CHAPTER - 5

QUENCH HARDNESS OF ALKALI HALIDES

(NaCl, KCl AND KBr)

5.1 INTRODUCTION :

In continuation of the study of variation of applied load with diagonal length of Knoop indentation, the present chapter reports detailed study of variation of hardness expressed by hardness number with quenching temperature, and orientation of the Knoop indenter with respect to crystal lattice :

The Knoop hardness number, H, is defined by the equation /1/

$$H = 14230P/d^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots(5.1)$$

or

$$H = c\,P/d^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots(5.2)$$

where applied load 'p' in gm and the diagonal length 'd' of the indentation mark is in microns and c = 14230 is a constant of the indenter geometry. This factor can be obtained in the following way from the general definition of Knoop hardness number :

$$H(Kg/mm^2) = \frac{\text{Applied load } P(Kg)}{\text{Projected area of the Knoop indentation mark } A(mm^2)} \ldots(5.2a)$$

The projected area A is given by

$$A = \tfrac{1}{2} d^2 \cot\frac{172.5}{2} \tan\frac{130}{2}$$

$$= \tfrac{1}{2} d^2 (0.0655)(2.1455)$$

$$= d^2 (0.07028)$$

where 'd' is in mm and 172.5° and 130° are the angles made by opposite edges of the indenter (cf. chapter III,fig. 3.1).

Thus,

$$H = \frac{P}{A} = \frac{P}{0.07028\ d^2}$$

$$= 14.230P/d^2\ Kg/mm^2$$

In the above formula 'P' is in Kg and 'd' is in mm. In actual work 'P' is in gm and 'd' is in micron (μm). Hence following the usual conversion, one obtains,

$$H = 14230\ P/d^2 \quad \ldots\ldots\ldots\ldots..(5.3)$$

where 'P' is in gm and 'd' is in micron.

The hardness number 'H' is not an ordinary number, but a constant having dimensions of stress and has a deep but less understood physical meaning. The combination of (5.2) with Kick's law ($P = ad^n$) yields,

$$H = c.a.d^{n-2} \quad \ldots\ldots\ldots\ldots\ldots\ldots(5.4)$$

or in terms of applied load and hardness number it is given by

$$H = c.a^{2/n}.P^{n-2/n} \quad \ldots\ldots\ldots\ldots.(5.5).$$

The above equation can be tested by comparing the values of left hand and right hand sides obtained from measurements. Thus 'H' can be determined from (5.3) whereas on the right hand side the value of 'a' can be substituted from the earlier studies of the above laws (cf. chapter IV). Since c and P or d are known, the right hand side value can be calculated. Comparison of values obtained for the two sides of (5.4) / (5.5) can indicate the degree of correlation of the experimental work with the theoretical work.

Instead of using Kick's law, it is also possible to use modified Kick's law by putting n = 2 and substituting (P-W) instead of P in the above formulae. Thus,

$$H = c.\frac{P-W}{d^2}$$

But $P - W = bd^2$

$$H = c.b \quad \text{........................(5.6)}$$

Since c and b are constants, the above equation indicates that hardness is a constant quantity, independent of applied load and dimension of indentation mark. The above equation shows that the multiplication of geometrical constant (numerical figure) with 'b' the standard hardness, gives the hardness number. The present work aims at analysing the hardness behaviour by examining the relations (5.4), (5.5) and (5.6) experimentally. It also aims at studying the quench hardness variation with orientation. It is mentioned above that the dimensions of hardness number and stress are the same. This similarity appears to have been obtained from the consideration of a solid subjected to uniaxial compression (or extension). For a uniaxially compressed solid, the Young's modulus of elasticity (E) is given by

$$E = \sigma/\epsilon \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(5.7)$$

where σ is the compressive stress defined as load per unit area.

$$\sigma = P/A \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(5.8)$$

and the compressive strain ϵ is defined as the decrease in length per unit length. The area of cross - section, A, increases with compression. Hence for a constant volume of a geometrically well defined solid, length is inversely proportional to the area of cross-section. If 'A_o' represents the initial area of cross-section with a normal length 'l_o' and A, the final area with normal length 'l' after small compression, one obtains,

$$l.A = l_o.A_o$$

$$\text{or} \quad l/l_o = A_o/A \qquad \ldots\ldots\ldots\ldots\ldots\ldots(5.9)$$

Therefore,

$$\epsilon = (l-l_o)/l = (A_o - A)/A \qquad \ldots\ldots(5.10)$$

substitution of σ and ϵ from (5.8) and (5.10) in (5.7) gives,

$$E = P/(A_o - A) \qquad \ldots\ldots\ldots\ldots\ldots\ldots(5.11)$$

Hence, for a simple uniaxial compressive stress, when the area is a geometrical function of deformation, determined here by constant volume, the resistance to permanent deformation can be expressed simply in terms of load and corresponding area. In indentation process, the volume change is very very small; volume of solid can therefore be considered as constant. Hence the indentation hardness can be measured by using the above formula (5.11).

Indenters are made in various geometrical shapes such as spheres, pyramids, etc. The area over which the force due to load on the indenter acts, increases with the depth of penetration. The resistance to permanent deformation or hardness can be expressed in terms of force or load and area alone (and/or depth of penetration). These remarks are true for solids which are amorphous or highly homogeneous and isotropic.

The above analysis presents a highly simplified picture of the processes involved because there is a great difference between deforming a solid under a simple uniaxial compression and deforming a surface of a solid by pressing a small indenter into it. Around the indentation mark, the stress distribution is exeedingly complex and the stressed material is under the influence of multiaxial stresses. The sharp corners of a pyramidal indenter produces a sizeable amount of plastic deformation which may reach 30% or more at the tip of the indenter. This should be compared with the deformation of a crystalline material which is even less than one percent of its original dimension. Further the surface of contact is inclined by varying amounts to the direction of applied force. In view of these complications a simple expression corresponding to that for the modulus of elasticity can not be derived for hardness. In the absence of any formula based on concrete theory, an arbitrary expression is used which includes both known variables - load and area - in the present case. Hence the hardness number, H, defined as the ratio of the load to the area of impression is,

$$H = P/A \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(5.12)$$

For pyramidal indenters the load P varies as the square of the diagonal 'd'. Thus for a given shape of pyramid,

$$P = ed^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(5.13)$$

where 'e' is a constant which depends on the material and shape of pyramid. The area of the impression, A, is also proportional to the square of the diagonal,

$$A = fd^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(5.14)$$

where 'f' depends upon the shape of the pyramid. Combination of equations (5.12), (5.13) and (5.14) gives,

$$H = ed^2/fd^2 = e/f = \text{constant}\ldots(5.15)$$

Hence for a given shape of pyramidal indenter, hardness is independent of load and size of indentation. This statement represents Kick's law. In view of defining equation (5.2a) for hardness, hardness number can also be considered as hardening modulus.

Due to complicated behaviour of indented anisotropic single crystals of various materials and arbitrary expression for hardness, it is clear that theoretical treatment of the problem is extremely difficult. Hence it is desirable to approach this problem via experimental observations, interpretations and with a probable development of empirical relation(s). Further the analysis can be used for developing model theory/theories of hardness. The present work is taken up from this phenomenological point of view and is an extension of the work carried out by earlier workers /2-5/.

5.2 OBSERVATIONS :

The observations which were recorded for studying the Kick's law ($P = ad^n$) are used in the present investigation. The Knoop hardness numbers are calculated using equation (5.1) for various orientations and for the thermally treated and untreated samples. The observations are graphically studied by plotting the graph of hardness number 'H' versus load P. (Fig. 5.1, 5.2 & 5.3). In what follows the hardness and Knoop hardness number will be used to indicate the same meaning.

5.3 RESULTS AND DISCUSSION :

5.3.1 Variation of Knoop Hardness Number with applied load at constant temperature and indenter orientation :

It is clear from the graphical analysis of the variation of hardness number H with applied load 'P' (Fig. 5.1, 5.2 & 5.3) that contrary to theoretical expectations, the hardness varies with load. For NaCl, KCl and KBr the hardness at first increases with load for all orientations and for all quenching temperatures, reaches a maximum value at a certain load, then gradually decreases with increasing load and attains almost a constant value for all higher applied loads. The complex behaviour of microhardness with load can be explained quatitatively on the basis of depth of penetration of the indenter. At small loads the indenter penetrates only surface layers, hence the effect is shown more sharply at these loads. However, as the depth of penetration (impression) increases, the effect of the surface layers become less dominant and after a certain depth of penetration, the effect of inner layer becomes more and more prominent than those of surface layers and ultimately there is practically no change in the value of hardness number Vs. load. The graph of H Vs. P can be conveniently divided into three parts, AB, BC and CD, where the first part represents the linear relation between hardness and load, the second part the non-linear relation and the third part the linear one. It should be noted that there is a fundamental difference between linear portion AB and CD of the graph ABCD . This possibly reflects the varied reactions of the cleavage surface to loads belonging to different regions.

The present approach for the study of hardness behaviour with a change in different parameters is an integrated one. Hence the graphical analysis of log d Vs. log P plots (cf. chapter IV) should now be extended in the present work by studying the relations (5.4), (5.5) and (5.6), namely,

$$(5.4).....H' = C.a.d^{(n-2)}$$

$$(5.5).....H = C.a^{2/n}.P^{(n-2)/n}$$

$$(5.6).....H = C.b.$$

For synthetic single crystals of NaCl, KCl and KBr there exists two distinct ranges of applied load, viz. LLR and HLR corresponding to plot of log d Vs. log P consisting of two straight lines with different slopes (n_1 and n_2) and intercepts (a_1 and a_2), whereas the plot of H Vs. P (Fig. 5.1, 5.2 and 5.3) shows three ranges of applied loads, namely, low load region LLR, intermediate load region ILR and high load region HLR designated by AB, BC and CD respectively and that CD corresponds to that range of applied load where hardness number calculated by using equation (5.1) is constant and independent of applied load. It is clear from the plots that for applied loads greater than 20 gm hardness is constant and independent of load. It is in this range of applied loads for which the hardness behaviour of these crystals is analysed and reported in the present work.

It was shown in the earlier chapter that the straight line plot of log d Vs. log P consists of two straight lines with different slopes and intercepts corresponding to LLR and HLR . The slope and intercept in this region (HLR) are n_2 and a_2, respectively. In the case of modified Kick's law b_2 corresponds to a_2 and n_2 = 2. This is equally true for curvilinear plots with a point of inflexion. It is therefore desirable to consider the following relations:

$$H = Ca_2 d^{(n_2-2)} \quad \ldots\ldots\ldots\ldots (5.16)$$

$$H = Ca_2^{2/n_2} P^{(n_2-2)/n_2} \quad \ldots\ldots (5.17)$$

$$H = Cb_2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (5.18)$$

instead of (5.4), (5.5) and (5.6) and try to find the correlation amongst these relations. The observed graphical values of hardness (Table 5.4 A, 5.5A & 5.6 A) can now be compared with the values of hardness at constant temperature and orientation, calculated from the formulae (5.17) and (5.18) and presented in a tabular form (Tables 5.4 B, 5.5 B, 5.6 B and 5.4 C, 5.5 C, 5.6 C). It is clear from the tables that there is excellent correlation between the hardness values. It can be concluded that hardness behaviour of NaCl, KCl and KBr cleavages at constant temperature and orientation indicates little difference amongst Kick's law, modified Kick's law and formula for hardness number. This was not the case with calcite and (d-AHT) single crystals studied in this laboratory. In those cases the percentage deviation was very large indicating very little correlation between hardness values. But in the case of sodium nitrate cleavages, there is appreciable correlation among Kick's law, modified Kick's law and formula for hardness number /4/. This simply suggests that the basic symmetry elements, physical and chemical properties of these different crystals might be intimately connected with the mechanical behaviour indicated by hardness at applied loads.

5.3.2 Variation of Knoop hardness number with quenching temperature for constant applied load in HLR and indenter orientation :

It is clear from the observations of hardness of quenched and unquenched samples (tables 5.1, 5.2 & 5.3) that hardness depends upon the quenching temperature T_q and that in HLR it is independent of load. Hence average values of hardness $\bar{H}$ in HLR are computed and are recorded in tables 5.4 A, 5.5 A, & 5.6.A. For NaCl, KCl and KBr the table of $\log \bar{H} T_q$ and $\log T_q$ are prepared (Table 5.7, 5.8 & 5.9) from the observations (vide tables 5.4 A, 5.5 A and 5.6 A). The plots of $\log \bar{H} T_q$ Vs. $\log T_q$ are straight lines (Figs. 5.4, 5.5 and 5.6) for different quenching temperatures and different orientations of indenter. It should be noted that the plots are shown for all orientations of indenter with respect to [100] direction for NaCl, KCl and KBr. The slopes of these lines for NaCl, KCl and KBr cleavages are given in Tables 5.7, 5.8 and 5.9 . The straight line graph follows the equation,

$$\text{Log } \bar{H} T_q = m \log T_q + \log C \quad \ldots\ldots\ldots (5.19)$$

where 'm' is the slope and log C is the intercept. Therefore,

$$\bar{H}\, T_q^{\,1-m} = C$$

$$\bar{H}\, T_q^{\,k} = C \quad \text{.....................(5.20)}$$

where, k =(1-m). The values of k are given for NaCl, KCl and KBr for different directions in tables 5.7, 5.8 and 5.9. For all indenter orientations and applied loads in the HLR hardness is constant and independent of load. 'k' is a number which is much less than unity and -ve for NaCl and KCl but both +ve and -ve for KBr. This shows that quench hardness increases with increasing quenching temperature for NaCl and KCl whereas it is decreasing and increasing with increasing quenching temperature in the case of KBr. In both these cases the change from room temperature value is quite small. This change is made detectable due to fine combination of measurable variables involved in the experiments on quench hardness studies. Further, 'k' values for NaCl and KCl change with orientation and is the highest for 40° orientation and 50° orientation. Such uniform variation is not found for KBr. The value of exponent 'k' or slope of the straight line plots of log $\bar{H}\ T_q$ Vs. log T_q (Figs. 5.4, 5.5 and 5.6) is so small that all of them appear to be parallel lines. However, close examination of these plots show them to be slightly unparallel Small value of 'k' indicates that variation of quenched hardness with quenching temperature is quite small. This is due to the fact that after quenching the surface layers get more affected. These layers are removed by cleaving the crystals. It is therefore clear that whatever effect the quenching process has produced in the crystal, is the body effect with surface effect which is practically zero.

Quench hardness thus determined represents 'body' hardness or of the highly deep interior layers. Obviously quench hardness will not differ very much from room temperature hardness. This is found to be the case for all crystals studied in this laboratory. The constant 'C' for all three crystals changes with indenter orientation. The quench hardness study on cleavage faces of NaCl, KCl and KBr has clearly shown that these crystals obey the relation

$$H_A \, T_q^{K_A} = \text{constant} = C_A \qquad \ldots\ldots\ldots(5.21)$$

and that k_A and C_A change with crystalline anisotropy. k_A and C_A have maximum and minimum values when the major diagonal of indenter makes an angle of 45°. i.e., when it is in the direction [110].

For a range of loads in HLR hardness is inversely proportional to the square of the length of major diagonal. Hence instead of plotting a graph of log $\bar{H}_A \, T_q$ Vs. log T_q it is possible to plot a graph of log T_q d Vs. log T_q . This should result in a straight line plot and the equation for this plot should yield, after simplification, the values of C_A and k_A . The plot of the above mentioned graphs for a range of, say r, of applied loads in HLR, are straight lines parallel to each other for a constant orientation of the indenter. For different orientations, the plots consist of a series of parallel straight lines with different intercepts. A typical set of parallel plots for constant orientation of the indenter (A = 0°) is shown in the Fig. 5.7, 5.8 and 5.9 (Tables : 5.10, 5.11 and 5.12). The straight line equation for such parallel plots will have the form,

$$\log T_q d = m_A \log T_q + \log C_A \quad ..... \quad (5.22)$$

where m_A is the slope of these parallel straight lines making different intercepts $\log C_{A1}$, $\log C_{A2}$, ...$\log C_{Ar}$ for 'r' parallel lines.

