

Time: 3 Hrs

Note: The candidates are required to attempt two questions each from Section A, B carrying 04 Marks each and the entire Section C consisting of 05 short answer type questions carrying 02 Marks each.

SECTION-A

1. Explain the term **Joule-Thomson Coefficient**. Show that Joule-Thomson Coefficient is zero for an ideal gas while it has a positive value in case of real gas.

(4)

2. State and explain the terms:p

(i) Molar heat capacity at constant volume (C_v)

(ii) Molar heat capacity at constant pressure (C_p)

Show that for one mole of an ideal gas

$$C_p - C_v = R$$

(4)

3. One mole of benzene is converted reversibly into vapor at the boiling point (80.2°C) by heating it. The vapor undergoes expansion against 1 atm. Pressure, assuming that the vapor behaved ideally. Calculate ΔH , w and ΔU for the process. The heat of vaporization of benzene is 396 Jg^{-1} .
4. (a) A Carnot engine converts one-sixth of heat input into work. When the temperature of the sink is reduced by 62°C , the efficiency is doubled. Find the temperature of the source and the sink.
(b) The enthalpy of combustion of C_2H_4 at 17°C and constant volume is -1389.9 kJ . What is the enthalpy of combustion at constant pressure?

(4)

(2+2)

SECTION-B

5. Calculate the entropy change if two moles of N_2 , three moles of H_2 and three moles of NH_3 are mixed at constant temperature, assuming that no chemical reaction is occurring.
6. (a) Explain the Nernst heat theorem.
(b) State and explain the Third law of thermodynamics.
7. State and explain Le-Chatelier's principle, work out the conditions which would favor the formation of ammonia by Haber's process:

(4)

(2+2)

P.T.O



$$\Delta H = -99.38 \text{ kJ}$$

(4)

8. Derive Clapeyron-Clausius equation in the form

$$dP/dT = \Delta H_v/TV_g$$

Under what conditions can it be integrated and how?

(4)

SECTION-C

9. (I) What is meant by inversion temperature?
(II) State the second law of Thermodynamics
(III) State and explain Hess's law of constant heat summation.
(IV) What is meant by Chemical potential?
(V) Explain the term residual entropy.

(5X2=10)