

B.Sc. 3rd Semester (Honours) Examination, 2020-2021

CHEMISTRY

Course ID: 31411

Course Code: UG/CHEM/301/C-5

Course Title: Physical Chemistry-II

Time: 1 Hour 15 Minutes

Full Marks: 25

The figures in the right hand side margin indicate marks.

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

1. Answer *any five* questions of the following: 1×5 = 5

- (a) Explain why the viscosity of ethyl alcohol is greater than that of ether?
- (b) Cite two advantages of conductometric titration.
- (c) What is the unit of fugacity coefficient?
- (d) Plot variation of chemical potential with pressure for three states of a substance.
- (e) Write the expression of distribution coefficient when the solute undergoes dimerization in one layer.
- (f) Indicate which of the following operator is linear operator?
(i) $\frac{d}{dx}$ (ii) \sin
- (g) Mention the experiments which demonstrate the particle and wave nature of electron.
- (h) What happens to the photoelectrons when intensity of the incident light is doubled?

2. Answer *any two* questions of the following: 5×2 = 10

- (a) Define viscosity coefficient. What is its dimension? Write down the Poiseuille's equation. Show how the time of flow of a liquid in a viscometer will change when the radius of the capillary is doubled? 1+1+1+2 = 5
- (b) Show that the yield of NH_3 is maximum when the ratio of N_2 & H_2 is 1:3. Show a graphical plot of the free energy G of a reacting system against the degree of advancement (ξ). 4+1 = 5

(c) Show that entropy of mixing of a binary mixture attains maxima at equal moles of the components. What is the physical significance of partial molar quantities? $3.5+1.5 = 5$

(d) Define Normalised wave function. The wave function of a particle moving within a box of length L is given by $\psi_n = A \sin \frac{n\pi x}{L}$. Find the value of A. $1+4 = 5$

3. Answer *any one* question of the following: $10 \times 1 = 10$

(a) (i) Define equivalent conductance. Mention its unit in S.I. system.

(ii) The specific conductance of a solution of NaCl in water decreases with dilution while the equivalent conductance increases with dilution. - Explain.

(ii) The crystallographic radii of Na^+ and Cl^- are 95 pm and 181 pm. Estimate the ion conductivities using Stokes's law ($\eta = 0.89 \times 10^{-3} \text{ Pa s}$). Could Walden's rule be used for hydroxide ion?

(iii) Explain abnormal transport number with suitable example.

$(1+1)+2+(3+1)+2 = 10$

(b) (i) What is Compton effect?

(ii) Show that the operators of position and x-component momentum are not commuting. Mention its physical significance.

(iii) Construct the Hamiltonian operator for particle in a one dimensional box of length L. Hence derive the expression of energy and normalize the wave function.

$1+(2+1)+(3+3) = 10$
