

Chemistry Worksheets Class 12 on Chapter 1 Solid State with Answers- Set 5

Q-1: Total volume occupied by the atoms of a metal in a FCC unit cell is:

- a.) $(12/3)\pi r^3$
- b.) $(16/3)\pi r^3$
- c.) $(20/3)\pi r^3$
- d.) $(24/3)\pi r^3$

Answer: (b.)

Explanation: The total number of atoms in a FCC unit cell is 4.

Volume occupied by one atom = $(4/3)\pi r^3$

Hence, volume occupied by 4 atoms = $4 \times (4/3)\pi r^3 = (16/3)\pi r^3$

Q-2: The alkali metal halides appear coloured because:

- a) F-centres
- b) Frenkel Defect
- c) Schottky Defect
- d) Interstitial positions

Answer: (a.)

Explanation: F-centres are formed when electrons get trapped into the anionic vacancies at the lattice sites. These electrons give a coloured appearance to the crystal.

Q-3: Which is the best electrical conductor out of SiO_2 (s), Si (s), NaCl (s) and Br_2 (l)?

Answer: Out of all the given substances, Si (s) is the best electrical conductor. This is because SiO_2 (s), NaCl (s) and Br_2 (l) are insulators while Si (s) is a semiconductor.

Q-4: What can be known from the ionic radius of an ionic solid?

- a) The magnetic property of the solid
- b) The nature of the chemical bond present
- c) The type of defect present in the solid
- d) The geometrical shape of the crystal

Answer: (d.)

Explanation: Ionic radius can be used to determine the coordination number and hence the geometrical shape of the solid substance.

Q-5: The density of a Li atom is 0.53 g cm^{-3} and its edge length is $3.5 \text{ \AA}$. Calculate the number of Li atoms present within one unit cell.

Answer: Aim: To calculate the number of atoms in a unit cell (Z)

Now, from the density formula:

$$\rho = \frac{Z \times M}{a^3 \times N_A}$$

Where ρ = density of the crystal (g cm^{-3})

Z = number of particles present within the unit cell

M = Atomic mass of the element (g mol^{-1})

a = edge length of the unit cell (cm)

N_0 = Avogadro's number

$$Z = \frac{\rho \times a^3 \times N_A}{M}$$
$$Z = \frac{0.53 \text{ g cm}^{-3} \times (3.5 \times 10^{-8} \text{ cm})^3 \times 6.023 \times 10^{23} \text{ mol}^{-1}}{6.94 \text{ g mol}^{-1}}$$
$$Z = 1.97 \simeq 2$$

Hence, the number of Li atoms present within one unit cell is 2.

Q-6: Which of the following substances is ferrimagnetic?

- a) TiO_2
- b) MnO
- c) CrO_2
- d) Fe_3O_4

Answer: (d.)

Explanation: Ferrimagnetism is a property by which the substances are strongly attracted to an external magnetic field. In general, iron oxides and magnetites show ferromagnetism.

Q-7: State the difference between the 13-15 and 12-16 compounds.

Answer: The group 13-15 compounds have a large covalent character. For example: AlP, GaAs, etc. While group 12-16 compounds do not possess the perfect covalent bond character. However, they do possess sufficient ionic character. For example: ZnS, CdS, etc.

Q-8: What is the energy gap in band theory?

Answer: The energy gap refers to the difference in energy between the valence band and the conduction band. The order of energy gap among different types of substances is as:
Conductor < Semiconductor < Insulators

Q-9: The dimensions of a tetragonal lattice are:

- a.) $a=b=c, \alpha=\beta=90^\circ \neq \gamma$
- b.) $a=b \neq c, \alpha=\beta=\gamma=90^\circ$
- c.) $a \neq b \neq c, \alpha=\beta=\gamma=90^\circ$
- d.) $a=b \neq c, \alpha=\beta=90^\circ; \gamma=120^\circ$

Answer: (b.)

Explanation: The dimensions of a tetragonal lattice are $a=b \neq c, \alpha=\beta=\gamma=90^\circ$.

Q-10: Why does the KCl crystal sometimes appear violet in colour?

Answer: This happens because in the presence of excess potassium, the chloride ions (Cl^-) leave their lattice sites; hence creating an anionic vacancy. These vacancies are then filled in by electrons making the F-centres. The F-centres thus impart colour to the crystal.

Q-11: Define superconductivity.

Answer: It is the property by which the substance shows no resistance to the flow of current (electricity) at a given temperature.

Q-12: Elaborate the effect of pressure on NaCl type crystals.

Answer: Pressure lays a significant effect on the geometry of a molecule. On applying pressure on a NaCl type crystal, the coordination number of each ion increases i.e. it changes from 6:6 to 8:8.

Q-13: What happens when a ferromagnetic substance is heated to a high temperature?

Answer: On heating, the property of ferromagnetic substances changes to paramagnetic. This happens because on heating, the different domains get randomised.

Q-14: AgI crystallises in a CCP ZnS structure. Determine the number of tetrahedral sites occupied by the Ag^+ ions.

Answer: In a FCC lattice, 8 tetrahedral voids are available. The Ag^+ ions occupy half of these voids. Hence, 4 tetrahedral sites are occupied by Ag^+ ions.

Q-15: Metallic lustre can be explained by ____.

- a.) the diffusion of metal ions
- b.) the oscillation of loose electrons
- c.) the existence of BCC lattice
- d.) the excitation of free protons

Answer: (b.)

Explanation: Metallic lustre is due to the oscillation of loose electrons.

Q-16: Explain why ionic crystals are hard and brittle.

Answer: The ionic crystals are hard because of the strong electrostatic forces of attraction in between the constituent ions. These crystals are brittle because of the non-directional nature of the ionic bond.

Q-17: The possible defect(s) that can occur in AgBr are ____.

- a.) Schottky defect only
- b.) Frenkel defect only
- c.) Both Frenkel and Schottky defect
- d.) None of the above

Answer: (c.)

Explanation: The AgBr crystal possesses both- the Schottky and the Frenkel defect.

Q-18: Give the significance of lattice points.

Answer: The lattice points accommodate the constituent particles of a solid substance. Hence, each lattice point represents a constituent particle which can either be an atom, a molecule or an ion.

Q-19: Why is glass called a supercooled liquid?

Answer: Glass has a short range order and is an amorphous solid. Glass also possesses the tendency to flow just like liquids, however this process takes a long time to be actually noticed with the naked eye. This is why the glass panes in old windows or doors of the old buildings are found to be slightly thicker at the bottom. Hence, the glass is sometimes referred to as the supercooled liquid.

Q-20: Why does the Frenkel defect not occur in pure alkali metal halides?

Answer: This is because, due to their large size, the alkali metal ions cannot accommodate in the interstitial sites.