

Indian School Muscat
Chemistry Department
Senior Section
IIT – JEE
Solid State

- 1 A crystallizes in a body centred cubic lattice with edge length 'a' equal to 387 pm. The distance between two A's in the lattice is
- A. 300
 - B. 335
 - C. 250
 - D. 200
- 2 If NaCl is doped with 10^{-4} mol % of SrCl_2 , the concentration of cation vacancies will be ($N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$)
- A. $6.02 \times 10^{23} \text{ mol}^{-1}$
 - B. $6.02 \times 10^{16} \text{ mol}^{-1}$
 - C. $6.02 \times 10^{17} \text{ mol}^{-1}$
 - D. $6.02 \times 10^{18} \text{ mol}^{-1}$
- 3 Silicon (IV) oxide which is found in mineral quartz is very similar to
- A. graphite
 - B. diamond
 - C. iron
 - D. copper
- 4 Metal which can be melted even by warmth of human palm is
- A. gallium
 - B. indium
 - C. aluminum
 - D. tungsten
- 5 Diamonds are hard and
- A. do not conduct electricity
 - B. bear high melting point
 - C. bear high boiling point
 - D. All of Above

- 6 Metals can be hammered into different shapes and drawn into wires hence they are
- A. soft
 - B. malleable
 - C. strong
 - D. weaker
- 7 Giant molecule is also name given to
- A. ionic lattice
 - B. crystal lattice
 - C. metallic lattice
 - D. covalent lattice
- 8 The number of octahedral void(s) per atom present in a cubic close-packed structure is
- A. 2
 - B. 4
 - C. 1
 - D. 3
- 9 Percentage of free space in a body centred cubic unit cell is
- A. 32%
 - B. 34%
 - C. 26%
 - D. 20%
- 10 The appearance of colour in solid alkali metal halides is generally due to
- A. Schottky defect
 - B. Frenkel defect
 - C. Interstitial defect
 - D. F-centre
- 11 In a face-centered cubic lattice, a unit cell is shared equally by how many unit cells?
- A. 2
 - B. 4
 - C. 6
 - D. 8
- 12 A compound formed by elements X and Y crystallizes in a cubic structure in which atoms X are at the corners of the cube and atoms Y are at the face-centers. The formula of the compound is
- A. X_3Y

- B. XY_3
- C. XY
- D. X_2Y_3

13 The pyknometric density of sodium chloride crystal is $2.165 \times 10^3 \text{ kg m}^{-3}$ while its X-ray density is $2.178 \times 10^3 \text{ kg m}^{-3}$. The fraction of the unoccupied sites in sodium chloride crystal is

- A. 5.96
- B. 5.96×10^{-1}
- C. 5.96×10^{-2}
- D. 5.96×10^{-3}

14 A metal crystallizes with a face-centered cubic lattice. The edge of the unit cell is 408 pm. The diameter of the metal atom is

- A. 144
- B. 248
- C. 288
- D. 418

15 In a compound, atoms of element Y form ccp lattice and those of element X occupy $\frac{2}{3}$ rd of tetrahedral voids. The formula of the compound will be

- A. X_3Y_4
- B. X_4Y_3
- C. X_2Y
- D. X_2Y_3

16 In a face-centered cubic lattice, a corner atom is equally shared by how many unit cells?

- A. 2
- B. 4
- C. 6
- D. 8

17 Total volume of atoms present in face-centred cubic unit cell of metal is (r is atomic radius)

- A. $\frac{24}{3} \pi r^3$
- B. $\frac{12}{3} \pi r^3$
- C. $\frac{16}{3} \pi r^3$
- D. $\frac{20}{3} \pi r^3$

18 An ionic compound has a unit cell consisting of A ions at the corners of a cube and B ions on the centres of faces of the cube. The empirical formula of the compound would be

- A. A_3B
- B. AB
- C. AB_3
- D. A_2B

19 How many unit cells are present in a cube-shaped ideal crystal of NaCl of mass 1.0 g?

- A. 5.14×10^{21}
- B. 1.28×10^{21}
- C. 1.17×10^{21}
- D. 2.57×10^{21}

20 A solid has a structure in which W atoms are located at the corners of a cubic lattice, O atom at the centre of the edges and Na atom at centre of the cubic. The formula for the compound is
 (A) $NaWO_2$ (B) $NaWO_3$ (C) Na_2WO_3 (D) $NaWO_4$

