

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) $\text{Scm}^2\text{mol}^{-1}$

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

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

(iv) Sm^{-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 CH_3COOH at infinite dilution by Kohlrausch's law.

(c) How does molar conductivity of strong electrolyte vary with concentration ? Explain with diagram.

(d) Why H^+ ion has exceptionally high ionic mobility ?

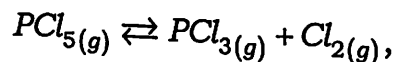
- (e) Define 'Components' and 'Degrees of freedom'.
- (f) What is the triple point of water? Why is it different from the normal melting point of ice? 1+1=2
- (g) State and explain lever rule.

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 (ΔG_{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

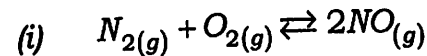
(ii) Ionic molality 2

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

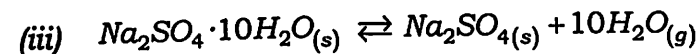
(e) (i) The electrical resistance of a column of $0.05M NaOH$ solution of diameter $1cm$ and length $50cm$ is $5.55 \times 10^3 Ohm$. Calculate its resistivity, conductivity and molar conductivity. 3

(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)**
10×1=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? 3