Rewritting corresponding to orientations A_1, A_2,..... ......A_r; the above equation for one of the parallel lines and one value of orientation, give-

$$\log T_q d_{Ar} = m_A \log T_q + \log C_{Ar}.$$

$$d_{Ar} T_q = C_{Ar} T_q^{m_A}$$

$$d_{Ar} T_q^{1-m_A} = C_{Ar} \quad .... \quad (5.23)$$

The above relation should be connected with (5.21), namely.

$$H_A T_q^{k_A} = H_A T_q^{1-m} = C_A$$

where H_A is hardness for different orientations A. Now combination of the above with (5.1) results into-

$$14230 \; P/d^2 \; T_q^{1-m} = C_A .$$

$$d^2 T_q^{m-1} = 14230 \; P/C_A.$$

Taking the squre-root and retaining +ve sign before the square-root, one gets,

$$d\, T_q^{\,(m-1)/2} = \sqrt{14230\ P/C_A} \quad \ldots.(5.24)$$

The relations (5.23) and (5.24) can be considered identical, if

$$1 - m_A = \frac{m-1}{2} = k_A/2$$

and

$$C_{Ar} = \sqrt{14230\ P/C_A}$$

Since 'r' represents range of applied loads corresponding to longer diagonals d_r, the values of P on R.H.S. of the equation are different. Hence to indicate this for a range 'r' of applied loads the above equations can be rewritten in a generalized form

$$1 - m_{Ar} = \frac{m_A - 1}{2} = \frac{K_A}{2}$$

$$C_{Ar} = \sqrt{14230\ P_r/C_A} = d_{Ar}\, T_q^{\,k/2}$$

Thus for different values of applied load P_r, i.e., for different values of 'r', there will be series of values of C_{Ar} and d_{Ar}.

Further, $C_{Ar}^2 / P_r = 14230/C_A$.

or

$$C_{Ar} / \sqrt{P_r} = \sqrt{14230 / C_A}$$

Calculation of values on the L.H.S. and R.H.S.

are made by using the relations for d and H, i.e. (5.21) and (5.23) and are shown in tables 5.13, 5.14 and 5.15 . The tables (5.13, 5.14 and 5.15) indicate that within experimental limits, these values are fairly in agreement with each other. This approach is supported by the recent work of Joshi and Pandya on calcite and sodium nitrate crystals /6,7/.

It is thus clear that for various applied loads P_r in the high load region, the relation between the longer diagonal of the Knoop indentation mark, d_{Ar}, quenching temperature, T_q and indenter orientation, A is given by,

$$d_{Ar} \, T_q^{k_A/2} = \sqrt{14230 \, P_r/C_A} \, .$$

The microhardness of all the crystals studied varied with load in a complex manner, the variation being sharp for small loads. This can be explained qualitatively on the basis of the effect of surface layers of the crystal on the value of the microhardness. Initially the impression of the diamond pyramidal indenter penetrates to a depth comparable with or considerably greater than the thickness of the surface layer. Since the surface layer of a cleavage face of the crystal pierced by the indenter at even small loads, its effect will show up more markedly. The microhardness varies sharply with increasing load. As the depth of the impression increases, the effect of the surface layers becomes less sharp indicating that less variation of microhardness with load and for large loads when the impression reaches a depth at which undistorted layers of the material exist, the microhardness ceases to depend on load and becomes almost constant. The surface energy of NaCl is the highest among the three crystals NaCl, KCl and KBr whereas KBr has the smallest value. Similarly for a given applied load in HLR and LLR the microhardness has maximum value for NaCl and the lowest for KBr.

The above behaviour can also be explained qualitatively on the basis of dislocations responsible for plastic deformation. Indentation produces plastic deformation accompanied by dislocations. Microhardness is the resistance offered to dislocation motion. Resistance to dislocation motion is normally considered to be of two types :

(1) Intrinsic resistance and

(2) Resistance due to imperfections.

In a perfect crystal the intrinsic resistance is due to the periodic variation of strain energy as dislocation moves through the crystal. The stress responsible for this is usually referred to as Pierels - Nabarrow stress e.g. see Cottrell, 1953). In real crystals, imperfections act as obstacles to dislocations. It is known that imperfections of varied types are responsible, affect, control several properties. Hardness is related to various physical parameters e.g. correlation between hardness and yield strength of alkali halides (Chin et al. 1972, 1973), expression for indentation hardness in terms of ionic bonding coupled with plastic deformation theory etc. At low loads, the number of dislocations generated is small and can move comparatively freely through crystal lattice.

As a result their effects on microhardness will be increasingly felt in LLR. In HLR a large number of dislocations will be created due to higher loads. Due to motions of large number of dislocations, they will be pinned down by the impurities and the lattice, thereby showing microhardness to be independent of applied loads in HLR.

5.4 CONCLUSIONS :

(1) Hardness varies with load. For NaCl, KCl and KBr cleavages for all orientations and for all quenching temperatures, initially it increases with load, reaches a maximum value at a certain load, then gradually decreases with increasing loads and attains almost a constant value for all higher applied loads.

(2) For NaCl, KCl and KBr cleavages, $H_A T_q^{k_A} = C_A$ for all indenter orientations and applied loads in the high load region where hardness is constant and independent of load. Quenched hardness (H_A) represents body hardness or the effects of layers highly deep inside a crystal. It does not differ very much from the room-temperature hardness of untreated crystals. The constants C_A and k, for NaCl, KCl and KBr cleavages change with indenter orientations with respect to [100]. k and C_A are anisotropic constants characterising quench hardness.

(3) For NaCl, KCl and KBr the relation between longer diagonal of Knoop indentation mark d_{Ar}

corresponding to different applied loads P_r in the high load region and quenching temperature T_q and orientation A of the indenter is given by

$$d_{Ar} \, T_q^{k_A/2} = \sqrt{\frac{14230 \, P_r}{C_A}} \, .$$

TABLE - 5.1 (i)

(FOR NaCl)

ROOM TEMPERATURE = 303°K

Load P in gm	H_k									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	18.75	18.75	18.70	17.97	17.99	17.88	17.88	17.70	17.10	18.81
2.50	19.50	18.96	18.88	18.15	17.91	17.91	17.99	18.88	18.87	18.75
3.75	19.80	19.74	19.44	18.11	18.21	17.99	18.24	19.94	19.55	18.99
5.00	21.05	20.99	19.14	19.00	18.99	17.99	18.85	19.54	19.97	19.45
6.25	21.60	22.70	20.16	19.22	18.91	18.91	19.00	19.99	20.22	20.97
7.50	23.34	23.41	20.75	19.57	19.22	18.99	19.35	20.55	22.88	21.54
8.75	22.28	22.15	21.15	20.01	19.77	19.75	19.89	20.94	23.14	22.22
10.00	22.25	21.91	20.22	19.99	19.61	19.61	20.05	21.22	23.14	22.28
11.25	22.22	21.88	21.01	20.25	19.01	19.01	20.01	21.44	22.88	22.25
12.50	22.07	22.15	21.15	20.54	18.05	18.11	20.22	21.40	22.22	22.22
13.75	21.65	22.00	21.00	21.07	18.00	18.01	22.48	21.10	20.25	22.07
15.00	19.80	20.19	19.95	19.55	18.45	18.40	20.01	19.85	21.15	21.61
16.25	20.51	20.05	19.44	19.85	18.41	18.40	19.85	19.54	20.05	20.25
17.50	20.35	19.97	19.01	19.56	17.94	18.01	19.66	19.22	20.00	20.44
18.75	20.15	19.44	19.07	19.05	17.88	18.00	19.01	19.11	19.54	20.35
20.00	19.75	19.17	19.85	18.99	17.45	17.74	19.07	19.15	19.17	20.15
25.00	19.90	19.55	18.99	18.85	17.11	17.22	18.85	19.00	19.61	19.00
30.00	19.50	19.91	18.88	18.77	17.00	17.11	18.77	18.95	19.85	19.44
40.00	19.50	19.14	19.00	18.41	17.14	16.99	18.14	18.99	19.22	19.44
50.00	19.34	18.99	18.77	18.01	16.99	16.88	18.15	18.77	19.88	19.33
60.00	19.66	19.47	18.57	17.94	16.79	16.61	17.99	18.57	18.85	19.60
70.00	19.35	19.88	18.65	17.98	16.95	16.74	17.99	18.85	19.55	19.35
80.00	19.55	19.44	19.01	17.99	16.99	16.55	17.85	18.78	19.55	19.55
100.00	19.61	19.67	18.01	17.55	16.77	16.47	17.44	18.11	19.57	19.61
110.00	19.86	18.88	18.11	17.77	16.66	16.44	17.01	18.11	19.00	19.80
120.00	19.51	18.99	18.41	17.88	16.44	16.33	17.15	18.40	18.56	19.50
140.00	19.90	18.88	18.51	17.89	16.44	16.37	17.88	18.00	18.91	19.91
160.00	19.75	18.71	18.01	17.88	16.34	16.37	17.88	18.00	18.81	19.75

TABLE - 5.1 (ii)

FOR NaCl CRYSTALS

QUENCHING TEMPERATURE = 473°K

Load P in gm	H_k									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	18.15	18.15	17.95	17.75	17.45	17.55	17.88	18.00	18.24	18.24
2.50	19.10	18.98	17.99	17.85	17.54	17.66	17.88	18.01	18.55	18.88
3.75	19.00	19.00	18.81	18.17	17.97	17.97	18.22	18.55	19.00	19.15
5.00	20.10	19.74	19.17	19.00	18.01	18.12	18.77	18.99	19.74	20.10
6.25	21.14	20.55	19.55	19.31	19.00	18.85	18.99	19.77	20.24	20.97
7.50	22.22	22.22	21.22	20.00	19.55	19.41	19.20	19.99	20.18	21.77
8.75	23.65	23.41	22.38	21.17	21.55	21.55	22.00	22.55	23.44	23.77
10.00	24.40	22.21	21.17	21.88	20.86	20.86	21.95	22.00	22.21	23.99
11.25	23.38	22.34	21.55	22.01	21.11	21.22	22.01	21.99	22.55	23.38
12.50	23.16	22.21	21.66	21.66	20.00	21.00	21.66	22.00	22.22	22.95
13.75	22.21	21.97	20.45	20.05	19.75	19.75	20.34	20.55	21.88	22.55
15.00	22.26	21.88	20.65	20.00	19.55	19.71	20.00	20.77	21.55	22.33
16.25	22.40	21.24	20.25	21.36	19.98	19.55	20.05	20.25	21.24	22.05
17.50	20.82	21.22	20.22	20.22	18.87	19.10	20.22	20.11	21.22	21.22
18.75	20.32	21.00	20.07	20.07	18.66	18.55	20.07	20.11	20.95	20.95
20.00	20.10	20.00	20.00	20.05	18.81	18.55	20.05	20.00	20.25	20.10
25.00	21.42	19.97	19.55	19.97	18.05	18.05	19.87	19.55	19.97	20.10
30.00	20.14	19.99	19.22	19.23	19.23	19.71	18.81	19.00	19.99	20.14
40.00	20.14	20.22	18.90	19.00	17.73	17.55	18.81	19.00	19.98	20.00
50.00	20.37	20.01	19.21	18.88	17.38	17.38	18.88	19.00	20.00	20.00
60.00	20.19	19.97	19.00	18.71	17.55	17.41	18.55	18.81	19.88	20.19
70.00	20.67	19.88	18.88	18.81	17.22	17.22	18.81	18.70	19.41	20.67
80.00	21.04	19.55	19.00	18.12	17.22	17.22	18.12	19.55	19.21	20.11
100.00	20.23	19.71	19.00	17.77	17.30	17.12	17.55	18.81	18.98	20.23
110.00	20.03	18.88	18.28	17.97	17.22	17.00	17.56	18.51	18.70	20.03
120.00	19.73	18.71	18.22	17.54	16.99	17.00	17.54	18.22	18.50	19.51
140.00	20.13	18.88	17.77	17.00	16.87	17.01	17.33	17.95	17.88	18.84
160.00	19.38	19.99	17.75	17.01	16.95	16.99	17.01	17.55	18.81	19.38

TABLE - 5.1 (iii)

(FOR NaCl)

QUENCHING TEMPERATURE = 573°K

Load P in gm	H_k									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	20.62	20.05	20.05	18.99	18.99	19.52	20.05	20.05	20.62	20.62
2.50	21.34	21.34	22.26	20.99	20.99	19.02	20.99	20.99	22.24	21.37
3.75	23.02	22.26	21.53	20.18	20.18	21.48	22.26	23.83	23.62	23.83
5.00	24.53	26.08	24.53	22.12	20.05	22.12	23.82	24.53	24.53	26.08
6.25	25.76	25.76	24.41	25.41	20.87	20.87	25.41	25.41	25.76	25 76
7.50	23.27	25.04	25.04	25.04	22.72	22.72	23.02	25.01	25.13	23.27
8.75	22.58	23.60	25.29	24.14	24.14	22.33	22.33	25.30	25.30	22.83
10.00	22.25	22.25	22.24	25.30	22.02	23.02	25.30	21.80	22.25	22.25
11.25	22.23	22.23	24.05	22.96	22.01	22.01	21.80	23.12	22.23	23.79
12.50	21.68	21.88	21.88	21.29	21.11	21.11	22.08	21.49	21.68	22.05
13,75	22.03	21.84	22.27	21.65	21.28	21.47	21.47	22.22	21.84	21.83
15.00	22.26	22.26	22.45	21.72	21.85	21.54	21.90	22.26	22.08	22.64
16.25	21.70	21.88	21.88	21.19	21.19	20.87	21.49	21.70	22.22	22.22
17.50	19.88	20.52	20.22	19.88	19.64	19.88	19.78	20.52	20.62	20.52
18.75	20.73	21.04	20.44	20.30	20.44	20.15	20.15	20.73	20.59	20.73
20.00	20.33	20.19	20.33	20.05	20.05	19.91	19.91	20.19	20.19	20.33
25.00	20.11	20.35	19.86	19.86	19.63	19.39	19.39	19.86	19.74	20.35
30.00	21.18	21.42	21.42	19.69	19.82	19.69	19.82	20.93	21.42	21.18
40.00	20.14	20.14	20.14	20.14	20.01	20.04	20.04	20.54	20.54	20.34
50.00	20.37	20.02	19.85	19.85	19.60	19.68	19.94	20.02	20.85	20.55
60.00	20.20	20.35	20.35	20.44	10.20	19.95	19.95	20.35	20.35	20.20
70.00	20.07	19.92	20.07	19.78	18.78	18.71	19.64	19.78	19.92	20.22
80.00	20.19	20.19	19.78	19.92	18.78	18.78	19.92	19.92	20.19	20.19
100.00	19.98	20.23	20.23	19.98	18.98	18.87	19.80	20.10	20.23	20.23
110.00	19.86	19.52	19.64	19.30	19.30	19.19	19.30	19.24	19.64	19.67
120.00	20.01	20.01	19.79	19.90	19.68	19.68	19.90	19.63	19.79	19.57
140.00	20.29	20.29	20.08	20.13	19.97	19.97	19.97	20.29	20.18	20.40
160.00	19.66	19.65	19.29	19.20	19.11	19.01	19.20	19.29	19.57	19.35

TABLE - 5.1 (iv)

(FOR NaCl)

QUENCHING TEMPERATURE = 673°K

Load P in gm	← H_k →									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	23.11	23.11	21.81	20.61	19.51	19.51	20.61	21.81	21.81	23.11
2.50	26.38	26.38	26.38	26.38	24.19	24.19	26.38	25.25	25.25	26.38
3.75	25.56	25.56	25.56	24.67	23.02	23.02	22.26	24.67	25.56	28.53
5.00	26.92	26.92	26.09	26.09	25.29	25.29	26.92	26.92	26.92	27.82
6.25	25.77	25.77	24.39	24.39	23.75	23.75	24.39	24.39	25.77	26.50
7.50	24.43	24.43	23.84	23.27	22.72	22.72	23.27	23.27	24.43	24.43
8.75	20.71	24.71	24.15	23.61	22.85	22.85	23.61	23.61	24.71	25.28
10.00	23.19	23.19	23.71	22.71	21.80	21.80	22.71	22.66	23.19	23.68
11.25	22.66	20.66	22.23	22.02	21.81	21.81	22.02	23.78	22.66	23.11
12.50	21.68	22.07	21.29	21.10	20.92	20.73	21.48	21.29	22.07	22.07
13.75	22.61	22.02	21.83	21.83	21.65	21.28	21.28	21.62	21.83	22.21
15.00	22.26	20.75	21.89	21.71	21.89	21.77	22.26	21.89	20.75	23.02
16.25	21.80	21.87	21.36	21.36	21.19	21.03	21.53	21.87	21.53	21.87
17.50	19.92	20.52	20.52	20.36	20.22	19.92	20.22	20.22	20.52	20.36
18.75	20.15	20.15	20.44	19.87	19.77	20.01	20.15	20.44	20.29	20.73
20.00	21.05	20.61	20.90	20.90	20.61	20.05	19.91	20.61	20.90	21.19
25.00	21.87	20.48	20.61	20.10	20.10	20.35	20.61	20.61	20.87	21.78
30.00	21.42	21.42	20.93	20.81	20.10	20.69	20.93	21.42	21.67	21.67
40.00	21.54	20.54	20.74	20.34	20.34	20.14	20.34	20.94	20.94	21.08
50.00	21.55	20.55	20.28	20.02	19.93	19.93	20.19	20.37	20.37	20.64
60.00	21.89	21.07	21.07	20.68	19.51	19.51	20.35	20.51	20.34	21.18
70.00	20.82	20.98	20.90	20.82	19.52	19.52	20.36	20.52	20.82	20.98
80.00	20.90	20.75	20.61	20.18	20.32	20.61	20.61	20.75	20.82	20.90
100.00	20.74	20.61	20.87	20.23	19.98	19.98	20.10	20.23	20.75	20.61
110.00	20.98	20.03	19.86	19.63	19.63	19.52	19.57	19.86	20.09	20.98
120.00	20.00	20.00	19.89	19.67	19.62	19.62	19.78	19.78	19.67	19.89
140.00	20.50	20.29	20.18	20.08	20.08	20.29	20.50	20.50	20.71	20.71
160.00	20.04	20.04	19.85	19.75	19.71	19.66	19.66	20.04	20.04	20.14

