Exam. Code : 103203
Subject Code : 1309

B.A./B.Sc. 3rd Semester

CHEMISTRY

(Physical Chemistry—B)

Time Allowed—3 Hours] [Maximum Marks—35

Note :— Attempt **FIVE** questions in all, selecting at least **ONE** question from each section. The **fifth** question may be attempted form any section. Each question carries **7** marks. Log tables may be asked for.

SECTION—A

1. (a) For an ideal gas, show that PV^r = constant.

   (b) Show that for isothermal expansion of an ideal gas, work done in a reversible process is greater than in irreversible process.

   (c) The Van der Waal constants 'a' and 'b' for a gas are 0.21and 0.017 in dm^3 atm units. Calculate the inversion temperature of the gas. 2,3,2

2. (a) Deduce an expression for Joule-Thomson coefficient.

   (b) While E is a definite quantity, q and w are not definite properties. Comment on this statement.

   (c) Four moles of an ideal gas expand reversibly and isothermally at 300°K from a volume of 1.5 dm^3 to 3.0 dm^3. Calculate q, w, ΔU and ΔH for the process. ($R = 8.314\ JK^{-1}\ mol^{-i}$) 2,1,4

SECTION—B

3. (a) State second law of thermodynamics in different ways. What was the need for this law ?

   (b) Calculate the standard enthalpy of formation of acetylene from the heat of combustion of C_2H_2, C (graphite) and H_2 given as -1300 kJ mol^{-1}, -395 kJ mol^{-1} and -286 kJ mol^{-1} respectively. 2.5,4.5

4. (a) Discuss in detail the cornot reversible cycle for establishing the maximum convertibility of heat into work.

   (b) Taking entropy as a function of T and V, show that

$$\left(\frac{\partial S}{\partial V}\right)_T = \frac{R}{V}.$$ 4,3

SECTION—C

5. (a) Explain Nernst heat theorem. How does it lead to the emergence of third law of thermodynamics ?

   (b) Find the molar increase in E, H, S, G and A in expanding one litre of an ideal gas at 27°C to 100 liters at the same temperature. 3,4

6. (a) Under what conditions A and G can be used as criteria for thermodynamic equilibrium and spontaneity ?

(b) Give thermodynamic derivation of law of mass action.

(c) Calculate the equilibrium constant (K) for the reaction :

$$2\,NOCl(g) \rightleftharpoons 2\,NO(g) + Cl_2(g) \text{ at } 400°K.$$

Given : $\Delta H° = 80$ kJ mol^{-1}, $\Delta S° = 120$ kJ mol^{-1} at 400°K. 2,2,3

SECTION—D

7. (a) State and derive Nernst distribution law. Elaborate its application in the process of extraction.

(b) Outline the principle of stream distillation. How will you find the molecular mass of a liquid by means of it ? 3.5,3.5

8. Explain the following terms giving suitable examples :

(a) Triple point

(b) Peritectic point

(c) Eutectic point

(d) Azeotrope 2,2,2,1