Electrical Circuits

Question Paper 2

Level	IGCSE
Subject	Physics
Exam Board	CIE
Topic	Electricity and Magnetism
Sub-Topic	Electrical Circuits
Paper Type	Alternative to Practical
Booklet	Question Paper 2

Time Allowed: **63 minutes**

Score: **/52**

Percentage: **/100**

1 The class is determining the resistance of a resistor.

Fig. 2.1 shows the circuit.

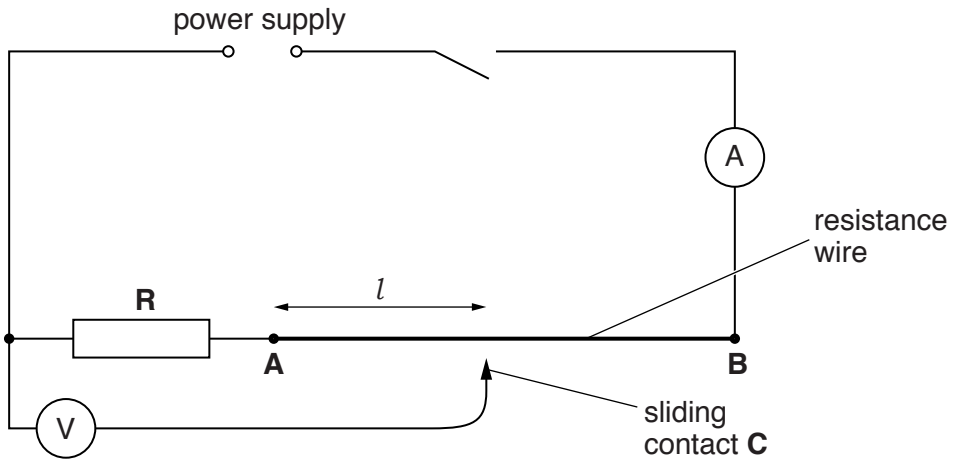


Fig. 2.1

(a) A student places the sliding contact **C** at a distance l from end **A** of the resistance wire. She records the reading on the voltmeter.

(i) Read the meter shown in Fig. 2.2. Record, in Table 2.1, this value of V for length $l = 100\,\text{cm}$.