TABLE - 5.1 (v)

(FOR NaCl)

QUENCHING TEMPERATURE = 77.3°K

Load P in gm	H_k									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	24.53	23.80	23.11	23.11	21.81	21.81	23.11	24.53	24.53	25.29
2.50	24.19	24.19	23.19	20.54	19.76	19.76	20.54	22.25	23.19	24.19
3.75	25.56	24.67	22.26	22.26	20.19	20.19	20.85	21.54	23.02	25.56
5.00	25.29	25.29	23.11	22.44	22.44	21,81	23.11	23.80	25.29	25.29
6.25	26.50	25.77	24.39	23.75	21.95	21.95	23.12	23.75	24.39	25.77
7.50	25.04	24.43	23.27	22.72	21.67	20.70	21.67	22.72	22.72	23.84
8.75	24.15	24.68	22.09	21.62	21.16	21.16	22.09	22.58	23.09	24.15
10.00	24.19	23.19	22.71	22.25	22.25	21.80	22.71	22.71	23.19	23.68
11.25	23.11	22.66	21.81	21.40	21.40	22.66	22.66	23.11	24.04	24.04
12.50	22.90	22.48	22.48	22.67	22.07	22.48	22.90	22.07	2.90	23.11
13.57	22.21	22.21	21.83	21.65	21.65	21.46	22.21	22.02	21.83	22.61
15.00	22.44	20.75	22.63	21.39	22.26	21.89	21.89	22.26	22.44	22.26
16.75	22.22	22.40	21.87	21.70	21.70	21.87	22.58	22.40	22.76	22.95
17.50	21.14	21.14	21.30	20.82	20.82	20.67	20.82	21.14	20.98	21.46
18.75	22.73	20.73	20.72	20.15	20.44	19.61	20.29	20.44	22.73	22.73
20.00	22.32	20.90	20.90	20.32	20.32	20.18	20.32	20.90	22.32	22.75
25.00	22.61	21.74	21.13	21.13	20.35	20.35	20.61	21.60	21.87	22.90
30.00	21.17	21.42	21.29	20.93	20.81	20.69	20.69	21.29	21.05	21.42
40.00	22.15	21.37	21.37	21.15	20.74	20.74	20.94	21.15	21.05	22.15
50.00	22.37	22.19	20.55	20.02	20.02	19.85	19.76	19.93	22.28	22.55
60.00	21.18	21.18	21.01	21.01	20.68	20.59	21.01	21.01	21.18	22.06
70.00	22.67	21.82	20.82	20.67	20.52	20.36	20.36	20.67	21.67	22.98
80.00	22.61	22.61	20.32	20.32	20.32	20.39	20.32	20.75	22.75	22.90
100.00	22.61	21.23	20.17	20.23	20.10	20.23	20.29	20.55	21.61	22.61
110.00	22.33	21.35	20.33	20.27	19.90	20.03	20.21	20.33	21.27	22.45
120.00	21.12	21.12	20.00	19.67	19.62	19.95	19.84	19.78	21.00	21.00
140.00	21.50	21.44	20.55	20.50	20.29	20.29	20.23	20.39	21.50	21.61
160.00	20.09	20.14	20.04	19.75	19.85	21.78	19.75	19.95	19.98	20.14

TABLE - 5.1 (vi)

(FOR NaCl)

QUENCHING TEMPERATURE = 873°K

Load P in gm	H_k									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	29.68	27.80	27.80	26.09	24.53	26.09	27.80	27.80	29.68	29.68
2.50	28.90	27.60	27.60	26.98	25.25	25.25	26.38	27.60	28.90	28.90
3.75	28.53	27.48	27.48	26.49	25.56	24.67	27.48	28.00	28.53	28.53
5.00	28.72	27.80	26.92	25.29	25.29	24.53	25.29	29.92	27.80	28.72
6.25	28.05	27.26	25.77	27.06	23.75	23.12	24.39	25.06	27.26	27.26
7.50	26.34	25.68	24.43	23.27	22.18	22.18	23.27	24.43	26.34	26.34
8.75	24.71	23.61	23.61	22.58	22.09	22.09	23.09	23.09	24.71	25.28
10.00	25.81	24.71	24.19	23.19	21.80	21.80	22.71	23.68	24.19	25.81
11.25	26.64	25.55	25.03	24.53	23.11	22.83	24.04	25.55	26.09	26.64
12.50	26.71	25.18	24.70	24.23	23.33	23.33	24.70	25.18	26.19	26.71
13.75	26.65	25.67	25.19	24.43	23.01	22.61	23.43	24.29	25.67	26.15
15.00	26.02	25.56	24.67	23.42	22.64	22.26	23.42	25.10	25.56	26.49
16.25	25.81	24.94	23.72	22.59	22.23	22.23	22.95	24.12	25.37	25.81
17.50	26.41	25.97	24.72	24.32	23.19	22.47	22.83	23.94	24.72	26.86
18.75	25.65	24.84	24.08	23.71	22.65	22.32	23.71	24.46	25.24	26.06
20.00	25.29	24.16	23.45	22.71	22.12	22.12	22.77	23.45	23.80	25.29
25.00	25.06	24.39	23.75	22.82	22.24	21.68	22.53	23.12	24.39	25.41
30.00	25.36	24.43	24.13	23.27	22.99	22.45	23.27	23.84	24.73	25.68
40.00	25.53	24.98	24.45	23.68	22.71	22.71	24.45	25.25	25.53	25.81
50.00	25.35	25.18	24.46	24.00	23.35	23.12	23.88	24.46	25.18	25.43
60.00	24.88	24.45	24.03	23.22	22.64	22.45	22.83	23.42	24.67	25.10
70.00	24.92	24.32	23.56	23.01	22.65	22.47	23.01	23.75	24.32	25.13
80.00	24.91	24.35	23.98	23.28	22.77	22.61	22.94	23.45	23.98	24.72
100.00	24.56	24.07	23.75	22.97	22.53	22.38	23.12	23.43	24.07	24.72
110.00	23.25	22.39	22.26	21.59	21.07	20.95	21.20	21.85	22.39	23.10
120.00	22.85	22.58	22.18	21.55	21.18	21.05	21.67	22.18	22.45	22.99
140.00	24.42	23.88	23.21	22.83	22.58	22.34	22.71	23.09	23.88	22.29
160.00	22.60	22.14	21.92	21.48	20.85	20.74	21.37	21.92	22.03	22.48

TABLE - 5.2 (i)

FOR KCl CRYSTALS

ROOM TEMPERATURE = 303°K

Load 'P' in gm	H_k									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	10.07	10.07	9.95	9.35	8.35	8.35	8.98	9.93	9.99	10.07
2.50	10.90	10.90	10.10	9.20	9.00	8.99	9.30	9.98	10.85	10.83
3.75	11.09	11.49	10.99	9.75	8.97	8.97	9.75	10.19	11.08	10.79
5.00	10.79	10.47	10.00	9.74	8.79	8.71	9.65	9.71	10.54	11.09
6.25	10.46	10.94	10.11	9.71	9.10	9.01	9.68	9.95	10.94	10.79
7.50	10.59	10.11	8.99	9.01	8.94	8.94	8.99	8.99	9.94	10.49
8.75	9.96	10.16	9.87	9.14	8.79	8.73	9.20	9.81	9.96	9.96
10.00	10.30	10.66	9.74	8.85	8.85	8.86	9.00	9.74	10.06	10.41
11.25	9.88	9.05	8.91	8.89	8.87	8.87	8.90	8.90	9.14	9.88
12.50	9.81	9.38	9.00	8.81	8.67	8.58	8.89	8.99	9.40	9.81
13.75	9.81	9.80	9.70	9.75	8.65	8.65	8.85	8.90	9.40	10.34
15.00	10.46	9.71	9.34	8.71	8.41	8.40	8.71	8.99	9.70	9.97
16.25	10.00	9.64	9.31	8.85	8.39	8.44	8.85	9.40	9.91	10.04
17.50	10.17	10.00	9.75	9.25	8.17	8.17	9.30	9.64	9.94	10.17
18.75	9.85	10.00	9.74	9.14	8.01	8.01	9.14	9.95	9.99	9.77
20.00	10.17	9.97	9.10	8.71	7.52	7.78	8.73	8.99	9.97	10.17
25.00	10.09	9.99	9.10	8.70	7.49	7.49	8.71	9.15	9.99	9.95
30.00	9.85	9.61	8.91	8.41	7.85	7.50	8.74	8.99	9.17	9.85
40.00	9.82	8.58	8.10	8.40	8.04	8.00	8.18	8.85	9.41	9.82
50.00	9.87	8.87	8.65	8.30	8.05	8.25	8.40	8.71	9.10	9.89
60.00	9.75	9.10	8.88	8.14	7.93	7.77	8.14	8.88	9.10	9.70
70.00	9.94	8.85	8.61	8.00	7.57	7.57	8.01	8.66	8.88	9.80
80.00	9.89	8.84	8.74	7.07	7.61	7.64	7.07	8.00	8.85	9.89
100.00	9.83	8.90	8.71	7.75	7.69	7.77	7.75	8.71	8.88	9.83
110.00	9.79	9.10	9.00	9.05	7.93	7.85	8.05	9.01	9.11	9.79
120.00	9.75	9.14	8.94	8.01	7.90	7.89	8.05	8.95	9.14	9.90
140.00	9.85	8.94	8.81	7.00	7.41	7.38	8.00	8.81	8.94	9.80
160.00	5.59	8.91	8.85	8.00	7.40	7.39	7.99	7.99	8.80	9.41

TABLE - 5.2(ii)

FOR KCl CRYSTALS

QUENCHING TEMPERATURE = 473°K

Load 'P' in gm	A=0°	A=10°	A=20°	A=30°	← H_k → A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	10.70	9.51	8.52	7.94	7.94	8.37	8.83	9.51	9.88	10.07
2.50	10.03	10.03	9.25	8.56	7.95	8.14	8.78	9.25	9.75	9.76
3.75	10.35	10.00	9.27	8.70	8.43	8.18	8.98	8.88	9.08	10.35
5.00	10.47	9.69	8.99	8.67	8.52	8.37	9.16	9.88	10.47	10.69
6.25	10.84	10.10	10.10	9.43	8.83	8.69	9.28	9.76	10.46	11.04
7.50	10.77	9.94	9.06	8.93	8.79	8.67	9.34	9.78	10.26	10.95
8.75	11.06	10.26	10.11	9.68	9.02	9.41	9.96	10.11	10.11	10.90
10.00	11.39	10.75	10.16	9.89	9.37	9.13	9.63	10.16	10.31	11.55
11.25	11.59	10.83	10.27	9.75	9.39	9.51	9.75	10.01	10.98	11.59
12.50	11.26	10.84	10.31	9.81	9.35	9.46	9.81	10.31	10.84	11.26
13.75	11.20	10.70	10.29	9.71	9.17	9.27	9.60	10.17	10.79	11.06
15.00	10.96	10.47	9.89	9.27	8.97	8.97	9.37	9.89	10.59	11.09
16.25	10.84	10.26	10.04	8.52	8.86	9.04	9.62	10.04	10.04	10.84
17.50	10.81	10.25	9.54	8.99	8.81	8.73	9.26	9.74	9.84	10.58
18.75	10.54	10.02	9.09	8.75	8.51	8.67	9.00	9.63	10.02	10.76
20.00	10.37	9.79	9.33	8.75	8.29	8.22	8.52	8.99	9.69	10.17
25.00	10.28	10.01	9.35	8.83	8.28	8.15	8.69	9.35	10.19	10.37
30.00	10.02	9.20	8.73	8.30	8.01	8.30	8.86	9.41	9.63	10.18
40.00	10.03	9.56	9.01	8.30	8.04	8.09	8.45	8.95	9.50	9.89
50.00	9.93	9.30	8.12	8.38	7.93	7.85	8.67	9.14	9.58	9.87
60.00	9.95	9.57	8.93	8.43	8.01	8.01	8.52	8.83	9.73	10.17
70.00	9.74	9.35	8.94	8.56	7.83	8.05	8.28	8.86	9.35	9.84
80.00	9.93	9.47	8.91	8.08	7.71	7.77	8.29	8.99	9.65	9.88
100.00	9.63	8.94	8.58	8.06	7.61	7.58	7.90	8.55	9.05	9.67
110.00	9.40	8.97	8.43	8.09	7.52	7.63	8.03	8.09	8.97	9.44
120.00	9.23	8.79	8.18	7.87	7.42	7.49	7.95	8.18	8.63	9.13
140.00	9.11	8.57	8.04	7.51	7.17	7.28	7.54	7.83	8.45	9.18
160.00	9.01	8.67	8.32	7.59	7.02	7.18	7.62	8.35	8.02	9.04

TABLE - 5.2 (iii)

FOR KCl CRYSTALS

QUENCHING TEMPERATURE = 573°K

Load 'P' in gm	H_k A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	10.95	9.89	9.12	8.95	8.40	8.84	8.90	8.99	9.75	10.99
2.50	10.99	10.25	10.30	9.60	8.90	8.91	9.62	10.28	10.23	10.99
3.75	11.05	10.99	10.17	9.60	9.46	9.43	9.60	10.16	11.00	11.05
5.00	10.95	10.69	9.95	9.75	9.55	9.51	9.74	9.95	10.68	10.94
6.25	11.44	11.10	10.85	10.13	9.86	9.87	10.14	10.84	11.18	11.43
7.50	11.56	10.84	10.06	9.99	9.84	9.80	9.98	10.04	10.83	11.56
8.75	11.95	11.35	11.15	9.89	10.10	10.00	9.90	11.15	11.34	11.94
10.00	12.00	11.64	11.16	10.80	10.41	10.45	10.78	11.18	11.62	12.01
11.25	12.25	11.83	11 17	10.72	10.28	10.23	10.73	11.16	11.85	12.24
12.50	12.26	11.85	11.28	10.65	10.34	10.32	10.68	11.29	11.88	12.27
13.75	12.20	11.75	11.30	10.17	10.25	10.28	10.20	11.32	11.73	12.21
15.00	11.84	11.47	10.89	10.30	9.88	9.91	10.32	10.90	11.48	11.82
16.25	11.54	11.37	11.05	10.48	9.97	9.90	10.50	11.08	11.36	11.53
17.50	11.90	11.25	10.60	9.98	9.81	9.80	9.90	10.63	11.27	11.91
18.75	11.44	11.04	10.08	9.79	9.55	9.53	9.81	10.06	11.06	11.43
20.00	11.38	10.79	10.45	9.84	9.34	9.31	9.83	10.48	11.76	11.36
25.00	11.34	11.01	10.36	9.94	9.31	9.30	9.95	10.38	11.00	11.35
30.00	11.05	10.34	9.98	9.50	9.10	9.00	9.41	9.98	10.36	11.04
40.00	11.10	10.54	9.99	9.45	9.15	9.17	9.51	9.93	10.82	11.12
50.00	10.84	10.24	9.92	9.44	8.95	8.94	9.44	9.98	10.22	10.83
60.00	10.85	10.24	9.89	9.50	9.08	9.10	9.52	9.87	10.24	10.84
70.00	10.75	10.34	9.95	9.65	8.85	8.90	9.62	9.92	10.33	10.73
80.00	10.95	10.45	9.99	9.18	8.65	8.63	9.19	9.98	10.47	10.94
100.00	10.93	10.00	9.65	9.18	8.75	8.72	9.18	9.71	10.01	10.92
110.00	10.40	9.95	9.34	9.90	8.53	8.52	9.90	9.36	9.12	10.40
120.00	10.24	9.64	9.81	8.88	8.45	8.47	8.81	9.83	9.66	10.23
140.00	10.11	9.67	9.38	8.65	8.25	8.26	8.70	9.40	9.67	10.12
160.00	10.05	9.54	9.34	8.95	8.20	8.18	8.91	9.34	9.55	10.05

