# Shiksha Classes Bhandara

**Subject : Chemistry** **Topic : Solution** **M.M. : 100**

**Marking Scheme:**

**(i) Each question is allotted 4 (four) marks for each correct response.**

**(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.**

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**Q.1** Concentrated nitric acid used in the 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 solution is 1.504 g $mL^{-1}$ ?

(A) 12.12 mol $L^{-1}$ (B) 20.12 mol $L^{-1}$

(C) 16.23 mol $L^{-1}$ (D) 34.78 mol $L^{-1}$

**Q.2** A sample of drinking water was found to be severely contaminated with chloroform, $CHCl_3$, supposed to be a carcinogen. The level of contamination was 15 ppm (by mass). Determine the molality of chloroform in the water sample.

(A) $2.12 \times 10^{-4}$ mol $kg^{-1}$

(B) $1.26 \times 10^{-4}$ mol $kg^{-1}$

(C) $0.12 \times 10^{-4}$ mol $kg^{-1}$

(D) $5.34 \times 10^{-4}$ mol $kg^{-1}$

**Q.3** An aqueous solution of hydrochloric acid-

(A) obeys Raoult's law.

(B) Shows negative deviations from Raoults' law.

(C) Shows positive deviations from Raoults' law.

(D) Obeys Henrys' law at all compositions.

**Q.4** The vapour pressure of a dilute aqueous solution of glucose ($C_6H_{12}O_6$) is p atm. at 373K. The mole fraction of the solvent is

(A) Patm. (B) $(P^0 - P)$ atm.

(C) $P^0$ atm. (D) $\frac{p^0 - P}{P^0}$ atm.

**Q.5** The vapour pressure of pure toluene and n-heptane at 50°C are 92.6 mm Hg and 140.9mm Hg. The composition of the liquid mixture of toluene, A and n- heptane, B at 50°C having $P_A = P_B$ is

(A) 0.41 mole fraction of A

(B) 0.522 mole fraction of A

(C) 0.603 mole fraction of A

(D) 0.373 mole fraction of A

**Q.6** Which of the following quantities is independent of temperature ?

(A) Molarity (B) Normality

(C) Molality (D) Formality

**Q.7** Which of the following colligative properties is associated with the concentration term 'molarity' ?

(A) Lowering of vap. pressure.

(B) Osmotic pressure.

(C) Depression in freezing point.

(D) Elevation in boiling point.

**Q.8** Vapour pressure of water at 293 K is 17.535 mm Hg. Calculate the vapour pressure of water at 293 K when 25g of glucose is dissolved in 450 g of water.

(A) 17.44 mm Hg (B) 12.12 mm Hg

(C) 20.56 mm Hg (D) 26.12 mm Hg

**Q.9** The mole fraction of urea (Mol. wt. = 60) in a 1.0 molal ethanolic solution of the compound is-

(A) 0.145 (B) 0.064

(C) 0.044 (D) 0.290

**Q.10** The vapour pressure of $CHCl_3$ and $CCl_4$ are 280 and 200mm Hg at 27°C. Calculate the mole fraction of each in the vapour phase when a mixture containing 2 moles of $CHCl_3$ and 8moles of $CCl_4$ is maintained at 27°C.

(A) 0.26, 0.741 (B) 0.31, 0.69

(C) 0.78, 0.22 (D) 0.5, 0.5

**Q.11** A 5% solution (by mass) of canesugar in water has freezing point of 271 K. Calculate the freezing point of a 5% glucose in water if freezing point of pure water is 273.15 K.

(A) 269.07 K (B) 230.27 K

(C) 290.78 K (D) 302.02 K

**Q.12** The osmotic pressure of equimolar solutions of $BaCl_2$, NaCl and glucose will be in the order –

(A) $BaCl_2$ > NaCl > glucose

(B) glucose > NaCl > $BaCl_2$

(C) NaCl > $BaCl_2$ > glucose

(D) NaCl > glucose > $BaCl_2$

**Q.13** Which of the following aqueous solution has osmotic pressure nearest to that an equimolar solution of $K_4[Fe(CN)_6]$?

