Experiment Δ*H* for the combustion of biodiesel.

Aim: To determine the value of Δ*H* for the combustion of biodiesel and compare it to the literature value.

Materials

- Thermometer
- 250 mL beakers
- Butane lighter
- Weighing Balance
- Gauze mat
- Stopwatch

Procedure

Step 1 - Add 50 mL of distilled water to a 250 mL beaker.
Step 2 - Sit the beaker directly on a gauze mat on top of a tripod as shown in fig.1.
Step 3 - Record the temperature of the water.
Step 4 - Weigh the spirit burner with the biodiesel.
Step 5 - Light the spirit burner and place under the beaker.
Step 6 - Record the temperature every minute for 5 minutes.
Step 7 – Extinguish the flame and reweigh the spirit burner and biodiesel.
Step 8 - Continue to record the temperature every minute for another 5 minutes after the spirit burner has been extinguished.

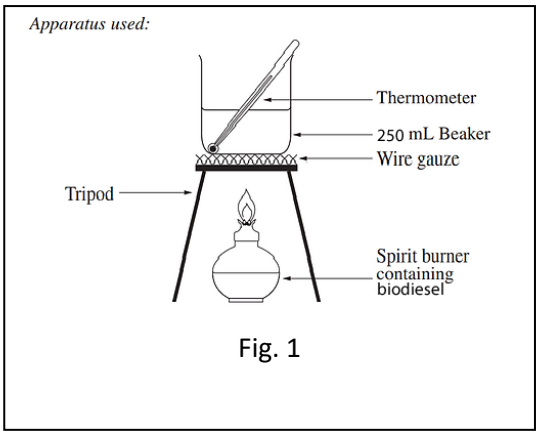


Fig. 1

Report

Record all of your results in an appropriate table.

