



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

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**PHYSICAL SCIENCE**

**0652/61**

Paper 6 Alternative to Practical

**October/November 2013**

**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 a 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 **20** printed pages.



- 1 A student is carrying out an experiment to study the conduction of heat through the wall of a bottle. She is using three bottles, one made from metal, one from plastic and one from glass. The apparatus is shown in Fig. 1.1.

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Use

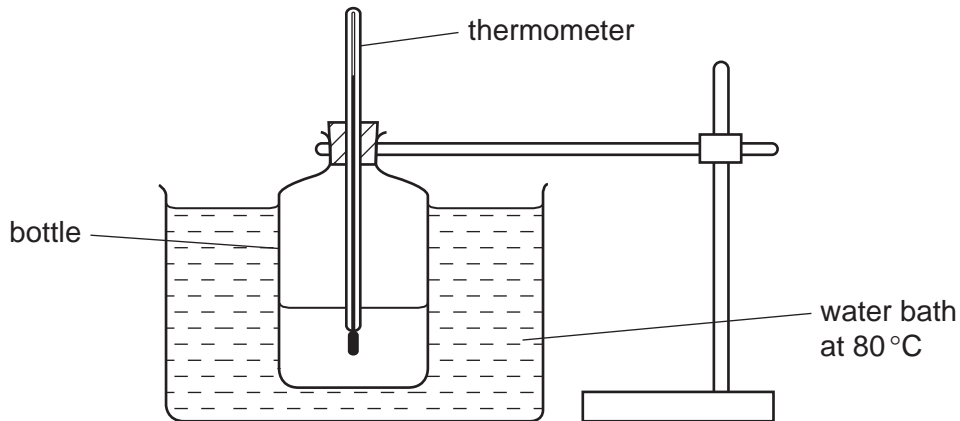


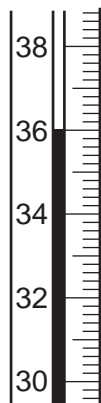
Fig. 1.1

- The student places water in the glass bottle.
- She inserts the cork carrying the thermometer.
- She reads the temperature of the water in the bottle and records it in Table 1.1.
- She suspends the bottle in the water bath kept at 80 °C.
- After each minute, for 5 minutes, she reads and records in Table 1.1 the temperature of the water in the bottle.
- She repeats the procedure using the other two bottles.

(a) Fig. 1.2 shows the thermometer readings for the missing temperatures.

Read the scales and complete Table 1.1.

[3]



t = 2 min



t = 3 min



t = 4 min

Fig. 1.2

Table 1.1

time / minutes	temperature of the water in the bottle / °C		
	glass bottle	metal bottle	plastic bottle
0	18	18	18
1	27	32	29
2		44	40
3		54	50
4		63	59
5	59	71	67

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- (b) Suggest the final temperature of the water in the bottles after a long time.

final temperature = ..... °C [1]

- (c) Place the three materials, glass, metal and plastic in order of their ability to conduct heat as shown by this experiment.

best .....

.....

worst .....

[1]

- (d) (i) The student is not sure that her conclusion about the relative ability of the three materials to conduct heat is reliable.

Suggest **one** other factor that could affect the rate of heat conduction through the walls of these three bottles.

..... [1]

- (ii) Suggest **two** conditions, not mentioned in the method, that should be kept constant during the experiment to make a fair comparison between the materials of the three bottles.

1 .....

2 ..... [2]

- (e) (i) Heat energy is conducted through a metal by particles that can move easily through the crystal structure.

Name these particles.

..... [1]

- (ii) Explain why these particles cannot move easily through the structures of glass and plastic.

.....  
..... [1]

*For  
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Use*

- 2 A student is doing an experiment with a converging lens. She is using the apparatus shown in Fig. 2.1.

A converging lens is thicker in the middle and refracts light so that an image of an object can be seen on a screen some distance away.

