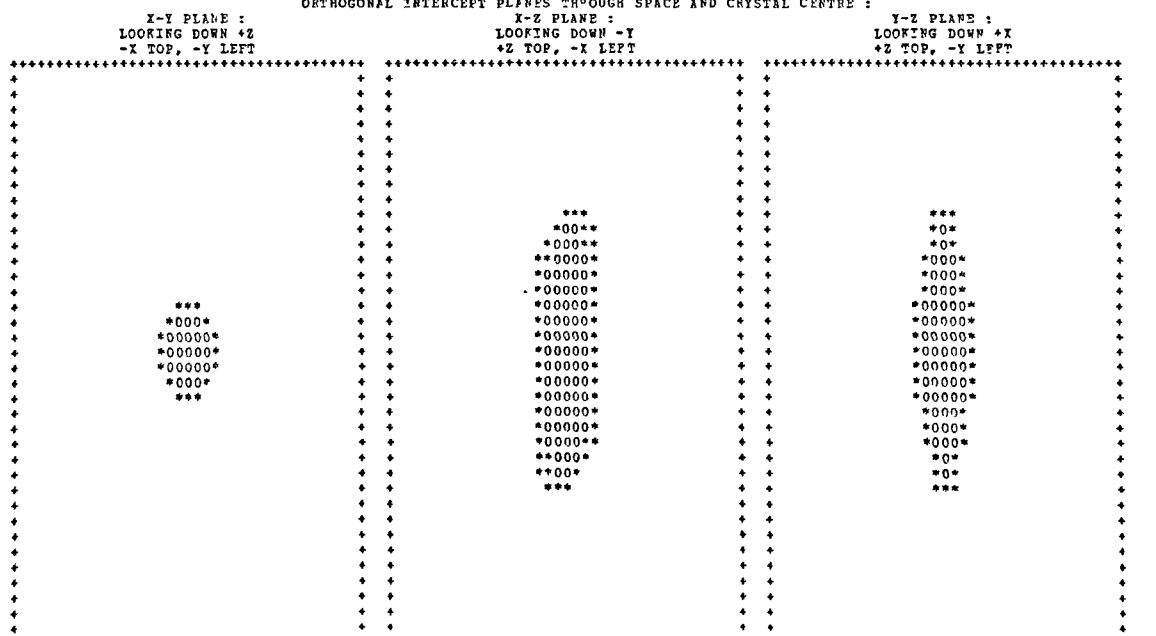
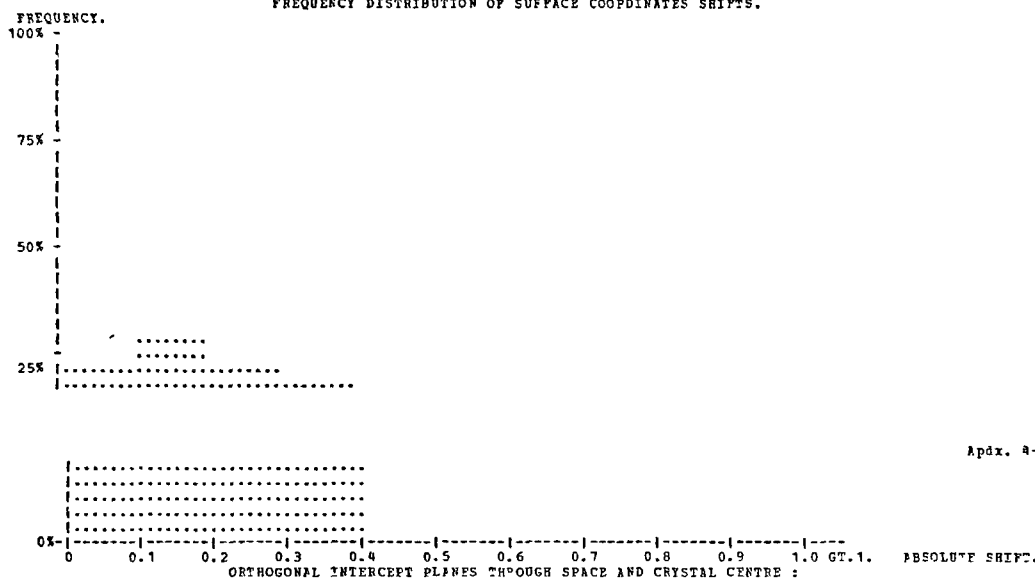
THEORETICAL CRYSTAL AREA = 87.4628 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 49.6935 CUBIC UNITS.
 4 TH SPACIAL DETERMINATION COMPLETED USING 221 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 146 SURFACE AND 75 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.5137
 MAXIMUM SHIFT = 0.3468 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 2.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 7.2801 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 2.0000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 6.0239 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.0731 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



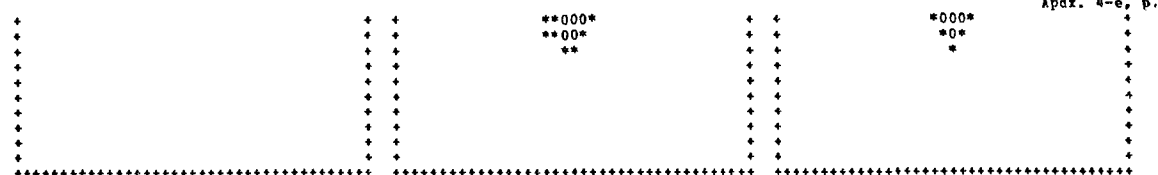
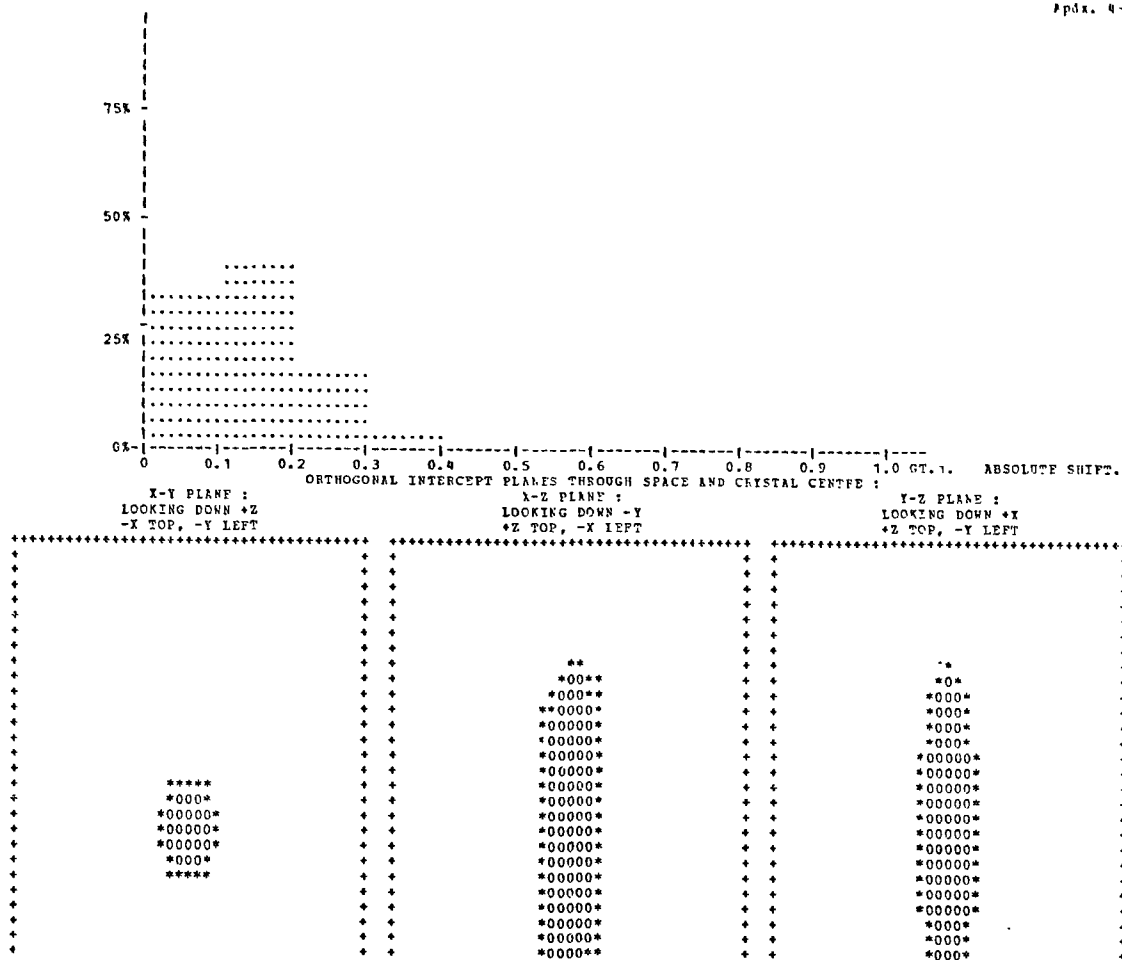


THEORETICAL CRYSTAL AREA = 155.4897 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 117.7923 CUBIC UNITS.
 5 TH SPACIAL DETERMINATION COMPLETED USING 401 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 228 SURFACE AND 173 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.7588
 MAXIMUM SHIFT = 0.3912 UNITS, MINIMUM SHIFT = 0.0106 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 2.4495 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 9.2105 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 2.5000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 7.5298 UNITS.
 MAXIMUM ABSOLUTE ERROR = +/- 0.1233 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0012 UNITS.
 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



THEORETICAL CRYSTAL AREA = 247.9529 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 230.0634 CUBIC UNITS.
 6 TH SPACIAL DETERMINATION COMPLETED USING 587 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 310 SURFACE AND 277 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.8935
 MAXIMUM SHIFT = 0.4181 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 2.0204 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 11.0850 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 3.0000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 9.0450 UNITS.
 MAXIMUM ABSOLUTE ERROR = +/- 0.0166 UNITS.
 MINIMUM ABSOLUTE ERROR = +/- 0.0 UNITS.
 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

FREQUENCY.
 100% -



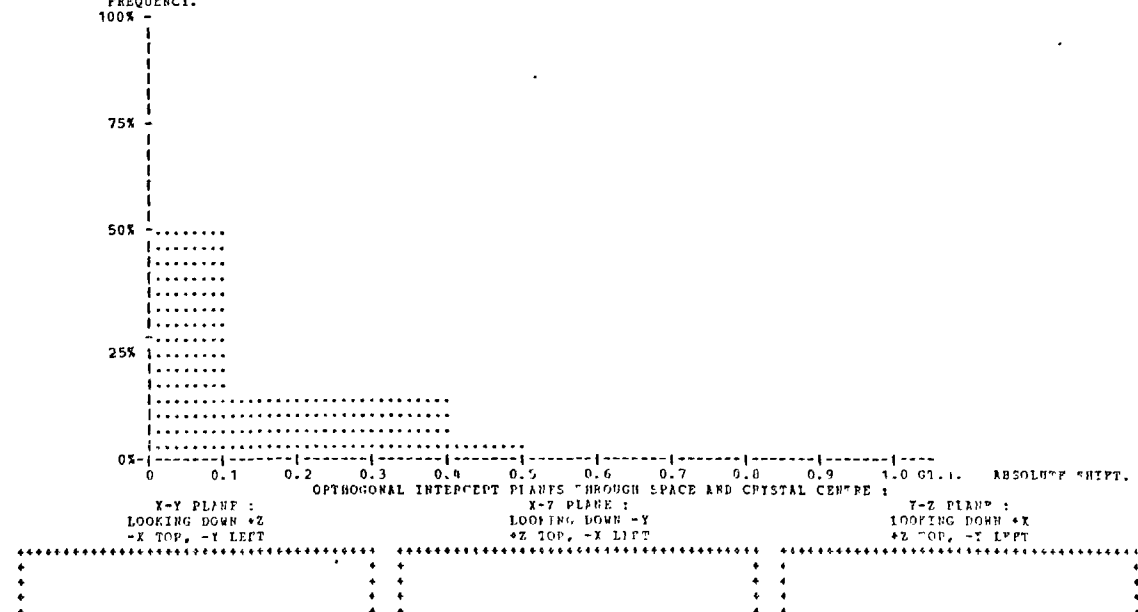
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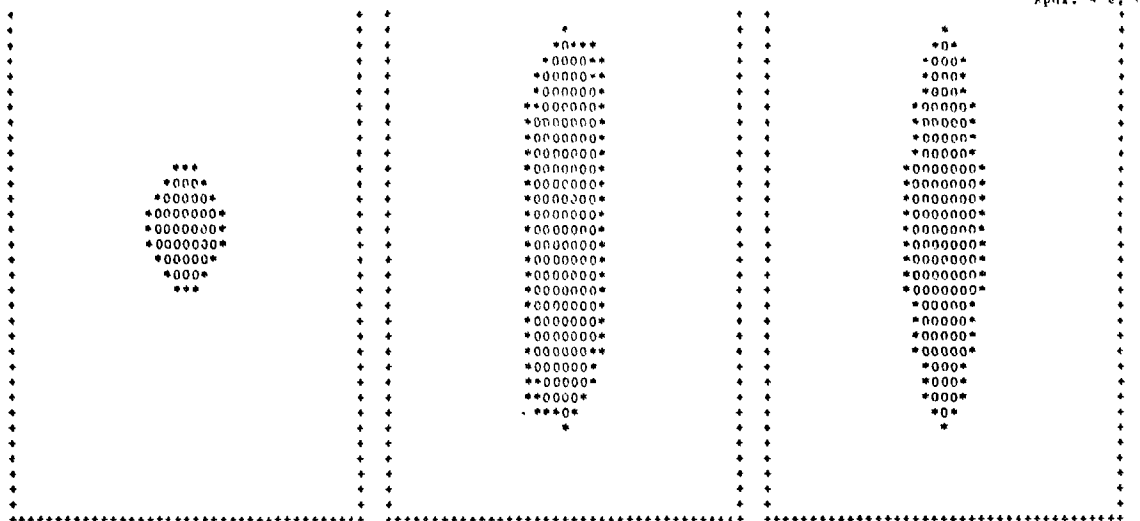
THEORETICAL CRYSTAL AREA = 349.8503 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 397.5883 CUBIC UNITS.
7 TH SPACIAL DETERMINATION COMPLETED USING 935 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED: CRYSTAL NOW DEFINED BY 416 SURFACE AND 519 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.2476
MAXIMUM SHIFT = 0.50000 UNITS, MINIMUM SHIFT = 0.0006 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 3.6056 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 13.0000 UNITS.
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 3.5000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 10.5417 UNI.
MINIMUM ABSOLUTE ERROR = +- 0.1250 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0001 UNITS.

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FREQUENCY.

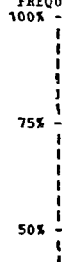
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



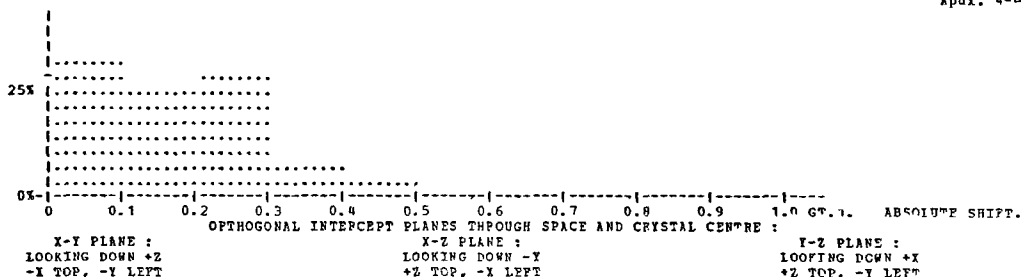


THEORETICAL CRYSTAL AREA = 476.1873 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 631.2932 CUBIC UNITS.
 8 TH SPACIAL DETERMINATION COMPLETED USING 1273 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 540 SURFACE AND 733 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.3574
 MAXIMUM SHIFT = 0.4778 UNITS, MINIMUM SHIFT = 0.0 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 4.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 15.0000 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 4.0000 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 12.0477 UNITS
 MAXIMUM ABSOLUTE ERROR = +- 0.0729 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0 UNITS.

FREQUENCY.



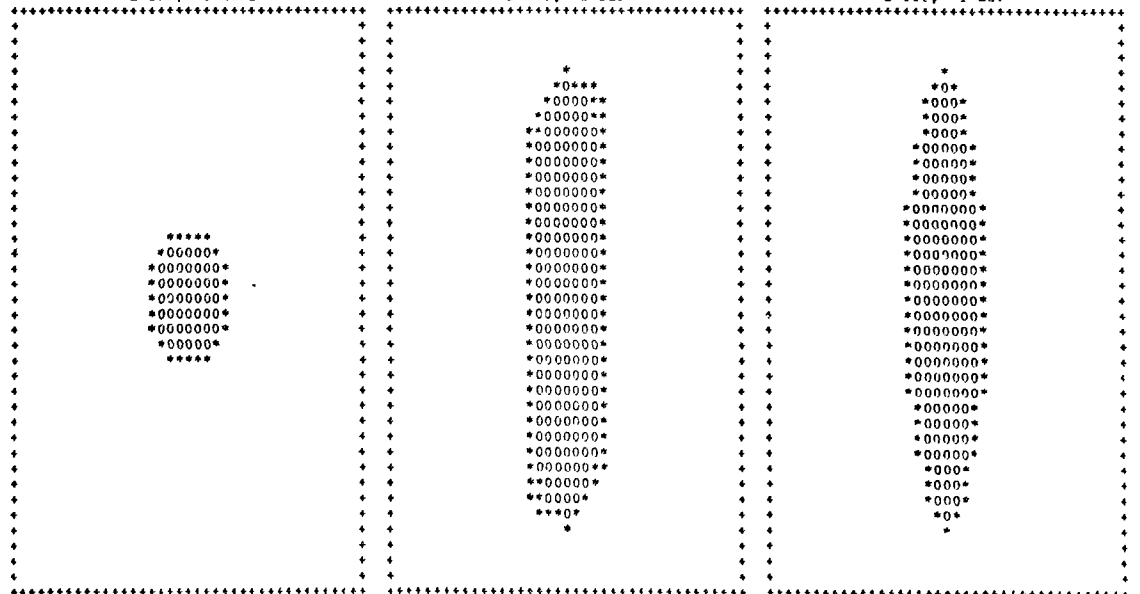
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



X-Y PLANE :
 LOOKING DOWN +Z
 -X TOP, -Y LEFT

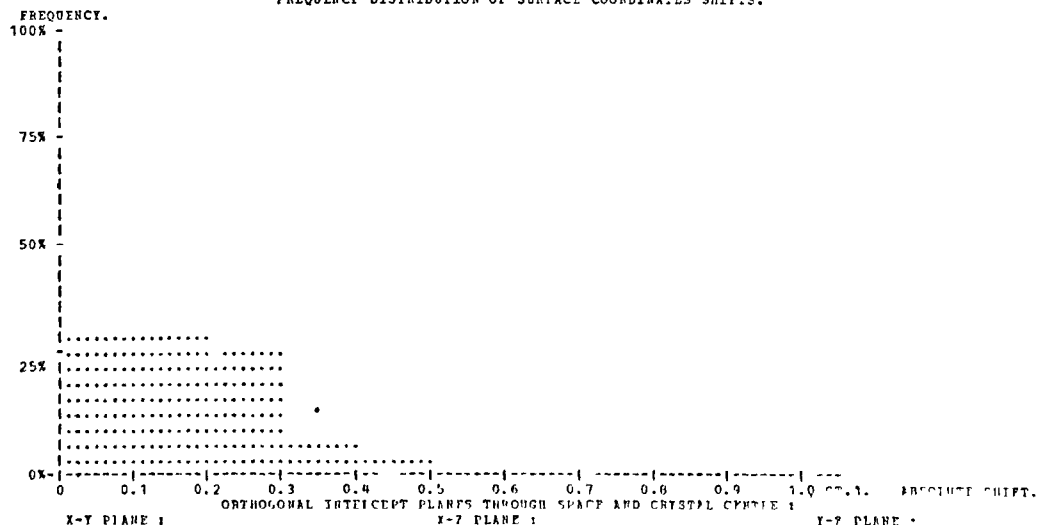
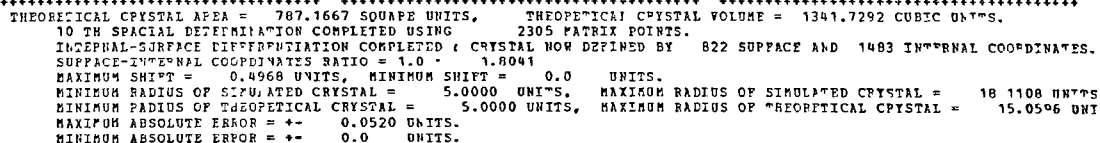
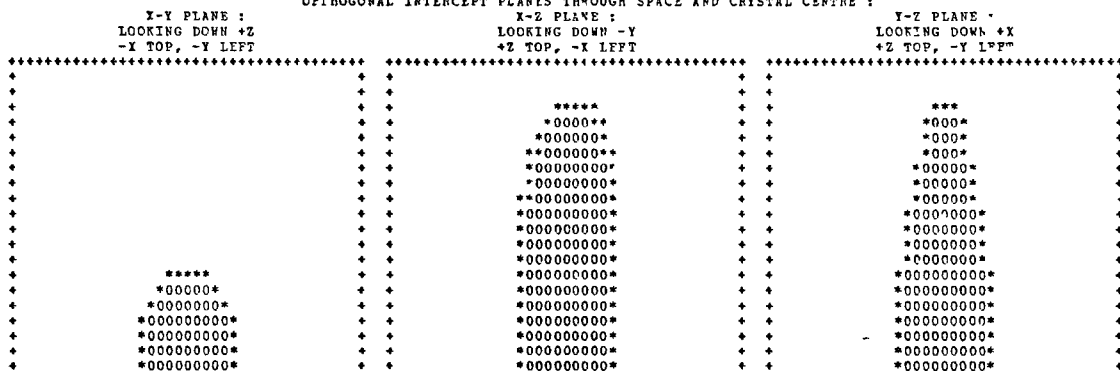
X-Z PLANE :
 LOOKING DOWN -Y
 +Z TOP, -X LEFT

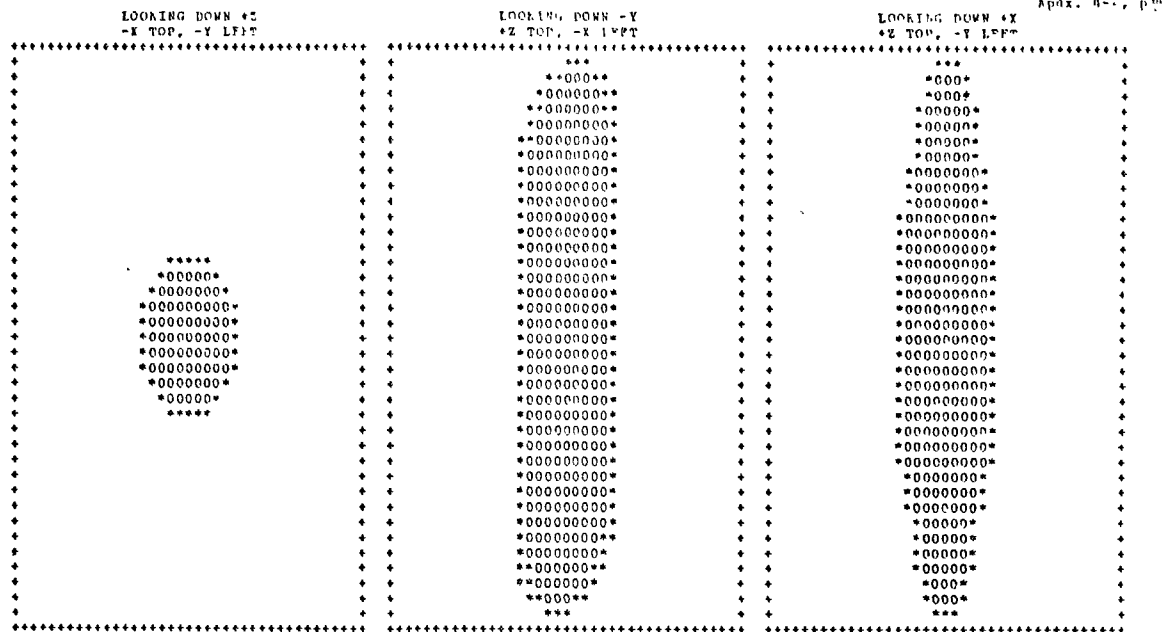
Y-Z PLANE :
 LOOKING DOWN +X
 +Z TOP, -Y LEFT



THEORETICAL CRYSTAL AREA = 621.9583 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 942.3396 CUBIC UNITS.
 9 TH SPACIAL DETERMINATION COMPLETED USING 1649 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 698 SURFACE AND 1151 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.6490
 MAXIMUM SHIFT = 0.5000 UNITS, MINIMUM SHIFT = 0.0001 UNITS.

