UG 4th Semester Examination - 2025 (Under NCCF)
Award: - B.Sc
Discipline : Chemistry
Course Type : MJ
Course Code : BSCCEMMJ402
Course Name : Physical Chemistry-II

Full Marks : 35(Regular)   **Time - 2 hours**

1. **Answer any five questions:**   1×5=5
    a)   Give expression of relative lowering of vapour pressure.
    b)   Partial molar temparature is irrelevent: Justify.
    c)   Define Le-Chatellier's principle.
    d)   What are the thermodynamic criteria for a solution to be ideal ?
    e)   Give expression of Joule Thomson coefficient.
    f)   Give expression of Van't Hoff isochore.
    g)   Define thermodynamic probability and mention its minimum value.
    h)   What is molal elevation constant ?

2. **Answer any five questions:**   5×2=10
    a)   What do you mean by entropy ?
    b)   Define inversion temperature.
    c)   In order to increase the efficiency of a carnot engine would you increase the temperature of the source or decrease the temperature of the sink.
    d)   One mole of He and one mole of Hydrogen, are mixed at constant temperature. What will be the entropy change ?
    e)   Plot cannot cycle in a P-T diagram. labelling the steps.
    f)   Show that the osmotic pressure equation is equivalent to ideal gas equation.
    g)   Evaluate the value of K_b for water mentioning its unit.
    h)   Why existence of Helium at a higher percentage in upper atmosphere is observed than that near the surface of earth?

3. **Answer any two questions for the students appearing for their regular courses:**   5×2=10
    a)   i)   Establish the relation $\left[\delta \left(G/T \right)/\delta T \right]_p = -H/T^2$.
         ii) Calculate the entropy change when 10gm of Neon is heated from 27ºC to 227ºC at constant volume. (C_v = 3 cal/ mole).   3+2
    b)   Deduce the expression ofm pressure and internal energy in terms of partition function.   2½+2½
    c)   i)   Show that Joule Thomson expansion is isoenthalpic process.
         ii) A 0.1 (M) $NaCl$ solution is found to be isotonic with 1.1% urea (mol wt 60). Calculate degree of dissociation of $NaCl$.   3+2
    d)   Derive osmotic pressure equation from Thermodynamic consideration.   5

4. **Answer any one question:** $10\times1=10$

    a) For a Van der waals' gas, show that Joule Thomson coefficient
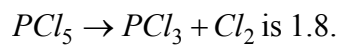
       $\mu = 1/C_p[(2a/RT) - b]$.

       Comment on the condition when

       i) $2a/RT > b$ and

       ii) $2a/RT < b$ 5+5

    b) i) Establish the Van't Hoff equation

         $\mathrm{dln}K_p /dT = \Delta H / RT^2$

     ii) Calculate the pressure in atmosphere necessary to obtain a 50% dissociation of PCl_5 at 25ºC, The equilibrium constant for the reaction.

         $PCl_5 \rightarrow PCl_3 + Cl_2$ is 1.8.   6+4

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