QB365 Question Bank Software Study Materials

Solid State Important 2 Marks Questions With Answers (Book Back and Creative)

12th Standard

Chemistry

Total Marks : 40

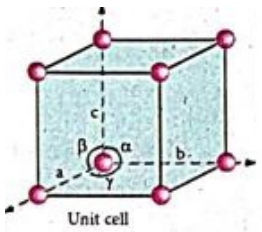
2 Marks

20 x 2 = 40

1) Define unit cell.

Answer : (i) A basic repeating structural unit of a crystalline solid is called a unit cell.

(ii) A crystal is consisted of large number of unit cells.



Unit cell

2) Classify the following solids

a. P_4

b. Brass

c. diamond

d. NaCl

e. Iodine

Answer : a. P_4 - Covalent solid

b. Brass - Metallic solid

c. Diamond - Covalent solid

d. NaCl - Ionic solid

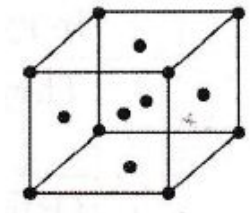
e. Iodine - Covalent solid

3) What are point defects?

Answer : The imperfection occurs due to missing atoms, displaced atoms or extra atoms, is named as a point defect. Such defects arise due to imperfect packing during the original crystallisation or they may arise from thermal vibrations of atoms at elevated temperatures.

4) Calculate the number of atoms in a fcc unit cell.

Answer : Number of atoms in a fcc unit cell = $\frac{N_c}{8} + \frac{N_f}{2} = \frac{8}{8} + \frac{6}{2} = 1 + 3 = 4$


Face centred cubic

5) Why ionic crystals are hard and brittle?

Answer : The structural units of an ionic crystal are cations and anions. They are bound together by strong electrostatic attractive forces. To maximize the attractive force, cations are surrounded by as many anions as possible and vice versa. Hence they are hard and brittle.

6) What is the two dimensional coordination number of a molecule in square close packed layer?

Answer : Linear arrangement of spheres in one direction is repeated in two dimension (i.e.) more number of rows can be generated identical to the one dimensional arrangement such that all spheres of different rows align vertically as well as horizontal.

If we denote the first row as A type arrangement, then the above mentioned packing is called AAA type, because all rows are identical as the first one. In this arrangement each sphere is in contact with four of its neighbours.

7) KF crystallizes in fcc structure like sodium chloride. Calculate the distance between K^+ and F^- in KF. (given : density of KF is 248 g cm^{-3})

Answer : $\text{Density } (\rho) = \frac{\text{nM}}{\text{a}^3\,\text{N}_\text{A}}$

$\text{n} = 4, \text{M} = \text{ Molar mass of KF} = 58.1 \text{ g/mol}$

$\rho = 2.48 \text{ g cm}^{-3}$

$\text{N}_\text{A} = 6.023 \times 10^{23}$

$a^3 = \frac{nM}{\rho N_A} = \frac{4 \times 58.1}{2.48 \times 6.023 \times 10^{23}}$

$a^3 = 15.55 \times 10^{-23}$

$a^3 = 0.1555 \times 10^{-21}$

$a = \sqrt[3]{0.1555 \times 10^{-21}}$

$a = 0.5375 \times 10^{-7} \text{ cm} = 5.375 \times 10^{-8} \text{ cm} = 537.5\text{pm}$

$d = \frac{a}{\sqrt{2}}(\text{ for fcc })[\because r = \frac{a\sqrt{2}}{4}]$

$= \frac{537.5}{1.414} = 380.13\text{pm}$

$\therefore$ The distance between K^+ and F^- in KF = 380.13 pm

8) An atom crystallizes in fcc crystal lattice and has a density of 10 gcm^{-3} with unit cell edge length of 100pm. Calculate the number of atoms present in 1 g of crystal.