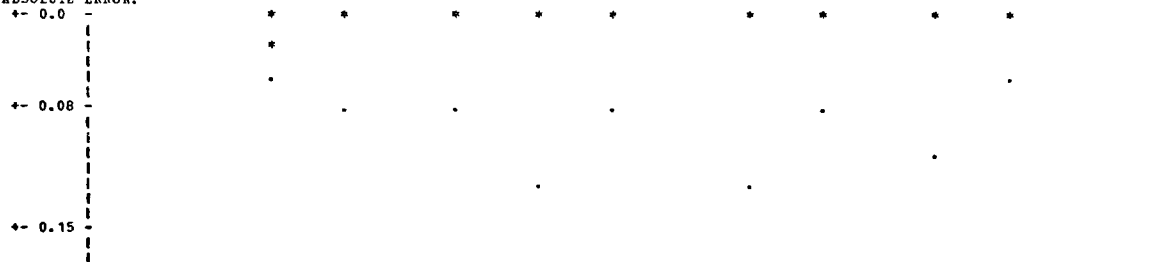
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIPS.



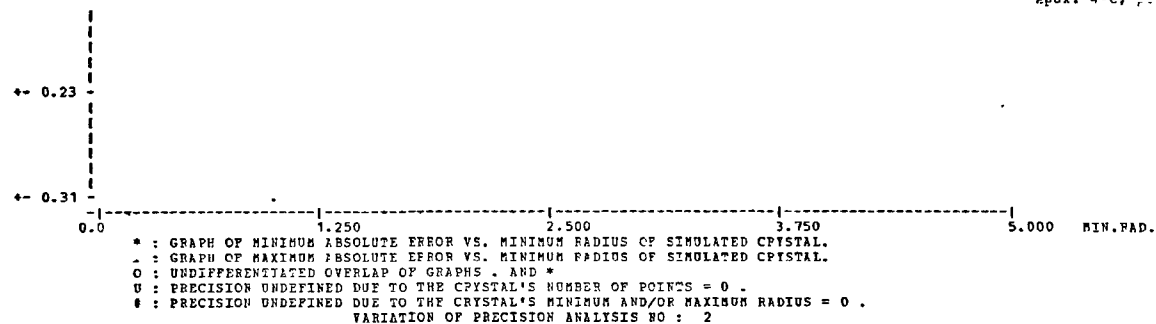


THEORETICAL CRYSTAL AREA = 971.8103 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 1840.5093 CUBIC UNITS.
 TERMINATION ON THE 11 TH ITERATION : CRYSTAL TOO BIG FOR ALLOWED SPACE, BORDER COORDINATE 16 20 39 BELONGS TO THE INTERF.,
 VARIATION OF PRECISION ANALYSIS NO : 1

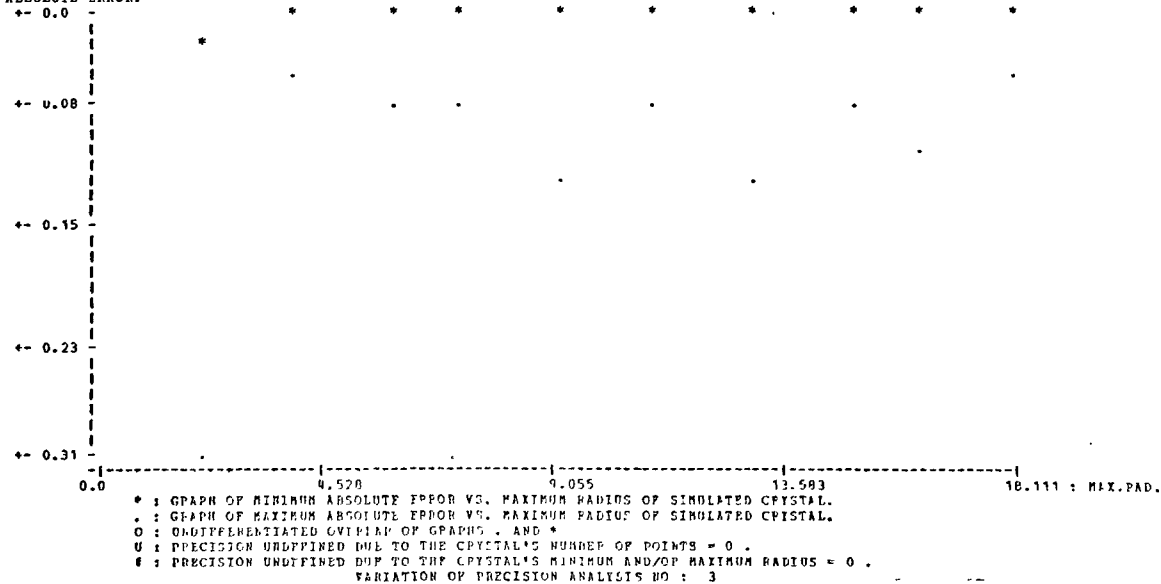
ABSOLUTE ERROR.



Apdx. 4-e, p.1

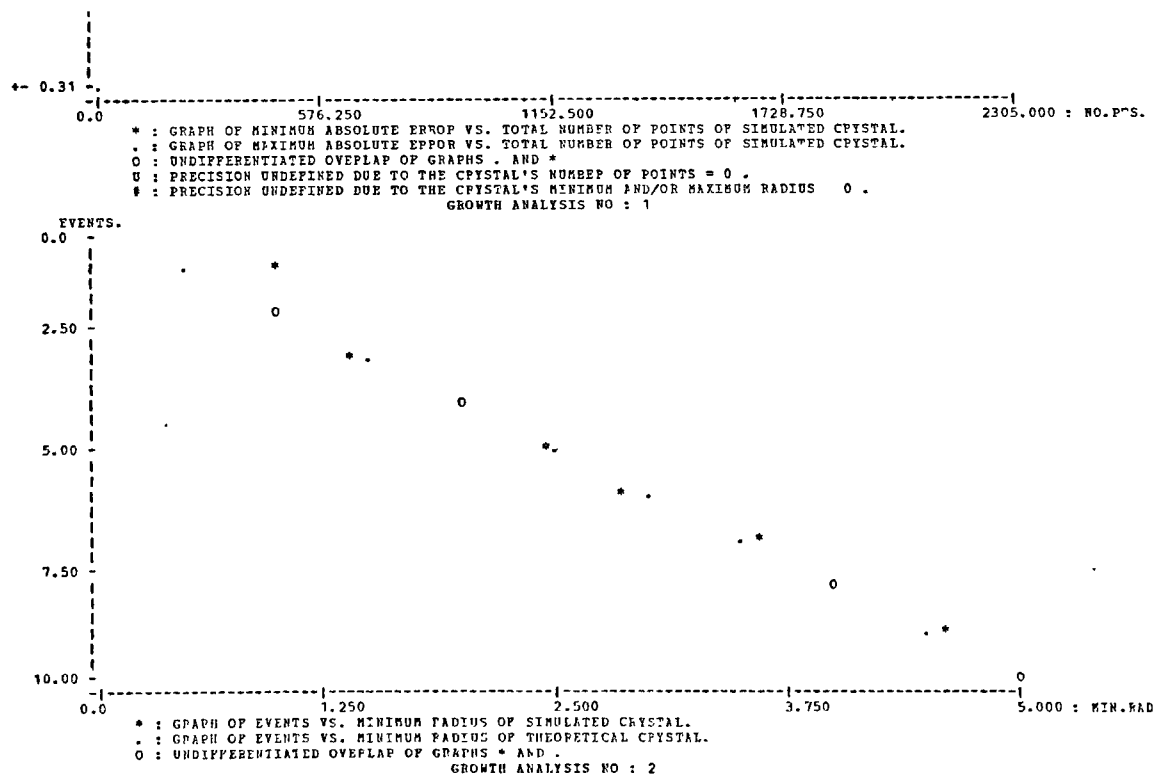
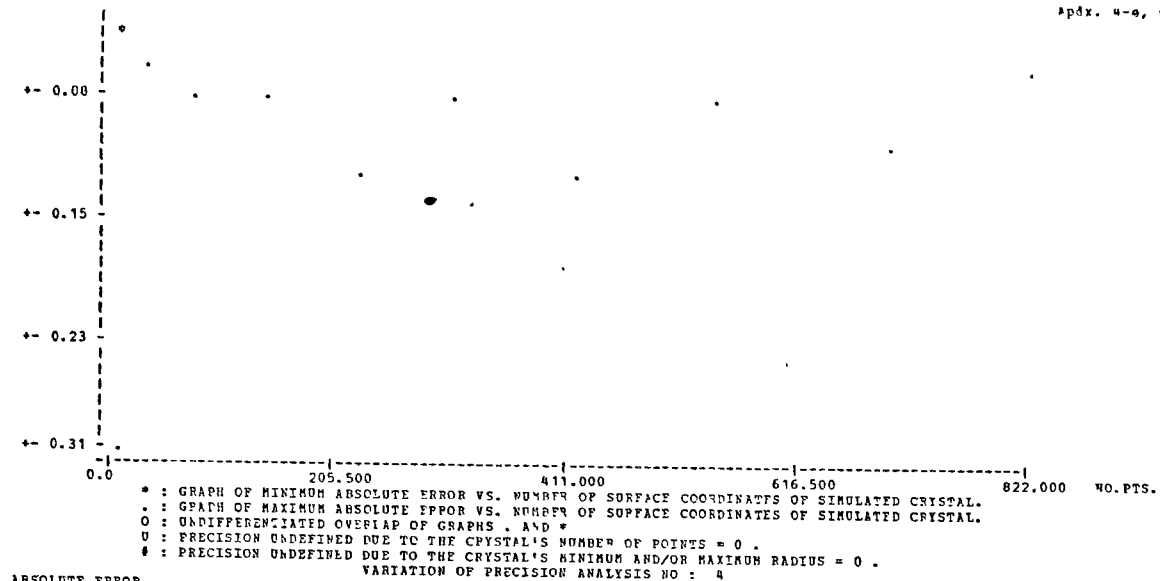


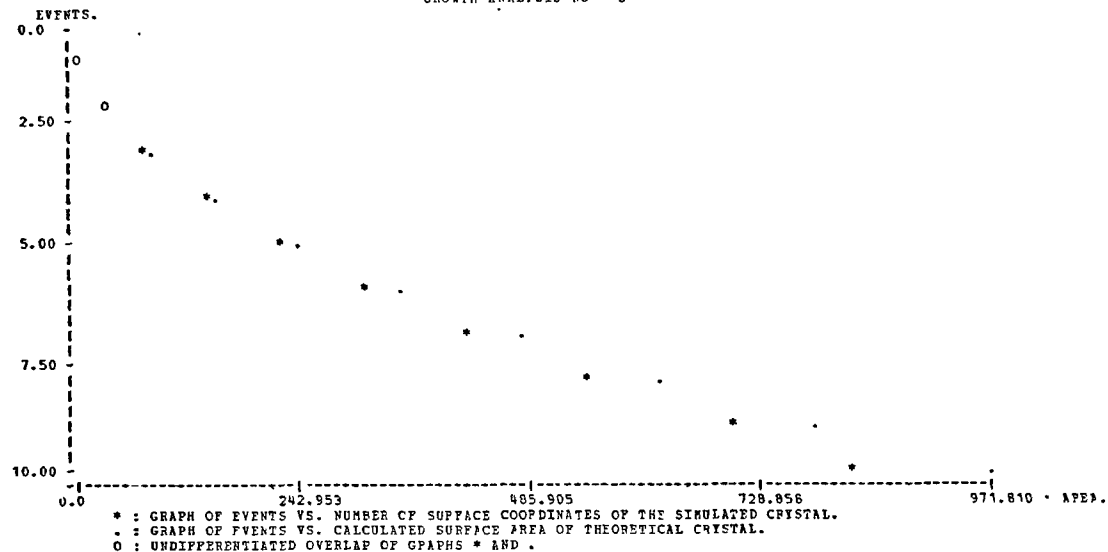
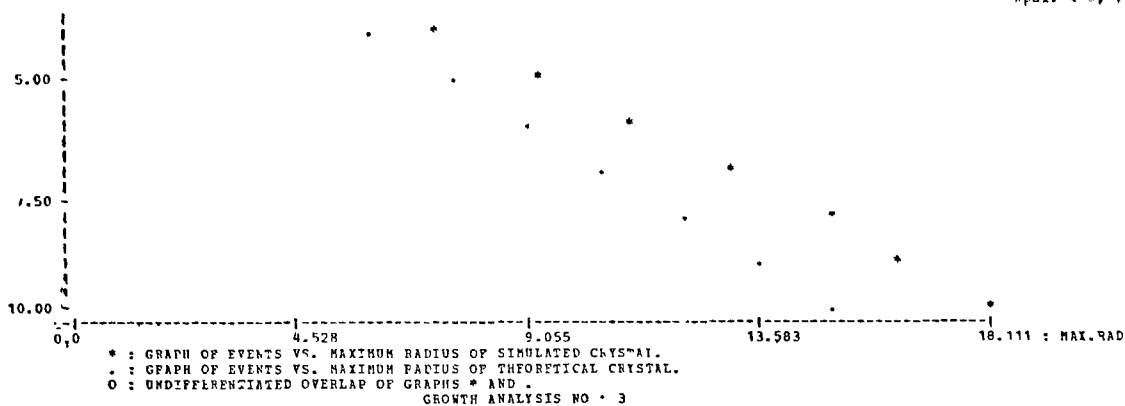
ABSOLUTE ERROR.



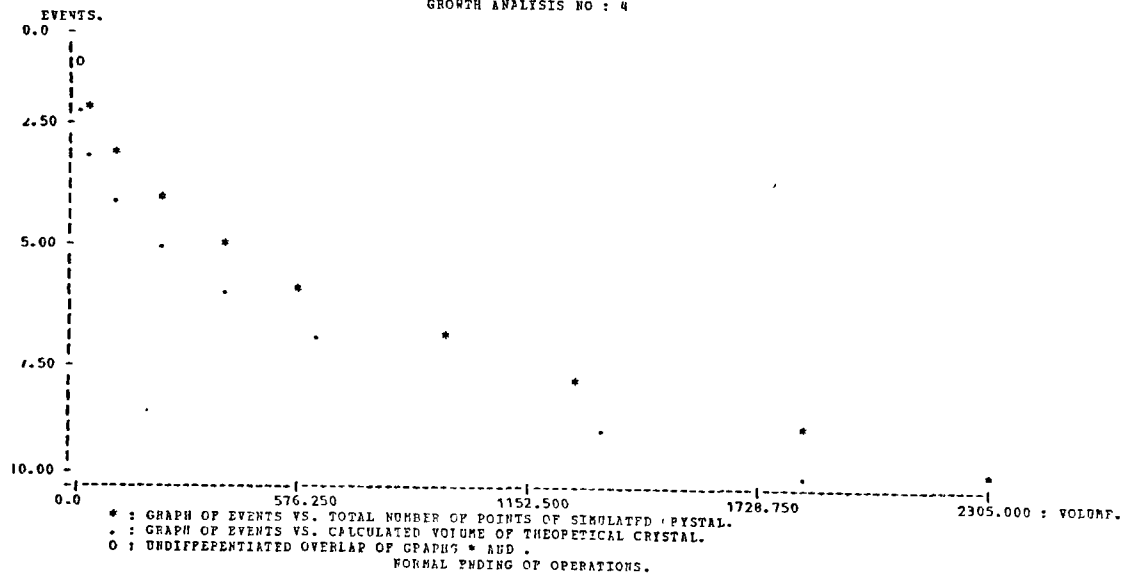
ABSOLUTE ERROR.







***** WARNING : GRAPHIC COORDINATE MAXIMUM VALUE IS THE THEORETICALLY CALCULATED ONE. ***** Apdx. 4-e, p 1
 GROWTH ANALYSIS NO : 4



The following is the simulation of the growth of a lamellar crystal, as performed by Module 2. Three orthogonal intersecting planes, passing through the centre of the crystal, and the frequency distribution of the surface coordinates which are presented, along with relevant information, after each growth increment. Near the end of the document, eight graphs illustrate the behaviour of the precision obtained during the simulated growth.

0

BEGINNING OF OPERATIONS.

LAIFADOBITP : ROGERS, 1937, P. 437.

STANDARD CRYSTAL'S FACES EQUATIONS (WITH CENTRE AT 0,0,0) ARE :

```

1.7499 X + 1.0912 Y + 0.0 Z = 1.0
-1.7499 X + 0.9144 Y + 0.0 Z = 1.0
-1.7499 X + -1.0912 Y + 0.0 Z = 1.0
1.7499 X + -0.9144 Y + 0.0 Z = 1.0
0.0 X + 2.0056 Y + 0.0 Z = 1.0
0.0 X + -2.0056 Y + 0.0 Z = 1.0
0.5871 X + 0.0968 Y + 1.2118 Z = 1.0
-0.5871 X + -0.0968 Y + -1.2118 Z = 1.0
-1.5407 X + 0.0 Y + 1.0692 Z = 1.0
1.5407 X + 0.0184 Y + -1.0692 Z = 1.0

```

TRANSPOSED CRYSTAL'S FACES EQUATIONS (WITH CENTRE AT 20 , 20 , 20) ARE :

```

1.7499 X + 1.0912 Y + 0.0 Z = 57.8220
-1.7499 X + 0.9144 Y + 0.0 Z = -15.7100
-1.7499 X + -1.0912 Y + 0.0 Z = -55.8220
1.7499 X + -0.9144 Y + 0.0 Z = 17.7100
0.0 X + 2.0056 Y + 0.0 Z = 41.1120
0.0 X + -2.0056 Y + 0.0 Z = -39.1120
0.5871 X + 0.0968 Y + 1.2118 Z = 38.9140
-0.5871 X + -0.0968 Y + -1.2118 Z = -36.9140
-1.5407 X + 0.0 Y + 1.0692 Z = -8.4300
1.5407 X + 0.0184 Y + -1.0692 Z = 10.7980

```

1 TH SPACIAL DETERMINATION COMPLETED USING

5 MATRIX POINTS.

INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 5 SURFACE AND 0 INTERNAL COORDINATES.

SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.0

MAXIMUM SHIFT = 0.4849 UNITS, MINIMUM SHIFT = 0.0369 UNITS.

MINIMUM RADIUS OF SIMULATED CRYSTAL = 0.0 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS

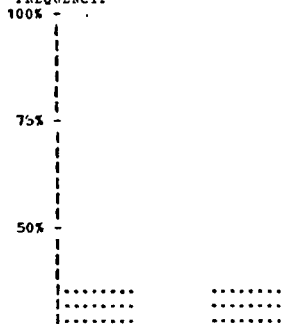
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 0.4049 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 0.7407 UNITS

MINIMUM ABSOLUTE ERROR = +- 0.2883 UNITS.

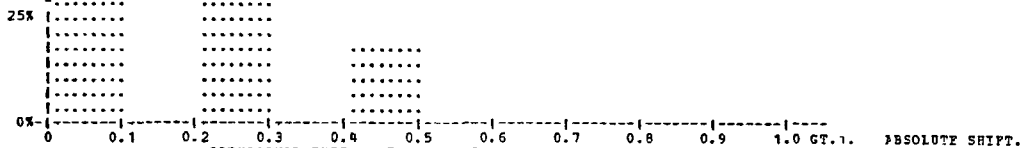
MINIMUM ABSOLUTE ERROR UNDEFINED BECAUSE OF CRYSTAL RADIUS = 0.0 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

FREQUENCY.



