Important Questions - Solid State

12th Standard CBSE

Chemistry

Reg.No. : ☐☐☐☐☐☐

Time : 01:00:00 Hrs

Total Marks : 50

Section - A

1) Wax is an example of   **1**

  (a) ionic crystal   (b) covalent crystal   (c) molecular crystal   (d) amorphous crystal

2) The number of octahedral sites per sphere in fcc structure is   **1**

  (a) 8   (b) 4   (c) 2   (d) 1

3) Which is not the correct statement for ionic solids in which positive and negative ions are held by strong   **1** electrostatic attractive forces ?

  (a) The radius ratio r^+/r^- increases as coordination number increases

  (b) As the difference in size of ions increases, coordination number increases

  (c) When coordination number is eight, r^+/r^- ratio lies between 0.225 to 0.414

  (d) In ionic solid of the type AX (ZnS, Wurtzite), the coordination number of Zn^{2+} and S^{2-} respectively are 4 and 4.

4) In crystal structure of NaCl, total number of Cl^- ions in a unit cell is   **1**

  (a) 6   (b) 4   (c) 8   (d) 2

5) Which kind of defect is found in KCl crystal ?   **1**

  (a) Frenkel   (b) Schottky   (c) Linear   (d) Impurity

6) Which of the following exists as covalent crystals in the solid state?   **1**

  (a) Phosphorus   (b) Iodine   (c) Silicon   (d) Sulphur

7) The vacant space in *bcc* lattice unit cell is   **1**

  (a) 23%   (b) 32%   (c) 26%   (d) 48%

8) The fraction of the total volume occupied by the atoms present in a simple cube is   **1**

  (a) $\frac{\pi}{4}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{3\sqrt{2}}$ (d) $\frac{\pi}{4\sqrt{2}}$

9) Perovskite,a mineral of titnium is found to contain calcium atoms at the corners,oxygen atoms at the face   **1** centres and titanium atoms at the centre of the cube.Oxidation number of titanium in the mineral is

  (a) +2   (b) +3   (c) +4   (d) +1

10) Structure of a mixed oxide is cubic close-packed(c.c.p) The cubic unit cell of mixed oxide is composed of oxide   **1** ions.One fourth of the tetrahedral voids are occupied by divalent metal A and the octahedral voids are occupied by a monovalent metal B.The formula of the oxide is:

  (a) $A_2B_3O_4$ (b) AB_2O_2 (c) ABO_2 (d) A_2BO_2

Section - B

11) Explain the following with suitable example:An n-type semiconductor.   2

12) How does amorphous silica differ from quartz?   2

13) The density of chromium metal is 7.2 g cm^{-3} . If the unit cell is cubic with edge length of 289 pm, determine   2
   the type of unit cell (simple, body centred or face centred) [Atomic mass of Cr = 52 a.m.u., N_0 = 6.02 $\times$ 10^{23} mol^{-1}].

14) Lithium borohydride,LiBH$_4$,crystallize in an orthorhombic system with 4 molecules per unit cell.The unit cell   2
   dimensions are: a=6.81$\overset{0}{A}$,b=4.43$\overset{0}{A}$ and c=7.17 $\overset{0}{A}$.Calculate the density of the crystal.Take atomic mass of
   Li=7,B=11 and H=1 a.m.u.

15) You are given marbles of diameter 10mm.They are to be placed such that their centres are lying in a square   2
   bound by four lines each of length 40mm.What will be the arrangement of marbles in a plane so that maximum
   number of marbles can be placed inside the area?Sketch the diagram and derive an expression for the number
   of marbles per unit area.

16) (a) What type of semiconductor is obtained when silicon is doped with boron? (b) What type of magnetism is   2
   shown in the following alignment of magnetic moments? (c) What type of point defects are produced when
   AgCl is doped with CdCl$_2$?

17) Iron has a body-centred cubic unit cell with a cell edge of 286.65 pm. The density of iron is 7.874 g cm^{-3}. Use   2
   this information to calculate Avogadro's number. (At. mass of iron=56 g mol^{-1})

18) Silver crystallizes in face-centred cubic unit cell. Each side of this unit cell has a length of 400 pm. Calculate   2
   the radius of the silver atom. (Assume the atoms just touch each other on the diagonal across the face of the
   unit cell. That is , each face atom is touching the four corner atoms.)

19) Define the term 'amorphous'. Give a few examples of amorphous'. Give a few examples of amorphous solids.   2

20) An ionic compound made up of atoms A and B has a face-centered cubic arrangement in the corner and   2
   atoms B are at the face-centers. If one of the atoms is missing from the corner, what is the simplest formula of
   the compound?

Section - C

21) Define the following: 5
   (i) Dislocation
   (ii) F-centre
   (iii) Anti-ferroelectric

22) Examine the given defective crystal **5**

A^+	B^-	A^+	B^-	A^+
B^-	O	B^-	A^+	B^-
A^+	B^-	A^+	O	A^+
B^-	A^+	B^-	A^+	B^-

Answer the following questions:

(i) What type of stoichiometric defect is shown by the crystal?

(ii) How is the density of the crystal affected by this defect?

(iii) What type of ionic substances show such defect?

23) Certain crystals, when subjected to a mechanical stress get deformed and produce electricity due to **5** displacement of ions. The electricity thus produced is called piezoelectricity and such crystals are called piezoelectric crystals. On the other hand, when such crystals are subjected to an electric field, the atomic displacements are produced which cause mechanical distortion in the crystals. These unique properties of piezoelectric crystals find several applications. Now, answer the following questions:

(i)How do piezoelectric crystals behave?

(ii) Mention one application of piezoelectric crystals.

(ill) Just like certain crystals piezoelectric crystals perform better even under mechanical stress and show' various application, how do you behave under stress? What values we can adopt from even these non-living crystals?

24) Compounds having general molecular formula AFe_2O_4 are called ferrites and posses spinel type structures. **5** Some common examples are $MgFe_2O_4$ and $ZnFe_2O_4$ They may be thought of being formed by replacing Fe^{2+} ions present in Fe_3O_4 by bivalent cations such as Mg^{2+}, Zn^{2+} ions etc. Now answer the following questions :

(i) What types of materials are ferrites?

(ii) What are the main uses of ferrites?

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