	INDIAN SCHOOL AL WADI AL KABIR	
Class: XII	Department of Science 2024 - 25 SUBJECT: CHEMISTRY	Date: 16.09.2024
Worksheet No: 06 WITH ANSWERS	Chapter: SOLUTIONS	Note: A4 FILE FORMAT
NAME OF THE STUDENT	CLASS & SEC:	ROLL NO.

	MULTIPLE CHOICE QUESTIONS	
1.	$K_H$ value for Ar(g), CO <sub>2</sub> (g), HCHO (g) and CH <sub>4</sub> (g) are 40.39, 1.67, 1.83 $\times$ 10 <sup>-5</sup> and 0.413 respectively. Arrange these gases in the <u>order</u> of their increasing solubility. a) HCHO < CH <sub>4</sub> < CO <sub>2</sub> < Ar b) HCHO < CO <sub>2</sub> < CH <sub>4</sub> < Ar c) Ar < CO <sub>2</sub> < CH <sub>4</sub> < HCHO d) Ar < CH <sub>4</sub> < CO <sub>2</sub> < HCHO	1
2.	When a non-volatile solid is added to pure <u>water</u> it will:  a) boil above 100°C and freeze above 0°C  b) boil below 100°C and freeze above 0°C	1
	c) boil above 100°C and freeze below 0°C  d) boil below 100°C and freeze below 0°C	
3.	Water- HCl mixture I. shows positive deviations II. forms minimum boiling azeotrope III. shows negative deviations IV. forms maximum boiling azeotrope a) I and II b) II and III c) I and IV d) III and IV	1
4.	An azeotropic solution of two liquids has boiling point lower than either of them when solute solvent interactions are:  a) Equal to solute solute and solvent solvent interactions b) Stronger than solute solute and solvent solvent interactions c) Weaker than solute solute and solvent solvent interactions d) None of the above	1
5.	Molarity of a solution at 60°C is than molarity at 30°C  a) More b) less c) same d) no effect of temperature	1
6.	For isotonic solutions which of the following is not equal a) concentration b) temperature c) osmotic pressure d) vapour pressure	1
7.	For non-electrolyte solute value of Van't Hoff factor is a)0 b) 1 c) >1 d) <1	1

8.	In reverse comocio:	1
	In reverse osmosis:  a) a pressure greater than osmotic pressure is applied on pure water side b) a pressure lesser than osmotic pressure is applied on pure water side c)a pressure greater than osmotic pressure is applied on salt water side d)a pressure lesser than osmotic pressure is applied on salt water side	
9.	Which of the following salt will have same value of Van't Hoff's factor (i) as that of K <sub>4</sub> [Fe (CN) <sub>6</sub> ] (a) Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> (b) NaCl (c) Al(NO <sub>3</sub> ) <sub>3</sub> (d) Na <sub>2</sub> SO <sub>4</sub>	1
10.	Which among the following is an example of a solid solution?  (a) Copper dissolved in gold  (b) Ethanol dissolved in water  (c) Glucose dissolved in water  (d) Sodium chloride dissolved in water	1
	ASSERTION –REASON TYPE QUESTIONS	
	Note: In the following questions (1-5) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.  (a) Assertion and reason both are correct statements and reason is the correct explanation for assertion.  (b) Assertion and reason both are correct statements but the reason is not a correct explanation for assertion.  (c) Assertion is a correct statement but the reason is the wrong statement.  (d) Assertion is a wrong statement but the reason is a correct statement.	
11.	Assertion: When methyl alcohol is added to water, the boiling point of water decreases.  Reason: When a volatile solute is added to a volatile solvent elevation in boiling point is observed.	1
12.	Assertion: Cooking time in a pressure cooker is reduced Reason: The boiling point inside the pressure cooker is raised	1
13.	Assertion: The vapour pressure of a liquid is constant at a constant temperature Reason: At equilibrium rate of evaporation becomes equal to the rate of condensation.	1
14.	Assertion: The components of the azeotropic mixture can be separated by distillation Reason: At a particular composition azeotropic mixture boils at the same temperature.	1
15.	Assertion: The shrinking of cells is called hemolysis.  Reason: Hemolysis occurs when a cell comes in contact with a solution of lower osmotic pressure than that of a cell	1
	SHORT AND LONG ANSWER TYPE QUESTIONS	