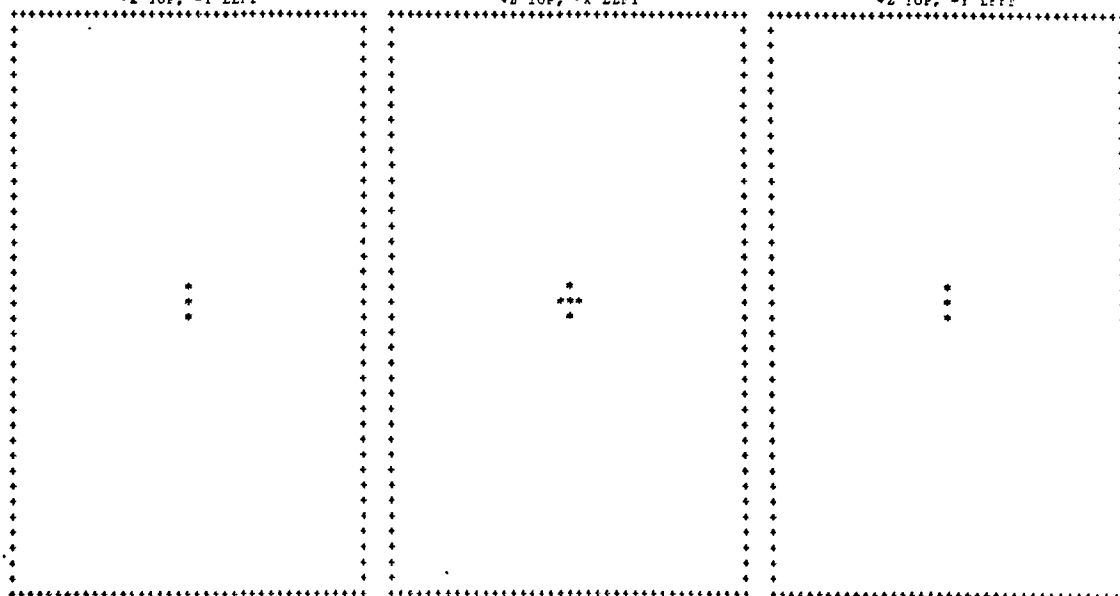
Appendix 4-f,



X-Y PLANE :
LOOKING DOWN +Z
-X TOP, -Y LEFT

X-Z PLANE :
LOOKING DOWN -Y
+Z TOP, -X LEFT

Y-Z PLANE :
LOOKING DOWN +X
+Z TOP, -Y LEFT



THEORETICAL CRYSTAL AREA = 6.2153 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 1.1328 CUBIC UNITS.

2 TH SPACIAL DETERMINATION COMPLETED USING

19 MATRIX POINTS.

INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 30 SURFACE AND 3 INTERNAL COORDINATES.

SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.1000

MAXIMUM SHIFT = 0.1213 UNITS, MINIMUM SHIFT = 0.0028 UNITS.

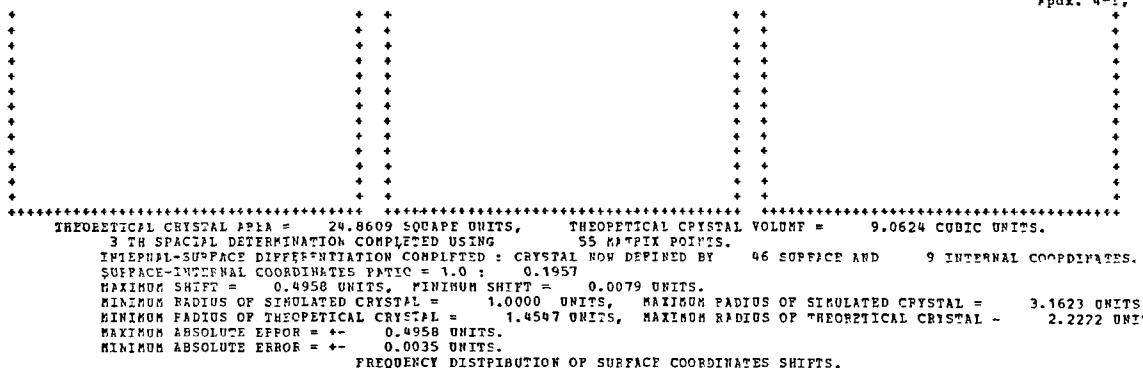
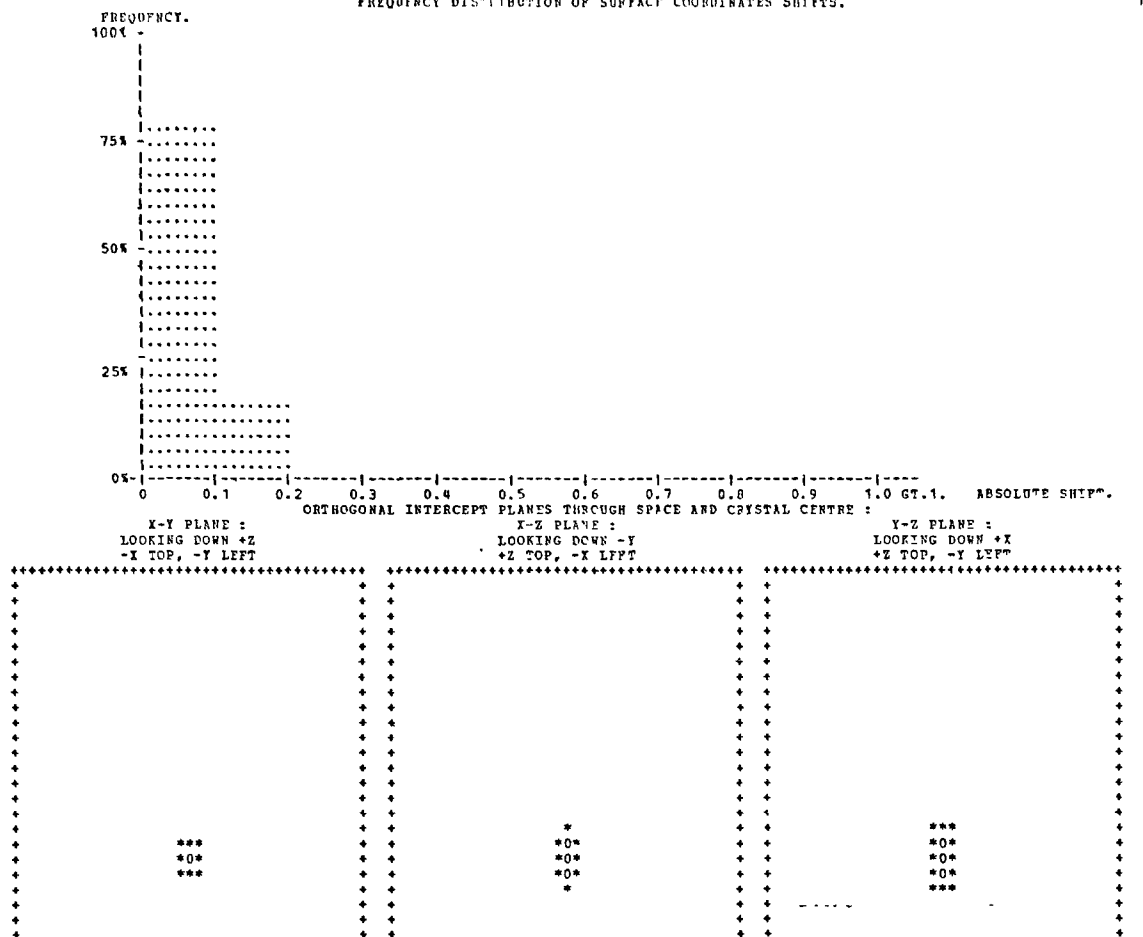
MINIMUM RADIUS OF SIMULATED CRYSTAL = 1.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 2.2361 UNITS

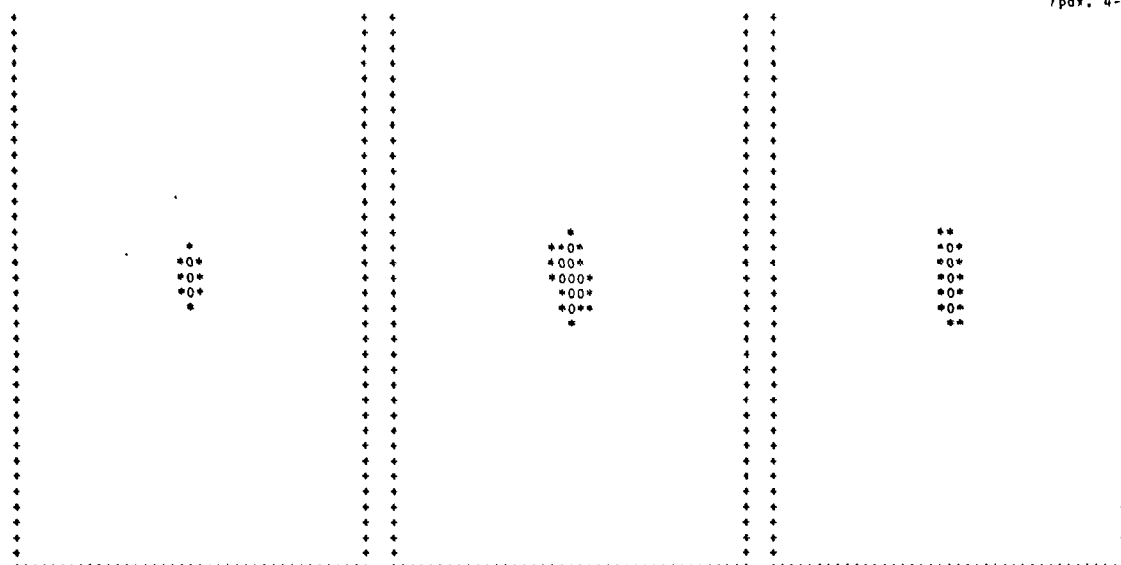
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 0.9690 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 1.4815 UNITS

MINIMUM ABSOLUTE ERROR = +- 0.1213 UNITS.

MINIMUM ABSOLUTE ERROR = +- 0.0012 UNITS.

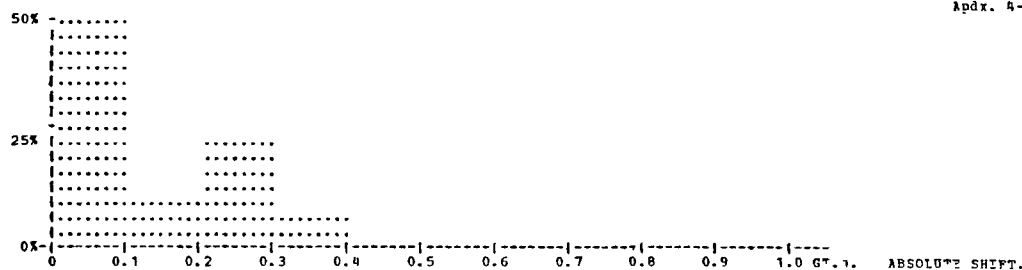
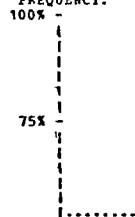
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.





THEORETICAL CRYSTAL AREA = 55.9371 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 30.5858 CUBIC UNITS.
 4 TH SPACIAL DETERMINATION COMPLETED USING 131 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 92 SURFACE AND 39 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 0.4239
 MAXIMUM SHIFT = 0.4088 UNITS, MINIMUM SHIFT = 0.0056 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 2.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 4.8721 UNITS
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 1.9396 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 2.9630 UNI
 MAXIMUM ABSOLUTE ERROR = +- 0.1282 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0012 UNITS.
 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

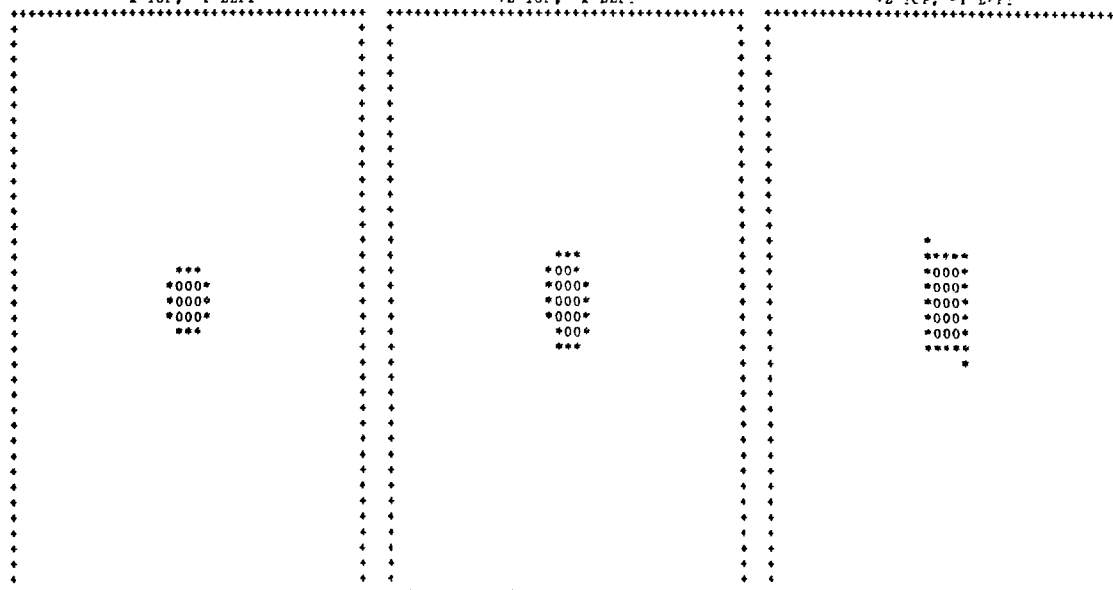
FREQUENCY.



X-Y PLANE :
 LOOKING DOWN +Z
 -X TOP, -Y LEFT

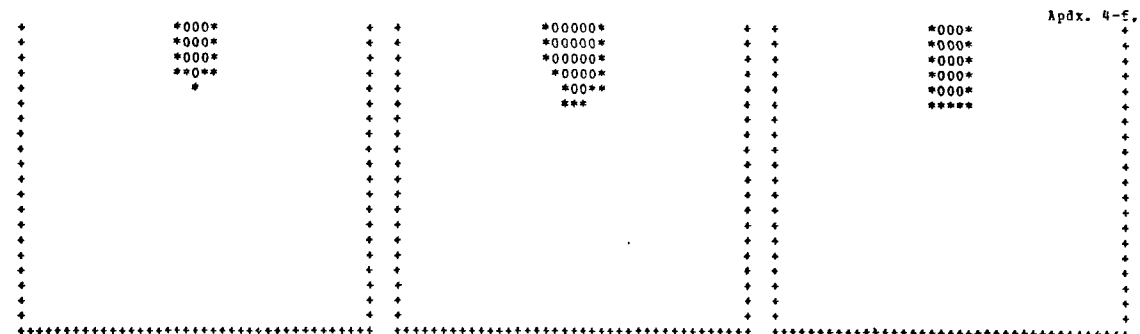
X-Z PLANE :
 LOOKING DOWN -Y
 +Z TOP, -X LEFT

Y-Z PLANE :
 LOOKING DOWN +X
 +Z TOP, -Y LEFT

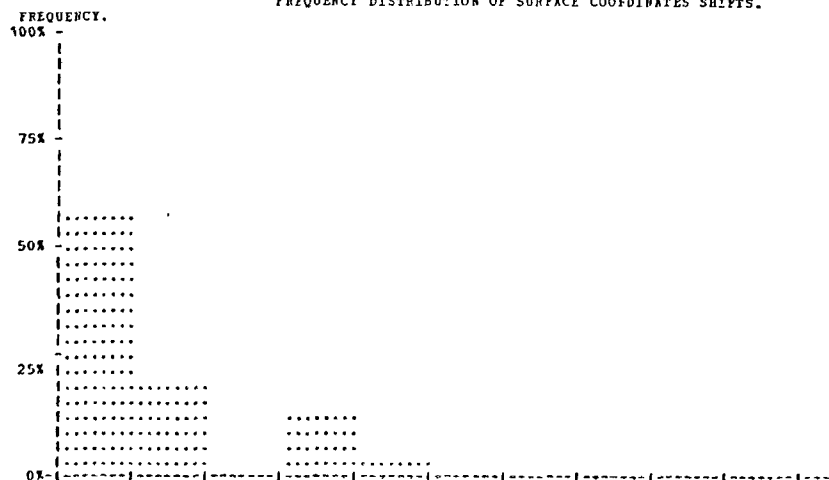


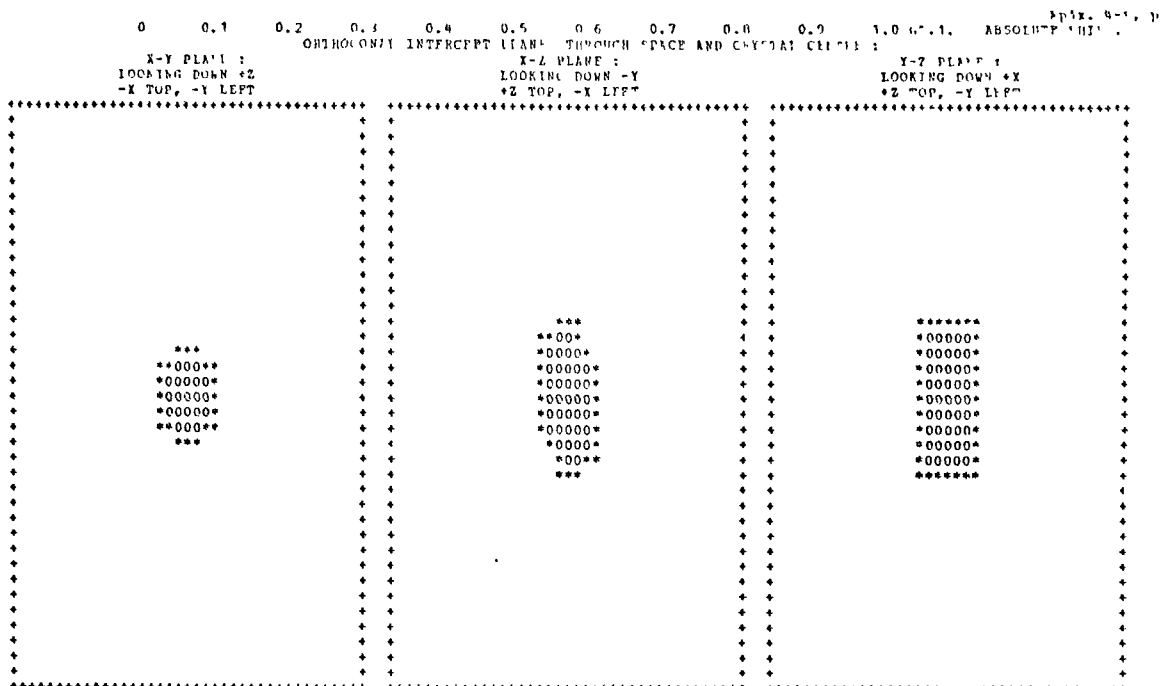
THEORETICAL CRYSTAL AREA = 99.4419 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 72.4998 CUBIC UNITS.
 5 TH SPACIAL DETERMINATION COMPLETED USING 205 MATRIX POINTS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



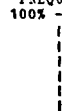
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



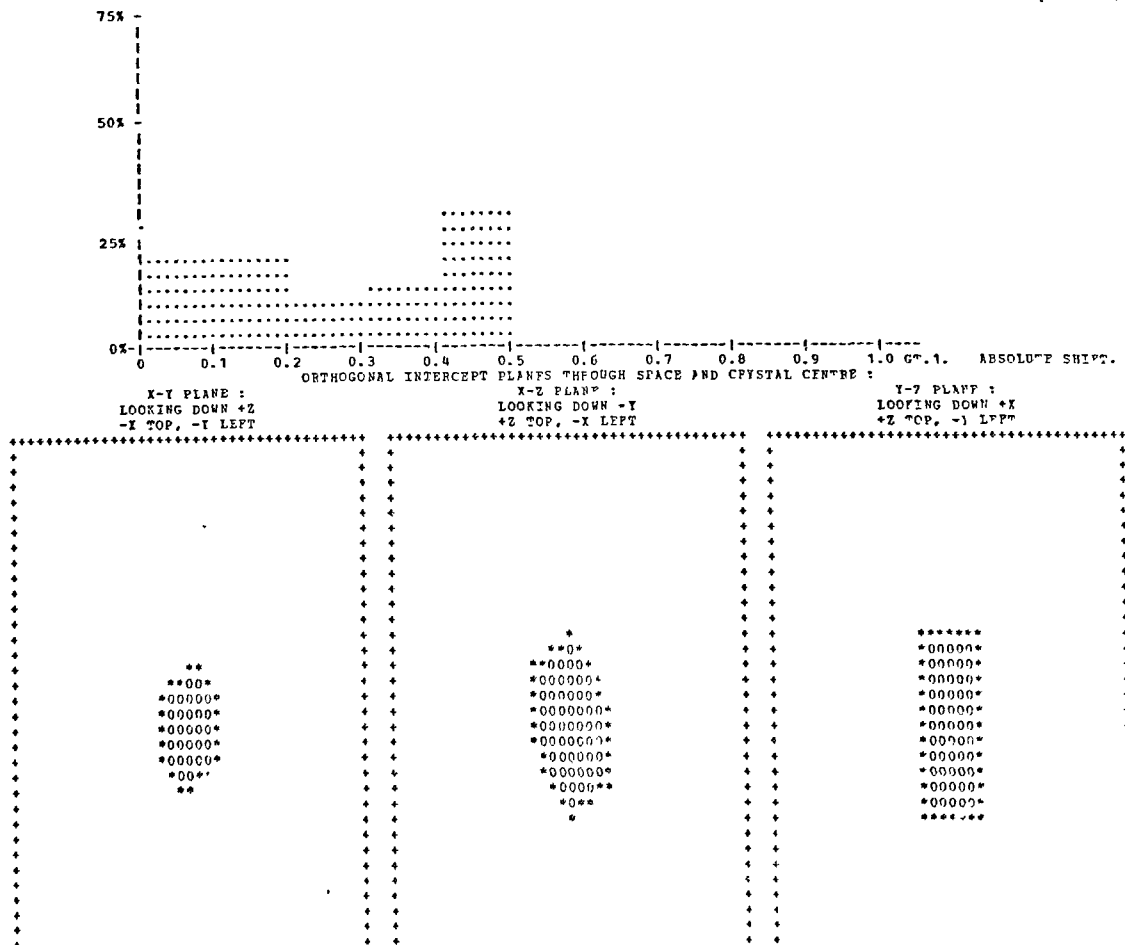


THEORETICAL CRYSTAL AREA = 223.7489 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 244.6874 CUBIC UNITS.
 7 TH SPACIAL DETERMINATION COMPLETED USING 498 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 251 SURFACE AND 247 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO - 1.0 : 0.9841
 MAXIMUM SHIFT = 0.4921 UNITS, MINIMUM SHIFT = 0.0002 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 3.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 6.7823 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 3.3943 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 5.1852 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.1634 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0000 UNITS.
 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

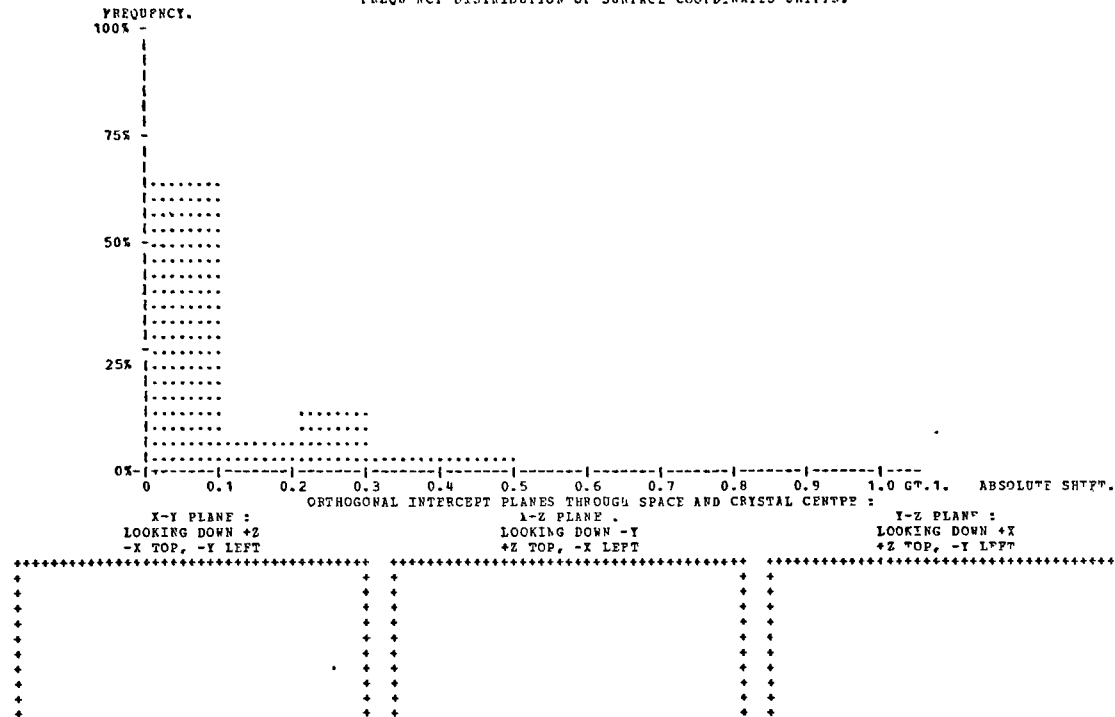
FREQUENCY.



