Solid State-1

1) Ionic solids are characterised by

1) Good conductivity in solid state 2) High vapour pressure

3) Low melting point 4) Solubility in polar solvents

2) Three metals X, Y and Z are crystallised in simple cubic, B.C.C and F.C.C lattices respectively. The number of unit cells in one mole each of the metals respectively

1) N, 2N, 4N 2) $N, \frac{N}{2}, \frac{N}{4}$ 3) $\frac{N}{4}, \frac{N}{2}, N$ 4) 4N, 2N, N

HINT: the number of atoms per unit cell in simple cubic, B.C.C, and F.C.C are 1, 2, 4 respectively.

3) The crystal system without any element of symmetry is

1) Monoclinic 2) Triclinic 3) Hexagonal 4) Cubic

Hint: cubic system is most symmetric and Triclinic is most unsymmetrical crystal systems.

4) How many unit cells are present in a cube-shaped ideal crystal of NaCl of mass 1.00 g?

1) 2.57×10^{21} unit cells 2) 5.14×10^{21} unit cells

3) 1.28×10^{21} unit cells 4) 1.71×10^{21} unit cells

Solution: 234gm NaCl contains $6X10^{23}$ unit cells. 1 g of NaCl contains = $\frac{6\times10^{23}}{234} = 2.57\times10^{21}$ unit cells

5) An element having bcc structure has12.08×10^{23} unit cells. The number of atoms in these cells is

1) 12.08×10^{23} 2) 24.16×10^{23} 3) 48.38×10^{23} 4) 12.08×10^{22}

Solution: No.of atoms per b.c.c unit cell=2, The number of atoms in 12.08×10^{23} unit cells= 12.08×10^{23} X2=24.16×10^{23} unit cells

6) The number of lattice point per unit cell in B.C.C. and end centered lattice respectively

1) 9, 10 2) 6, 6 3) 6, 8 4) 6, 10

7) In a close packed lattice containing 'n' particles, the number of tetrahedral and octahedral voids respectively

1) 2n, n 2) n, 2n 3) n, n 4) 2n, n/2

8) Which of the following is not true about crystalline solids?

1) They are rigid and hard

2) They possess planes surfaces

3) They have definite geometric configuration

4) They are obtained by rapid cooling of molten substances

9) A salt AB crystallises in the CsCl structure. The anions at the corners and the cation in the centre hence, the limiting radius ratio is

1) 0.225 2) 0.441 3) 0.625 4) 0.732

10) The coordination numbers of oxygen and silicon in SiO_2 respectively

1) 1, 2 2) 2, 1 3) 4, 2 4) 2, 4

11) The crystal system of a compound with unit cell dimensions a=0.387, b=0.387 and c=0.504nm and $\alpha = \beta = 90^\circ$ and $\gamma = 120^\circ$ is

1) Cubic 2) Hexagonal 3) Orthorhombic 4) Rhombohedral

12) Which of the following is not a crystalline solid?

1) KCl 2) CsCl 3) Glass 4) Rhombic sulphur

13) Which of the following is a molecular solid?

1) ZnS 2) MgO 3) Diamond 4) Dry Ice

14) Which one has highest melting point?

1) Ionic crystal 2) Molecular crystal

3) Covalent crystal 4) Metallic crystal

15) For a covalent solid, the units which occupy lattice point are

1) Ions 2) Electrons 3) Atoms 4) Molecules or atoms

16) The structural unit of a crystal is called

1) Structural motif 2) Unit Cell 3) Crystal Lattice 4) Space Lattice

17) (Unit cell) (no of the atoms per unit cell)

A) bcc 1) 1

B) fcc 2) 2

C) Simple cube 3) 4

The correct match is

	A	B	C		A	B	C
1)	2	3	1	2)	2	1	3
3)	3	1	2	4)	1	2	3

18) In which of following crystal system F.C.C unit cell exists?

1) Cubic, hexagonal 2) Orthorhombic, cubic

3) Tetragonal, orthorhombic 4) Tricilinic, monoclinic

19) Out of seven crystal systems how many have primitive unit cell?

