



বিদ্যাসাগর বিশ্ববিদ্যালয়
VIDYASAGAR UNIVERSITY
Question Paper

B.Sc. Honours Examinations 2020

(Under CBCS Pattern)

Semester - III

Subject: CHEMISTRY

Paper : C 5-T & C 5-P

(Physical Chemistry - II)

Full Marks : 60 (Theory-40 + Practical-20)

Time : 3 Hours

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

The figures in the margin indicate full marks.

[THEORY]

Answer any *two* questions :

2 × 20 = 40

1. (a) “Viscosity of a liquid decreases with increase in temperature”– why?
- (b) Do you find any inconsistency in the statement – “equivalent conductance of 0.01 (M) KCl is greater than its specific conductance”.
- (c) What is abnormal transport number?
- (d) Write the Van’t Hoff’s reaction isobar.
- (e) Are all the reactions reversible? – explain.
- (f) What is fugacity? How it different from pressure?
- (g) $[x, P_x] = ?$

- (h) Normalize the function : $\sin x (0, 2\pi)$
- (i) Do the x and d/dx commute ?
- (j) Define chemical potential. what is its significance ? **2×10=20**
2. (i) (a) State the Fick's law of diffusion in liquids and find out the dimension of the coefficient of diffusion. **5**
- (b) The viscosity co-efficient of gaseous CO_2 at 27°C is 15×10^{-4} Poise. Find its molecular diameter. **3**
- (ii) (a) What would be the effect of dilution on the magnitude of the following properties of a strong electrolyte ? Conductivity, equivalent conductivity. Explain with reasons. **3 + 3**
- (b) The mobility of NH_4^+ is $7.623 \times 10^{-8} \text{ m}^2\text{v}^{-1}\text{s}^{-1}$. Calculate its ionic conductivity. **4**
- (c) Define transport number. **2**
3. (i) (a) Derive Gibbs-Duhem relation for chemical potential. **3**
- (b) Can equilibrium constant be independent of temperature ? **2**
- (ii) (a) What are limitations of Nernst's distribution law. **2**
- (b) Write the Raoult's law for ideal solution. Mention its deviations. **3**
- (iii) (a) Find the lowest kinetic energy of an electron in a rectangular box of dimensions $1 \times 10^{-13} \text{ cm}$, $1.5 \times 10^{-13} \text{ cm}$ and $2 \times 10^{-13} \text{ cm}$. **3**
- (b) What is the eigen value of the eigen function e^{-ax} of P_x operator ? **2**
- (iv) (a) What is the physical significance of zero point energy with respect to uncertainty principle for simple Harmonic oscillator ? **3**
- (b) Prove that Hermitian operators give real eigen values. **2**
4. (i) (a) Predict the nature of changes expected into the following cases :
- i) Liquid = Vapour; Heat is applied.
- ii) $2\text{CO} + \text{O}_2 = 2\text{CO}_2$; Volume of the system is decreased. **3**
- (b) For a certain reaction $\Delta G^\circ = 0$; What is the value of equilibrium constant ? **2**
- (c) Write the Ostwald's dilution law and explain. **2½**
- (d) Write the principles of moving-boundary method. **2½**

- (ii) (a) The equivalent conductance at 18°C of a 0.01 N aqueous solution of ammonia is $9.6 \text{ ohm}^{-1} \text{ cm}^2 \text{ equiv}^{-1}$. For $\Lambda^{\infty}(\text{NH}_4\text{Cl}) = 129.8$ and ion conductances of OH^- and Cl^- ions are 174 and 65.6, respectively. Calculate the degree of dissociation of 0.01 N NH_4OH . **3**
- (b) From the Van't Hoff's isotherm, what do you expect the type of the plot of ΔG and T. **2**
- (c) When a conductometric titration is possible? **2**
- (d) Can pH of a solution be negative? **2**
- (e) What is linear operator? Is d^2/dx^2 a linear operator? **1**

Paper - C-5-P
(Physical Chemistry - II)
(Practical)

Discuss any one of the following experiments with respect to working principle experimental procedure and nature of plot. **1 × 20 = 20**

1. Study of viscosity of (glycerol) with respect to water. **20**
 2. Determination of partition coefficient for the distribution of I_2 between water and CHCl_3 . **20**
 3. Conductometric titration of an acid (strong, weak/monobasic, dibasic) against strong base. **20**
-