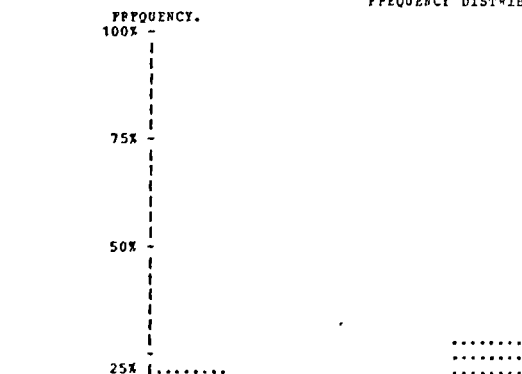
Apdx. 4-f, p. 4

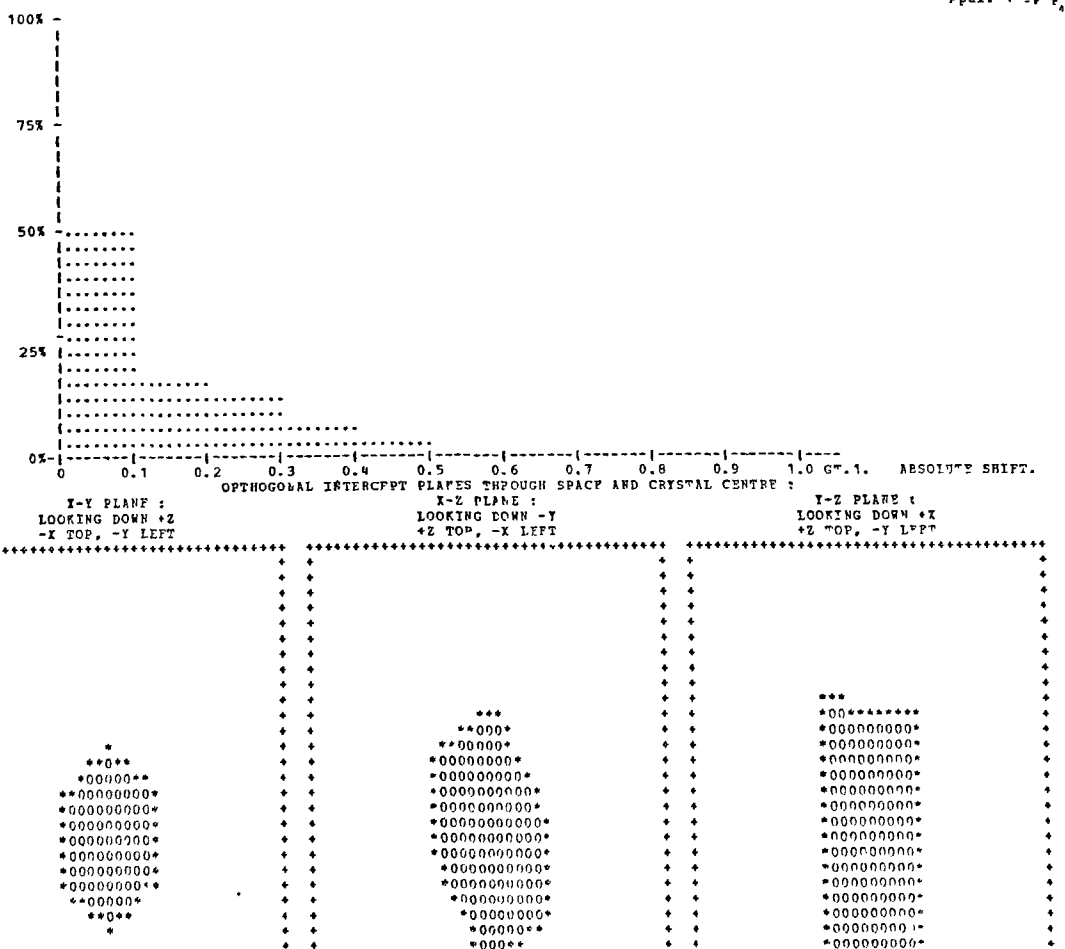
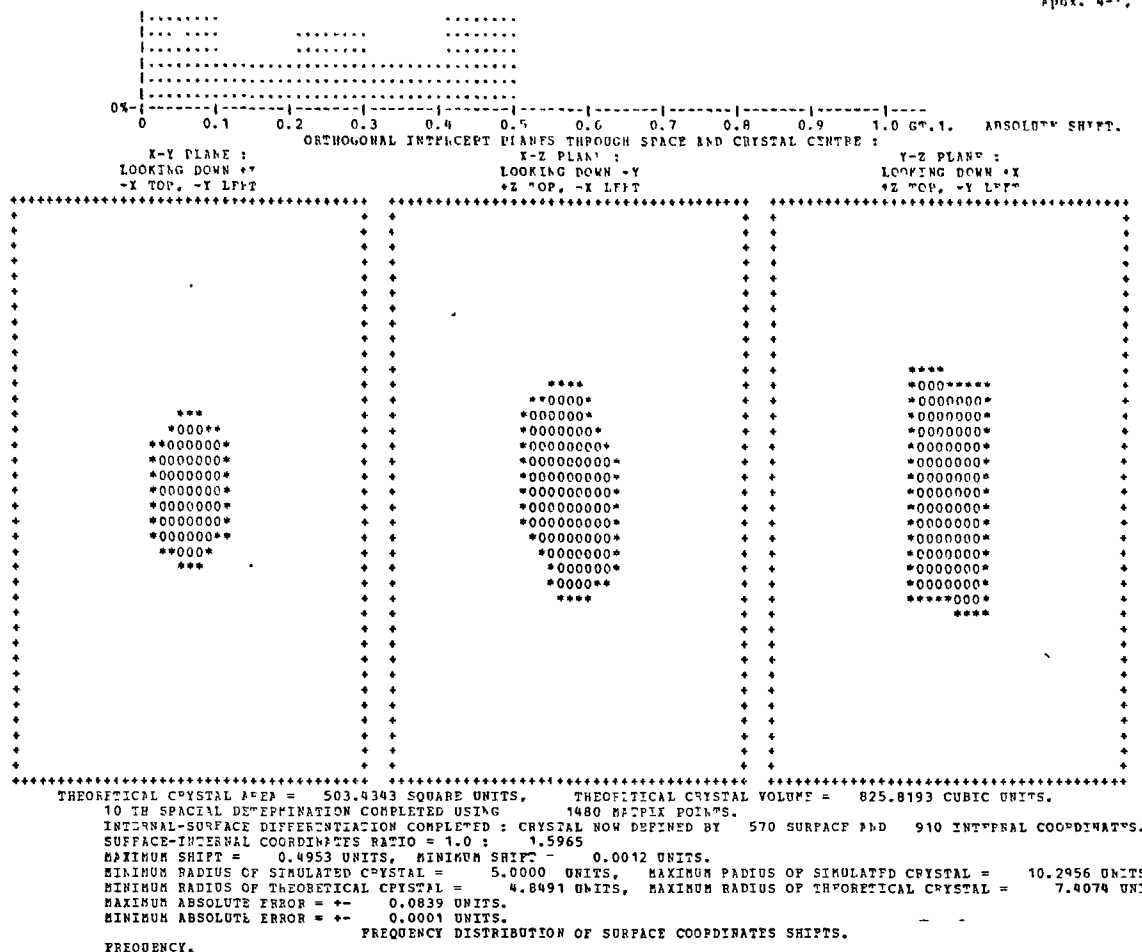


THEORETICAL CRYSTAL AREA = 704.5469 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 300.5537 CUBIC UNITS.
 8 TH SPACIAL DETERMINATION COMPLETED USING 812 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 366 SURFACE AND 446 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.2186
 MAXIMUM SHIFT = 0.4891 UNITS, MINIMUM SHIFT = 0.0036 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 3.6056 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 8.0623 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 3.8793 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 5.9259 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.0059 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0005 UNITS.
 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



THEORETICAL CRYSTAL AREA = 397.7751 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 579.9988 CUBIC UNITS.
 9 TH SPACIAL DETERMINATION COMPLETED USING 1022 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 439 SURFACE AND 583 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 1.3280
 MAXIMUM SHIFT = 0.4966 UNITS, MINIMUM SHIFT = 0.0036 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 4.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 8.9443 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 4.3642 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 6.6666 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.1219 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0005 UNITS.
 FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

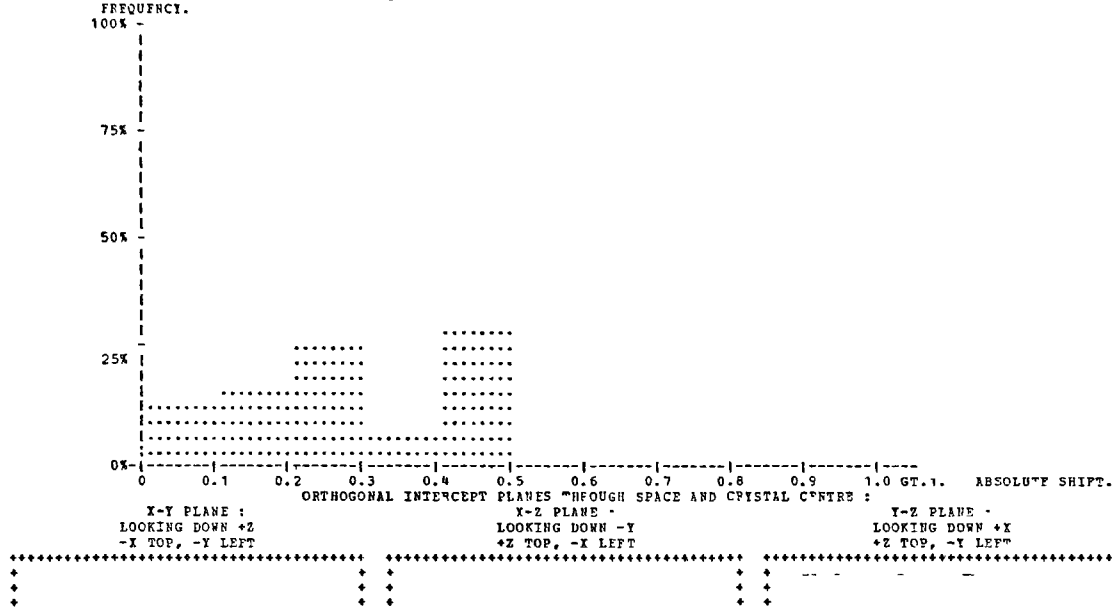




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*****004
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THEORETICAL CRYSTAL AREA = 621.5739 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 1132.8118 CUBIC UNITS.
11 TH SPACIAL DIFFRACTION COMPLETED USING 1792 HARKER POINTS.
INTERNAL-SURFACE DIFFRACTION COMPLETED - CRYSTAL NOW DEFINED BY 662 SURFACE AND 1130 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 - 1.7069
MAXIMUM SHIFT = 0.4961 UNITS, MINIMUM SHIFT = 0.0003 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 5.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 11.1801 UNITS.
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 5.3340 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 8.1481 UNITS.
MAXIMUM ABSOLUTE ERROR = +- 0.0069 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0000 UNITS.
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

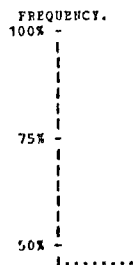
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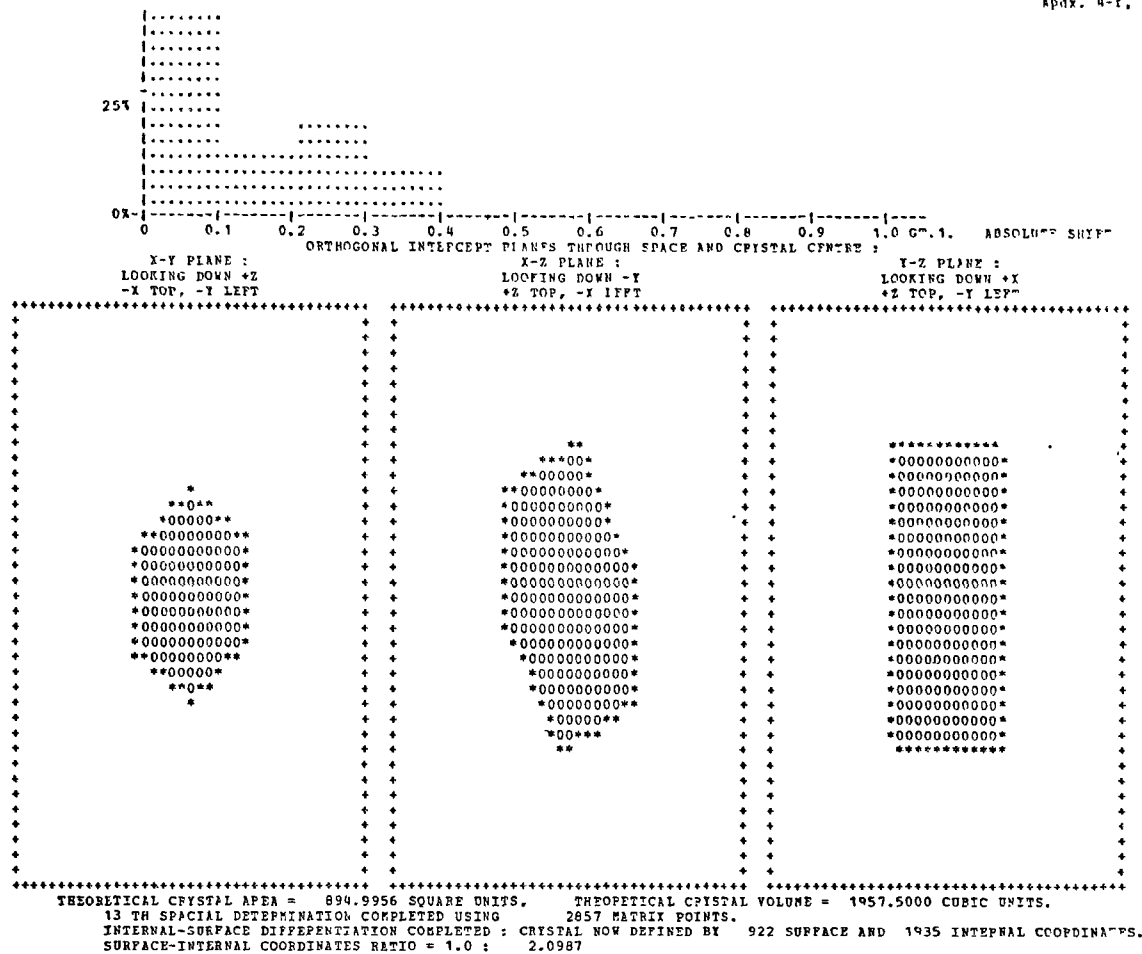


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THEORETICAL CRYSTAL AREA = 757.0444 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 1507.7725 CUBIC UNITS.
12 TH SPACIAL DIFFRACTION COMPLETED USING 2421 HARKER POINTS.
INTERNAL-SURFACE DIFFRACTION COMPLETED - CRYSTAL NOW DEFINED BY 818 SURFACE AND 1603 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 - 1.9597
MAXIMUM SHIFT = 0.4944 UNITS, MINIMUM SHIFT = 0.0007 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 5.6569 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 11.7047 UNITS.
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 5.0189 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 8.8849 UNITS.
MAXIMUM ABSOLUTE ERROR = +- 0.0545 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0001 UNITS.
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

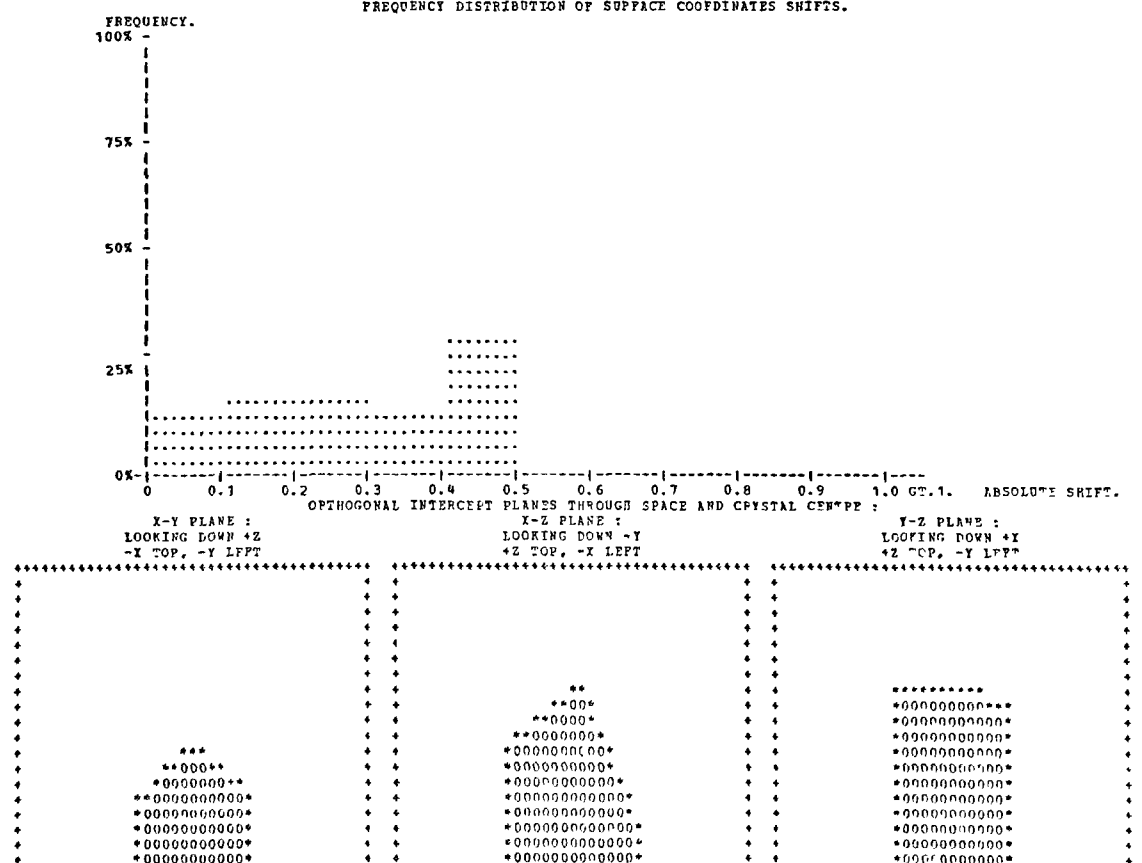
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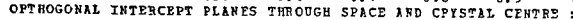
MAXIMUM SHIFT = 0.4819 UNITS, MINIMUM SHIFT = 0.0013 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 6.0000 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 12.5698 UNITS
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 6.3038 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 9.6296 UNITS
MAXIMUM ABSOLUTE ERROR = +- 0.0803 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0001 UNITS.

Apdx. 4-f, p



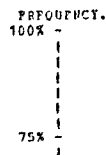
17 dx. 4-6, p.