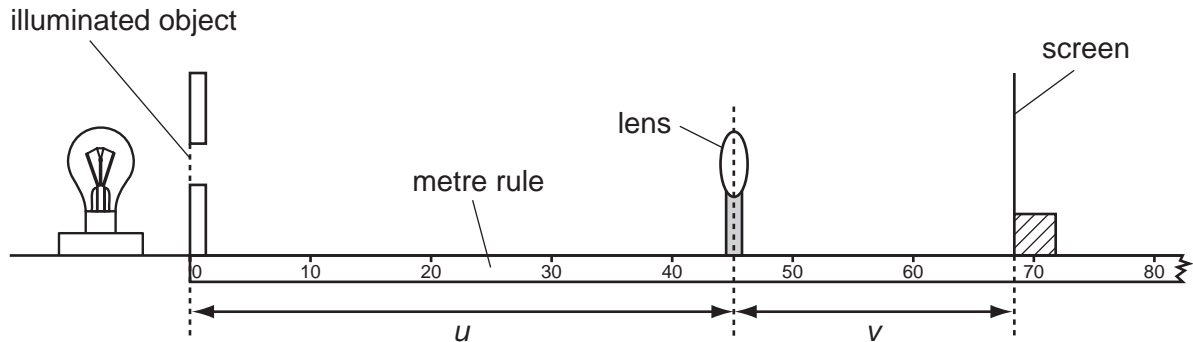


Fig. 2.1

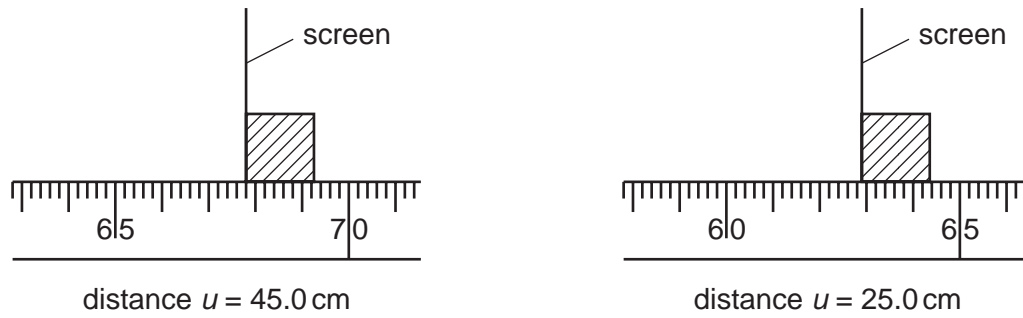
When the lens is in the correct position between the illuminated object and the screen, a sharp image is formed on the screen.

The student is investigating the relationship between  $u$ , the distance between the object and the lens and  $v$ , the distance between the image on the screen and the lens.

- She places the lens so that  $u$ , the distance between the object and the lens, is 45.0 cm.
- She adjusts the position of the screen until a sharp image of the illuminated object is formed on the screen.
- She records, in Table 2.1, the position of the screen on the rule.
- She uses the position of the screen and  $u$  to calculate  $v$ .
- She calculates the ratio  $v/u$ .
- She repeats the procedure for the other values of  $u$  shown in Table 2.1, on page 6.

The positions of the screen when the values of  $u$  are 45.0 cm and 25.0 cm are shown in Fig. 2.2.

For  
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Use



**Fig. 2.2**

- (a) (i) Read the position of the screen for the missing values and record them in Table 2.1. [2]
- (ii) Calculate the values of  $v$ , when the distances of  $u$  are 45.0 cm and 25.0 cm. Record these values in Table 2.1.

[2]

- (iii) Calculate the missing values of the ratio  $v/u$ . Record them in Table 2.1. [2]

