PHYSICAL / INORGANIC CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 33

Total Marks : 33

Max. Time : 36 min.

Topic : Electro Chemistry

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.7	**(3 marks, 3 min.)**	**[21, 21]**
Subjective Questions ('–1' negative marking) Q.8 to Q.10	**(4 marks, 5 min.)**	**[12, 15]**

1. To observe the effect of concentration on the conductivity, electrolytes of different nature are taken in two vessel 'A' and 'B'. 'A' contains weak electrolyte e.g., NH_4OH and 'B' contains strong electrolyte e.g., NaCl. In both container concentration of respective electrolyte is increased and conductivity observed :
(A) in 'A' conductivity increases, in 'B' conductivity decreases
(B) in 'A' conductivity decreases while in 'B' conductivity increases
(C) in both 'A' and 'B' conductivity increases
(D) in both 'A' and 'B' conductivity decreases

2. The conductivity of 0.1 N NaOH solution is 0.022 S cm^{-1}. To this solution equal volume of 0.1 N HCl solution is added which results into decrease of conductivity of solution to 0.0055 S cm^{-1}. The equivalent conductivity of NaCl solution in S cm^2 $equiv^{-1}$ is :
(A) 0.011 (B) 110 (C) 0.0055 (D) 55.0

3. 100 mL of solutions of A and B (containing the same strong electrolyte) fill a conductivity cell with the electrodes being exactly half dipped into the solution and the conductances of 0.01 S and 0.005 S were registered. What would be the conductance if both solution are mixed together and tested upon in the same conductivity cell ?
(A) 0.0075 S (B) 0.015 S (C) 0.03 S (D) none of these

4. The specific conductivity is 0.0382 Ω^{-1} cm^{-1} for a solution which is 0.1 M in KCl and 0.2 M in NaCl (a strong electrolyte). Calculate $\lambda(Na^+)$ if the $\lambda(k^+)$ = 74 and $\lambda(Cl^-)$ = 76 resp.
(A) 10 (B) 20 (C) 30 (D) 40

5. The solubility of $[Co(NH_3)_4Cl_2]\ ClO_4$ if the $\lambda_{CO(NH_3)_4Cl_2^+}$ = 50, $\lambda_{ClO_4^-}$ = 70 and the measured resistance was 33.5 Ω in a cell with cell constant of 0.20 is ________
(A) 59.7 mmol/L (B) 49.7 mmol/L (C) 39.7 mmol/L (D) 29.7 mmol/L

6. For a saturated solution of AgCl at 25°C, $\kappa = 3.4\times10^{-6}$ S cm^{-1} and that of H_2O (ℓ) used is 2.02×10^{-6} S cm^{-1}. Λ°_m for AgCl is 138 S cm^2 mol^{-1} then the solubility of AgCl in moles per liter will be -
(A) 10^{-5} (B) 10^{-10} (C) 10^{-14} (D) 10^{-16}

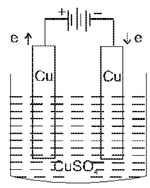
7. Given that (in S cm^2 eq^{-1}) at T = 298 K :
Λ°_{eq} for $Ba(OH)_2$, $BaCl_2$ & NH_4Cl are 228.8, 120.3 & 129.8 respectively.
Specific conductance for 0.2 N NH_4OH solution is 4.766×10^{-4} S cm^{-1}, then value of pH of the given solution of NH_4OH will be nearly.
(A) 9.2 (B) 11.3 (C) 12.1 (D) 7.9

8. The resistance of a $\frac{N}{10}$ KCl solution is 250 Ω. Calculate the specific conductance and the equivalent conductance of the solution if the electrodes in the cell are 7 cm apart and each has an area of 7 sq. cm.

Integer Answer Type

This section contains 2 questions. The answer to each of the questions is a single digit integer, ranging from 0 to 9.

9. In the adjacent diagram the electrolytic cell contains 1 L of an aqueous 1 M Copper (II) sulphate solution. If 0.4 mole of electrons are passed through the cell, the molar concentration of copper ion after passage of the charge will be :



10. The charge required for discharging 115 gram of Na from molten NaCl is .... Faradays.

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Answer Key

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1.	(D)	**2.**	(B)	**3.**	(B)	**4.**	(D)	**5.**	(B)
6.	(A)	**7.**	(B)	**8.**	40 Ω^{-1} cm^2 eq^{-1}	**9.**	1	**10.**	5

Hints & Solutions

PHYSICAL / INORGANIC CHEMISTRY

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1. Weak electrolyte is weakly ionizing substance, dilution promotes ionization thus conductivity.
For strong electrolyte, as concentration increases interionic attraction increases and conduction decreases.

2. Normality of resulting solution = $\frac{0.1V}{2V}$ = 0.05 N

$$\wedge_{eq.} = \frac{K \times 1000}{N} = \frac{0.0055 \times 1000}{0.05} = 110$$

3. $R_A = \frac{1}{0.01} = 100$

$R_B = \frac{1}{0.005} = 200$

$\frac{1}{Req} = \frac{1}{R_A} + \frac{1}{R_B}$

Sep = $S_A + S_B$ = 0.01 + 0.005 = 0.0155

6. $\kappa_{electrolyte} = \kappa_{solution} - \kappa_{solvent}$
$= 3.4 \times 10^{-6} - 2.02 \times 10^{-6} = 1.38 \times 10^{-6}$ Scm^{-1}

$$\text{Solubility} = \frac{\kappa_{electrolyte} \times 1000}{\lambda^{o}_{m}}$$

$$= \frac{1.38 \times 10^{-6} \times 1000}{138} = 10^{-5}\ M.$$

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7. $\Lambda^{\circ}_{eq} Ba(OH)_2 = \lambda^{o} Ba^{2+} + \lambda^{o}eq, OH^{-}$

$\lambda^{o}eq\ BaCl_2 = \lambda^{o}eq\ Ba^{2+} + \lambda^{o}eq, Cl^{-}$

$\lambda^{o}eq\ NH_4Cl = \lambda^{o}eq\ NH^{+}_4 + \lambda^{o}eq, Cl^{-}$

$\lambda^{o}eq, NH_4OH = \lambda^{o}eq, NH_4^{+} + \lambda^{o}eq, OH^{-}$

I + III + II

$\lambda^{o}eq, NH_4OH = (228.8 + 129.8) - 120.3 = 238.33\ cm^2 eq^{-1}$

$$\lambda eq, NH_4OH = \frac{4.766 \times 10^{-14} \times 1000}{0.2} = 2.383$$

$$\alpha = \frac{\lambda eq, NH_4OH}{\lambda^{o} eq, NH_4OH} = 10^{-2}$$

$NH_4OH \rightleftharpoons NH_4^{+} + OH^{-}$

$c(1-\alpha) \quad c\alpha \quad c\alpha$

$[OH^{-}] = 0.2 \times 10^{-12} = 2 \times 10^{-3}$

$pOH = 3 - \log 2 \Rightarrow \quad pH = 14 - (3 - \log 2) = 11.3$

$$\Lambda_{eq} = \frac{0.004}{0.1} \times 1000\ \Omega^{-1}\ cm^2\ eq^{-1} = 40\ \Omega^{-1}\ cm^2\ eq^{-1}.$$

9. Number of moles of Cu^{2+} discharged from anode = number of moles of Cu^{2+} deposited at cathode.

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