16.	Give an example of a 'liquid in solid' type solution.	1
17.	Which of the following is a dimensionless quantity; molarity, molality, or mole fraction?	
18.	10 gm glucose is dissolved in 400 gm. of solution. Calculate the percentage concentration of the solution.	
19.	Gases tend to be less soluble in liquids as the temperature is raised. Why?	1
20.	A mixture of chlorobenzene and bromobenzene forms a nearly ideal solution but	1
20.	a mixture of chloroform and acetone does not. Why?	1
21.	State the conditions which must be satisfied if an ideal solution is to be formed.	2
22.	Suppose <i>kf</i> for water is 1.86 K kg mol–1. What is the freezing point of 0.1 molal solution?	2
23.	a. What is the value of van't Hoff factor (i) for Na <sub>2</sub> SO <sub>4</sub> ? 10H <sub>2</sub> O?	2
	b. What is the value of the van't Hoff factor (i) if solute molecules undergo dimerization?	_
24.	The Phase diagram for pure solvent and the solution containing non-volatile solute are recorded below. The quantity indicated by 'X' in the figure is	2
	b.  AgNO <sub>3</sub> on reaction with NaCl in aqueous solution gives white precipitate. If the two solutions are separated by a semi-permeable membrane will there be appearance of a white ppt. in the side 'X' due to osmosis?  O.1 M S O.01 M AgNO <sub>3</sub> P NaCl X M Y	
25.	a.  The vapour pressure curve for three solutions having the same non-volatile solute in the same solvent are shown. The curves are parallel to each other and do not intersect. What is the correct order of the concentrations of the solutions.  1 atm.  V.P.  Temp	2
	b. Can we separate water from the HNO <sub>3</sub> solution? Justify your answer	
26.	$30 \text{ g of urea } (M = 60 \text{ gmol}^{-1}) \text{ is dissolved in 846 g of water. Calculate the vapour}$	3
	pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.	_
27.	Calculate the temperature at which a solution containing 54 g of glucose, (C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> ), in 250 g of water will freeze.	3

28.	A solution containing 15g of urea ( $M = 60 \text{ gmol}^{-1}$ ) per litre of solution in water has the same osmotic pressure (isotonic) as a solution of glucose ( $M = 180 \text{ gmol}^{-1}$ ) in water. Calculate the mass of glucose present in one litre of its solution.	3
29.	a. An experiment was carried out in the laboratory, to study depression in freezing point. 1M aqueous solution of Al(NO <sub>3</sub> ) <sub>3</sub> and 1 M aqueous solution of glucose were taken. From the given figure identify solution 1 and solution 2. Give a plausible reason for your answer.	2
	anssaud modey  Temperature  Temperature	
	<ul> <li>b. The osmotic pressure of a solution of cane sugar was found to be 2.46 atm at 300 K. If the solution was diluted five times, calculate the osmotic pressure at the same temperature.</li> <li>How can the osmotic pressure of the given cane sugar solution be decreased without changing its volume? Give a reason for your answer.</li> </ul>	3
30.	a. While giving intravenous injections to the patients, the doctors take utmost care of the concentration of the solution used. Why is it necessary to check the concentration of the solution?	2
	b. What concentration of nitrogen should be present in a glass of water at room temperature? Assume a temperature of 25° C, total pressure of 1 atmosphere and mole fraction of nitrogen in air of 0.78. [KH for nitrogen = 8.42 × 10–7 M/mm Hg]	3
	CASE STUDY TYPE QUESTIONS	
31.	Many chemical and biological processes depend on osmosis, the selective passage of solvent molecules through the porous membrane from a dilute solution to a more concentrated one. The osmotic pressure depends on the molar concentration of the solution ( $\pi$ = CRT).	4
	If two solutions are of equal solute concentration and, hence, have the same osmotic pressure, they are said to be isotonic. If two solutions are of unequal osmotic pressures, the more concentrated solution is said to be hypertonic and the more diluted solution is described as hypotonic.	
	Osmosis is the major mechanism, for transporting water upward in the plants.  Transpiration in the leaves supports the transport mechanism of water. The	

osmotic pressure of seawater is about 30 atm; this is the pressure that must be applied to the seawater (separated from pure water using a semi-permeable membrane) to get drinking water.

- i) What will happen if a plant cell is kept in a hypertonic solution?
- ii) Blood cells are isotonic with 0.9% sodium chloride solution. What happens if we place blood cells in a solution containing in 1.2% sodium chloride solution?
- iii) What happens when the external pressure applied becomes more than the osmotic pressure of the solution?