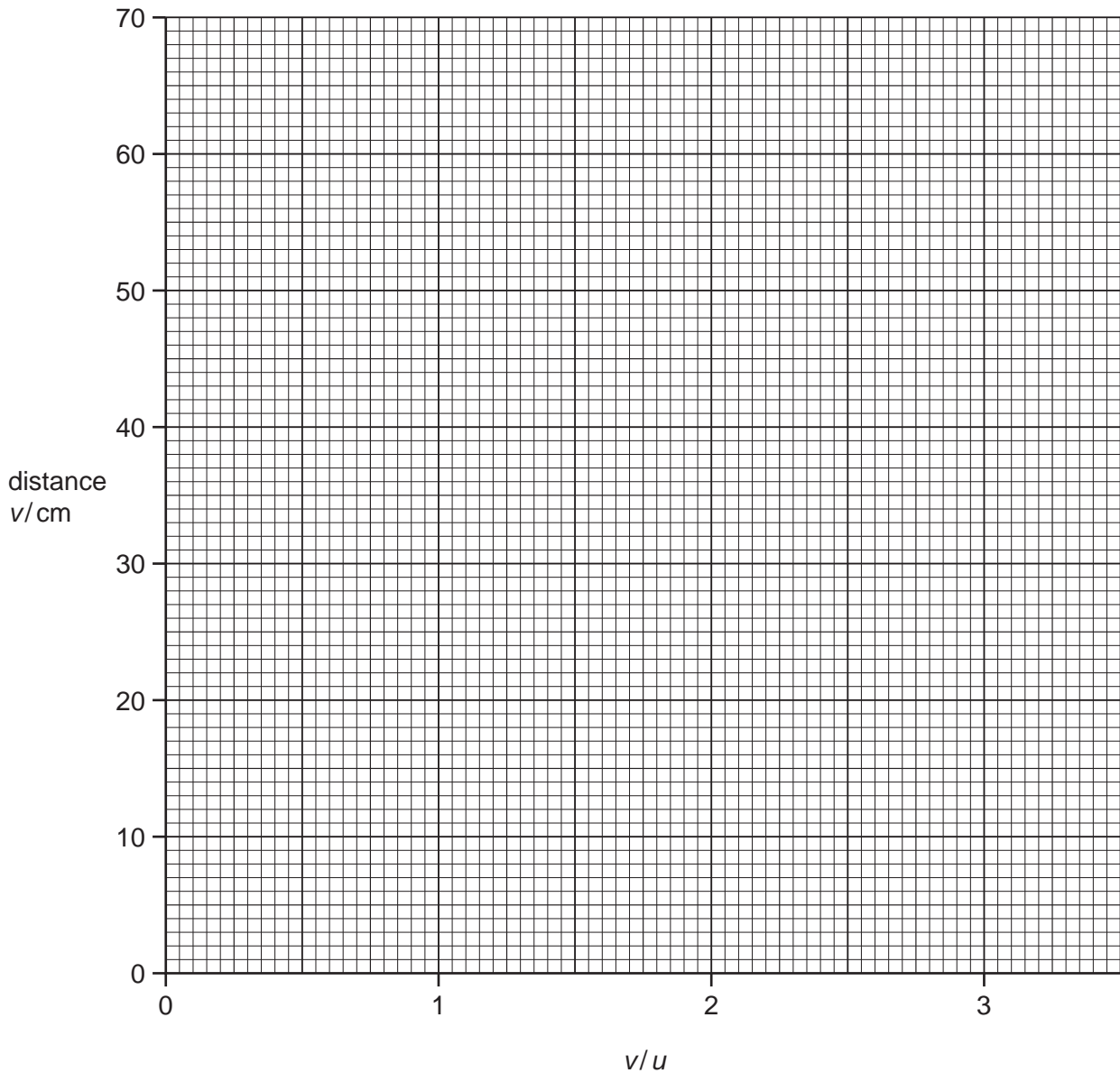
**Table 2.1**

distance $u$ /cm	position of screen/cm	distance $v$ /cm	ratio $v/u$
45			
35	61.4	26.4	0.75
30	59.8	29.8	0.99
25			
20	80.2	60.2	3.01

- (b) (i) On the graph grid provided, plot a graph of distance  $v$  against the ratio  $v/u$ .

Draw the best straight line. The line will not pass through the point  $(0,0)$ . [2]

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Use



- (ii) The gradient of the line is a useful number that indicates how much a lens can magnify an image.

Find the gradient of the straight line you have drawn.

Show on your graph the values you use to calculate the gradient.

gradient = ..... [2]

- 3 A student has been given solid **X**, a green powder. She is carrying out tests on solid **X** so that she can identify it.

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### Test 1

She heats solid **X** as shown in Fig. 3.1.