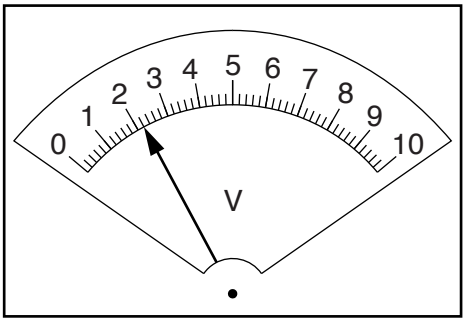


Fig. 2.2

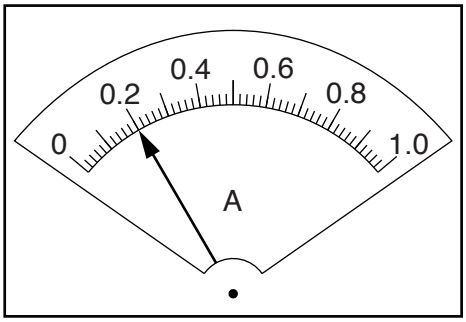


Fig. 2.3

Table 2.1

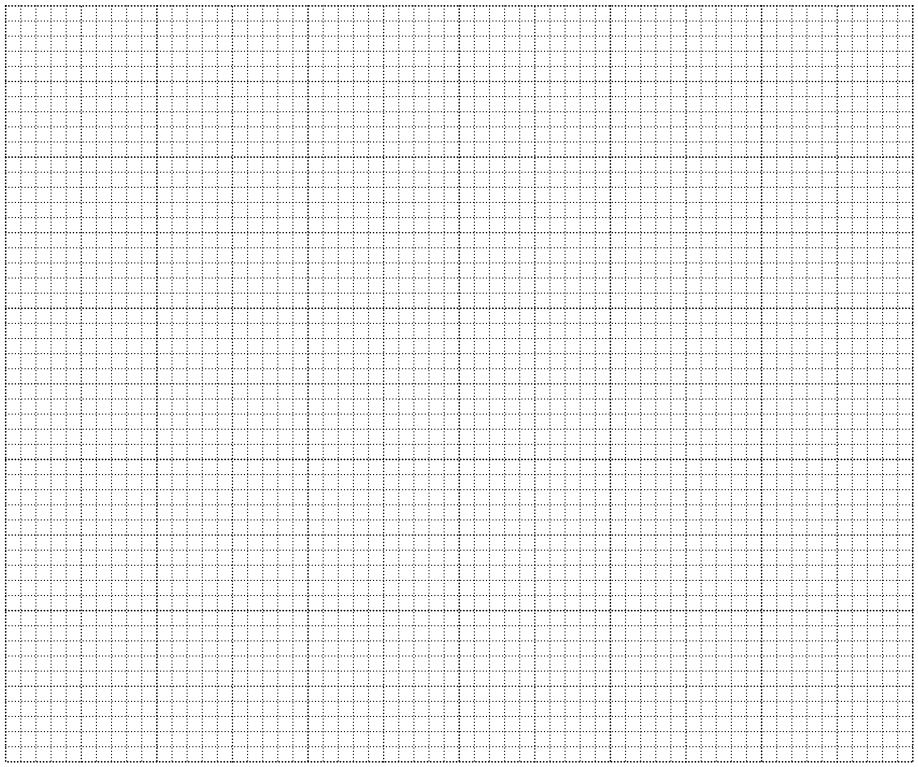
l/cm	V/V
20.0	1.1
40.0	1.4
60.0	1.6
80.0	1.9
100.0	

[1]

(ii) Read the meter shown in Fig. 2.3. Record this current I.

I = ...[1]

(b) Plot a graph of V/V (y-axis) against l/cm (x-axis). Start both axes at the origin (0, 0).



[4]

(c) **(i)** Determine the value of the intercept Y on the y-axis.

Y = ...[1]

(ii) Calculate the ratio $\frac{Y}{I}$. The value of I is your answer to part **(a)(ii)**.

$\frac{Y}{I}$ = ...

(iii) $\frac{Y}{I}$ is numerically equal to the resistance R of the resistor **R**.

Write down a value for R to a suitable number of significant figures for this experiment. Include the unit.

R = ...
[2]

[Total: 9]

2 The class is investigating the combined resistance of resistors in series and parallel arrangements.

The circuit is shown in Fig. 3.1.

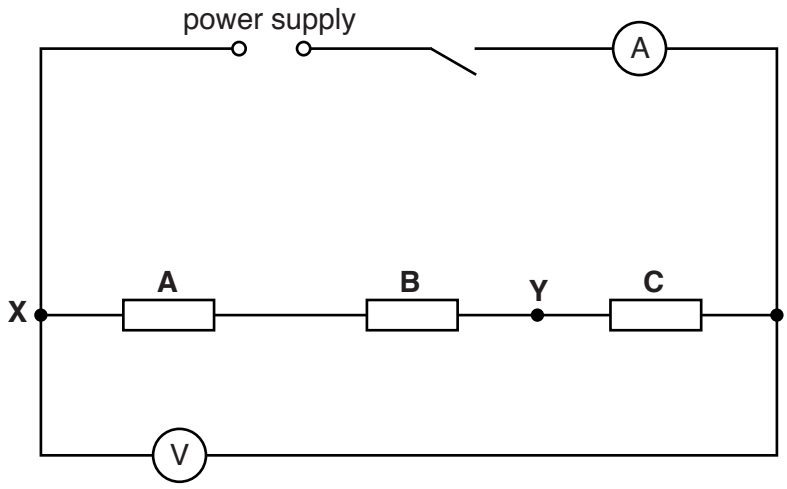


Fig. 3.1

(a) (i) Record the potential difference V_1 across the resistors and the current I_1 in the circuit, as shown in Figs. 3.2 and 3.3.