Answer : $\text{Density}(\rho) = \frac{\text{nM}}{\text{a}^3\,\text{N}_\text{A}}$

$\rho = 10 \text{ g cm}^{-3}; \text{a} = 100\text{pm} = 1 \times 10^{-8} \text{ cm}; \text{N}_\text{A} = 6.023 \times 10^{23}; \text{n} = 4; \text{M} = ?$

$M = \frac{\rho \text{a}^3 \text{N}_\text{A}}{n}$

$= \frac{10 \times (1 \times 10^{-8})^3 \times 6.023 \times 10^{23}}{4}$

$= \frac{6.023}{4}$

= 1.505 g /mol

$\text{No. of moles} = \frac{\text{Mass}}{\text{Molar mass}} = \frac{1}{1.505}$

= 0.664 moles

Hence number of atoms = 0.664 x 6.023 x 10^{23} = 3.99 x 10^{23} atoms

9) Atoms X and Y form bcc crystalline structure. Atom X is present at the corners of the cube and Y is at the centre of the cube. What is the formula of the compound?

Answer : Number of X type atoms in the unit cell $= 8 \times \frac{1}{8} = 1$

Number of Y type atoms in the unit cell $= 1 \times \frac{1}{1} = 1$

Hence the formula is XY (or) X_1Y_1

10) Sodium metal crystallizes in bcc structure with the edge length of the unit cell 4.3 x 10^{-8} cm. Calculate the radius of sodium atom.

Answer : For bcc structure $(r) = \frac{\sqrt{3}}{4}a$

a = 4.3 $\times$ 10^{-8} cm, r = ?

$= \frac{1.732 \times 4.3 \times 10^{-8}}{4}$

$r = 1.86 \times 10^{-8} \text{ cm}$

11) Why do solids have a definite volume?

Answer : (i) The intermolecular forces of attraction that are present in solids are very strong.

(ii) The constituent particles of solids have fixed position.

(iii) Hence, solids have a definite volume.

12) What is the total number of atoms per unit cell in a face - centered cubic structure (fcc)?

Answer : Total number of atoms per unit cell in a fcc structure = 4 atoms.

13) What is point defect in crystals?

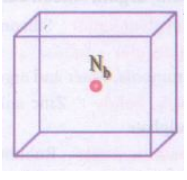
Answer : The defects which are caused by missing or misplaced atoms or ions in the crystal.

14) Write a note on the assignment of atoms per unit cell in body centred cubic lattice or CsCl.

Answer : The total number. of atoms per unit cell in bcc.

$= \frac{N_c}{8} + \frac{N_b}{1} = \frac{8}{8} + \frac{1}{1} = 1 + 1 = 2$

N_b = Number of atoms inside the body; Nc is the number of atoms at the comers.



15) Define packing efficiency.

Answer : The percentage of total volume occupied by these constituent spheres gives the packing efficiency of an arrangement.

Packing efficiency in simple cubic arrangement.

$$\{\text{Packing fraction (or)efficiency}\} = \frac{\{\text{Total volume occupied by spheres in a unit cell }\}}{\text{Volume of the unit cell}} \times 100$$

16) Why is FeS not formed in stoichiometric composition?

Answer : In FeS, Fe^{2+} ions are replaced by Fe^{3+} ions. To maintain electrical neutrality, 3 Fe^{2+} ions are replaced by $2Fe^{3+}$ ions

17) What is F centre?

Answer : Anionic vacancies which are occupied by: unpaired electrons are called F centers. Hence, the formula of NaCI which contains excess Na^+ ions can be written as Na_{1+x} Cl.

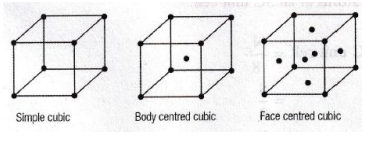
18) What is space lattice?

Answer : i) This regular three dimensional arrangement of spaces (atoms/ons/melecules) throughout the crystal. is called space lattice.

ii) A base repeating structural unit a Crystalline solid is callad a unit cell.

19) Sketch the a) Simple cubic b) Body-centred cubic c) Face centred cubic lattices.

Answer :



20) Write a note on covalent solids. (or) Define covalent solids.

Answer : (i) In covalent solids, the constituents (atoms) are bound together in a three dimensional network entirely by covalent bonds.

(ii) They are very hard, and have high melting point.

(iii) They are usually poor thermal and electrical conductors.

Examples: Diamond, silicon carbide etc.