CBSE Test Paper-05

Class - 12 Chemistry (Solutions)

1. Aquatic animals are more comfortable in cold water rather that warm water because
   a. Solubility of gas in liquid changes with pressure
   b. They are cold blooded animals
   c. Solubility of gas in liquid increases with decrease in temperature
   d. Concentration increases with increase in temperature
2. The depression in freezing point for 1M urea, 1 M glucose and 1 M NaCl are in the ratio of
   a. 1:1:2
   b. 3:2:2
   c. 1:1:1
   d. 1:2:3
3. 0.1 M solution of urea, at a given temperature, is isotonic with:
   a. 0.1 M glucose solution
   b. 0.1 M BaCl2 solution
   c. 0.1 M NaCl solution
   d. 0.02 M KCl solution
4. Liquid ammonia bottle is first cooled before opening because
   a. Vapour pressure increases on cooling
   b. None of these
   c. Vapour pressure decreases on cooling
   d. Vapour pressure of liquid ammonia is very low at room temperature
5. Greater the value of KH, lower will be the
   a. Pressure
   b. Solubility
   c. Concentration
   d. Temperature
6. Give reason: When 30 ml of ethyl alcohol and 30 ml of water are mixed, the volume of resulting solution is more than 60 ml.
7. Give an example of a solution containing a liquid solute in a solid solvent.

8. How much urea (molar mass 60 g/mol) should be dissolved in 50 g of water so that its vapour pressure at room temperature is reduced by 25%?
9. Name two factors on which the vapour pressure of the liquid depend?
10. What happens when blood cells are placed in pure water?
11. Define the terms: Van't Hoff factor
12. 100 mg of a protein is dissolved in just enough water to make 10.0 mL of solution. If this solution has an osmotic pressure of 13.3 mm Hg at 25°C what is the molar mass of the protein?

    (R = 0.0821 L at mol^{-1} K^{-1} 760 mm Hg = 1 atm)
13. Calculate the molarity and molality of a 15% solutions (by weight) of sulphuric acid density 1.020 g cm^{-3} (Atomic mass H = 1, O = 16 ,S = 32 amu).
14. Calculate the mass of ascorbic acid (Vitamin C, $C_6H_8O_6$) to be dissolved in 75 g of acetic acid to lower its melting point by 1.5^0C. $Kf = 3.9\,K\,kg\,mol^{-1}$
15. Henry's law constant for CO_2 in water is 1.67×10^8 Pa at 298 K. Calculate the quantity of CO_2 in 500 mL of soda water when packed under 2.5 atm CO_2 pressure at 298 K.

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1. c. Solubility of gas in liquid increases with decrease in temperature

   Explanation: Because of increase in kinetic energy of gas molecules with temperature there tendency to escape from the liquid will increase.

2. a. 1:1:2

   Explanation: NaCl has i=2 while urea and glucose will have i=1

3. a. 0.1 M glucose solution

   Explanation: 0.1 M solution of urea, at a given temperature, is isotonic with 0.1 M glucose solution as both are non electrolytic.

4. a. Vapour pressure decreases on cooling

   Explanation: Vapour pressure decreases on cooling so that it remain in liquid state rather than going in vapour state.

5. a. Solubility

   Explanation: $P_{gas} = \ K_H \times \ X_{gas.} \quad X_{gas}$

   is measure of solubility of gas.

6. Ethyl alcohol and water are non ideal solutions which show positive deviation from Raoult's law. The forces of attraction becomes less in ethyl alcohol and water mixture as compared to pure ethanol and pure water. Hence the vapour pressure of the mixture increases. Due to decrease in magnitude of intermolecular forces in solutions, the molecules of ethanol and water will be loosely held and there will be increase in volume on mixing ethanol and water.i.e.,$\triangle_{mixing}V \ = \ +ve$
7. Amalgam of mercury with sodium. They are called solid solutions.
8. $\frac{P_A^0 - P_A}{P_A^0} = \frac{W_B \times M_A}{W_A \times M_B}$

   P_A^0 = Vapour pressure of water = 100

   P_A = Vapour pressure of solution = 75

   W_B = mass of urea = ?

