Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

5039762117

CO-ORDINATED SCIENCES **0654/61**

Paper 6 Alternative to Practical **October/November 2016**

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 on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use 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.

This document consists of **16** printed pages.

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CAMBRIDGE
International Examinations

[Turn over

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

- He places 2 cm^3 of starch solution inside each of two tubes made of clear and colourless artificial membrane. He ties both ends of each tube with a knot to enclose the starch solution inside. This makes two soft tubing bags.
- He places one bag into a beaker of water. This is beaker **A**.
- He places the other bag into a beaker of iodine solution. This is beaker **B**.
- Fig. 1.1 shows how the experiment is set up.

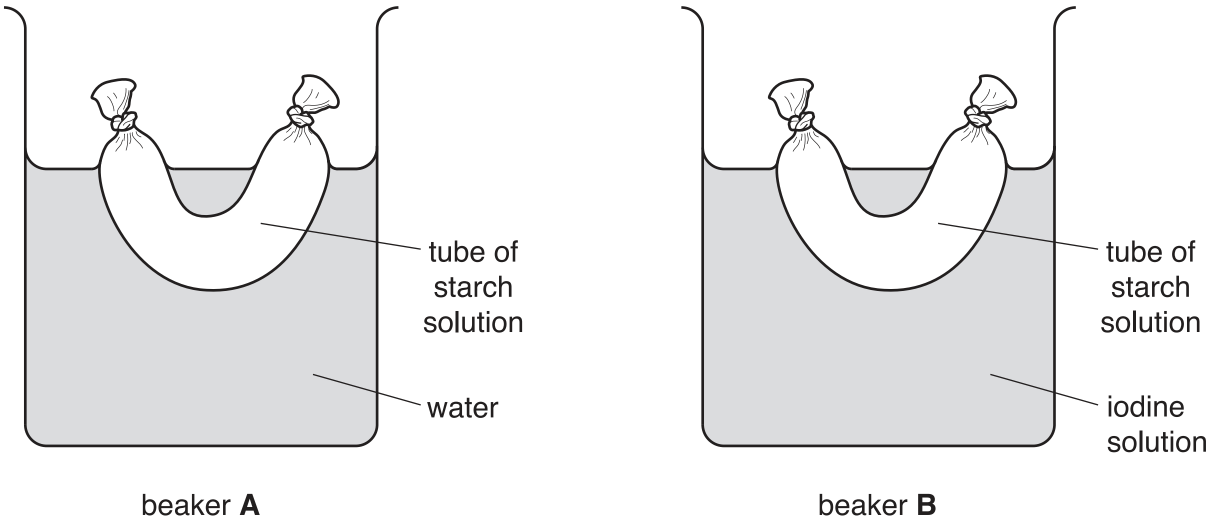


Fig. 1.1

- He starts the stopwatch and records the appearance of the starch solution inside the tubes every 2 minutes for 10 minutes. His results are shown in Table 1.1.

(a) Complete the headings in Table 1.1.

Table 1.1

.... /	....	
	beaker **A**	beaker **B**
0	cloudy	cloudy
2	cloudy	cloudy
4	cloudy	cloudy
6	cloudy	cloudy with some black areas
8	cloudy	black
10	cloudy	black

[2]

(b) The artificial membrane allows some molecules to pass through it, but starch molecules are too large to pass through. Use this information and Table 1.1 to explain the observations for beaker **B**.

....

....

....

....[3]

(c) **(i)** Amylase is an enzyme that breaks down starch into reducing sugar. The student now adds amylase to the contents of the tube in beaker **B** and leaves in a warm place for a few minutes.

Predict what he will observe.

....

....[1]

(ii) Explain your answer to **(c)(i)**.

....

....[1]

(iii) Describe a test you could carry out to confirm that reducing sugar has been produced. Include the observation for a positive result in your answer.

....

....

....

....[3]

2 A student is given a pale green solution **J** containing a dissolved salt and a grey solid **L**, which is an element. He carries out some experiments to identify the ions of the salt in **J** and to identify the element **L**.

