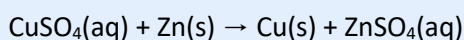


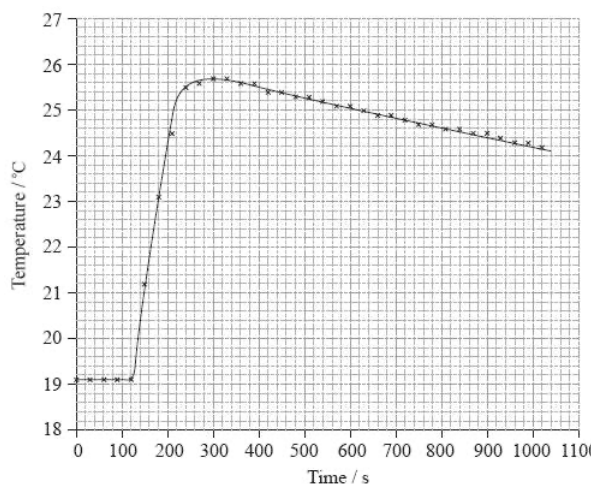
## SL & HL Questions on Measuring energy changes

1. When  $100 \text{ cm}^3$  of  $1.00 \text{ mol dm}^{-3}$  sodium hydroxide,  $\text{NaOH}(\text{aq})$ , is added to  $100 \text{ cm}^3$  of  $1.00 \text{ mol dm}^{-3}$  hydrochloric acid,  $\text{HCl}(\text{aq})$ , the temperature increases from  $19.3 \text{ }^\circ\text{C}$  to  $26.1 \text{ }^\circ\text{C}$ . Determine the enthalpy change of neutralization for the reaction.

2. A student determined the enthalpy change for the reaction:



She placed  $50 \text{ cm}^3$  of  $0.140 \text{ mol dm}^{-3}$  copper sulfate solution in a polystyrene cup and recorded the temperature for two minutes before adding an excess of zinc powder. She continued stirring and taking the temperature for a further fifteen minutes to produce the graph on the right.

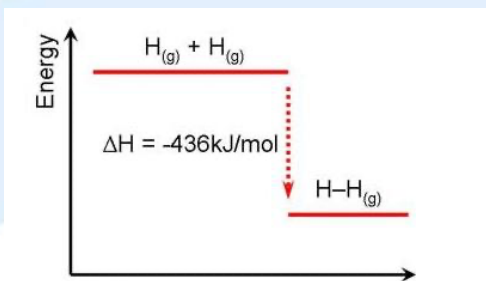


- Determine the temperature increase if there had been no heat lost to the surroundings and hence the enthalpy change for the reaction.
- State two assumptions that have been made in order to calculate the answer above from the data given.

3.  $1.21 \text{ g}$  of ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , was burned in a spirit burner. The heat produced raised the temperature of  $400 \text{ g}$  of water placed in a beaker above the flame from  $17.0 \text{ }^\circ\text{C}$  to  $29.9 \text{ }^\circ\text{C}$ .

- Calculate the enthalpy change, in  $\text{kJ mol}^{-1}$ , for the reaction taking place.
- State four reasons why this value is not equal to  $-1371 \text{ kJ mol}^{-1}$  which is the data book value for the standard enthalpy of combustion of ethanol.

4. Consider the following enthalpy level diagram



- What process is occurring during this reaction?
- Distinguish between *energy* and *enthalpy*.
- Explain whether the products are more or less thermodynamically stable than the reactants.