CHEMISTRY

BOOKS - ARIHANT PUBLICATION

THE SOLID STATE

Sample Question

1. X-ray diffraction studies show that copper crystallises in a fcc unit cell with cell edge of 3.608×10^{-8} cm. In a separate experiment,

copper is determined to have a density of $8.92 g/cm^3$, calculate the atomic mass of copper.

2. An element X with an atomic mass of 60 $g\,mol^{-1}$ has density of $6.23g\,cm^{-3}$. If the edge length of its cubic unit cell is 400 pm, identify the cubic unit cell. Calculate the radius of an atom of this element.

3. The radius of $Mg^{2+}, Cs^+, O^{2-}, S^{2-}$ and Cl^- ions are 0.65 Å, 1.69 Å, 1.40 Å, 1.84 Å and 1.81 Å respectively. Calculate the coordination numbers of cations in the crystals of MgS, MgO and CsCl.

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Part I Question For Practice Multiple Choice Type Questions

1. Which of the following statements about amorphous solids is incorrect?

    A. They melt over a range of temperature

    B. They are isotropic

    C. There is no orderly arrangement of particles

    D. They are rigid and incompressible

Answer: C

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1. Which one of the following exists as covalent crystals in the solid state?

    A. Iodine

    B. Silicon

    C. Sulphur

    D. Phosphorus

Answer: B

2. What type of solid is naphthalene?

A. Ionic solid

B. Covalent solid

C. Metallic solid

D. Molecular solid

Answer: D

3. Which one of the following is a covalent crystal?

A. Rock salt

B. Ice

C. Quartz

D. Dry ice

Answer: C

4. Which one of the following forms a molecular solid when solidified?

A. Silicon carbide

B. Calcium fluoride

C. Rock salt

D. Methane

Answer: D

1. Why are liquids and gases categorised as fluids?

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2. Which types of solids have definite enthalpy of fusion?

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3. The type of solids which have sharp melting points is ....

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4. Why are amorphous solids called pseudo solids or supercooled liquids?

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5. Under which situation can an amorphous substance change to crystalline form?

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6. The type of intermolecular force is present in ice is........

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7. Ionic solids conduct electricity in molten state but not in solid state. Explain.

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8. What types of solids are electric conductors, malleable and ductile?

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9. Solid A is a very hard, electrical insulator in solid as well as in molten state and melts at extremely high temperature. What type of solid is it?

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Part I Question For Practice Short Answer Type I Questions

1. Why are solids incompressible?

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

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3. Refractive index of a solid is observed to have the same value along all directions. Comment on the nature of this solid. Would it show cleavage property?

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4. Inspite of long range order in the arrangement of particles, why are the crystals usually not perfect?

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5. Metallic solids are conductors of heat and electricity. Why?

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6. Graphite is a conductor of electricity. Give reasons.

7. Classify the following as amorphous or crystalline solids.

Polyurethane, naphthalene, benzoic acid, teflon, potassium nitrate, cellophane, polyvinyl chloride, fibre glass, copper.

1. What makes a glass different from a solid such as quartz? Under what conditions could quartz be converted into glass?

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

Potassium sulphate, tin, benzene, urea, ammonia, water, zinc sulphide, graphite, rubidium, argon, silicon carbide.

3. Classify each of the following solids as ionic, metallic, molecular, network (covalent) or amorphous.

(i) Tetraphosphorus decaoxide (P_4O_{10})

(ii) Ammonium phosphate $(NH_4)_3PO_4$

(iii) SiC (iv) I_2 (v) P_4

(vi) Graphite (vii) Brass (viii) Rb

(ix) LiBr (x) Si (xi) Plastics

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Part I Question For Practice Long Answer Type Questions

1. Explain

(a) the basis of similarities and differences between metallic and ionic crystals.

(b) ionic solids are hard and brittle.

2. Stability of a crystal is reflected in the magnitude of its melting point, comment. Collect melting points of solid water, ethyl alcohol, diethyl ether and methane from data book What can you say about the intermolecular forces between these molecules?

1. A crystalline solid

   A. changes abruptly from solid to liquid

   B. has no definite melting point

   C. undergoes deformation of its geometry easily

   D. has an irregular 3-dimensional arrangement

Answer: A

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1. Match the Column I with Column II.

Choose the correct option.