1) 4 2) 2 3) 3 4) 7

20. Which of the following crystallises in both hexagonal & trigonal crystals?

1) Ice 2) Quart 3) Diamond 4) Both 1 &2

21) The number of atoms per unit cell of a cubic crystal system is 2, the arrangement of atoms is

1) Body centred cubic 2) Face centred cubic

3) End centred cubic 4) Simple cubic

22) Coordination number of Na^+ in NaCl is

(1) 3 (2) 4 (3) 5 (4) 6

23) For an ionic crystal or general formula AB and co-ordination number 6, the value of radius ratio will be

(1) Greater than 0.73 (2) In between 0.414 and 0.732

(3) In between 0.225 and 0.414 (4) Less than 0.155

24) Which of the following structure is most uncommon for metals?

1) B.C.C 2) Simple cubic 3) C.C.P 4) H.C.P

Hint: Only Po has simple cubic packing.

25) Which of the following describes hexagonal close packed arrangement of spheres?

1) ABC ABA..... 2) ABC ABC ..... 3) ABBABB..... 4) ABA ABB.....

26) For f.c.c arrangement the lowest radius ratio limit is

1) 0.155 2) 0.732 3) 0.414 4) 0.225

27) Which of the following is an example of body centered cube?

1) Mg 2) Zinc 3) Copper 4) Potassium

28) The co-ordination number of a metal crystallising in a hexagonal close paced structure is

1) 12 2) 4 3) 8 4) 6

29) Tetrahedral void is surrounded by how many spheres?

1) 6 2) 4 3) 8 4) 12

30) The void between two oppositely directed planar triangles of spheres in adjacent layers is called

1) Cubic void 2) Tetrahedral void 3) Octahedral void 4) Any of these

31) Which of the following packing is more efficient?

1) Square close – packing 2) Hexagonal close - packing

3) Tetrahedral arrangement 4) None of the above

32) The packing efficiency in a simple cubic cell system of crystals is

1) 68% 2) 52% 3) 74% 4) 92%

33) The percent of void space in a body - centered cubic lattice is

1) 32% 2) 48% 3) 52% 4) 68%

34) If the radius of K^+ and F^- are 133 pm and 136 pm respectively, the distance between K^+ and F^- in KF is

1) 269 pm 2) 134.5 pm 3) 136 pm 4) 133 pm

Hint: distance between K^+ and F^- in KF= $r_{k+}+r_{cl-}$

35) Potassium crystallizes with a

(1) Face-centered cubic lattice (2) Body-centered cubic lattice

(3) Simple cubic lattice (4) Orthorhombic lattice

36) Glass is

(1) Super cooled liquid (2) Crystalline solid

(3) Liquid crystal (4) None of these

37) Amorphous solids

1) Have sharp melting points 2) Give X-ray diffraction bands

3) Give a regular cut with knife 4) Are Isotropic.

38) In a cubic arrangement of A and B atoms, A atoms are at corners of unit cell and B atoms at edge centers. One "A" atom is missing from one corner in each unit cell. The simplest formula of the compound is

1) A_2B_3 2) AB_3 3) A_7B_4 4) $A_{7/8}B_3$

Solution: A occupy 7 corners=7X1/8 =7/8, B occupy edge centers=12X1/4 =3

39) In a compound, atoms of element Y form cubical - closest packing and those of element X occupy 2/3 of tetrahedral voids. The formula of the compound will be

1) X_3Y 2) X_4Y_3 3) X_2Y_3 4) X_2Y

Solution: If no. of 'Y' atoms=a, then no of tetrahedral voids=2a

Given element X occupies 2/3 of tetrahedral voids. Thus no. of X atoms= 2aX 2/3=4a/3 X: Y= 4a/3: a =4:3 $\therefore$ The formula of the compound is X_4Y_3

40) In an ionic crystal, cation "A" occupies the lattice points in a FCC array and anion "B" occupies the two types of tetrahedral voids. The correct formula of the ionic compound is

1) AB_2 2) A_2B 3) AB 4) A_2B_3

Hint: for every atom two tetrahedral voids exist.

