UNIT-6

Q1 Calculate the enthalpy of formation of $C_6H_6(l)$ given that the enthalpy of combustion of benzene is $-3267.7\ KJ$ and the enthalpies of formation of $CO_2(g)$ and $H_2O(l)$ are $-393.3\ KJ$ and $-286.6\ KJ$ respectively.

Q2 Calculate the enthalpy of combusion of enthylene at 298K and one atmosphere pressure. Given that enthalpy of formation of $CO_2(g)$, $H_2O(l)$ and $C_2H_4(g)$ are -393.7, -241.8 and $+52.3\ KJ\ mol^{-1}$ respectively.

Q3 Calculate the enthalpy of transition when C (diamond) changes to C (graphite) given that the enthalpies of combustion of C (diamond) and C (graphite) are -393.5 and $-395.4\ KJ\ mol^{-1}$ respectively.

Q4 Calculate the enthalpy of hydration of $BaCl_2(s)$ to $BaCl_2 \cdot 2H_2O(s)$ given that the enthalpy of solution of $BaCl_2(s)$ is $-20.6\ KJ\ mol^{-1}$ and that of $BaCl_2 \cdot 2H_2O(s)$ is $+8.8\ KJ\ mol^{-1}$

Q5 For a reaction at 298K

$$2A + B \longrightarrow C$$

$\Delta H = 400\ KJ\ mol^{-1}$ and $\Delta S = 0.2\ KJ\ K^{-1}\ mol^{-1}$

At what temperature will the reaction become spontaneous considering ΔH and ΔS to be constant over the temperature range?

Q6 For a reaction $2A(g) + B(g) \longrightarrow 2D(g)$

$\Delta U_{298} = -10.5\ KJ$ and $\Delta S^{\ominus} = -44.1\ JK^{-1}$

Calculate ΔU_{298} for the reaction and predict whether the reaction is

spontantaneous or not.

Q7 Equilibrium constant for the reaction is 10. Calculate the value of ΔG^θ ; given.
$R = 8\ J\ K^{-1}\ mol^{-1}$ $T = 300K$

Q8 Comment on the thermodynamic stability of NO(g) and $NO_2(g)$ given:

$\frac{1}{2} N_2(g) + \frac{1}{2} O_2(g) \longrightarrow NO(g)$ $\Delta_f H^\theta = 90\ KJ\ mol^{-1}$

$NO(g) + \frac{1}{2} O_2(g) \longrightarrow NO_2(g)$ $\Delta_f H^\theta = -74\ KJ\ mol^{-1}$

Q10 Calculate the entropy change in surroundings when 1.0 mol of $H_2O(l)$ is formed under standard conditions. Given $\Delta H^\theta = -286\ KJ\ mol^{-1}$

Q11 In following changes state whether order has increased or decreased and consequently the direction of change of entropy of system

(i) $H_2O(l) \longrightarrow H_2O(s)$

(ii) $CO_2 + H_2O \xrightarrow{Light}$ carbohydrate $+ O_2$

(iii) Protein (helical form) $\longrightarrow$ Protein

(iv) Natural egg $\longrightarrow$ Hard boiled egg

(v) $H_2(g) \longrightarrow 2H(g)$

Q12 If water vapour is assumed to be a perfect gas, molar enthalpy change for vaporisation of 1 mole of H_2O at 1 bar and 100°C is $41\ KJ\ mol^{-1}$. Calculate the internal energy change when.

(i) 1 mole of water is vaporised at 1 bar pressure and 100°C.

(ii) 1 mole of water is converted into ice.