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 2021**

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 workings.
Do **not** use staples, paper clips, highlighters, glue or correction fluid.
Do **not** write on the barcode.

Answer **all** questions.
Dictionaries are **not** allowed.

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.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

This document consists of **9** printed pages and **3** blank pages.

1 A student is provided with two substances **A** and **B**.

He is expected to determine their relative acidity or alkalinity.

A is aloe juice and **B** is copper(II) carbonate.

He is also provided with test-tubes labelled **A** and **B**.

(a) He pours about 2 cm^3 of substance **A** into a test-tube labelled **A**.

He also pours about 2 cm^3 of distilled water into test-tube **B**.

Then he adds a spatula full of substance **B** into test-tube **B** and stirs.

He adds a few drops of Universal Indicator solution into each of the test-tubes, **A** and **B** to determine the pH of the substances.

Table 1.1 shows the pH values he obtains.

Table 1.1

substance	colour of Universal Indicator	pH value	conclusion
A		11	
B		7	

(i) Complete the second column of Table 1.1 by stating the colour of the Universal Indicator in each substance. [2]

(ii) Draw a conclusion about the two substances, **A** and **B** based on the pH values.

Record your conclusion in the fourth column of Table 1.1. [2]

(iii) Describe how the student determined the exact pH values of the substances.

..... [1]

(b) He uses the apparatus in Fig. 1.1 to heat substance **B**, copper(II) carbonate.

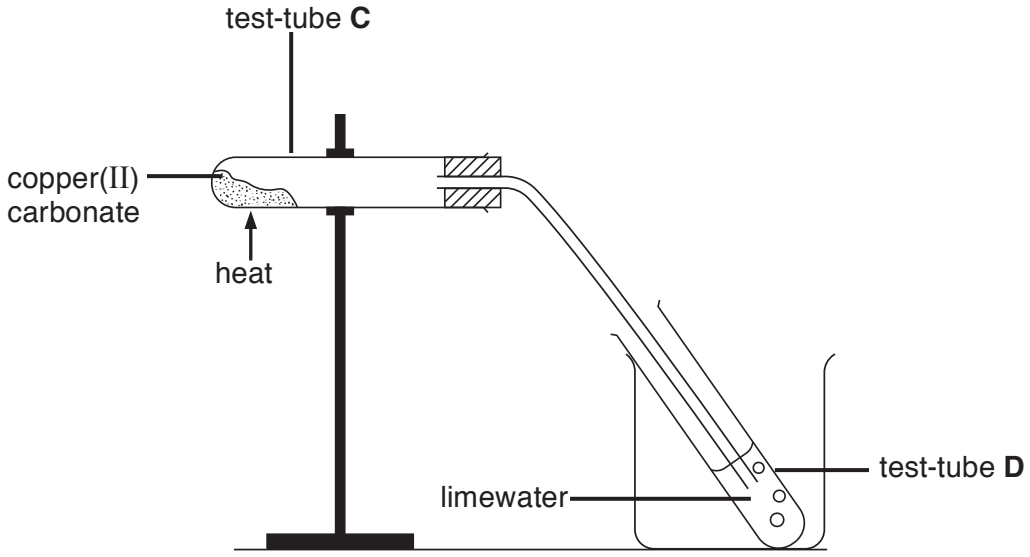

Fig. 1.1

He heats the copper(II) carbonate with a strong Bunsen burner flame for about three minutes.

The copper(II) carbonate turns black.

(i) State the observation that shows that the gas produced is carbon dioxide.

..... [1]

(ii) Name the type of reaction that has taken place in test-tube **C**.

..... [1]

(iii) Explain, using the observations given in **(b)**, why a chemical change has occurred.

.....

.....

..... [2]

(c) The student then prepares carbon dioxide gas using the apparatus shown in Fig.1.2.