OR

iii) Which mechanisms help in the transportation of water in a plant?

32. The boiling point or freezing point of the liquid solution would be affected by the dissolved solids in the liquid phase. A soluble solid in solution has the effect of raising its boiling point and depressing its freezing point. The addition of non-volatile substances to a solvent decreases the vapor pressure and the added solute particles affect the formation of pure solvent crystals. According to many researchers, the decrease in freezing point directly correlated to the concentration of solutes dissolved in the solvent. This phenomenon is expressed as freezing point depression and it is useful for several applications such as freezing the concentration of liquid food and finding the molar mass of an unknown solute in the solution.

Freeze concentration is a high-quality liquid food concentration method where water is removed by forming ice crystals. This is done by cooling the liquid food below the freezing point of the solution. The freezing point depression is referred to as a colligative property and it is proportional to the molar concentration of the solution (m), along with vapor pressure relative lowering, boiling point elevation, and osmotic pressure. These are physical characteristics of solutions that depend only on the identity of the solvent and the concentration of the solute. The characters are not depending on the solute's identity.

(Jayawardena, J. A. E. C., Vanniarachchi, M. P. G., & Wansapala, M. A. J. (2017). Freezing point depression of different Sucrose solutions and coconut water.)

## Answer the following:

- a. What is the relation between the vapour pressure of solid and liquid states at freezing point?
- b. Why freezing point of 0.1m solution of acetic acid in benzene is less than freezing point of 0.01m solution?
- c. Out of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression?

KCl,  $C_6H_{12}O_6$ ,  $Al_2(SO_4)_3$ ,  $K_2SO_4$ 

Оŀ

c.

If  $K_f$  for water is 1.86 °C/m, explain why 1m NaCl in water does not have a freezing point equal to

4

	a) 1969C	
	a) -1.86 °C	
	b) -3.72°C	
	CBSE BOARD-BASED – PREVIOUS YEARS' QUESTIONS	
33.	a) If boiling point of an aqueous solution containing a non-volatile solute is	3
	100.15°C. What is its freezing point? Given latent heat of fusion and vapourisation	
	of water are 80cal/g and 540 cal/g respectively.	
	b) Electrolyte A gives 4 ions and B is a non-electrolyte. If 0.1 molar solution of solute	
	B produces an osmotic pressure 'p', then 0.02 molar solution of A will produce how	
	much osmotic pressure?	
34.	0.6 mL of acetic acid CH3COOH, having a density of 1.06 g/mL, is dissolved in 1	3
	litre of water. The depression in the freezing point observed for this strength of acid	
	was 0.0205°C. Calculate the van't Hoff factor and the dissociation constant of acid.	
	Kf= 1.86 K kg /mol.	
35.	[A]The colligative property used for the determination of the molar mass of	1
	polymers and proteins are:	
	(a) Osmotic pressure	
	(b) Depression in freezing point	
	(c) Relative lowering in vapour pressure	
	(d) Elevation in boiling point	
		1
	[B] Low concentration of oxygen in the blood and tissues of people living at	
	high altitude is due to:	
	(a) high atmospheric pressure	
	(b) low temperature	
	(c) low atmospheric pressure	
	(d) both low temperature and high atmospheric pressure	
	ANGWEDS MCO	
1	ANSWERS - MCQ	1
1. 2.	A	1
3.	D	1
4.	C	1
5.	В	1
6.	D	1
7.	В	1
8.	С	11
9.	A	1
10.	A	1
	ANSWERS – ASSERTION & REASON	
11.	С	1
12.	A	1
13.	A	1
14.	D	1
15.	D	1

