



‘সমানো মন্ত্র: সমিতি: সমানী’

**UNIVERSITY OF NORTH BENGAL**  
B.Sc. Honours 4th Semester Examination, 2022

**CC10-CHEMISTRY**  
**PHYSICAL CHEMISTRY**

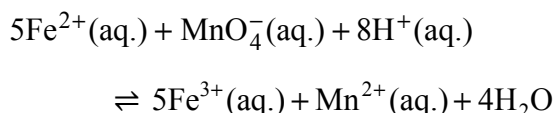
Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.  
All symbols are of usual significance.*

**Answer any four questions**

1. (a) Define ‘Standard electrode potential’ and ‘Standard emf of a cell’. 3+4+3  
(b) The redox reaction between  $\text{Fe}^{2+}$  and  $\text{MnO}_4^-$  in presence of 1M  $\text{H}_2\text{SO}_4$  is —



Write down the electrochemical cell for this reaction to take place. Calculate the equilibrium constant for this reaction.

Given  $E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^\circ = 0.77 \text{ V}$  and

$E_{\text{MnO}_4^-/\text{Mn}^{2+}}^\circ = 1.51 \text{ V}$  at  $25^\circ\text{C}$

- (c) Write down the construction and functions of a salt bridge.
2. (a) How do you calculate standard free energy change and equilibrium constant of a given reaction from emf measurement? 4+3+3  
(b) Explain ionic product of water. Calculate pH of  $10^{-8} \text{ M HCl (aq.)}$  solution.  
(c) In a strong acid-base titration, conductance falls rapidly while in precipitation titration conductance decreases slowly, why?
3. (a) Define equivalent conductance and molar conductance. Derive relation between them. What are their S.I. units? 4+1+3+2  
(b) The ion conductance of  $\text{Li}^+$  ion is less than that of  $\text{K}^+$  ion. — Explain.  
(c) Describe moving boundary method for determination of transport numbers.  
(d) Explain how does a reference electrode provide in measuring the potential of electrochemical processes?

4. (a) The specific conductance of a saturated solution of AgCl is  $1.56 \times 10^{-6} \text{ ohm}^{-1} \text{ cm}^{-1}$ . The mobilities of  $\text{Cl}^-$  and  $\text{Ag}^+$  ions are  $5.6 \times 10^{-4} \text{ cm/sec}$  and  $6.8 \times 10^{-4} \text{ cm/sec}$ . Calculate the solubility product of AgCl. 4+3+3
- (b) State and explain the Kohlrausch's law of independent migration of ions with suitable examples.
- (c) Describe the general possible rate determining steps in an electrolytic chemical reaction.
5. (a) Differentiate between paramagnetism and diamagnetism. 2+3+3+2
- (b) What is magnetic susceptibility? Give its significance.
- (c) What is Clausius-Mossotti equation? Give its significance.
- (d) What do you mean by dipole moment and polarizability?
6. (a) Molar polarization value of  $\text{O}_2$  and  $\text{CH}_4$  are independent of temperature while that of HCl and  $\text{CH}_3\text{Cl}$  decreases with increase in temperature in their gaseous phase. — Explain. 4+3+3
- (b) Three different dichlorobenzene have dipole moments—  
(i) 1.48 D, (ii) 0.0 D and (iii) 2.25 D.  
Identify the isomers with explanation.
- (c) Explain the order of polarizability and dipole moments of the following compounds in their gaseous phases: HCl, HBr, HI.
7. Write short note (any **four**) on the following:  $2 \frac{1}{2} \times 4 = 10$
- (a) Glass electrode
- (b) Transport number
- (c) Concentration cells
- (d) Conductometric titration
- (e) Electrochemical cell
- (f) Debye-Huckel theory.

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