Friday Worksheet **Name: …….**

Enthalpy worksheet 8

Consider

1) When 24.6 g of H2S was burned in excess oxygen, 376 kJ was released. What is the Δ*H* for the following equation?

2 H2S(g) + 3 O2(g) 2 SO2(g) + 2 H2O(g); Δ*H* = ?

,Step 1 Find the mol of H_2S

⇨ 24.6 / 34.0 = 0.724

Step 2 Find the energy released per mol of H_2S.

⇨ 376 / 0.724 = 519 kJ/mol

Step 3 Looking at the equation we need to find the energy release from two mol of H_2S.

⇨ Energy released from two mol of H_2S = 2 X 519 = 1038 kJ

⇨ *ΔH = -1038 kJ/mol*

2) Calculate H for the following equation:

$PbCl_2(s) + Cl_2(g) \Rightarrow PbCl_4(l)$ Δ*H* = ???

Given: 1) ---- $Pb(s) + Cl_2(g) \Rightarrow PbCl_2(s)$ $\Delta H_1 = -359.4$ kJ

2) ---- $Pb(s) + 2\ Cl_2(g)\ PbCl_4(l)$ $\Delta H_2 = -329.3$ kJ

Step 1 Reverse equation 1 and change the sign of the Δ*H*

3) ---- $PbCl_2(s) \Rightarrow Pb(s) + Cl_2(g)$ $\Delta H_3 = +359.4$ kJ

Step2 Add equation 3) and 2)

4) ---- $PbCl_2(s) + Cl_2(g) \Rightarrow PbCl_4(l)$ Δ*H* = 359.4 -329.3 = +30.1 kJ/mol

3) Give a balanced thermochemical equation for the combustion reaction of liquid octane. Show all states and the Δ*H* of the reaction. You may need to refer to your VCAA Data Booklet

Step 1 Write the balanced chemical equation.

$2C_8H_{18}(l) + 25O_2(g) \Rightarrow 16CO_2(g) + 18H_2O(g)$

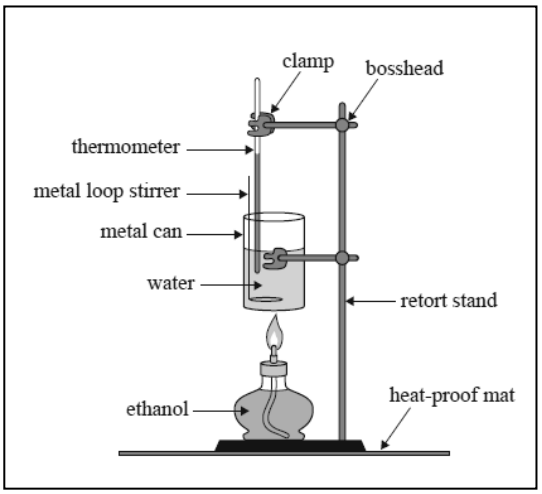
Step 2 According to the data book the molar heat of combustion of liquid octane is 5464 kJ/mol

⇨ Hence for two mols of liquid octane the Δ*H* = - 2 X 5464 kJ/mol = -10928 kJ/mol

4) The enthalpy for the combustion of ethanol is provided in the data book. This combustion of ethanol is represented by the following equation.

$C_2H_5OH(l) + 3O_2(g) \Rightarrow 2CO_2(g) + 3H_2O(l)$

A spirit burner used 1.90 g of ethanol to raise the temperature of 100.0 g of water in a metal can from 27.0 °C to 42.0 °C.



a) Calculate the percentage of heat lost to the environment and to the apparatus.

Step 1 calculate the mol of ethanol

=> 1.90 / 46.1 = 0.0412 mol

Step 2 calculate the theoretical release of 0.0412 mol of ethanol

=> Form the data book molar heat of combustion of ethanol is 1364

$C_2H_6O(l) + O_2 \Rightarrow H_2O(l) + CO_2(g)$ ΔH = - 1364kJ/mol

=> Energy released by 0.412 mol = 0.0412 X 1364 = 56.2 kJ

Step 3 Calculate the energy that went into heating the water

=> energy = 4.18 X 100.0 X (42.0 - 27.0) = 6.27 kJ

Step 4 Calculate the percentage of energy lost

=> ((56.2 – 6.27) / 56.2) x 100 = 88.8%

b) The heat content of coal is measured kJ/gram. Why is it not measure in kJ/mol?

Coal is not a pure substance and hence has no molar mass. Coal is a mixture of organic compounds and hence its heat content is measure in kJ/gram.