11920

3 Hours / 70 Marks   Seat No.

Instructions – (1) All Questions are *Compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

(7) Use of Steam tables, logarithmic, Mollier's chart is permitted.

Marks

1.   **Attempt any FIVE of the following:**   10

a) Define open system and closed system.

b) Define Intensive and Extensive properties with examples.

c) State first law of thermodynamics.

d) Give the expression for C_p and C_v.

e) Define Internal energy.

f) Define degree of freedom.

g) Define standard entropy.

2.   **Attempt any THREE of the following:**   **12**

   a) Define system, surrounding, boundary.

   b) Give the statement of Zeroth law of thermodynamics and write its mathematical statement.

   c) Draw the phase diagram of Sulphur system.

   d) Calculate the increase in entropy of 3 mol of an ideal gas as it changes from 27°C at 0.2 atm to 727°C at 2 atm. C_p = 7 cal/mol.k.

3.   **Attempt any THREE of the following:**   **12**

   a) Define :

      (i)   Isothermal process.

      (ii)   Adiabatic process.

      (iii) Isochloric process.

      (iv)   Isobaric process.

   b) Define Enthalpy, Heat Capacity, Specific heat.

   c) State Third law of Thermodynamics.

   d) Two mole of an ideal gas is heated from 90°K to 320°K. Calculate ΔS if

      (i)   The volume is kept constant.

      (ii)   The pressure is kept constant. Assume that C_v = 1.5 R.

4.   **Attempt any THREE of the following:**   **12**

   a) Derive relation between ΔG and K.

   b) Give the statement of Second law of thermodynamics.

   c) State Clausius inequality. Give the expression for reversible and irreversible process.

   d) Determine degree of freedom for the following.

      (i)   ICE $\rightleftharpoons$ Water $\rightleftharpoons$ Vapour
             (s)   (l)   (g)

   e) Derive the relation between K_p and K_y.

5.   **Attempt any TWO of the following:**   **12**

    a) Prove that $C_p - C_v = R$ for an ideal gas.

    b) State Gibb's phase rule and define the term involved.

    c) Derive Van't Hoff equation.

6.   **Attempt any TWO of the following:**   **12**

    a) Explain phase diagram of Water system with sketch.

    b) Write Van-der Waal's equation of state. Also explain Van-der Waal's constant.

    c) Calculate K_p for ammonia synthesis at a total pressure of 30 atm at 400°C. Reaction is $N_2 + 3H_2 \longleftrightarrow 2NH_3$. Percentage of ammonia at equilibrium is 10%.

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