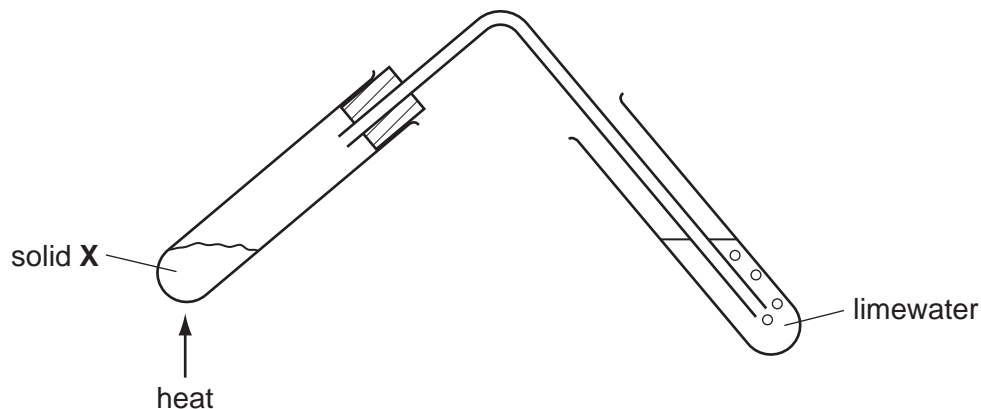


Fig. 3.1

When solid **X** is heated, a gas bubbles into the limewater. The appearance of the limewater changes. A black powder is left in the heated test-tube.

- (a) (i) Describe the change in the appearance of the limewater.

.....  
..... [1]

- (ii) Name the gas that bubbles into the limewater.

..... [1]

- (iii) As a result of this test, what can the student conclude about solid **X**?

..... [1]



**(b) Test 2**

The student allows the black powder left in the test-tube to cool. Then she adds dilute nitric acid and shakes the mixture. The black powder dissolves and a blue solution is made. She filters the mixture to obtain a blue filtrate.

Draw a labelled diagram to show how she filters the mixture.

[2]

**(c) Test 3**

She divides the blue filtrate into two parts. To the first part, she adds a few drops of ammonia solution. A blue precipitate is formed.

- (i) The student thinks that there are copper ions in the blue solution.

Name the blue precipitate.

..... [1]

- (ii) The student adds more ammonia solution until the ammonia is in excess. The appearance of the mixture changes.

State how the appearance of the mixture has changed.

..... [1]

**(d) Test 4**

To the second part of the blue filtrate from **(b)**, the student adds some iron filings. She shakes the mixture. The tube becomes warm and the appearance of the mixture changes.

**(i)** how the appearance of the solution changes,

..... [1]

**(ii)** how the appearance of the iron filings changes.

..... [1]

**(e)** Use the results of **Tests 1 – 4** to state the name and formula of solid **X**.

name .....

formula ..... [1]

**Please turn over for Question 4.**

4 Sulfuric acid can react with sodium hydroxide to form two different salts.

A student is trying to make samples of these two salts. He has a bottle of aqueous sodium hydroxide and a bottle of dilute sulfuric acid. The concentrations of these solutions are unknown.

- He places  $20.0\text{ cm}^3$  of the dilute sulfuric acid in a conical flask.
- He adds a few drops of litmus solution.
- He fills a burette to the  $0.0\text{ cm}^3$  mark with the aqueous sodium hydroxide.
- He adds the sodium hydroxide to the acid until the litmus changes colour.

(a) (i) Fig. 4.1 shows the scale of the burette after the litmus has changed colour.

Read the scale and record the volume.

volume of aqueous sodium hydroxide used = .....  $\text{cm}^3$  [1]