A. A-II, B-I, C-IV, D-III

B. A-I, B-II, C-III, D-IV

C. A-III, B-II, C-I, D-IV

D. A-II, B-IV, C-I, D-III

Answer: B

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2. Covalent or network solids are insulator except,

A. Graphite

B. SiC

C. SiO_2

D. Diamond

Answer: A

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1. A solid translucent material exhibited different optical clarity when seen through, from different side. What is the reason of such observation?

2. ... and...... are two examples of substances which have same chemical composition but have different crystalline characters.

3. The type of molecular solids which is supposed to be harder is .....

4. Give example of a solid substance which conducts electricity even when possessing covalent bonds.

1. Why does urea have a sharp melting point but glass does not?

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2. Which type of intermolecular forces are present in the crystal lattice of iodine molecules?

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3. Under what conditions a substance exist in solid state?

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4. How do the structures of quartz and quartz glass differ from each other?

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5. Diamond and solid rhombic sulphur both are covalent solids but the latter has very low melting point than the former. Explain, why?

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6. Distinguish hydrogen bonded molecular solids from other types of molecular solids.

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1. Write binding forces present in the following types of solids along with giving an example of each.

(i) Non-polar molecular solids

(ii) Polar solids molecular solids

(iii) Network solids

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2. Explain

Electrical conductivity by ionic substances is different from that of metallic ones.

3. Explain

Crystalline solids have sharp melting points.

1. Classify crystalline solids on the basis of nature of intermolecular forces existing between the molecules, Give suitable examples for each category.

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1. The crystal system of a compound with unit cell dimension a = 0.387, b=0.387 and c= 04 nm and $\alpha = \beta = 90°$ and $\gamma = 120°$ is

    A. cubic

    B. hexagonal

    C. orthorhombic

    D. rhombohedral

Answer: B

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2. In which of the following packing, 74% space is occupied by the atoms with ABCABC packing of atoms?

A. Hexagonal closed packing

B. Simple cubic

C. Body centred cubic

D. Cubic closed packing

Answer: D

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3. If 'a' stands for the edge length of the cubic systems, simple cubic, body centred cubic and face centred cubic, then the ratio of radii of the spheres in these systems will be respectively,

A. $\dfrac{1}{2}a : \dfrac{\sqrt{3}}{4}a : \dfrac{1}{2\sqrt{2}}a$

B. $\dfrac{1}{2}a : \sqrt{3}a : \dfrac{1}{\sqrt{2}}a$

C. $\dfrac{1}{2}a : \dfrac{\sqrt{3}}{2}a : \dfrac{\sqrt{2}}{2}a$

D. $1a : \sqrt{3}a : \sqrt{2}a$

Answer: A

4. Which set of characteristics of ZnS crystal is correct?

A. Coordination number (4:4): ccp, Zn^{2+} ions in the alternate tetrahedral voids

B. Coordination number (6:6), hcp, Zn^{2+} ions in all tetrahedral voids

C. Coordination number (6:4), hcp, Zn^{2+} ions in all octahedral voids

D. Coordination number (4:4), ccp, Zn^{2+}

ion in all tetrahedral voids

Answer: D

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5. In an antifluorite structure, cations occupy

A. centre of cube

B. tetrahedral voids

C. corners of cube

D. octahedral voids

Answer: B

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1. Give significance of a 'lattice point'.

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2. What is the two dimensional coordination number of a molecule in square close-packed layer?

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3. The atoms per unit cell (Z) present in bcc unit cell are ......

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4. How many atoms constitute one unit cell of a face-centred cubic crystal?

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5. What is the maximum radius of a sphere that can be filled in a tetrahedral void of cubic close packing of spheres of radius R without disturbing the packing?

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6. AgI crystallises in cubic close-packed ZnS structure. What fraction of tetrahedral sites is occupied by Ag^+ ions?

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7. The coordination number of each type of ions in a rock salt type crystal structure are ...... and ...... respectively

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8. What happens to a sodium chloride structure when high pressure is applied to it?

9. Which of the following lattices has the highest packing efficiency?

(i) Simple cubic

(ii) Body-centred cubic

(iii) Hexagonal close-packed lattice

10. Gold (atomic radius = 0.144 nm) crystallises in a face centred unit cell. What is the length of the side of the cell?

11. Aluminium crystallises in a fcc structure. Atomic radius of the metal is 125 pm. What is the length of the side of the unit cell of the metal?

1. Explain, how much portion of an atom located at (i) corner and (ii) body centre of a cubic unit cell is part of its neighbouring unit cell?

