Practice session III (Homework)

Thermodynamics

1. The heats of solution of one mole of KCl in 200 moles of H_2O under one atmospheric pressure are $\Delta H = 4339$ cal at 21°C and $\Delta H = 4260$ cal at 23°C. Calculate ΔH value at 25°C. (Hint: Kirchhoff's equation)
2. The molar enthalpies of combustion of isobutane and n-butane are –2871 kJ $\cdot mol^{-1}$ and –2878 $kJ.mol^{-1}$, respectively at 298K and 1 atm. Calculate $\Delta_r H$ for the conversion of one mole of n-butane to one mole of isobutane.

3. n mole of ideal gas undergoes isothermal free expansion from volume V_1 to V_2 at temperature T. Calculate the (a) $\Delta_{sys}S$, (b) $\Delta_{surr}S$, (c) $\Delta_{total}S$. Comment on the result.

4. The Joule Thompson coefficient of a van der Waal's gas is given by the expression,

   $$\mu_{JT} = -\frac{1}{C_p}\left(\frac{\partial H}{\partial P}\right)_T = -\frac{1}{C_p}\left(\frac{2a}{RT} - b\right)$$

   Calculate ΔH for the isothermal expansion of one mole of CO_2 from 100 atm to 1 atm at 200K. Given, a = 3.59 $atm.lit^2.mol^{-2}$ and b = 0.043 $lit.mol^{-1}$

5. Show that, the difference in $(C_p - C_v)$ value for a non-ideal gas differs from that of a perfect gas by the expression: $\left(\frac{\partial V}{\partial T}\right)_P \left(\frac{\partial U}{\partial V}\right)_T$