EVERWIN MATRIC. HR. SEC. SCHOOL

STD: XII Material of the month-June

Chemistry - Ln.6 Solid state

1. Choose the incorrect statement among the following:

   i) Solids have definite volume and shape

   ii) Solids do not have strong cohesive force

   iii) Solids have short inter atomic distance.

   a) (i) and (ii) b) (ii) only c) (i) and (iii) d) all

2. The meaning of krystallos is

   a) clear ice b)quartz stone c) crystal d) solid

3. Example for covalent solid is

   a) Nacl b) rubber c) diamond d) glass

4. Statement 1: Ionic solids do conduct electricity in molten state

   Statement 2: In molten state ions are free to move in the solution.

   a) Statement 1 and 2 are false

   b) Statement 1 and 2 are correct and statement 2 is the correct explanation for statement 1

   c) Statement 1 and 2 are correct

   d) Statement 1 and 2 are correct and statement 2 is not the correct explanation for statement 1

5. The solids which possess excellent electrical and thermal conductivity is

   a) molecular solids b) metallic solids c) covalent solids

   d) ionic solids

6. In Polar molecular crystal, the molecules are held together by _____ interactions.

   a) dipole-dipole b) Hydrogen-Hydrogen

   c) anionic-cationic d) all the above

7. Which among the following is an example for polar molecular solid?

   a) H_2O b) Urea c) NH_3 d) Au

8. Which of the following is not a characteristic of a crystalline solid?

   a) definite heat of fusion b) isotropic nature

   c) a regular repeated pattern of constituent particles

   d) a true solid

9. The sharp melting point of crystalline solids is due to _____.

   a) a regular arrangement of constituent particles observed over a long distance in the crystal lattice

   b) a regular arrangement of constituent particles observed over a short distance in the crystal lattice

   c) same arrangement of constituent particles in different directions

   d) anisotrophic nature

10. Cations are present in the interstitial sites in _____.

    a) Frenkel defect b) Schottky defect

    c) Valancy defect d) Metal deficiency defect

11. Schottky defect is observed in crystal when _____.

    a) Some cations move from their lattice site to interstitial sites

    b) Some lattice sites are occupied by electrons

    c) Some impurity is present in the lattice

    d) equal number of cations and anions are missing from the lattice

12. Which of the following point defect is shown by $AgBr_{(s)}$ crystal?

a) Schottky defect b) Frenkel defect

c) metal excess defect d) metal deficiency defect

13. The percentage of empty space in a body centred cubic arrangement is _____.

a) 74 b) 68 c) 32 d) 26

14. The correct order of the packing efficiency in different types of unit cells is _____.

a) fcc < bcc < simple cubic b) fcc > bcc > simple cubic

c) fcc > bcc < simple cubic d) bcc < fcc > simple cubic

15. The number of atoms per unit cell of fcc is _____.

a) 2 b) 4 c) 6 d) 1

16. The number of atoms per unit cell of BCC is _____.

a) 2 b) 4 c) 6 d) 1

17. The defect observed when $cdcl_2$ is dopped with Agcl is _____.

a) Schottky defect b) Frenkel defect c) impurity defect

d) metal excess defect

18. Amorphous solids are _____.

a) solid substance in real sense b) liquid in real sense

c) super cooled liquid

d) substance with definite melting point

19. In which compound 8 : 8 coordination is found _____.

a) Cscl b) MgO c) Al_2O_3 d) All of these

20. For some crystals, the radius ratio of cation and anion is 0.525, its coordination number will be _____.

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

21. Which type of crystal defect is indicated in the diagram below:

Na^+ Cl^- Na^+ Cl^- Na^+ a) interstitial defect

Cl^- Na^+ Na^+ Cl^- b) Schottky defect

Na^+ Cl^- Na^+ Cl^- Na^+ c) Frenkel defect

Cl^- Cl^- Na^+ Cl^- d) both b and c

22. A match box exhibits _____ geometry.

a) cubic b) monoclinic c) orthorhombic d) tetragonal

23. An element (atomic mass 100g/mol) having bcc structure has unit cell edge 400pm. Then density of the element is _____.

a) 10.376g/cm^3 b) 5.188g/cm^3 c) 7.289g/cm^3

d) 2.144g/cm^3

Solution: $P=\frac{nM}{a^3N_A\times10^{-30}}=\frac{2\times100}{(400)^3(6.02\times10^{23})\times10^{-30}}=5.188g/cm^3$