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2. A cubic solid is made up of two elements P and Q. Atom Q is present at corners of the

cube and atom P at the body centre. What is the formula of the compound? What are the coordination numbers of P and Q?

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3. What is meant by the term coordination number?

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4. What is the coordination number of atoms

(a) in a cubic close packed structure?

(b) in a body centred cubic structure?

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5. How will you distinguish between the following pairs of terms?

Tetrahedral and octahedral voids

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6. How will you distinguish between the following pairs of terms?

Crystal lattice and unit cell

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7. A compound forms hexagonal close packed structure. What is the total number of voids in 0.5 mole of it? How many of these are tetrahedral voids?

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8. In a cubic close-packed structure of a mixed oxide one-eighth of tetrahedral voids are occupied by divalent ions X^{2+} while one half of the octahedral voids are occupied by trivalent ions Y^{3+}. What is the formula of the compound?

9. Ferric oxide crystallises in a hexagonal close packed array of oxide ions with two out of

every three octahedral holes occupied by ferric ions. Derive the formula of the ferric oxide.

10. Calculate the packing efficiency of a metal crystal for a simple cubic lattice.

11. An element with density 2.8 g cm^{-3} forms fcc unit cell with edge length 4×10^{-8} cm.

Calculate the molar mass of the element.

(Given, $N_A = 6.022 \times 10^{23} \text{mol}^{-1}$)

12. An element with density 11.2 g cm^{-3} forms a fcc lattice with edge length of 4×10^{-8} cm.

Calculate the atomic mass of the element.

(Given, $N_A = 6.022 \times 10^{23} \text{mol}^{-1}$)

13. Silver crystallises in fcc lattice. If edge length of the cell is 4.07×10^{-8} and density is 10.5 g cm^{-3}. Calculate the atomic mass of silver.

14. Copper crystallises into a fcc lattice with edge length 3.61×10^{-8}cm. Show that the calculated density of Cu is in agreement with its measured value of 8.92 g cm^{-3}.

Part Ii Question For Practice Short Answer Type Ii Questions

1. How many lattice points are there in one unit of each of the following lattice?

(i) Face centred cubic

(ii) Face centred tetragonal

(iii) Body centred cubic

2. How will you distinguish between the following pairs of terms?

Crystal lattice and unit cell

3. If the radius of the octahedral void is r and radius of the atoms in close packing is R, derive a relation between r and R.

Draw a diagram showing octahedral void and derive the relation between r and R.

4. An element crystallises in fcc lattice having edge length 400 pm, Calculate the maximum diameter of atom which can be placed in interstitial site without distorting the structure.

5. An element with molar mass 27 g mol^{-1} forms a cubic unit cell with edge length

4.05×10^{-8} cm. If its density is 2.7 g cm^{-3}, what is the nature of the cubic unit cell?

6. An element with molar mass 2.7×10^{-2} kg mol^{-1} forms a cubic unit cell with edge length 405 pm. If its density is 2.7×10^{3} kg m^{-3}. What is the nature of the cubic unit cell?

7. An element occurs in bcc structure. It has a cell edge length of 250 pm. Calculate the molar mass if its density is 8.0 g cm^{-3} . Also calculate the radius of an atom of this element.

8. Niobium crystallises in a body-centred cubic structure. If its density is 8.55 g cm^{-3}, calculate the atomic radius of niobium using its atomic mass 93 u.

9. Aluminium crystallises in a cubic closed packed structure. Its metallic radius is 125 pm.

(i) What is the length of the side of the unit cell?

(ii) How many unit cells are there in 1.00 cm^3 of aluminium?

1. Discuss

(i) Close packing in one dimension.

(ii) Close packing in two dimensions.

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2. Calculate the packing efficiency of a metal crystal for a simple cubic lattice.

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1. When the centres of the four immediate neighbouring spheres are joined a square is formed. Thus, this packing is called

    A. square close packing

    B. hexagonal close packing

    C. rectangular close packing

    D. None of the above

Answer: A

2. The molar volume of KCl and NaCl are 37.46 mL and 27.94 mL, respectively. The ratio of the unit cube edges of the crystals is

A. 1.296

B. 1.102

C. 1.341

D. 0.950

Answer: B

3. The ionic radii of Rb^+ and I^- are $1.46\overset{\circ}{A}$ and $2.16\overset{\circ}{A}$. The most probable type of structure exhibited by it is :

    A. CsCl type

    B. ZnS type

    C. NaCl type

    D. CaF_2 type

Answer: C

Part Ii Question For Assessment Very Short Answer Type Questions

1. An example of a compound, which forms a crystal system in which all the edges and angles are different from each other is ....

