KIIT questions (previous years)

Thermodynamics questions

1. (a) 10moles of an ideal gas expand isothermally from a volume of 2litres to 20litres. Find the entropy change accompanying the expansion. [2 × 10

(b) For the reaction, $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$, the free energy changes at 25 ^{0}C and 35 ^{0}C are –3.98 and –3.37 Kcal respectively. Calculate the heat of reaction at 35 ^{0}C. [4

(c) For the dissociationreaction of a metal oxide, $\Delta H = 35$ kJ/mol and $\Delta S = 0.08$ kJ/K at 1 atm pressure. Find the temperature up to which the reaction would not be spontaneous.

(b) Enthalpy and entropy changes of a reaction are 40.63KJ/mol and 108.8 J/molK respectively. Predict the feasibility of the reaction at 27 ^{0}C. [4

(a) The voltage of the cell $Pb/PbSO_4| Na_2SO_4.10\ H_2O| HgSO_4/Hg$ is 0.9647V at 25 ^{0}C. The temperature coefficient is 1.74×10^{-4} VK^{-1}. Calculate the value of ΔG, ΔS and ΔH. [4

3. (a) Show that for $H_2O\,(l) \longleftrightarrow H_2O(v)$, $ln\frac{P_2}{P_1} = \frac{\Delta H_V}{R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$.

Where P_1 & P_2 are vapour pressures at T_1 & T_2 temperatures respectively and ΔH_V is the molar heat of vaporisation of water.

(b) What is Chemical potential? Derive Gibb's Duhem equation.

(b) Show that,

$\Delta G = \Delta H + T\left[\frac{\partial(\Delta G)}{\partial T}\right]_P$, where G, H, T,and P are usual thermodynamic parameters.

6. (a) The equilibrium constant for a reaction at 327 °C and 427 °C are 10^{-12} and 10^{-7} respectively. Calculate the enthalpy change of the reaction. [4]

$\Delta H = 402$ kJ/mol

(b) At what temperature a reaction would be spontaneous; if the $\Delta H = 30$ KJ/mol and $\Delta S = 0.08$ KJ/mol at 1 atm.pressure for the reaction. [4]

375 K

(b) The degree of dissociation of PCl_5 at 500K and 1 atm pressure is 0.75. Find K_p.

(c) For the dissociationreaction of a metal oxide, $\Delta H = 35$ kJ/mol and $\Delta S = 0.08$ kJ/K at 1 atm pressure. Find the temperature up to which the reaction would not be spontaneous.

(b) K_p for a reaction is 1.6×10^{-4} at 400^0 C. Find K_p at 500^0 C? [4
Heat of reaction in this temperature range is –25.0 kcal.

(b) The equilibrium constant for a reaction at 400 °C is 1.5×10^{-5}. Find the same at 500 °C. Given heat of the reaction is -90 kJ/mole.

Give the graphical representation of vapour pressure vs. mole fraction for non ideal solution and explain the curves.