

**4 SEM TDC CHMH (CBCS) C 10**

**2025**

( May/June )

**CHEMISTRY**

( Core )

Paper : C-10

( **Physical Chemistry** )

Full Marks : 53

Pass Marks : 21

Time : 3 hours

*The figures in the margin indicate full marks  
for the questions*

1. Choose the correct answer (any five) : 1×5=5

(a) The value of molar conductivity of KCl solution

(i) increases linearly with the increase in concentration

(ii) decreases linearly with the increase in concentration

(iii) increases non-linearly with the increase in concentration

(iv) decreases non-linearly with the increase in concentration



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(b) The Debye-Hückel-Onsager equation is not valid for

(i)  $\text{CH}_3\text{COOH}$

(ii)  $\text{HCl}$

(iii)  $\text{KCl}$

(iv)  $\text{KNO}_3$

The correct statement for an electro-chemical cell is

(i) it converts electrical energy into chemical energy

(ii) oxidation takes place on cathode

(iii) oxidation takes place on anode

(iv) the two electrodes are set up in the same electrolytic solution

(d) Which is not true about standard hydrogen electrode (SHE)?

(i) Potential of SHE is arbitrary taken as zero

(ii) It always acts as cathode with other half-cell electrodes

(iii) Platinized platinum is used as electrode material for electrical conductivity

(iv) Hydrogen gas at 1 atm pressure should be supplied

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(e) For a diamagnetic substance

(i) magnetic permeability,  $\mu = 1$

(ii) magnetic permeability,  $\mu < 1$

(iii) magnetic permeability,  $\mu > 1$

(iv) magnetic permeability,  $\mu = 0$

(f) The values of magnetic moment for the complexes  $[\text{Fe}(\text{CN})_6]^{3-}$  and  $[\text{FeF}_6]^{3-}$  are

(i) 5.91 BM and 5.91 BM respectively

(ii) 1.73 BM and 1.73 BM respectively

(iii) 5.91 BM and 1.73 BM respectively

(iv) 1.73 BM and 5.91 BM respectively

2. Answer the following questions :  $2 \times 5 = 10$

(a) What do you mean by ionic mobility? Write its unit.

(b) Ionic mobility of  $\text{Li}^+$  ion is more than  $\text{Na}^+$  and  $\text{K}^+$  ions. Explain.

(c) Describe the construction of standard hydrogen electrode (SHE).

(d) What are reference electrodes? Give examples.

(e) The dipole moment of a halo-benzene is 1.55 D. The bond distance of  $\text{X}-\text{C}_6\text{H}_5$  is 2.8 Å. Calculate the percentage of ionic character of the bond.



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3. Answer the following question [either (a) or (b)] : 3
- (a) Discuss the effect of dilution on specific conductance and equivalent conductance. 3
- (b) Define molar conductance and specific conductance. Write the relationship between specific conductance and molar conductance. 2+1=3
4. Answer any *three* of the following questions : 4×3=12
- (a) What is meant by abnormal transport number of an ion? Discuss the effect of concentration on the transport number of  $\text{Cd}^{2+}$  ion in aqueous solution of  $\text{CdI}_2$ . 2+2=4
- (b) What is cell constant? Write its unit. How is cell constant determined? 1+1+2=4
- (c) Define transport number of an ion. How is it related to the ionic mobility of the ions? State and explain the Hittorf's rule. 1+1+2=4
- (d) Draw and explain the conductometric titration curves for (i)  $\text{NH}_4\text{OH}$  is titrated against  $\text{HCl}$  and (ii)  $\text{HCl}$  is titrated against  $\text{NH}_4\text{OH}$ . 2+2=4

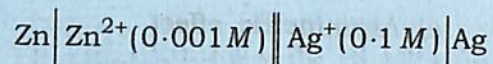
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- (e) Write short notes on the following : 2+2=4
- (i) Asymmetric effect
- (ii) Electrophoretic effect
5. Answer the following question [either (a) or (b)] : 3
- (a) Describe how the hydrogen electrode can be used for the determination of pH of a solution. 3
- (b) Discuss with diagram, the variation of the e.m.f. during the potentiometric titration of a strong acid with a strong base. How can the exact equivalence point in a potentiometric titration be detected? 2+1=3
6. Answer any *three* of the following questions : 4×3=12
- (a) Deduce the Nernst equation for cell potential of a reversible cell represented by the general equation
- $$aA + bB + \dots = xX + yY + \dots$$
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- (b) Write the cell reaction and calculate the e.m.f. of the following cell :



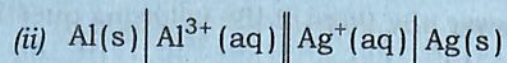
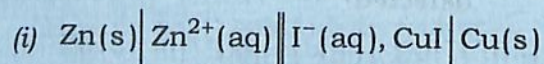
Given,  $E_{\text{Zn}^{2+}/\text{Zn}}^{\circ} = -0.76\text{ V}$  and

$E_{\text{Ag}^{+}/\text{Ag}}^{\circ} = 0.80\text{ V}$ . 1+3=4

- (c) What is liquid junction potential? How can it be eliminated? 1+3=4

- (d) Write the half-cell reaction for the calomel electrode. Using the Nernst equation, show that the cell potential depends on chloride ion concentration at fixed temperature. 1+3=4

- (e) Write the cell reactions of the following cells : 2+2=4



7. Answer any *two* of the following questions :

4×2=8

- (a) Discuss a method for the determination of magnetic susceptibility of a material. 4

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- (b) Define magnetic permeability and magnetic susceptibility. Deduce the relationship between them. 2+2=4

- (c) What do you mean by polarizability of a molecule? Explain different types of polarization that may take place when a molecule is placed in an electric field. 1+3=4

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