TABLE - 5.2 (iv)

FOR KCl CRYSTALS

QUENCHING TEMPERATURE = 673°K

Load 'P' in gm	A=0°	A=10°	A=20°	A=30°	A=40° (H_k)	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	11.86	10.95	10.15	9.97	9.85	9.84	9.98	10.13	10.94	11.87
2.50	11.95	11.32	11.44	10.54	9.94	9.93	10.53	11.43	11.33	11.96
3.75	11.96	11.85	11.19	10.68	10.64	10.63	10.69	11.20	11.81	11.95
5.00	11.99	11.71	10.96	10.70	10.15	10.16	10.72	10.95	11.73	11.99
6.25	12.24	12.15	11.75	11.21	10.81	10.82	11.22	11.73	12.17	12.21
7.50	12.55	11.95	11.16	10.95	10.75	10.74	10.98	11.17	11.91	12.58
8.75	12.98	12.44	12.19	10.75	11.11	11.10	10.73	12.20	12.43	12.99
10.00	12.95	12.67	12.21	11.81	11.45	11.47	11.83	12.22	12.62	12.99
11.25	13.05	12.75	12.18	11.67	11.30	11.32	11.69	12.19	12.78	13.08
12.50	13.25	12.81	12.30	11.56	11.35	11.36	11.57	12.32	12.80	13.26
13.75	13.28	12.70	12.28	11.71	11.31	11.30	11.73	12.28	12.72	13.29
15.00	12.88	12.50	11.98	11.34	10.89	10.88	11.34	11.99	12.52	12.89
16.25	12.64	12.47	12.10	11.85	10.98	10.96	11.86	12.11	12.49	12.63
17.50	12.90	12.34	11.65	10.89	10.85	10.84	10.90	11.66	12.36	12.92
18.75	12.54	12.05	11.61	10.79	10.59	10.58	10.73	11.62	12.00	12.55
20.00	12.44	11.98	11.50	10.85	10.43	10.41	10.83	11.52	11.99	12.43
25.00	12.45	12.00	11.40	10.80	10.34	10.32	10.82	11.41	12.02	12.43
30.00	12.09	11.38	10.90	10.60	10.21	10.24	10.62	10.91	11.38	12.08
40.00	12.15	11.95	10.92	10.54	10.20	10.22	10.52	10.93	11.96	12.13
50.00	11.95	11.35	10.85	10.56	9.98	9.99	10.58	10.83	11.36	11.99
60.00	11.97	11.34	10.93	10.51	10.01	10.00	10.51	10.94	11.34	11.98
70.00	11.64	11.40	10.91	10.45	9.89	9.85	10.46	10.92	11.41	11.63
80.00	11.85	11.45	11.00	10.20	9.69	9.68	10.21	11.02	11.47	11.85
100.00	11.90	11.15	10.63	10.19	9.77	9.75	10.20	10.61	11.17	11.91
110.00	11.54	10.94	10.35	10.88	9.61	9.62	10.86	10.33	10.92	11.54
120.00	11.34	10.65	10.84	9.95	9.51	9.53	10.00	10.82	10.67	11.33
140.00	11.15	10.66	10.44	9.74	9.34	9.36	9.73	10.40	10.66	11.17
160.00	11.11	10.55	10.35	9.90	9.27	9.27	9.92	10.35	10.53	11.11

TABLE - 5.2 (v)

FOR KCl CRYSTALS

QUENCHING TEMPERATURE = 773°K

Load 'P' in gm	<— H_k —>									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	12.75	11.84	11.25	10.95	10.75	10.73	10.95	11.24	11.82	12.76
2.50	12.88	12.35	12.34	11.45	10.89	10.88	11.43	12.32	11.31	12.85
3.25	12.95	12.91	12.21	11.56	10.94	10.94	11.57	12.23	12.95	12.93
5.00	12.94	12.84	11.98	11.69	11.19	11.19	11.70	11.99	12.84	12.95
6.25	13.15	13.40	12.64	11.12	11.74	11.73	11.15	12.63	13.41	13.16
7.50	13.44	12.95	12.24	11.95	11.65	11.63	12.01	12.25	12.93	13.42
8.75	13.96	13.18	13.10	11.55	12.18	12.19	11.59	13.10	13.19	13.98
10.00	13.85	13.66	13.21	12.81	12.55	12.53	12.80	13.22	13.67	13.84
11.25	13.88	13.78	13.20	12.60	12.38	12.37	12.58	13.21	13.79	13.83
12.50	14.14	13.88	13.28	12.61	12.45	12.43	12.59	13.27	13.89	14.13
13.75	14.34	13.76	13.35	12.75	12.39	12.37	12.76	13.35	13.77	14.35
15.00	13.96	13.61	12.91	12.40	11.88	11.87	12.41	12.92	13.62	13.93
16.25	13.54	13.51	12.99	12.80	11.91	11.90	12.82	12.98	13.52	13.51
17.50	13.95	13.44	12.65	11.85	11.58	11.57	11.86	12.67	13.43	13.92
18.75	13.55	13.15	12.59	11.71	11.50	11.51	11.72	12.60	14.14	13.58
20.00	13.48	12.95	12.55	11.81	11.41	11.40	11.83	12.53	12.99	13.49
25.00	13.54	12.98	12.60	11.79	11.43	11.45	11.78	12.63	12.96	13.55
30.00	13.14	12.35	11.95	11.56	11.27	11.29	11.54	11.93	12.33	13.18
40.00	13.18	12.95	11.99	11.64	11.21	11.26	11.63	12.00	12.98	13.19
50.00	12.96	12.33	11.84	11.65	10.95	10.98	11.68	11.83	12.33	12.96
60.00	12.99	12.29	11.95	11.61	11.10	10.99	11.64	11.94	12.30	12.99
70.00	12.65	12.39	11.98	11.75	10.85	10.88	11.73	12.01	12.38	12.64
80.00	12.78	12.50	12.01	11.34	10.55	10.49	11.38	12.03	12.54	12.79
100.00	12.91	12.25	11.69	11.25	10.71	10.69	11.28	11.69	12.29	12.95
110.00	12.55	11.95	11.65	11.85	10.65	10.61	11.83	11.65	11.99	12.56
120.00	12.35	11.85	11.85	10.85	10.55	10.52	10.85	11.83	11.84	12.37
140.00	12.25	11.68	11.41	10.88	10.34	10.32	10.89	11.42	11.67	12.27
160.00	12.21	11.54	11.35	10.91	10.35	10.33	10.90	11.34	11.53	12.23

TABLE - 5.2 (vi)

FOR KCl CRYSTALS

QUENCHING TEMPERATURE = 873°K

Load 'P' in gm	A=0°	A=10°	A=20°	A=30°	A=40° H_k	A=50°	A=60°	A=70°	A=80°	A=90°
1.20	13.85	12.95	12.30	11.95	11.35	11.38	11.94	12.31	12.93	13.83
2.25	13.98	12.99	13.41	12.55	11.85	11.83	12.56	12.43	12.98	13.97
3.75	13.84	13.84	13.44	12.56	11.99	12.00	12.54	13.46	13.63	13.83
5.00	13.91	13.81	13.15	12.75	12.25	12.23	12.73	13.18	13.82	13.92
6.25	14.45	13.35	13.61	12.21	12.64	12.63	12.23	13.14	13.37	14.73
7.50	15.54	13.91	13.30	12.96	12.75	12.73	12.97	13.28	13.93	14.53
8.75	14.86	14.20	14.19	12.45	13.25	13.28	12.46	14.12	14.22	14.87
10.00	14.71	14.61	14.25	13.79	13.56	13.57	13.78	14.27	14.63	14.73
11.25	14.89	14.68	14.21	13.40	13.48	13.47	13.42	14.20	14.67	14.88
12.5	14.99	14.44	14.31	13.50	13.44	13.43	13.51	14.32	14,43	14.99
13.75	15.13	14.56	14.38	13.55	13.47	13.46	13.55	14.37	14.57	15.13
15.00	14.98	14.65	13.98	13.48	12.85	12.86	13.50	13.92	14.63	14.97
16.20	14.44	14.51	13.99	13.88	12.94	12.96	13.89	13.99	14.52	14.43
17.50	14.86	14.64	13.54	12.86	12.65	12.66	12.87	13.52	14.62	14.86
18.75	14.45	14.20	13.61	12.79	12.54	12.53	12.80	13.65	14.22	14.49
20.00	14.52	13.91	13.50	12.95	12.45	12.43	12.80	13.48	13.92	14.53
25.50	14.61	13.99	13.66	12.84	12.41	12.42	12.82	13.69	14.00	14.62
30.00	14.25	13.50	12.96	12.61	12.35	12.35	12.62	12.98	13.55	14.28
40.00	14.29	13.98	12.99	12.69	12.37	12.36	12.70	12.99	13.99	14.30
50.00	13.98	13.35	12.85	12.71	11.96	11.96	12.72	12.83	13.39	13.98
60.00	13.99	13.30	12.96	12.75	12.27	12.25	12.73	12.94	13.32	13.99
70.00	13.45	13.78	12.99	12.65	11.88	11.89	12.64	12.96	13.39	13.49
80.00	13.71	13.45	13.05	12.41	11.65	11.67	12.42	13.02	13.44	13.72
100.00	13.94	13.35	12.75	12.35	11.77	11.18	12.36	12.76	13.38	13.98
110.00	13.45	12.98	12.74	12.05	11.66	11.65	12.63	12.63	12.99	13.49
120.00	13.38	12.85	12.89	11.79	11.65	11.63	11.80	12.87	12.83	13.42
140.00	13.33	12.66	12.55	11.85	11.43	11.45	11.86	12.55	12.68	13.35
160.00	13.20	12.45	12.36	11.89	11.38	11.37	11.99	12.37	12.47	13.21

TABLE - 5.3 (i)

FOR KBr CRYSTALS

ROOM TEMPERATURE = 303°K

Load P in gm	<———— Hk ————>									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.250	7.420	7.420	6.950	6.950	6.730	6.630	6.950	6.730	7.420	7.420
2.500	7.570	7.570	7.390	7.220	7.060	7.060	7.220	7.390	7.570	7.570
3.750	8.014	8.180	7.860	7.550	7.550	7.410	7.525	7.860	8.180	8.014
5.000	8.220	8.080	8.080	7.940	7.940	7.940	8.080	8.080	7.940	8.370
6.250	8.550	8.540	8.410	8.280	8.030	7.900	8.280	8.410	8.690	8.690
7.500	8.790	8.790	8.540	8.540	8.180	8.185	8.540	8.540	8.790	8.790
8.750	9.144	9.145	8.893	8.770	8.420	8.420	8.890	8.890	9.150	9.144
10.000	10.160	9.889	8.895	8.900	8.560	8.560	8.780	9.760	8.890	10.160
11.250	10.540	10.406	10.007	9.270	8.620	8.720	9.270	9.870	10.406	10.685
12.500	9.753	10.566	10.180	9.460	8.620	8.530	9.460	10.180	10.570	9.850
13.750	9.379	9.490	10.410	9.600	8.770	8.680	9.600	10.410	9.470	9.380
15.000	9.069	8.970	9.270	9.890	9.020	9.070	9.890	9.270	8.970	9.070
16.250	8.850	8.860	9.130	10.200	9.320	9.320	10.260	9.130	8.860	8.860
17.500	8.644	8.560	8.560	9.740	9.440	9.440	9.640	8.560	8.540	8.640
18.750	8.130	7.980	7.840	8.830	9.720	9.720	8.830	7.840	7.980	8.200
20.000	8.222	8.150	8.009	8.080	9.420	9.420	8.080	7.940	8.150	8.220
25.000	8.152	8.220	7.900	7.780	7.780	7.900	7.780	7.840	8.220	8.150
30.000	8.119	8.062	7.890	7.520	7.270	7.220	7.520	7.890	8.060	8.120
40.000	8.040	7.897	7.890	7.480	7.220	7.220	7.440	7.890	7.897	8.040
50.000	8.064	7:020	7.890	7.520	7.390	7.170	7.520	7.850	8.020	8.060
60.000	8.014	7.930	7.810	7.517	7.230	7.230	7.480	7.810	7.930	7.970
70.000	8.015	7.910	7.120	7.387	7.320	7.320	7.390	7.720	7.910	8.020
80.000	8.079	8.080	7.009	7.480	7.268	7.268	7.480	8.009	8.080	8.080
100.000	7.903	7.810	7.720	7.466	7.380	7.380	7.466	7.720	7.810	7.840
110.000	7.914	7.910	7.690	7.090	7.085	7.040	7.110	7.690	7.970	7.910
120.000	7.921	7.870	7.750	7.340	7.240	7.270	7.340	7.750	7.870	7.920
140.000	7.808	7.730	7.660	6.868	6.868	6.830	6.868	7.660	7.730	7.830

TABLE - 5.3(ii)

(FOR KBr)

QUENCHING TEMPERATURE = 473°K

Load P in gm	Hk A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.250	5.950	5.950	5.780	5.780	5.990	5.990	5.780	5.780	5.780	5.780
2.500	7.570	7.480	7.220	7.060	7.060	6.940	7.098	7.098	7.089	7.570
3.750	8.180	8.260	8.090	7.550	7.410	7.410	7.550	8.070	8.260	8.180
5.000	9.690	9.510	9.510	8.070	8.220	8.220	8.070	9.510	9.208	9.510
1.250	9.510	9.590	9.430	8.550	8.548	8.550	8.550	9.430	10.210	9.510
7.500	10.170	10.430	9.630	8.670	8.993	8.993	8.670	9.630	10.330	9.630
8.750	10.900	10.896	9.680	9.017	9.339	9.017	9.017	10.900	10.596	10.900
10.000	10.900	10.749	9.880	9.498	8.781	8.781	9.498	9.380	10.749	10.900
11.250	10.100	10.007	10.007	9.510	8.939	8.940	9.920	10.007	10.007	10.570
12.500	9.810	9.812	10.180	9.810	9.135	9.139	9.335	10.180	9.812	9.335
13.750	9.510	9.240	10.536	10.170	9.270	10.034	10.170	10.536	9.240	9.806
15.000	9.118	9.216	9.330	9.260	9.780	9.756	9.260	9.330	9.216	9.118
16.250	9.008	9.813	9.086	9.039	9.825	9.864	9.039	9.086	9.813	9.205
17.500	9.040	9.257	9.211	9.231	9.250	9.250	9.231	9.083	9.257	9.041
18.750	9.003	8.957	9.321	9.173	8.832	8.832	9.173	9.250	8.978	9.003
20.000	9.010	8.790	9.035	8.952	8.711	8.714	8.952	9.380	8.790	9.010
25.000	8.900	8.617	8.985	8.550	8.150	8.153	8.850	8.985	8.620	8.612
30.000	8.890	9.129	8.794	8.600	8.119	8.600	8.600	8.794	9.129	8.919
40.000	8.780	8.615	8.982	8.400	8.093	8.093	8.400	8.982	8.615	8.780
50.000	8.690	8.507	8.407	8.290	8.154	8.154	8.290	8.407	8.562	8.690
60.000	8.210	8.197	8.302	8.302	8.302	8.302	8.302	8.302	8.197	8.210
70.000	8.620	8.500	8.224	8.166	8.053	8.053	8.166	8.224	8.500	8.620
80.000	8.490	8.537	8.331	8.331	8.258	8.258	8.331	8.331	8.537	8.490
100.000	8.210	8.057	8.248	7.990	7.910	7.910	7.990	8.248	8.057	8.210
110.000	8.500	8.384	8.214	7.790	7.940	7.940	7.790	8.448	8.384	8.500
120.000	7.400	8.110	8.226	7.810	8.005	8.005	7.810	8.228	8.110	7.400
140.000	8.120	7.910	8.111	8.020	8.027	8.027	8.020	8.111	7.910	8.120

TABLE - 5.3 (iii)

(FOR KBr)

