Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

8033530479

CO-ORDINATED SCIENCES **0654/62**

Paper 6 Alternative to Practical **October/November 2020**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **20** pages. Blank pages are indicated.

DC (CJ/FC) 194556/3

1 A student investigates the movement of molecules through a membrane.

The student uses some Visking tubing which acts like a membrane. This tubing allows small molecules to pass through it but not large molecules.

(a) Procedure

The student:

- ties a knot in one end of the piece of Visking tubing
- adds 2 cm^3 of starch solution into the tubing
- ties the open end to make a bag as shown in Fig. 1.1

Fig. 1.1

- thoroughly rinses the outside of the bag with water
- repeats the procedure with another piece of Visking tubing but adds 2 cm^3 of solution **X** instead of starch solution
- places each bag into iodine solution as shown in Fig. 1.2
- records in Table 1.1 the colour of the solutions in each bag and each beaker every minute for five minutes.

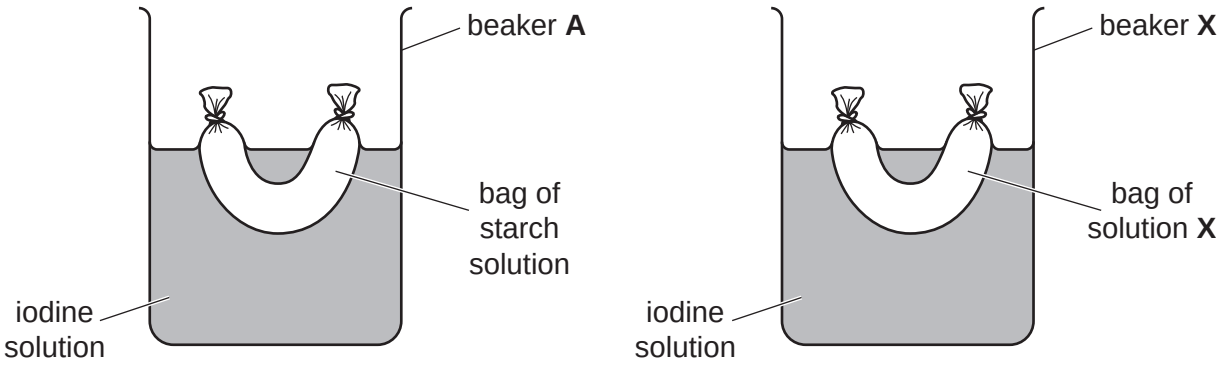

Fig. 1.2

Table 1.1

time /……..	colour of solution in			
	bag of starch solution	beaker **A**	bag of solution **X**	beaker **X**
0	colourless	brown	colourless	brown
1	colourless	brown	colourless	brown
2	colourless	brown	colourless	brown
3	colourless	brown	colourless	brown
4	blue-black	brown	brown	brown
5	blue-black	brown	brown	brown

(i) Complete Table 1.1 by adding the unit for time. [1]

(ii) Name a piece of apparatus suitable for measuring the 2 cm^3 of starch solution in the procedure in **(a)**.

..... [1]

(b) Iodine solution is used as a test for starch.

Iodine molecules are small.

Starch molecules are large.

Visking tubing allows small molecules to pass through it but not large molecules.

(i) Use this information and the results in Table 1.1 to explain the observations for the colour of the starch solution inside the bag of starch solution and the colour of the iodine solution in beaker **A**.

bag of starch solution .....

.....

beaker **A** .....

.....

[2]

(ii) Use the information in **(b)** and the results in Table 1.1 to make a conclusion about solution **X**.

..... [1]

(c) **(i)** State the time when the solution in bag **X** changes colour.

time = ... [1]

(ii) Suggest why the colour of the solutions inside bag **A** and bag **X** change colour at the same time.

.....

..... [1]

(d) Suggest why the Visking tubing is rinsed in the procedure in **(a)**.

..... [1]

(e) At higher temperatures molecules move more quickly. A student carries out the procedure in **(a)** and **(b)** at a higher temperature. Suggest how this would affect the results for bag **A**.

..... [1]

(f) The teacher says that solution **X** contains reducing sugar. Describe the test used to confirm the presence of reducing sugar.

test .....

.....

observation for a positive result .....
[3]

[Total: 12]

2 Fig. 2.1 shows a photograph of a slice of cucumber.

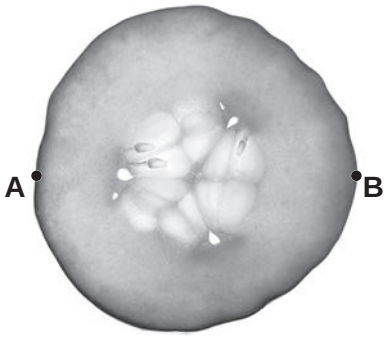

Fig. 2.1

(a) In the box, make an enlarged detailed pencil drawing of the cucumber in Fig. 2.1. [3]

(b) (i) Measure the diameter of the cucumber slice in Fig. 2.1 between points **A** and **B**.

