A-Level Chemistry

Teachers:

- Dr Dixon
- Mrs Hardaker
- Mrs Lenton

A required subject for applications to study Medicine, Dentistry and Veterinary Science at university.

Strong Maths skills required.

Lots of practical sessions and opportunities to complete CREST awards.

CHEMISTRY IS EVERYWHERE – lots of career opportunities.

Energetics Revision

Starter

1. Explain Enthalpy Change.
2. Draw and Energy profile diagram for the combustion of methane.
3. What is the most accurate way to measure 25cm^3 of HCl(aq)
4. $q=mc\triangle T$ What are the units of q?
5. What are the units for $\triangle H$?

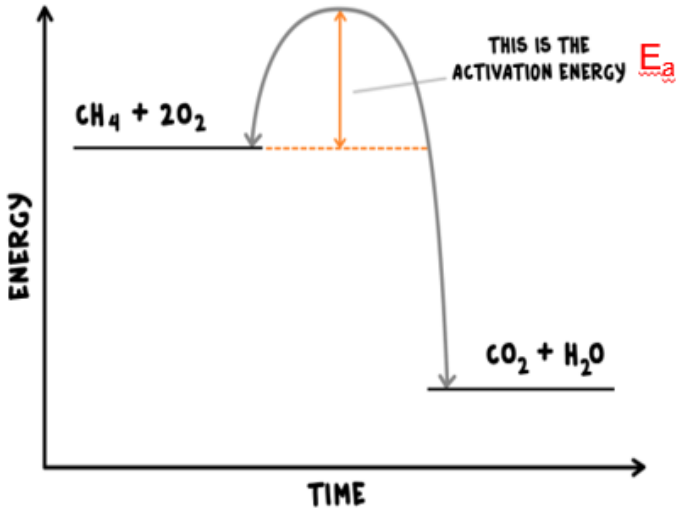
Energetics Revision

Starter

1. Explain Enthalpy Change.

The enthalpy change for a process is the heat energy exchanged with the surroundings at constant pressure.

2. Draw and Energy profile diagram for the combustion of methane.
3. What is the most accurate way to measure $25cm^3$ of HCl(aq)? Use a glass pipette or burette
4. $q=mc\Delta T$ What are the units of q? Joules (c is the specific heat capacity of water (4.18 $JK^{-1}g^{-1}$). M is mass of solution in grams
5. What are the units for ΔH? $KJmol^{-1}$