QUENCHING TEMPERATURE = 573°K

Load P in gm	Hk									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.250	5.880	5.970	5.880	5.880	5.620	5.620	5.620	5.880	5.880	5.970
2.500	6.470	6.470	6.180	6.180	6.180	6.180	6.470	6.470	6.470	6.470
3.750	6.710	6.710	6.710	6.120	6.120	6.120	6.410	6.410	6.710	6.710
5.000	8.160	8.160	8.160	7.800	7.800	7.800	8.160	8.160	8.350	8.350
6.250	9.310	9.310	9.310	8.890	7.740	7.390	8.890	8.490	9.310	9.310
7.500	9.730	9.290	9.730	8.870	8.730	9.290	9.730	9.290	9.290	9.730
8.750	9.890	9.890	9.440	9.660	9.890	9.440	9.890	9.440	9.890	10.350
10.000	9.400	9.400	8.970	8.970	8.570	8.570	9.180	9.180	9.180	9.400
11.250	9.210	9.210	9.790	8.590	8.400	8.400	8.400	9.210	9.210	9.650
12.500	9.335	9.335	8.914	9.335	8.710	8.710	8.910	8.910	9.335	9.550
13.750	8.940	8.150	9.360	8.940	8.740	8.540	8.940	9.360	9.150	9.150
15.000	8.490	8.115	8.115	7,400	7.060	7.070	7.400	8.115	8.115	8.490
16.250	8.996	8.996	8.996	7.650	7.310	7.310	9.070	9.040	9.040	8.996
17.500	7.870	7.870	7.870	7.520	7.180	7.180	7.520	7.870	7.870	7.870
18.750	8.050	8.060	7.690	7.690	7.340	7.350	7.690	8.050	8.050	8.060
20.000	8.200	7.830	7.830	7.490	7.150	7.150	7.490	7.490	7.830	8.200
25.000	8.200	8.000	7.840	7.450	7.100	7.100	7.550	7.650	8.010	8.300
30.000	8.130	8.520	7.760	7.410	7.080	7.080	7.760	7.760	8.130	8.130
40.000	8.820	8.610	9.020	8.220	8.090	8.090	8.220	9.020	8.610	8.610
50.000	7.800	7.670	7.500	7.550	8.169	7.800	7.980	8.436	8.550	8.957
60.000	7.430	7.430	7.100	7.100	7.100	6.939	7.430	7.430	7.430	7.786
70.000	7.910	7.910	7.556	7.556	7.210	7.210	7.556	7.910	7.910	8.285
80.000	8.250	8.059	7.875	7.875	7.875	8.059	7.975	8.250	8.250	8.250
100.000	8.190	8.190	8.002	7.819	7.819	7.819	8.002	8.190	8.190	8.574
110.000	8.210	8.210	8.027	7.850	7.850	7.490	7.490	7.850	8.210	8.210
120.000	7.805	7.805	7.450	7.450	7.450	7.450	7.627	7.805	7.805	7.805
140.000	8.300	7.930	7.570	7.930	7.233	7.233	6.907	7.570	7.930	8.300

TABLE - 5.3 (iv)

(FOR KBr)

QUENCHING TEMPERATURE = 673°K

Load P in gm	Hk A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.250	5.890	5.890	5.840	5.620	5.620	5.760	5.840	5.809	5.890	5.970
2.500	6.470	6.470	6.470	6.098	6.180	6.180	6.180	6.470	6.470	6.470
3.750	6.720	6.720	6.420	6.120	6.120	8.850	6.420	6.460	6.720	6.720
5.000	8.169	7.980	7.980	7.800	7.800	7.620	7.980	8.169	8.169	8.350
6.250	9.312	8.890	8.890	8.490	7.390	7.460	8.490	8.890	8.890	9.312
7.500	9.730	9.290	8.870	8.870	8.670	8.670	9.290	9.290	9.730	9.730
8.750	9.890	9.890	9.445	9.445	9.230	9.230	9.665	9.890	9.890	9.890
10.000	8.970	8.570	8.570	7.820	7.470	7.820	8.190	8.570	8.570	8.970
11.250	8.400	8.400	8.210	8.020	7.660	7.660	8.400	8.400	8.790	8.790
12.500	8.914	8.914	8.711	8.513	8.130	8.130	8.513	8.914	8.914	9.330
13.750	8.940	8.940	8.940	8.739	8.540	8.350	8.160	8.739	8.739	8.940
15.000	8.497	7.750	7.750	7.400	7.067	7.067	7.400	7.750	7.750	8.115
16.250	8.790	8.590	8.395	7.660	6.980	6.980	7.660	8.017	8.395	8.790
17.500	7.520	7.181	7.181	6.858	6.858	6.700	7.350	7.350	7.520	7.520
18.750	7.017	7.019	7.019	6.700	6.400	6.400	6.700	6.700	7.019	7.019
20.000	7.490	7.490	7.490	7.140	6.827	6.827	7.140	7.140	7.490	7.490
25.000	7.950	8.517	7.770	7.084	7.804	7.084	7.420	7.770	7.770	8.134
30.000	7.950	8.512	7.770	7.084	7.084	7.084	7.420	7.770	7.770	8.134
40.000	7.503	7.503	7.165	6.875	6.843	6.834	6.530	7.503	7.857	7.503
50.000	7.801	7.801	7.450	7.450	6.794	7.450	7.801	7.801	7.801	8.169
60.000	7.436	7.436	6.781	6.781	6.476	6.476	6.781	7.101	7.101	7.436
70.000	7.556	7.556	7.216	7.216	6.890	6.734	7.216	7.216	7.556	7.556
80.000	8.250	8.059	7.875	7.875	7.350	7.350	7.875	7.875	8.059	8.250
100.000	7.820	7.820	7.820	7.468	7.290	7.290	7.820	7.820	8.002	8.002
110.000	8.214	8.214	7.845	7.154	7.154	6.830	6.830	7.154	7.154	7.145
120.000	7.770	7.698	7.662	7.627	7.627	7.557	7.557	7.627	7.698	7.770
140.000	8.304	7.574	7.574	7.233	7.233	6.907	6.596	7.233	7.930	7.930

TABLE - 5.3 (v)

(FOR KBr)

QUENCHING TEMPERATURE = 773°K

Load P in gm	Hk									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	10.68	11.59	11.35	10.27	10.07	10.07	10.90	10.68	11.59	11.35
2.50	11.55	11.55	11.55	10.90	10.90	10.74	11.22	11.22	11.55	10.90
3.75	11.63	11.49	11.63	11.09	11.09	10.83	11.09	11.63	11.35	11.35
5.00	11.35	11.47	11.47	11.12	10.79	10.90	10.68	11.35	11.35	11.24
6.25	11.03	11.03	11.74	10.84	10.46	10.55	10.64	10.64	11.63	11.24
7.50	10.76	10.94	10.94	10.59	10.59	10.42	10.42	10.94	10.76	10.94
8.75	10.26	10.11	10.41	9.96	9.96	10.11	10.64	10.41	10.41	10.26
10.00	10.45	10.16	10.16	10.16	10.30	9.88	9.88	10.30	10.59	10.59
11.25	10.54	10.68	10227	9.87	9.87	10.27	10.27	9.75	9.75	9.16
12.50	10.30	10.05	10.05	10.17	9.81	9.81	10.05	10.17	10.17	10.43
13.73	10.41	10.53	10.28	9.93	9.87	10.04	9.99	10.28	10.53	10.28
15.00	10.46	10.23	10.23	10.00	10.00	10.46	10.46	10.40	10.58	10.58
16.25	10.60	10.36	10.36	10.25	10.14	10.03	10.14	10.36	10.76	10.71
17.50	10.46	10.69	10.46	10.35	10.35	10.35	10.58	10.58	10.81	10.35
18.75	10.53	10.53	10.53	10.32	10.22	10.22	10.16	10.15	10.15	10.53
20.00	10.37	10.68	10.57	10.37	10.17	10.17	10.37	10.37	10.57	10.68
25.00	10.53	10.27	10.18	10.09	10.09	10.46	10.36	10.55	10.46	10.64
30.00	10.25	10.34	10.17	10.17	9.85	9.85	10.09	10.09	10.25	10.42
40.00	10.09	10.09	10.16	10.02	9.82	9.82	9.95	10.09	10.16	10.16
50.00	10.11	10.11	10.99	9.99	9.75	9.87	9.99	9.99	10.17	10.14
60.00	10.23	10.11	10.11	9.94	9.94	9.89	10.00	10.00	10.23	10.29
70.00	10.19	10.35	10.30	10.19	10.04	10.04	10.19	8.78	10.35	10.35
80.00	10.12	10.02	9.92	9.92	9.87	9.83	9.97	9.97	10.12	10.17
100.00	10.14	10.09	10.09	9.92	9.79	9.79	9.92	9.92	10.01	10.01
110.00	10.07	10.07	9.99	9.99	9.87	9.83	9.95	9.49	10.07	10.11
120.00	10.05	10.01	9.93	9.93	9.85	9.85	9.93	10.05	10.05	10.09
140.00	9.71	9.40	9.67	9.37	9.95	9.47	9.54	9.96	9.78	9.71

TABLE - 5.3(vi)

(FOR KBr)

QUENCHING TEMPERATURE = 873°K

Load P in gm	<———— Hk ————>									
	A=0°	A=10°	A=20°	A=30°	A=40°	A=50°	A=60°	A=70°	A=80°	A=90°
1.25	10.68	11.12	10.68	10.27	9.87	9.87	10.68	10.47	10.68	11.12
2.50	11.22	10.59	10.59	10.02	10.02	10.30	10.90	10.90	11.55	11.55
3.75	11.35	11.35	10.68	11.09	10.83	11.09	11.63	11.91	11.60	11.91
5.00	11.83	11.83	11.35	11.35	11.35	11.59	11.71	11.83	11.83	11.71
6.75	12.00	11.88	11.66	11.66	11.66	11.88	12.11	12.11	12.11	12.34
7.50	11.80	11.91	11.70	11.70	11.31	11.31	11.60	11.70	11.91	11.91
8.75	11.41	11.41	11.06	10.89	10.27	10.81	11.06	11.23	11.41	11.23
10.00	11.30	11.22	11.22	10.98	10.90	10.74	10.90	11.22	11.22	11.55
11.75	10.82	10.75	10.97	10.75	10.54	10.54	10.97	11.12	11.27	11.12
12.50	11.26	11.26	11.33	11.11	10.90	10.97	11.04	11.41	11.26	11.11
13.75	11.26	11.33	11.40	11.19	10.92	11.05	11.01	11.19	11.19	11.33
15.00	11.22	10.96	11.02	10.77	10.77	10.71	10.83	10.96	10.92	10.96
16.75	11.33	11.47	11.51	11.27	11.02	11.02	11.14	11.26	11.71	11.33
17.50	10.98	10.81	11.81	10.52	10.69	10.63	10.81	10.86	11.16	11.16
18.75	10.09	11.09	10.98	10.75	10.64	10.75	10.98	10.98	11.09	11.09
20.00	10.01	11.12	11.01	10.79	10.79	10.68	10.47	10.68	10.79	11.12
25.00	10.84	10.55	10.64	10.55	10.36	10.32	10.46	10.64	10.84	10.74
30.00	10.90	10.72	10.76	10.55	10.59	10.50	10.68	10.68	10.94	10.94
40.00	10.86	10.90	10.67	10.67	10.56	10.52	10.67	10.74	10.74	10.82
50.00	10.76	10.63	10.63	10.70	10.53	10.53	10.50	10.56	10.63	10.70
60.00	10.80	10.71	10.71	10.64	10.64	10.64	10.71	10.77	10.89	10.89
70.00	10.83	10.58	10.75	10.78	10.63	10.63	10.58	10.69	10.81	10.98
80.00	10.76	10.68	10.65	10.57	10.57	10.63	10.60	10.63	10.79	10.79
100.00	10.69	10.69	10.67	10.57	10.50	10.50	10.46	10.60	10.69	10.69
110.00	10.68	10.77	10.68	10.59	10.59	10.55	10.64	10.64	10.73	10.73
120.00	10.50	10.42	10.42	10.38	10.38	10.40	10.50	10.50	10.53	10.55
140.00	10.11	9.99	9.99	10.03	9.96	9.92	9.92	10.03	10.11	10.11

TABLE - 5.4 A

FOR NaCl CRYSTALS

MEAN HARDNESS VALUES $\bar{H}$ IN Kg/mm^2 FROM PLOTS OF H Vs P

FOR NaCl : (APPLIED LOADS > 20 gm)

Orientation A	Temperature T					
	303°K	473°K	573°K	673°K	773°K	873°K
0	19.62	20.10	20.224	21.09	22.08	24.66
10	19.51	19.84	20.220	20.61	21.56	24.13
20	18.53	19.02	20.130	20.54	20.69	23.61
30	17.84	17.94	19.910	19.94	20.54	22.92
40	16.75	17.35	18.890	19.92	20.32	22.44
50	16.66	17.10	18.860	20.01	20.32	22.31
60	17.45	18.05	19.790	20.31	20.39	22.86
70	18.31	19.15	20.065	20.50	20.68	23.44
80	19.47	20.10	20.200	20.61	21.57	24.14
90	19.62	20.26	20.260	21.00	22.27	24.76

TABLE - 5.4 B

FOR NaCl CRYSTALS

CALCULATION OF $\bar{H}$ BY USING RELATION.

$$\bar{H} = 14230 \times a_2^{2/n_2} \times p^{\frac{n_2-2}{n_2}} .$$

P = 100 gm.

Orientation A in degree	Temperature T					
	303°K	473°K	573°K	673°K	773°K	873°K
0	20.870	21.020	20.997	23.408	22.114	23.484
10	21.005	20.994	20.120	21.112	22.083	23.125
20	19.000	19.997	20.545	20.330	21.536	22.628
30	17.238	17.900	18.497	19.227	20.835	21.211
40	15.996	16.996	17.497	18.238	19.446	20.377
50	14.997	15.600	17.336	18.334	18.834	20.552
60	16.496	17.445	18.217	19.446	20.226	20.887
70	17.100	18.498	19.846	23.251	21.557	21.994
80	20.497	20.994	21.102	21.455	22.281	22.972
90	21.998	21.999	22.229	22.849	23.047	23.330

TABLE - 5.4 C

FOR NaCl CRYSTALS

CALCULATION OF $\bar{H}$ BY USING RELATION

$$\bar{H} = 14230 \times b_2$$

Orientation A in degree	Temperature T in °K					
	303	473	573	673	773	873
0	20.188	20.000	22.500	21.999	22.440	22.874
10	20.185	20.499	21.000	20.225	22.881	21.131
20	18.597	19.499	21.199	21.000	20.439	21.117
30	17.566	17.899	19.399	20.000	20.642	20.885
40	15.895	15.889	18.500	18.550	19.240	19.873
50	15.882	16.700	17.389	18.880	18.884	19.624
60	17.566	17.999	17.800	20.000	19.478	20.873
70	18.705	18.550	19.499	22.420	19.486	21.471
80	20.185	19.799	21.899	22.880	22.312	22.840
90	20.220	20.499	22.799	23.119	21.855	23.119

TABLE - 5.5 A

FOR KCl CRYSTALS

MEAN HARDNESS VALUES $\bar{H}$ IN Kg/mm^2 FROM PLOTS OF H Vs P

FOR KCl : (LOAD APPLIED GREATER THAN 20 gm)

Orientation A	Temperature T					
	303°K	473°K	573°K	673°K	773°K	873°K
0	9.8609	9.7407	10.768	11.813	12.84	13.853
10	9.1384	9.2392	10.234	11.292	12.30	13.319
20	8.8000	8.7360	9.850	10.847	11.90	12.943
30	8.0415	8.2115	9.380	10.390	11.45	12.472
40	7.7200	7.7538	8.810	9.865	10.87	11.894
50	7.7100	7.8100	8.807	9.864	10.80	11.893
60	8.1400	8.2592	9.382	10.400	11.45	12.461
70	8.7461	8.7553	9.858	10.845	11.91	12.936
80	9.1800	9.2640	10.300	11.298	12.37	13.334
90	9.8700	9.7561	10.760	11.813	12.85	13.873

TABLE - 5.5 B

FOR KCl CRYSTALS

CALCULATION OF $\bar{H}$ BY USING RELATION

$$\bar{H} = 14230 \times a_2^{2/n_2} \times P^{\frac{n_2-2}{n_2}} .$$

P = 100 gm

Orientation A in degree	Temperature T °K					
	303	473	573	673	773	873
0	11.542	12.466	11.953	12.360	12.804	14.367
10	12.348	12.043	12.866	11.519	13.386	14.114
20	11.223	11.175	11.813	11.193	13.312	13.855
30	10.889	10.088	11.835	10.565	12.774	13.336
40	9.368	9.645	10.174	10.128	12.065	13.110
50	10.111	8.897	10.346	10.231	11.980	12.996
60	10.884	9.997	11.339	11.013	12.587	12.986
70	11.403	10.913	12.017	11.411	12.995	13.597
80	11.883	11.054	12.712	12.818	15.728	14.309
90	12.563	11.991	12.002	12.410	13.565	14.564

TABLE - 5.5 C

FOR KCl CRYSTALS

CALCULATION OF $\bar{H}$ BY USING RELATION

$$\bar{H} = 14230 \times b_2 .$$

Orientation A in degree	Temperature T °K					
	303	473	573	673	773	873
0	10.752	10.584	10.665	11.485	12.560	13.316
10	11.200	10.338	11.086	10.985	12.118	13.175
20	10.55	11.011	10.197	10.571	12.156	13.019
30	10.116	9.955	10.856	10.191	11.762	12.856
40	8.742	9.881	9.990	10.321	11.134	11.951
50	8.512	9.618	10.017	9.855	11.216	11.987
60	9.147	8.818	10.885	10.185	11.756	12.186
70	10.258	10.999	11.196	11.255	12.075	12.858
80	10.224	11.159	12.197	10.961	12.345	13.305
90	11.036	10.464	12.018	11.345	12.601	13.323

TABLE - 5.6 A

FOR KBr CRYSTALS

MEAN HARDNESS VALUES $\overline{H}$ IN Kg/mm^2 FROM PLOTS OF H Vs P FOR KBr : (APPLIED LOADS > 20 gm).

