Roll No. .....

(12/24)

5193

B.Sc. EXAMINATION

(Third Semester)

(For Batch 2011 & Onwards)

CHEMISTRY

CH-202

Physical Chemistry

Time : Three Hours *Maximum Marks :* 26

Note : Attempt *Five* questions in all, selecting *two* questions from Section A and *two* questions from Section B. Q. No. **1** is compulsory.

1. (a) Why absolute value of internal energy can not be determined ?

   (b) What is the internal energy change in cyclic process ?

   (c) Are bond energy of all C-H bonds in methane same ? Comment on your answer.

(d) Explain the role of zinc in Parke's process for desilverisation of lead.

(e) What are the temperature and pressure conditions for better yield of ammonia production from Haber process ?

(f) Can we find the distribution coefficient of iodine between water and ethyl alcohol ? Why *or* why not ? 1×6=6

Section A

2. (a) Derive an expression for Joule-Thomson coefficient for real gas. Also determine inversion temperature expression from it.

(b) Calculate w, q and ΔU when 0.75 mole of an ideal gas expands isothermally and reversibly at 27°C from a volume of 15 L to 25 L.

(c) Prove that the heat given to the system at constant pressure is always equal to enthalpy change of that system.

2½+1½+1

3. (a) Explain the fact that internal energy is a state function but work and heat are path functions.

(b) Calculate the C-C bond energy from the following data :

(i) $2\ C_{(graphite)} + 3\ H_{2(g)} \rightarrow C_2H_{6(g)}$, $\Delta H = -86.47$ kJ

(ii) $C_{(graphite)} \rightarrow C(g)$, $\Delta H = 716.7$ kJ

(iii) $H_2(g) \rightarrow 2\ H_{(g)}$, $\Delta H = 435.9$ kJ.

Assume the C-H bone energy as 416 kJ.

(c) Derive adiabatic expression PV^{γ} = constant. 1½+2+1½

4. (a) Prove that the internal energy of the system is function of temperature only.

(b) Show that the slope of the adiabatic curve is steeper than the slope of isothermal curve both graphically and thermodynamically.

(c) Calculate the amount of work done when one mole of an ideal gas contained in a bulb of 10 L capacity at 1 atmospheric is allowed to enter into an evacuated bulb of 100 L capacity. 2+2+1

Section B

5. (a) Derive thermodynamic derivations of Nernst Distribution law.

(b) Derive Van't Hoff reaction isochore to explain the effect of temperature on equilibrium constant.

(c) Why 100% extraction is not possible howsoever large number of installments of extracting solvent may be used ? 2+2+1

6. (a) Derive Clausius-Clapeyron equation for the liquid vapour equilibrium in intergrated form. Explain its application to show the effect of pressure on the melting point of ice.

(b) Discuss the application of distribution law for the determination of degree of hydrolysis and hydrolysis constant for aniline hydrochloride. 3+2

7. (a) Derive the law of chemical equilibrium thermodynamically.

(b) Describe the modification of distribution law when solute undergoes association in one of the solvent.

(c) At 15°C an aqueous solution of oxalic acid containing 8 g of it in 100 ml of water, is in equilibrium with an ethereal solution containing 0.45 g of oxalic acid in 100 ml ethereal solution. The solubility of oxalic acid in water at 15°C is 10 g per 100 ml. calculate the solubility of ether. 1½+1½+2