2. Which of the crystals will have more density- a crystal with bcc unit cells or a crystal with fcc unit cell?

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3. In CaF_2 crystal, Ca^{2+} ions are present in fcc arrangement, then the number of F^- ions in the unit cell is.......

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4. Which crystal system has least and which one has higher volumes of empty spaces?

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1. How cubic lattices are different from tetragonal lattices?

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2. What is the total number of atom(s) contributed by vertices in each of these two cases-bcc and fcc unit cell?

3. In one type of crystal of an element there are more octahedral voids than tetrahedral ones while in another type there are more tetrahedral voids than the octahedral ones.

Which of these two crystals has higher density and why?

1. An element occurs in bcc structure with cell edge 300 pm. The density of the element is 5.2 g cm^{-3}. How many atoms of the element does 200 g of the element contain?

2. A solid $A^+ B^-$ has NaCl type close packed

structure. If the anion has a radius of 241.5 pm,

what should be the idealradius of the cation?

Can a cation C^+ having radius of 50 pm be

fitted into tetrahedral hole of the crystal

$A^+ B^{-1}$?

3. A metallic element crystallises into a three dimensional lattice containing a sequence of layers of ABABAB... Any packing of spheres leaves out voids in the lattice. What percentage by volume of this lattice is empty space?

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1. Discuss the placing of third layer over the second layer, during close packing in the following two cases:

(i) When tetrahedral voids are covered.

(ii) When octahedral voids are covered.

2. What is the maximum radius of a sphere that can be filled in a tetrahedral void of cubic

close packing of spheres of radius R without disturbing the packing?

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1. The flame colours of metal ions are due to

    A. Frenkel defect

    B. Schottky defect

C. metal deficiency defect

D. metal excess defect

Answer: D

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2. When electrons are trapped into the crystal in anion vacancy, the defect is known as

A. Schottky defect

B. Frenkel defect

C. stoichiometric defect

D. F-centres

Answer: D

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3. Which of the following is a wrong statement regarding a crystal containing Schottky defect?

A. Electrical neutrality of the crystal is

   maintained

B. Entropy of the crystal increases

C. The density of the overall crystal remains

   the same

D. The density of the overall crystal reduces

Answer: C

4. Which of the following has the highest value of energy gap?
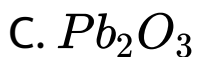
A. Aluminium

B. Silver

C. Germanium

D. Diamond

Answer: D
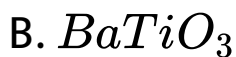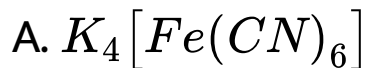
5. Which amongst these is a ferroelectric compound?

A. $K_4\left[Fe(CN)_6\right]$

B. $BaTiO_3$

C. Pb_2O_3

D. None of these

Answer: B

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6. The n-type semiconductor is obtained when Si is doped with

A. Al

B. Ge

C. B

D. As

Answer: D

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

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2. What type of stoichiometric defect is shown by ZnS?

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3. What type of stoichiometric defect is shown by AgBr?

4. What type of stoichiometric defect is shown by ZnS?

5. Why does Frenkel defect not change the density of AgCl crystal?

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6. The density of a crystal .... due to Schottky defect.

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7. Why is the Frenkel defect not found in pure alkali metal halides?

8. What is the effect of Frenkel defect on electrical conductivity of solid?

9. .... is an example of ionic compound which shows Schottky defect.

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10. What type of defect is produced when NaCl is doped with $SrCl_2$?

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11. What makes the alkali metal halides sometimes coloured which are otherwise colourless?

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12. How may the conductivity of an intrinsic semiconductor be increased?

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13. Which other element may be added to silicon to make electrons available for conduction of electricity?

14. Solid solution of group 13 or group 15 impurities with the group 14 elements are found to exhibit unusual electrical properties. Why?

15. A group 14 element is to be converted into n-type semiconductor by doping it with a suitable impurity. To which group should this impurity belong?

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16. Account for the following:

Conductivity of silicon increases on doping it with phosphorus.

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17. Assign reasons for the following:

Phosphorus doped silicon is a semiconductor.

