



Bachelor of Science (B.Sc.) Semester—II Examination

CH-202 : CHEMISTRY

(Physical Chemistry)

Compulsory Paper—II

Time—Three Hours]

[Maximum Marks—50

N.B. :— (1) All **FIVE** questions are compulsory and carry equal marks.

(2) Draw diagrams and give chemical equations whenever necessary.

1. (A) What is Joule-Thomson effect ? Show that in Joule Thomson experiment the enthalpy of gas remains constant. What is Joule-Thomson Coefficient ? 5
- (B) State and explain Hess's law of constant heat summation.

The heat of combustion of $\text{CH}_4(\text{g})$ is -887 kJ.mol^{-1} . The heat of formation of $\text{CO}_2(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ are -393 kJ.mol^{-1} and -285 kJ.mol^{-1} respectively. Calculate the heat of formation of methane. 5

OR

- (C) Distinguish between reversible and irreversible process. 2½
- (D) Calculate the maximum work done when two moles of an ideal gas expand isothermally and reversibly from 2dm^3 to a volume of 10 dm^3 at 293 K . ($R = 8.314\text{ JK}^{-1}\text{ mol}^{-1}$). 2½
- (E) Define the following terms :—
- (i) State functions and path functions
 - (ii) Open, closed and isolated systems. 2½
- (F) Derive relation between heat of reaction at constant volume and at constant pressure. 2½
2. (A) Draw and discuss the phase diagram of sulphur system. 5
- (B) What is critical solution temperature ? Discuss the systems :
- (a) With lower critical solution temperature
 - (b) With upper critical solution temperature. 5

OR

(C) Define degrees of freedom. Calculate the degrees of freedom of :

(a) Sulphur at transition point

(b) Pb-Ag system at the eutectic point. $2\frac{1}{2}$

(D) Discuss Pattinson's process of desilverisation of lead. $2\frac{1}{2}$

(E) State and explain Nernst Distribution law. $2\frac{1}{2}$

(F) In the distribution of benzoic acid between water and benzene, the following results were obtained.

C_1 (In Water)	0.163	0.436
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C_2 (In Benzene)	0.761	5.43
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What information do you gather regarding the molecular state of benzoic acid in benzene ? $2\frac{1}{2}$

3. (A) State and explain Kohlrausch's law of independence migration of ions. The molar conductances of sodium acetate, hydrochloric acid and sodium chloride at infinite dilution are 91.0×10^{-4} , 426.16 and $126.45 \times 10^{-4} \text{ Sm}^2 \text{ mol}^{-1}$ respectively, at, 25°C . Calculate the molar conductance at infinite dilution for acetic acid. 5



- (B) What do you mean by transport number? Describe moving boundary method for the determination of transport number. 5

OR

- (C) The resistance of 0.5 M solution of an electrolyte is 45 ohm^{-1} . Calculate equivalent conductance if the electrodes of the cell are 2.2 cm apart and have a cross sectional area of 3.8 cm^2 . $2\frac{1}{2}$
- (D) How do specific conductance, equivalent conductance and molar conductance vary with dilution? $2\frac{1}{2}$
- (E) How will you determine the solubility of sparingly soluble salts by conductance measurement? $2\frac{1}{2}$
- (F) Discuss the variation conductance in the titration of a mixture of strong acid and weak acid against a strong base. 104 $2\frac{1}{2}$
4. (A) What is first order reaction? Derive the equation of rate constant for first order reaction. 5
- (B) Discuss transition state theory. Derive an expression for the rate constant based on equilibrium constant. 5

OR



(C) Describe the Ostwalds Isolation Method for the determination of order of reaction. $2\frac{1}{2}$

(D) For a reaction $A \rightarrow B$, the rate constant doubled when temperature was raised from 25°C to 35°C . Calculate the activation energy of the reaction. $2\frac{1}{2}$

(E) What do you mean by activation energy ? How Arrhenius equation helps in the calculation of activation energy graphically ? $2\frac{1}{2}$

(F) Discuss the Lindemann's theory as applied to the unimolecular reaction. $2\frac{1}{2}$

5. Attempt any **TEN (10)** questions out of the following :—

- (i) Give two statements of first law of thermodynamics.
- (ii) Define bond energy.
- (iii) Define inversion temperature.
- (iv) Explain the term metastable equilibrium.
- (v) Give any two limitations of Nernst Distribution Law.
- (vi) State Henry's law.
- (vii) Write Debye-Huckel Onsagar equation.



(viii) Define molar conductivity.

(ix) Give two advantages of conductometric titration ?

(x) Define rate constant.

(xi) What do you mean by zero order reaction.

(xii) Give any two advantages of transition state theory over collision theory.

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