Record this diameter in millimetres to the nearest millimetre.

diameter of cucumber slice = ... mm [1]

(ii) Draw a line to show this diameter on your drawing.

Record the length of this line in millimetres to the nearest millimetre.

diameter on drawing = ... mm [1]

(iii) Use your measurements in **(b)(i)** and **(b)(ii)** to calculate the magnification *m* of your drawing. Use the equation shown.

$$m = \frac{\text{diameter on drawing}}{\text{actual diameter}}$$

m = ... [1]

(c) A student tests some cucumber for the presence of protein.

(i) Name the testing solution she uses to test for the presence of protein.

..... [1]

(ii) State the observation for a positive result.

..... [1]

[Total: 8]

3 A student is provided with solid **J**, which is a mixture of **two** compounds.

Solid **J** contains one cation and two anions.

One compound is soluble in water and the other is insoluble in water.

A student does a series of experiments to identify the ions in **J**.

(a) The student:

- places some of solid **J** into a beaker
- adds water to **J** and stirs thoroughly
- filters the mixture into a test-tube and keeps both the residue and the blue filtrate
- washes the residue with distilled water.

(i) Suggest why the student stirs the mixture of water and **J**.

.....

..... [1]

(ii) The student places a small sample of the residue from the filter paper into a test-tube.

The student adds dilute nitric acid to the residue.

The mixture fizzes and gives a blue solution. Carbon dioxide is made.

State the test used to identify carbon dioxide and give the observation for a positive result.

test .....

observation .....
[1]

(iii) Identify an anion shown to be present in **J**.

..... [1]

(iv) As soon as the mixture in **(a)(ii)** stops fizzing the student divides the solution into two portions.

- To one portion the student adds aqueous sodium hydroxide drop by drop until it is in excess. A light blue precipitate is formed that is insoluble in excess.

- To the other portion the student adds aqueous ammonia drop by drop until it is in excess. A light blue precipitate is formed that is soluble in excess to give a dark blue solution.

Identify the cation shown to be present in **J**.

..... [1]

(v) Explain why it is important to wash the residue with distilled water.

.....

..... [1]

(b) The student tests the blue filtrate from the test-tube in **(a)**.

The student adds dilute nitric acid followed by aqueous barium nitrate to the filtrate.

A white precipitate is formed.

Identify the other anion shown to be present in **J**.

anion ..... [1]

(c) Draw a labelled diagram of the assembled apparatus used to filter the mixture in **(a)**.

[1]

[Total: 7]

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4 A student investigates the time taken for the reaction between magnesium ribbon and different concentrations of dilute hydrochloric acid.

Magnesium reacts with dilute hydrochloric acid to form hydrogen gas and a colourless solution of magnesium chloride.

(a) The student:

- measures 10.0 cm^3 of dilute hydrochloric acid into a beaker
- measures 15.0 cm^3 of water and pours this into the beaker of acid
- stirs the mixture thoroughly
- adds a 30 mm piece of magnesium ribbon to the mixture in the beaker and immediately starts a stop-watch
- stops the stop-watch when all the magnesium has reacted (disappeared)
- records in Table 4.1 the time on the stop-watch to the nearest second. This is the reaction time.

The student repeats the experiment using the volumes of dilute hydrochloric acid and water shown in Table 4.1.

Table 4.1

experiment number	volume of dilute hydrochloric acid added / cm^3	volume of water added / cm^3	reaction time / s
1	10.0	15.0	
2	12.5	12.5	
3	15.0	10.0	
4	20.0	5.0	
5	25.0	0.0	

The student's results are shown in Fig. 4.1.

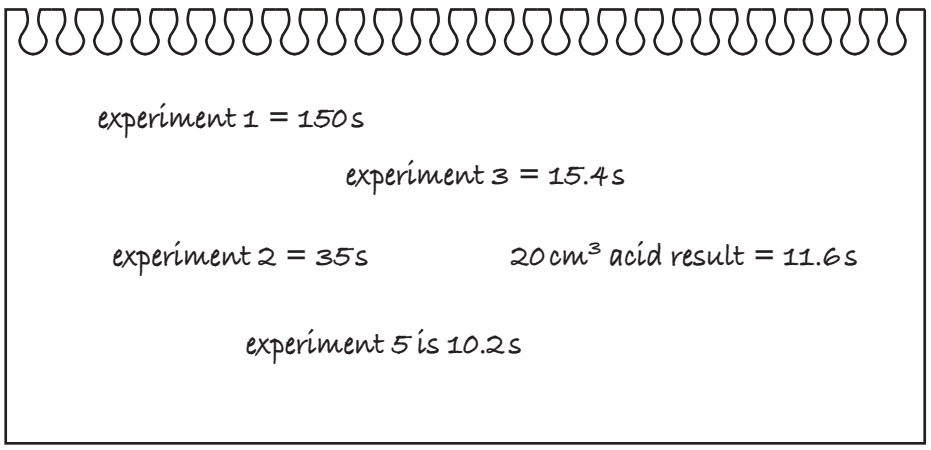


Fig. 4.1

(i) Record in Table 4.1, to the nearest second, these results. [3]

(ii) Powdered magnesium has a larger surface area than magnesium ribbon.

