



OSDAV Public School, Kaithal
Marking Scheme
July Unit Test (2024-25)
Subject: CHEMISTRY(043)
Class: XII

SET-A

1	c	1
2	d	1
3	b	1
4	d	1
5	a	1
6	b	1
7	a	1
8.	d	1
9	The Higher the osmotic pressure, the more hypertonic, the solution there are more particles in 1M NaCl than in 1M glucose because of dissociation. Therefore, NaCl is more hypertonic. NaCl solution will show higher elevation of boiling point.	1 1
10	Cathode Reaction: $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$ Anode Reaction: $2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-$ Net Cell Reaction: $2H_2 + O_2 \rightarrow 2H_2O$	1 1
11	Isotonic solutions are solutions having same osmotic pressure. 1.0 M glucose solution is isotonic with 1.0 M fructose solution as both solutions have same osmotic pressure. When isotonic solutions are separated by a semipermeable membrane, there is no flow of solvent in either direction.	1 1
12	It is given that vapour pressure of water, = 23.8 mm of Hg Weight of water taken, $w_1 = 850$ g Weight of urea taken, $w_2 = 50$ g Molecular weight of water, $M_1 = 18$ g mol ⁻¹ Molecular weight of urea, $M_2 = 60$ g mol ⁻¹ Now, we have to calculate vapour pressure of water in the solution. We take vapour pressure as p_1 . Now, from Raoult's law, we have:	1/2

	$\frac{P_1^0 - P_1}{P_1^0} = \frac{n_2}{n_1 + n_2}$	1/2
	$\Rightarrow \frac{P_1^0 - P_1}{P_1^0} = \frac{\frac{w_2}{M_2}}{\frac{w_1}{M_1} + \frac{w_2}{M_2}}$	1/2
	$\Rightarrow \frac{23.8 - P_1}{23.8} = \frac{\frac{50}{60}}{\frac{850}{18} + \frac{50}{60}}$	1/2
	$\Rightarrow \frac{23.8 - P_1}{23.8} = \frac{0.83}{47.22 + 0.83}$	
	$\Rightarrow \frac{23.8 - P_1}{23.8} = 0.0173$	
	$\Rightarrow P_1 = 23.4 \text{ mm of Hg}$	
	Hence, the vapour pressure of water in the given solution is 23.4 mm of Hg and its relative lowering is 0.0173.	
13	A Salt bridge is used to maintain electrical neutrality inside the circuit of a galvanic cell. A Salt bridge acts as an electrical connection between two half cells. A Salt bridge prevents the diffusion of solution from one cell to the other.	1+1
14	<p>Given: $w_b = 12.48 \text{ g}$, $w_a = 1 \text{ kg} = 1000 \text{ g}$, $m_b (\text{BaCl}_2)$ $= 208.34 \text{ g/mol}$ $\Delta T_b = 373.0832 - 373 = 0.0832 \text{ K}$ $K_b = 0.52 \text{ K kg mol}^{-1}$</p> <p>$\therefore \Delta T_b = i K_b m = i K_b \times \frac{w_b}{m_b} \times \frac{1000}{w_a (g)}$</p> $0.0832 = i \times 0.52 \times \frac{12.48}{208.34} \times \frac{1000}{1000}$ $i = 2.67$ <p>$\text{BaCl}_2 \longrightarrow \text{Ba}^{2+} + 2\text{Cl}^-$ $\alpha = \text{degree of dissociation}$ BaCl_2 $\xrightarrow{1-\alpha}$ Ba^{2+} $\xrightarrow{\alpha}$ $+ 2\text{Cl}^-$ $\xrightarrow{2\alpha}$</p> $i = \frac{1 + 2\alpha}{1} = 1 + 2\alpha \quad \text{or} \quad 1 + 2\alpha = 2.67$ $\alpha = \frac{1.67}{2} = 0.835$	1 1 1

