Course: CHM202

Energetics and dynamics of chemical reactions

Assignment – III

Q.1 The standard reaction enthalpy for the hydrogenation of propene,

$$CH_2 = CHCH_3(g) + H_2(g) \rightarrow CH_3CH_2CH_3(g)$$

is -124 kJ mol-1. The standard reaction enthalpy for the combustion of propane,

$$CH_3CH_2CH_3(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$$

is -2220 kJ mol-1. Calculate the standard enthalpy of combustion of propene employing the Hess's law.

Q.2 Given the following heats of reaction at 25 ºC:

$C_2H_4(g) + 3O_2(g) = 2CO_2(g) + 2H_2O(l)$; ΔH^o = -337.3 KCal

$2H_2(g) + O_2(g) = 2H_2O(l)$; ΔH^o = -136.6 KCal

$2C_2H_6(g) + 7O_2 = 4CO_2(g) + 6H_2O(l)$; ΔH^o = -745.6 KCal

Calculate the enthalpy for the reaction; $C_2H_4(g) + H_2(g) = C_2H_6(g)$ at 25 ºC.

Q.3 At constant volume at 27 ºC,

$2C_6H_6(g) + 15O_2(g) = 12CO_2(g) + 6H_2O(l)$; ΔU = -1600 KCal

$C_2H_2(g) + 5O_2(g) = 4CO_2(g) + 2H_2O(l)$; ΔU = -620 KCal

Find the heat of polymerisation of acetylene to benzene at constant pressure.

Q.4 Heat of neutralization of

(i) $NH_4OH + HCl = NH_4Cl + H_2O$; ΔH^o = -51.46 K.J./mole,

(ii) $CH_3COOH + NaOH = CH_3COONa + H_2O$; ΔH^o = -50.63 K.J./mole,

(iii) $NaOH + HCl = NaCl + H_2O$; ΔH^o = -57.54 K.J./mole.

Calculate the heat of neutralization of NH_4OH and CH_3COOH.

Q.5 At 25 ºC the heats of the following reactions are:

(a) $Na(s) + \frac{1}{2}Cl_2(g) = NaCl(s)$; ΔH^o = -98,230 Cal

(b) $H_2(g) + S(g) + 2O_2(g) = H_2SO_4(l)$; ΔH^o = -193,910 Cal

(c) $2Na(s) + S(s) + 2O_2(g) = Na_2SO_4(s)$; ΔH^o = -330,500 Cal

(d) $\frac{1}{2}H_2(g) + \frac{1}{2}Cl_2(g) = HCl(g)$; ΔH^o = -22,060 Cal

Calculate the heat of reaction at constant volume at 25 ºC for

$2NaCl(s) + H_2SO_4(l) = Na_2SO_4(s) + 2HCl(g)$.

Q.6 Calculate the enthalpy of formation of $N_2O_5(g)$ from the following data:

$2NO(g) + O_2(g) = 2NO_2(g)$; ΔH^o = -114 KJ $mole^{-1}$

$4NO_2(g) + O_2(g) = 2N_2O_5(g)$; ΔH^o = --110 KJ $mole^{-1}$

$N_2(g) + O_2(g) = 2NO(g)$; ΔH^o = -181 KJ $mole^{-1}$.