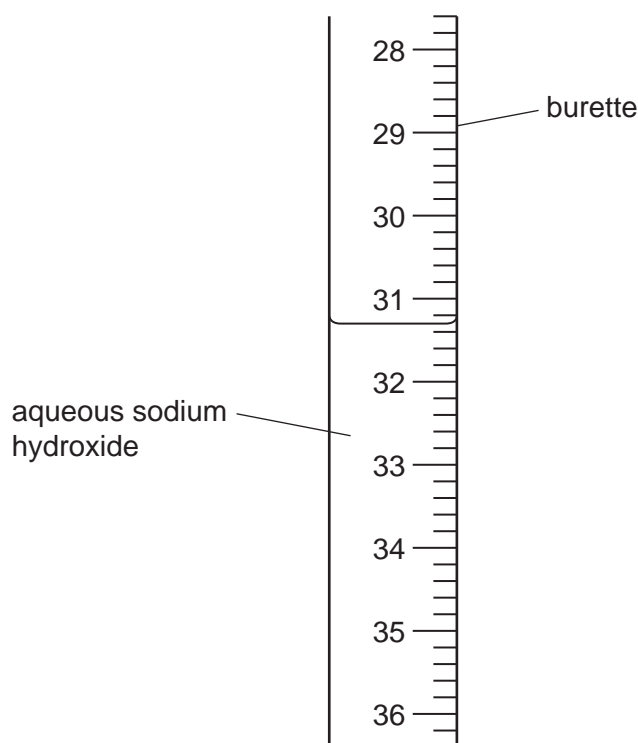


Fig. 4.1

(ii) State the colour change of the litmus solution that the student observes.

from ..... to ..... [1]

The teacher has given the student the equations for the reactions of sodium hydroxide with sulfuric acid to form two the different salts.

For  
Examiner's  
Use



**(b)** The salt produced in the conical flask when the litmus has changed colour is sodium sulfate.

Explain why this salt, not sodium hydrogen sulfate, is formed.

.....

.....

..... [2]

**(c)** Describe how the student can make a pure dry crystalline sample of sodium sulfate, using the same solutions as before and the result from part **(a)**.

.....

.....

.....

.....

..... [4]

**(d)** Suggest how the student must change the method you have described in part **(c)** so that he can make crystals of sodium hydrogen sulfate.

.....

.....

..... [2]

- 5 The science class is making a display to show the elements in Period 3 of the Periodic Table, as in Fig. 5.1.

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A sample of each element is placed next to a card giving its symbol and atomic number.

