**Determining the enthalpy change of a reaction with the use of Arduino**

**(Teacher Notes)**

Sample Result :

1. Data Collected by Arduino System with temperature sensor (sampling rate = 1 sec)

Time of addition of Zinc powder = 173 second

Mass of Zinc powder = 4.02 g

2. Initial Temperature T1 = 20.19oC

Highest Temperature T2 = 69.06oC

Temperature difference (Δ*T* ) = 20.19-69.06 = -48.87 oC

3. Δ*H* = m *c* Δ*T*

 = 50.0 × 1.0 × 4.18 × (-48.87)

 = -10213.83 J

Zn(s) + CuSO4(aq) 🡒 ZnSO4(aq) + Cu(s)

Number of mole of copper (II) sulphate = 1.0 × 50.0×10-3 = 0.0500 mol

 Number of mole of zinc = 6.05/65.3 = 0.0926 mol

Mole ratio of CuSO4 : Zn = 1:1

Therefore, CuSO4 is a limiting reactant

Δ*Hper mole of CuSO4*

 = -10213.83/0.0500 = -204277 J mol-1

= -204.28 kJ mol-1

Answers for the questions:

 (Teachers may choose the questions appropriate for their students to work out.)

1. - Heat loss to the surroundings

- Specific Heat Capacity of the solution is not the same as that of water

- The total mass of the reaction mixture is not 50g

1. The reaction of zinc and copper(II) sulphate solution is exothermic. Therefore the temperature of the mixture increased when the reaction was underway.
After reaching the peak temperature, all copper(II) sulphate solution was reacted and the mixture started to cool down, as it lost its heat to the surrounding environment.

Note :

Stirring should be done through the experiment.

Experimental result comparison with Data Logger System:



The temperature was recorded simultaneously with

Data logger system with temperature sensor (sampling rate = 1 sec)

Arduino System with temperature sensor (sampling rate = 1 sec)

Data Collected simultaneously by Data Logger with temperature sensor (sampling rate = 1 sec)



The enthalpy change of the above reaction recorded by Pasco Datalogger system was -212.88 kJ mol-1. The enthalpy change recorded by Arduino System was -204.28 kJ mol-1.

The theoretical value of the enthalpy change of the above reaction was -217 kJ mol-1.