24. The arrangement ABC ABC ABC …. is referred as _____.

a) octahedral close packing b) Hexagonal close packing

c) tetragonal close packing d) Cubic close packing

25. The number of close neighbour in a body centred cubic lattice of identical sphere is _____.

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

26. If the number of atoms per unit in a crystal is 2, the structure of crystal is _____.

a) octahedral b) BCC c) FCC d) simple cube

27. For some crystals, the radius ratio of cation and anion is 0.525, its structure will be _____.

a) trigonal planar b) tetrahedral c) octahedral d) cubic

28. If we place the second layer on the depression of the first layer - the type of void is

a) tetrahedral b) octabedral c) both d) None of these

29. If the stacking of layers is continued in abcabc….. pattern then the arrangement is called _____ structure.

a) cubic closed pack b) Hexagonal closed pack

c) octahedral closed pack d) All of these

30. The appearance of an electrical potential across the sides of a crystal when we subject it to mechanical stress is called

a) Hydroelectricity b) piezoelectricity c) dipole moment d) Thermal electricity

2 Mark Questions

1. Define the term isotropy and Anisotropy.

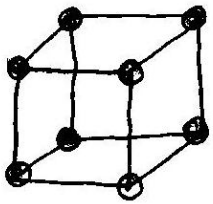
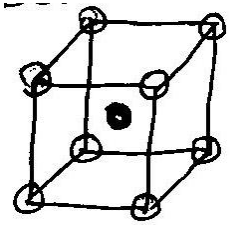
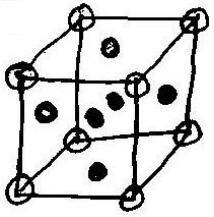
Isotropy is the term defined as having identical values of physical properties such as refractive index electrical conductance in all directions. Eg: glass

Anisotropy is the term defined as having different values of physical properties such as refractive index, electrical conductance in all directions.

2. Define crystal lattice.

The regular arrangement of constituent species through out the crystal is called crystal lattice.

3. Sketch the following: i) SC ii) BCC iii) FCC

i)  ii)  iii) 

4. Calculate the number of atoms per unit cell of SC, BCC and FCC.

No. of atoms in a SC unit cell = $\frac{Nc}{8} = \frac{8}{8} = 1$

No. of atoms in a BC unit cell = $\left[\frac{Nc}{8} + \frac{Nb}{8}\right] = \left[\frac{8}{8} + \frac{1}{1}\right] = 2$

No. of atoms in a FCC unit cell = $\left[\frac{Nc}{8} + \frac{Nf}{2}\right] = \left[\frac{8}{8} + \frac{6}{2}\right] = 1+3 = 4$

5. State Bragg's Equation.

$n\lambda = 2d\sin\theta$ n – order of reflection

λ - Wavelength of x-ray θ- angle of defraction

d – interplanar distance

6. Calculate the percentage efficiency of packing incase of simple cubic system.

Packing fraction = Total volume occupied by

$$\frac{sphere\ in\ a\ unit\ cell}{voluem\ of\ the\ unit\ cell} \text{ x } 100$$

→ Volume of cube = a × a × a = a^3

→ Radius of the sphere = a=2r

$$r = \frac{a}{2}$$

Volume of sphere = $\frac{4}{3}\pi r^3$

$$= \frac{4}{3}\pi \frac{a^3}{8}$$

$$= \frac{\pi a^3}{6}$$

In a simple cubic arrangement, number of spheres belong to a unit cell is equal to one.

∴ Total volume occupied by the spheres

in sc unit cell = $1 \times \left[\frac{\pi a^3}{6}\right]$

Packing fraction = $\frac{\frac{\pi a^3}{6}}{a^3} \times 100 = \frac{100\,\pi}{6} = 52.31\%$

7. If the number of closed packed spheres in face centered cubic system is 3 then calculate the number of octahedral and tetrahedral voids.

Solution: n=3

i) The number of octa hedralvoids is n=3

ii) The number of tetra hedral voids =2n =2x3=6

8. What is dopping?

Dopping is the process by adding impurities to intrinsic

semiconductors to alter their properties.

Eg: Trivalent and pentavalent elements are used to doped with Silicon and Germanium.