18. What happens when ferrimagnetic Fe_3O_4 is heated at 850 K and why?

19. Write the type of magnetism observed when the magnetic moments are oppositely aligned and cancel out each other.

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Part Iii Question For Practice Short Answer Type I Questions

1. Examine the given defective crystal

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

Answer the following questions.

What type of stoichiometric defect is shown by the crystal?

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2. Examine the given defective crystal

A⁺	B⁻	A⁺	B⁻	A⁺
B⁻		B⁻	A⁺	B⁻
A⁺	B⁻	A⁺		A⁺
B⁻	A⁺	B⁻	A⁺	B⁻

Answer the following questions.

How is the density of the crystal affected by this defect?

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3. Ionic solids which have anionic vacancies due to metal excess defect, develop colour.

Explain with the help of a suitable example.

4. Why LiCl acquires pink colour when heated in Li vapours?

5. Schottky defects generate an equal number of cation and anion vacancies while doping

produces only cation vacancies and not anion vacancies. Why?

6. The crystal AB (rock salt structure) has molecular weight 6.023 y u where, y is an arbitrary number and u is the unified atomic mass unit. If the minimum distance between cation and anion is $y^{1/3}$ nm and the observed density is 20 kg/m^3 then find the

(i) density in kg/m^3 and

(ii) type of defect.

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7. Explain, how vacancies are introduced in an ionic solid when a cation of higher valency is added as an impurity in it?

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8. In terms of band gaps, what is the difference between a conductor and an insulator?

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9. In terms of band gaps, what is the difference between a conductor and a semiconductor?

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10. Non-stoichiometric cuprous oxide, Cu_2O can be prepared in the laboratory. In this oxide, copper to oxygen ratio is slightly less than 2:1. Can you account for the fact that this substance is a p-type semiconductor?

11. What change occurs when AgCl is doped with $CaCl_2$?

12. What type of semiconductor is produced when silicon is doped with boron?

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13. Classify of the following as being either a p-type or a n-type semiconductor.

Ge doped with In.

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14. What type of semiconductor is produced when silicon is doped with boron?

15. Write the type of magnetism observed when the magnetic moments are aligned in parallel and anti-parallel directions in unequal number.

16. Which stoichiometric defect decreases the density of the crystal?

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17. What type of substances would make better permanent magnets, ferromagnetic or ferrimagnetic? Justify your answer.

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1. If NaCl is doped with 10^{-3} mole % of $SrCl_2$, what is the concentration of the cation vacancies?

2. Analysis shows that nickel oxide has the formula $Ni_{0.98}O_{1.00}$. What fractions of the nickel exist as Ni^{2+} and Ni^{3+} ions?

Part Iii Question For Practice Long Answertype Questions

1. What is a semiconductor? What aren-type and p-type semiconductors?

2. Explain the following with suitable examples:

Ferromagnetism

3. Explain the following with suitable examples:

Paramagnetism

4. Explain the following with suitable examples:

Ferrimagnetism

5. Explain the following with suitable examples:

Anti-ferromagnetism

6. Explain the following with suitable examples:

Diamagnetism

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7. Explain the following with suitable examples:

n-type semiconductor

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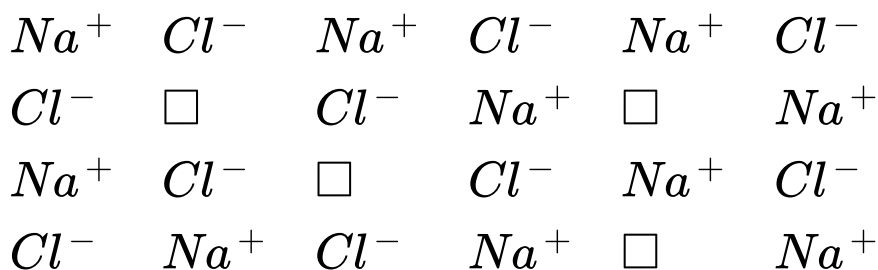
8. Explain the following with suitable examples:

p-type semiconductor

Part Iii Question For Assessment Multiple Choice Type Questions

1. What type of crystal defect is indicated in the diagram below?

Na^+	Cl^-	Na^+	Cl^-	Na^+	Cl^-
Cl^-	□	Cl^-	Na^+	□	Na^+
Na^+	Cl^-	□	Cl^-	Na^+	Cl^-
Cl^-	Na^+	Cl^-	Na^+	□	Na^+