Orientation A	Temperature T					
	303°K	473°K	573°K	673°K	773°K	873°K
0	8.00	8.43	8.08	7.86	10.13	11.41
10	7.94	8.41	8.03	7.81	10.08	10.61
20	7.72	7.91	7.78	7.52	10.14	10.60
30	7.40	7.68	7.62	7.27	9.98	10.48
40	7.27	7.65	7.58	7.07	9.19	10.30
50	7.25	7.65	7.54	7.05	9.20	10.29
60	7.40	7.78	7.68	7.24	9.78	10.50
70	7.81	7.91	7.90	7.51	9.95	10.61
80	7.95	8.40	8.02	7.68	10.15	10.77
90	7.99	8.44	8.12	7.67	10.20	11.43

TABLE - 5.6. B

FOR KBr CRYSTALS

CALCULATION $\bar{H}$ BY USING RELATION

$$\bar{H} = 14230 \times a_2^{2/n_2} \times P^{\frac{n_2-2}{n_2}} .$$

P = 100 gm

Orientation A in degree	Temperature T °K					
	303	473	573	673	773	873
0	9.143	10.389	9.285	8.850	10.855	7.533
10	8.716	10.150	9.115	8.170	10.116	10.811
20	8.226	10.016	8.916	7.815	11.187	10.189
30	7.085	8.616	8.636	7.112	9.169	9.756
40	6.851	7.881	6.515	6.302	8.455	9.499
50	6.667	8.021	6.345	6.309	8.150	9.499
60	7.096	8.859	7.181	6.916	8.770	9.998
70	8.051	9.899	7.999	7.884	9.566	10.177
80	8.722	10.154	8.872	8.116	8.185	10.999
90	9.156	10.446	9.009	8.850	10.855	11.755

TABLE - 5.6 C

FOR KBr CRYSTALS

CALCULATION $\bar{H}$ BY USING RELATION

$$\bar{H} = 14230 \times b_2$$

Orientation A in degree	Temperature T °K					
	303	473	573	673	773	873
0	8.451	9.101	8.345	7.997	9.566	10.616
10	8.015	8.516	8.101	7.317	9.216	10.322
20	7.561	7.918	7.916	7.230	8.956	9.855
30	6.915	7.008	7.500	6.134	8.185	9.100
40	6.276	6.991	6.326	6.113	7.617	8.562
50	6.335	6.999	6.335	5.751	7.658	8.562
60	7.001	7.583	6.991	6.134	8.220	9.236
70	7.617	7.617	6.999	6.917	8.956	10.313
80	8.057	9.000	7.213	7.385	9.226	10.594
90	8.616	9.202	8.186	7.884	9.666	10.615

TABLE - 5.7

FOR NaCl CRYSTALS

$\log T_q$	$\log \bar{H} T_q$									
	A=0	A=10	A=20	A=30	A=40	A=50	A=60	A=70	A=80	A=90
2.4814	3.7741	3.7716	3.7493	3.7328	3.7054	3.7031	3.723	3.7441	3.7708	3.7741
2.6748	3.9780	3.9724	3.9541	3.9286	3.9141	3.9078	3.931	3.9570	3.9780	3.9815
2.7581	4.0640	4.0639	4.0619	4.0572	4.0343	4.0336	4.054	4.0605	4.0635	4.0647
2.8280	4.1520	4.1420	4.1406	4.1277	4.1273	4.1292	4.135	4.1397	4.1420	4.1502
2.8880	4.2311	4.2218	4.2039	4.2007	4.1961	4.1961	4.197	4.2037	4.2220	4.2383
2.9410	4.3330	4.3235	4.3141	4.3012	4.2920	4.2895	4.300	4.3109	4.3237	4.3347

Slope(m)	1.1666	1.1660	1.2250	1.3000	1.3330	1.3330	1.300	1.1660	1.1666	1.1666
C	7.4448	7.1647	4.5708	2.8840	2.2353	2.3856	2.331	6.4595	7.1647	7.4448
K=1-m	-0.1666	-0.1660	-0.2250	-0.3000	-0.3330	-0.3330	-0.333	-0.1650	-0.1647	-0.1666

TABLE - 5.8

FOR KCl CRYSTALS

	Log $\bar{H}$ T_q									
Log T_q	A=0	10	20	30	40	50	60	70	80	90
2.4814	3.4753	3.4423	3.4259	3.3867	3.3690	3.3684	3.392	3.4232	3.4442	3.4757
2.6748	3.6634	3.6404	3.6161	3.5892	3.5643	3.5675	3.591	3.6171	3.6616	3.6641
2.7581	3.7903	3.7682	3.7515	3.7030	3.7030	3.7020	3.730	3.7519	3.7709	3.7899
2.8280	3.9004	3.8807	3.8633	3.8446	3.8220	3.8220	3.845	3.8632	3.8810	3.9004
2.8880	3.9967	3.9780	3.9640	3.9409	3.9244	3.9240	3.946	3.9640	3.9805	3.9970
2.9610	4.0825	4.0654	4.0530	4.0369	4.0163	4.0163	4.036	4.0528	4.0659	4.0831

Slope(m)	1.1333	1.1333	1.2000	1.3000	1.3333	1.3330	1.300	1.2220	1.1330	1.1333
C	4.8613	4.6425	2.8840	1.4454	1.1030	1.1030	1.462	2.5644	4.6960	4.8013
K=(1-m)	-0.1333	-0.1333	-0.2000	-0.3000	-0.3330	-0.3330	-0.300	-0.2220	-0.1330	-0.1333

TABLE - 5.9

FOR KBr CRYSTALS

	← Log $\bar{H}$ T_q →									
Log T_q	A = 0	10	20	30	40	50	60	70	80	90
2.4814	3,3846	3.3812	3.369	3.3506	3.3429	3.3417	3.3506	3.374	3.3818	3.3839
2.6748	3.6000	3.5996	3.573	3.5602	3.5368	3.5385	3.5658	3.573	3.5991	3.6012
2.7581	3.6655	3.6620	3.649	3.6400	3.6378	3.6355	3.6435	3.656	3.6623	3.6677
2.8280	3.7234	3.7206	3.704	3.6895	3.6774	3.6762	3.6877	3.703	3.7133	3.7239
2.8881	3.8937	3.8916	3.894	3.8873	3.8514	3.8519	3.8785	3.886	3.8946	3.8967
2.9410	3.9982	3.9667	3.966	3.9613	3.9538	3.9534	3.9622	3.966	3.9732	3.9990
Slop(m)	1.1386	1.1386	0.941	0.9419	1.1386	1.1386	0.9414	0.941	1.1386	1.1386
C	3.3641	3.3641	11.084	11.0842	2.9303	2.9303	11.0842	11.084	3.3641	3.3641
K=(1-m)	-0.1386	-0.1386	0.058	0.0586	-0.1386	-0.1386	0.0586	+0.058	-0.1386	-0.1386

TABLE - 5.10

FOR NaCl CRYSTALS

	← Log T_q^d → For Angle = 0°												
Log T_q	20	25	30	40	50	60	70	80	100	110	120	140	160
2.4814	4.5559	4.5999	4.6361	4.7069	4.7567	4.7944	4.8308	4.8584	4.9063	4.9321	4.9808	5.0143	-
2.6748	4.7478	4.7933	4.8295	4.8959	4.9463	4.9827	5.0179	5.0459	5.0989	5.1129	5.1598	5.2055	-
2.7581	4.8311	4.8819	4.9040	4.9836	5.0296	5.0711	5.1059	5.1336	5.1843	5.2063	5.2236	5.2540	5.282
2.8280	4.8934	4.9336	4.9777	5.0390	5.0873	5.1234	5.1678	5.1960	5.2462	5.2643	5.2935	5.3217	5.355
2.8880	4.9408	4.9865	5.0404	5.0930	5.1393	5.1908	5.2095	5.2391	5.2876	5.3110	5.3420	5.3715	5.418
2.9410	4.9666	5.0170	5.0541	5.1151	5.1634	5.2087	5.2418	5.2709	5.3225	5.3551	5.3777	5.3960	5.442

TABLE - 5.11

FOR KCl CRYSTALS

	← Log T_q^d → For Angle = 0°												
Log T_q	20	25	30	40	50	60	70	80	100	110	120	140	160
2.4814	4.7048	4.7550	4.7998	4.8630	4.9100	4.9526	4.9819	5.0119	5.0617	5.0830	5.1030	5.134	5.169
2.6748	4.8940	4.9444	4.9895	5.0518	5.1024	5.1416	5.1797	5.2045	5.2595	5.2855	5.3084	5.344	5.376
2.7581	4.9570	5.0064	5.0516	5.1131	5.1667	5.2061	5.2416	5.2665	5.3154	5.3469	5.3691	5.405	5.435
2.8280	5.0077	5.0560	5.1019	5.1633	5.2154	5.2546	5.2941	5.3193	5.3668	5.3942	5.4169	5.454	5.483
2.8880	5.0504	5.0979	5.1440	5.2058	5.2579	5.2970	5.3362	5.3630	5.4093	5.4301	5.4385	5.493	5.523
2.9410	5.0871	5.1342	5.1792	5.2411	5.2943	5.3337	5.3758	5.4006	5.4459	5.4739	5.4939	5.528	5.559

TABLE - 5.12

FOR KBr CRYSTALS

	← Log $T_q d$ → For Angle = 0°										
Log T_q	20	30	40	50	60	70	80	100	110	120	140
2.4814	4.7510	4.8414	4.9064	4.9514	4.9954	5.028	5.0558	5.1090	5.1294	5.1482	5.1852
2.6748	4.9249	5.0154	5.0806	5.1324	5.1833	5.2061	5.2382	5.2940	5.3073	5.3364	5.3696
2.7581	5.0163	5.1181	5.1031	5.2381	5.2881	5.3081	5.3281	5.3781	5.3981	5.4281	5.4481
2.8280	5.1180	5.1930	5.2680	5.3080	5.3580	5.3880	5.3980	5.4580	5.4680	5.4990	5.5180
2.8881	5.1073	5.1977	5.2636	5.3116	5.3482	5.3829	5.4136	5.4616	5.4844	5.5030	5.5440
2.9410	5.1471	5.2374	5.3006	5.3510	5.3898	5.4226	5.4531	5.5029	5.5238	5.5464	5.5882

TABLE - 5.13

FOR NaCl CRYSTALS

VALUES FROM THE PLOT OF LOG $T_q d$ Vs LOG T_q FOR NaCl CRYSTALS AT ANGLE = 0°

Load P_r	Slope m_r	$\frac{C_{Ar}}{\sqrt{P_r}}$ = $\sqrt{\frac{14230}{C_A}}$		% Variations of L.H.S. and R.H.S
20	0.9285	39.91		7.92
25	0.9257	40.19		7.29
30	0.9280	39.33		9.25
40	0.9227	41.23		4.87
50	0.9162	43.01		0.77
60	0.9330	37.78		12.85
70	0.9000	47.31	= 43.35	9.14
80	0.9375	38.06		12.18
100	0.9165	42.85		1.13
110	0.9094	45.15		3.85
120	0.9154	46.71		7.77
140	0.9154	46.74		7.84

Values of C_{Ar} taken from the equation $d_{Ar} T_q^{1-m} = C_{Ar}$

Values of C_A from the equation $\bar{H}\ T_q^{1-m_A} = C_A$

TABLE - 5.14

FOR KCl CRYSTALS

VALUES FROM THE PLOT OF LOG T_q d Vs LOG T_q FOR KCl CRYSTALS AT ANGLE = 0°

Load P in gm	Slope= m_r	$C_{Ar}/\sqrt{Pr}$	= $\sqrt{14230/CA}$	% Variation of L.H.S and R.H.S.
20	0.9355	54.9136		1.2247
25	0.9337	55.6253		0.0554
30	0.9255	58.144		4.5858
40	0.9255	58.1444		4.5858
50	0.9330	55.7058		0.2002
60	0.9400	53.5208		3.7300
70	0.9400	53.5218	55.5945	3.7300
80	0.9337	55.4834		0.1998
100	0.9165	61.2131		11.9051
110	0.9165	61.2131		11.9051
120	0.9330	55.6104		0.0286
140	0.9330	55.6104		0.0286
160	0.9220	59.3193		6.6999

Value of C_{Ar} taken from the equation $d_{Ar}\ T_q^{\ 1-m} = CAr$

Value of C_A taken from the equation $H\ T_q^{\ 1-m_A} = CA$

TABLE - 5.15

FOR KBr CRYSTALS

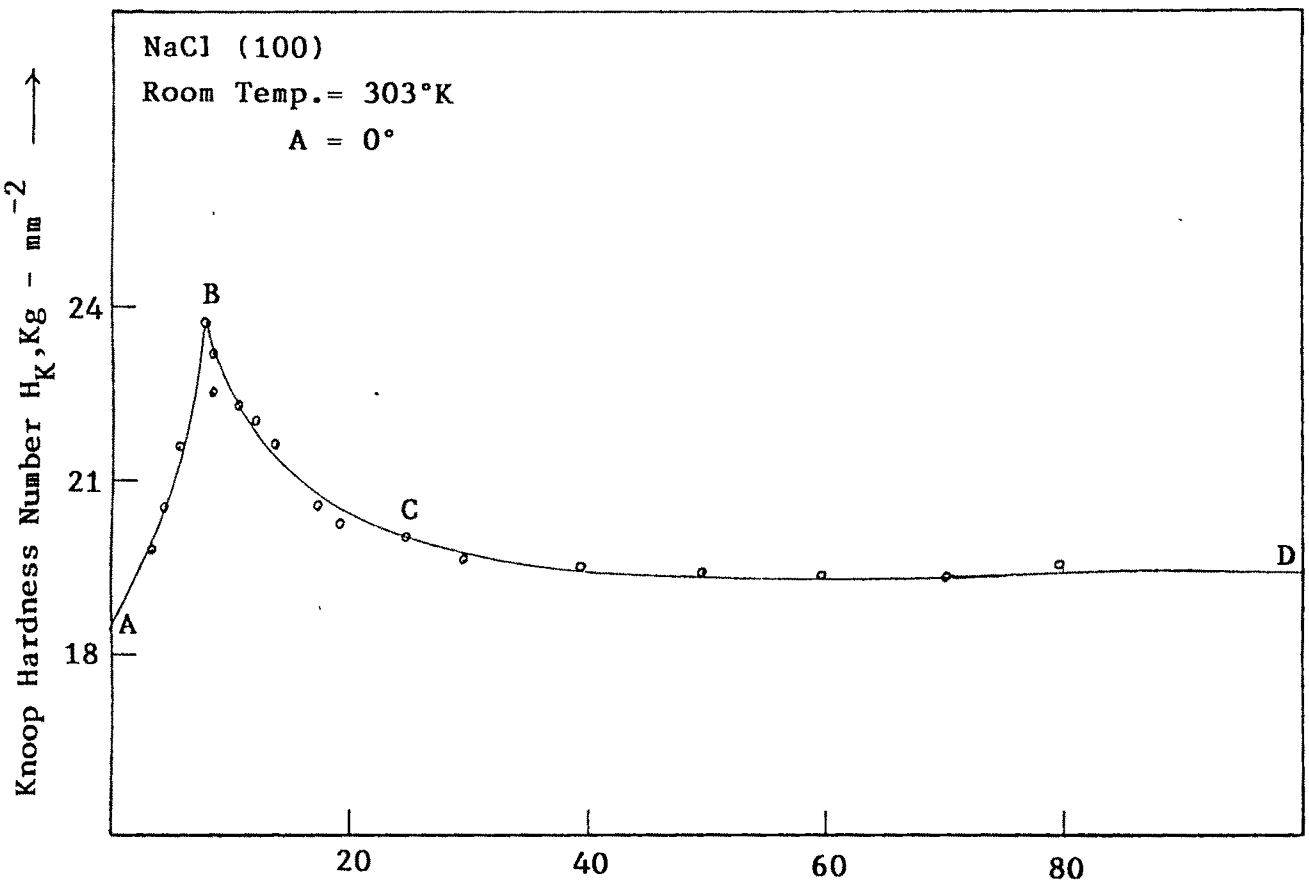
VALUES FROM THE PLOT OF LOG $T_q d$ Vs LOG T_q FOR KBr CRYSTAL AT ANGLE = 0°

