

2018

CBCS

3rd Semester

CHEMISTRY

PAPER—C5T

(Honours)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Physical Chemistry-II**Group—A**

Answer any one questions :

1. (a) Evaluate the commutator, $[\hat{x}, \hat{p}_x]$. 3
- (b) Define ionic mobility and ion conductance with proper unit. Derive the relation between them. 1+1+3

(Turn Over)

- (c) Define Hermitian operator. 2
2. (a) Discuss how viscosity of liquid varies with temperature ?
- (b) The transport number of Na^+ in NaCl is 0.385. The equivalent conductance of infinite dilution of NaCl is $126.5 \text{ S.cm}^2.\text{equiv}^{-1}$. Calculate the distance traversed in one hour by Na^+ , when NaCl solution is electrolysed between two electron of 1 cm apart. The potential difference is 30 volts. 3
- (c) If ψ_1 and ψ_2 are non degenerate eigen functions of a Hermitian operator, then show that they are orthogonal.

Group—B

Answer any four questions : 4x5

3. (a) Derive Gibbs—Duhem equation. 3
- (b) Show that entropy change of mixing of two ideal gases is maximum for 50–50 mixing. 2
4. (a) Derive thermodynamically partition coefficient when a solute exists as monomer in one phase and exists as dimer completely in another phase. 2
- (b) Viscosity coefficient of a liquid decreases by 2% per degree celsius rise in temperature. Show that if

viscosity coefficient is measured at 25°C and 75°C, then the ratio of viscosity coefficient will be (1:e).

3

5. (a) How can you justify La Chatelier's principle thermodynamically. 3
- (b) At 2000 K, for the reaction $N_2 + O_2 \rightleftharpoons 2NO$ $\Delta G^\circ = 22000 - 2.5T$. Calculate K_p at this temperature ?

6. (a) Define stationary state in quantum mechanics. 2
- (b) Determine with reasons, whether each of following function are acceptable or not over the indicated interval.

(i) $\sin^{-1} x$ (-1,1) (ii) $\frac{1}{x}$ (0,∞) 1½ × 2

7. (a) Derive an expression for energy of a particle confined in a box of length 'a'. 3
- (b) If ψ is an eigen function of two operators α and β then they must commute. 2
8. (a) In a moving boundary experiment 0.01 mole per litre LiCl, the boundary in a tube having cross sectional area 0.125 cm², moves through 7.3 cm in 1490 second when 1.8×10^{-3} amp. current is used calculate t_+ .

- (b) Write Kohlrausch's law of independent migration of ions for Na_2SO_4 with respect to equivalent ion conductance. 2

Group—C

Answer any *five* question : 5×2

9. (a) Define Linear operator in quantum mechanics with example. 2
- (b) What is the expression of transport no. of Na^+ for a solution containing NaCl and KCl .
- (c) Write Poiseuille's equation for viscosity of liquid and mention when it is valid.
- (d) Write the expression of fugacity w.r.t. 2nd virial coefficient for a real gas. 2
- (e) How can you determine λ° graphically for weak electrolyte? 2
- (f) How equilibrium constant depends on temperature and pressure. 2
- (g) For the reaction $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ K_p at 300 K is 50. Find ΔG° from K_c at 300 K.
- (h) Calculate ΔS_{mix} when 2 mole N_2 and 3 mole H_2 are mixed at 25°C and 1 atm pressure. 2