EXAMINATIONS COUNCIL OF ESWATINI
Eswatini General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICAL SCIENCE **6888/03**

Paper 3 Practical Test **October/November 2023**

1 hour 15 minutes

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 an 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 appropriate units.
Chemistry practical notes for this paper are printed on page 12.

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 **12** printed pages.

1 **(a)** You are going to investigate the amount of energy released by a peanut and by ethanol when they undergo combustion.

Fig. 1.1 shows the set-up of the experiment you will use.

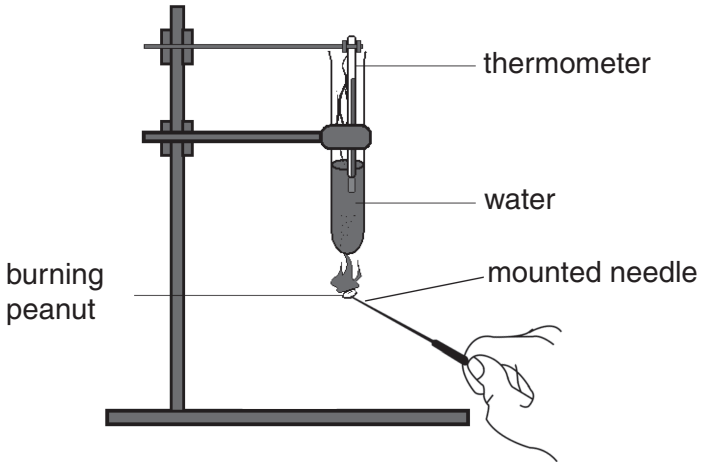


Fig. 1.1

- Accurately measure approximately 8 cm^3 of water using a measuring cylinder.
- Pour the water into a test-tube.

(i) Suggest another instrument, more accurate than a measuring cylinder, that could be used to measure 8 cm^3 of water.

..... [1]

(ii) Use the thermometer to measure the temperature of the water.

Record the temperature.

..... °C

(b) Insert the needle into the peanut with the mounted needle as shown in Fig. 1.2.

Fig 1.2

- Use a Bunsen burner flame to ignite the peanut.
- Use the peanut to heat the water in the test-tube for about 4 minutes.

(i) Immediately record the temperature of the water after about 4 minutes.

..... °C [1]

- Continue burning the peanut until it burns completely to form ash.
- Place the ash on a petri dish and keep it for later use.

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

$\Delta T =$ ..... °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

..... J [2]

(iv) From your observations in **(b)**, identify a chemical change that has happened.

.....

..... [1]

(v) From your results, explain why this is an exothermic reaction.

.....

.....

..... [1]

(c) Another student heats the same amount of water using ethanol.

Table 1.1 shows the results obtained when 10 g of ethanol was used to heat 8 cm^3 of water for 5 minutes.

Table 1.1

time/minutes	temperature/°C.
0	24
1	26
2	28
3	31
4	33
5	36

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

.....

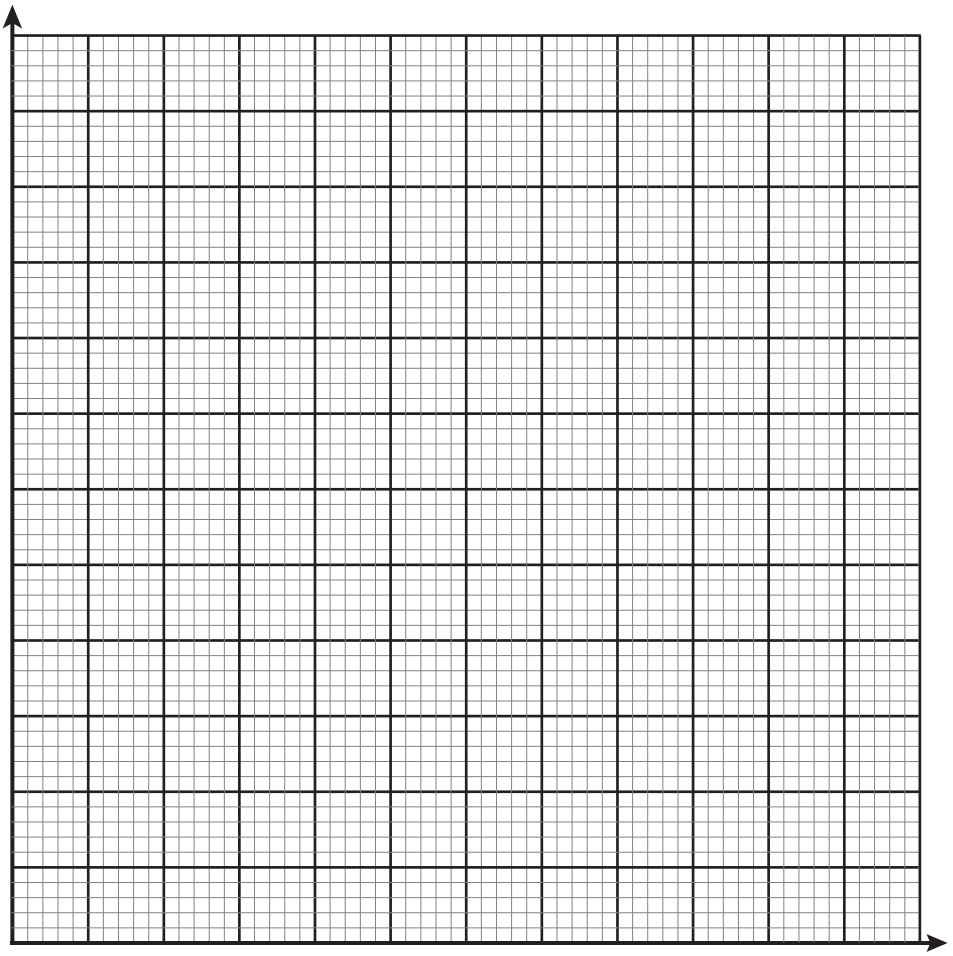
.....

