EXAMINATIONS COUNCIL OF ESWATINI
Eswatini General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICAL SCIENCE **6888/04**

Paper 4 (Alternative to Practical) **October/November 2023**

1 hour

Candidates answer on the Question Paper.

No additional materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided.
Write in dark blue or black pen.
You may use a HB pencil for any diagrams, graphs, tables or rough working.
Do **not** use staples, paper clips, highlighters, glue or correction fluid.
Do **not** write on the barcode.

Answer **all** questions.

You may use an electronic calculator.
You may lose marks if you do not show your working or if you do not use the appropriate units.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks is 40.

For Examiner's Use	
1	
2	
Total	

This document consists of **10** printed pages and **2** blank pages.

1 A student carries out an investigation to compare the amount of energy released by a peanut and by ethanol when they each undergo combustion.

(a) He measures approximately 9 cm^3 of water using a measuring cylinder and pours the water into a test-tube.

Suggest another instrument, more accurate than a measuring cylinder, that could be used to measure the 9 cm^3 of water.

..... [1]

(b) He inserts a mounted needle into the peanut.

He uses a Bunsen burner to ignite the peanut.

He then uses the peanut to heat the water for approximately 5 minutes.

Fig. 1.1 shows apparatus he uses to heat the water using the burning peanut.

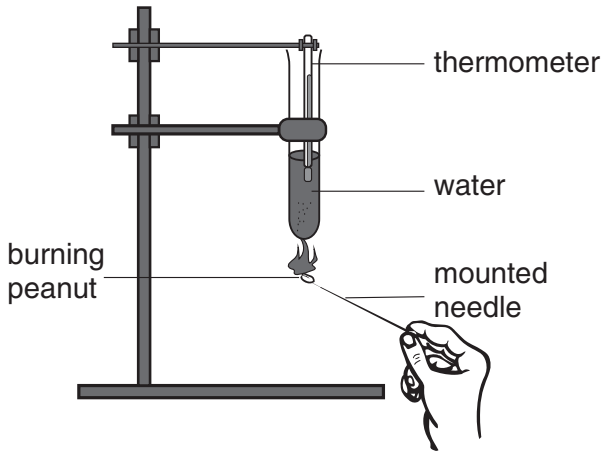


Fig. 1.1

The burnt peanut turns into black ash which the student places in a petri dish.

(i) The initial temperature of the water is 25 °C.

Fig. 1.2 shows the final temperature of the water.

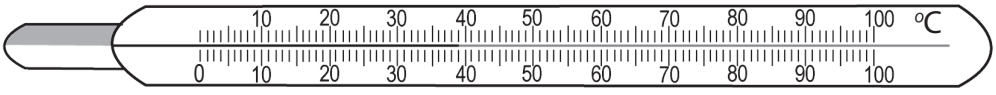


Fig. 1.2

Read and record the final temperature of the water shown in Fig. 1.2.

…….....……°C [1]

(ii) Determine the temperature change (ΔT) of the water.

…….....……°C [1]

(iii) Use the formula, $q = m\ c\ \Delta T$ to calculate the amount of energy released by the peanut.

[Use c = 4.2 J / g °C; m = mass of water]

Hint: 1 cm^3 of water = 1 g

…….....…….. [3]

(iv) Explain why this is an exothermic reaction.

.....

..... [1]

(v) Explain why the combustion of the peanut is an example of a chemical change.

.....

..... [1]

(vi) Suggest **one** way to improve the rate at which the combustion of the peanut takes place in this experiment.

.....

..... [1]

(c) The student then carries out an experiment to measure the amount of energy released when ethanol undergoes combustion.

He heats 5 g of water using 10 g ethanol for 5 minutes.

Table 1.1 shows the results he obtains.

Table 1.1

Time/minutes	Temperature/°C
0	25
1	26
2	28
3	31
4	33
5	36

(i) Describe how the mass of 10 g of liquid ethanol was measured by the student.

.....