A. Frenkel defect

B. Schottky defect

C. Interstitial defect

D. Frenkel and Schottky defects

Answer: B

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2. Insulators are the solids with very low conductivities ranging between A.... Here, A refers to

A. 10^4 to $10^7 \Omega^{-1} m^{-1}$

B. 10^{-20} to $10^{-5} \Omega^{-1} m^{-1}$

C. 10^{-20} to $10^{-10} \Omega^{-1} m^{-1}$

D. 10^{-6} to $10^4 \Omega^{-1} m^{-1}$

Answer: C

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3. The substances, which shows permanent magnetism even in the absence of magnetic field are called

A. ferrimagnetic

B. ferromagnetic

C. diamagnetic

D. paramagnetic

Answer:

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Part Iii Question For Assessment Very Short Answer Type Questions

1. How are point defects and line defects different?

2. What is meant by 'doping'in a semiconductor?

3. What is the function of photodiode?

4. The type of alignment in crystals is.... which makes them ferromagnetic.

5. Why are the defects of the crystalline solids called thermodynamic defects?

1. How are the following properties of crystals affected by Schottky and Frenkel defects?

(i) Density (ii) Electrical conductivity

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2. Why FeO shows non-stoichiometric defect with the formula $Fe_{0.95}O$?

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1. If Al^{3+} replace Na^+ at the edge centre of NaCl lattice, then calculate the vacancies in one mole of NaCl.

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2. What type of defect is shown by KCl and why?

3. Give reason: Zinc oxide becomes yellow on heating

4. What type of magnetism is shown in the following alignment of magnetic moments?

↑ ↑ ↑ ↑ ↑ ↑

1. The number of atoms in bcc arrangement is

A. 1

B. 4

C. 2

D. 6

Answer: C

2. In hcp mode of stacking, a sphere has coordination number.

A. 4

B. 6

C. 8

D. 12

Answer: D

3. If edge of a bcc crystal of an element is 'd' cm, M is the atomic mass and 'N' is the Avogadro number, then density of the crystal is

A. $\dfrac{4M}{a^3 N}$

B. $\dfrac{2N}{Ma^3}$

C. $\dfrac{2M}{Na^3}$

D. $\dfrac{Ma^3}{2N}$

Answer: C

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4. The unit cell with crystallographic dimensions $a = b \neq c, \alpha = \beta = \gamma = 90°$ is

A. cubic

B. tetragonal

C. monoclinic
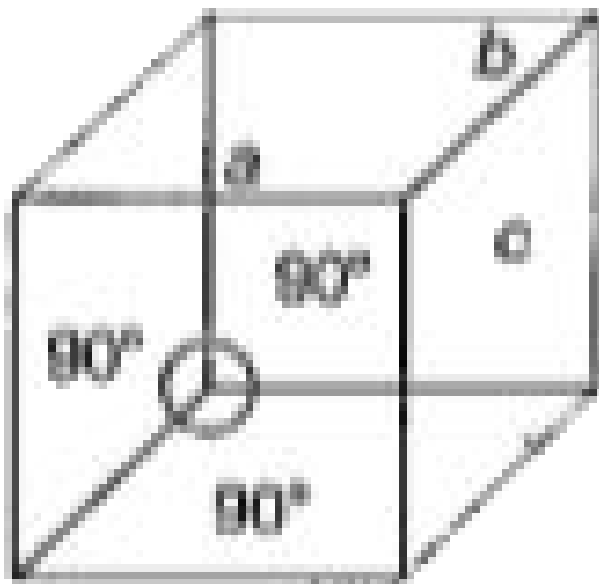
D. hexagonal

Answer: B

5. The structure of sodium chloride is

A. hexagonal

B. octahedral

C. rhombohedral

D. tetrahedral

Answer: B

6. The unit cell with the structure below refers

to .... crystal system.

A. cubic

B. orthorhombic

C. tetragonal

D. trigonal

Answer: A

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7. The arrangement ABC, ABC ... is referred to as

A. octahedral close packing

B. hexagonal close packing

C. tetrahedral close packing

D. cubic close packing

Answer: D

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8. Which among the following will show

anisotropy?

A. glass

B. barium chloride

C. wood

D. paper

Answer: B

9. If the radius of the octahedral void is r and radius of the atoms in close packing is R, derive a relation between r and R.

Draw a diagram showing octahedral void and derive the relation between r and R.