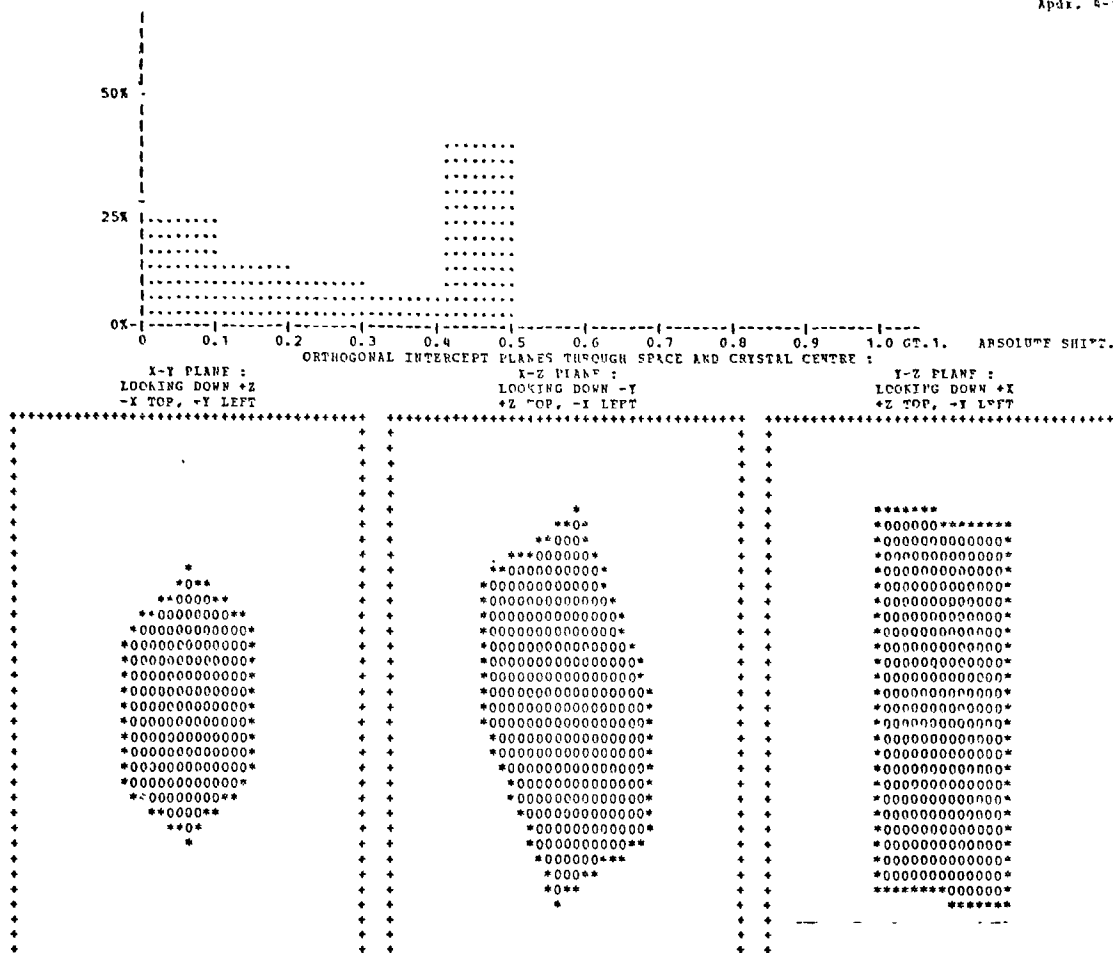
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.



Ррѡх. 4-ѣ, рѡ

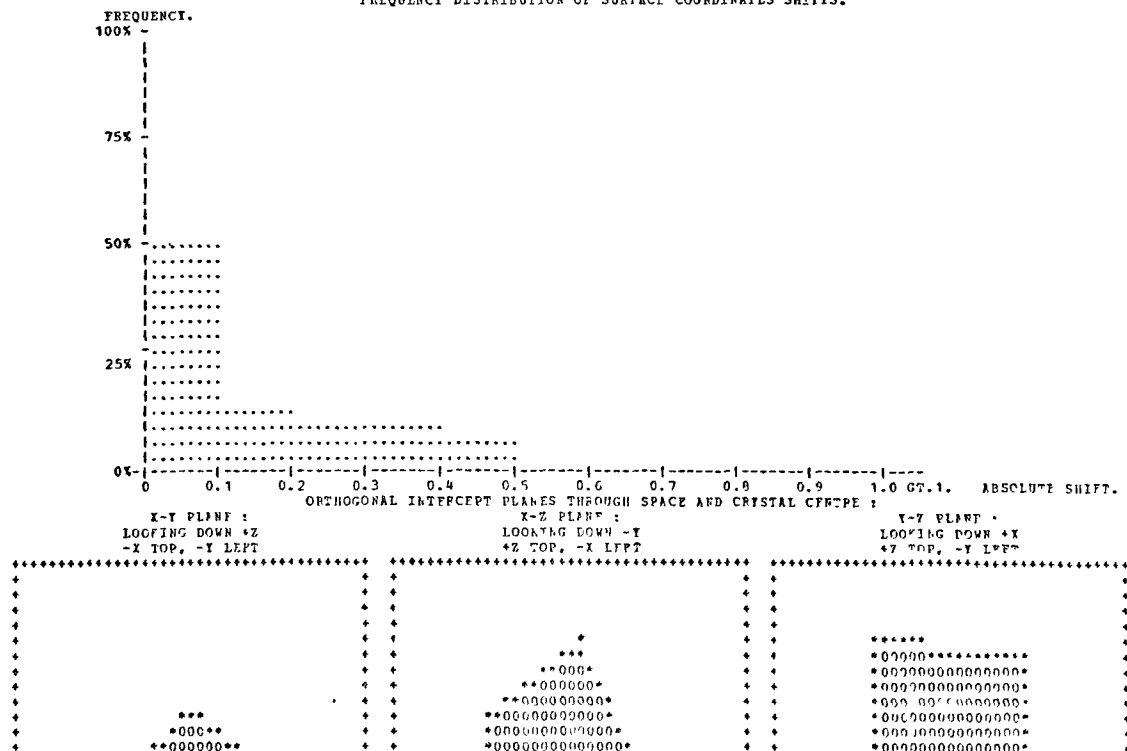
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

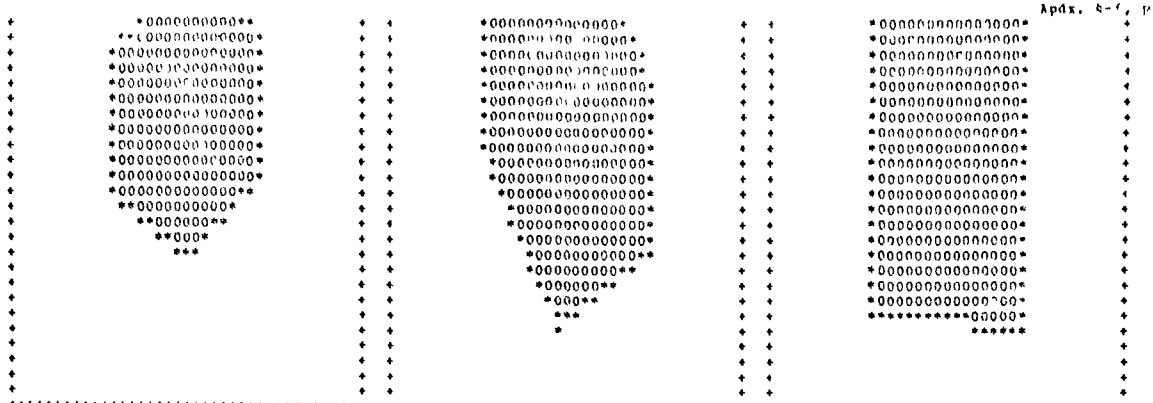




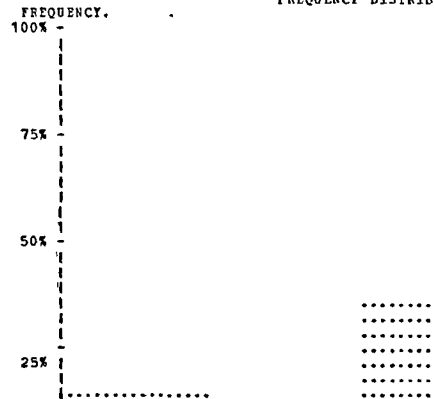
THEORETICAL CRYSTAL AREA = 1398.4312 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 3823.2449 CUBIC UNITS.
16 TH SPECIAL DETERMINATION COMPLETED USING 5511 MATRIX POINTS.
INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 1446 SURFACE AND 4065 INTERNAL COORDINATES.
SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 2.8112
MINIMUM SHIFT = 0.4999 UNITS, MINIMUM SHIFT = 0.0020 UNITS.
MINIMUM RADIUS OF SIMULATED CRYSTAL = 7.6158 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 16.1555 UNITS
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 7.7585 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 11.6518 UNITS
MINIMUM ABSOLUTE ERROR = +- 0.0495 UNITS.
MINIMUM ABSOLUTE ERROR = +- 0.0002 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

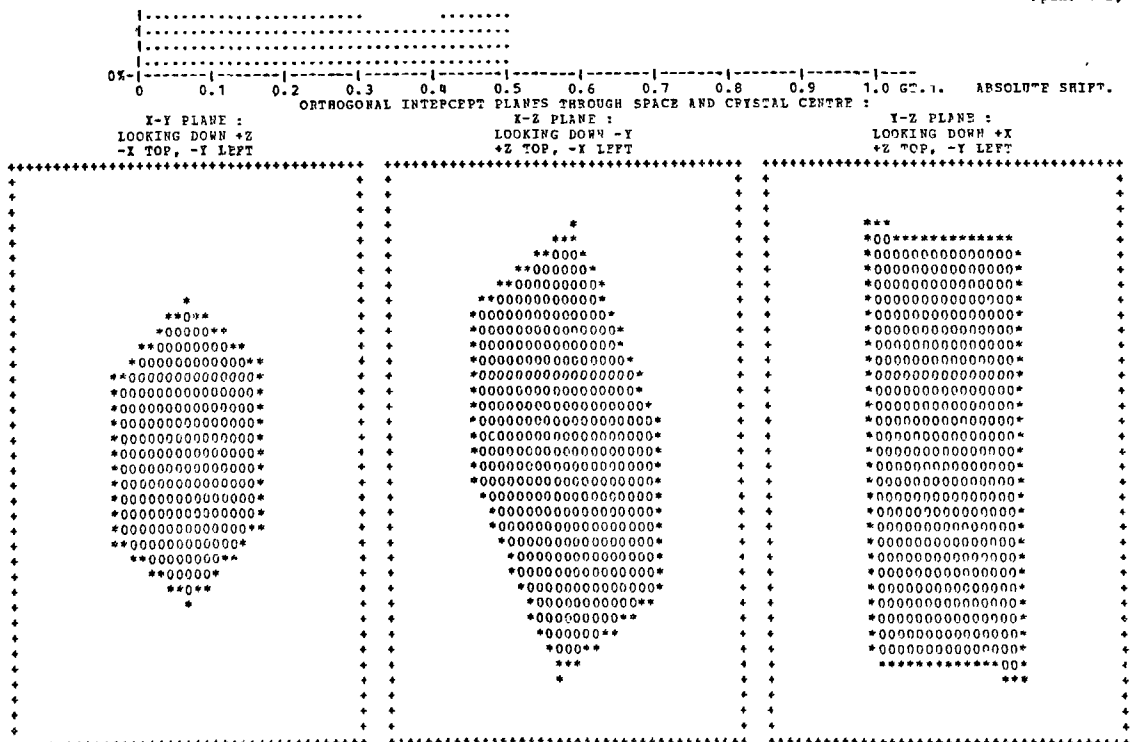




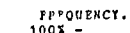
FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

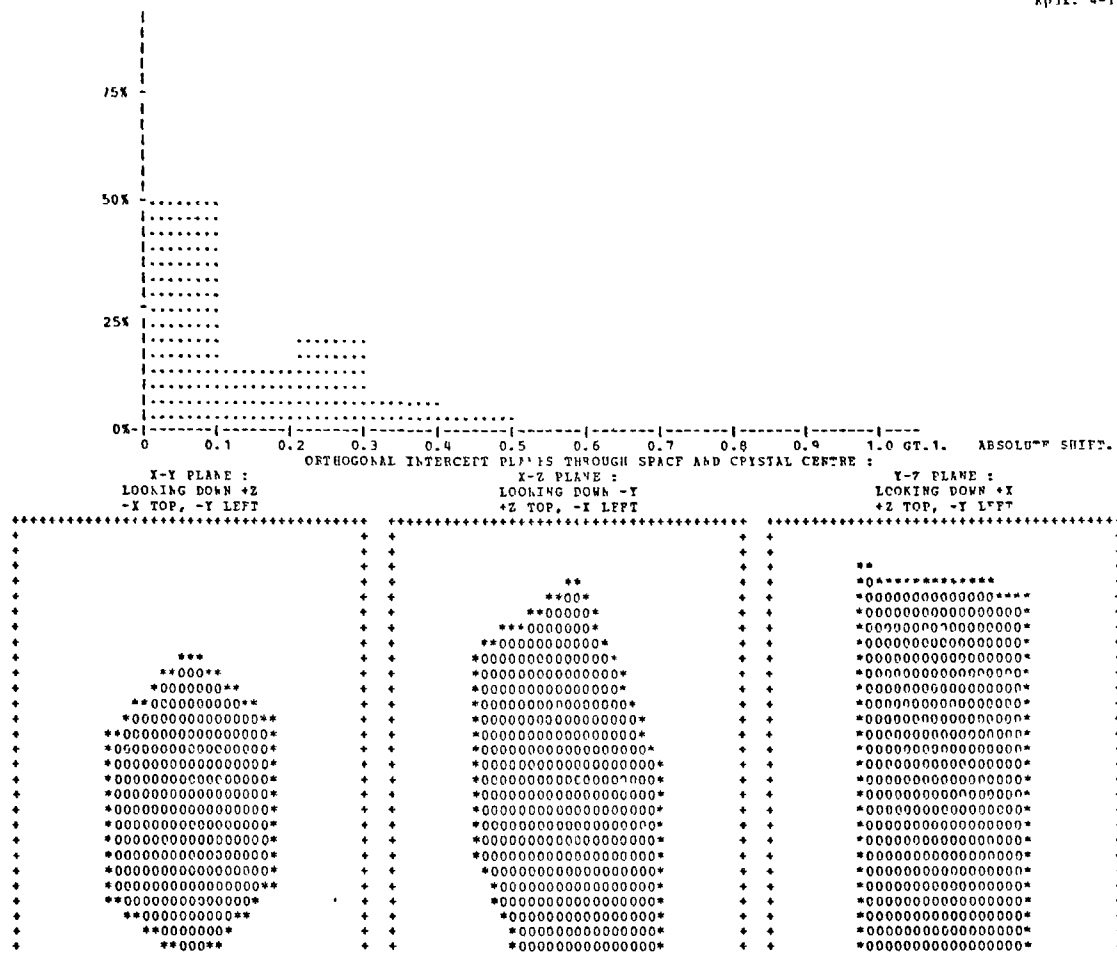


Apdx. 4-f, p



FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.





THEORETICAL CRYSTAL AREA = 2013.7402 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 6606.5547 CUBIC UNITS.

19 TH SPACIAL DIFFERENTIATION COMPLETED USING 8596 MATRIX POINTS.

INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 1969 SURFACE AND 6627 INTERNAL COORDINATES.

SURFACE-INTERNAL COORDINATES RATIO = 1.0 * 3.3657

MAXIMUM SHIFT = 0.4592 UNITS, MINIMUM SHIFT = 0.0012 UNITS.

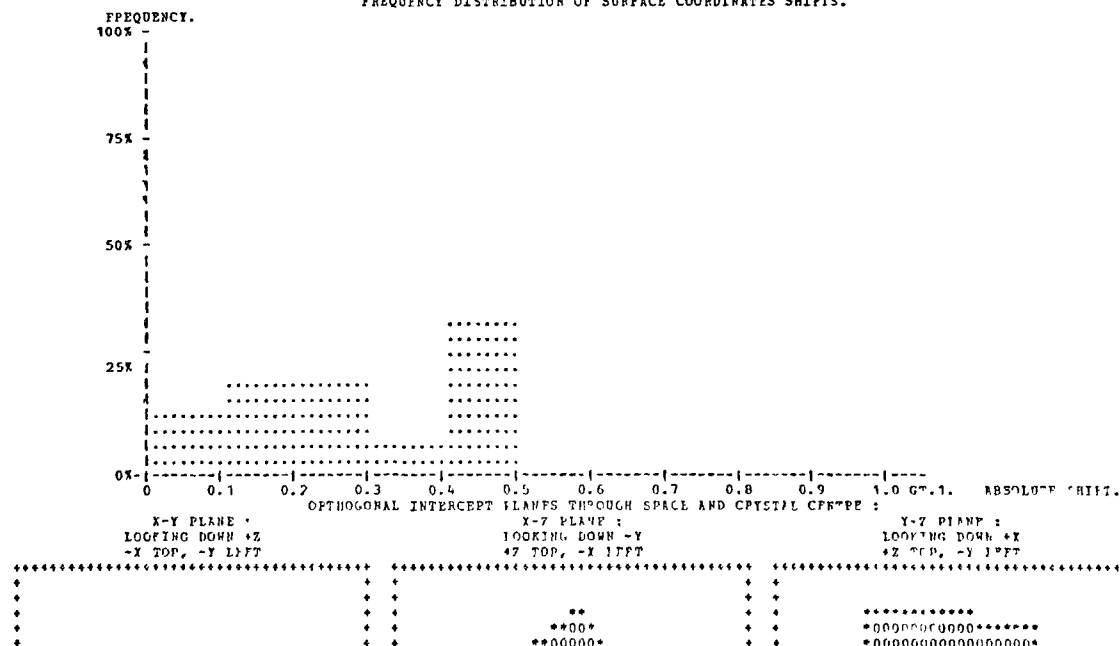
MINIMUM RADIUS OF SIMULATED CRYSTAL = 8.9443 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 19.2614 UNITS

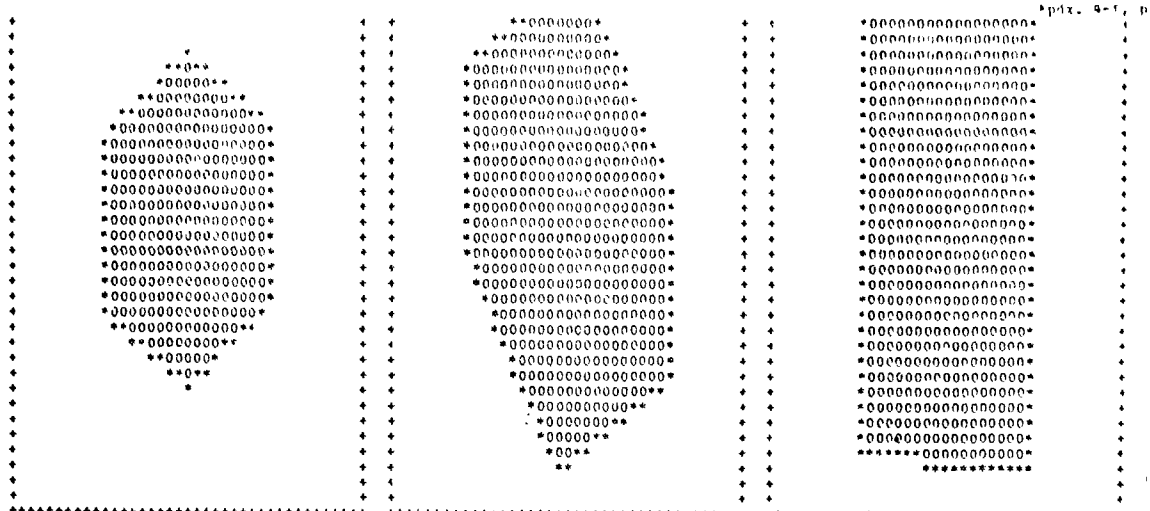
MINIMUM RADIUS OF THEORETICAL CRYSTAL = 9.2132 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 14.0740 UNITS

MAXIMUM ABSOLUTE ERROR = +- 0.0526 UNITS.

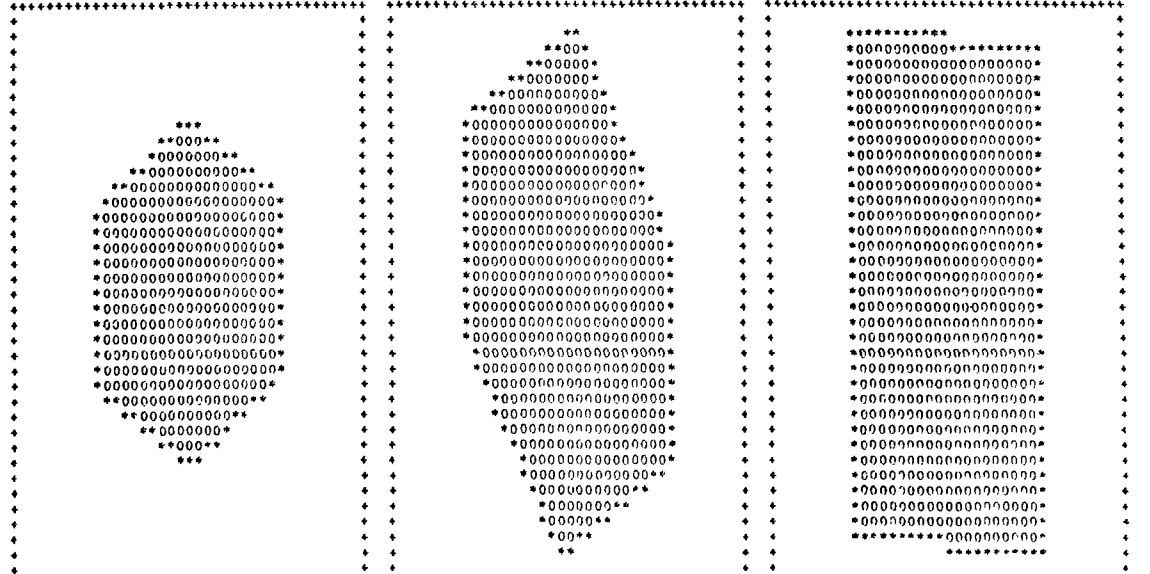
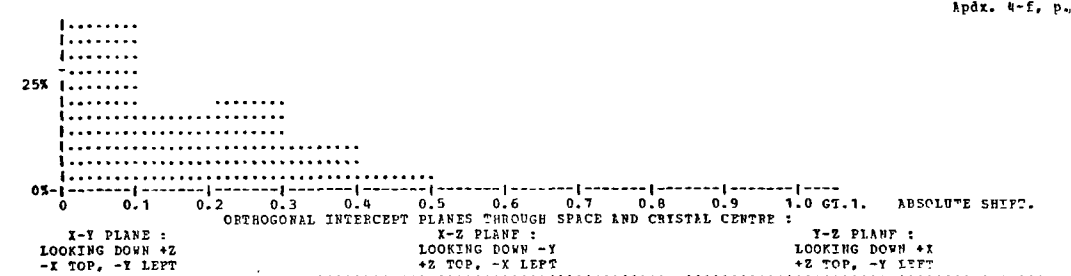
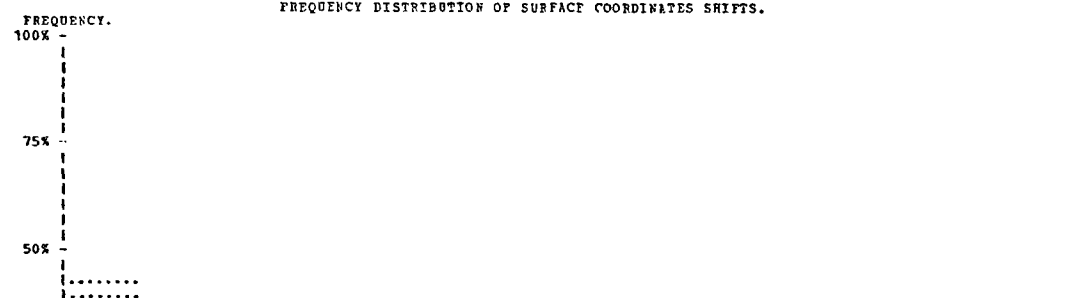
MINIMUM ABSOLUTE ERROR = +- 0.0001 UNITS.