Load P in gm	Slope m_r	L.H.S. $\frac{C_{Ar}}{\sqrt{P_r}}$	= R.H.S $\sqrt{\frac{14230}{C_A}}$	% Variation in L.H.S. and R.H.S.
20	0.9562	53.2560		13.73
30	0.9337	61.0560		1.06
40	0.9233	65.6175		6.32
50	0.9259	63.7100		3.23
60	0.9608	52.7165		14.58
70	0.9585	53.3136	61.7150	13.61
80	0.9657	51.0174		17.33
100	0.9729	49.5227		19.75
110	0.9527	55.5435		10.00
120	0.9604	53.1170		13.93
140	0.9539	55.5879		9.92

Value of C_{Ar} from the equation

$$d_{Ar} T_q^{1-m} = C_{Ar}$$

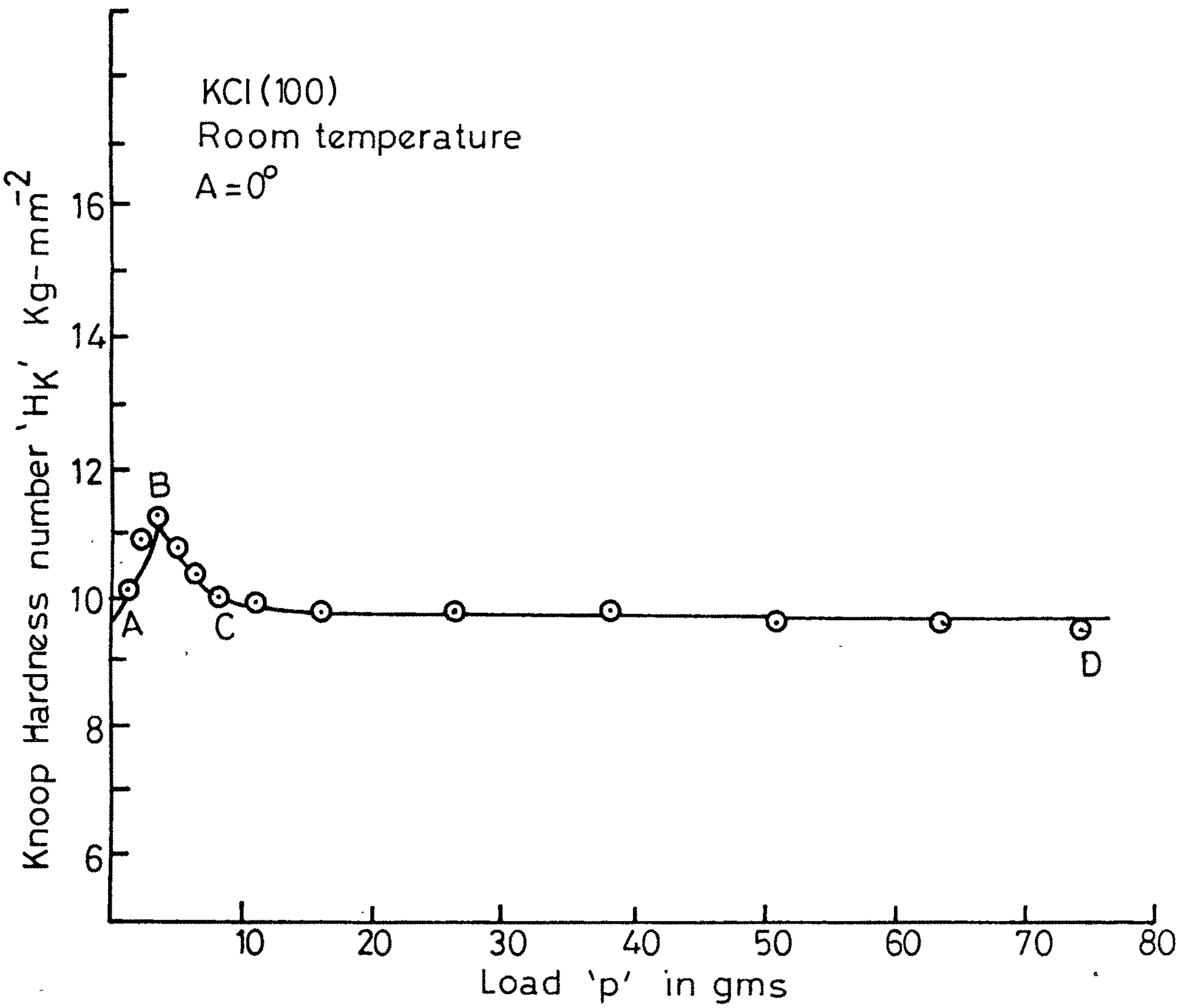
Value of C_A from the equation $H T_q^{1-m_A} = C_A$