15	<p>a) " At infinite dilution the molar conductivity of the electrolyte at infinite dilution is the sum of the ionic conductivities of cations and anions, this is called Kohlrausch's law". $\Lambda^{\circ} = \lambda^{\circ}_{+} + \lambda^{\circ}_{-}$.</p> <p>b)</p> $\Lambda^{\circ}_{\text{NaCl}} = 126.4 \text{ S cm}^2 \text{ mol}^{-1}$ $\Lambda^{\circ}_{\text{HCl}} = 425.9 \text{ S cm}^2 \text{ mol}^{-1}$ $\Lambda^{\circ}_{\text{CH}_3\text{COONa}} = 91.0 \text{ S cm}^2 \text{ mol}^{-1}$ $\Lambda^{\circ}_{\text{CH}_3\text{COOH}} = \Lambda^{\circ}_{\text{CH}_3\text{COONa}} + \Lambda^{\circ}_{\text{HCl}} - \Lambda^{\circ}_{\text{NaCl}}$ $= 91.0 + 425.9 - 126.4 = 390.5 \text{ S cm}^2 \text{ mol}^{-1}$	1 1 1
16	<p>From the given cell representation, Ag⁺/Ag couple act as cathode Zn²⁺/Zn couple act as anode</p> $E^{\circ}_{\text{cell}} = E^{\circ}_{\text{cathode}} - E^{\circ}_{\text{anode}}$ $E^{\circ}_{\text{cell}} = 0.80 - (-0.76)$ $E^{\circ}_{\text{cell}} = 1.56 \text{ V}$ <p>The given cell reaction is, Zn(s) + 2Ag⁺(aq) → Zn²⁺(aq) + 2Ag n = 2</p> <p>By Nernst equation,</p> $E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{0.0591}{n} \log \frac{[\text{Zn}^{2+}]}{[\text{Ag}^{+}]^2}$ $E_{\text{cell}} = E^{\circ}_{\text{cell}} + \frac{0.0591}{n} \log \frac{[\text{Ag}^{+}]^2}{[\text{Zn}^{2+}]}$ $E_{\text{cell}} = 1.56 + \frac{0.0591}{2} \log \frac{[0.01]^2}{[0.1]}$ $E_{\text{cell}} = 1.56 + \frac{0.0591}{2} \log (1 \times 10^{-3})$ $E_{\text{cell}} = 1.56 - \frac{0.0591}{2} \times 3$ $E_{\text{cell}} = 1.56 - 0.088 = 1.472 \text{ V}$	1 1 1
17	<p>a) When solution is diluted, the total number of ions increases due to increase in the degree of dissociation. Hence, molar conductance increases with dilution. But the number of ions per unit volume decreases. Hence, specific conductance decreases with dilution.</p> <p>b) Cathode - Reduction Ag⁺ + e⁻ → Ag Anode - Oxidation Ag → Ag⁺ + e⁻</p>	1 1 1
18 a)	<p>i) It would fill with water and burst. The red blood cell would shrink as it loses water to the salt solution in the test tube.</p>	1 1

<p>18 b)</p>	<p>ii) The process of movement of solvent through a semipermeable membrane from the solution to the pure solvent by applying excess pressure on the solution side is called reverse osmosis. Reverse osmosis is a membrane treatment process primarily used to separate dissolved solutes from water.</p> <p>iii) The interaction between them is intermolecular hydrogen. The total vapour pressure of the mixture will be below the vapour pressure of ideal compounds due the strong hydrogen bond between compound A and B. There will be lowering of vapor pressure from ideal solutions hence, shows negative deviation</p> <p>It is given that:</p> $K_H = 1.67 \times 10^8 \text{ Pa}$ $p_{\text{CO}_2} = 2.5 \text{ atm} = 2.5 \times 1.01325 \times 10^5 \text{ Pa}$ $= 2.533125 \times 10^5 \text{ Pa}$ <p>According to Henry's law:</p> $p_{\text{CO}_2} = K_H \cdot x$ $\Rightarrow x = \frac{p_{\text{CO}_2}}{K_H}$ $= \frac{2.533125 \times 10^5}{1.67 \times 10^8}$ $= 0.00152$ $x = \frac{n_{\text{CO}_2}}{n_{\text{CO}_2} + n_{\text{H}_2\text{O}}} \approx \frac{n_{\text{CO}_2}}{n_{\text{H}_2\text{O}}}$ <p>We n_{CO_2} is negligible as compared to $n_{\text{H}_2\text{O}}$ [Since,] can write,</p> <p>In 500 mL of soda water, the volume of water = 500 mL [Neglecting the amount of soda present] We can write:</p> <p>500 mL of water = 500 g of water</p> $= \frac{500}{18} \text{ mol of water}$ $= 27.78 \text{ mol of water}$	<p>1</p> <p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>
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$$\frac{n_{\text{CO}_2}}{n_{\text{H}_2\text{O}}} = x$$

Now,

$$\frac{n_{\text{CO}_2}}{27.78} = 0.00152$$

$$n_{\text{CO}_2} = 0.042 \text{ mol}$$

Hence, quantity of CO_2 in 500 mL of soda water = $(0.042 \times 44)\text{g}$
= 1.848 g