FREQUENCY DISTRIBUTION OF SURFACE COORDINATES SHIFTS.

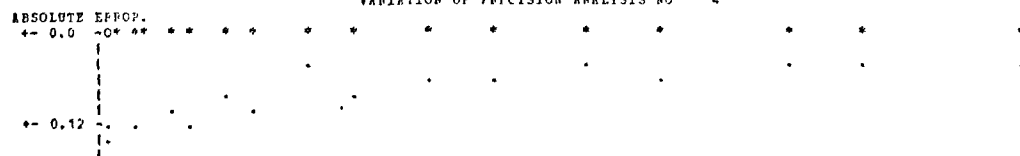
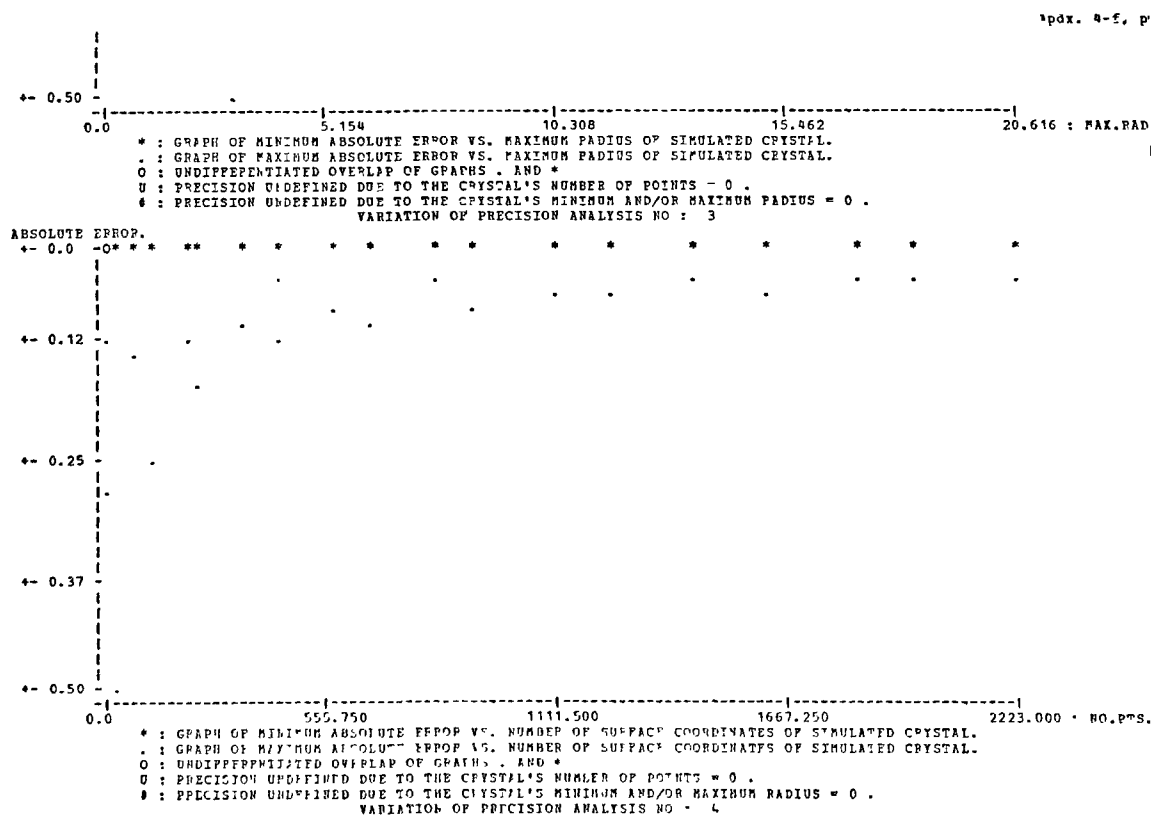
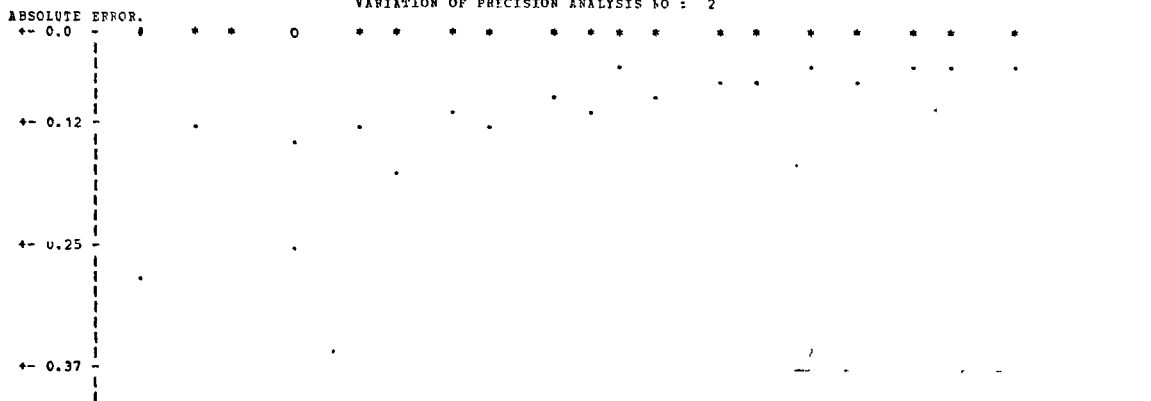
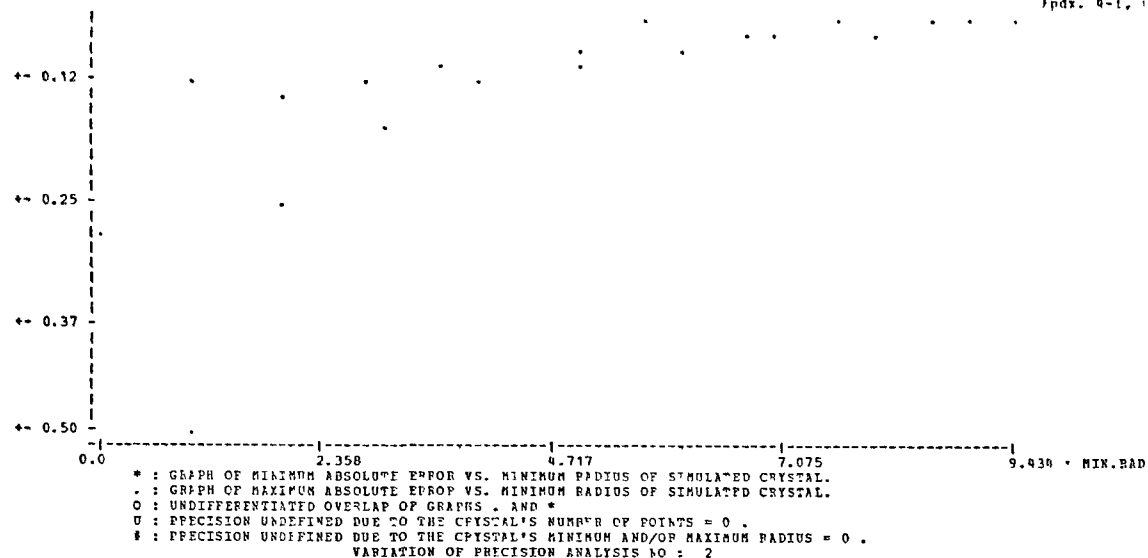


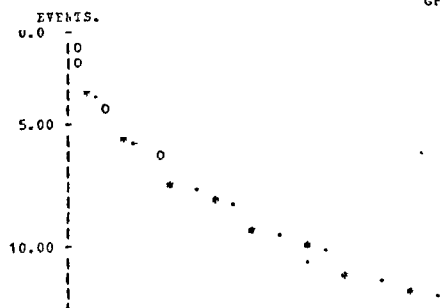
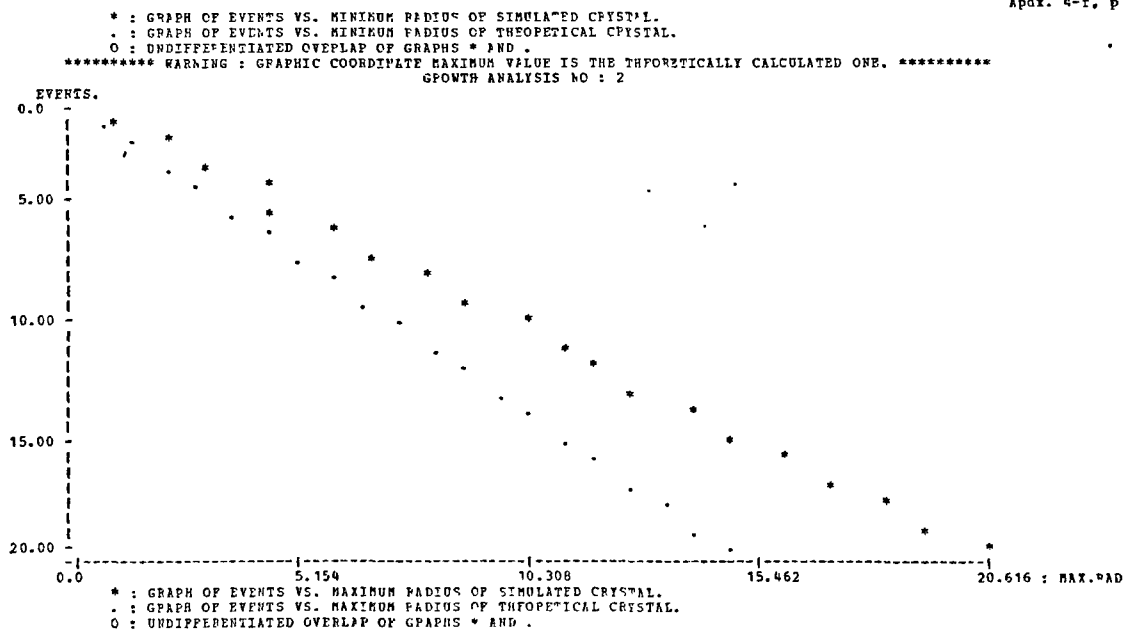
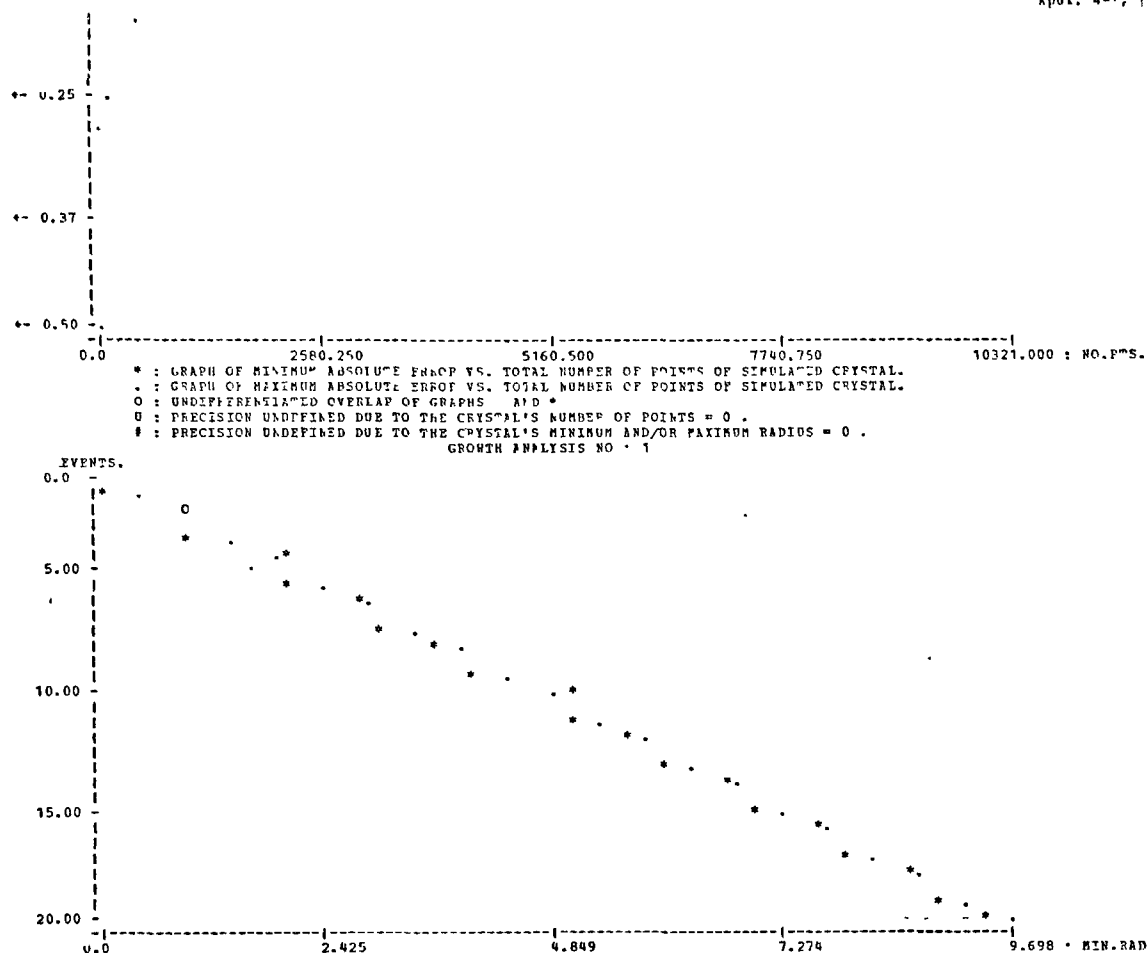


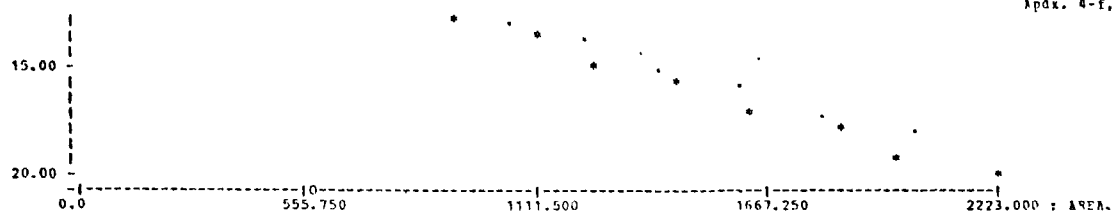
THEORETICAL CRYSTAL AREA = 2243.7048 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 7769.9531 CUBIC UNITS.
 20 TH SPACIAL DIFFRACTION COMPLETED USING 10321 MATRIX POINTS.
 INTERNAL-SURFACE DIFFERENTIATION COMPLETED : CRYSTAL NOW DEFINED BY 2223 SURFACE AND 8098 INTERNAL COORDINATES.
 SURFACE-INTERNAL COORDINATES RATIO = 1.0 : 3.6428
 MAXIMUM SHIFT = 0.4982 UNITS, MINIMUM SHIFT = 0.0018 UNITS.
 MINIMUM RADIUS OF SIMULATED CRYSTAL = 9.4340 UNITS, MAXIMUM RADIUS OF SIMULATED CRYSTAL = 20.6155 UNITS.
 MINIMUM RADIUS OF THEORETICAL CRYSTAL = 9.6982 UNITS, MAXIMUM RADIUS OF THEORETICAL CRYSTAL = 14.8147 UNITS.
 MAXIMUM ABSOLUTE ERROR = +- 0.0447 UNITS.
 MINIMUM ABSOLUTE ERROR = +- 0.0001 UNITS.



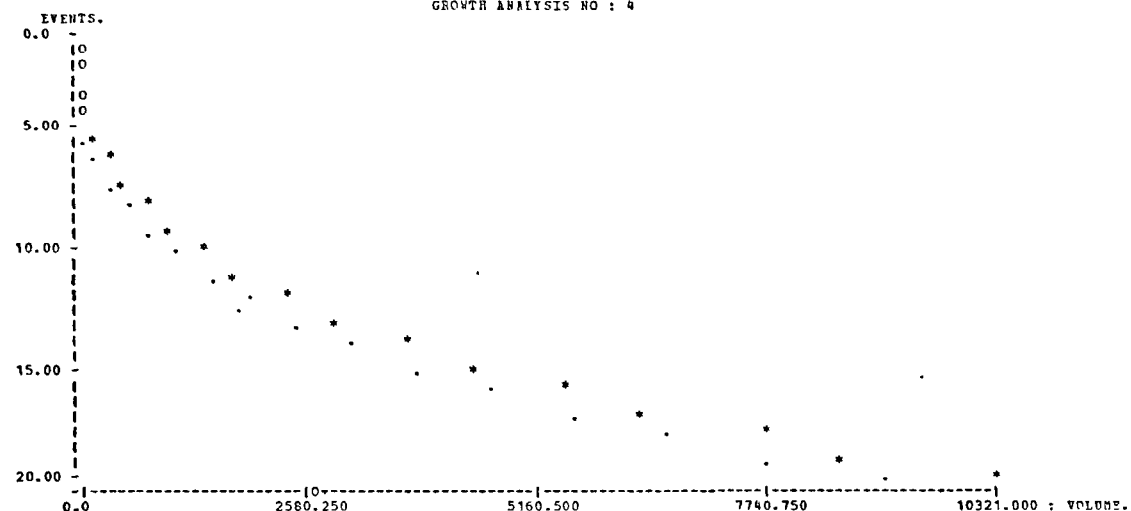
THEORETICAL CRYSTAL AREA = 2486.0991 SQUARE UNITS, THEORETICAL CRYSTAL VOLUME = 9062.4922 CUBIC UNITS.
 TERMINATION ON THE 21 TH ITERATION : CRYSTAL TOO BIG FOR ALLOWED SPACE, BORDER COORDINATE 19 10 39 BELONGS TO THE INTER
 VARIATION OF PRECISION ANALYSIS NO : 1
 ABSOLUTE ERROR.
 +- 0.0







* : GRAPH OF EVENTS VS. NUMBER OF SURFACE COORDINATES OF THE SIMULATED CRYSTAL.
 . : GRAPH OF EVENTS VS. CALCULATED SURFACE AREA OF THEORETICAL CRYSTAL.
 O : UNDIFFERENTIATED OVERLAP OF GRAPHS * AND .
 GROWTH ANALYSIS NO : 4



* : GRAPH OF EVENTS VS. TOTAL NUMBER OF POINTS OF SIMULATED CRYSTAL.
 . : GRAPH OF EVENTS VS. CALCULATED VOLUME OF THEORETICAL CRYSTAL.
 O : UNDIFFERENTIATED OVERLAP OF GRAPHS * AND .
 NORMAL ENDING OF OPERATIONS.

APPENDIX 5

LISTING OF THE FORTRAN STATEMENTS MAKING UP 'VISION', A PROGRAM DESIGNED TO DISPLAY THE CRYSTALS STORED IN THE SPACE SIMULATING MATRIX.