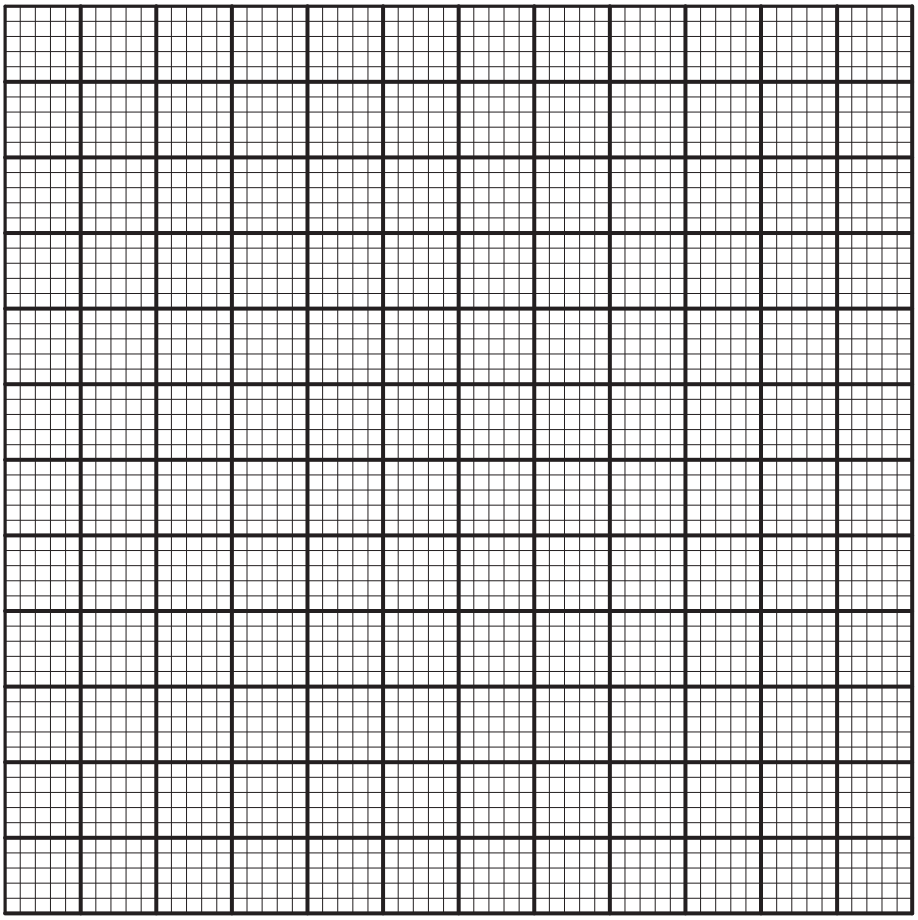
.....

..... [2]

(ii) Plot the results from Table 1.1 on the grid and draw the line of best-fit.

Plot time on the horisontal axis and temperature on the vertical axis.

temperature / °C



time / m

[3]

(iii) Calculate the amount of energy released by the ethanol per unit mass using the formula q = mass of water $\times$ $c \times \Delta T$.

[Use $c = 4.2\,\text{J / g°C}$]

……..…….. [3]

(iv) The energy released per unit mass is calculated for the peanut and for the ethanol.

Suggest **one** improvement that could be made in the experiment to make it a fair comparison of the energy released per unit mass of fuel.

.....

..... [1]

[Turn over

(v) From your results in **(b)** and **(c)**, explain why ethanol is a more efficient fuel than a peanut.

.....

..... [1]

(d) The student then dissolves the ash from **(b)** in 5 cm^3 ethanol.

The ethanol has a neutral pH.

(i) He uses Universal Indicator paper to determine the pH value of the solution formed. The Universal Indicator turns blue.

Suggest the pH value of the solution when the ash dissolves in the ethanol.

pH value ..... [1]

(ii) From the results, suggest the class of substances formed when a peanut is burned.

