# Chapter-1

# Solid State Marks 3 with option 5

## Multiple choice questions (1 mark)

1. Which of the following types of solids contain molecules as constituent particles?
   **a. molecular solids** b. Ionic solids
   c. metallic solids d. covalent network solids
2. Which of the following crystal systems contain four Bravais lattices?
   a.cubic b.tetragonal **c.orthorhombic** d.monoclinic
3. The number of spheres surrounded by octahedral void is—--
   a. 3 b. 4 **c.6** d.8
4. The amorphous solid among the following is
   a. copper sulphate b.magnesium **c.tar** d. diamond
5. A paired cation-anion vacancy is called……
   **a. Schottky defect** b. Frenkel defect c. impurity defect d. vacancy defect
6. The unit cell of a simple cubic system has atoms at the eight corners. Hence, number of atoms in an unit cell is
   **a. 1** b. 2 c. 3 8
7. In crystal lattice formed by primitive unit cell, the space occupied by particles is
   a.32% b. 47.6% **c.52.4%** d. 68%
8. The coordination number of spheres in hcp lattice in three dimension is
   a.2 b.4 c.6 **d.12**
9. A compound is made up of two elements X and Y and crystallizes in bcc structure.
   atoms of X are present at the corners of the cube. Atoms of Y are present at the center of the cube.
   The formula of the compound is
   a. $X_2Y$ **b. XY** c. $XY_2$ d. $X_2Y_3$
10. Sodium crystallizes in bcc structure. If the edge length of unit cell is $4.3X10^{-8}$ cm, the radius of Na atom is
    **a. $1.86\times10^{-8}$cm** b. $1.52\times10^{-8}$cm
    c. $2.15\times10^{-8}$cm d. $4.3\times10^{-8}$cm

## Very short answer questions (1 Mark)

1. Write the effect on density of a substance in the Frenkel defect?
2. Write an example of a diamagnetic substance.
3. Give one property common to both hcp and ccp crystal lattices.
4. Write the relationship between the radius of the atom and edge length of the fcc unit cell.
5. Draw diagram of bcc unit cell.
6. Find the number of tetrahedral voids formed if the number of atoms in a crystal is N/2.
7. Write the percentage of empty space in the bcc lattice.
8. If the total volume of a simple cubic unit cell is $6.817\times10^{-23}$ $cm^3$, what is the volume occupied by particles in the unit cell? **(Ans:$3.57\times10^{-23}$ $cm^3$)**
9. Calculate the number of octahedral voids formed in 0.5 mol of a compound forming hcp structure **(Ans:$3.011x10^{23}$)**
10. Write the number of atoms in the fcc unit cell.

## Short answer questions (Type- I) (2 Marks)

1. Explain the terms: a) Isomorphism b) Polymorphism with examples
2. Classify the following solids as molecular, ionic, covalent and metallic solids. Pb, $MgF_2$, $SO_2$ and quartz
3. Explain vacancy defect with diagram.
4. Calculate the number of unit cells in 0.3 g of a species having density of 8.5 $g/cm^3$ and unit cell edge length $3.25\times10^{-8}$ cm. **(Ans:$1.028\times10^{21}$)**
5. A compound crystallizes in bcc structure. What is the unit cell edge length if the diameter of its atom is 120 pm? **(Ans:138.6 pm)**
6. Distinguish between crystalline solids and amorphous solids**.**
7. When gold crystallizes,it forms fcc unit cells.The unit cell edge length is 408 pm.Calculate the density of gold.Molar mass of gold is 197 g/mol. **(Ans: 19.27$g/cm^3$ )**
8. Explain the terms: a) Substitutional impurity defect b) Interstitial impurity defect.

## Short answer questions (Type- II) (3 Marks)

1. Calculate the packing efficiency for bcc lattice.
2. In case of hcp structure, how are spheres in the first, second and third layers arranged?
3. A substance crystallizes in fcc structure. The unit cell edge length is 367.8pm. Calculate the molar mass of the substance if its density is 21.5 g/cm$^3$. **(Ans:161.1 g/mol)**
4. The unit cell of Na is bcc and its density is 0.97 g/cm$^3$. What is the radius of a sodium atom if the molar mass of Na is 23 g/mol? **(Ans:1.86×10$^{-8}$ cm)**
5. Write classification of non-stoichiometric point defects. Explain with a diagram the metal deficiency defect.
6. Explain with one example each, the diamagnetic, paramagnetic and ferromagnetic substances.
7. Write the relationship between 'a' and 'r' for sc,bcc and fcc unit cells.
8. Define: a. Diamagnetic solids b. Paramagnetic solids c. Ferromagnetic solid

## Long answer questions (4 marks)

1. What are non stoichiometric point defects? Explain with a diagram the formation of F-centers.
2. Write the classification of stoichiometric point defects. What is a substitutional impurity defect? Explain solid solutions of metals and vacancy through aliovalent cations.
3. Derive the relationship between density of substance, its molar mass and the unit cell edge length. Explain how you will calculate the number of particles, and number of unit cells in *x* g of metal.
4. Define Bravais lattices. Niobium forms bcc structure. The density of niobium is 8.55 g/cm$^3$ and the edge length of the unit cell is 330.6 pm.How many atoms and unit cells are present in 0.5 g of niobium?

   **(Ans: no.of atoms- 3.237x10 $^{21}$ and no.of unit cell- 1.618x10$^{21}$)**
5. Define: a. Conductors b. Insulators c. Semiconductors d. Doping