[illegible]

```

1 SN 0052 C ALL T,X,T,(C,L,4)
1 SN 0053 D J 4 =1,M,T,V I
1 SN 0054 A=NMV(1,1)
1 SN 0055 B=NMV(1,2)
1 SN 0056 C=NMV(1,3)
1 SN 0057 CALL T,X,T,(A,B,C,LT)
1 SN 0059 T=IP(1,1)-X
1 SN 0059 T=IP(1,2)-Y
1 SN 0060 I=JL(1,0)
1 SN 0061 C,LL=I+JL(1,0)
1 SN 0062
1 SN 0063 11 C,LL=T,X,T,(A,B)
1 SN 0064 C,LL=T,T,(C,L)
1 SN 0065 J=J+1
1 SN 0066 I=JL(1,0)
1 SN 0067 D=J-1-1,N,LT,F
1 SN 0068 J=J+1-IP(1,1),(1,1),1)
1 SN 0069 J=J-1-IP(NM,IP(1,2),1)
1 SN 0070 J=J-1-IP(1,1),(1,1),2)
1 SN 0071 J=J-1-IP(1,1),(1,2),C)
1 SN 0072 CALL T,T,IT(1,1,1,1,2)
1 SN 0073 CALL T,T,F(610)
1 SN 0074 7 C,LL=0
1 SN 0075 IS(1,1)=IT(1,1)
1 SN 0076 N=1
1 SN 0077 C,LL=T,X,T,(A,B)
1 SN 0078 C,LL=T,T,(C,L)
1 SN 0079 F=
1 SN 0080 C,LL=T,X,T,(A,B)
1 SN 0081 A=IT(1,1)
1 SN 0082 C=LL(1,2),L
1 SN 0083 I(1,1)=C,L
1 SN 0084 C=LL(1,1)
1 SN 0085 CALL T,T,IP(1,1,1,1,2)
1 SN 0086 J=J+1-IP(1,1),(1,1),1)
1 SN 0087 J=J-1-IP(NM,IP(1,2),1)
1 SN 0088 J=J-1-IP(1,1),(1,1),2)
1 SN 0089 J=J-1-IP(1,1),(1,2),C)
1 SN 0090 CALL T,T,IT(1,1,1,1,2)
1 SN 0091 CALL T,T,F(610)
1 SN 0092 11 C,LL=T,X,T,(A,B)
1 SN 0093 C,LL=T,T,(C,L)
1 SN 0094 F=
1 SN 0095 C,LL=T,X,T,(A,B)
1 SN 0096 A=IT(1,1)
1 SN 0097 C=LL(1,2),L
1 SN 0098 I(1,1)=C,L
1 SN 0099 C=LL(1,1)
1 SN 0100 CALL T,T,IP(1,1,1,1,2)
1 SN 0101 J=J+1-IP(1,1),(1,1),1)
1 SN 0102 J=J-1-IP(NM,IP(1,2),1)
1 SN 0103 J=J-1-IP(1,1),(1,1),2)
1 SN 0104 J=J-1-IP(1,1),(1,2),C)
1 SN 0105 CALL T,T,IT(1,1,1,1,2)
1 SN 0106 CALL T,T,F(610)
1 SN 0107 11 C,LL=T,X,T,(A,B)
1 SN 0108 C,LL=T,T,(C,L)
1 SN 0109 F=
1 SN 0110 C,LL=T,X,T,(A,B)
1 SN 0111 A=IT(1,1)
1 SN 0112 C=LL(1,2),L
1 SN 0113 I(1,1)=C,L
1 SN 0114 C=LL(1,1)
1 SN 0115 CALL T,T,IP(1,1,1,1,2)
1 SN 0116 J=J+1-IP(1,1),(1,1),1)
1 SN 0117 J=J-1-IP(NM,IP(1,2),1)
1 SN 0118 J=J-1-IP(1,1),(1,1),2)
1 SN 0119 J=J-1-IP(1,1),(1,2),C)
1 SN 0120 CALL T,T,IT(1,1,1,1,2)
1 SN 0121 CALL T,T,F(610)
1 SN 0122 11 C,LL=T,X,T,(A,B)
1 SN 0123 C,LL=T,T,(C,L)
1 SN 0124 F=
1 SN 0125 C,LL=T,X,T,(A,B)
1 SN 0126 A=IT(1,1)
1 SN 0127 C=LL(1,2),L
1 SN 0128 I(1,1)=C,L
1 SN 0129 C=LL(1,1)
1 SN 0130 CALL T,T,IP(1,1,1,1,2)
1 SN 0131 J=J+1-IP(1,1),(1,1),1)
1 SN 0132 J=J-1-IP(NM,IP(1,2),1)
1 SN 0133 J=J-1-IP(1,1),(1,1),2)
1 SN 0134 J=J-1-IP(1,1),(1,2),C)
1 SN 0135 CALL T,T,IT(1,1,1,1,2)
1 SN 0136 CALL T,T,F(610)
1 SN 0137 11 C,LL=T,X,T,(A,B)
1 SN 0138 C,LL=T,T,(C,L)
1 SN 0139 F=
1 SN 0140 C,LL=T,X,T,(A,B)
1 SN 0141 A=IT(1,1)
1 SN 0142 C=LL(1,2),L
1 SN 0143 I(1,1)=C,L
1 SN 0144 C=LL(1,1)
1 SN 0145 CALL T,T,IP(1,1,1,1,2)
1 SN 0146 J=J+1-IP(1,1),(1,1),1)
1 SN 0147 J=J-1-IP(NM,IP(1,2),1)
1 SN 0148 J=J-1-IP(1,1),(1,1),2)
1 SN 0149 J=J-1-IP(1,1),(1,2),C)
1 SN 0150 CALL T,T,IT(1,1,1,1,2)
1 SN 0151 CALL T,T,F(610)
1 SN 0152 11 C,LL=T,X,T,(A,B)
1 SN 0153 C,LL=T,T,(C,L)
1 SN 0154 F=
1 SN 0155 C,LL=T,X,T,(A,B)
1 SN 0156 A=IT(1,1)
1 SN 0157 C=LL(1,2),L
1 SN 0158 I(1,1)=C,L
1 SN 0159 C=LL(1,1)
1 SN 0160 CALL T,T,IP(1,1,1,1,2)
1 SN 0161 J=J+1-IP(1,1),(1,1),1)
1 SN 0162 J=J-1-IP(NM,IP(1,2),1)
1 SN 0163 J=J-1-IP(1,1),(1,1),2)
1 SN 0164 J=J-1-IP(1,1),(1,2),C)
1 SN 0165 CALL T,T,IT(1,1,1,1,2)
1 SN 0166 CALL T,T,F(610)
1 SN 0167 11 C,LL=T,X,T,(A,B)
1 SN 0168 C,LL=T,T,(C,L)
1 SN 0169 F=
1 SN 0170 C,LL=T,X,T,(A,B)
1 SN 0171 A=IT(1,1)
1 SN 0172 C=LL(1,2),L
1 SN 0173 I(1,1)=C,L
1 SN 0174 C=LL(1,1)
1 SN 0175 CALL T,T,IP(1,1,1,1,2)
1 SN 0176 J=J+1-IP(1,1),(1,1),1)
1 SN 0177 J=J-1-IP(NM,IP(1,2),1)
1 SN 0178 J=J-1-IP(1,1),(1,1),2)
1 SN 0179 J=J-1-IP(1,1),(1,2),C)
1 SN 0180 CALL T,T,IT(1,1,1,1,2)
1 SN 0181 CALL T,T,F(610)
1 SN 0182 11 C,LL=T,X,T,(A,B)
1 SN 0183 C,LL=T,T,(C,L)
1 SN 0184 F=
1 SN 0185 C,LL=T,X,T,(A,B)
1 SN 0186 A=IT(1,1)
1 SN 0187 C=LL(1,2),L
1 SN 0188 I(1,1)=C,L
1 SN 0189 C=LL(1,1)
1 SN 0190 CALL T,T,IP(1,1,1,1,2)
1 SN 0191 J=J+1-IP(1,1),(1,1),1)
1 SN 0192 J=J-1-IP(NM,IP(1,2),1)
1 SN 0193 J=J-1-IP(1,1),(1,1),2)
1 SN 0194 J=J-1-IP(1,1),(1,2),C)
1 SN 0195 CALL T,T,IT(1,1,1,1,2)
1 SN 0196 CALL T,T,F(610)
1 SN 0197 11 C,LL=T,X,T,(A,B)
1 SN 0198 C,LL=T,T,(C,L)
1 SN 0199 F=
1 SN 0200 C,LL=T,X,T,(A,B)
1 SN 0201 A=IT(1,1)
1 SN 0202 C=LL(1,2),L
1 SN 0203 I(1,1)=C,L
1 SN 0204 C=LL(1,1)
1 SN 0205 CALL T,T,IP(1,1,1,1,2)
1 SN 0206 J=J+1-IP(1,1),(1,1),1)
1 SN 0207 J=J-1-IP(NM,IP(1,2),1)
1 SN 0208 J=J-1-IP(1,1),(1,1),2)
1 SN 0209 J=J-1-IP(1,1),(1,2),C)
1 SN 0210 CALL T,T,IT(1,1,1,1,2)
1 SN 0211 CALL T,T,F(610)
1 SN 0212 11 C,LL=T,X,T,(A,B)
1 SN 0213 C,LL=T,T,(C,L)
1 SN 0214 F=
1 SN 0215 C,LL=T,X,T,(A,B)
1 SN 0216 A=IT(1,1)
1 SN 0217 C=LL(1,2),L
1 SN 0218 I(1,1)=C,L
1 SN 0219 C=LL(1,1)
1 SN 0220 CALL T,T,IP(1,1,1,1,2)
1 SN 0221 J=J+1-IP(1,1),(1,1),1)
1 SN 0222 J=J-1-IP(NM,IP(1,2),1)
1 SN 0223 J=J-1-IP(1,1),(1,1),2)
1 SN 0224 J=J-1-IP(1,1),(1,2),C)
1 SN 0225 CALL T,T,IT(1,1,1,1,2)
1 SN 0226 CALL T,T,F(610)
1 SN 0227 11 C,LL=T,X,T,(A,B)
1 SN 0228 C,LL=T,T,(C,L)
1 SN 0229 F=
1 SN 0230 C,LL=T,X,T,(A,B)
1 SN 0231 A=IT(1,1)
1 SN 0232 C=LL(1,2),L
1 SN 0233 I(1,1)=C,L
1 SN 0234 C=LL(1,1)
1 SN 0235 CALL T,T,IP(1,1,1,1,2)
1 SN 0236 J=J+1-IP(1,1),(1,1),1)
1 SN 0237 J=J-1-IP(NM,IP(1,2),1)
1 SN 0238 J=J-1-IP(1,1),(1,1),2)
1 SN 0239 J=J-1-IP(1,1),(1,2),C)
1 SN 0240 CALL T,T,IT(1,1,1,1,2)
1 SN 0241 CALL T,T,F(610)
1 SN 0242 11 C,LL=T,X,T,(A,B)
1 SN 0243 C,LL=T,T,(C,L)
1 SN 0244 F=
1 SN 0245 C,LL=T,X,T,(A,B)
1 SN 0246 A=IT(1,1)
1 SN 0247 C=LL(1,2),L
1 SN 0248 I(1,1)=C,L
1 SN 0249 C=LL(1,1)
1 SN 0250 CALL T,T,IP(1,1,1,1,2)
1 SN 0251 J=J+1-IP(1,1),(1,1),1)
1 SN 0252 J=J-1-IP(NM,IP(1,2),1)
1 SN 0253 J=J-1-IP(1,1),(1,1),2)
1 SN 0254 J=J-1-IP(1,1),(1,2),C)
1 SN 0255 CALL T,T,IT(1,1,1,1,2)
1 SN 0256 CALL T,T,F(610)
1 SN 0257 11 C,LL=T,X,T,(A,B)
1 SN 0258 C,LL
```

```

1 N 011      I(1)= 70.0
1 N 0111     ( )=-70.0
1 N 0114     I(4) =  .0
1 N 0115     GO TO 10
1 N 0116     STOP
1 N 0117     END

```

LEVEL 21.7 (JAN 73)

US/360 FORTRAN H

```

COMPILER OPTIONS NAME= MAIN,OPT=07,LIN CNT=60,SIZE=0000K,
SOURCE,LCODIC,NCLIST,NODECK,LCAD,MAP,NODEIT,1D,NOXREF
1 N 0002     SUBROUTINE TRANS(X1,Y1,Z1,BETA)
1 N 0003     REAL FATA(3,3)/Z*1E+0,2*2 .0,2*15.0,2*25.0,15.0,25.0,15.0,25.0,
1 N 0004     COMMON /EC 44/ EX,EY
1 N 0005     COMMON /IAT IX/ TRP(3,3),CCN,DSCALE
1 N 0006     COMMON /EYL/ E1,F2,F3
1 N 0007     AA=E1-20.0
1 N 0008     BB=E2-20.0
1 N 0009     CC=F3-20.0
1 N 0010     DD=SQRT(AA**2+(BB**2+CC**2))
1 N 0011     A=AA/DD
1 N 0012     B=CC/DD
1 N 0013     C=CC/DD
1 N 0014     D=SQRT(1.0-C**2)
1 N 0015     TRP(1,1)=B
1 N 0016     TRP(1,2)=-A
1 N 0017     TRP(1,3)=0.0
1 N 0018     TRP(2,1)=-A*B
1 N 0019     TRP(2,2)=-A*C
1 N 0020     TRP(2,3)=D*D
1 N 0021     TRP(3,1)=A*D
1 N 0022     TRP(3,2)=B*D
1 N 0023     TRP(3,3)=C*D
1 N 0024     CON=1.0/D
1 N 0025     Y=0.0
1 N 0026     DSCALE=1.0
1 N 0027     DO 2 I=1,8
1 N 0028     CALL TRANS(FATA(I,1),FATA(I,2),FATA(I,3),BETA)
1 N 0029     IF (ABS(EY).GT.Y) Y=ABS(EY)
1 N 0030     2 CONTINUE
1 N 0031     DSCALE=390.0/Y
1 N 0032     RETURN
1 N 0033     END
1 N 0034

```

LEVEL 21.7 (JAN 73)

US/360 FORTRAN H

```

COMPILER OPTIONS NAME= MAIN,OPT=02,LIN CNT=60,SIZE=0000K,
SOURCE,LCODIC,NCLIST,NODECK,LCAD,MAP,NODEIT,1D,NOXREF
1 N 0002     SUBROUTINE TRANS(X1,Y1,Z1,BETA)
1 N 0003     REAL T(3)
1 N 0004     COMMON /MATRIX/ TRP(3,3),CCN,DSCALE
1 N 0005     COMMON /ECRAN/ EX,EY
1 N 0006     COMMON /EYL/ E1,E2,E3
1 N 0007     X=X1-F1
1 N 0008     Y=Y1-F2
1 N 0009     Z=Z1-F3
1 N 0010     DO 1 I=1,3
1 N 0011     T(I)=CON*(TRP(1,1)*X+TRP(1,2)*Y+TRP(1,3)*Z)
1 N 0012     C FX=DSCALE*(ETA*T(1)/T(3)
1 N 0013     C EY=DSCALE*BETA*T(2)/T(3)
1 N 0014     C
1 N 0015     RETURN
1 N 0016     END

```

LEVEL 21.7 (JAN 73)

US/360 FORTRAN H

```

COMPILER OPTIONS NAME= MAIN,OPT=02,LIN CNT=60,SIZE=0000K,
SOURCE,LCODIC,NCLIST,NODECK,LCAD,MAP,NODEIT,1D,NOXREF
1 N 0002     SUBROUTINE TATE(*)
1 N 0003     COMMON /TENTPC/ ICODER
1 N 0004     J=ICODER
1 N 0005     ICODER=0
1 N 0006     IF (J.EQ.24) STOP
1 N 0007     IF (J.EQ.24) RETURN
1 N 0008     RETURN
1 N 0009     END

```


ISN 0003		X=(J11) (111)	A 183
ISN 0004		X=(J11) (111)	A 183
ISN 0005		Y=(J11) (111)	A 184
ISN 0006		Y=(J11) (111)	A 184
ISN 0007		Y=(J11) (111)	A 184
ISN 0008	24	Y=(J11) (111)	A 184
ISN 0009	25	Y=(J11) (111)	A 184
ISN 0010	26	Y=(J11) (111)	A 184
ISN 0011	27	Y=(J11) (111)	A 184
ISN 0012	28	Y=(J11) (111)	A 184
ISN 0013		Y=(J11) (111)	A 184
ISN 0014		Y=(J11) (111)	A 184
ISN 0015		Y=(J11) (111)	A 184
ISN 0016		Y=(J11) (111)	A 184
ISN 0017		Y=(J11) (111)	A 184
ISN 0018		Y=(J11) (111)	A 184
ISN 0019		Y=(J11) (111)	A 184
ISN 0020		Y=(J11) (111)	A 184
ISN 0021		Y=(J11) (111)	A 184
ISN 0022		Y=(J11) (111)	A 184
ISN 0023		Y=(J11) (111)	A 184
ISN 0024		Y=(J11) (111)	A 184
ISN 0025		Y=(J11) (111)	A 184
ISN 0026		Y=(J11) (111)	A 184
ISN 0027		Y=(J11) (111)	A 184
ISN 0028		Y=(J11) (111)	A 184
ISN 0029		Y=(J11) (111)	A 184
ISN 0030		Y=(J11) (111)	A 184
ISN 0031		Y=(J11) (111)	A 184
ISN 0032		Y=(J11) (111)	A 184
ISN 0033		Y=(J11) (111)	A 184
ISN 0034		Y=(J11) (111)	A 184
ISN 0035		Y=(J11) (111)	A 184
ISN 0036		Y=(J11) (111)	A 184
ISN 0037		Y=(J11) (111)	A 184
ISN 0038		Y=(J11) (111)	A 184
ISN 0039		Y=(J11) (111)	A 184
ISN 0040		Y=(J11) (111)	A 184
ISN 0041		Y=(J11) (111)	A 184
ISN 0042		Y=(J11) (111)	A 184
ISN 0043		Y=(J11) (111)	A 184
ISN 0044		Y=(J11) (111)	A 184
ISN 0045		Y=(J11) (111)	A 184
ISN 0046		Y=(J11) (111)	A 184
ISN 0047		Y=(J11) (111)	A 184
ISN 0048		Y=(J11) (111)	A 184
ISN 0049		Y=(J11) (111)	A 184
ISN 0050		Y=(J11) (111)	A 184
ISN 0051		Y=(J11) (111)	A 184
ISN 0052		Y=(J11) (111)	A 184
ISN 0053		Y=(J11) (111)	A 184
ISN 0054		Y=(J11) (111)	A 184

LEVEL 21.7 (JUNE 71)

03/300 FORTRAN H

COMPILER OPTIONS		MAIN,OPT=0,LINECNT=50,SIZE=0000K, CUPCF,FCCIC,NCLIST,MOULCK,LCAD,MAP,NOEDIT,IO,NOARCF	
ISN 0003		SUBROUTINE A EVCL	
ISN 0004		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0005		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0006		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0007		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0008		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0009		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0010		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0011		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0012		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0013		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0014		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0015		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0016		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0017		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0018		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0019		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0020		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0021		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0022		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0023		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0024		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0025		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0026		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0027		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0028		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0029		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0030		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0031		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0032		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0033		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0034		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0035		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0036		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0037		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0038		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0039		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0040		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0041		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0042		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0043		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0044		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0045		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0046		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0047		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0048		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0049		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0050		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0051		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0052		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0053		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	
ISN 0054		COMMON /X(50),PY(50),APZ(50),APD(50),APF(50)	

ISN 0055		DO 10 JK=1,N,2	N 56
ISN 0056		IF (Y(JJ).EQ.X4(JK).AND.XP(11).EQ.X4(JK+1).OR.AY(JJ).EQ.Y4(JK+1).	N 57
ISN 0057		1/ND.X4(11).EQ.X4(JK)) GO TO 13	N 58
ISN 0058		CONTINUE	N 59
ISN 0059		II=II+1	N 60
ISN 0060		IF (II.GT.LL) GO TO 12	N 61
ISN 0061		IF (X4(11).EQ.0) GO TO 11	N 62
ISN 0062		GO TO 4	N 63
ISN 0063		WRITE (7,21)	N 64
ISN 0064		FORMAT('1',10X,' EPREU : UN PLAN N A PAS ASSEZ DE POINTS.')	N 65
ISN 0065		JJ=JJ+1	N 66
ISN 0066		AY(JJ)=X4(11)	N 67
ISN 0067		X4(11)=0	N 68
ISN 0068		IF (JJ.LT.LL) GO TO 8	N 69
ISN 0069			N 70
ISN 0070			N 71
ISN 0071			N 72
ISN 0072			N 73
ISN 0073			N 74
ISN 0074			N 75
ISN 0075			N 76
ISN 0076			N 77
ISN 0077			N 78
ISN 0078			N 79
ISN 0079			N 80
ISN 0080			N 81
ISN 0081			N 82
ISN 0082			N 83
ISN 0083			N 84
ISN 0084			N 85
ISN 0085			N 86
ISN 0086			N 87
ISN 0087			N 88
ISN 0088			N 89
ISN 0089			N 90
ISN 0090			N 91
ISN 0091			N 92
ISN 0092			N 93
ISN 0093			N 94
ISN 0094			N 95
ISN 0095			N 96
ISN 0096			N 97
ISN 0097			N 98
ISN 0098			N 99
ISN 0099			N 100
ISN 0100			N 101
ISN 0101			N 102
ISN 0102			N 103
ISN 0103			N 104
ISN 0104			N 105
ISN 0105			N 106
ISN 0106			N 107
ISN 0107			N 108
ISN 0108			N 109
ISN 0109			N 110
ISN 0110			N 111
ISN 0111			N 112
ISN 0112			N 113
ISN 0113			N 114
ISN 0114			N 115
ISN 0115			N 116
ISN 0116			N 117
ISN 0117			N 118
ISN 0118			N 119
ISN 0119			N 120
ISN 0120			N 121
ISN 0121			N 122
ISN 0122			N 123
ISN 0123			N 124
ISN 0124			N 125
ISN 0125			N 126
ISN 0126			N 127
ISN 0127			N 128
ISN 0128			N 129
ISN 0129			N 130
ISN 0130			N 131
ISN 0131			N 132
ISN 0132			N 133
ISN 0133			N 134
ISN 0134			N 135
ISN 0135			N 136
ISN 0136			N 137
ISN 0137			N 138
ISN 0138			N 139
ISN 0139			N 140
ISN 0140			N 141
ISN 0141			N 142
ISN 0142			N 143
ISN 0143			N 144
ISN 0144			N 145
ISN 0145			N 146
ISN 0146			N 147
ISN 0147			N 148
ISN 0148			N 149
ISN 0149			N 150
ISN 0150			N 151
ISN 0151			N 152
ISN 0152			N 153
ISN 0153			N 154
ISN 0154			N 155

```

COMPILER OPTIONS NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBODIC,NOLIST,NODECK,LOAD,MAP,NODEIT,IO,NOXREF
1 N 0002 SUBROUTINE HIDEOS
1 N 0003 C C C
1 N 0004 COMMON /ECONS/ X(50),Y(50),Z(50),A(50),FLAG(50)
1 N 0005 COMMON /EYES/ E1,E2,E3
1 N 0006 COMMON /INDI/ NEO,NPTT,NPTVI,NLIES,NAPEX
1 N 0007 DETERMINATION DES PLANS CACHES.
1 N 0008 DO 1 I=1,N
1 N 0009 A1=((X(I)*E1)+(Y(I)*E2)+(Z(I)*E3))-(A(I))
1 N 0010 A2=((X(I)*E2)+(Y(I)*E3)+(Z(I)*E1))-(A(I))
1 N 0011 A3=((X(I)*E3)+(Y(I)*E1)+(Z(I)*E2))-(A(I))
1 N 0012 IF(AES(A1/A3).LT.0.000009) GO TO 2
1 N 0013 IF(A1.GT.0.0.AND.A2.LT.0.0.OR.A1.LT.0.0.AND.A2.GT.0.0) FLAG(I)=10.0
1 N 0014 IF(A1.GT.0.0.AND.A2.GT.0.0.OR.A1.LT.0.0.AND.A2.LT.0.0) FLAG(I)=-10.0
1 N 0015 GO TO 1
1 N 0016 FLAG(I)=-10.0
1 N 0017 CONTINUE
1 N 0018 RETURN
1 N 0019 END
1 N 0020
1 N 0021 CALL LTEXT(PI,4)
1 N 0022 CALL LTEXT(PI,4)
1 N 0023 CALL LTEXT(PI,4)
1 N 0024 CALL LTEXT(PI,4)
1 N 0025 CALL LTEXT(PI,4)
1 N 0026 CALL LTEXT(PI,4)
1 N 0027 CALL LTEXT(PI,4)
1 N 0028 CALL LTEXT(PI,4)
1 N 0029 CALL LTEXT(PI,4)
1 N 0030 CALL LTEXT(PI,4)
1 N 0031 CALL LTEXT(PI,4)
1 N 0032 CALL LTEXT(PI,4)
1 N 0033 CALL LTEXT(PI,4)
1 N 0034 CALL LTEXT(PI,4)
1 N 0035 CALL LTEXT(PI,4)
1 N 0036 CALL LTEXT(PI,4)
1 N 0037 CALL LTEXT(PI,4)
1 N 0038 CALL LTEXT(PI,4)
1 N 0039 CALL LTEXT(PI,4)
1 N 0040 CALL LTEXT(PI,4)
1 N 0041 CALL LTEXT(PI,4)
1 N 0042 CALL LTEXT(PI,4)
1 N 0043 CALL LTEXT(PI,4)
1 N 0044 CALL LTEXT(PI,4)
1 N 0045 CALL LTEXT(PI,4)
1 N 0046 CALL LTEXT(PI,4)
1 N 0047 CALL LTEXT(PI,4)
1 N 0048 CALL LTEXT(PI,4)
1 N 0049 CALL LTEXT(PI,4)
1 N 0050 CALL LTEXT(PI,4)
1 N 0051 CALL LTEXT(PI,4)
1 N 0052 CALL LTEXT(PI,4)
1 N 0053 CALL LTEXT(PI,4)
1 N 0054 CALL LTEXT(PI,4)
1 N 0055 CALL LTEXT(PI,4)
1 N 0056 CALL LTEXT(PI,4)
1 N 0057 CALL LTEXT(PI,4)
1 N 0058 CALL LTEXT(PI,4)
1 N 0059 CALL LTEXT(PI,4)