A. 0.155

B. 0.732

C. 0.414

D. 0.225

Answer: C

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10. The number of octahedral voids in a unit cell of a cubic close packed structure is

A. 2

B. 3

C. 4

D. 6

Answer: C

1. Diamond and graphite are:

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2. Diamond and solid rhombic sulphur both are covalent solids but the latter has very low melting point than the former. Explain, why?

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3. The total number of atoms per unit cell of a face centred cubic crystal is

4. What is the maximum radius of a sphere that can be filled in a tetrahedral void of cubic close packing of spheres of radius R without disturbing the packing?

5. Explain isotropy.

6. Define anisotropy.

7. Define a unit cell of a crystal.

8. What are interstitials?

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9. What are the types of lattice imperfections found in crystals?

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10. What do you mean by crystal lattice?

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11. How many types of close packing are known in crystals?

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12. Define coordination number of a crystal.

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13. Explain interstitial voids.

14. How many types of lattice points occur in different cubic unit cells?

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15. how many atoms are present per unit cell of a body centred cubic crystal ?

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16. What is a polycrystalline solid?

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17. What are crystallites?

▶ **Watch Video Solution**

18. The number of atoms in bcc arrangement is

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19. Give two examples of ionic solids.

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20. Diamond, graphite and quartz are ....

solids.

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21. Define metallic solids.

▶ **Watch Video Solution**

22. What is meant by molecular solids?

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23. What is meant by radius ratio?

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24. Why is carbon tetrachloride immiscible in water ?

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25. The solubility of a solid .... by increase of pressure. (increased, not changed, decreased)

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26. What is the effect of pressure on the solubility of a solid ?

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27. solubility of calcium acetate _____ with increase in temperature.

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28. Give two examples of molecular solid.

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29. Give an example of hcp and bcc crystals.

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30. What is the commercial name of SiC ?

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31. What are the coordination numbers of Cs^+ and Cl^- in CsCl lattice ?

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1. Give two difference between crystalline and amorphous solids.

2. If the radii of the cation and anion are 95 pm and 181 pm respectively, what would be coordination number and the type of crystal geometry?

3. Explain how hcp or ccp for the same element give the same identity?

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4. What should be the ideal radius of the anion in a type of structure if the radius of the cation is r?

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5. Calculate the radius ratio $\left(\dfrac{r^+}{r^-}\right)$ and the coordination number of Li^+ and F^- in LiF crystal from the given data, $r_{Li^+} = 60$ pm and $r_{F^-} = 136$ pm.

6. Silver crsytallises in fcc lattice with all the atoms at the lattice points. The length of the edge of the unit cell as determined by X-ray diffraction studies is found 408.6 pm. The

density of silver is 10.5 g cm^{-3}. Calculate the atomic mass of silver.

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7. Explain the difference between conductor and insulator.

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8. Explain the difference between conductor and semiconductor.

9. Explain the following with suitable examples:

Ferromagnetism

10. Explain the following with suitable examples:

Paramagnetism

11. Explain the following:

Antiferromagnetism

12. Explain the following with suitable examples:

Ferrimagnetism

13. Explain interstitial voids.

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1. Write four important characteristics of solids.

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2. Give two difference between crystalline and amorphous solids.

> ▶ **Watch Video Solution**

3. What are chief characteristics of ionic crystals?

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4. Describe a few general characteristics of covalent crystals.

5. What are molecular crystals? How many types of molecular crystals are known?

6. Explain metallic crystals and their properties?

7. What do you understand by the terms space lattice and unit cell?

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8. Define coordination number in crystals. Is the coordination number of a sphere in ccp and hcp arrangement same or different?

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9. Discuss the following types of cubic structures.

(i) Simple cubic

(ii) Body centred cubic

(iii) Face centred cubic

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10. How does radius ratio help in determining the structures of compounds?

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11. What are interstitial sites? Discuss tetrahedral and octahedral interstitial sites in a closed packed arrangement.

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12. Explain why diamond is hard while graphite is soft.

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1. Describe various characteristics of solids.

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2. What do you understand by close packing of spheres? Discuss briefly hexagonal close packing and cubic close packing of spheres.

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3. Describe fcc, bcc and hcp crystals of simple ionic compounds.

4. Discuss the characteristics of solids. Give the classification of solids into ionic, covalent, molecular and metallic solids.

5. Explain the crystal defects and their origin in the crystal.

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1. TiO_2 is well known example of

    A. triclinic system

    B. tetragonal system

C. monoclinic system

D. None of these

Answer: B

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2. A crystal made of metal crystallises into a lattice containing a sequence of layers ABABABA... Packing of spheres leaves out voids in the lattice. What percentage by volume of this lattice is occupied?