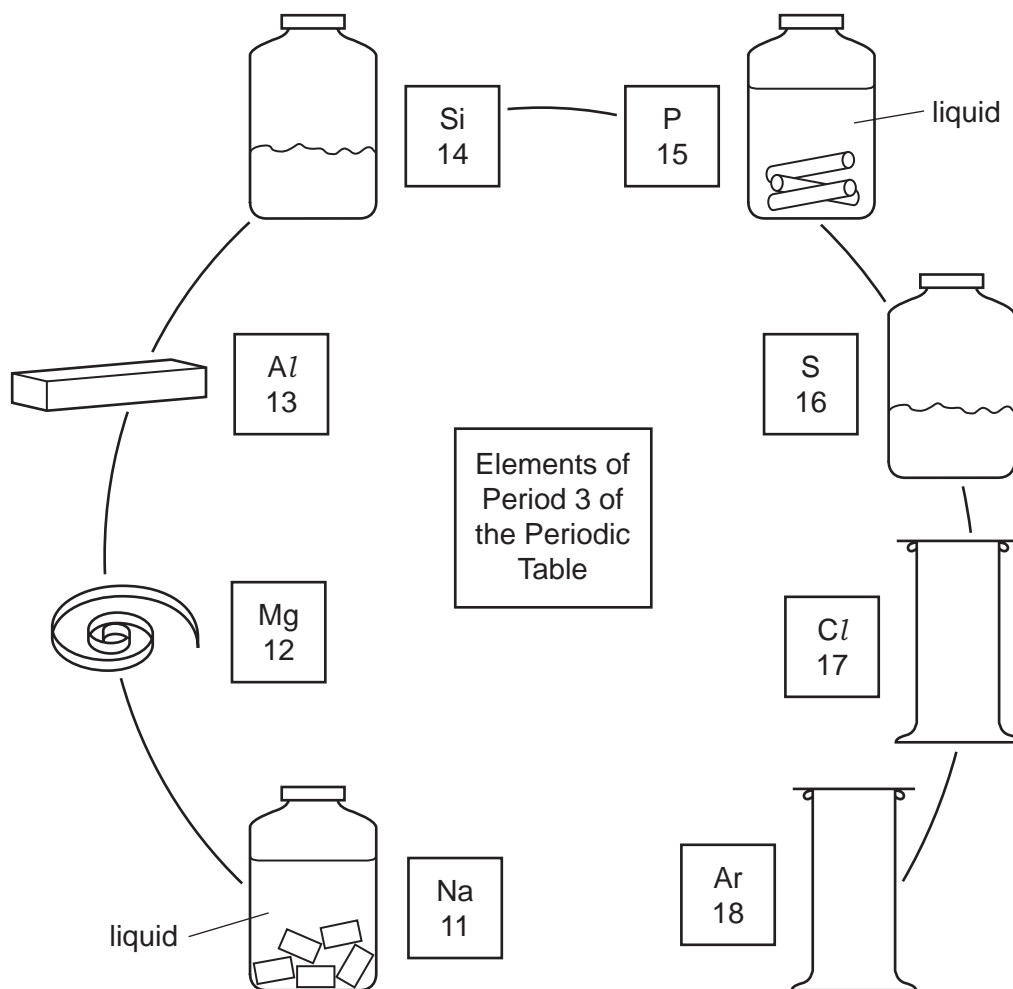


Fig. 5.1

- (a) Write the names of element number 12 and element number 14.

12 ..... 14 ..... [2]

- (b) Elements 11 and 15 are contained in bottles and covered with a liquid to prevent the element reacting with air.

One element is covered by water and the other one by oil.

Complete the sentences.

The name of the element covered by water is .....

The name of the element covered by oil is ..... [1]

(c) The two gas-jars holding samples of elements 17 and 18 have lost their labels.

How can a student tell from the appearance of the gases which gas-jar contains element number 17?

..... [1]

(d) Describe an experiment that a student can do to show that element number 13 is a metal.

State the observation that the student will make.

You may draw a diagram to help you.

.....  
.....  
..... [2]

Another student is doing an experiment to show the burning of element number 16 in oxygen. This is shown in Fig. 5.2.

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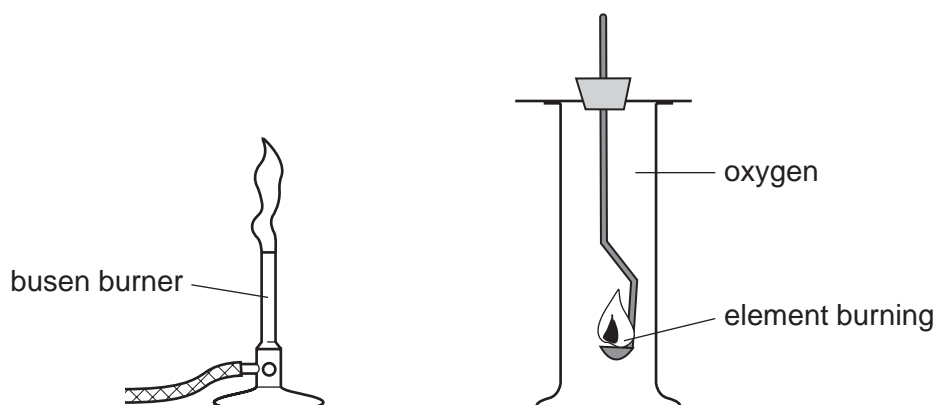


Fig. 5.2

He places some of the powder in a spoon and heats it in a Bunsen flame. When the element ignites, he holds the spoon in the gas-jar of oxygen. After the powder finishes burning, he adds water to the gas-jar, places the lid on and shakes the jar. Then he adds Universal Indicator (full-range indicator) solution.

(e) (i) State the flame colour of the burning element number 16.

..... [1]

(ii) Suggest why the student adds water to the gas-jar.

..... [1]

(iii) State the colour of the Universal Indicator in the gas-jar.

..... [1]

(iv) The student does the same experiment with a piece of element number 12.

Suggest the colour of the Universal Indicator in this gas-jar.

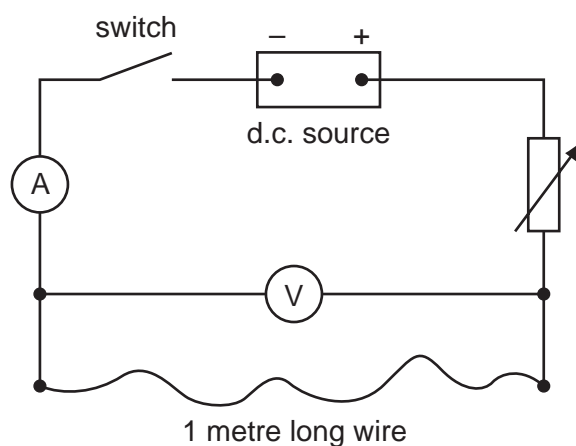
..... [1]



**Please turn over for Question 6.**

- 6 A student is finding the accurate value for the electrical resistance of a piece of resistance wire of length 1 metre uses the circuit shown in Fig. 6.1.

