

Previous HSE Questions from the chapter "The Solid State"

- 1) Teacher explained the stoichiometric defects in a class room.
 - a) Explain with the help of diagrams the important differences in Schottky and Frenkel defects. (2)
 - b) What are the consequences? (1) [March 2008]
- 2) a) Write an equation for the calculation of density of a crystal from its structure? (1)
b) Calculate the density of PbS crystal (fcc) if the edge length of its unit cell is 500pm. ($N_A = 6.022 \times 10^{23}$, atomic mass of Pb = 207.2, S = 32) (2) [SAY 2008]
- 3) Defects are found even in crystals prepared very carefully.
 - a) Which stoichiometric defect causes decrease in density of the solid? (1)
 - b) Frenkel defect is not found in NaCl. Why? (1)
 - c) KCl crystal is colourless. But on heating it in an atmosphere of potassium vapour, it becomes violet in colour. Account for this. (1) [March 2009]
- 4) In magnesium crystal, the layers of atoms are being stacked in a pattern ABABAB..... type of arrangement.
 - a) Name the close packed structure. (1)
 - b) Calculate the number of tetrahedral and octahedral voids, if the Mg crystal contains 'n' atoms. (2) [March 2010]
- 5) a) Schottky and Frenkel defects are two stoichiometric defects shown by crystals.
 - i) Classify the crystals into those showing Schottky defects and Frenkel defects: NaCl, AgCl, CsCl, CdCl₂ (2)
 - ii) Name a crystal showing both Schottky defect and Frenkel defect. (½)b) Schematic alignment of magnetic moments of ferromagnetic, antiferromagnetic and ferrimagnetic substances are given below. Identify each of them.
 - i) $\uparrow \downarrow \uparrow \downarrow \uparrow \downarrow \uparrow \downarrow$
 - ii) $\uparrow \uparrow \uparrow \uparrow \downarrow \downarrow \downarrow \downarrow$
 - iii) $\uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow \uparrow$ (1 ½) [March 2010]
- 6) Crystal defects give rise to some special properties in the solids.
 - a) What is meant by Frenkel defect? (1)
 - b) Why does LiCl does not exhibit Frenkel defect? (1)
 - c) Explain the pink colour of LiCl when heated in the vapour of Li? (2) [March 2011]
- 7) A cubic unit cell is characterized by $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$.
 - a) Name the three important types of cubic unit cells. (1 ½)
 - b) Calculate the number of atoms in one unit cell in the above three cases. (1 ½)
 - c) A metal forms cubic crystals. The mass of one unit cell of it is M/N_A gram, where M is the atomic mass of the metal and N_A is the Avogadro number. What is the type of cubic unit cell possessed by the metal? (1) [SAY 2011]
- 8) Solids can be classified into three types based on their electrical conductivities.
 - i) Name three types of solids classified on the basis of electrical conductivity. (1 ½)
 - ii) How will you explain such classification based on band theory? (2 ½) [March 2012]

- 9) Schottky and Frenkel defects are stoichiometric defects.
- Write any two differences between Schottky and Frenkel defects. (2)
 - When pure NaCl crystal is heated in an atmosphere of sodium vapours, it turns yellow. Give reason. (2) [SAY 2012]
- 10) a) NaCl has fcc structure. Calculate the number of NaCl units in a unit cell of NaCl. (2)
- Calculate the density of NaCl, if edge length of NaCl unit cell is 564 pm. [Molar mass of NaCl = 58.5 g/mol]. (2) [March 2013]
- 11) Unit cells can be broadly classified into 2 categories – primitive and centred unit cells.
- What is a unit cell? (1)
 - Name the three types of centred unit cells. (1 ½)
 - The unit cell dimension of a particular crystal system is $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$. Identify the crystal system. (1)
 - Give one example for the above crystal system. (½) [SAY 2013]
- 12) a) Every substance has some magnetic properties associated with it. How will you account for the following magnetic properties?
- Paramagnetic property (1)
 - Ferromagnetic property (1)
 - A compound is formed by two elements P and Q. atoms of Q (as anions) make hcp lattice and those of the element P (as cations) occupy all the tetrahedral voids. What is the formula of the compound? (2) [March 2014]
- 13) a) Crystalline solids are 'anisotropic'. What is anisotropy? (1)
- Copper crystals have fcc unit cells.
 - Compute the number of atoms per unit cell of copper crystals. (1)
 - Calculate the mass of a unit cell of copper crystals. (Atomic mass of Cu = 63.54u) (2) [SAY 2014]
- 14) Unit cells can be divided into two categories – primitive and centred unit cells.
- Differentiate between unit cell and crystal lattice. (2)
 - Calculate the number of atoms per unit cell in the following:
 - Body centred cubic unit cell (bcc)
 - Face centred cubic unit cell (fcc) (2) [March 2015]
- 15) a) Which of the following is not a characteristic of a crystalline solid?
- Definite heat of fusion
 - isotropic nature
 - A regular orderly arrangement of constituent particles
 - A true solid (1)
- Frenkel defect and Schottky defects are two stoichiometric defects found in crystalline solids.
 - What are stoichiometric defects? (1)
 - Write any two differences between Schottky and Frenkel defects? (2) [SAY 2015]
- 16) a) Which of the following is a molecular solid?
- (a) Diamond (b) graphite (c) ice (d) quartz (1)
 - Unit cells can be classified into primitive and centred unit cells. Differentiate between primitive and centred unit cells. (1)
 - Presence of excess Sodium makes NaCl crystal coloured. Explain on the basis of crystal defects. (2) [March 2016]
- 17) A unit cell is a term related to crystal structure.

- a) What do you mean by unit cell? (1)
- b) Name any two types of cubic unit cells. (1)
- c) Calculate the number of atoms in each of the above mentioned cubic unit cells. (1)
- d) Identify the substance which shows Frenkel defect:
- (i) NaCl (ii) KCl (iii) ZnS (iv) AgBr (1) [SAY 2016]

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