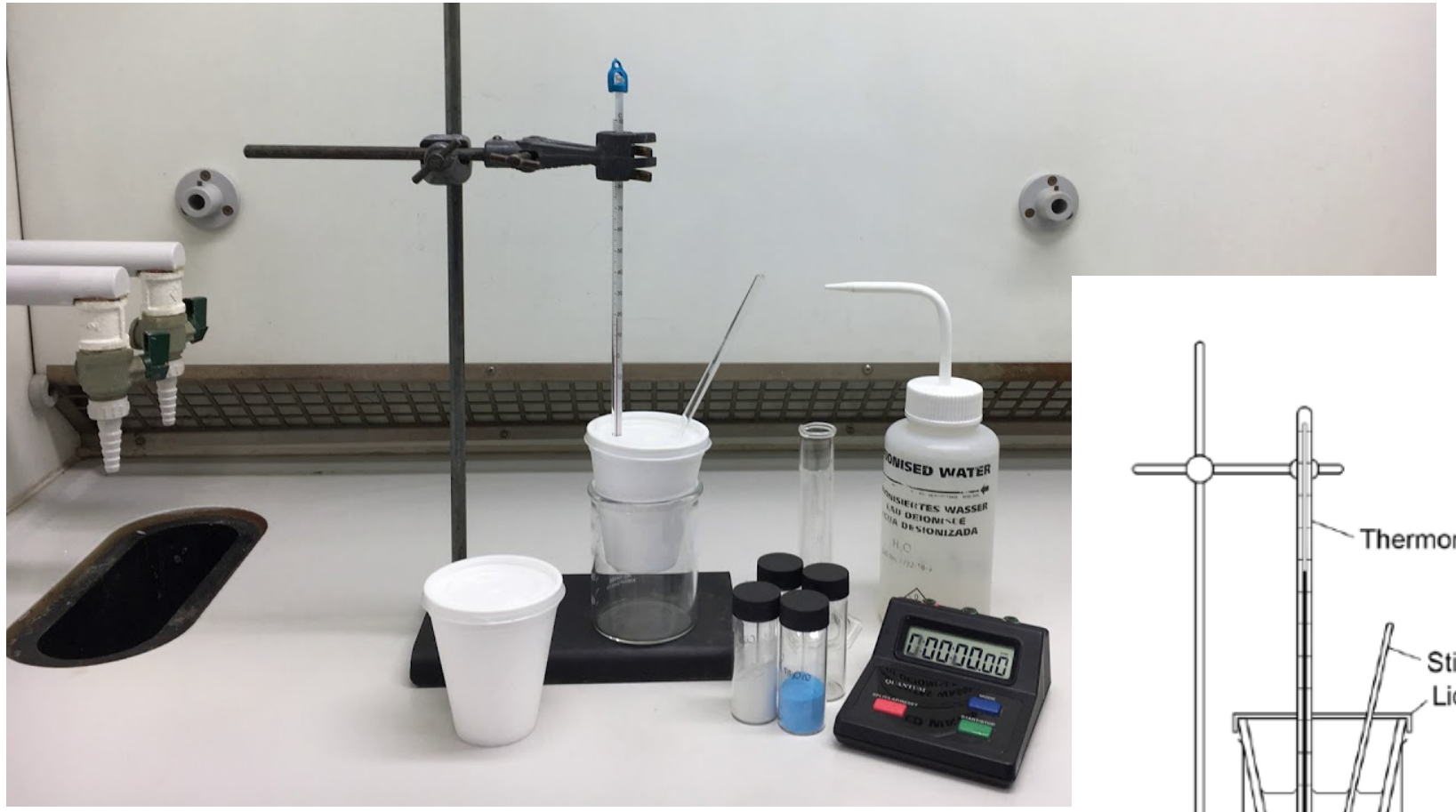


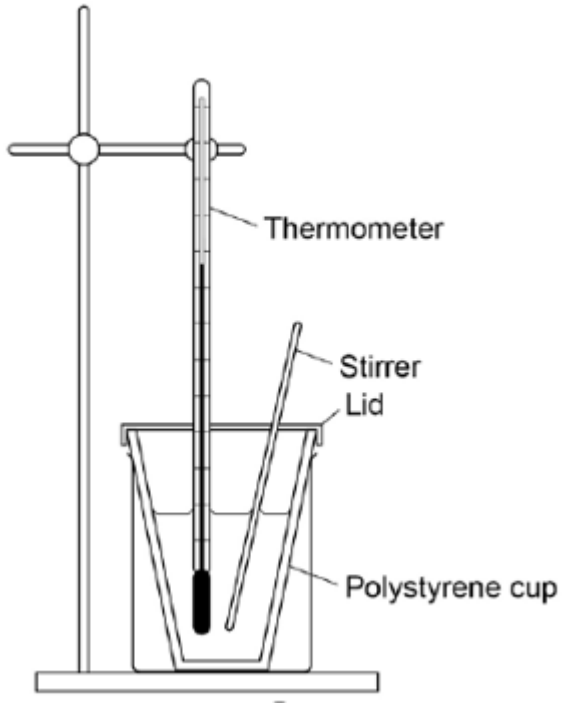
Task

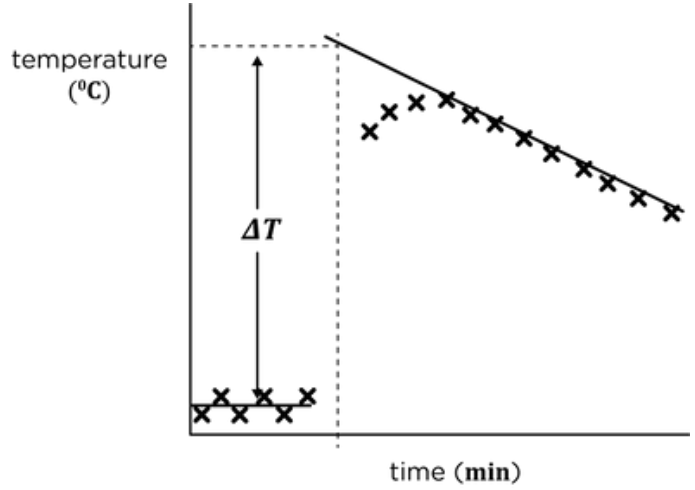
- Think about the question below and then make bullet point notes:

How could you measure the enthalpy change for the displacement reaction between copper sulfate(aq) and zinc(s)?