Suggest **one** reason why powdered magnesium is **not** used in this investigation.

.....

..... [1]

(iii) The surface area of the magnesium is controlled in this experiment.

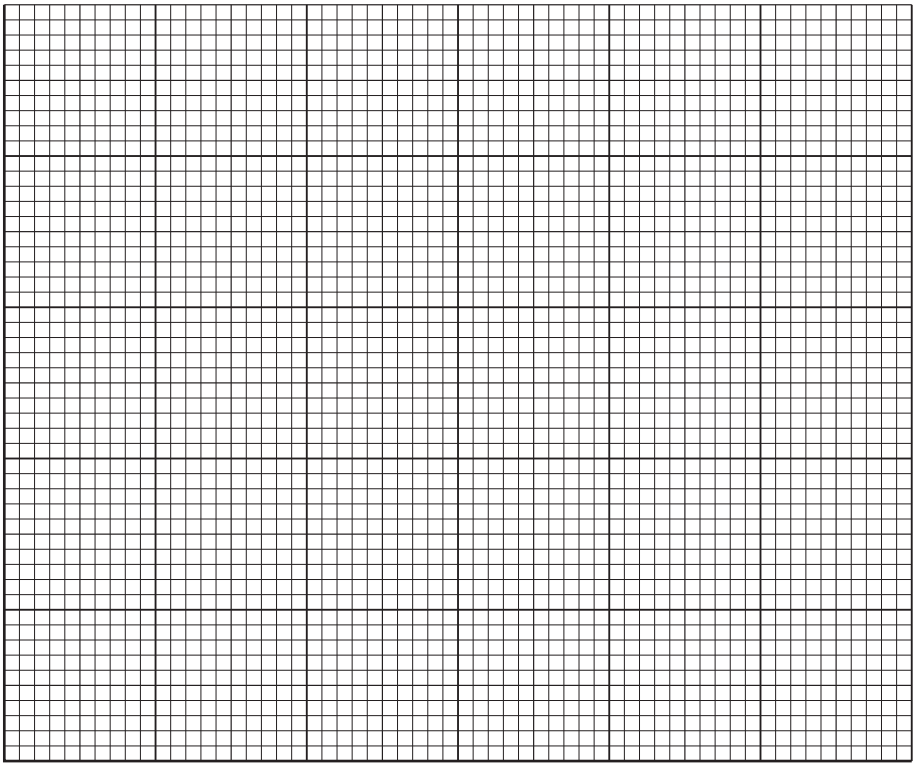
State **two other** variables that are controlled in this experiment.

variable 1 .....

variable 2 .....

[2]

(b) (i) On the grid provided, plot a graph of reaction time (vertical axis) against volume of dilute hydrochloric acid added.



[3]

(ii) Draw the curve of best fit. [1]

(c) Describe in detail the relationship between the volume of dilute hydrochloric acid added and the reaction time.

.....

.....

..... [2]

(d) The student uses a 25 cm^3 measuring cylinder.

State **one** reason why it is better to use a 10 cm^3 measuring cylinder to measure the volume of water in experiment number **4**.

.....

.....

..... [1]

[Total: 13]

5 A student investigates how the resistance R of a lamp and its power P vary with the length l of resistance wire in series with the lamp.

(a) The student:

- sets up the circuit shown in Fig. 5.1

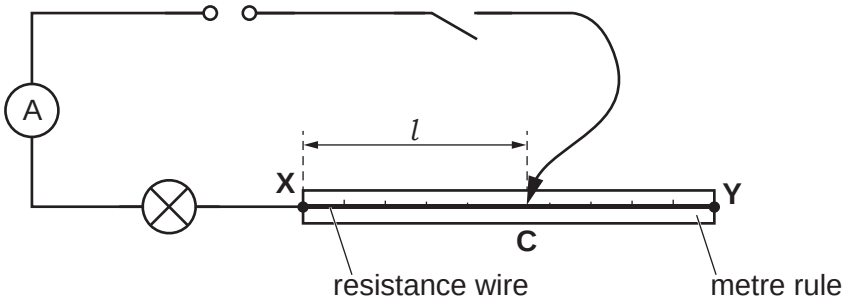


Fig. 5.1

- connects a voltmeter to measure the potential difference (p.d.) V across the lamp.

