

2023

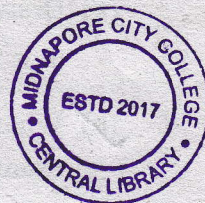
3rd Semester Examination

CHEMISTRY (Honours)

Paper : C 5-T

[Physical Chemistry - II]

[CBCS]



Full Marks : 40

Time : Two Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Group - A

1. Answer any *five* questions : 2×5=10
- (a) At what temperature K_p and K_c value of the reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ is same?
 - (b) Explain abnormal transport number with an example.
 - (c) What are the dimension and SI unit of coefficient of viscosity?
 - (d) Depict the wave function of 1st four energy states of a particle in a one dimensional box.

P.T.O.

(2)

- (e) Do conductance, specific conductance and molar conductance depend on cell constant? Explain.
- (f) State Nernst distribution law.
- (g) Draw with proper explanation $\log K_p$ vs. $1/T$ plot for an exothermic reaction.
- (h) What is meant by linear operator? Give one example.

Group - B

Answer any four questions : $5 \times 4 = 20$

2. (a) Evaluate the commutator,

$$\left[\left(\frac{d}{dx} + x \right), \left(\frac{d}{dx} - x \right) \right].$$

- (b) State with reason which of the following functions is acceptable over the indicated interval (i) $\sin x$ (0, π) (ii) $\tan x$ (0, π).

3. (a) Depict with explanation conductometric titration curve of $AgNO_3$ vs. HCl .

- (b) The specific conductance of a saturated solution of $AgCl$ is $1.55 \times 10^{-6} \text{ ohm}^{-1}\text{cm}^{-1}$. The mobility of Cl^- and Ag^+ are 5.6×10^{-4} and $6.8 \times 10^{-4} \text{ cm}^2\text{s}^{-1}\text{volt}^{-1}$ respectively. Calculate the solubility product of $AgCl$.

(3)

4. (a) For a particle in a 1D box of length 2\AA calculate the probability of finding the particle between 0 to 1.1\AA .

- (b) Construct the Hamiltonian of a linear simple harmonic oscillator.

5. (a) Discuss the effect of addition of inert gas to the equilibrium of a reaction.

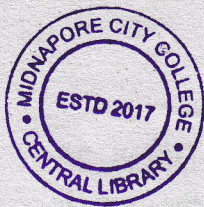
- (b) Calculate entropy of mixing when 2 moles of hydrogen gas is mixed with 3 moles of nitrogen at 27°C .

6. (a) Write the principle of Stokes method for determination of viscosity of a liquid.

- (b) Equivalent conductance of a weak monobasic acid at infinite dilution is $388.5 \text{ mho cm}^2\text{eqv}^{-1}$. Find the equivalent conductance of 0.1 M solution, the degree of dissociation of which is 6%.

7. If K_p is the equilibrium constant of the reaction $PCL_5 \rightleftharpoons PCL_3 + Cl_2$ at temperature T and pressure P , then express degree of dissociation of PCL_5 in terms of K_p and P . Hence discuss the effect of pressure on the equilibrium of the reaction. Judge whether it supports the Le-Chatelier's principle or not.





(4)

Group - C

Answer any *one* questions : 10×1=10

8. (a) Define molar conductance. Both for strong and weak electrolyte molar conductance increases with dilution. Explain with reason. 4
- (b) For the reversible reaction $2A + B = 2C$, ΔG° at 500 K is 2 kJ. Find the equilibrium constant of the reaction $A + \frac{1}{2}B = C$ at 500 K? 3
- (c) What is the de-Broglie wavelength of an electron that has been accelerated through a potential difference of 100 volt? 3
9. (a) Derive Gibbs-Duhem equation. 3
- (b) Judge whether the operator d^2/dx^2 is hermitian or not. 3
- (c) The viscosity coefficient of ethanol at 25°C is 0.0109 poise and activation energy for viscous flow of ethanol is 3.23 kcal mol⁻¹. Calculate the viscosity coefficient at 0°C. 3
- (d) Write thermodynamic criteria for a solution to be ideal. 1

Handwritten calculations and notes:

298

$\ln K = -\frac{\Delta G^\circ}{RT}$

$\ln K = -\frac{2000}{8.314 \times 500}$

$\ln K = -0.48$

$K = e^{-0.48} = 0.62$

298

$\ln K = -\frac{\Delta G^\circ}{RT}$

$\ln K = -\frac{3230}{8.314 \times 298}$

$\ln K = -1.62$

$K = e^{-1.62} = 0.19$

584.00 - 1568 = 9.23