CHEMISTRY

BOOKS - VIKRAM PUBLICATION (ANDHRA PUBLICATION)

SOLID STATE

Textual Examples

1. A compound is formed by two elements X and Y . Atoms of the element Y (as anions)

make ccp and those of the element X(as cations) occupy of the octahderal voids . What is the formula of the compound ?

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2. Atoms of element B form hcp lattice and those of the element A occupy $2/3^{\text{rd}}$ of tetrahedral voids . What is the formula of the compound formed by the element A and B ?

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

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4. X-ray diffraction studies show that copper crystallises in an 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 .

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5. Silver froms ccp lattice and X-ray studies of its crystals show that the edge length of its unit cell is 408.6 pm. Calculate the density of silver (atomic mass $= 107.9u$).

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Very Short Answer Questions

1. Define the term amorphous.

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

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3. Classify the following solids as ionic , metallic , molecular , covalent network or amorphous .

i) Si ii) I_2 iii) P_4 iv) Rb v) SiC

vi) LiBr vii) Ammonium Phosphate $(NH_4)_3PO_4$ viii) Plastic

ix) graphite x) Tetra phosphorous decoxide

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4. What is meant by the term "coordination number"?

b. What is the coordination number of atoms:

i. in a cubic-packed structure?

ii. In a body-centreds structure?

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5. What is the co-ordination number of each sphere in cubic close packing and hexagonal close packing ?

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6. The coordination number of each atom in body centered cubic unit cell is

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7. a. "Stability of a crystal is reflected is reflected in the magnitude of its melting points" Comment.

b. Melting points of some compounds are given below water $= 273K$, ethyl alcohol $= 153.7K$, diethyl ether $= 156.8K$, methane

$= 90.5K$. What can you say about the intermolecular forces between the molecules of these compounds?

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8. How are the intermolecular forces among the molecules affect the melting point ?

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9. How do you distinguish between hexagonal close - packing and cubic close - packing structures ?

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10. How do you distinguish between crystal lattice and unit cell ?

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11. How many lattice points are there in one unit cell of face centered cubic lattice

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

a. Face-centred cubic

b. Face-centred tetragonal

c. Body-centred

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13. How many lattice points are there in one unit cell of body centered cubic lattice ?

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14. What is a semi conductor ?

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15. What is Schottky defect ?

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16. What is Frenkl defect ?

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17. What is interstitial defect ?

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18. What are f-centers ?

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19. Explain Ferromagnetism with suitable example .

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20. Explain paramagnetism with suitable example .

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21. Explain Ferrimagnetisms with suitable example.

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22. Explain Antiferromagnetism with suitable example .

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23. Why X- rays are needed to probe the crystal structure ?

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Short Answer Questions

1. Explain similarities between metallic and ionic crystals .

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2. Explain differences between metallic and ionic crystals .

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3. Explain why ionic solids are hard and brittle .

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4. Calculate the efficiency of packing in case of a metal of simple cubic crystal .

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5. Calculate the efficiency of packing in case of a metal of body centered cubic crystal .

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6. Calculate the efficiency of the packaing in case of face - centered cubic crystal .

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7. A cubic solid is made of two elements P and Q . Atoms of Q are at the corners of the cube and 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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8. If the radius of the octahedral void is r and radius of the atoms in close packing is R , derive relation between r and R .

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9. Describe the two main types of semiconductors and contrast their conduction mechanism .

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10. Classify each of the following as either a p-type or a n -type semiconductor .

1. Ge doped with In 2 . Si doped with B .

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11. Analysis shows that nickel oxide has the formula $Ni^{0.98}0, 1.00$, what fractions of nickel exist as Ni^{2+} and Ni^{3+} ions ?

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12. Gold (atomic radius = 0.144 nm) crystallizes in a face centered unit cell . What is the length of a side of the unit cell ?

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

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14. In terms of band theory , what is the difference between a conductor and a semi-conductor ?

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15. In NaCl is doped with 1×10^{-3} mol percent of $SrCl_2$, what is the concentration of cation vacancies ?

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16. Derive Bragg's equation .

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Long Answer Questions

1. How do you determine the atomic mass of an unknown metal if you know its density and dimension of its unit cell ? Explain .

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2. Silver crystallizes in FCC lattice . If edge of the cell is 4.07×10^{-8} and density is $10.5 g . cm^3$. Calculate the atomic mass of silver .

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3. Niobium crystallizes in body - centered cubic structure . If density is 8.55 g cm^{-3} , calculate atomic radius of niobium using its atomic mass 93 U .

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4. Copper crystallizes into a FCC lattice with edge length 3.61×10^{-8} cm . Show that the calculated density is in agreement with its measured value of $8.92g.\ cm^{-3}$.

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5. Ferric oxide crystallizes in a hexagonal close - packed array of oxide ions with two of every three octahedral holes occupied by ferric ions . Derive the formula of ferric oxide .

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6. Aluminium crystallizes in a cubic close packed structure . Its metallic radius is 125 pm

.

What is the length of the side of the unit cell .

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7. Aluminium crystallizes in a cubic close packed structure . Its metallic radius is 125 pm .

How many unit cells are there in 1.00 cm^3 of aluminium.

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8. How do you obtain the diffraction pattern for a crystalline substance ?

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Intext Questions

1. Why are solids rigid ?

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2. Why do solids have a definite volume ?

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3. Classify the following as amorphous or crystalline solids : polyurethane , naphthalene , benzoic acid , teflon , potassium nitrate , cellophane , polyvinyl chloride , fibre glass , copper .

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4. Why is glass considered a supercooled liquid ?

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

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6. 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 .

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

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9. What type of solids are electrical conductors , malleable and ductile ?

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10. Give the significance of a lattice point .

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11. Name the parameters that characterise a unit cell .

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12. Distinguish between

hexagonal and monoclinic unit cells .

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13. Distinguish between

face-centred and end-centred unit cells .

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14. Explain how much portion of an atom located at

Corner ?

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15. Explain how much portion of an atom located at

body-centre of a cubic unit cell is part of its neighbouring unit cell ?

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

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

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18. A compound is formed by two elements M and N . The element N forms ccp and atoms of M occupy $\frac{1}{3}$ rd of tetrahedral voids . What is the formula of the compound ?

i) Find the number of tetrahedral voids as number of tetrahedral voids = $2 \times$ number of atoms present in the lattice .

ii) Calculate the number of atoms (or ratio) of elements M and N as a chemical formula represents the number of atoms of different

elements presents in a compound .

iii) Derive the formula .

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

i) Simple cubic ii) Body- centred cubic

iii) Hexagonal close-packed lattice

Packing efficiency in

i) Simple cubic lattice = 52.4 %

ii) body-centred cubic lattice = 68 %

iii) Hexagonal close-packed lattice = 74 %

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20. An element with molar mass $2.7 \times 10^{-2} kgmol^{-1}$ forms a cubic unit cell with edge length 405 pm . If its density is $2.7 \times 10^{3} kgm^{-3}$ what is the nature of the cubic unit cell ?

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21. What type of defect can arise when a solid is heated ? Physical property is affected by it and in what why ?

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22. What type of stoichiometric defect is shown by

ZnS

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23. What type of stoichiometric defect is shown by

AgBr

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24. Explain how vacancies are introduced in an ionic solid when a cation of higher valence is aded as an impurity in it ?

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25. Ionic solids , which have anionic vacancies due to metal excess defect , develop colour . Explain with the help of a suitable example .

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26. A group 14 elements is to be converted into n- type semiconductor by doping in with a suitable impurity. To which group shouyld theis impurity belong ?

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

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