Load 'P' in gms ⟶

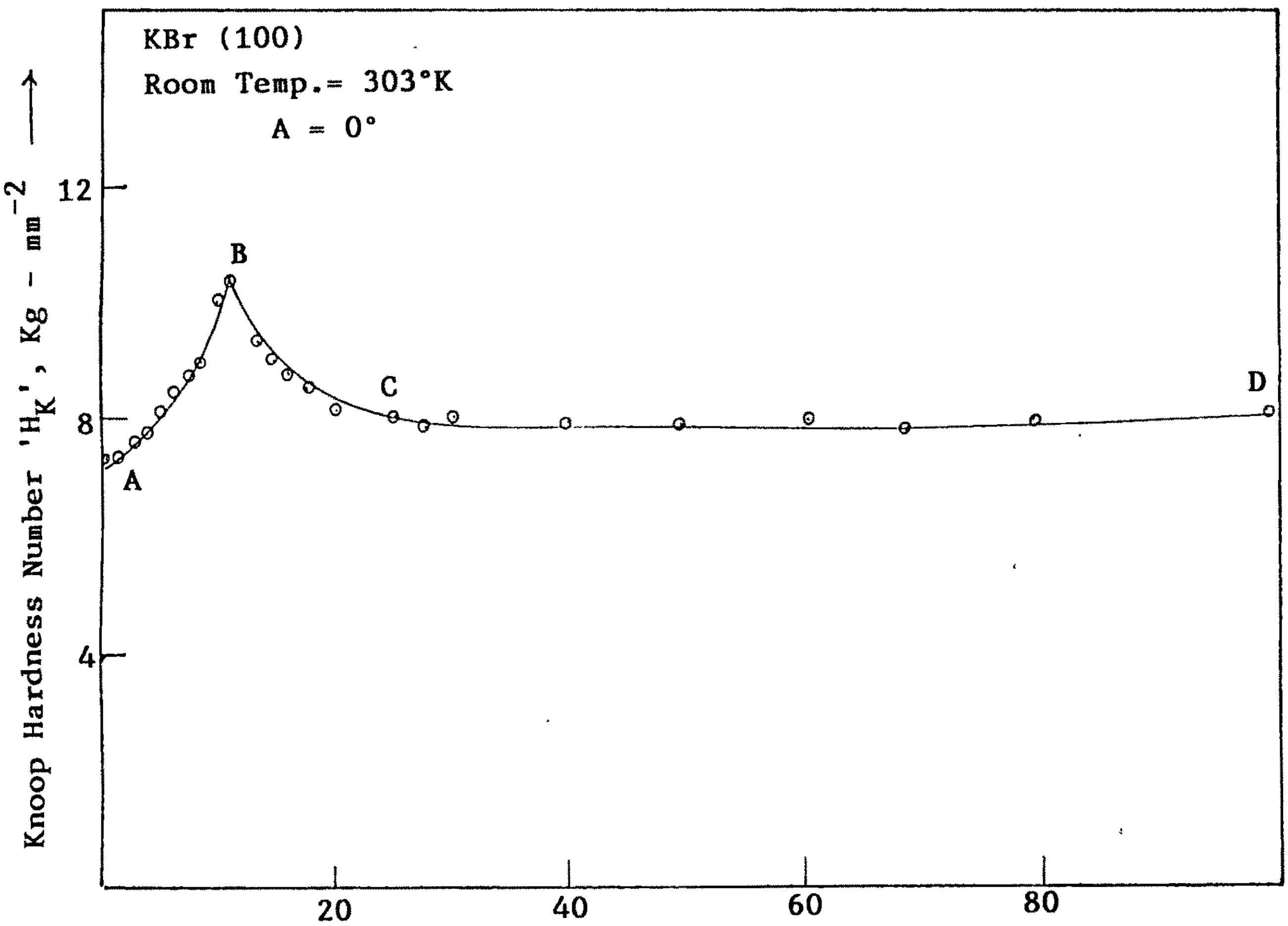
Plot of Knoop Hardness Number Vs Load

Fig. No. : 5.1



Plot of Knoop Hardness number Vs. load

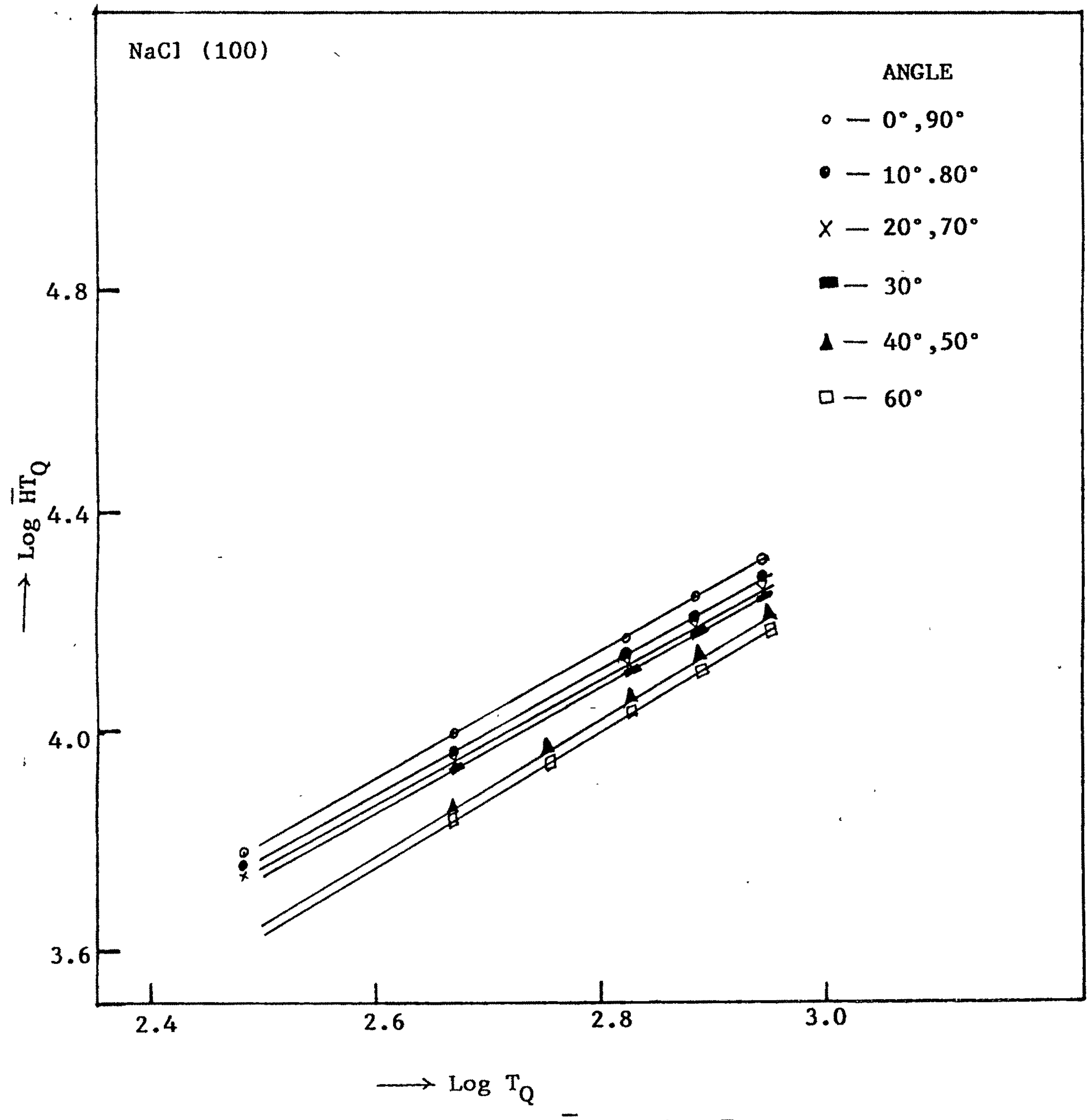
Fig. 5.2



Load 'P' in gms ⟶

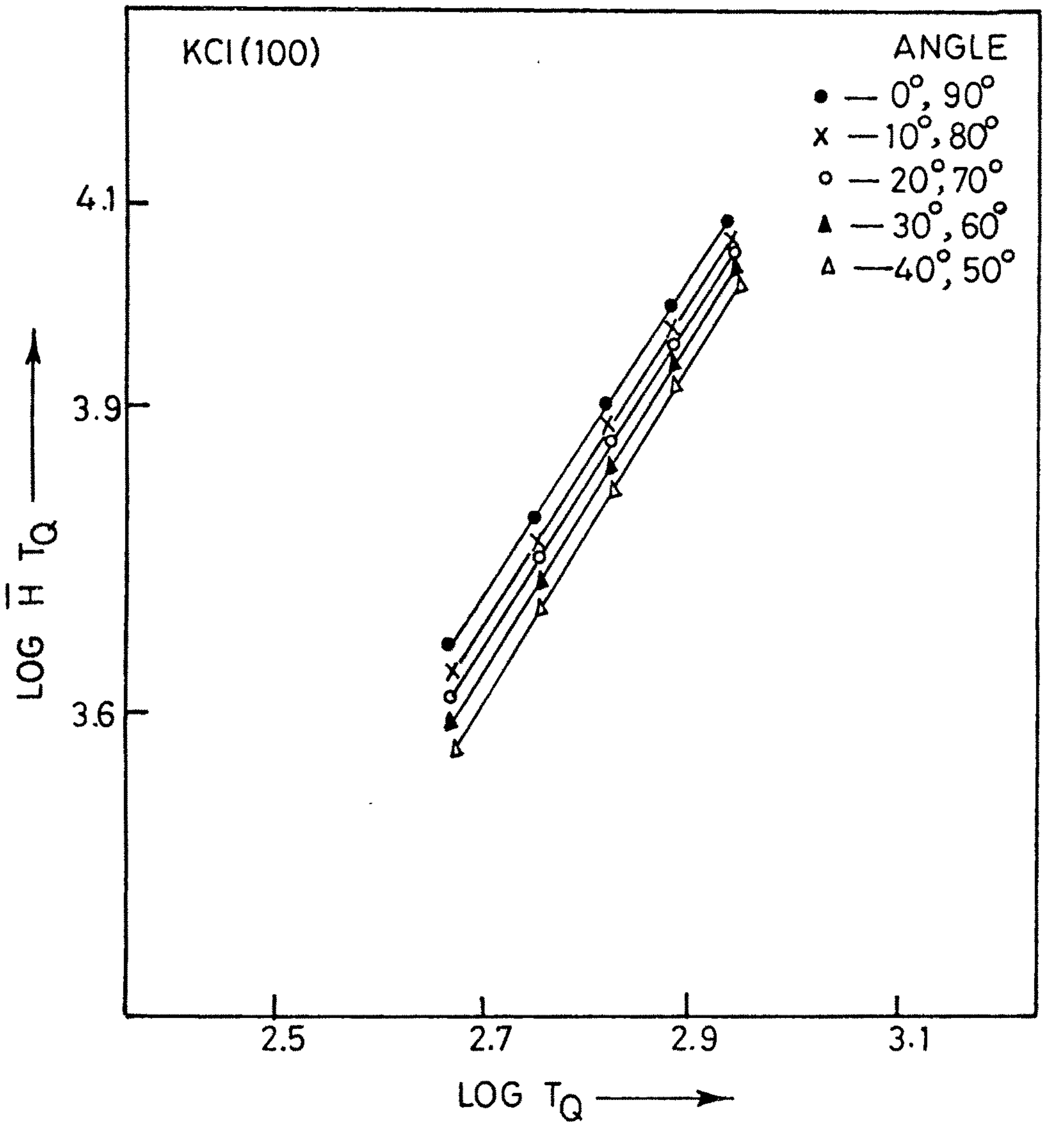
Plot of Knoop Hardness Number Vs Load

Fig. No. : 5.3



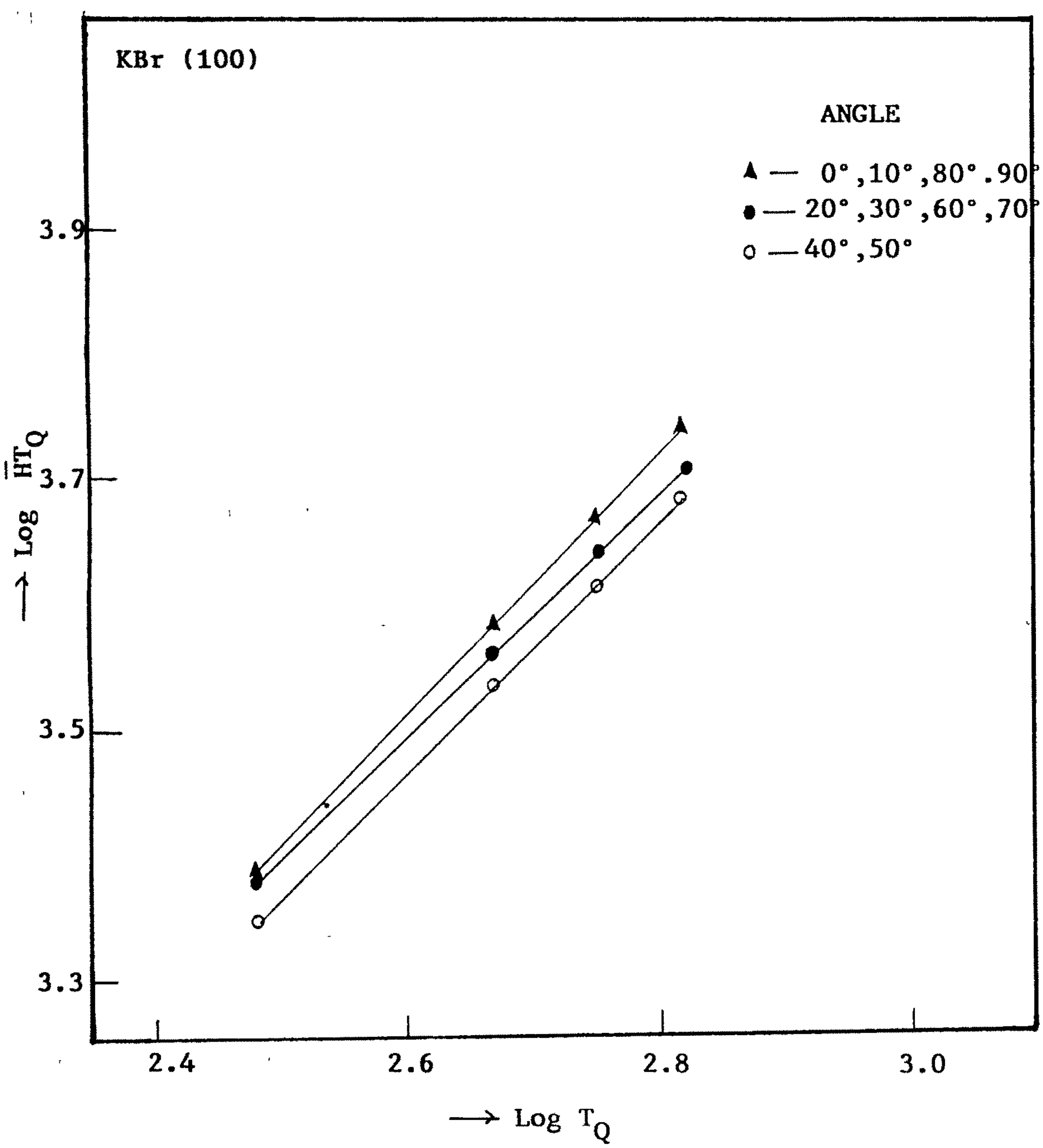
Plot of Log $\overline{H}T_Q$ Vs Log T_Q

Fig. No. : 5.4



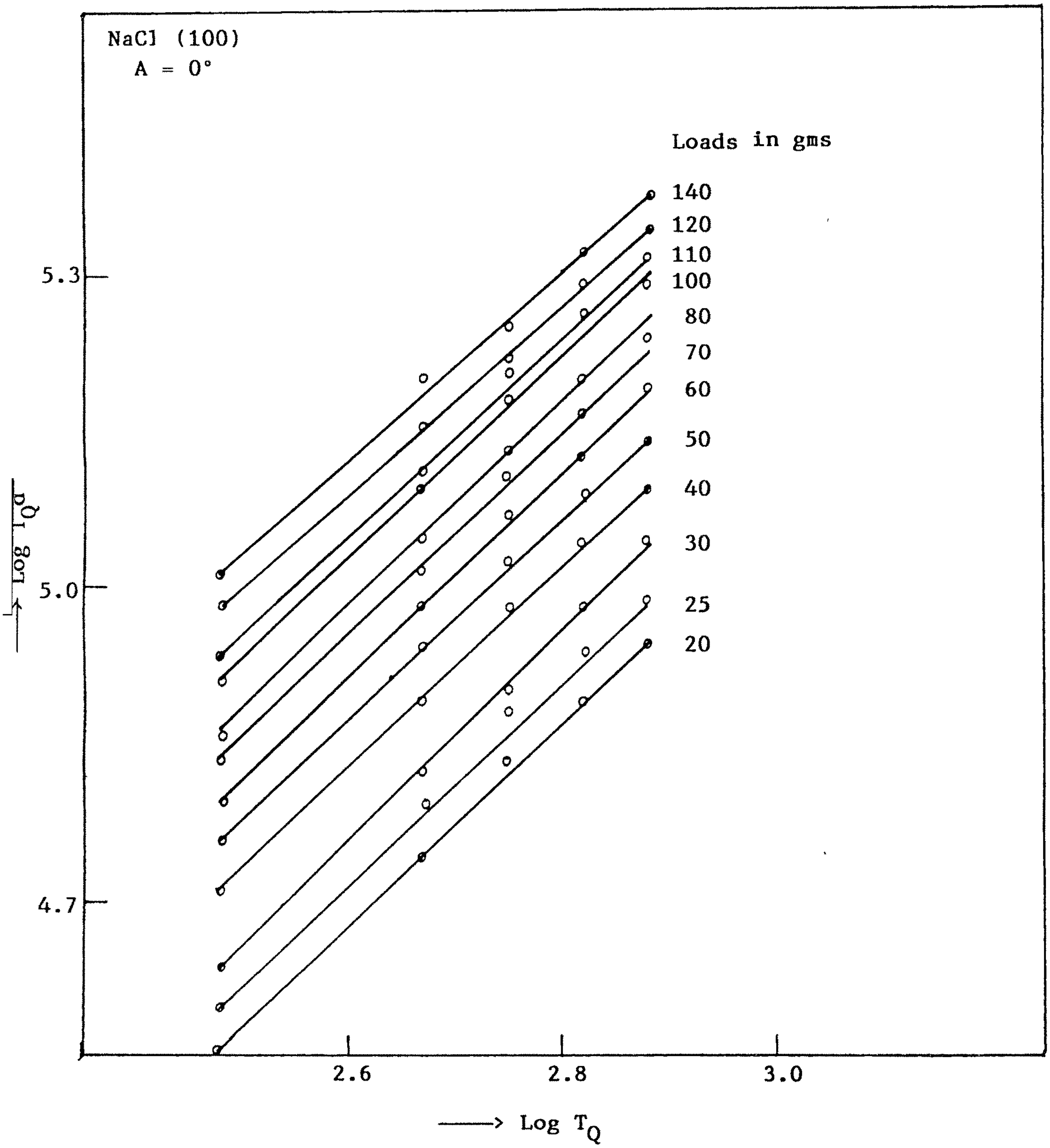
PLOT OF LOG $\bar{H}$ T_Q Vs. LOG T_Q

Fig. 5.5



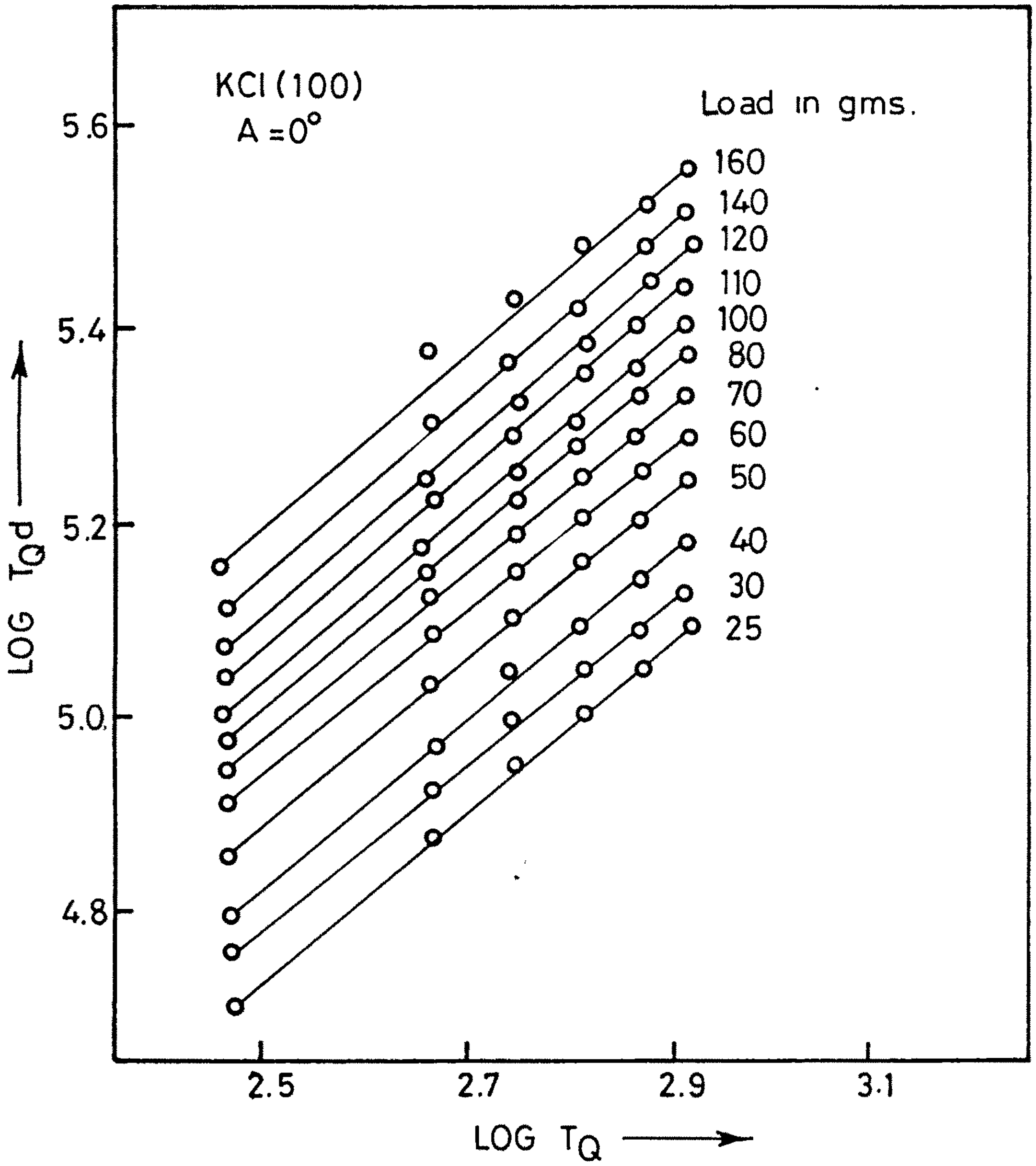
Plot of Log $\bar{H}T_Q$ Vs Log T_Q

Fig.No.: 5.6



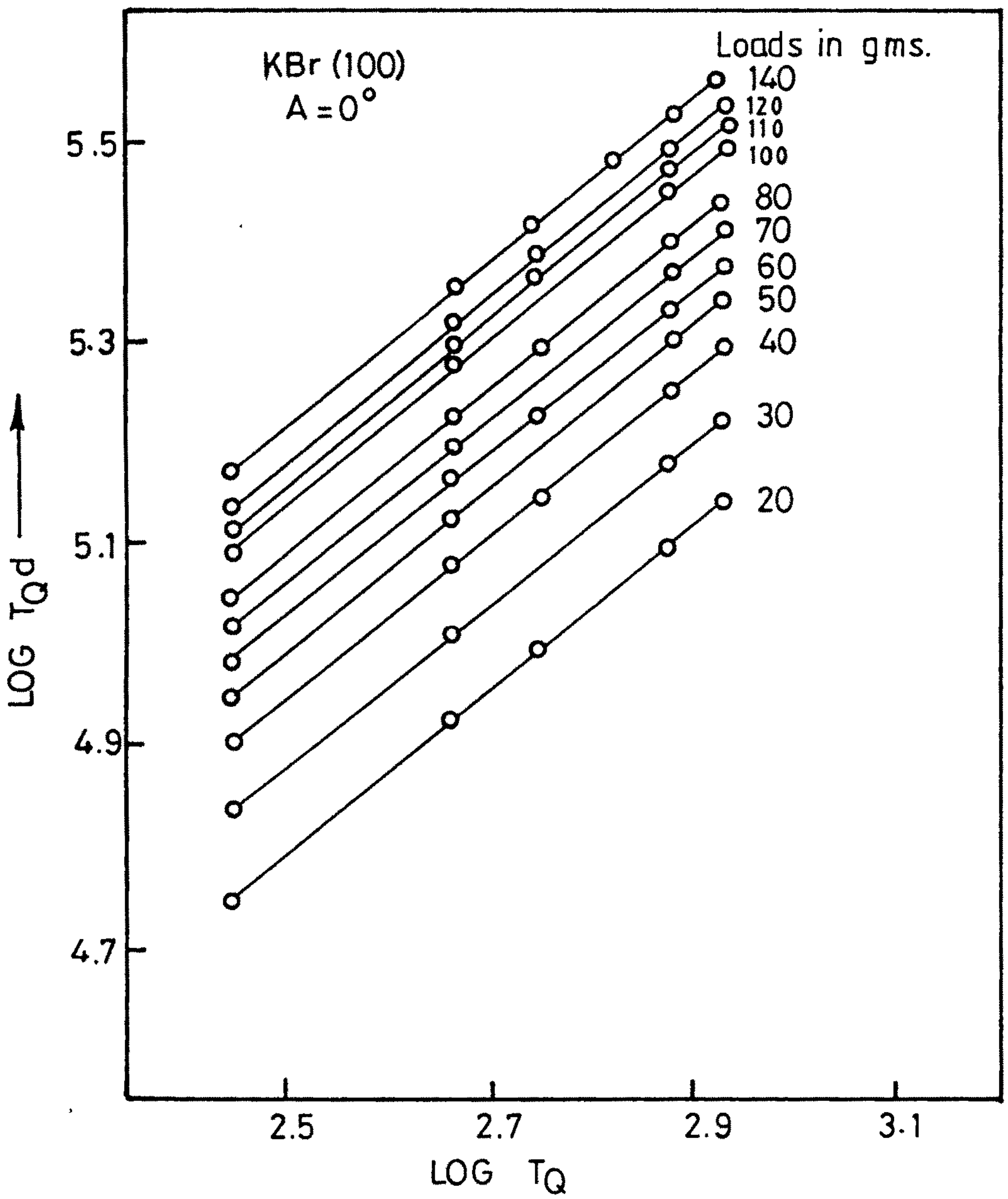
Plot of Log T_Qd Vs Log T_Q

Fig. No.: 5.7



PLOT OF LOG $T_Q d$ Vs. LOG T_Q

Fig. 5.8



PLOT OF LOG $T_Q d$ Vs. LOG T_Q

Fig. 5.9

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