2 Alcohols such as methanol (CH_3OH), ethanol (CH_3CH_2OH) and propan-1-ol ($CH_3CH_2CH_2OH$) are good fuels.

0 2 . 1 A student carried out an experiment to determine the enthalpy of combustion of methanol.

Methanol was placed in a spirit burner and the mass of the spirit burner measured. The student placed 100 g of water in a copper calorimeter and clamped it above the spirit burner. The burner was lit and allowed to burn for a few minutes. The flame was then extinguished and the new mass of the spirit burner found.

The measured temperature rise was 38.0 °C. The specific heat capacity of water is 4.18 J K^{-1} g^{-1}.

Figure 1, a diagram of the apparatus, is shown alongside **Table 1** which shows the measurements the student recorded.

Figure 1

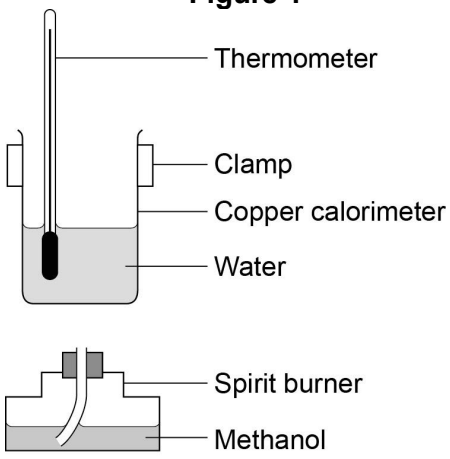

Table 1

Mass of burner containing methanol before experiment	214.02 g
Mass of burner containing methanol after experiment	212.37 g

Use the student's data to calculate an experimental value for the enthalpy of combustion of methanol in kJ mol^{-1}.

[4 marks]

0 2 . 2 Suggest **one** reason, other than incomplete combustion or heat transfer to the atmosphere, why the student's value for the enthalpy of combustion of methanol is different from that in a Data Book.

[1 mark]

0 2 . 3 The uncertainty in each of the temperature readings from the thermometer in this experiment was ±0.25 °C. This gave an overall uncertainty in the temperature rise of ±0.5 °C.

Calculate the percentage uncertainty for the use of the thermometer in this experiment.

[1 mark]

0 2 . 4 The student said correctly that using a thermometer with an overall uncertainty for the rise in temperature of ±0.5 °C was adequate for this experiment.

Explain why this thermometer was adequate for this experiment.

[1 mark]

0 2 . 5 The enthalpy of combustion of ethanol is −1371 kJ mol^{-1}. The density of ethanol is 0.789 g cm^{-3}.

Calculate the heat energy released in kJ when 0.500 dm^3 of ethanol is burned. Give your answer to an appropriate number of significant figures.

[3 marks]