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HOLIDAY HOME WORK

CLASS: XII **SUB: CHEMISTRY**

Solid State

1. Classify each of the following solids as *ionic*, *metallic*, *molecular*, *network* (*covalent*) or *amorphous*.
   (*a*) Tetra phosphorus decoxide (P_4O_{10}) (*b*) Ammonium phosphate $(NH_4)_3PO_4$
   (*c*) SiC (*d*) I_2 (*e*) P_4 (*f*) Plastic (*g*) Graphite
   (*h*) Brass (*i*) Rb (*j*) LiBr (*k*) Si
2. Calculate the efficiency of packing in case of a metal crystal for
   (*i*) simple cubic (*ii*) body-centred cubic (*iii*) face-centred cubic
   (with the assumptions that atoms are touching each other).
3. Silver crystallises in *fcc* lattice. If edge length of the cell is 4.07×10^{-8} cm and density is 10.5 g cm^{-3}, calculate the atomic mass of silver.
4. A cubic solid is made of two elements **P** and **Q**. Atoms of **Q** are at the corners of the cube and **P** at the body-centre. What is the formula of the compound? What are the coordination numbers of **P** and **Q**?
5. Niobium crystallises in body-centred cubic structure. If density is 8.55 g cm^{-3}, calculate atomic radius of niobium using its atomic mass 93 u.
6. 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?
7. Ferric oxide crystallises 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.
8. Gold (*atomic radius* = 0.144 nm) crystallises in a *face-centred* unit cell. What is the length of a side of the cell?
9. Aluminium crystallises in a cubic close-packed structure. Its metallic radius is 125 pm.
   (*a*) What is the length of the side of the unit cell?
   (*b*) How many unit cells are there in 1.00 cm^3 of aluminium?
10. A compound is formed by two elements **M** and **N**. The element **N** forms *ccp* and atoms of **M** occupy ⅓rd of tetrahedral voids. What is the formula of the compound?
11. An element with molar mass 2.7×10^{-2} kg mol^{-1} forms a cubic unit cell with edge length 405 pm. If its density is 2.7×10^3 kg^{-3}, what is the nature of the cubic unit cell?

Solutions

1. Calculate the mole fraction of water in a mixture consisting of 9.0 water, 120 g acetic acid, and 115 g ethyl alcohol.
2. The density of a 2.0 M solution of acetic acid in water is 1.02 g/mL. Calculate the mole fraction of acetic acid.
3. The density of a 2.03 M solution of acetic acid in water is 1.017 g/mL. Calculate the molality of solution.
4. The molality of a solution of ethyl alcohol in water is 1.54 mol/kg. How many grams of alcohol is dissolved in 2.50 kg water?
5. What is the mole fraction of the solute in a 1.00 m aqueous solution?
6. The given sample of sulphuric acid was found to have mole fraction of H_2SO_4 as 0.15. Calculate the molality of solution.

7. If 29 mg of nitrogen dissolves in water at 0ºC and 760 Torr nitrogen pressure, how much N_2 will dissolve in 1 L of water at 0ºC and 5 atm N_2 pressure?
8. Benzene with boiling point 353.1 K and toluene with boiling point 383.6 K are the two hydrocarbons which form nearly ideal solution. At 313 K, the vapour pressures of pure benzene and pure toluene are 21.1 kPa and 8.0 kPa respectively. Calculate the partial vapour pressures of benzene and toluene, and the total vapour pressure in bar under the following conditions: (*a*) A solution made by mixing equal number of moles of benzene and toluene. (*b*) A solution made by mixing 4 moles of toluene and 1 mole of benzene. (*c*) A solution made by mixing equal masses of toluene and benzene.
9. Concentrated nitric acid used in laboratory work is 68% nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the density of the solution is 1.504 g mL^{-1}?
10. A solution of glucose in water is labelled as 10% *w/w*, what would be the molality and mole fraction of each component in the solution? If the density of solution is 1.2 g mL^{-1}, then what shall be the molarity of the solution?
11. The partial pressure of ethane over a solution containing 6.56×10^{-3} g of ethane is 1 bar. If the solution contains 5.00×10^{-2} g of ethane, then what shall be the partial pressure of the gas?
12. If the density of some lake water is 1.25 g mL^{-1} and contains 92 g of Na^+ ions per kg of water, calculate the molality of Na^+ ions in the lake.
13. If the solubility product of CuS is 6×10^{-16}, calculate the maximum molarity of CuS in aqueous solution.
14. Calculate the mass percentage of aspirin ($C_9H_8O_4$) in acetonitrile (CH_3CN) when 6.5 g of $C_9H_8O_4$ is dissolved in 450 g of CH_3CN.
15. Nalorphene ($C_{19}H_{21}NO_3$), similar to morphine, is used to combat withdrawal symptoms in narcotic users. Dose of nalorphene generally given is 1.5 mg. Calculate the mass of 1.5×10^{-3} *m* aqueous solution required for the above dose.
16. The air is a mixture of a number of gases. The major components are oxygen and nitrogen with approximate proportion of 20% is to 79% by volume at 298 K. The water is in equilibrium with air at a pressure of 10 atm. At 298 K if the Henry's law constants for oxygen and nitrogen at 298 K are 3.30×10^7 mm and 6.51×10^7 mm respectively, calculate the composition of these gases in water.