..... [1]

2 A student conducts an experiment to determine the density of a wooden block shown in Fig. 2.1

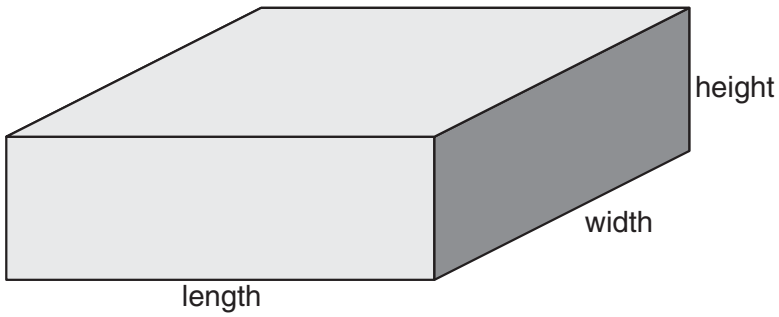


Fig. 2.1

(a) (i) Measure the length, height and width of the wooden block shown in Fig. 2.1 with a ruler.

length ..... cm

width ..... cm

height ..... cm

[1]

(ii) Calculate the volume of the wooden block, using the equation:

volume = length × width × height

volume = ... cm^3 [2]

(b) She suspends a 100 g mass at the 43.8 cm mark of the metre rule.

The 100 g mass is the load, L in Fig 2.2.

She also suspends the wooden block on the metre rule as shown in Fig. 2.2.

She then moves the wooden block to the 75 cm mark and the rule balances.

[Turn over

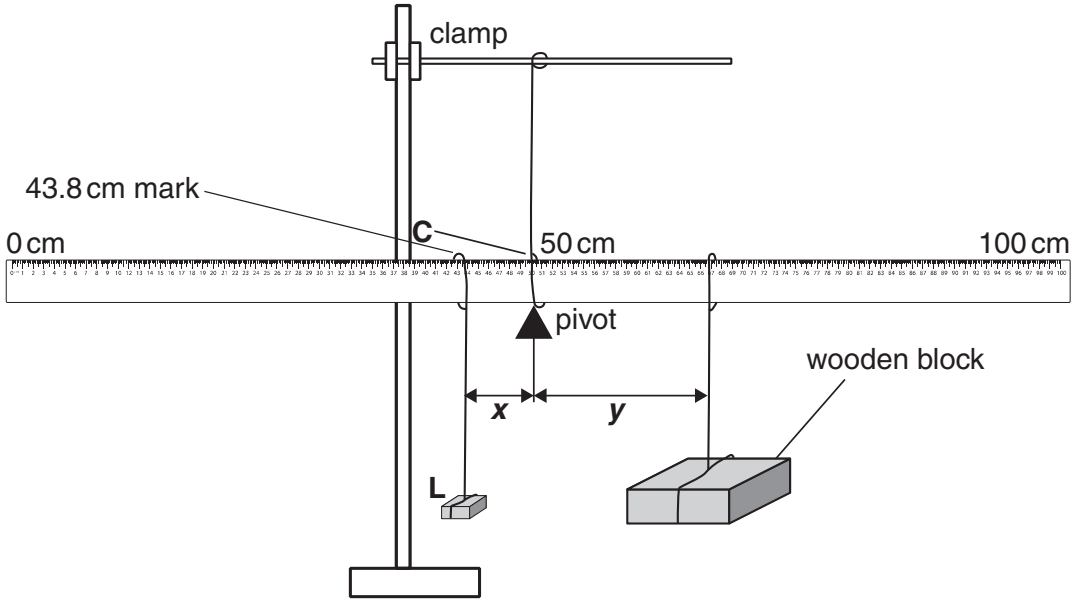


Fig. 2.2

(i) Record the distance ***x*** from the position of the load, **L**, to the pivot, **C**, in Fig. 2.2.

x = ... cm [1]

(ii) Record the distance ***y*** from the pivot, **C**, to the position of the wooden block in Fig. 2.2.

y = ... cm [1]

(iii) Calculate the moment of the 100 g mass about the pivot, **C**, using the formula:

Moment = mass × distance

[Use 10 g = 0.1 N]

..... Nm [2]

(c) Calculate the mass, *m*, of the wooden block using the equation:

$$m = \frac{100\boldsymbol{x}}{\boldsymbol{y}}$$

m = ... g [2]

(d) (i) She moves the load, **L**, to the 40 cm mark.

