Friday Worksheet **Name: ……………….**

Calorimetry worksheet 1

1) Ethanol is used to calibrate a bomb calorimeter. 2.29 g of ethanol is placed in the bomb calorimeter and reacted with excess oxygen. After the reaction is complete, the temperature of the water surrounding the bomb in the calorimeter has increased by 34.2°C. Calculate, to an appropriate number of significant figures, the calibration factor of the calorimeter, in kJ°C^{-1}.

   Use the data sheet to obtain the molar enthalpy of combustion of ethanol as **1364 kJ mol^{-1}**

   Step 1 $n_{ethanol}$ = 2.29 / 46.0 = 0.0498

   Step 2 Find the energy released by 0.0498 mol of ethanol.

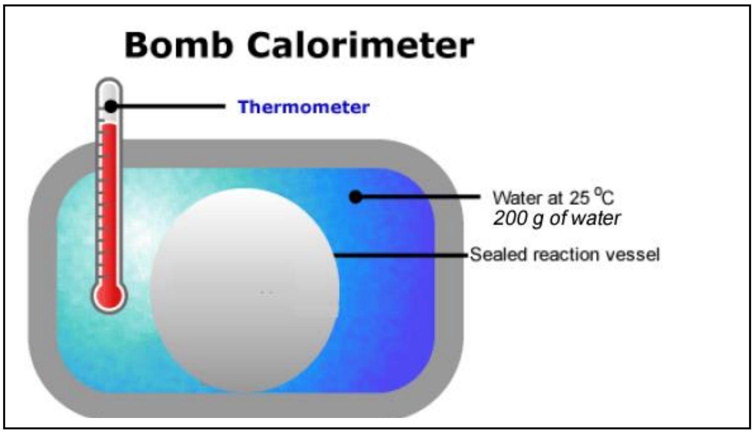
   0.0498 X 1364 = 67.93 kJ

   Step 3 Find the calibration factor of the calorimeter

   67.93/34.2 = 1.99

   The question often arises about the impact of relative atomic masses on significant figures, particularly H given as 1.0 in the data book. It may be appropriate to quote the accepted rules for the use of significant figures in calculations.
   1. For multiplication and division, the result contains the same number of significant figures as the measurement with the fewest significant figures.
   2. For example, the mass of 0.251 mol H_2 = 0.251 x 2.0 = 0.50. For addition and subtraction, the result has the same number of decimal places as the measurement with the fewest decimal places. For example,
   M(C_2H_6O) = 2 x 12.0 + 6x1.0 + 1x16.0 = 46.0. For example, 34.652 – 2.36 = 32.29.

2) The same bomb calorimeter as in question 1) above is used to burn a pure 0.300 gram sample of ethane gas in excess oxygen. The temperature was originally measured at 25.00 °C and reached a maximum of 32.82 °C .



   a) Calculate the mol of ethane.

   0.300 / 30.0 = 0.0100 mol

   b) Calculate the molar heat of combustion of ethane

   Amount of energy produced from 0.300 grams of ethane

   => E = C_f X ΔT

   =>E = 1.99 X 7.82 = 15.5 kJ

   => E = 15.5 / 0.0100 = 1550 kJ mol^{-}

c) Write the combustion reaction of ethane

$2C_2H_6(g) + 7O_2(g)$ => $4CO_2(g) + 6H_2O(g)$

d) Calculate the ΔH of the combustion reaction in c) above.

=> 2 X 1550 kJ mol^{-}

=> $2C_2H_6(g) + 7O_2(g)$ => $4CO_2(g) + 6H_2O(g)$ ΔH = -3100 kJ mol^{-}