A. 50 %

B. 26 %

C. 74 %

D. None of these

Answer: C

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3. In which of the following crystals alternate tetrahedral voids are occupied ?

A. NaCl

B. ZnS

C. CaF_2

D. Na_2O

Answer: B

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4. How many Cs^+ ions occupy the second nearest neighbour locations of Cs^+ ion in the structure CsCl (8:8 coordination)?

A. 16

B. 8

C. 6

D. 24

Answer: C

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1. The type of solid SiC is ......

2. What is the coordination number of each atom in ccp structure?

3. Which non-stoichiometric point defect is responsible for colour in alkali metal halides?

4. The type of semiconductor formed when silicon is doped with N is......

5. Why diamond is harder than graphite?

Chapter Practice Short Answer Type I Questions

1. What are different types of voids formed in close packed structures?

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2. In NaCl crystal, Cl ions are in fcc arrangement. Calculate the number of Cl ions in its unit cell.

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3. Lithium iodide crystal has a face-centred cubic unit cell. If the edge length of the unit cell is 620 pm, determine ionic radius of I^- ions.

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4. A compound formed by the elements X and Y crystallises in the cubic structure. Atoms Y are present on the corners as well as face centres whereas atoms X are present in the

edge centres as well as body centre. What is the formula of the compound?

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5. Copper crystallises with face centred cubic unit cell. If the radius of copper atom is 127.8 pm, calculate the density of copper metal.

(Atomic mass of Cu= 63.55 u and Avogadro's number, $N_A = 6.02 \times 10^{23} \text{mol}^{-1}$)

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6. The density of copper is 17.90 gcm^{-3}. It has a fcc structure. What is the radius of copper atom?

(Atomic mass $oCu = 63.5\text{g mol}^{-1}, N_A = 6.02 \times 10^{23}\text{mol}^{-1}$]

7. Tungsten crystallises in body centred cubic crystal. If the edge of the unit cell is 316.5 pm, what is the radius of tungsten atom?

8. Explain, why does conductivity of germanium crystals increases on doping with galium?

9. Why does the electrical conductivity of semiconductors increase with rise in temperature?

10. Why electrical conductivity occurs in ionic solid and metals?

Chapter Practice Short Answer Type Ii Questions

1. Compare the following properties of crystalline and amorphous solids.

(i) Orderly arrangement

(ii) Melting points

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2. An element has a body centred cubic (bcc) structure with a cell edge of 288 pm. The density of the element is $7.2g/cm^3$. How many atoms are present in 208 g of the element?

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3. Calculate the distance between Na^+ and Cl^- ions in NaCl crystal if its density is 2.165 g cm^{-3}.

[Molar mass of NaCl $= 58.5\text{g mol}^{-1}$, $N_A = 6.02 \times 10^{23}\text{mol}^{-1}$]

4. The edge length of unit cell of a metal having molecular weight 75 g/mol is 5 Å which crystallises in cubic lattice. If the density is

$2g/cm^3$ then, find the radius of metal atom.

$$\left(N_A = 6.022 \times 10^{23}\right)$$

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5. Define coordination number of a crystal.

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6. What is the number of atoms in a unit cell

of

(a) a face-centred cubic structure?

(b) a body-centred cubic structure?

7. Calcium metal crystallises in a face centred cubic lattice with edge length of 0.556 nm. Calculate the density of the metal if it contains

(i) 0.2% Frenkel defects

(ii) 0.1% Schottky defects

8. AB crystallises in a rock salt structure with A : B =1:1. The shortest distance between A and B is $Y^{1/3}$ nm. The formula mass of AB is 6.023 Y, where Y is an arbitrary constant. Find the density in kg m^{-3} ?

9. Name the ions which form the close packed structure (along with the type of packing) and the ions which fill the voids (along with the

types of voids) in the compounds:

$(i) NaCl$ $(ii) ZnS$ $(iii) CaF_2$

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Chapter Practice Long Answer Type Questions

1. A crystal of lead (II) sulphide has NaCl structure. In this crystal, the shortest distance between the Pb^{2+} ion and S^{2-} ion is 297 pm. What is the length of the edge of the unit cell

in lead sulphide ? Also, calculate the unit cell

volume.

2. Show that in a cubic close packed structure,

eight tetrahedral voids are present per unit

cell.