She then moves the wooden block to the 90.6 cm mark for the rule to balance.

Calculate and record the values of ***x*** and ***y***.

x ..... cm

y ..... cm

Calculate the mass, *m*, using the formula in **(c)**.

m ..... g [1]

(ii) She moves the load, **L**, to the 38 cm mark.

She then moves the wooden block to the 98.7 cm mark for the rule to balance.

Record the values of ***x*** and ***y***.

x ..... cm

y ..... cm

Calculate the mass, *m*, using the formula in **(c)**.

m ..... g [1]

(e) (i) Calculate the average value for the mass of the wooden block, *m*, using the three values of mass in **(c)**, **(d)(i)** and **(d)(ii)**.

average mass, *m* =..... g [2]

(ii) State why it is necessary to calculate the average value of mass, *m*.

.....

..... [1]

(f) (i) Using the values obtained in **(a)(ii)** and **(e)(i)**, calculate the density of the wooden block using the equation,

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

density =..... g/cm^3 [2]

(ii) Explain whether the wooden block will sink or float in ethanol.

The density of ethanol is 0.79 g/cm^3.

.....

..... [1]

(g) State **one** precaution taken to ensure an accurate reading is obtained from the metre rule.

.....

..... [1]

(h) Another student suspends a wooden block with a larger mass than the one in Fig. 2.2 as shown in Fig. 2.3.

He moves the wooden block until the rule balances.

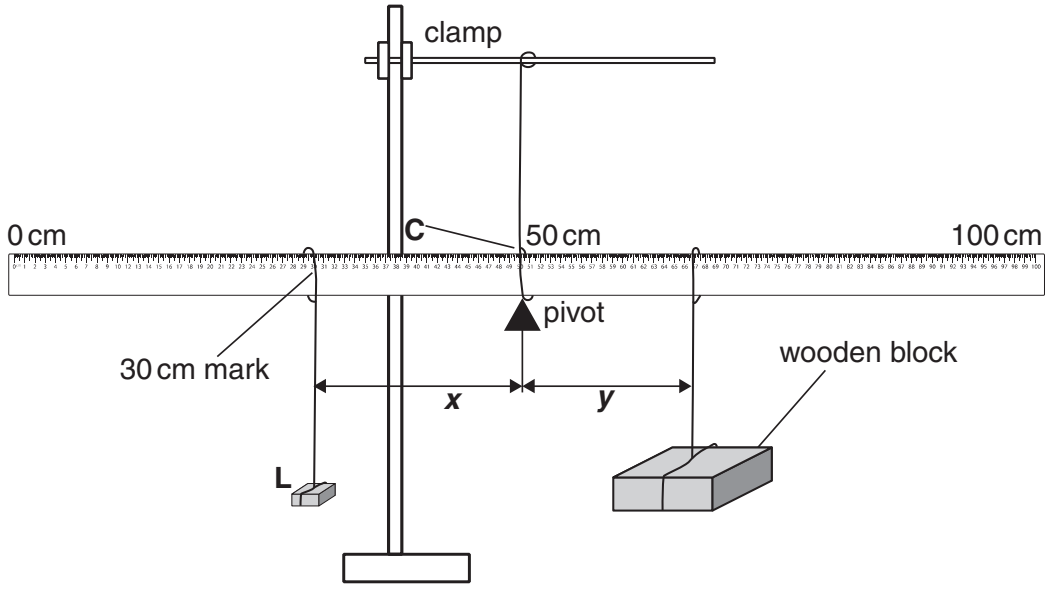


Fig. 2.3

Explain whether the value of ***y*** will be greater or smaller than the value of ***y*** in **(b)(ii)**.

.....

..... [1]

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