1/2



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SET-B

1	b	1
2	a	1
3	d	1
4	b	1
5	a	1
6	c	1
7	a	1
8.	d	1
9	<p>Given $I = 5A$</p> <p>Time = $20 \times 60 = 1200 \text{ s}$</p> <p>$\therefore$ Charge = current \times time</p> <p style="text-align: center;">$= 5 \times 1200$</p> <p style="text-align: center;">$= 6000 \text{ C}$</p> <p>According to the reaction. $Ni^{2+} (aq.) + 2e \rightarrow Ni (s)$</p> <p>Nickel deposit by $(2 \times 96487) \text{ C} = 58.7 \text{ g}$</p> <p>$\therefore$ Nickel deposit by $6000 \text{ C} = \frac{58.7 \times 6000}{2 \times 96487}$</p> <p style="text-align: center;">$= 1.825 \text{ g}$</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>
10	<p>$T = 300 \text{ K}$ $W = 30 \text{ g}$ $V = 1 \text{ L}$ $\pi_1 = 4.98 \text{ bar}$ $\pi_2 = 1.52 \text{ bar}$ $C_2 = ? \pi_1 = C_1 RT \quad ; \quad \pi_2 = C_2 RT$ $\frac{\pi_1}{\pi_2} = \frac{C_1}{C_2}$ $C_2 = \frac{\pi_2}{\pi_1} \times C_1$ $C_2 = \frac{1.52}{4.98} \times \frac{30}{180 \times 1}$ $= 0.0508 \text{ M}$</p>	<p>1/2</p> <p>1/2</p> <p>1</p>

11	<p>Ionization of acidified water: $\text{H}_2\text{O} \rightleftharpoons \text{H}^+ + \text{OH}^-$ $\text{H}_2\text{SO}_4 \rightleftharpoons 2\text{H}^+ + \text{SO}_4^{2-}$</p> <p>Ions present in solution are SO_4^{2-}, OH^- and H^+ +ve charge move towards cathode whereas -ve charge move towards anode.</p> <p>Reaction at cathode: $\text{H}^+ + \text{e}^- \rightarrow \text{H}$ $\text{H} + \text{H} \rightarrow \text{H}_2$</p> <p>Reaction at anode OH^- ion discharge in preference to SO_4^{2-} $\text{OH}^- \rightarrow \text{OH} + \text{e}^-$ $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2$</p> <p>Hence, during electrolysis of acidulated water, hydrogen is collected at cathode and oxygen is collected at anode.</p>		1 1
12	<p>Generally a primary cell known as Leclanche cell is used in the transistor.</p> <p>Anode Reaction: $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$</p> <p>Cathode Reaction: $\text{MnO}_2 + \text{NH}_4^+ + \text{e}^- \rightarrow \text{MnO}(\text{OH}) + \text{NH}_3$</p>		1 1
13	<p>Henry's law states that the solubility of the gas is directly proportional to the pressure of the gas at a constant temperature. This means that the more the pressure of the gas is, the more soluble the gas is. Also, if the pressure of the gas is low, we can say that the gas is not soluble or it is less soluble.</p> <p>$p_A = K_H X_A$</p> <p>Gas must be ideal and should not undergo any compound formation with solvent.</p>	1 1	
14	<p>Weight of non volatile organic solvent = 5g Weight of solvent, (water) = 95g Molecular mass of solvent (M) = 18 g Molecular mass of non volatile solute, m = ? p° the vapour pressure of pure solvent at 373K = 760 mm Vapour pressure of solution = 745 mm Substituting the value in the given below expression :</p> $\frac{p^\circ - p}{p} = \frac{w \times M}{m \times W}$ $\frac{760 - 745}{760} = \frac{5 \times 18}{m \times 95}$ $m = \frac{5 \times 18 \times 760}{95 \times 15} = 48\text{g}$		1/2 1/2 1/2 1
15	<p>a) The solution shows positive deviation from Raoult's law.</p> <p>b) $i = 2$ as it is an electrolyte and dissociates to give 2 ions. Thus as the van't Hoff factor is higher for KCl, thus depression in freezing point will be higher. Thus 1M urea solution has higher freezing point.</p> <p>c) Azeotropic mixture is a mixture of two or more liquids with a similar boiling point and a similar composition in their vapour phase. Azeotropic mixture either has a higher or lower boiling point than its components.</p>	1 1 1	