..... [2]

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

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

temperature / °C



time / m

[3]

(iii) Use the formula q = mass of water $\times$ $c \times \Delta T$ to calculate the energy released by ethanol.

[Use $c = 4.2$ J/g °C]

..... J [3]

(iv) From your results in **(a)**, **(b)** and **(c)**, explain whether ethanol or a peanut is the more efficient fuel.

.....

..... [1]

(v) The energy released per unit mass is calculated for the peanut in **(a)** and the energy released per unit mass is calculated for ethanol in **(c)**.

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

.....

..... [1]

(d) Ethanol has a neutral pH.

Pour approximately 5 cm^3 ethanol onto the ash in the petri dish and stir.

(i) Use the Universal Indicator paper provided to determine pH value of the solution formed.

colour of universal indicator paper after testing the solution .....

pH value ..... [2]

(ii) From your results in **(d) (i)**, suggest the class of substances formed when a peanut is burned.

..... [1]

2 In this experiment you are going to determine the density of a wooden block.

You are provided with a wooden block similar to the one shown in Fig. 2.1.

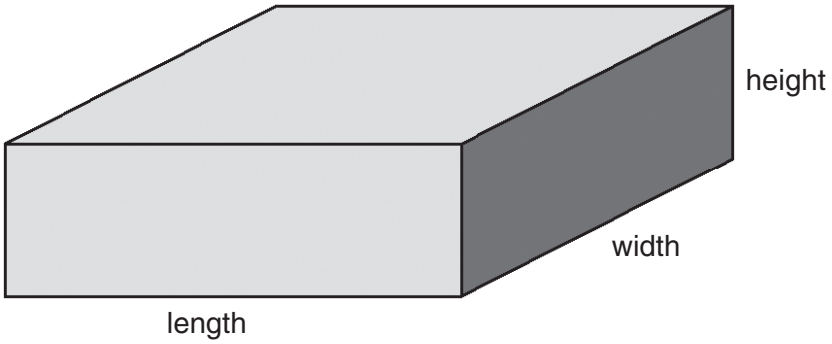


Fig. 2.1

(a) (i) Measure the length, height and width of the wooden block provided using a ruler.

[Do not measure the dimensions of Fig. 2.1.]

length ..... cm

width ..... cm

height .....cm

[1]

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

volume = length × width × height

Volume = ... cm^3 [2]

[Turn over

(b) You are going to use the set up shown in Fig. 2.2 to determine the mass of the wooden block.

Hang the 10 g mass at the 30 cm mark of the metre rule.

The 10 g mass is the load, **L**, as shown in the diagram.

Hang the wooden block on the metre rule.

Move the wooden block until the rule balances (do not change the position of **L** and of the pivot).