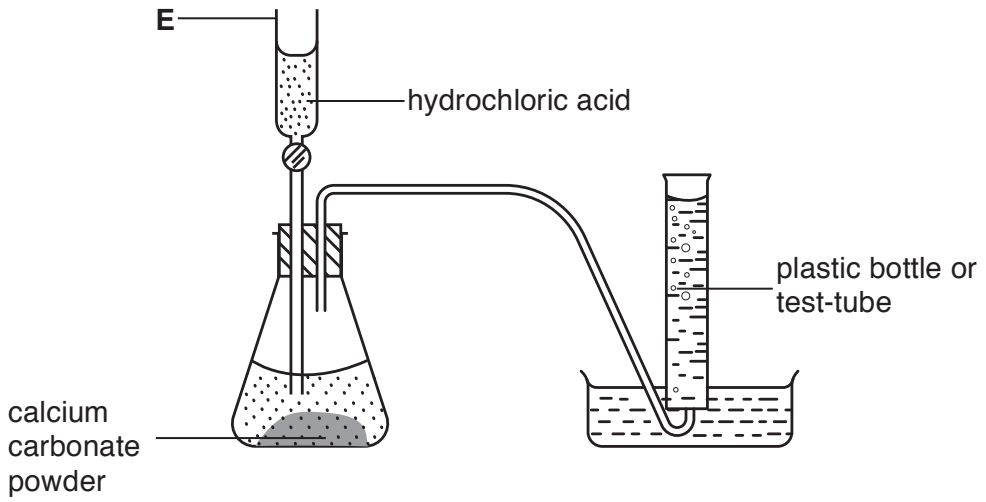

Fig. 1.2

The student collects two samples of carbon dioxide gas, one sample in a plastic bottle and another in a test-tube.

He keeps the bottle closed and the test-tube in an upright position at all times.

(i) Name part **E** in Fig. 1.2.

..... [1]

(ii) State the smell of carbon dioxide gas in the test-tube.

..... [1]

(iii) Describe the correct method of determining the smell of a gas he uses.

..... [1]

(iv) He measures about 30 cm^3 of distilled water in a measuring cylinder.

He opens the plastic bottle.

He adds the 30 cm^3 of distilled water and then quickly closes the bottle tightly.

He shakes the bottle for about a minute.

The bottle collapses and decreases in size.

Explain this observation.

.....

.....

..... [2]

(v) Explain why the carbon dioxide will escape slowly when the test-tube is in an upright position.

..... [1]

(vi) Describe how the design of the experiment in Fig. 1.2 can be modified to:

increase the speed of the reaction,

..... [1]

measure the volume of the carbon dioxide gas produced.

..... [1]

(d) Describe an experiment that can be used to test for the presence of iron(III) ions in substance **A**.

.....

.....

.....

..... [3]

2 A student investigates the effect of height in driving a steel nail into a bar of soap by dropping a 1 kg mass.

Fig. 2.1 shows the set-up he uses.

