



**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  $-887 \text{ kJ.mol}^{-1}$ . The heat of formation of  $\text{CO}_2(\text{g})$  and  $\text{H}_2\text{O}(\text{l})$  are  $-393 \text{ kJ.mol}^{-1}$  and  $-285 \text{ kJ.mol}^{-1}$  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  $2\text{dm}^3$  to a volume of  $10\text{ dm}^3$  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 :

- Sulphur at transition point
- Pb-Ag system at the eutectic point. 2½

(D) Discuss Pattinson's process of desilverisation of lead. 2½

(E) State and explain Nernst Distribution law. 2½

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

C <sub>1</sub> (In Water)	0.163	0.436
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C <sub>2</sub> (In Benzene)	0.761	5.43
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What information do you gather regarding the molecular state of benzoic acid in benzene ? 2½

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  $91.0 \times 10^{-4}$ , 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  $45 \text{ ohm}^{-1}$ . Calculate equivalent conductance if the electrodes of the cell are 2.2 cm apart and have a cross sectional area of  $3.8 \text{ cm}^2$ . 2½

(D) How do specific conductance, equivalent conductance and molar conductance vary with dilution ? 2½

(E) How will you determine the solubility of sparingly soluble salts by conductance measurement ? 2½

(F) Discuss the variation conductance in the titration of a mixture of strong acid and weak acid against a strong base. *(Ans)* 2½

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. 2½

(D) For a reaction  $A \rightarrow B$ , the rate constant doubled when temperature was raised from  $25^\circ C$  to  $35^\circ C$ . Calculate the activation energy of the reaction. 2½

(E) What do you mean by activation energy ? How Arrhenius equation helps in the calculation of activation energy graphically ? 2½

(F) Discuss the Lindemann's theory as applied to the unimolecular reaction. 2½

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. 10