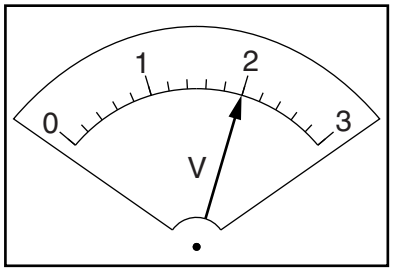


Fig. 3.2

V_1 = ...

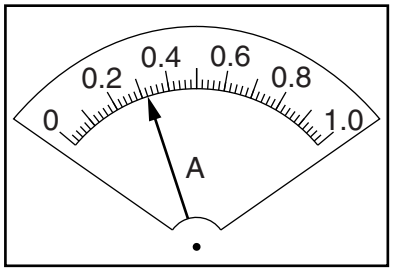


Fig. 3.3

I_1 = ...

[2]

(ii) Calculate the combined resistance R_1 of the resistors using the equation $R_1 = \frac{V_1}{I_1}$.

R_1 = ...[1]

(b) A student rearranges the circuit shown in Fig. 3.1. He follows these instructions:

- Disconnect resistors **A** and **B**.
- Connect together the resistors **A** and **B** in parallel.
- Connect one side of this parallel combination to the resistor **C** at the point labelled **Y** in Fig. 3.1.
- Connect the other side of the parallel combination to the point labelled **X** in Fig. 3.1.
- Do not make any other changes to the circuit.

On Fig. 3.4, complete the diagram of this new circuit using standard circuit symbols.

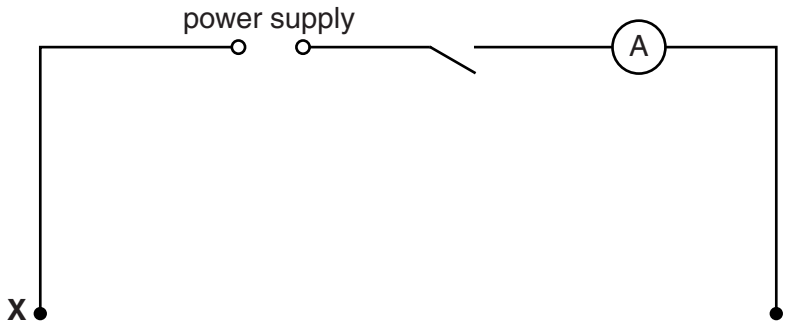


Fig. 3.4

[2]

(c) Using the new circuit, a student measures the potential difference V_2 across the three resistors and the current I_2 in the circuit.

V_2 = 2.1 V

I_2 = 0.69 A

(i) Calculate the combined resistance R_2 of the resistors using the equation $R_2 = \frac{V_2}{I_2}$.

R_2 = ...

(ii) Calculate the ratio $\frac{R_1}{R_2}$.

$\frac{R_1}{R_2}$ = ...

[2]

(d) R_1 should equal $2 \times R_2$ when all three resistors are identical.

State whether the results indicate that the resistors are identical. Justify your answer by reference to the results.

statement .....

justification .....

.....

.....

[2]

[Total: 9]

3 The class is studying the resistance of identical wires connected in parallel.

The circuit is set up as shown in Fig. 4.1, with a crocodile clip connected to the right-hand end of wire **A**.

