

Total number of printed pages-7

63(FY) SEM-4/MAJ/CHMMAJ2054

2025

**CHEMISTRY**

(Major)

Paper : CHMMAJ2054

**(Physical Chemistry-II)**

Full Marks : 50

Pass Marks : 20

Time : Two hours

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

1. Choose the correct answer : 1×5=5

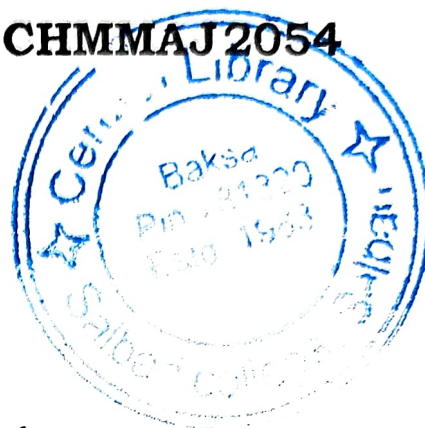
(a) Select the correct relation :

(i)  $\Delta G = RT \ln K_p$

(ii)  $K_p = e^{-\Delta G^\circ/RT}$

(iii)  $K_p = e^{\Delta H^\circ/RT}$

(iv)  $K_p = \Delta G^\circ/RT$



(b) Which one is the SI unit of molar conductivity ?

(i)  $S\text{cm}^2\text{mol}^{-1}$

(ii)  $S\text{m}^2(\text{equiv})^{-1}$

(iii)  $S\text{m}^2\text{mol}^{-1}$

(iv)  $S\text{m}^{-1}$

(c) For an ideal solution obeying Raoult's law

(i)  $\frac{P_A}{P_A^0} = X_A$

(ii)  $P_A X_A = P_A^0$

(iii)  $P_A = X_A / P_A^0$

(iv)  $P_A = P_A^0 (1 - X_A)$

(d) Which one is reduced phase rule ?

(i)  $F = C - P + 1$

(ii)  $F = C - P + 2$

(iii)  $F + P = C + 2$

(iv)  $F = C + P - 1$

- (e) An increase in equivalent conductance of a strong electrolyte with dilution is due to
- (i) increase in ionic mobility of ions
  - (ii) 100% ionisation of electrolyte at normal dilution
  - (iii) increase in both the number of ions and ionic mobility of ions
  - (iv) increase in number of ions

2. Answer the following questions : **(any five)**

2×5=10

- (a) What do you mean by advancement of a reaction? Express the reaction rate in terms of advancement.
- (b) Explain how will you determine the equivalent conductivity of  $\text{CH}_3\text{COOH}$  at infinite dilution by Kohlrausch's law.
- (c) How does molar conductivity of strong electrolyte vary with concentration? Explain with diagram.
- (d) Why  $\text{H}^+$  ion has exceptionally high ionic mobility?

(e) Define 'Components' and 'Degrees of freedom'.

(f) What is the triple point of water? Why is it different from the normal melting point of ice? 1+1=2

(g) State and explain lever rule.

3. Answer the following questions : **(any five)**  
5×5=25

(a) What is meant by standard free energy change of a reaction? Obtain expression for Gibb's free energy of mixing ( $\Delta G_{mix}$ ) of ideal gas. 1+4=5

(b) (i) Establish the relationship between  $K_p$  and  $K_c$ . Under what conditions  $K_p = K_c$ ? 3

(ii) Calculate the number of moles of  $Cl_2$  produced in the reaction?



when 1.00mole of  $PCl_5$  is heated at  $250^\circ C$  in a  $10.0dm^3$  vessel.  
( $K = 0.041$ ) 2

(c) Write short notes on :

(i) Debye-Huckel theory of strong electrolytes 3

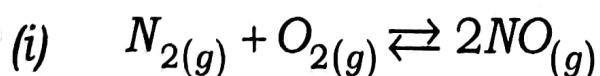
(ii) Ionic molality 2

(d) Deduce Clausius-Clapeyron Equation. Give its application for liquid-vapour equilibrium. 3+2=5

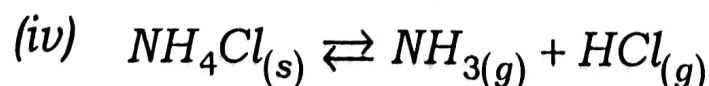
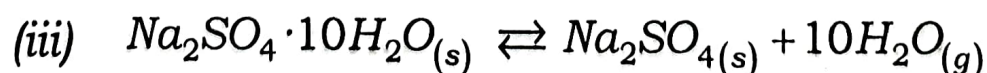
(e) (i) The electrical resistance of a column of 0.05M NaOH solution of diameter 1cm and length 50cm is  $5.55 \times 10^3 \text{ Ohm}$ . Calculate its resistivity, conductivity and molar conductivity. 3

(ii) Sketch the conductometric—titration curves of HCl vs NaOH. Give an explanation of variation of conductance from the curves. 2

(f) Find the no. of components and degrees of freedom for the following systems : 1×5=5



(ii) An aqueous solution of  $CH_3COOH$



(v) A binary azeotrope

(g) Draw the phase diagram of lead-silver system. How can you explain pattinson's process for the desilverisation of lead from argentiferous lead with the help of the diagram ?  $2+3=5$

(h) (i) Define chemical potential. How does it vary with temperature and pressure ? 3

(ii) State Nernst distribution law. Under what conditions is the law valid ? 2

4. Answer the following questions : **(any one)**  
 $10 \times 1 = 10$

(a) (i) Discuss the phase diagram of sulphur. Justify the diagram with proper explanation.  $4+3=7$

(ii) Write short note on steam distillation. 3

(b) (i) What is transport number ? Describe the Hittorf's method employed in determining the transport number of an ion.

$2+5=7$

(ii) How can you determine the solubility product of a salt by conductance measurements?

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