(a) He chooses from the following solutions to carry out tests to identify the cation and the anion in solution **J**.

barium nitrate solution
dilute nitric acid
silver nitrate solution
sodium hydroxide solution

(i) State the details of the test and the observations which allow him to identify the cation as Fe^{2+}.

cation

test ....

....

observations ....

.... [2]

(ii) State the details of the test and the observations which allow him to identify the anion as SO_4^{2-}.

anion

test ....

....

observations ....

.... [3]

(b) (i)
- The student places solid **L** in a test-tube. He adds dilute hydrochloric acid.
- He warms the test-tube gently for a short time to increase the rate of reaction.
- He stirs carefully and tests the gas produced.
- He records in Table 2.1 his observations and the test which identifies this gas.

Table 2.1

test	observation
add dilute hydrochloric acid	fizzing and colourless solution is formed
lighted splint at mouth of test-tube	popping sound

Identify the gas produced.

gas produced .... [1]

(ii)
- The student filters the mixture from **(b)(i)** into a test-tube.
- To the filtrate in the test-tube he slowly adds sodium hydroxide solution until there are no further changes.
- He identifies the element **L** as zinc.

Suggest the observations which lead him to this conclusion.

observations ....

....

....[2]

(c) The student then places magnesium powder in a test-tube. He adds solution **J** to the magnesium powder and records his observations.

observations test-tube becomes warmer

After three minutes, he filters the mixture into another test-tube and records the appearance of the filtrate.

appearance of filtrate colourless

He then adds sodium hydroxide solution slowly to a portion of the filtrate until there is no further change. He records his observations.

observations faint white ppt

(i) Using your answers to **(a)** and this information, suggest what has happened to the **cation** in solution **J**.

....

....[1]

(ii) State the name given to a reaction that gives out heat.

....[1]

3 A student investigates how the period of a simple pendulum depends on its length.

The period of a pendulum is the time for one complete swing (oscillation) of the pendulum. This is shown in Fig. 3.1, where the period is the time taken for the bob to swing from **P** to **Q** and back to **P** again.

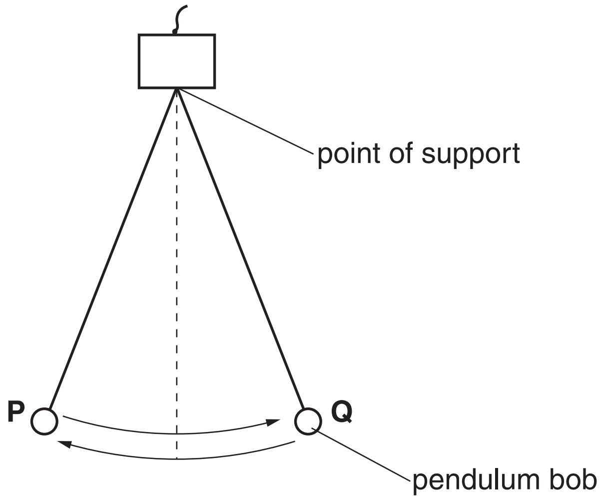


Fig. 3.1

She sets up the pendulum as shown in Fig. 3.2.