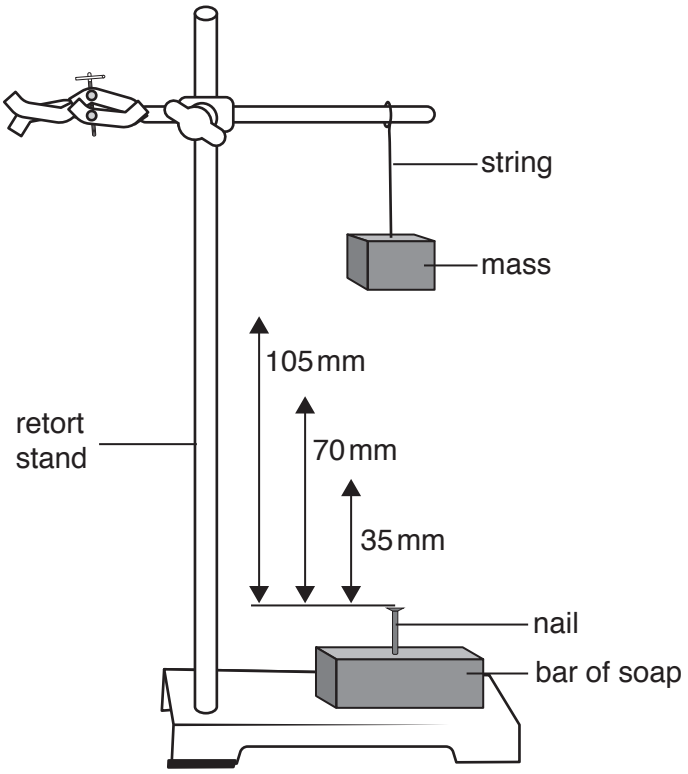

Fig. 2.1

(1) He pushes the nail into the bar of soap up to a marked position, 1 cm from the tip of the nail.

(2) He raises the mass such that its base is 35 mm from the top of the nail and keeps it steady.

(3) He places the bar of soap with the nail directly below the centre of the mass.

(4) He releases the mass such that it falls and hits the nail directly on the head.

(5) He marks, with a letter **X**, at the position where the nail protrudes above the bar of soap as shown in Fig. 2.2.

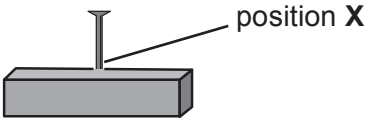

Fig. 2.2

(6) He then removes the nail from the bar of soap.

(a) He measures the depth by which the nail has been forced into the bar of soap as shown in Fig. 2.3.

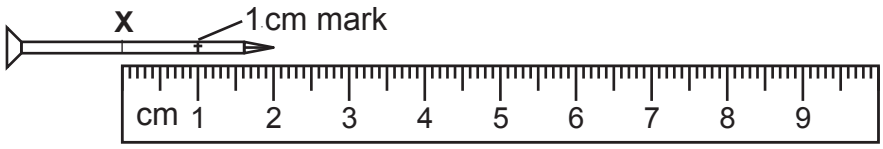

Fig. 2.3

(i) Read the depth in Fig. 2.3 and record it in Table 2.1. [1]

(ii) State **one** precaution that you take when taking the reading from the ruler.

.....

..... [1]

(b) He repeats steps **1** to **6** with a second and third nail with the same mass at heights 70 mm and 105 mm, respectively.

Table 2.1 shows his results for the heights of 70 mm and 105 mm.

Table 2.1

height/mm	length/mm
35	
70	18
105	25

(i) The depths of penetration of the nail into the bar are not proportional to the height through which the mass has been raised as shown in Table 2.1.

Explain this observation.

.....

..... [1]

(ii) State the kind of energy the **mass** has as it hits the nail.

..... [1]

(c) In step **4**, when the mass hits the nail, it is forced into the bar of soap.

The energy of the mass is then transformed into other forms of energy.

State the forms of energy that are observed.

.....

..... [2]

(d) State and explain, using the results in Table 2.1, the height that causes the nail to be forced the greatest distance into the bar of soap.

height .....

explanation .....

..... [2]

(e) Write a conclusion on the relationship between the height from which the mass is released and the distance moved by the nail into the soap.

..... [1]

(f) When the mass is released, it accelerates at 10 m/s^2.

(i) Calculate, using the formula, $E_p = mgh$, the potential energy gained by the mass when it is raised to a height of 70 mm.

..... J [2]

(ii) Calculate, using the formula, $v = \sqrt{2gh}$, the maximum speed at which the mass hits the nail when released from the 70 mm height.

..... [3]

(g) In raising the mass to 70 mm, more energy is used than that calculated in **(f)(i)**.

Explain why more energy is used.

.....

.....

..... [2]

(h) Suggest **two** changes in the design of the experiment in Fig. 2.1, without changing the height, that the student can make so that the nail can be driven further into the bar of soap.

1 .....

.....

2 .....

..... [2]

(i) In another experiment, the student replaces the bar of soap with a wooden block.

Draw a diagram, based on the principle of moments, to show how the student can easily pull out the nail from the wooden block.

[2]

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