Solid State

Short Answer Type Questions

1. Why are liquids and gases categorised as fluids?
2. Why are solids incompressible?
3. Inspite of long range order in the arrangement of particles why are the crystals usually not perfect?
4. Why does table salt, NaCl, some times appear yellow in colour?
5. Why is FeO (s) not formed in stoichiometric composition?
6. Why does white ZnO (s) becomes yellow upon heating?
7. Why does the electrical conductivity of semiconductors increase with rise in temperature?
8. Explain why does conductivity of germanium crystals increase on doping with galium.
9. In a compound, nitrogen atoms (N) make cubic close packed lattice and metal atoms (M) occupy one-third of the tetrahedral voids present. Determine the formula of the compound formed by M and N?
10. Under which situations can an amorphous substance change to crystalline form?

Matching Type Questions

Note : In the following questions match the items given in Column I with the items given in Column II. In some questions more than one item of Column I and Column II may match.

1. Match the defects given in Column I with the statements in given Column II.

Column I	Column II
(i) Simple vacancy defect	(a) shown by non-ionic solids and increases density of the solid.
(ii) Simple interstitial defect	(b) shown by ionic solids and decreases density of the solid.
(iii) Frenkel defect	(c) shown by non ionic solids and density of the solid decreases
(iv) Schottky defect	(d) shown by ionic solids and density of the solid remains the same.

2. Match the type of unit cell given in Column I with the features given in Column II.

Column I	Column II
(i) Primitive cubic unit cell	(a) Each of the three perpendicularedges compulsorily have the differentedge length i.e; a≠b≠c.
(ii) Body centred cubic unit cell	(b) Number of atoms per unit cell is one.
iii) Face centred cubic unit cell	(c) Each of the three perpendicularedges compulsorily have the sameedge length i.e; a = b = c
iv) End centred orthorhombic unit cell	(d) In addition to the contribution fromthe corner atoms the number of atomspresent in a unit cell is one.
	(e) In addition to the contribution fromthe corner atoms the

number ofatoms present in a unit cell is three.

3. Match the types of defect given in Column I with the statement given in Column II.

Column I	Column II
(i) Impurity defect	a) NaCl with anionic sites called F-centres
(ii) Metal excess defect	b) FeO with Fe^{3+}
iii) Metal deficiency defect	(c) NaCl with Sr^{2+} and some cationic sites vacant

4. Match the items given in Column I with the items given in Column II.

Column I	Column II
(i) Mg in solid state	(a) p-Type semiconductor
ii) $MgCl_2$ in molten state	(b) n-Type semiconductor
iii) Silicon with phosphorus	(c) Electrolytic conductors
iv) Germanium with boron	(d) Electronic conductors

5. Match the type of packing given in Column I with the items given in Column II.

Column I	Column II
(i) Square close packing in two dimensions	(a) Triangular voids
ii) Hexagonal close packing in two dimensions	(b) Pattern of spheres is repeated in every fourth layer
iii) Hexagonal close packing in three dimensions	(c) Coordination number 4
iv) Cubic close packing in	(d) Pattern of sphere is repeated in alternate layers

Assertion and Reason Type Questions

Note : In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(i) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(ii) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(iii) Assertion is correct statement but reason is wrong statement.
(iv) Assertion is wrong statement but reason is correct statement.

1. Assertion : The total number of atoms present in a simple cubic unit cell is one.
   Reason : Simple cubic unit cell has atoms at its corners, each of which is shared between eight adjacent unit cells.
2. Assertion : Graphite is a good conductor of electricity however diamond belongs to the category of insulators.
   Reason : Graphite is soft in nature on the other hand diamond is very hard and brittle.
3. Assertion : Total number of octahedral voids present in unit cell of cubic close packing including the one that is present at the body centre, is four.
   Reason : Besides the body centre there is one octahedral void present at the centre of each of the six faces of the unit cell and each of which is shared between two adjacent unit cells.
4. Assertion : The packing efficiency is maximum for the fcc structure.
   Reason : The cordination number is 12 in fcc structures.
5. Assertion : Semiconductors are solids with conductivities in the intermediate range from $10^{-6} - 10^4$ ohm^{-1}m^{-1}.
   Reason : Intermediate conductivity in semiconductor is due to partially filled valence band.

Long Answer Type Questions

1. With the help of a labelled diagram show that there are four octahedral voids per unit cell in a cubic close packed structure.
2. Show that in a cubic close packed structure, eight tetrahedral voids are present per unit cell.
3. How does the doping increase the conductivity of semiconductors?
4. A sample of ferrous oxide has actual formula $Fe_{0.93}O_{1.00}$. In this sample what fraction of metal ions are Fe^{2+} ions? What type of nonstoichiometric defect is present in this sample?