	ANSWERS – SHORT & LONG ANSWERS TYPE	
16.	Amalgam of Hg in Sodium	1
17.	mole fraction	1
18.	=10g/410g*100	1/2
	= 2.43%  w/w	1/2
19.	because the dissolution of gases in liquids is an exothermic process. When the temperature rises, heat is supplied, which shifts the equilibrium of the solution towards the backward direction, thus reducing gas solubility.	1
20.	A mixture of chlorobenzene and bromobenzene forms a nearly ideal solution because they have similar molecular structures and do not create new interactions upon mixing.	1/2 1/2
	In contrast, when chloroform and acetone are mixed, there is a significant change in enthalpy and volume, indicating that new interactions (H-bonding) are formed, which deviates from ideal behavior.	
21.	<ol> <li>The solution must obey Raoult's law, meaning that the partial vapor pressure of each component in the solution is proportional to its mole fraction.</li> <li>The enthalpy of mixing (ΔmixH) must be zero, indicating no heat is</li> </ol>	ANY TWO POINTS
	<ul> <li>absorbed or released during the mixing process.</li> <li>3. The volume change on mixing (ΔmixV) must also be zero, meaning there are no volumetric changes when the components are combined.</li> </ul>	1
22.	ΔTf = Kf * m	1
	$\Delta Tf = 1.86 ^{\circ}C ^{kg} ^{mol^{-1}} ^{*} ^{0.1} ^{mol/kg}$ $\Delta Tf = 0.186 ^{\circ}C$	
	Freezing Point = 0 °C - 0.186 °C Freezing Point = -0.186 °C	
23.	a. i = 3 b. I = 0.5	1 1
24.	a. ΔT <sub>b</sub>	1
	b. No precipitate, because only solvent particles move through SPM	1
25.	a. A < B < C	1 1
	b. No, we cannot separate water from a nitric acid (HNO3) solution because water and nitric acid form an azeotropic mixture. This means that during processes like evaporation or vaporization, both components vaporize together to maintain a constant composition in the liquid phase, making complete separation impossible.	

26.	$p_1^{\circ} - p_1 = w_2 \times M_1$	1
	$\frac{1}{P_1^{\circ}} \frac{1}{M_2 \times w_1}$	1
		1
	$23.8 - p1 = 30 \times 18$	
	$\frac{23.8}{23.8} \frac{\text{pt}}{60 \times 846}$	
	23.0 00 ^ 040	
	D = 22 547 H-	
	$P_1 = 23.547 \text{ mm Hg}$	
27.	$\Delta Tf = \frac{Kf \times w_2 \times 1000}{M_2 \times w_1}$	1
	1912 ~ W1	1
	$= 1.86 \times 54 \times 1000$	1
	$180 \times 250$	
	= 2.232 K	
	$\Delta Tf = Tf^{\circ} - Tf$	
	2.232 = 273.15 – Tf Tf = 270.918 K	
28.	$\pi$ of urea = $\pi$ of glucose (isotonic)	1
20.		1
	$\frac{\mathbf{w}_2}{\mathbf{M}_2 \times \mathbf{V}} = \frac{\mathbf{w}_2}{\mathbf{M}_2 \times \mathbf{V}}$	1
		1
	15 = mass of glucose	
	60 180	
	Mass of glucose = $45 g$	
29.	a.	1
	Depression in the freezing point is a colligative property. In dilute	1/2
	solutions the depression of the freezing point ( $\Delta Tf$ ) is directly	1/2
	proportional to the molal concentration of the solute in a solution.	
	From the graph, it is interpreted that Solution 2 shows more	
	depression in freezing point	
	1 M Al(NO) <sub>3</sub> has higher i value (i=3) than 1 M glucose (i=1)	
	1 M Al(NO) <sub>3</sub> will have higher depression,	
	hence	
	solution 2 is Al(NO) <sub>3</sub> solution and solution 1 is glucose solution.	
	b.	
	$\pi = (n_2/V) RT$	1
	Given $\pi = 2.64$ atm	1
	Let $V_1 = V$ $V_2 = 5V \text{ (On dilution by 5 times)}$	1/2 1
	$V_2$ = 5V (On dilution by 5 times) $\pi_1 = (n/V_1)$	1 1/2
	$\begin{array}{l} \pi_1 = (\text{IIV V}_1) \\ \pi_2 \text{ (n/V2)} \end{array}$	<sup>72</sup> ½
	$ \begin{array}{l}     k_2 (n/\sqrt{2}) \\     2.64 = (n/V) \end{array} $	1/2
	$\frac{2.04 - (11/V)}{\pi_2 (n/5V)}$	/2
	$\pi_2 = 0.528 \text{ atm}$	
	// <sub>2</sub> =0.520 unii	