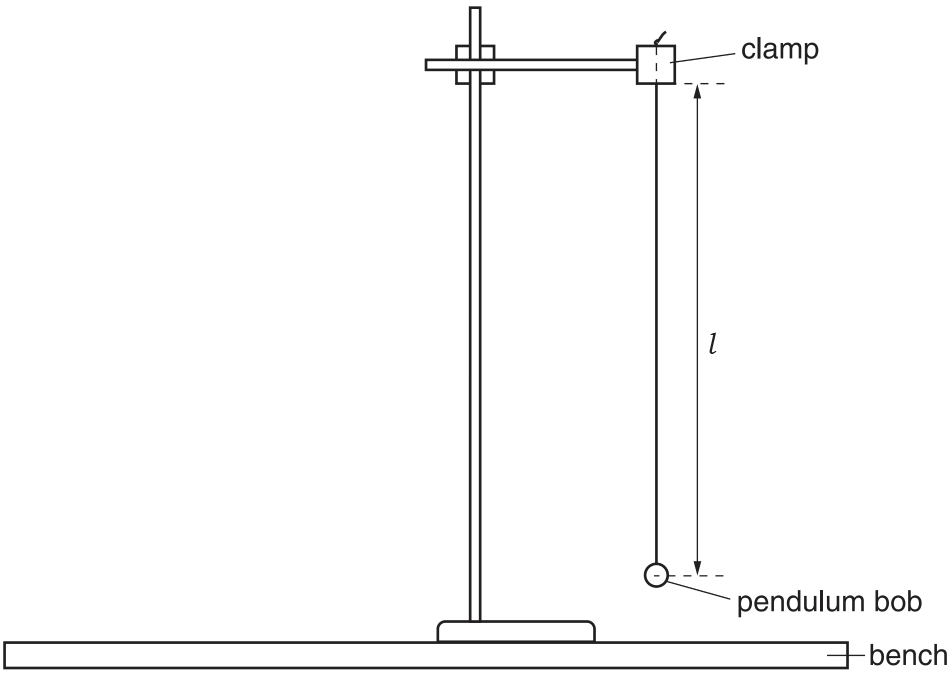


Fig. 3.2

Fig. 3.2 is drawn to a scale of **one-tenth full size**.

(a) **(i)** Measure the length l of the pendulum in Fig. 3.2 to the nearest 0.1 cm.

length l = ... cm [1]

(ii) Calculate the actual length l_A of the pendulum she uses. Record your answer below and in Table 3.1 in **(b)**.

actual length l_A = ... cm [1]

(iii) The actual length l_A of the pendulum is the distance from the point of support to the centre of the pendulum bob.

Describe a precaution that the student should take to measure l_A as accurately as possible. You may draw a diagram if you wish.

....

....[1]

(b) The student then moves the pendulum bob to position **P** and releases it so that it oscillates. She records the time taken for 20 oscillations. Fig. 3.3 shows the reading on the stopwatch.

00 : 30 . 98

Fig. 3.3

Record in Table 3.1 the reading on the stopwatch to three significant figures. [1]

Table 3.1

l_A / cm	time for 20 oscillations / s	period T / s	T^2 / s^2
50.0	28.4	1.42	2.0
40.0	25.4	1.27	1.6
30.0	22.0	1.10	1.2
20.0	18.0	0.90	0.8

She repeats the procedure described in **(b)** for lengths l_A of 50.0 cm, 40.0 cm, 30.0 cm and 20.0 cm.