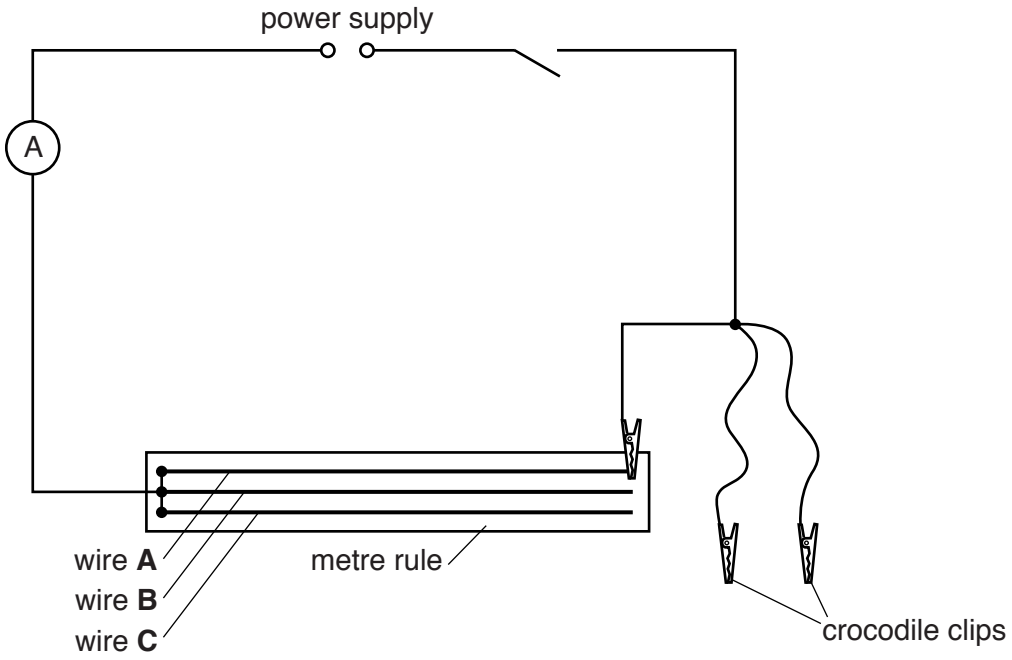


Fig. 4.1

(a) On Fig. 4.1, use the appropriate symbol to show a voltmeter connected to measure the potential difference across wire **A**. [1]

(b) In Table 4.1, write down the potential difference V and the current I for wire **A** as shown in Figs. 4.2 and 4.3.

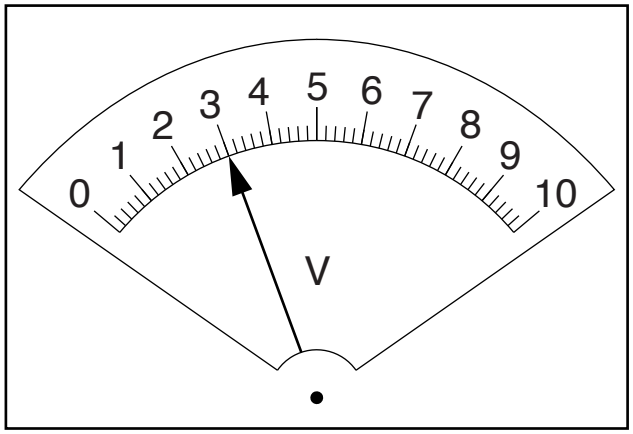


Fig. 4.2

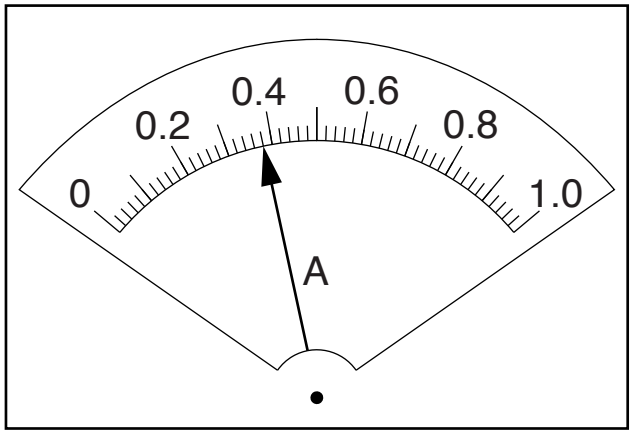


Fig. 4.3

Table 4.1

wire combination	V/V	I/A
A only		
A and **B** in parallel	2.9	0.77
A, **B** and **C** in parallel	2.6	0.98

[1]

(c) The other crocodile clips are used, first to connect wires **A** and **B** in parallel, and then wires **A**, **B** and **C** in parallel. The readings for each circuit are shown in Table 4.1.

On Figs. 4.4 and 4.5, draw arrows to show the meter readings for the circuit in which wires **A** and **B** are connected in parallel.