21 The density of CaF_2 (fluorite structure) is 3.18 g/cm^3 . The length of the side of the unit cell is
 (A) 253 pm (B) 344 pm (C) 546 pm (D) 273 pm

22 Which of the following statements is/are correct :
 (A) The coordination number of each type of ion in CsCl is 8.
 (B) A metal that crystallises in BCC structure has a coordination number 12.
 (C) A unit cell of an ionic crystal shares some of its ions with other unit cells
 (D) The length of the unit cell in NaCl is 552 pm.
 [$r_{Na^+} = 95 \text{ pm}$; $r_{Cl^-} = 181 \text{ pm}$]

23 Which of the following statements is/are correct :
 (A) In an anti-fluorite structure anions form FCC lattice and cations occupy all tetrahedral voids.
 (B) If the radius of cations and anions are 0.2 \AA and 0.95 \AA then coordinate number of cation in the crystal is 4.
 (C) An atom/ion is transferred from a lattice site to an interstitial position in Frenkel defect.
 (D) Density of crystal always increases due to substitutional impurity defect.

24 Fraction of total volume occupied by atoms in a simple cube is -

- (A) $\frac{\pi}{2}$
- (B) $\frac{\sqrt{3}\pi}{2}$
- (C) $\frac{\sqrt{2}\pi}{6}$
- (D) $\frac{\pi}{6}$

25 In a crystal both ions are missing from normal sites in equal number. This is an example of -
 (A) F-centres (B) Interstitial defect (C) Frenkel defect (D) Schottky defect

26 Xenon crystallizes in face centre cubic lattice and the edge of the unit cell is 620 PM, then the radius of Xenon atom is -
 (A) 219.20 PM (B) 438.5 PM (C) 265.5 PM (D) 536.94 PM

27 The edge length of cube is 400 PM. Its body diagonal would be -
 (A) 500 PM (B) 693 PM (C) 600 PM (D) 566 PM

- 28 A compound alloy of gold and copper crystallizes in a cube lattice in which the gold atoms occupy the lattice points at the corners of cube and copper atoms occupy the centres of each of the cube faces. The formula of this compound is -
 (A) AuCu (B) AuCu₂ (C) AuCu₃ (D) None
- 29 Lithium borohydride (LiBH₄), crystallises in a 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 LiBH₄ is 21.76 g mol⁻¹. The density of the crystal is -
 (A) .668 g cm⁻³ (B) .585 g cm² (C) 1.23 g cm⁻³ (D) None
- 30 The unit cell of a metallic element of atomic mass 108 gm/mole and density 10.5 g/cm² is a cube with edge length of 409 pm. The structure of the crystal lattice is -
 (A) fcc (B) bcc (C) hcp (D) None
- 31 Copper metal has a face-centred cubic structure with the unit cell length equal to 0.361 nm. Picturing copper ions in contact along the face diagonal. The apparent radius of a copper ion is -
 (A) 0.128 nm (B) 1.42 nm (C) 3.22 nm (D) 4.22 nm
- 32 Which of the following statements is/are correct :
 (A) The coordination number of each type of ion in CsCl is 8.
 (B) A metal that crystallises in BCC structure has a coordination number 12.
 (C) A unit cell of an ionic crystal shares some of its ions with other unit cells
 (D) The length of the unit cell in NaCl is 552 pm.
 [$r_{\text{Na}^+} = 95 \text{ pm}$; $r_{\text{Cl}^-} = 181 \text{ pm}$]
- 33 The coordination number of cation and anion in Fluorite CaF₂ and CsCl are respectively
 (A) 8:4 and 6:3 (B) 6:3 and 4:4 (C) 8:4 and 8:8 (D) 4:2 and 2:4
- 34 The interstitial hole is called tetrahedral because
 (A) It is formed by four spheres.
 (B) Partly same and partly different.
 (C) It is formed by four spheres the centres of which form a regular tetrahedron.
 (D) None of the above three.
- 35 The tetrahedral voids formed by ccp arrangement of Cl⁻ ions in rock salt structure are
 (A) Occupied by Na⁺ ions (B) Occupied by Cl⁻ ions
 (C) Occupied by either Na⁺ or Cl⁻ ions (D) Vacant
- 36 The number of nearest neighbours around each particle in a face-centred cubic lattice is
 (A) 4 (B) 6 (C) 8 (D) 12
- 37 A compound XY crystallizes in BCC lattice with unit cell edge length of 480 pm. If the radius of Y⁻ is 225 pm, then the radius of X⁺ is
 (A) 127.5 pm (B) 190.68 pm (C) 225 pm (D) 255 nm