Hints for measuring enthalpy change

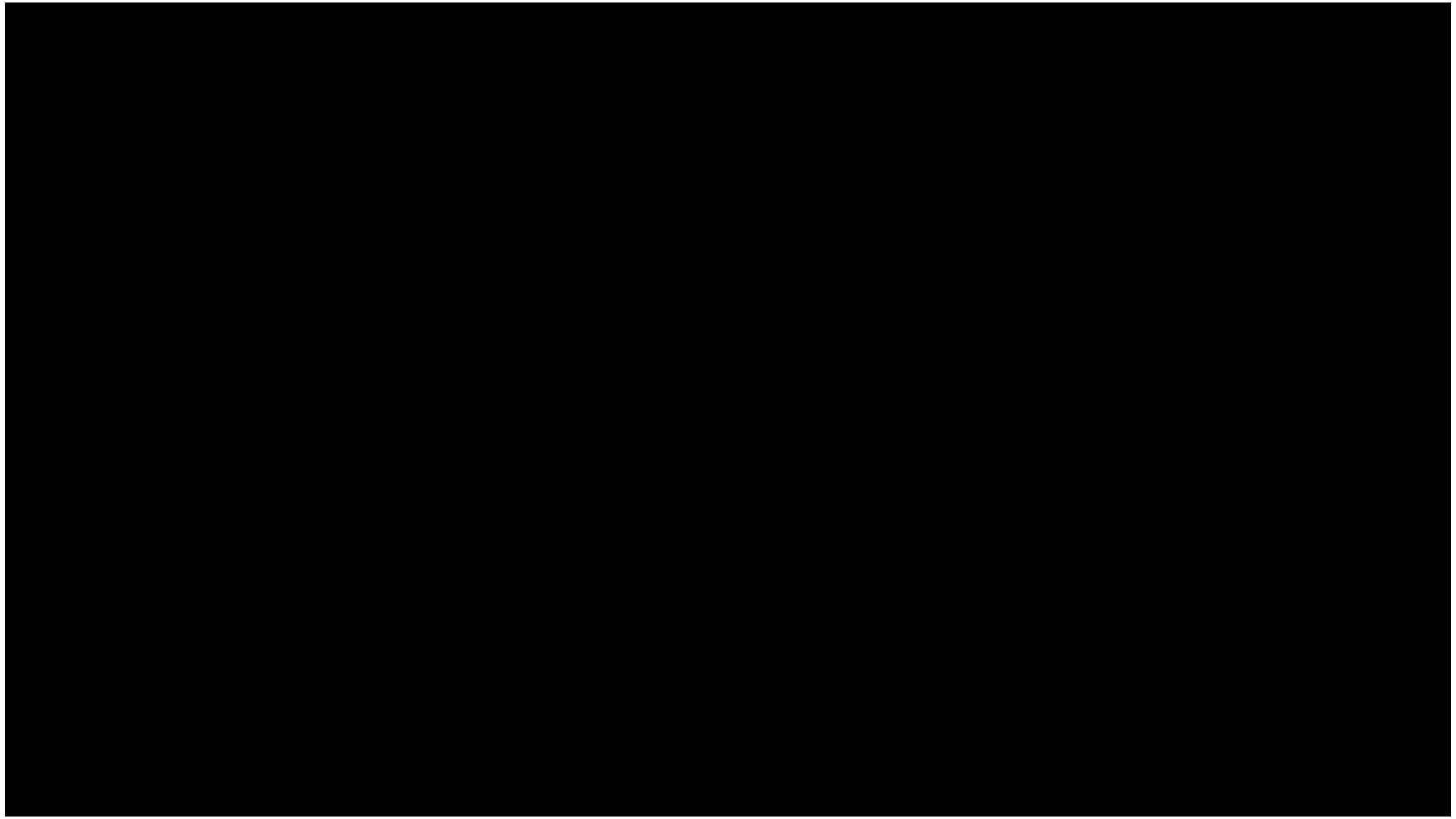






Video – Measuring Enthalpy Change

Watch the video – any improvements?



Improvements

- Do you think it would be best to reweigh the weighing boat after zinc powder is added to the copper sulfate?
- Why would you do this?
- Would it help to have a more concentrated solution of copper sulfate?
- Why was the Zinc powdered?
- Why is an accurate mass of Zinc needed if it is in excess?