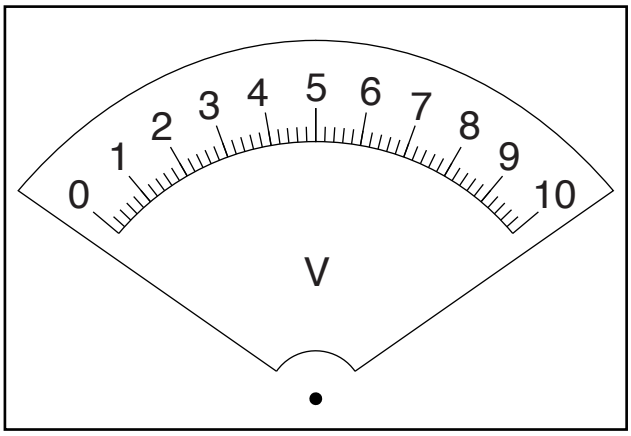


Fig. 4.4

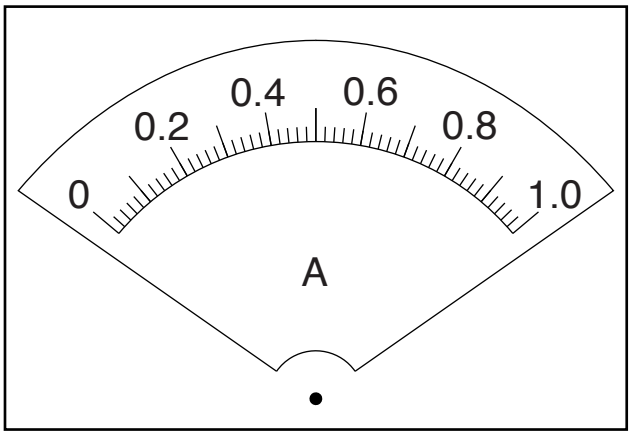


Fig. 4.5

[1]

(d) Calculate, and record below, the resistance R of each wire combination, using the equation $R = \frac{V}{I}$.

resistance of wire **A** R_1 = ...

resistance of wires **A** and **B** in parallel R_2 = ...

resistance of wires **A**, **B** and **C** in parallel R_3 = ...

[3]

(e) **(i)** A student suggests that when 2 identical wires are connected in parallel, their resistance should be equal to 1/2 of the resistance of a single wire.

State whether your findings agree with this suggestion.

Justify your answer by reference to your results, giving values to support your justification.

statement .....

.....

justification .....

.....

[2]

(ii) Use your results to suggest the relationship that should exist between R_3 and R_1.

.....

.....[1]

[Total: 9]

4 The IGCSE class is investigating the resistance of a resistor.

Fig. 3.1 shows the circuit.

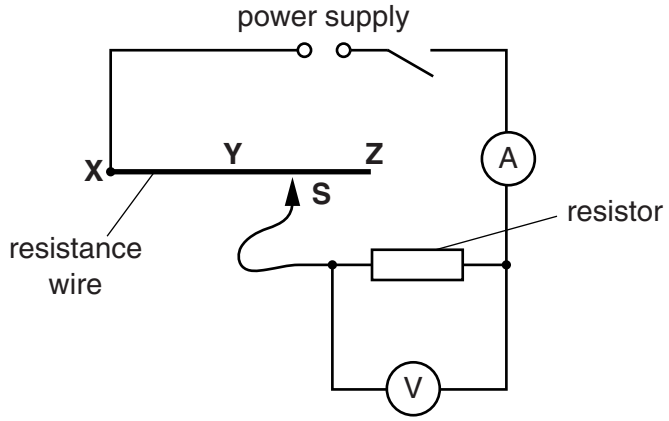


Fig. 3.1

(a) A student connects the sliding contact **S** to point **X** in the circuit. She measures the potential difference V across the resistor and the current I in the circuit. The meters are shown in Fig. 3.2.

