Calorimetry worksheet 3


1) An electric current of 1.40A at a potential difference of 6.50V was passed for 3.50 minutes through the heating coil of a small calorimeter, as shown below, containing 100.0 mL of water. The temperature rose from 23.21 to 25.35 °C.
   a) Find the calibration factor of this calorimeter in J °C⁻

   Simple Calorimeter

   THERMOMETER

   STIRRER

   LID

   casing

   container wall

   solution

   insulation

   b) 50.0 mL of a 1.00M NaOH is mixed with 50.0 mL of a 1.00M HCl. Each solution was originally at 20.00 °C and after mixing reached a maximum temperature of 23.10 °C.
      i.   Write a balanced chemical equation for the neutralisation reaction above.

      ii.   Calculate the ΔH of the reaction
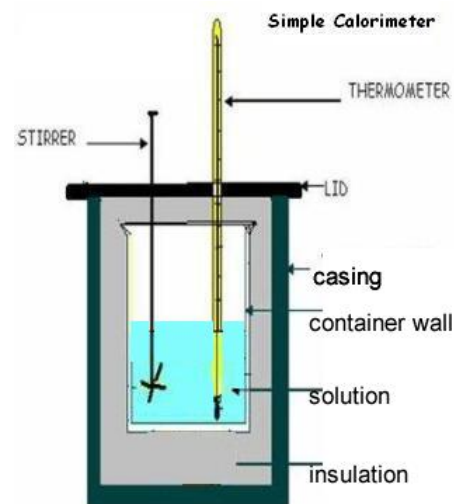
   c) Using the same calorimeter 50.0 mL of a 0.800M NaOH is mixed with 50.0 mL of a 1.00M HCl. Calculate the expected maximum temperature of the mixture if both solutions are originally at 20.0 °C

2) Substance "X" has a molar mass of 87.1 g mol⁻ , a density of 0.891 g/mL and burns in oxygen according to the equation below.

$$2X(l) + 3O_2(g) => 3Z(g) + 2Y(g) \quad \Delta H = -25.4 \text{ kJ/mol}$$
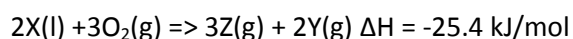
1.15 mL of X is placed in a bomb calorimeter with excess oxygen gas. The bomb calorimeter contains 10.0 mL of water at 20°C.

   a) What amount of X , in mol, is placed in the calorimeter?

   b) What amount of energy, in Joules, is given off by 1.15 mL of X?

   c) If 60.0% of the total energy generated by the combustion of X goes into heating the water, while 40% goes into heating the container or escapes into the environment, calculate the final temperature of the water in the calorimeter.