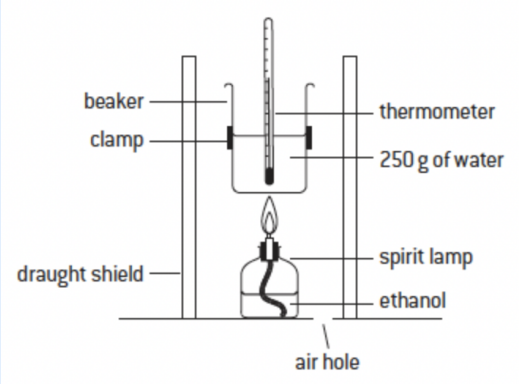
SL HL Paper 3 Section A Experimental work (4)

A student determined the enthalpy of combustion of ethanol using a spirit lamp to heat up a known mass of water as shown in the diagram below:



A mass of 0.553 g of ethanol was combusted. This was measured by filling the spirit lamp with ethanol, and weighing it before and after the experiment, Other than when the ethanol was being combusted a cap was placed on the spirit lamp. The temperature of the 250 g of water increased by 10.4 °C during the experiment.

(a) State why it is necessary to use a cap on the spirit lamp apart from when the ethanol is being combusted. ***[1]***

b) Show that the enthalpy of combustion of ethanol determined from the experiment is equal to – 906 kJ mol^{-1} if the specific heat capacity of water is taken as 4.18 kJ kg^{-1} K^{-1}. ***[2]***

(c) Use Section 13 of the data booklet to determine the experimental error. ***[1]***

(d) In his write-up of the experiment the student listed the following reasons which contributed to the experimental error.

- There was incomplete combustion as the ethanol was being combusted in air, not oxygen.
- There was considerable heat loss from the apparatus during the combustion.
- The ethanol may not have been completely pure.
- The water used in the beaker was tap water, not distilled water.
- All of the 0.553 g of ethanol was assumed to have combusted.
- Only one result was obtained - The experiment should have been repeated several times and an average taken.

Suggest two more reasons that contributed to the experimental error. ***[2]***