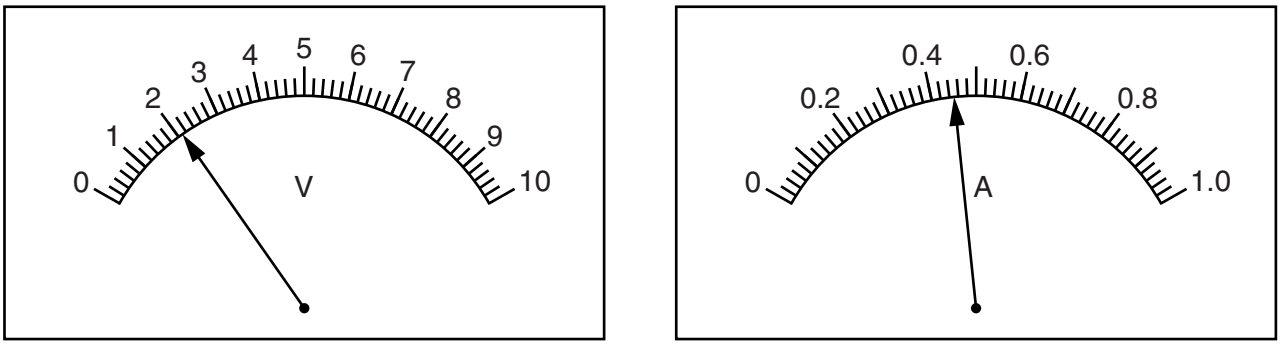


Fig. 3.2

(i) Write down the readings shown on the meters in Fig. 3.2.

V = ...

I = ...

[2]

(ii) Calculate the resistance R of the resistor using the equation $R = \frac{V}{I}$.

R = ... [2]

(b) The student repeats the steps in **(a)**, moving the sliding contact to point **Y** and then to point **Z**.

Comment on the effect, if any, on the current I in the circuit of changing the position of the sliding contact in this way.

.....

.....[1]

(c) In this experiment, the resistance wire **XYZ** acts as a variable resistor (rheostat).

Draw the standard circuit symbol for a variable resistor.

[1]

(d) A student carries out this experiment using a different resistor. He takes readings using various lengths of resistance wire in the circuit. He plots a graph of V/V against I/A.

Fig. 3.3 is a sketch of the graph.

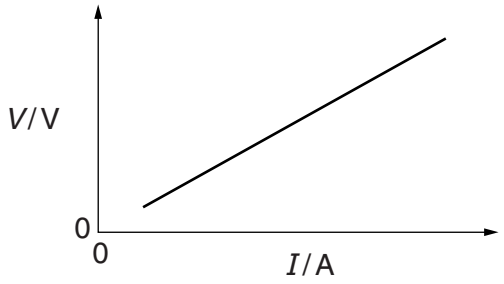


Fig. 3.3

Explain briefly how the student would use the graph to determine the gradient of the line. You may draw on the graph of Fig. 3.3. You are not asked to calculate the value of the gradient.

.....

.....

.....[2]

[Total: 8]

5 Some IGCSE students are investigating resistance using a set of wires.

The circuit they are using is shown in Fig. 3.1.

They measure the potential difference and current for three wires **A**, **B** and **C** inserted in turn between the crocodile clips. All three wires have the same diameter and are made from the same material.

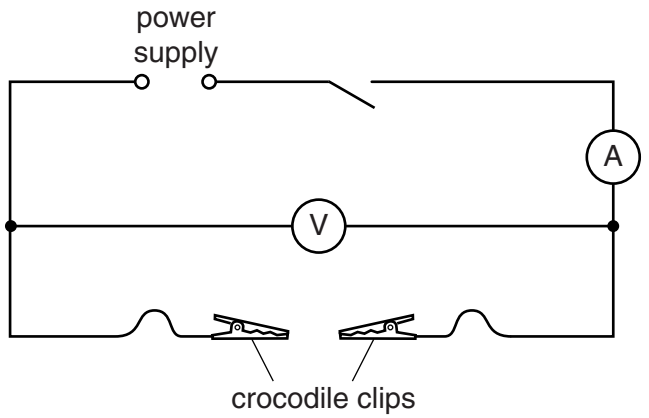


Fig. 3.1

(a) The crocodile clips are connected to the ends of wire **A** and the circuit is switched on. The readings on the voltmeter and ammeter are shown in Fig. 3.2.