(i) Add a voltmeter to the circuit in Fig. 5.1 so that the potential difference across the lamp can be measured. [2]

(ii) The student:

- closes the switch and places the sliding contact **C** on the resistance wire at a distance l = 15.0 cm from end **X**
- measures the current I in the lamp
- measures the potential difference V across the lamp
- opens the switch.

The ammeter and voltmeter readings are shown in Fig. 5.2.

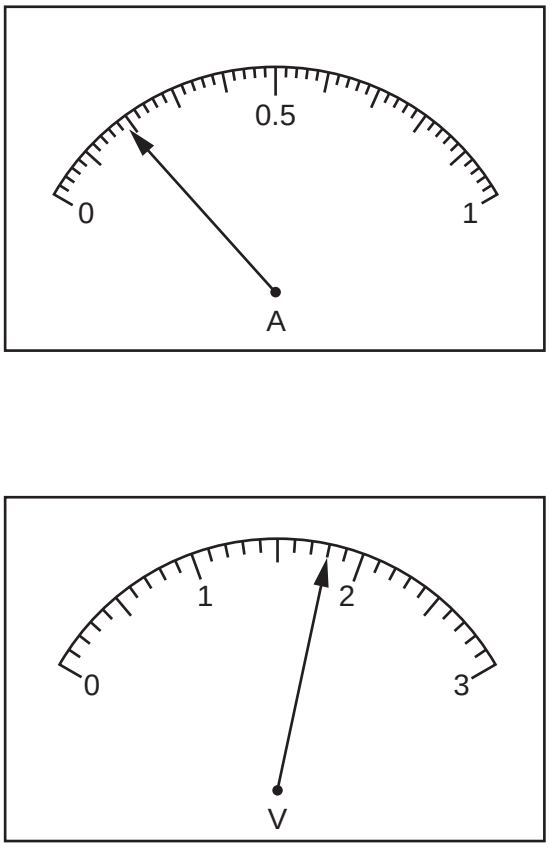


Fig. 5.2

Record in Table 5.1, the current I in the lamp and the potential difference V across the lamp.

Table 5.1

length l / cm	current I /	potential difference V / .....
15.0		
30.0	0.18	1.6
40.0	0.17	1.4
65.0	0.15	1.2
80.0	0.13	1.0

[2]

(iii) The student repeats **(a)(ii)** for values of l = 30.0 cm, 40.0 cm, 65.0 cm and 80.0 cm.

His values of I and V are shown in Table 5.1.

Complete Table 5.1 with the units for current and potential difference. [1]

(iv) State why it is important to open the switch between taking readings.

.....

..... [1]

(b) (i) Calculate the resistance R of the lamp when $l = 40.0\,\text{cm}$. Use the equation shown.

$$R = \frac{V}{I}$$

Record this value of R in Table 5.2. [1]

Table 5.2

length l / cm	resistance R / Ω	power P / W
15.0	9.5	0.34
30.0	8.9	0.29
40.0		0.24
65.0	8.0	
80.0	7.7	0.13

(ii) Describe how the resistance R of the lamp changes as the length l of resistance wire in series with it increases.

..... [1]

(c) (i) Calculate the power P of the lamp when $l = 65.0\,\text{cm}$. Use the equation shown.

$$P = V \times I$$

Record this value of P in Table 5.2. [1]

(ii) The power P of the lamp decreases as the length l increases. Suggest an observation that the student makes during the experiment to confirm this.

..... [1]

(iii) A student suggests that the resistance of the lamp is directly proportional to its power.

State whether the values of *R* and *P* in Table 5.2 support the suggestion.

Explain your answer.

.....

.....

.....

..... [1]

(d) Another student repeats the experiment and finds that when the length of resistance wire is greater than 80.0 cm, the lamp does not glow.

State how the student can check that the lamp is not broken.

.....

..... [1]

(e) The student repeats the investigation, but replaces the resistance wire with an electrical component that still allows him to change the current in the lamp and the potential difference across it.

State the name of this component.

..... [1]

[Total: 13]

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[Turn over

6 A student investigates how the extension of a spring depends upon the original length of the spring.

Plan an experiment to investigate how the extension of a spring depends upon its original length.

The apparatus available is listed:

- 30 cm rule graduated in millimetres
- boss, clamp and stand
- set of four 100 g masses and a 100 g mass hanger
- selection of springs of different lengths.

  The selection includes springs of different diameters and made of different materials.

You **must** select apparatus for your experiment from the list above. You may **not** use any other apparatus.

You should:

- explain briefly how you would carry out the experiment
- state the key variables you would control
- draw a table with column headings to show how you would present your results (you are **not** required to enter any readings in the table)
- explain how you would use your readings to reach a conclusion.

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[7]

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