<p>16</p>	<p>From the given cell representation, Ag^+/Ag couple act as cathode Zn^{2+}/Zn couple act as anode</p> $E_{\text{cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ}$ $E_{\text{cell}}^{\circ} = 0.80 - (-0.76)$ $E_{\text{cell}}^{\circ} = 1.56 \text{ V}$ <p>The given cell reaction is, $\text{Zn(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag}$ $n = 2$</p> <p>By Nernst equation,</p> $E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.0591}{n} \log \frac{[\text{Zn}^{2+}]}{[\text{Ag}^+]^2}$ $E_{\text{cell}} = E_{\text{cell}}^{\circ} + \frac{0.0591}{n} \log \frac{[\text{Ag}^+]^2}{[\text{Zn}^{2+}]}$ $E_{\text{cell}} = 1.56 + \frac{0.0591}{2} \log \frac{[0.01]^2}{[0.1]}$ $E_{\text{cell}} = 1.56 + \frac{0.0591}{2} \log (1 \times 10^{-3})$ $E_{\text{cell}} = 1.56 - \frac{0.0591}{2} \times 3$ $E_{\text{cell}} = 1.56 - 0.088 = 1.472 \text{ V}$		<p>1</p> <p>1</p> <p>1</p>
<p>17</p>	<p>a) Zinc has higher standard oxidation potential than Iron. Tin, copper and nickel have lower oxidation potential than iron. as zinc has more tendency to undergo oxidation than iron, it acts as anode and provides protection to iron also known as cathodic protection.</p> <p>b) Conductivity varies with the change in the concentration of the electrolyte. The number of ions per unit volume decreases on dilution. So conductivity decreases with decrease in concentration. Therefore conductivity of CH_3COOH decreases on dilution</p> <p>c) When solution is diluted, the total number of ions increases due to increase in the degree of dissociation</p>	<p>1</p> <p>1</p> <p>1</p>	
<p>18 a)</p>	<p>$P_{\text{N}_2} = P_{\text{T}} \times \text{mole fraction} = 5 \times 0.8 = 4$ From Henry's law $P_{\text{N}_2} = K_{\text{H}} \times X_{\text{N}_2}$ $X_{\text{N}_2} = 4 \times 10^{-5}$ $X_{\text{N}_2} = \frac{n_{\text{N}_2}}{n_{\text{N}_2} + n_{\text{water}}}$ $n_{\text{N}_2} \ll n_{\text{water}}$ $X_{\text{N}_2} = \frac{n_{\text{N}_2}}{n_{\text{water}}}$ $n_{\text{N}_2} = 4 \times 10^{-4}$</p>	<p>1/2</p> <p>1/2</p> <p>1</p>	

18 b)	$= \frac{1}{(78 \text{ g mol}^{-1}) \times (0.5 \text{ kg})}$ $= 0.5 \text{ mol kg}^{-1}$ <p>Placing the values in Eq. (i), we find the value of van't Hoff factor (i)</p> $i = \frac{1}{(1.86 \text{ K kg mol}^{-1}) \times (0.5 \text{ mol kg}^{-1})}$ $= 1.0753$ <p>Step II: Calculation of degree of dissociation of the acid</p> <p>Suppose degree of dissociation at the given concentration is α</p> $\text{CH}_2\text{FCOOH} \rightleftharpoons \text{C}^+ + \text{C}^-$ <p>Initial conc. $C \text{ mol kg}^{-1}$ $C(1 - \alpha)$</p> <p>At equilibrium</p> <p>Total = $C(1 + \alpha)$</p> $\therefore i = \frac{C(1 + \alpha)}{C} = 1 + \alpha$ $\alpha = i - 1 = 1.0753 - 1 = 0.0753$ <p>Step III: Calculation of dissociation constant for the acid</p> <p>(Molal) $C = 0.5 \text{ m}$ (From Eq. (ii))</p> $K_a = \frac{[\text{CH}_2\text{FCOO}^-][\text{H}^+]}{[\text{CH}_2\text{FCOOH}]} = \frac{C\alpha \cdot C\alpha}{C(1 - \alpha)} = \frac{C\alpha^2}{(1 - \alpha)}$ $K_a = \frac{(0.5)(0.0753)^2}{(1 - 0.0753)} = \frac{(0.5) \times (0.0753)^2}{(0.9247)} = 3.07 \times 10^{-3}$	<p>1</p> <p>1</p> <p>1</p>
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