	Osmotic pressure is directly proportional to temperature.	
	The osmotic pressure of cane sugar can be decreased by decreasing	
	the temperature.	
30.	a. While giving intravenous injection to the patients, utmost care of	1
	concentration of the solution is to be taken. The solution must have	1/2
	the same concentration as that of blood cells.	1/2
	If the solution becomes more concentrated than the concentration of	
	the blood will lead to the shrinking of blood cells and fluid will	
	start flowing out because of endosmosis.	
	If concentration is less concentrated than the concentration of the	
	blood it will lead to swelling of blood cells will take place. Both	1
	situations are life-threatening.	l 1
	b.	1 1
	$P_{N_2} = 0.78 \text{ atm} = 0.78 \times 760 \text{ mm Hg}$	1
	= 592.8 mm Hg $K_{\rm H} = 8.42 \times 10^{-7} \text{ M/mmHg}$	
	$K_H = 8.42 \times 10^{-1} \text{M/minHg}$ $X_{N_2} = ?$	
	$X_{N_2} = K_H \times P_{N_2}$	
	$= 8.42 \times 10^{-7} \text{ M/mmHg} \times 592.8 \text{ mmHg} = 4991.376 \times 10^{-7}$	
	$X_{N_2} = 4.99 \times 10^{-4}$	
	$X_{N_2}$ $X_{N_2}$	
	$X_{N_2} = \frac{X_{N_2}}{X_{N_2} + X_{H_2O}} = \frac{X_{N_2}}{X_{H_2O}}$	
	$X_{N_2} = X_{H_2O} \times X_{N_2} = \frac{1000}{18} \times 4.99 \times 10^{-4} = 0.0277$	
	$X_{N_2} = 2.77 \times 10^{-2} = 2.77 \times 10^{-2} M$	
21	ANSWERS – CASE STUDY TYPE	1
31.	i. When a plant cell is kept in a hypertonic solution, water inside the cell is drawn out through osmosis, leading to shrinkage from the cells.	1 1
	ii. When blood cells are placed in a 1.2% sodium chloride solution, which is	2
	hypertonic relative to the cells, water will flow out of the cells. This	2
	causes the cells to shrink as they lose water.	
	iii. When the external pressure applied to a solution exceeds its osmotic	
	pressure, reverse osmosis occurs, effectively allowing the pure solvent to	
	flow out of the solution through SPM.	
	OR	
	iii.The transportation of water in plants primarily involves two mechanisms: the	
	<u>absorption of water from the soil through the roots and the upward movement of</u>	
	water through the plant.	
32.	a. Equal	1
	b. Depression in FP in 0.1m solution is more than 0.01 solution so FP of first	1
	is less.	2
	c. $C_6H_{12}O_6$	
	OR	
	c. a) as there are 2 moles of ions per mol of NaCl b) degree of ionisation is not 100% at freezing point due to stronger	
	interactions for 1m solution.	
	moracuons for the solution.	

	ANSWERS - CBSE BOARD-BASED	
33.	a) $\Delta T_b = K_b  m$ , $\Delta T_f = K_f  m$ $K_f / K_b = \frac{T_f^2  X  latent  heat  of  fusion}{T_b^2 X  latent  heat  of  vapour is at ion}$ $= \Delta T_f /  \Delta T_b$ $K_f = \frac{R \times M_1 \times T_f^2}{1000 \times \Delta_{fus} H} \qquad \Delta T_f = 0.542$ $K_b = \frac{R \times M_1 \times T_b^2}{1000 \times \Delta_{vap} H} \qquad T_f = 0-0.542$ $= -0.542 \circ C$	3
34.	b) 0.8p	3
	mass of acetic acid = 0.6 X 1.06 = 0.636 g molar mass of acetic acid = 60 g/mol $i = \frac{0.0205}{1.86 \times 0.0106} = 1.04$	
	no. of moles of acetic acid = $\frac{mass\ of\ acetic\ acid}{molar\ mass\ of\ acetic\ acid} \frac{0.636}{60} = 0.0106$ As n=2, $CH_3COOH = CH_3COO^- + H^+$ molality = $\frac{No.\ of\ moles}{mass\ of\ solvent} = \frac{0.0106}{1} = 0.0106\ m$ $\alpha = \frac{i-1}{n-1} = \frac{1.04-1}{2-1} = 0.04$ (As density of water = 1 g/cm <sup>3</sup> ) $\therefore$ 1 L = 1kg	
	Dissociation constant $K_a = \frac{[cH_3COO^-][H^+]}{[cH_3COOH]} = \frac{c\alpha \times c\alpha}{c(1-\alpha)} = \frac{c\alpha^2}{1-\alpha} = \frac{0.0106 \times 0.04 \times 0.04}{1-0.04} = 1.76 \times 10^{-5}$	
35.	(a) (c)	1 1

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