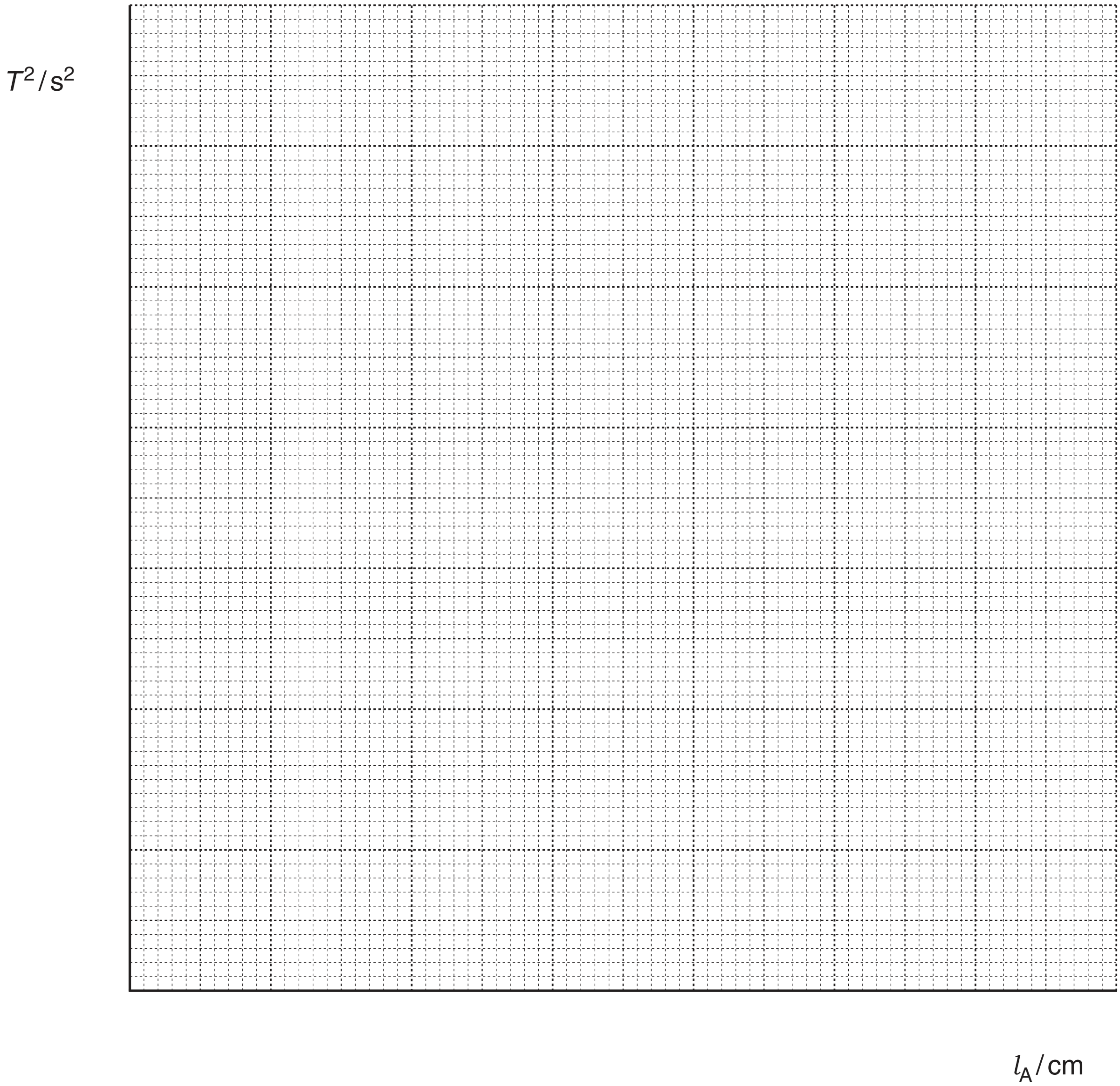
Her values are shown in Table 3.1.

(c) Complete Table 3.1 by calculating the period T of the pendulum and T^2 for the first set of results. Remember that the period is the time for **one** oscillation.

[2]

(d) On the grid provided, use the information in Table 3.1 to plot a graph of T^2 against l_A.

Start both axes of your graph from the origin (0, 0). Draw the best-fit straight line.



[3]

(e) Another student suggests that T^2 is directly proportional to l_A.

State whether your graph supports this suggestion. Give a reason for your answer.

....

....

....[1]

4 Three students investigate the effect of acid on the growth of some seedlings.

Each student sets up three petri dishes. One of the dishes is shown in Fig. 4.1.

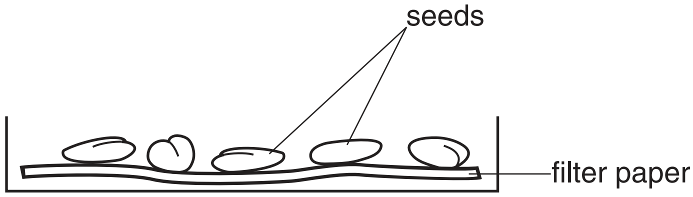


Fig. 4.1

Dish **A** is watered with distilled water. Dishes **B** and **C** are watered with dilute acid. The acid used in dish **C** is more concentrated than the acid used in dish **B**.

The dishes are left in a warm place for a week and then the height of the tallest seedling in each dish is measured to the nearest millimetre. The results for dishes **B** and **C** are shown in Table 4.1.

Table 4.1

dish	seedling height / mm			average seedling height / mm
	student **1**	student **2**	student **3**	
A	32			
B	14	18	16	
C	2	3	1	

(a) **(i)** Measure to the nearest millimetre, the height of each of the seedlings in Fig. 4.2 from the top of the filter paper to the top of the seedling.