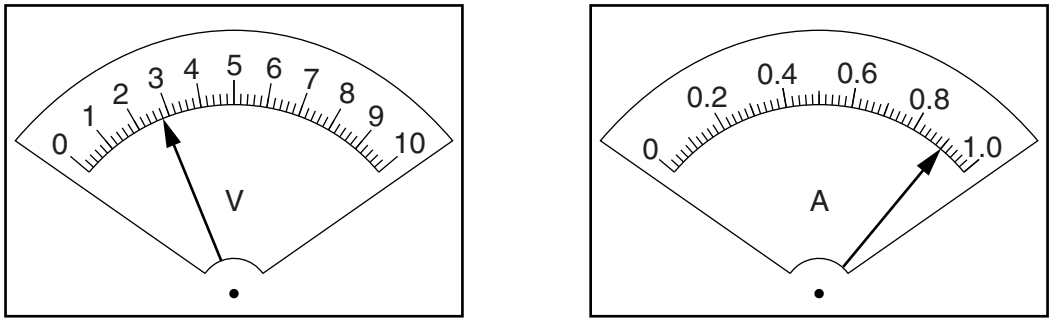


Fig. 3.2

Read, and record in Table 3.1, the potential difference V and the current I.

Table 3.1

wire	length/cm	V/	I/
A	90.0		
B	60.0	2.6	1.33
C	30.0	2.3	2.31

[3]

(b) The procedure is repeated for wire **B** and for wire **C** and the readings are as shown in the table.

Complete the column headings in the table.

(c) **(i)** Calculate and record the resistance R of each wire, using the readings from Table 3.1 and the equation $R = \frac{V}{I}$.

resistance of wire **A**, R_A = ...

resistance of wire **B**, R_B = ...

resistance of wire **C**, R_C = ...

[2]

(ii) One student suggests that R_A should be equal to ($R_B + R_C$).

State whether the findings support this suggestion. Justify your answer by reference to the results.

statement .....

.....

justification .....

.....

.....

[1]

(d) One problem encountered in this type of investigation is that resistance can be affected by a rise in temperature of the wire.

Suggest one way in which this effect could be kept to a minimum.

.....

.....

.....[1]

[Total: 7]

6 The IGCSE class is investigating the resistance of a wire.

The circuit used is shown in Fig. 3.1.

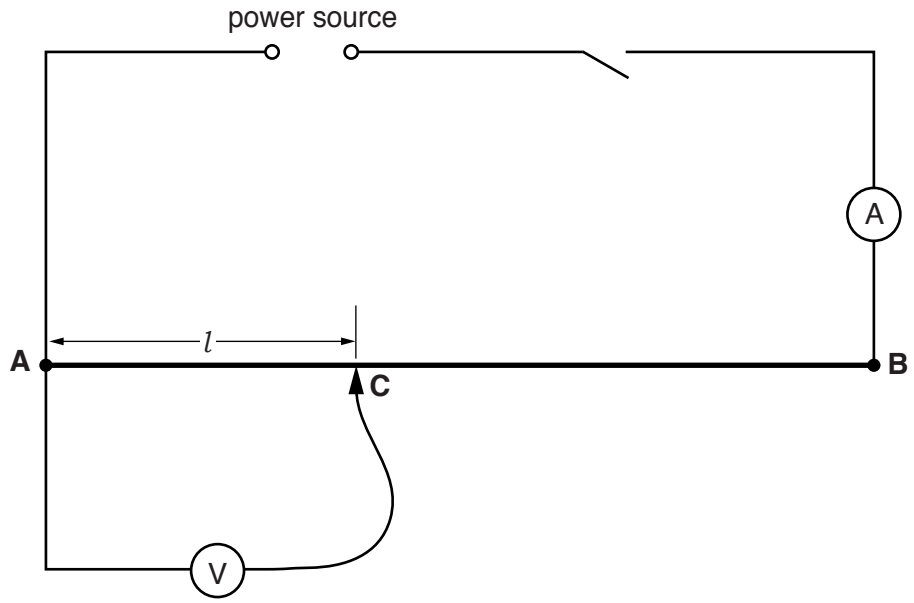


Fig. 3.1

(a) A student measures the potential difference V across different lengths l of the wire **AB** and the current I in the wire. The wire **AB** is 1.00 m long. The readings are shown in Table 3.1.

