

SOLID STATES

45 QUESTIONS

ENGLISH

- 1 Lithium has a bcc structure. Its density is 530 kg m^{-3} and its atomic mass is 6.94 g mol^{-1} . Calculate the edge length of unit cell of lithium metal. ($N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$). (a) 527 pm (b) 264 pm (c) 154 pm (d) 352 pm 1
- 2 The white ZnO turns yellow on heating because of (a) Frenkel defect (b) Metal excess defect (c) Metal deficiency defect (d) Schottky defect 1
- 3 In fcc, what is volume occupied?

(a) $\frac{4}{3}\pi r^3$	(b) $\frac{8}{3}\pi r^3$
(c) $\frac{16}{3}\pi r^3$	(d) $\frac{64r^3}{3\sqrt{3}}$
- 4 Which of the following is an amorphous solid? (a) Graphite (C) (b) Quartz glass (SiO_2) (c) Chrome alum (d) Silicon carbide (SiC)
- 5 The total number of tetrahedral voids in the face centred unit cell is _____. (a) 6 (b) 8 (c) 10 (d) 12 1
- 6 In which pair most efficient packing is present? (a) hcp and bcc (b) hcp and ccp (c) bcc and ccp (d) bcc and simple cubic cell 1
- 7 Which kind of defects are introduced by doping? (a) Dislocation defect (b) Schottky defect (c) Frenkel defects (d) Electronic defects 1
- 8 Under the influence of electric field, which of the following statements is true about the movement of electrons and holes in a p-type semiconductor? (a) Electron will move towards the positively charged plate through electron holes. (b) Holes will appear to be moving towards the negatively charged plate. (c) Both electrons and holes appear to move towards the positively charged plate. (d) Movement of electrons is not related to the movement of holes. 1
- 9 Fe_3O_4 is ferrimagnetic on heating becomes _____. 1
- 10 For an atom to occupy an octahedral void, its radius must be _____ times radius of the sphere. 1

- 11 Ancient samples of glass become milky due to some crystallisation. [True/False] 1
- 12 Why are crystalline solids anisotropic? 1
- 13 What is meant by an 'intrinsic semiconductor'? 1
- 14 What is the formula of a compound in which the element Y forms hcp lattice and atoms of X occupy 1/3rd of octahedral voids? 1
- 15 Which of the following oxides behaves as conductor or insulator depending upon temperature? (a) TiO (b) SiO₂ (c) TiO₃ (d) MgO 1
- 16 Cations are present in the interstitial sites in _____. (a) Frenkel defect (b) Schottky defect (c) Vacancy defect (d) Metal deficiency defect 1
- 17 A perfect crystal of silicon is doped with some elements as given in the options. Which of these options show n-type semiconductors? 1
- 18 Match the items given in Column I with the items given in Column II.
- | Column I | Column II | |
|---------------------------------------|-------------------------------|---|
| (a) Mg in solid state | (i) p-Type semiconductor | |
| (b) MgCl ₂ in molten state | (ii) n-Type semiconductor | 1 |
| (c) Silicon with phosphorus | (iii) Electrolytic conductors | |
| (d) Germanium with boron | (iv) Electronic conductors | |
- 19 MgO has _____ melting point than NaCl. 1
- 20 Zn and Cd are diamagnetic solids. [True/False] 1
- 21 Write a point of distinction between a metallic solid and an ionic solid other than metallic lustre. 1

22 Atoms of element B form hcp lattice and those of the element A occupy $\frac{2}{3}$ rd of tetrahedral voids. What is the formula of the compound formed by these elements A and B? 1

23 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.

(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. (c) Assertion is correct statement but reason is wrong statement. (d) Assertion is wrong statement but reason is correct statement.

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.

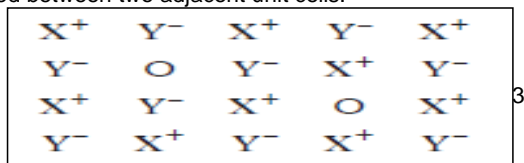
24 In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices. (a) Assertion and reason both are correct statements and reason is correct explanation for assertion. (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. (c) Assertion is correct statement but reason is wrong statement. (d) Assertion is wrong statement but reason is correct statement. 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

25 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. (a) Assertion and reason both are correct statements and reason is correct explanation for assertion. (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion. (c) Assertion is correct statement but reason is wrong statement. (d) Assertion is wrong statement but reason is correct statement. 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.

26 Iron has a body-centred cubic unit cell with a cell edge of 286.65 pm.

The density of iron is 7.874 g cm^{-3} . Use this information to calculate

Avogadro's number. (At. mass of iron = 56 g mol^{-1})



27 Examine the given defective crystal:

Answer the following questions:

3

- (i) Is the above defect stoichiometric or non-stoichiometric? (ii) Write the term used for this type of defect. Give an example of the compound which shows this type of defect. (iii) How does this defect affect the density of the crystal?
- 28 Tungsten crystallizes in body-centred cubic unit cell. If the edge of the unit cell is 316.5 pm, what is the radius of tungsten atom? 3
- 29 Silver crystallizes in face-centred cubic unit cell. Each side of this unit cell has a length of 400 pm. Calculate the radius of the silver atom. (Assume the atoms just touch each other on the diagonal across the face of the unit cell. That is, each face atom is touching the four corner atoms.) 3
- 30 In terms of band theory, what is difference between insulator and semiconductor? Give two difference. 3
- 31 The well-known mineral fluorite is chemically calcium fluoride. It is known that in one unit cell of this mineral, there are 4 Ca^{2+} ions and 8 F^- ions and that Ca^{2+} ions are arranged in a fcc lattice. The F^- ions fill all tetrahedral holes in the face-centred cubic lattice of Ca^{2+} ions. The edge of the unit cell is 5.46×10^{-8} cm in length. The density of the solid is 3.18 g cm^{-3} . Use this information to calculate Avogadro's number. (Molar mass of $\text{CaF}_2 = 78.08 \text{ g mol}^{-1}$) 3
- 32 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? 3
- 33 Assign reasons for the following:
(i) Phosphorus doped silicon is a semiconductor. 3
(ii) Schottky defect lowers the density of a solid. (iii) Some of the very old glass objects appear slightly milky instead of being transparent.
- 34 Refractive index of a solid is observed to have the same value along all directions. Comment on nature of this solid. Would it show cleavage property? 2
- 35 Which type of ionic substances show Schottky defect in solids? 2
- 36 Conductivity of silicon increases on doping it with phosphorus. Why? 2
- 37 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: $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$) 2

- 38 An element with density 10 g cm^{-3} forms a cubic unit cell with edge length $3 \times 10^{-8} \text{ cm}$. What is the nature of the cubic unit cell if the atomic mass of the element is 81 g mol^{-1} ? 2
- 39 An element with density 2.8 g cm^{-3} forms a fcc unit cell with edge length $4 \times 10^{-8} \text{ cm}$. Calculate the molar mass of the element. (Given: $N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$) 2
- 40 Name the type of crystal defect which is produced when NaCl crystal is doped with MgCl_2 . 2
- 41 How many atoms can be assigned to its unit cell if an element forms (i) a body-centred cubic (ii) a face-centred cubic. 3
- 42 Why does LiCl acquire pink colour when heated in Li vapours? 5