Shiksha Classes Bhandara

Subject : Chemistry **Topic : Solid State** **M.M. : 100**

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

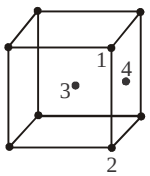
(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 Solid CO_2 is an example of the crystal type –

(A) ionic (B) covalent

(C) metallic (D) molecular

Q.2 In an f.c.c. unit cell, atoms are numbered as shown below. The atoms not touching each other are (Atom numbered 3 is face centre of front face).



(A) 3 & 4 (B) 1 & 3

(C) 1 & 2 (D) 2 & 4

Q.3 A Schottky defect may involve all but one of the following. Which one is incorrect?

(A) A vacant cation and a vacant anion in an MX lattice.

(B) Vacant cation:anion sites in a ratio 1:2 in an MX_2 lattice.

(C) A vacant cation and a vacant anion sites in a ratio 2:1 in an M_2X lattice.

(D) Random vacancies in any lattice.

Q.4 Lithium borohydride ($LiBH_4$), crystallises in an orthorhombic system with 4 molecules per unit cell. The unit cell dimensions are: a = 6.81 Å, b = 4.43 Å, c = 717 Å. If the molar mass of $LiBH_4$ is 21.76 g mol^{-1}. The density of the crystal is-

(A) 0.668 g cm^{-3} (B) 0.585 g cm^2

(C) 1.23 g cm^{-3} (D) None of these

Q.5 Which statement is incorrect?

(A) FeO is always O deficient.

(B) UO_2 tends to have an anion-excess lattice.

(C) TiO is non-stoichiometric.

(D) In a metal deficient $M^{2+}O^{2-}$ lattice, some metal sites contain M^{3+} ions.

Q.6 If a crystal contains a total of N atoms, and n Schottky defect are produces by removing n cations and r anions from the interior of the crystal, then

(A) $n = N \exp(-E_p/2k_BT)$

(B) $N = n \exp(-E_p/2k_BT)$

(C) $n = N \exp(-E_p/k_BT)$

(D) $n = N \exp(E_p/k_BT)$

Q.7 The number of atoms per unit cell in a simple, face centred and body centred cubes are :

(A) 1 , 4 , 2 (B) 1 , 2 , 4

(C) 8 , 4 , 2 (D) 4 , 1 , 2

Q.8 A metal crystallises with a bcc structure with a density of 19.3 $g.cm^{-3}$ Calculate the length of the body diagonal of the unit cell. (Atomic weight of metal = 183.9)

(A) 3.21 Å (B) 4.34 Å

(C) 8.78 Å (D) 5.48 Å

Q.9 The edge length of the cubic unit cell of lead is 4.92 Å. The density of lead is 11.55 g/cc. What is the type of cubic lattice taken up by lead ? (Atomic mass of lead = 207.2.)

(A) fcc (B) bcc

(C) hcp (D) bcp

Q.10 Select the correct statement(s) -

(a) The C.N. of cation occupying a tetrahedral hole is 4

(b) The C.N. of cation occupying a octahedral hole is 6.

(c) In schottky defects, density of the lattice decreases,

(A) a, b (B) b, c

(C) a, b, c (D) a, c

Q.11 Sodium metal crystallizes in bcc lattice with cell edge = 4.29Å. The radius of sodium atom will be-

(A) 1.50 Å (B) 1.86 Å

(C) 2.80 Å (D) None of these

Q.12 About half of all the crystals studied so far belong to the _____ crystal system.

(A) hexagonal (B) orthorhombic

(C) cubic (D) monoclinic

Q.13 The spinel structure (Ab_2O_4) consists of an fcc array of O^{2-} ion in which the

(A) A cation occupies one-eighth of the tetrahedral holes and the B cations the octahedral holes.

(B) A cation occupies one-fourth of the tetrahedral holes and the B cations the octahedral holes.
(C) A cation occupies one-eighth of the octahedral holes and the B cations the tetrahedral holes.
(D) A cation occupies one-fourth of the octahedral holes and the B cations the tetrahedral holes.

Q.14 Choose the correct statement –
(A) Equivalent points in unit cells of a periodic lattice lie on a Bravais lattice.
(B) Equivalent points in unit cells of a periodic lattice do not lie on a Bravais lattice.
(C) There are four Bravais lattice in two dimensions.
(D) There are five Bravais lattice in three dimensions.

Q.15 A metal crystallizes in two cubic phases, face centred cubic (fcc) and body centred cubic (bcc) whose unit cell length are 3.5 and 3.0 Å respectively. Calculate the ratio of density of fcc and bcc.
(A) 2.123 (B) 1.259
(C) 5.124 (D) 3.134

Q.16 Compute the percentage void space per unit volume of unit cell in zinc fluoride structure.
(A) 15.03% (B) 22.18%
(C) 18.23% (D) 25.07%

Q.17 This one is amorphous –
(A) Fe metal (B) fused quartz
(C) Wurtzite (D) NiAs

Q.18 Structure of a compound of the formula A_2B in which each B^{2-} ions is co- ordinated by eight A^+ ions and each A^+ ion by four B^- ions is called
(A) diamagnetic structure
(B) anti - fluorite structure
(C) ferromagnetic structure
(D) paramagnetic structure

Q.19 Consider a body centred cubic (BCC) arrangement, let d_e, d_{fd}, d_{bd} be the distances between successive atoms located along the edge, the face-diagonal, the body diagonal respectively in a unit cell. Their order is given by –
(A) $d_e < d_{fd} < d_{bd}$ (B) $d_{fd} > d_{bd} > d_e$
(C) $d_{fd} > d_e > d_{fd}$ (D) $d_{bd} > d_e > d_{fd}$

Q.20 A crystal in which dipoles align themselves in an ordered way so as to give some net dipole moment, on applying a field the direction of polarization changes. Such crystals are called
(A) Ferrielectric crystals
(B) Ferroelectric crystals
(C) Antiferrielectric crystals
(D) Piezoelectric crystals

For Q.21-Q.25 :
The answer to each question is a NUMERICAL VALUE.

Q.21 In a face-centered cubic lattice, each lattice point located in a face of the unit cell is shared equally with _____ other unit cells.

Q.22 If in diamond, there is a unit cell of carbon atoms as fcc and if carbon atom is sp^3, what will be the number of carbon atoms per unit cell?

Q.23 Silver metal crystallises in a cubic closed packing arrangement with the edge of the unit cell a = 407pm. The radius of silver atom is (X + 3.9) pm. Find the value of X.

Q.24 A body centered cubic lattice is made up of hollow spheres of B. Spheres of solid A are present in hollow spheres of B. Radius of A is half of radius of B. The ratio of total volume of spheres of B unoccupied by A in a unit cell and volume of unit cell is $\frac{7\pi\sqrt{X}}{64}$. Find the value of X.

Q.25 A crystal formula AB_3 has A ions at the cube corners and B ions at the edge centres. The coordination numbers of A and B are respectively 6 and X. Find the value of X.