41. A solid is made up of two types of atoms "X" and "Y". Atoms of "X" occupy all the octahedral sites while the atoms of "Y" have hcp arrangement. Its formula is

1) XY 2) X_2Y 3) XY_2 4) XY_4

Hint: for every atom, one octahedral void exists. $\therefore$ Both X & Y are in 1:1 ratio.

42) A solid has a structure in which W atoms are located at the corners of the cubic lattice, O atoms at the centre of the edges and Na atom at the centre of the cube. The formula of the compound is

1) $NaWO_2$ 2) $NaWO_3$ 3) $NaWO_4$ 4) Na_2WO_3

Solution: No. of W at corners = 8X1/8=1

No of O at edges =12X1/4 =3

No of Na at center = 1

$\therefore$ s Formula:. $NaWO_3$

43) Edge length of a body centered cube is 400 pm. its body diagonal length would be

1) 600 pm 2) 566 pm 3) 693 pm 4) 500 pm

Hint: body diagonal length = $\sqrt{3}$ a

44) Copper crystallises in fcc with a unit cell length of 361 pm. What is the radius of copper atom?

1) 127 pm 2) 157 pm 3) 181 pm 4) 108 pm

Hint: atomic radius (r) = $\frac{a}{2\sqrt{2}}$ = 0.3535 a

45) Ar crystallizes in a F.C.C lattice with one atom at each lattice point. If the edge length is 5.311A^0 at OK, the distance between nearest neighbouring atoms in Ar at 'O'K is

1) 3.755 A^0 2) 7.355 A^0 3) 5.735 A^0 4) 1.877 A^0

Hint: in fcc distance between nearest neighbours (d) = 2r = $\frac{a}{\sqrt{2}}$ = 0.707 a

46) $KMnO_4$ is well known example of

(1) Triclinic system (2) Tetragonal system (3) Monoclinic System (4) Trigonal

47) Body diagonal of a cube is 866 pm. Its edge length would be

1) 408 pm 2)1000 pm 3) 500 pm 4) 600 pm

Hint; length of body diagonal= $\sqrt{3}\,a$

48) The radius of Na^+ is 92 pm and that of Cl^- is 178 pm. The edge length of unit cell in NaCl would be (pm)

1) 178 2) 86 3) 270 4) 540

Hint: edge length of f.c.c unit cell (a) =2[r_c +r_a]

49) A body centered cubic solid is made up of two elements A and B. Atom of A occupies two corners of the cube. If the remaining position in the cell are occupied by the atoms of B, the formula of the compound

1) AB_3 2) A_3B_2 3) AB_2 4) AB_7

Hint: effective no. of 'A' atoms=2X1/8 =1/4

Effective no. of 'B' atoms =6X1/8 +1 =7/4

Formula = $A_{1/4}B_{7/4}$ i.e. AB_7

50) Match the elements (in List I) with the shape of the crystal (in List II)

List I	List II
(A) Be	1. Body-centred cubic
(B) Ca	2. Simple cubic
(C) Ba	3. Face-centred cubic
(D) Po	4. Hexagonal close- packed

1) A - 4, B-3, C-1, D-2 2) A - 4, B-3, C-2, D-1

3) A-2, B-4, C-1, D-3 4) A-4, B-1, C-3, D-2

Key

1) 2 2) 1 3) 2 4) 1 5) 2 6) 1 7) 1 8)4 9) 4 10) 4

11) 2 12) 3 13) 4 14) 3 15) 3 16) 1 17) 1 18) 2 19) 4 20) 4

21) 1 22) 4 23) 2 24) 2 25) 2 26) 3 27) 4 28) 1 29) 2 30) 3

31) 2 32) 2 33) 1 34)1 35) 2 36)1 37)4 38)4 39)2 40)1

41)1 42) 2 43) 3 44) 1 45) 1 46)4 47)3 48)4 49) 3 50)1