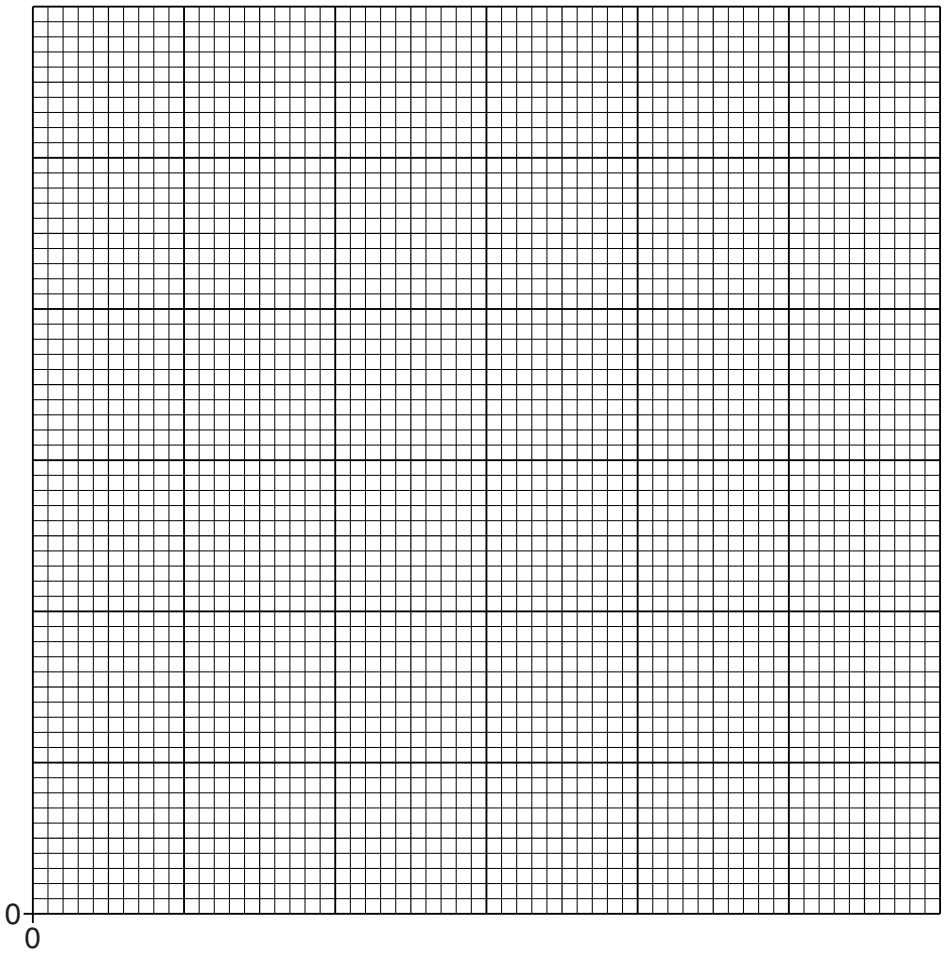
Calculate the resistance R of each length l of the wire **AB**, using the equation $R = \frac{V}{I}$. Record the values of R in the table.

Table 3.1

l/cm	V/V	I/A	R/Ω
10.0	0.36	0.73	
20.0	0.70	0.71	
30.0	1.10	0.73	
40.0	1.45	0.73	
50.0	1.80	0.72	

[2]

(b) Plot a graph of R/Ω (y-axis) against l/cm (x-axis). Start both axes at the origin (0,0).



[5]

(c) State whether your graph shows that the resistance R is proportional to the length l. Justify your answer by reference to the graph.

statement .....

justification .....

.....

[2]

(d) Suggest how you could further test your statement in **(c)**, using the same apparatus.

.....

.....[1]

[Total: 10]