BS/2110 5213/ NH

Paper: III
SEM-III
Title of the Paper: **Physical Chemistry**

Time allowed: 3 hrs Maximum Marks: 26

Note: Attempt **Five** questions in all selecting **Two** questions each from each Section-A and B and the Entire Section-C which is compulsory. Each question in Section-A and Section-B carries 4 marks and compulsory question 9 carries **10** marks

Section A

1. a) Why do gases show Joule Thomson effect? Why is it zero for ideal gases?

   b) Derive the mathematical expression for first law of thermodynamics.

2. a) Explain the term enthalpy of neutralization.

   b) What is the thermodynamic basis of Stess's law

   c) The molar heat capacities at constant pressure of $H_2(g)$, $Cl_2(g)$ and HCl(g) are respectively 29.3, 34.7 add 28.9 JK^{-1}. If the heat of formation of HCl(g) at constant pressure at 293 K is a -91.2 KJ, what will be the heat of formation of 313 K.

3. a) Show that

   $$TV^{r-1} = \text{constant}$$

   during adiabatic reversible expansion of an ideal gas

   b) Show that the heat capacity of an ideal gas at constant volume having transitional kinetic energy is equal to 3 cal/mol

4. a) State and explain car notes theorem show that the efficiency of a reversible car not cycle is T2 - 31 / 82 where 21 hour the temperature of the source and sink

   b) write short note on thermodynamic scale of temperature

Section B

5. a) Mixing of gases is always accompanied by increase in entropy. Justify by drawing the required expression.

   b) How can efficiency of carnot engine be increased.

6. a) How do the result of Nernst theorem lead to the enunciation of 3rd law of thermodynamics

   b) Define work function. Show how

   $$-\Delta = W_{max}$$

7. a) Explain residual entropy calculate for $FClO_3$.

   b) Four moles of an ideal gas expands isothermally from 1 litre to 10 litre at 300K. Calculate the change in the free energy of the gas ($R = 8.314\ JK^{-1}\ mol^{-1}$)

8. a) Derive Van's Hoff equation giving the effect of temperature on equilibrium constant

   b) Predict suitable condition for getting maximum yield of Sulphur trioxide according to Le-Chatelier's principle

Section C

9.

   a. Give the difference between state and path function
   b. What are the limitations of first law of thermodynamics?
   c. What is the Clausius inequality. Show that for spontaneous cooling

      $$dS_{total} > 0$$

   d. Define thermodynamic equation of state
   e. Derive the expression

      $$K_p = K_c\ (RT)^{\Delta n}$$