Improvements

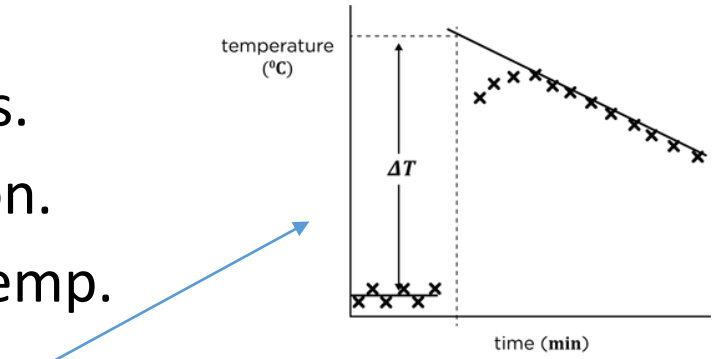
- Do you think it would be best to reweigh the weighing boat after zinc powder is added to the copper sulfate? Yes
- Why would you do this? Some powder may have been left in the boat and must be accounted for.
- Would it help to have a more concentrated solution of copper sulfate? It would give a bigger temperature change and so could improve accuracy of results.
- Why was the Zinc powdered? Greater surface area, reacts more quickly.
- Why is an accurate mass of Zinc needed if it is in excess? So that you can calculate the number of moles added – needed to calculate enthalpy change.

Write a detailed method.

Write a detailed method that could be used to measure the enthalpy change for the reaction between 6g of zinc powder and 25cm^3 of 1M copper sulfate solution.

Checkpoints - Measuring enthalpy change

- Measure out the solution into an insulated container, using a glass pipette (or burette).
- When you weigh a solid – weigh the container, empty and then reweigh the container (just in case some solid is left on the container)
- Measure the temperature of the solution every 60 seconds.
- Keep the thermometer vertical with the bulb in the solution.
- On the 4th minute, add the solid then continue to record Temp.
- Plot time (x-axis) vs Temperature (y-axis).
- Extrapolate back to when you added the solid and find temperature change, ΔT
- Use this and volume of solution to calculate q.
- Convert q to KJ (divide by 1000).
- Find number of moles of solid added.
- Calculate enthalpy change by dividing q (KJ) by number of moles of solid.
- If the temperature increased it is exothermic so add a negative sign (and vice versa)



Example Exam Q - 2017 AS Paper 1

0 3 A student planned and carried out an experiment to determine the enthalpy of reaction when magnesium metal displaces zinc from aqueous zinc sulfate.

$$Mg(s) + Zn^{2+}(aq) \rightarrow Mg^{2+}(aq) + Zn(s)$$

The student used this method:

- A measuring cylinder was used to transfer 50 cm^3 of a 1.00 mol dm^{-3} aqueous solution of zinc sulfate into a glass beaker.
- A thermometer was placed in the beaker.
- 2.08 g of magnesium metal powder were added to the beaker.
- The mixture was stirred and the maximum temperature recorded.

The student recorded a starting temperature of 23.9 °C and a maximum temperature of 61.2 °C.

0 3 . 1 Show by calculation which reactant was in excess.

Use the data to calculate the experimental value for enthalpy of reaction in kJ mol^{-1} (Assume that the specific heat capacity of the solution is 4.18 J $K^{-1}g^{-1}$ and the density of the solution is 1.00 g cm^{-3}).

[6 marks]

Example Exam Q - 2017 AS Paper 1

Question	Marking Guidance	Mark	Additional Comments/Guidance
03.1	M1 Amount $ZnSO_4$ = 1.0 x $^{50}/_{1000}$ mol or Amount $ZnSO_4$ =0.050 mol	1	Mark M1 and M2 independently
	M2 Amount Mg = $^{2.08}/_{24.3}$ mol or Amount Mg= 0.0856 mol	1	
	(Hence Mg in excess)		
	M3 $Q=mc\Delta T$	1	M3 could be scored in M4
	M4 Q=50.0 x 4.18 x 37.3 or Q=7795.7J	1	If an error in M4, lose M4 and M5 and only award M6 for correct use of their incorrect M4 and division by their correct limiting reagent
	M5 (Energy released per mole) = $^{7.796}/_{0.05}$kJmol^{-1} or $^{7796}/_{0.05}$ Jmol^{-1}	1	M5 division by their limiting reagent
	M6 ΔH= − 156 kJmol^{-1}	1	