```

```

COMPILER OPTIONS NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBODIC,NOLIST,NODECK,LOAD,MAP,NODEIT,IO,NOXREF
1 N 0002 SUBROUTINE HIDEOS
1 N 0003 C C C
1 N 0004 COMMON /ECONS/ X(50),Y(50),Z(50),A(50),FLAG(50)
1 N 0005 COMMON /EYES/ E1,E2,E3
1 N 0006 COMMON /INDI/ NEO,NPTT,NPTVI,NLIES,NAPEX
1 N 0007 DETERMINATION DES PLANS CACHES.
1 N 0008 DO 1 I=1,N
1 N 0009 A1=((X(I)*E1)+(Y(I)*E2)+(Z(I)*E3))-(A(I))
1 N 0010 A2=((X(I)*E2)+(Y(I)*E3)+(Z(I)*E1))-(A(I))
1 N 0011 A3=((X(I)*E3)+(Y(I)*E1)+(Z(I)*E2))-(A(I))
1 N 0012 IF(AES(A1/A3).LT.0.000009) GO TO 2
1 N 0013 IF(A1.GT.0.0.AND.A2.LT.0.0.OR.A1.LT.0.0.AND.A2.GT.0.0) FLAG(I)=10.0
1 N 0014 IF(A1.GT.0.0.AND.A2.GT.0.0.OR.A1.LT.0.0.AND.A2.LT.0.0) FLAG(I)=-10.0
1 N 0015 GO TO 1
1 N 0016 FLAG(I)=-10.0
1 N 0017 CONTINUE
1 N 0018 RETURN
1 N 0019 END
1 N 0020
1 N 0021 CALL LTEXT(PI,4)
1 N 0022 CALL LTEXT(PI,4)
1 N 0023 CALL LTEXT(PI,4)
1 N 0024 CALL LTEXT(PI,4)
1 N 0025 CALL LTEXT(PI,4)
1 N 0026 CALL LTEXT(PI,4)
1 N 0027 CALL LTEXT(PI,4)
1 N 0028 CALL LTEXT(PI,4)
1 N 0029 CALL LTEXT(PI,4)
1 N 0030 CALL LTEXT(PI,4)
1 N 0031 CALL LTEXT(PI,4)
1 N 0032 CALL LTEXT(PI,4)
1 N 0033 CALL LTEXT(PI,4)
1 N 0034 CALL LTEXT(PI,4)
1 N 0035 CALL LTEXT(PI,4)
1 N 0036 CALL LTEXT(PI,4)
1 N 0037 CALL LTEXT(PI,4)
1 N 0038 CALL LTEXT(PI,4)
1 N 0039 CALL LTEXT(PI,4)
1 N 0040 CALL LTEXT(PI,4)
1 N 0041 CALL LTEXT(PI,4)
1 N 0042 CALL LTEXT(PI,4)
1 N 0043 CALL LTEXT(PI,4)
1 N 0044 CALL LTEXT(PI,4)
1 N 0045 CALL LTEXT(PI,4)
1 N 0046 CALL LTEXT(PI,4)
1 N 0047 CALL LTEXT(PI,4)
1 N 0048 CALL LTEXT(PI,4)
1 N 0049 CALL LTEXT(PI,4)
1 N 0050 CALL LTEXT(PI,4)
1 N 0051 CALL LTEXT(PI,4)
1 N 0052 CALL LTEXT(PI,4)
1 N 0053 CALL LTEXT(PI,4)
1 N 0054 CALL LTEXT(PI,4)
1 N 0055 CALL LTEXT(PI,4)
1 N 0056 CALL LTEXT(PI,4)
1 N 0057 CALL LTEXT(PI,4)
1 N 0058 CALL LTEXT(PI,4)
1 N 0059 CALL LTEXT(PI,4)

```

```

COMPILER OPTIONS NAME= MAIN,OPT=02,LINECNT=60,SIZE=0000K,
SOURCE,EBODIC,NOLIST,NODECK,LOAD,MAP,NODEIT,IO,NOXREF
1 N 0002 SUBROUTINE HIDEOS
1 N 0003 C C C
1 N 0004 COMMON /ECONS/ X(50),Y(50),Z(50),A(50),FLAG(50)
1 N 0005 COMMON /EYES/ E1,E2,E3
1 N 0006 COMMON /INDI/ NEO,NPTT,NPTVI,NLIES,NAPEX
1 N 0007 DETERMINATION DES PLANS CACHES.
1 N 0008 DO 1 I=1,N
1 N 0009 A1=((X(I)*E1)+(Y(I)*E2)+(Z(I)*E3))-(A(I))
1 N 0010 A2=((X(I)*E2)+(Y(I)*E3)+(Z(I)*E1))-(A(I))
1 N 0011 A3=((X(I)*E3)+(Y(I)*E1)+(Z(I)*E2))-(A(I))
1 N 0012 IF(AES(A1/A3).LT.0.000009) GO TO 2
1 N 0013 IF(A1.GT.0.0.AND.A2.LT.0.0.OR.A1.LT.0.0.AND.A2.GT.0.0) FLAG(I)=10.0
1 N 0014 IF(A1.GT.0.0.AND.A2.GT.0.0.OR.A1.LT.0.0.AND.A2.LT.0.0) FLAG(I)=-10.0
1 N 0015 GO TO 1
1 N 0016 FLAG(I)=-10.0
1 N 0017 CONTINUE
1 N 0018 RETURN
1 N 0019 END
1 N 0020
1 N 0021 CALL LTEXT(PI,4)
1 N 0022 CALL LTEXT(PI,4)
1 N 0023 CALL LTEXT(PI,4)
1 N 0024 CALL LTEXT(PI,4)
1 N 0025 CALL LTEXT(PI,4)
1 N 0026 CALL LTEXT(PI,4)
1 N 0027 CALL LTEXT(PI,4)
1 N 0028 CALL LTEXT(PI,4)
1 N 0029 CALL LTEXT(PI,4)
1 N 0030 CALL LTEXT(PI,4)
1 N 0031 CALL LTEXT(PI,4)
1 N 0032 CALL LTEXT(PI,4)
1 N 0033 CALL LTEXT(PI,4)
1 N 0034 CALL LTEXT(PI,4)
1 N 0035 CALL LTEXT(PI,4)
1 N 0036 CALL LTEXT(PI,4)
1 N 0037 CALL LTEXT(PI,4)
1 N 0038 CALL LTEXT(PI,4)
1 N 0039 CALL LTEXT(PI,4)
1 N 0040 CALL LTEXT(PI,4)
1 N 0041 CALL LTEXT(PI,4)
1 N 0042 CALL LTEXT(PI,4)
1 N 0043 CALL LTEXT(PI,4)
1 N 0044 CALL LTEXT(PI,4)
1 N 0045 CALL LTEXT(PI,4)
1 N 0046 CALL LTEXT(PI,4)
1 N 0047 CALL LTEXT(PI,4)
1 N 0048 CALL LTEXT(PI,4)
1 N 0049 CALL LTEXT(PI,4)
1 N 0050 CALL LTEXT(PI,4)
1 N 0051 CALL LTEXT(PI,4)
1 N 0052 CALL LTEXT(PI,4)
1 N 0053 CALL LTEXT(PI,4)
1 N 0054 CALL LTEXT(PI,4)
1 N 0055 CALL LTEXT(PI,4)
1 N 0056 CALL LTEXT(PI,4)
1 N 0057 CALL LTEXT(PI,4)
1 N 0058 CALL LTEXT(PI,4)
1 N 0059 CALL LTEXT(PI,4)

```


15/100	1	112211

```

1SN 0043      DO 7 LI=1,N
1SN 0044      IF((NLI=J(LI,1)).EQ.(NSTORE(L)).AND.(NLIEN(LI,2)).EQ.(NSTORE(M)).D
          &R.(NLI=J(LI,1)).EQ.(NSTORE(M)).AND.(NLIEN(LI,2)).EQ.(NSTORE(L)))D
          & GO TO 5
1SN 0046      7 CONTINUE
1SN 0047      N=N+1
1SN 0048      NLIEN(N,1)=NSTORE(L)
1SN 0049      NLIEN(N,2)=NSTORE(M)
1SN 0050      NLIEN(N)=N
1SN 0051      5 CONTINUE
1SN 0052      4 CONTINUE
1SN 0053      1 CONTINUE
1SN 0054      RTURN
1SN 0055      END

```

APPENDIX 6

LISTING OF THE FORTRAN STATEMENTS MAKING UP MODULE 3', A PROGRAM
DESIGNED TO SIMULATE THE NUCLEATION AND GROWTH OF CRYSTALLINE AGGREGATES
AND THE FORMATION OF TEXTURES

[illegible]

```

LEVEL 21.A ( JUN 74 )                                C /3rc FORTRAN H

      COMPILER OPTI F5      N44' - 4A1 , IT=0F,LINFCIT (0,5127=) ONK,
                          SDC C , IC IC,ILLIST,NDOFCR,LOA),CAP,ND DIT,TD,NOXRF

      ISN 0002          SUDFJUTIR INIS Y
      ISN 0003          COT JH /N IAC / SDC
      ISN 0004          COTIG - 2 , 2 ( 70 , 2 , 2 ),BLANK /' /,H(CDFP/11/
      ISN 0005          COT 1 I-1,39
      ISN 0006          COT 1 J-1,39
      ISN 0007          D) 1 K-1,3,
      ISN 0008          CACI(1,J,K) PL4 *
      ISN 0009          IF(1, J,1,07,1, 2,2 ,CO,J,LO,1,CX,J,FO,39,OR,K,CO,1,OF,K,EO,39)
      ISN 0010          1,2,2,2(1,1,J,K) HD-1
      ISN 0011          C E T I J
      ISN 0012          C T O J
      ISN 0013          ENL

```

[illegible]

```

COMPILER OPTIONS NAME= MAIN,OPT=02,LIN CNT=60,SIZE=0000K,
SOURCE,ERCDIC,NOLIST,NODECK,LOAD,MAP,NODEIT,ID,NOXREF
ISN 0002 SUBROUTINE ORIENT
ISN 0003 COMMON /ZCENTR/ N1(50),N2(50),N3(50),TIME,NXTAL,NFACE,NALFAA(50),
INALFAL(50),NALFAC(50)
ISN 0004 DO 1 N=1,NXTAL
ISN 0005 DO 2 K=1,NFACE
ISN 0006 DO 3 J=1,10
ISN 0007 IF (I1(50,6,6)
ISN 0008 IY=IY+1674-2647+1
ISN 0009 YL=IY
ISN 0010 YL=YL+.4000613E-3
ISN 0011 IX=IY
ISN 0012 NOJN=IF (IY*760.0)
ISN 0013 GO TO (2,3,4,5),K
ISN 0014 NALFAA(N)=N1
ISN 0015 NALFAA(N)=N2
ISN 0016 NALFAA(N)=N3
ISN 0017 CONTINUE
ISN 0018 CONTINUE
ISN 0019 RETURN
ISN 0020 END

```

```

COMPILER OPTIONS NAME= MAIN,OPT=02,LIN CNT=60,SIZE=0000K,
SOURCE,ERCDIC,NOLIST,NODECK,LOAD,MAP,NODEIT,ID,NOXREF
ISN 0002 SUBROUTINE ORIENT
ISN 0003 COMMON /ZCENTR/ N1(50),N2(50),N3(50),TIME,NXTAL,NFACE,NALFAA(50),
INALFAL(50),NALFAC(50)
ISN 0004 COMMON /ZAXTA/ TA(50,30),TY(50,30),TZ(50,30),TA(50,30),X(30),Y(30)
ISN 0005 DO 1 N=1,NXTAL
ISN 0006 A1=((NALFAA(N)*3.14159)/180.0)
ISN 0007 SINA=SIN(A1)
ISN 0008 COSA=COS(A1)
ISN 0009 A2=((NALFAA(N)*3.14159)/180.0)
ISN 0010 SINP=SIN(A2)
ISN 0011 COSP=COS(A2)
ISN 0012 A3=((NALFAL(N)*3.14159)/180.0)
ISN 0013 SINP=SIN(A3)
ISN 0014 COSC=COS(A3)
ISN 0015 IF (ABS(SINA).LT.0.00001) SINA=0.0
ISN 0016 IF (ABS(SINC).LT.0.00001) SINP=0.0
ISN 0017 IF (ABS(COSA).LT.0.00001) COSA=0.0
ISN 0018 IF (ABS(COSP).LT.0.00001) COSP=0.0
ISN 0019 IF (ABS(COSC).LT.0.00001) COSC=0.0
ISN 0020 DO 2 K=1,NFACE
ISN 0021 BEFORE ANY ROTATION, STANDARD FORM = X(I)*X+Y(I)*Y+Z(I)*Z=A(I)
ISN 0022 START ROTATION ALONG +X
ISN 0023 XA1=X(K)
ISN 0024 XB1=(Y(K)*COSA)+(Z(K)*SINA)
ISN 0025 XC1=(Z(K)*COSA)-(Y(K)*SINA)
ISN 0026 XD1=X(K)
ISN 0027 AFTER ROTATION ALONG +X, EQU.= XA1X+XB1Y+XC1Z=XD1, START ALONG -Y
ISN 0028 XA2=XA1
ISN 0029 XB2=XB1
ISN 0030 XC2=(XC1*COSB)-(XA1*SINB)
ISN 0031 XD2=XD1
ISN 0032 AFTER ROTATION ALONG -Y, EQU.= XA2X+XB2Y+XC2Z=XD2, START ALONG +Z
ISN 0033 XA3=XA2
ISN 0034 XB3=(XB2*COSC)+(XC2*SINC)
ISN 0035 XC3=XC2
ISN 0036 XD3=XD2
ISN 0037 AFTER ROTATION ALONG +Z, EQU.= XA3X+XB3Y+XC3Z=XD3.
ISN 0038 ROTATIONS ARE NOW COMPLETED FOR THIS FACE.
ISN 0039 TX(N,K)=XA3
ISN 0040 TY(N,K)=XB3
ISN 0041 TZ(N,K)=XC3
ISN 0042 TA(N,K)=XD3
ISN 0043 CONTINUE
ISN 0044 CONTINUE
ISN 0045 WRITE(6,10)
ISN 0046 FORMAT(' ',//,26X,' ORIENTED CRYSTAL FACES EQUATIONS, ANGLES IN
ISN 0047 1 DEGREES. ')
ISN 0048 DO 11 I=1,NXTAL
ISN 0049 WRITE(6,12) I,NALFAA(I),NALFAL(I),NALFAC(I)
ISN 0050 FORMAT(' ',//,19X,' NUCLEATION SITE NO. ',I2,' , ROT. ON +X=',I3,'
ISN 0051 1, PCT. ON -Y=',I3,' , ROT. ON +Z=',I3)
ISN 0052 DO 13 J=1,NFACE
ISN 0053 WRITE(6,14) TX(I,J),TY(I,J),TZ(I,J),TA(I,J)
ISN 0054 FORMAT(' ',//,21X,F10.4,'X+',F10.4,'Y+',F10.4,'Z+',F10.4)

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ISN 0054 13 CONTINUE
ISN 0055 11 CONTINUE
ISN 0056 RETURN
ISN 0057 END

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COMPILER OPTIONS NAME= MAIN,OPT=02,LIN CNT=60,SIZE=0000K,
SOURCE,ERCDIC,NOLIST,NODECK,LOAD,MAP,NODEIT,ID,NOXREF
ISN 0002 SUBROUTINE TRANSF
ISN 0003 COMMON /ZCENTR/ N1(50),N2(50),N3(50),TIME,I1,I10,NALFAA(50),NALFAL
ISN 0004 (50),NALFAC(50)
ISN 0005 COMMON /ZAXTA/ TA(50,30),TY(50,30),TZ(50,30),TA(50,30),X(30),Y(30)
ISN 0006 INTENS TIME
ISN 0007 WRITE(6,100)
ISN 0008 100 FORMAT(' ',//,24X,' TRANSFORMED-ORIENTED CRYSTAL FACES EQUATIONS :')
ISN 0009 DO 1 J=1,11
ISN 0010 N1,N2,N3=NUCLEATION SITES IN CRYST.
ISN 0011 X(1),Y(1),Z(1),N1(1),N2(1),N3(1)
ISN 0012 FORMAT(' ',//,22X,' NUCLEATION SITE NO. ',I2,' COORDINATES :',31A
ISN 0013 1)
ISN 0014 DO 5 K=1,N3
ISN 0015 TA(I,K)=((TX(I,K)-I1(J))+(TY(I,K)-I2(J)))+(TZ(I,K)-I3(J))
ISN 0016 WRITE(6,101) TX(I,K),TY(I,K),TZ(I,K),TA(I,K)
ISN 0017 101 FORMAT(' ',//,21X,F10.4,'X+',F10.4,'Y+',F10.4,'Z+',F10.4)
ISN 0018 CONTINUE
ISN 0019 RETURN
ISN 0020 END

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22 CO FURTHER

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OS/360 FORTRAN H

UUUU

COMPILER OPTIONS NAME = MAIN,OPT=0,LIN CNT=6,SIZE=3000K,

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      SOURCE=CHOMIC,HOLIST,NMODCN,LDAL,MAP,NOLC IT,INDXARLF
      SUBROUTINE MATLXP
      COMMON /NSPACE/ SPAC(
      COMMON /NCEPTR/ N1(50),N2(50),N3(50),TIME,NATAL,NFACE,NALFAA(50),
      1NALLAB(1),NALLFA(1)
      ISN 0002      INTLG=4*2 SPAC(39,39),V(39)
      ISN 0003      WRITE(6,100) TIME
      ISN 0004      1000      FORMAT(' ',54X,' SIMULATION TIME IS :',14,///)
      ISN 0005      DO 1 I=1,39
      ISN 0006      J=40-I
      ISN 0007      V(I)=J
      ISN 0008      1      CONTINUE
      ISN 0009      WRITE(6,4)
      ISN 0010      WRITE(6,5)
      ISN 0011      WRITE(6,6)
      ISN 0012      WRITE(6,7)
      ISN 0013      DO 2 I=1,39
      ISN 0014      I2=I
      ISN 0015      WRITE(6,8) (SPACE(I),K,I2),K=1,39)
      ISN 0016      WRITE(6,9) (SPACE((V(I))),I2,(V(I1))),K=1,39)
      ISN 0017      WRITE(6,10) (SPACE(I2,K,(V(I1))),I2=1,39)
      ISN 0018      CONTINUE
      ISN 0019      2      FORCAT(' ',///,4'X','ORTHOGONAL INTERCEPT PLANES THROUGH SPACE CENTR
      ISN 0020      11: ')
      ISN 0021      5      FORMAT(' ',///,17X,'X-Y PLANE :',29X,'X-Z PLANE :',33X,'Y-Z PLANE
      ISN 0022      3: ')
      ISN 0023      6      FORCAT(' ',///,14X,'LOOKING DOWN +Z',26X,'LOOKING DOWN -Y',26X,'LOOK
      ISN 0024      11G DOWN +X')
      ISN 0025      7      FORCAT(' ',///,14X,'-X TOP, -Y LEFT',26X,'+Z TOP, -X LEFT',26X,'+Z T
      ISN 0026      10P, -Y LEFT',///)
      ISN 0027      8      FORCAT(' ',1X,40A1)
      ISN 0028      9      FORCAT(' ',42X,40A1)
      ISN 0029      10     FORCAT(' ',93X,40A1)
      ISN 0030      RETURN
      END

```