Record these for dish **A** for students **2** and **3** in Table 4.1. [2]

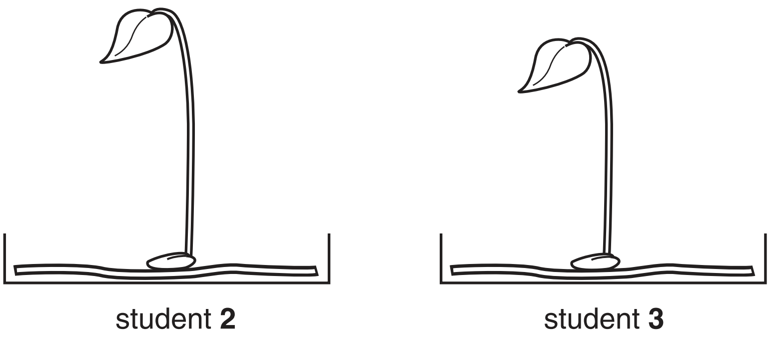
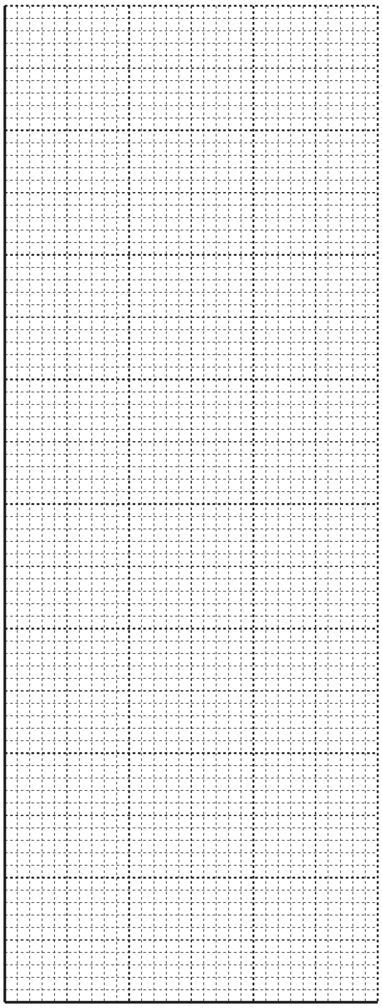


Fig. 4.2

(ii) Calculate the average heights for the seedlings in dishes **A**, **B** and **C** and record these in Table 4.1. [1]

(b) **(i)** On the grid below, draw a bar chart to show the data collected by **student 1**.



[3]

(ii) Explain why it would be better to draw a bar chart using the average heights instead of just the results from one student.

....

....[1]

(c) Describe the effect of the acid solutions on the growth of the seedlings.

....

....[2]

(d) State **one** environmental factor that needs to be kept the same for each of dishes **A**, **B** and **C**.

....[1]

5 A science class is investigating the properties of five different colourless gases.

The teacher has given them test-tubes containing the gases **V**, **W**, **X**, **Y** and **Z**. Each test-tube contains only one gas.

The students carry out different tests on the gases.

(a) **Test 1**. A glowing splint is inserted into a test-tube of each gas. In gas **Z** the splint relights. Suggest the name of gas **Z**.

....[1]

(b) **Test 2**. Gases **V**, **W** and **Y** are tested to find out if they are acidic, alkaline or neutral.

(i) Describe how a student can show that a gas is acidic or alkaline. Include any observations in your answer.

....

....

....

....[2]

(ii) Describe how a student can show that a gas is neutral.

....

....

....[1]

(c) **Test 3**. The teacher gives the students a bowl of water. They have no other apparatus except the test-tubes containing the gases.

Draw a diagram to show how the students could use only this to find out if the gases are soluble in water.

Show clearly what is seen if the gas is soluble in water.

[2]

(d) The students find out that gases **V** and **W** are soluble in water. They also find out that gas **V** is alkaline and gas **W** is acidic.

Use these results to suggest a name for the gases **V** and **W**.

gas **V** ....

gas **W** ....
[2]

(e) These tests may not be able to identify carbon dioxide gas.