   M_A = molar mass of water = 18g

W_A = mass of water = 50g

M_B = molar mass of urea = 60g/mol

$\frac{100-75}{100} = \frac{W_B \times 18}{50 \times 60}$

$W_B = \frac{25 \times 60 \times 50}{100 \times 18} = 41.66g$

9. Vapour pressure depends upon
   i. Nature of liquid: Each liquid has different magnitude of intermolecular forces. Those with weak intermolecular forces tend to escape into vapour phase and have greater vapour pressure.
   ii. Temperature: Vapour pressure of a liquid increases with increase in temperature. As the molecules acquire kinetic energy and tend to escape from vapour phase resulting in higher vapour pressure.
10. Due to osmosis, water molecules move into blood cells through the cell walls. As a results, blood cells swell and may even burst. As osmosis is the process of movement of molecules from lower concentration to higher concentration.
11. **Van't Hoff factor:** Van't hoff factor 'i' is a correction factor defined as the ratio between the actual concentration of particles produced when the substance is dissolved and the concentration of a substance as calculated from its mass.

    $i = \frac{\text{Observed value of colligative property}}{\text{Normal value of colligative property}}$
12. Here W = 100 mg = 0.100 g

    V = 10.0 mL = 0.01 L

    $\pi = 13.33 mm\,Hg = \frac{13.3}{760} atm$

    T = 25°C = 25 + 273 = 298 K

    R = 0.0821 L atm mol^{-1} K^{-1}

    M = ?

    Molar Mass M $= \frac{WRT}{\pi V}$

    $= \frac{0.1 \times 0.0821 \times 298}{\frac{13.3}{760} \times 0.01}$

    $= \frac{0.1 \times 0.0821 \times 298 \times 760}{13.3 \times 0.01}$

    $= \frac{1859 \times 4008}{0.133}$ = 13980.4 g mol^{-1}
13. $M = \frac{W_B}{M_B \times V_L}$

    Molecular weight of H_2SO_4 = $M_B = (2 \times 1)\ + (1 \times 32)\ + (4 \times 16)$

    = 98 $gmol^{-1}$

$= \frac{15g \times 1000}{98g/mol \times 115g \times 1.02g/cm^3}$

$= \frac{15000}{11495.4} M$ = 1.3048 molar

m (molality) $= \frac{W_B \times 1000}{W_B \times 100g}$

$= \frac{15g \times 10}{98\, g\, mol^{-1}} = \frac{150}{98}$ = 1.53 molal.

14. Mass of acetic acid, $w_1 = 75g$

Molar mass of ascorbic acid $(C_6H_8O_6)\,, M_2 = 6 \times 12 + 8 \times 1 + 6 \times 16$

$= 176 gmol^{-1}$

Lowering of melting point, $\Delta T_f = 1.5K$

We know that:

$\Delta T_f = \frac{K_f \times w_2 \times 1000}{M_2 \times w_1}$

$w_2 = \frac{\Delta T_f \times M_2 \times w_1}{K_f \times 1000}$

$= \frac{1.5 \times 176 \times 75}{3.9 \times 1000}$ = 5.08 g (approx)

Hence, 5.08 g of ascorbic acid is needed to be dissolved.

15. K_H = 1.67 $\times$ 10^8 Pa

P_{CO2} = 2.5 atm = 2.5 $\times$ 101325 Pa

Applying Henry's law,

P_{CO2} = K_H $\times$ x_{CO2}

$x_{CO_2} = \frac{P_{CO_2}}{K_H}$

$= \frac{2.5 \times 101.325 Pa}{1.67 \times 10^8 Pa}$

= 1.517 × 10^{-3}

i.e. $\frac{n_{CO_2}}{n_{H_2O} + n_{CO_2}} = \frac{n_{CO_2}}{n_{H_2O}} = 1.517 \times 10^{-3}$

For 500 mL of soda water, water present = 500 mL

$= 500g = \frac{500g}{18gmol^{-1}}$ = 27.78 moles

$\therefore \frac{n_{CO_2}}{n_{H_2O}} = 1.517 \times 10^{-3}$

$\frac{n_{CO_2}}{27.78} = 1.517 \times 10^{-3}$

$n_{CO_2} = 1.517 \times 10^{-3} \times 27.78$ = 42.14 m mol

$= 42.14 \times 10^{-3} \times 44g$= mass of carbondioxide

= 1.854 g