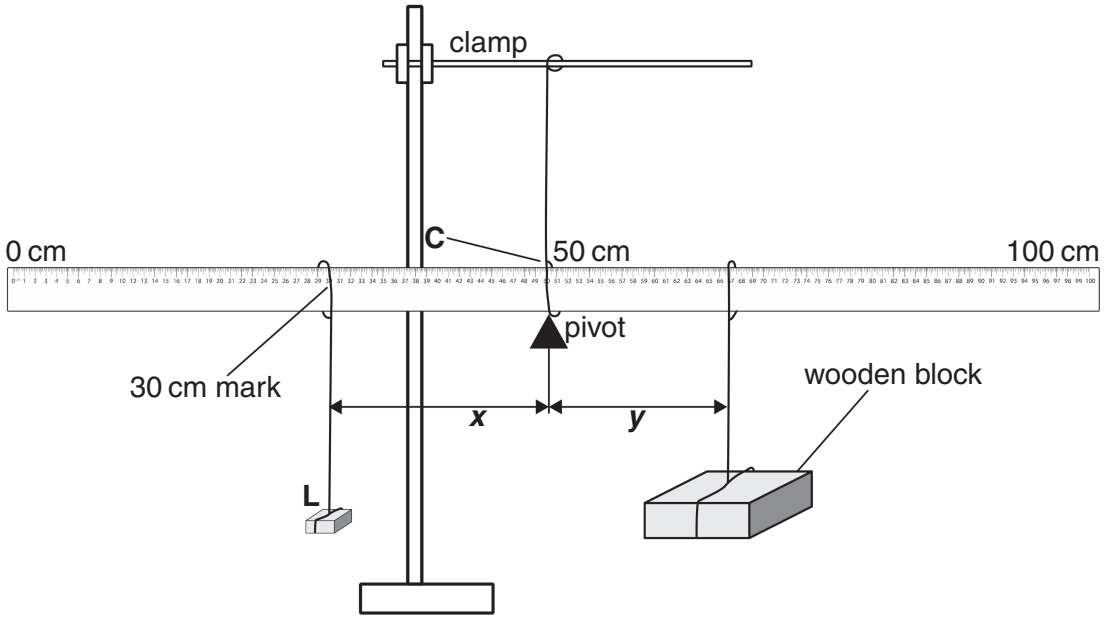


Fig. 2.2

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

x = ... cm [1]

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

y = ... cm [1]

(iii) Calculate the moment of the 10 g mass about the pivot 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:

$$m = \frac{10\boldsymbol{x}}{\boldsymbol{y}}$$

m = ... g [2]

(d) (i) Move the load, **L**, to the 20 cm mark.

Move the wooden block until the rule balances.

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) Move the load, **L**, to the 15 cm mark.

Move the wooden block until the rule balances.

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 of the mass for 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,

$$\text{density} = \frac{\text{mass}}{\text{volume}},$$ and state the units.

density = ... [3]

(ii) Predict whether the wooden block will sink or float in water.

.....

..... [1]

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

.....

..... [1]

(h) Another student hangs a wooden block of 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.

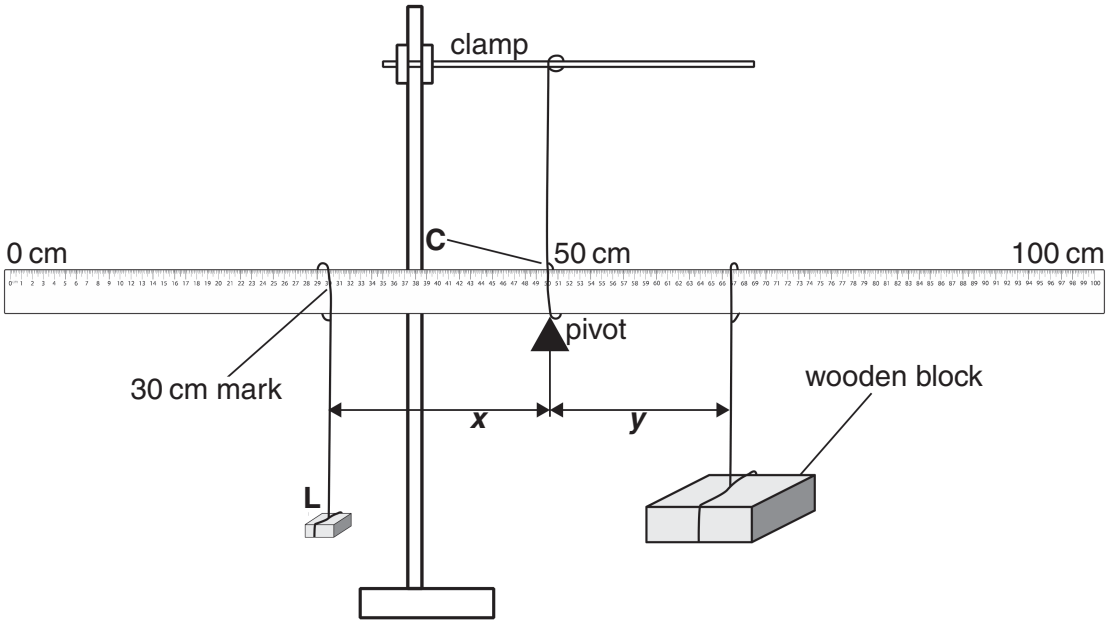


Fig. 2.3

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

.....

..... [1]

CHEMISTRY PRACTICAL NOTES

Tests for anions

Anion	*Test*	*Test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt
Iodide(I^-) [in solution]	acidify with dilute nitric acid, and then add aqueous lead(II) nitrate/aqueous silver nitrate	yellow ppt.
nitrate (NO^{3-}) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt

Tests for aqueous cations

Cation	*Effect of aqueous sodium hydroxide*	*Effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	–
Calcium (Ca^{2+})	white ppt, insoluble in excess	no ppt or very slightly white ppt.
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess, giving a colourless solution

Tests for gases

gas	*test and test results*
ammonia (NH_3)	turns damp litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	'pops' with a lighted splint
oxygen (O_2)	relights a glowing splint