MEGA LECTURE

Topic 4 Exercise 3 – measuring enthalpy changes

In all the following questions, assume that the densities and specific heat capacities of the solutions are the same as pure water
i.e. $\rho = 1.0\ gcm^{-3}$ and $c = 4.18\ Jg^{-1}K^{-1}$

1. Zinc will displace copper from copper (II) sulphate solution according to the following equation:
   $CuSO_4(aq) + Zn(s) \rightarrow Cu(s) + ZnSO_4(aq)$
   If an excess of zinc powder is added to 50 cm^3 of 1.0 $moldm^{-3}$ copper(II) sulphate, the temperature increases by 6.3 ^oC. Calculate the enthalpy change for the reaction.

2. Magnesium will also displace copper from copper (II) sulphate solution. If an excess of magnesium is added to 100 cm^3 of 1.0 $moldm^{-3}$ copper(II) sulphate, the temperature increases by 46.3 ^oC. Calculate the molar enthalpy change for the reaction

3. When 5.73 g of sodium chloride (NaCl) dissolves in 100 cm^3 of water, the temperature of the water fell from 22.4 ^oC to 19.8 ^oC. Calculate the enthalpy change of the reaction.

4. When 2.3 g of magnesium chloride dissolves in 200 cm^3 of water, the temperature rose by 3.4 ^oC. Calculate the enthalpy change for the reaction.

5. If 50 cm^3 of 0.1 $moldm^{-3}$ HCl and 50 cm^3 of 0.1 $moldm^{-3}$ NaOH are mixed, the temperature of the solution rises by 0.68 ^oC. Calculate the enthalpy change of the reaction in $kJmol^{-1}$.

6. If 50 cm^3 of 1.0 $moldm^{-3}$ NaOH is added to 25 cm^3 of 2.0 $moldm^{-3}$ CH_3COOH, the temperature rose by 5.3 ^oC. Calculate the molar enthalpy change for the reaction.

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7. A spirit burner containing ethanol (C_2H_5OH) was used to heat 100 cm^3 of water in a copper can by 30 ^oC. As a result, the mass of the spirit burner decreased by 0.62 g. Calculate the enthalpy of combustion of ethanol.

8. A spirit burner containing butan-1-ol (C_4H_9OH) was used to heat 200 cm^3 of water in a copper can by 20 ^oC. As a result, the mass of the spirit burner decreased by 0.81 g. Calculate the enthalpy of combustion of butan-1-ol.

9. Explain why measuring energy changes tend to result in an underestimate of the actual energy change in the reaction.