Suggest a test to identify carbon dioxide gas and state the observations for a positive result.

test ....

....

observations ....

....
[2]

6 A student carries out an experiment to compare the electrical resistance of wires **L** and **M**. The wires are made of different metal alloys and are each 100 cm long.

The student connects wire **L** into the circuit shown in Fig. 6.1 so that the current and voltage can be measured when the switch is closed.

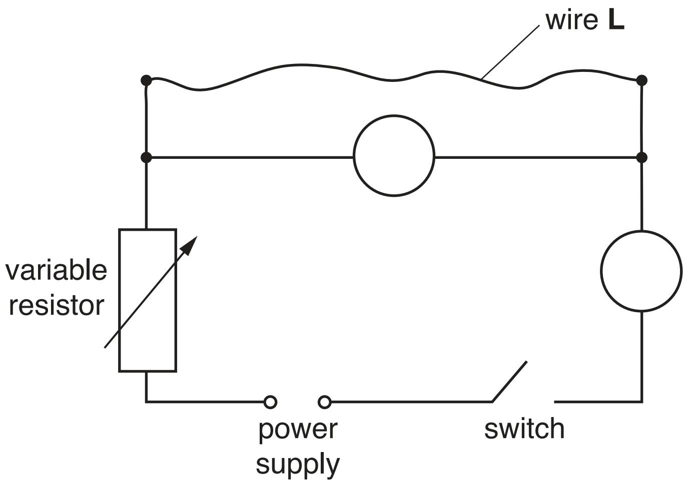


Fig. 6.1

(a) Complete the symbols for the ammeter and voltmeter in Fig. 6.1. [1]

(b) The student closes the switch. She adjusts the variable resistor until there is a small current in wire **L**. She reads the ammeter and voltmeter and records the readings in Table 6.1.

She opens the switch.

She repeats the experiment using wire **M**.

Table 6.1

wire	current / A	voltage / V
L	0.80	1.2
M		

Fig. 6.2 shows the ammeter and voltmeter readings for wire **M**.

Read the current to the nearest 0.05 A and the voltage to the nearest 0.1 V.

Record the values in Table 6.1. [2]

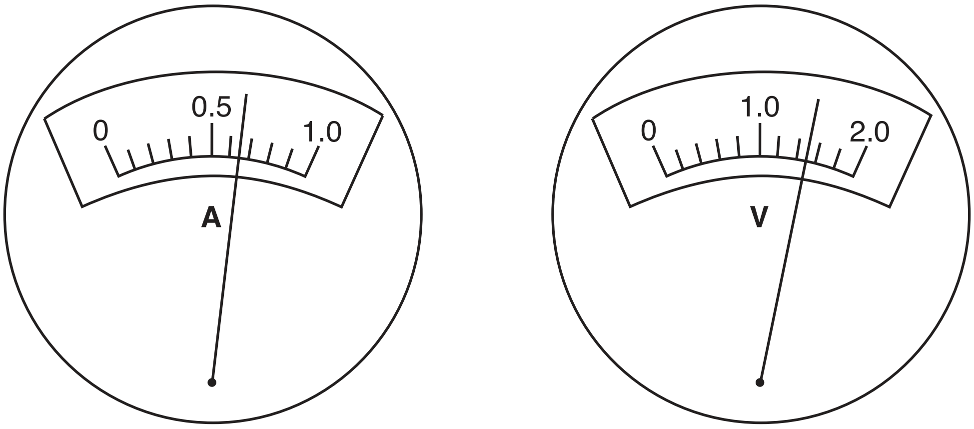


Fig. 6.2

(c) Calculate the resistances of wires **L** and **M** using the formula shown.

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

State the unit of resistance.

resistance of wire **L** = ...

resistance of wire **M** = ...

unit = ...
[3]

(d) Using the circuit in Fig. 6.1, design an experiment to find out how the resistance of a wire changes with its length.

In your answer you should include the lengths of the wire to be used, the variables to be controlled and an appropriate circuit diagram.

State the results you would record and how you would present your results to show the relationship.

....

....

....

....

....

....[4]