Simple calorimetry to find the enthalpy of combustion of alcohols

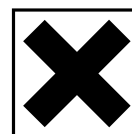## Aims

You will use simple calorimetry estimate the enthalpy of combustion of an alcohol.

Apparatus

Goggles   Steel can
Bench mat   Digital balance
Stand, boss, clamp   Access to spirit burners containing:
Thermometer   methanol, ethanol,
$100cm^3$ measuring cylinder   propanol or butanol

Method

1. Draw up a suitable table or tables to record your results.

2. Measure $100cm^3$ of water in the measuring cylinder.
   Pour the water into the steel can and record its temperature.

3. Choose a spirit burner.
   Record the name of the fuel, and the mass of the whole burner (including the lid and fuel inside).

4. Clamp the steel can, and set it up so that the spirit burner will fit comfortably under it.

5. Light the wick of the spirit burner, and put it under the steel can.

6. Stir the water **gently** with the thermometer, and watch the temperature.
   When it has increased by 20°C, put the lid on the spirit burner to put the flame out.
   Record the new mass of the whole burner (including the lid and fuel inside).

7. Using fresh water each time, repeat the experiment at least twice with the same fuel.

Analysis

1. Calculate the energy transferred to the water using the equation $q = mc\Delta T$
   Assume that $1cm^3$ of water has a mass of 1g and $c = 4.18$ J g^{-1} K^{-1}.

2. For each replicate experiment, perform the calculations described below:

   a) Calculate the mass of fuel burnt.

   b) Calculate the M_r of the fuel used. Use your answer to part a) to work out the amount of fuel burnt.

   c) Work out the energy transferred to the water in kJ mol^{-1}, and so the enthalpy of combustion.

3. Estimate the maximum errors in the using each piece of apparatus, and the total apparatus error.

Evaluation

1. Discuss the reliability of your results. Are they close to each other?

2. Compare your calculated enthalpy values with these accepted values – is the apparatus error enough to account for any differences?

3. Discuss other sources of error and improvements to the experiment.

alcohol	C atoms	kJ mol^{-1}
methanol	1	–726
ethanol	2	–1367
propanol	3	–2021
butanol	4	–2676