9. Mention the application of Dopping.

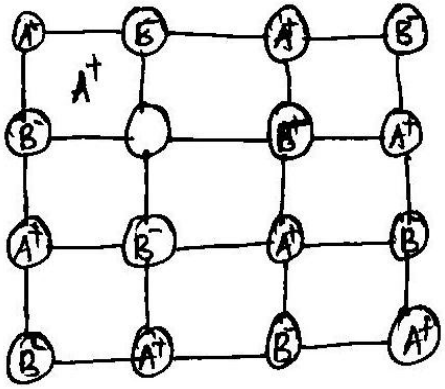
Dopping increases the electrical conductivity of a semi conductor material. Eg: Silicon

10. What type of stoichiometric defect is shown by i) Zns ii) AgBr

i) Zns – shows Frenkel defect

ii) AgBr – shows Schottky and Frenkel defect

11. Examine the defective crystal lattice given below and answer the following questions:



i) Name the crystal defect present in ionic solid Frenkel defect

ii) Out of Agcl and Nacl, which is most likely to show this type of defect?

iii) Why this defect is also known as dislocation defect?

In this defect, the ion is missing from the lattice point and occupies an interstitial position.

12. What type of defect can arise when a solid is heated? Which physical property is affected by it and in what way?

When a solid is heated vacancy defect can arise. A solid crystal is said to have vacancy defect when some of the lattice sites are vacant. Vacancy defect leads to a decrease in the density of the solid.

13. Explain how electrical neutrality is maintained in compounds showing Frenkel and Schottky defect.

In compound showing Frenkel defect, ions just get displaced within the lattice. While in compounds showing Schottky defect, equal number of anions and cations are removed from the lattice. Thus electrical neutrality is maintained in both cases.

14. Classify the following solids in different categories based on the nature of intermolecular forces operating in them.

i) Potassium Sulphate ii) Graphite iii) Benzene

iv) Urea v) Water

i) Potassium Sulphate → ionic solid

ii) Graphite → Covalent solid

iii) Benzene → Molecular solid

iv) Urea → Polar molecular solid

v) Water → Hydrogen bonded molecular solid

15. The window panes seem to be thicker at the bottom in case of old buildings. What can be the reason?

The glass panes fixed to windows of old buildings are found to be thicker at the bottom due to the fluid nature of glass. The glass flows down very slowly and makes the bottom portion slightly thicker.

16. Why is glass considered as super cooled liquid?

Similar to liquids, glass has the tendency to flow, though very slowly. Therefore, Glass is considered as a super cooled liquid.

17. Name the parameters that characterise a unit cell.

The six parameters that characterise a unit cell are as follows:

i) its dimensions along the three edges or lattice constants a, b, c may or may not be equal.

ii) angles between the edges α, β, γ

18. Explain how much portion of an atom located at i) corner ii) Body centre of a cubic unit cell is part of its neighbouring unit cell.

i) An atom located at the corner of a cubic unit cell is shared by eight adjacent unit cells. Therefore $\frac{1}{8}$th portion of the atom is shared by one unit cell.

ii) An atom located at the body centre of a cubic unit cell is not shared by its neighbouring unit cell. Therefore the atom

belongs only to the unit cell in which it is present.
i.e., its contribution to the unit cell is 1.

19. Name the seven primitive crystal systems.
Cubic, tetragonal, orthorhombic, hexagonal, monoclinic, triclinic and rhombohedral.

20. The energy required to vapourise one mole of copper is smaller than that of energy required to vapourise one mole of diamond. Give reason.
Copper is a metallic solid having metallic bonds while diamond is a covalent solid having covalent bonds. Metallic bonds are weaker than covalent bonds and thus less amount of energy is required to break metallic bonds than covalent bonds.

21. Name the solid which has weakest intermolecular force.
Ice

22. Give the significance of a lattice point.
The significance of a lattice point is that each lattice point represents one constituent particle of a solid which may be an atom, a molecule or an ion.

23. Distinguish between hexagonal and monoclinic unit cells.
i) Hexagonal unit cell:
For hexagonal unit cell a=b≠ c and $\alpha=\beta=90^0$, $\gamma=120^0$
ii) Monoclinic unit cell:
For a monoclinic unit cell, a≠b≠ c and $\alpha=\gamma=90^0$, $\beta \neq 90^0$

24. i) Which Stoichiometric defect does not change the density of the crystal?
Frenkel defect
ii) Which Stoichiometric defect decreases the density of the crystal?
Schottky defect (large number of cations and anions are missing)

25. Which of the following lattices has the highest packing efficiency i) SC ii) BCC iii) hcp
Hexagonal close-packed lattice has the highest packing efficiency of 74% The packing efficiencies of simple cubic and body centered cubic lattices are 52.4% and 68% respectively.