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Use



**Fig. 6.1**

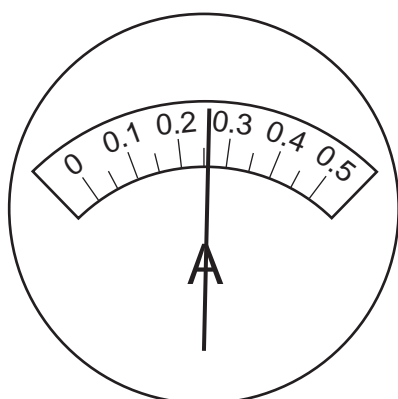
- The student sets the variable resistance at a high value.
- He closes the switch.
- He reads the ammeter to the nearest 0.01 A and the voltmeter to the nearest 0.05 V. He records the values in Table 6.1, reading number 1.
- He opens the switch and decreases the variable resistance.
- He closes the switch and records the new values for current and voltage, reading number 2.
- He repeats this procedure until he has five sets of readings.

**Table 6.1**

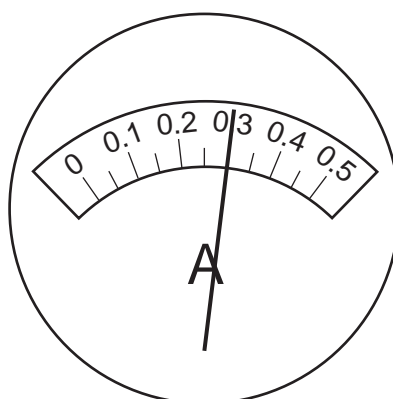
reading number	1	2	3	4	5
current / A	0.16	0.20			0.34
voltage / V	0.90	1.15			2.00
resistance of wire / ohms	5.6	5.7			5.9

(a) The ammeter and voltmeter dials for the missing readings are shown in Fig. 6.2.

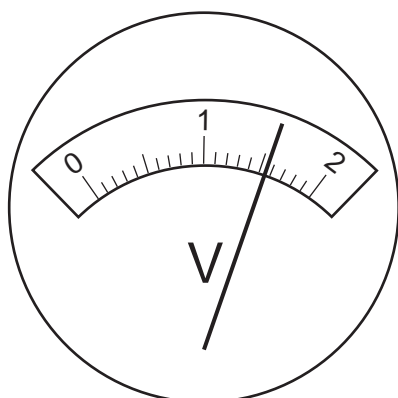
Record in Table 6.1 the values of current and voltage to the nearest 0.01 A and 0.05 V. [4]



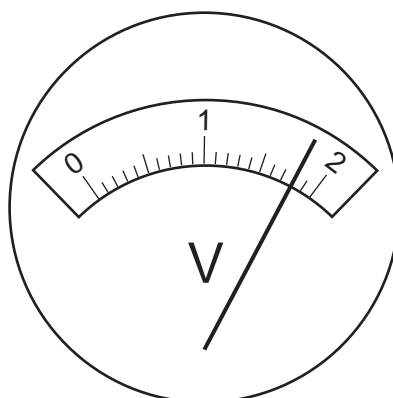
reading number 3



reading number 4



reading number 3



reading number 4

Fig. 6.2

(b) (i) Find the resistance of the wire using the values for readings numbers 3 and 4 and record the answers in Table 6.1.

Calculate the resistance in ohms to one decimal place.

Use the formula

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

[2]

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- (ii) The values of the resistance of the wire obtained from the five readings are not all the same.

Study the experimental details again.

Suggest a reason why the calculated values of the resistance are not all the same.

.....  
..... [1]

- (iii) The student decides that reading number 5 gave the best value for the resistance of the wire.

Suggest a better way of using the results to find the resistance of the wire.  
(You do not have to find the value for the resistance.)

.....  
..... [1]

- (c) A current travels through the resistance wire each time that the student closes the switch. The teacher says that when the current is flowing, particles are passed from atom to atom along the wire.

- (i) Name these particles. .... [1]

- (ii) On Fig. 6.1, draw an arrow to show the direction of movement of these particles along the resistance wire. [1]

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