CHEMISTRY

NCERT - NCERT CHEMISTRY(ENGLISH)

THE SOLID STATE

Exercise

1. Why are solid rigid?

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2. Why do solids have definite volume?

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

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

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5. Classify the following solids in different categories based on the nature of the inter molecular forces : sodium sulphate, copper, benzene, urea, ammonia, water, zinc sulphide, diamond, rubedium, argon, silicon carbide.

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6. Solid X is a very hard solid which is electrical insulator in solid as well as in molten state and has extremely high melting point. What type of solid is it ?

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

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8. What type of solids are electrical conductors, malleable or ductile?

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9. Give the significance of "lattice point."

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10. Name the parameters that characterized a unit cell.

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11. Distinguish between

a. Hexagonal and monoclinic unit cells

b. Face-centred and end-centred unit cells

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12. Explain how much portin of an atom located at (a) corner and (b) body centre of a cubic unit cell is part of its neighouring unit cell.

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

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14. 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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15. A compound is formed by two elements Y and Z . The element Z forms ccp and atoms Y occupy 1/3 rd of tetrahedral voids. The formula of the compound is

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16. Which of the following lattices has the highest packing efficency (a) simple cubic, (b) body-centred cubic, and (c) hexagonal close-packed lattice?

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17. An element with molar mass $2.7 \times 10^{-2} kgmol^{-1}$ forms a cubic unit cell

with edge length 405pm.If its density is $2.7 \times 10^3 kg^{-3}$, what is the nature of the cubic unit cell?

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18. What type of defect can arise when a solid is heated?

Which physical property is affected by it and in what way?

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19. What type of stoichiometric defect is shown by:

(a) ZnS (b) $AgBr$

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20. Explain how vacancies are introduced in an ionic solid when a cation of higher valencey is added as an impurity in it.

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21. Ionic solids, which have anioninc vacancies due to metal excess defect, developed colour. Explain with the help of a suitalbe example.

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

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

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24. Define the term "amorphous". Give a few example of amorphous solids.

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25. What makes a glass different from a solid susch as quartz? Under what conditions could quartz be converted into glas?

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

a. Tetra phosphorus decoxide (P_4O_{10})

b. Graphite c. Brass

d. Ammonium phosphate $(NH_4)_3PO_4$

e. Sic f. Rb g. I_2 h. $LiBr$

i. P_4 j. Si k. Plastic

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

b. What is the coordination number of atoms:

i. in a cubic closed-packed structure?

ii. In a body-centred cubic structure?

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28. How can you determine the atoic mass of an unknown metal if you know its density and the dimension of its unit cell ? Explain.

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29. a. "Stability of a crystal 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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30. How will you distinguish between the following pairs of terms?

a. Hexagonal close-packing and cubic close-packing

b. Crystal lattice and unit cell

c. Tetrahedral void octahedral void

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31. 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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32. Explain

a. The basic of sumilarities and differences

between metallic and ionic crystals.

b. Ionic solids are hard and brittle.

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33. Calculate the efficiency of packing in case of a metal crystal for

a. Simple cubic

b. Body-centred cubic

c. Face-centred cubic (with the assumptions that atoms are touching each other).

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34. Silver crystallizes in fcc lattic. If the edge length of the cell is $4.07 \times 10^{-8} cm$ and density is $10.5 g cm^{-3}$. Calculate the atomic mass of silver.

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35. A cubic solid is made of two element P and Q Atoms of Q are the corners of the cube P at the body-centre. What is the formula of the

compound? What are the coordination number fo P and Q?

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36. Niobium crystallizes in body-centred cubic structure. If the density is $8.55 gcm^{-3}$, calculate the atomic radius of niobium using its atomic mass $93u$.

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37. If the radius of the octaheral void is r and the radius of the atoms in close-packing is R, derive relation between r and R

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38. Copper crystallizer into an fcc lattice with edge length $3.61 \times 10^{-8} cm$, Show that the calculated density in in agreement with its measured value of $8.92 g cm^3$.

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

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40. What is a semiconductor? Describe the two main types of semiconductor and contrast their conduction mechanism.

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41. Non-stoichiometric cuprous oxide. Cu_2O can be perpared in 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 semiconductors?

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42. Ferric oxide crystalliizes 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.

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43. Classify each of the following as being either a p-type or an n-type semiconductor

a. Ge doped with In

b. B doped with Si

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44. Gold (atoic radius = 0.144 nm) crystallizes in a facelcentred unit cell. What is the length of a side of the cell?

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45. In terms of band theory, what is the difference between

a. a condcutor and an insulator

b. a conductor and a semiconductor

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46. Explain the following terms with suitable example:

a. Schottky defect b. Frenkel defect

c. Interstitials d. F-centres

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47. Aluminium crystallizes in a cubic close-packed structre. Its metallic radius is $125p \pm$

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

b. How many unit cell are there in $1.00cm^3$ of aluminium?

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

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49. Example the following with suitable examples:

a. Ferromagnetism b. Paramagnetism

c. Ferrimagnetism d. Antiferromagnetism

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Solved Examples

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

make ccp and those of element X (as cation) occupy all the octahedral voids. What is the formula of the compound?

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2. Atoms of elements B from hcp lattice and those of element A occupy two-thirds of tetrahedral voids. What is the formula of the compound formed by elements A and B?

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3. An element has a 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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