(A) $Na_2SO_4$ (B) $BaCl_2$

(C) $Al_2(SO_4)_3$ (D) $C_{12}H_{22}O_{11}$

**Q.14** Calculate the mass of a solvent in the mixture obtained by mixing 300 g of a 25% and 400 g of a 40% solution by mass.

(A) 66.4% (B) 55.2%

(C) 72.1% (D) 58.2%

**Q.15** A 25 gm cube of ice at 0.0ºC is added to 100gm of liquid at 22.0ºC in a thermally insulated container. The heat of fusion of ice is 6.01 KJ $mol^{-1}$ and the specific heat of liquid water is 4.18 J $gm^{-1}{}^{o}C^{-1}$.What is the temperature in the final condition ?

(A) 1.625ºC (B) 0.625ºC

(C) 3.125ºC (D) 2.635ºC

**Q.16** The molal freezing point depression constant, $K_f$ is equal to

(A) $\frac{RT_0}{1000\,L_f}$ (B) $\frac{R\times 1000}{T_0 L_f}$

(C) $\frac{RT_0^2}{1000\,L_f}$ (D) $\frac{R.L_f}{1000.T_0^2}$

($T_0$ = Freezing point of the solvent,

R = cas constant,

$L_f$ = Latent heat of fusion per gm of solvent)

**Q.17** Acetone has a vapour pressure of 185.2 mm Hg and ether 443.5 mm Hg at 20ºC. For a liquid mixture of acetone and ether containing 0.457 mole fraction of acetone, the partial pressure of ether is

(A) 218.8 mm (B) 240.8 mm

(C) 318.8 mm (D) 381.8 mm

**Q.18** A dilute solution may be defined as one in which

(A) the solvent obeys Raoult's law.

(B) the solution has a higher boiling point than pure solvent.

(C) the solution has a lower vapour pressure than pure solvent.

(D) the solution has a lower freezing point.

**Q.19** Which of these aqueous solutions would have the lowest freezing point?

(A) 1.0 molal glucose sugar

(B) 1.0 molal magnesium sulphate

(C) 1.0 molal cesium iodide

(D) 1.0 molal lithium sulphate

**Q.20** The osmotic pressure of an aqueous solution of sucrose at 303 K is 2.47 atm, the molar volume of water at this temperature is 18.10 $cm^3$. Calculate the elevation of boiling point of this solution $\Delta H$ vap = 539 cal $gm^{-1}$.

(A) 0.51 K (B) 0.12 K

(C) 0.051 K (D) 0.721 K

**For Q.21-Q.25 :**

**The answer to each question is a NUMERICAL VALUE.**

**Q.21** A mixture of equal weights of liquids A (molecular weight = 154) and B (molecular weight = 170) has a vapour pressure 173.5 mm at 25ºC. The vapour pressure values of pure A and pure B are 115 mm and 238 mm respectively. The partial pressure of A in the vapour is (X + 0.3) mm. Find the value of X. Assume ideal behavior.

**Q.22** When 1 mole of a solution is dissolved in 1kg of $H_2O$, boiling point of solution was found to be 100.5ºC. $K_b$ for $H_2O$ is (1/X). Find the value of X.

**Q.23** The vapour pressure of water is 12.3 kPa at 300K. The vapour pressure of 1 molar solution of a solute in it is (X + 0.8) kPa. Find the value of X.

**Q.24** The vapour pressure of pure water at 298 K is 23.76 mm. The vapour pressure of a solution of sucrose ($C_{12}H_{22}O_{11}$) in 5.56 moles of water is 23.392 mm Hg. The mass (in g) of sucrose in the solution is –

**Q.25** The vapour pressure of a dilute aqueous solution of glucose is 750 mm of mercury at 373 K. The mole fraction of solute in the solution is (1/X). Find the value of X.