Results

Time (minutes)										
Temperature °C										

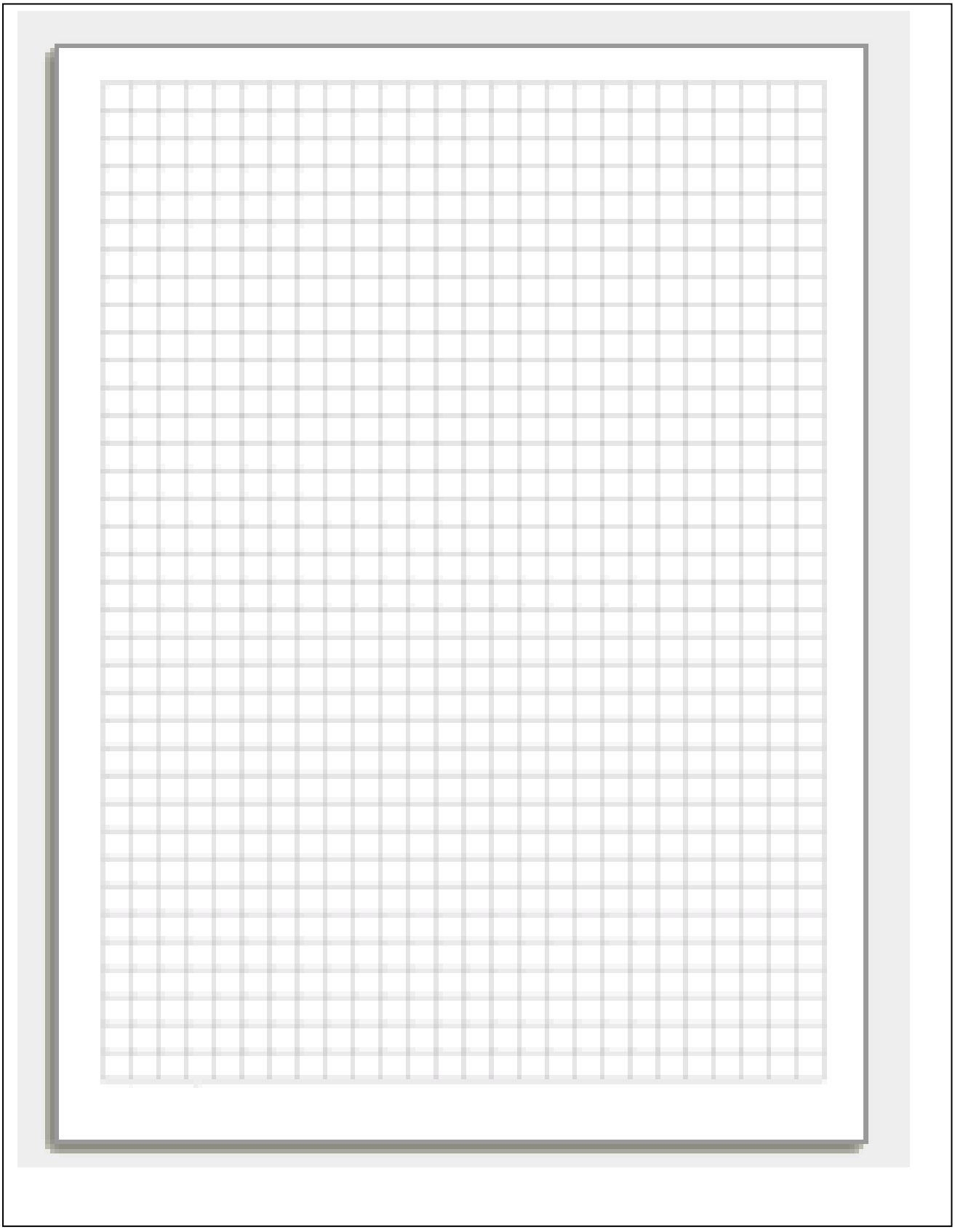
Table 1

Quantity	Measurement
Mass of spirit burner before burning	
Mass of spirit burner after burning	

Table 2

Analysis Questions

1. Graph the results from table 1 on the graph paper provided. *(2 marks)*



2. Calculate the amount of heat absorbed by the water when it was heated by the spirit burner. (Assume water density = 1.00 g/mL)

   a. Give your answer in kilojoules. *Be sure your answer is to the correct number of significant figures.*

   (2 marks)

   b. Using your experimental data.

      i. Calculate the experimental value for the heat of combustion of biodiesel in kJ/g

      (2 marks)

      ii. What assumption was made in calculating the heat of combustion in question i. above. ?

      (1 mark)

      iii. Suggest why it is not possible to give the experimental molar heat of combustion.

      (1 mark)

3. Are the results valid? Explain.

   (2 marks)

4. What specific modification to the set-up (fig. 1) could be done to obtain data that better reflects the temperature change of the water to the energy produced by the combustion?

   (1 mark)

5. On your graph sketch and **label** a second graph showing how your modification would affect the graph of temperature vs time. Be sure to label this curve.

   (1 mark)

6. Four more trials were conducted by the same group and achieved results for ΔT of 53.2°C, 26.0°C, 63.5°C, 40.2°C.

a. Are the results precise? Explain *(2 marks)*

b. Are the results repeatable? Explain *(1 mark)*

c. i. What type of error could have produced these results? *(1 mark)*

ii. Would increasing the number of trials remove this error you mentioned in i. above? Explain *(1 mark)*

7. Although a mixture, the basic biodiesel chemical formula is $C_{17}H_{34}O_2$.

a. Calculate the heat of combustion for the biodiesel in kJ/mol using your experimental data.

(2 marks)

b. Write a balanced chemical equation, states included, using the basic chemical formula given above, for the complete combustion of the biodiesel at 25°C.

(3 marks)

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8. Another group obtained the following values for the heat of combustion.
2.54 X 10^3 kJ/mol, 2.52 X 10^3 kJ/mol and 2.53 X 10^3 kJ/mol.

a. Assuming the literature value for this particular biodiesel is 4.54 X 10^3 kJ/mol are the results accurate? Explain

(1 mark)

b. What type of error could have caused this?

(1 mark)

c. Explain what can be done to minimise the impact of this error.

(1 mark)

d. The impact of what type of error can be minimised by conducting multiple trials?

(1 mark)

Solutions