- 38 The mass of a unit cell of CsCl corresponds to
(A) 1 Cs⁺ and 1 Cl⁻ (B) 1 Cs⁺ and 6 Cl⁻ (C) 4 Cs⁺ and 4 Cl⁻ (D) 8 Cs⁺ and 1 Cl⁻
- 39 Which one of the following schemes of ordering closed packed sheets of equal sized spheres do not generate close packed lattice.
(A) ABCABC (B) ABACABAC (C) ABBAABBA (D) ABCBCABCBC
- 40 An ionic compound AB has ZnS type structure. If the radius A⁺ is 22.5 pm, then the ideal radius of B⁻ would be
(A) 54.35 pm (B) 100 pm (C) 145.16 pm (D) none of these
- 41 NH₄Cl crystallizes in a body-centered cubic type lattice with a unit cell edge length of 387 pm. The distance between the oppositely charged ions in the lattice is
(A) 335.1 pm (B) 83.77 pm (C) 274.46 pm (D) 137.23 pm
- 42 In diamond, carbon atom occupy FCC lattice points as well as alternate tetrahedral voids. If edge length of the unit cell is 356 pm, then radius of carbon atom is
(A) 77.07 pm (B) 154.14 pm (C) 251.7 pm (D) 89 pm
- 43 Which of the following will show schottky defect
(A) CaF₂ (B) ZnS (C) AgCl (D) CsCl
- 44 Copper metal crystallizes in FCC lattice. Edge length of unit cell is 362 pm. The radius of largest atom that can fit into the voids of copper lattice without disturbing it.
(A) 53 pm (B) 45 pm (C) 93 pm (D) 60 pm
- 45 In FCC unit cell, what fraction of edge is not covered by atoms?
(A) 0.134 (B) 0.24 (C) 0.293 (D) None of these
- 46 In a solid "AB" having NaCl structure "A" atoms occupy the corners of the cubic unit cell. If all the face-centred atoms along one of the axes are removed, then the resultant stoichiomet
(A) AB₂ (B) A₂B (C) A₄B₃ (D) A₃B₄
- 47 The coordination number of a metal crystallising in a hcp structure is
(A) 12 (B) 4 (C) 8 (D) 6

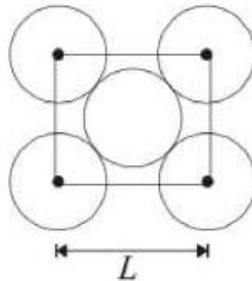
48 Which of the following FCC structure contains cations in alternate tetrahedral voids?
 (A) NaCl (B) ZnS (C) Na₂O (D) CaF₂

49 The number of atoms in this HCP unit cells is
 (A) 4 (B) 6 (C) 12 (D) 17

50 The volume of this HCP unit cell is
 (A) $24\sqrt{2}r^3$ (B) $16\sqrt{2}r^3$ (C) $12\sqrt{2}r^3$ (D) $\frac{64}{3\sqrt{3}}r^3$

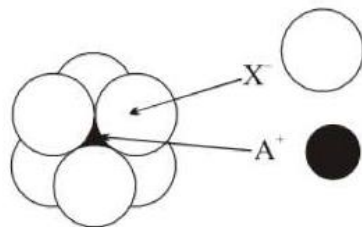
51 The empty space in this HCP unit cell is
 (A) 74% (B) 47.6% (C) 32% (D) 26%

52 The packing efficiency of the two-dimensional square unit cell shown below is



(A) 39.27% (B) 68.02% (C) 74.05% (D) 78.54%

53 The arrangement of X⁻ ions around A⁺ ion in solid AX is given in the figure (not drawn to scale). If the radius of X⁻ is 250 pm, the radius of A⁺ is



(A) 104 pm (B) 125 pm (C) 183 pm (D) 57 pm

