Electrical Quantities

Question Paper 1

Level	IGCSE
Subject	Physics
Exam Board	CIE
Topic	Electricity and Magnetism
Sub-Topic	Electrical Quantities
Paper Type	Alternative to Practical
Booklet	Question Paper 1

Time Allowed: **58 minutes**

Score: **/48**

Percentage: **/100**

1 A student is investigating the resistance of a lamp filament.

The circuit is shown in Fig. 3.1.

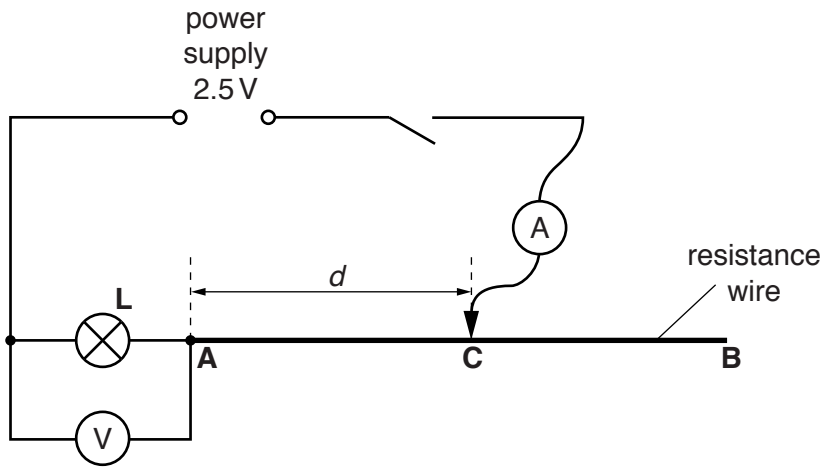


Fig. 3.1

(a) The student places a sliding contact **C** on the resistance wire at a distance d = 0.200 m from point **A**. He measures the current I in the circuit and the p.d. V across the lamp **L**.

He repeats the procedure using values for d of 0.400 m, 0.600 m and 0.800 m. The readings are shown in Table 3.1.

(i) Calculate the resistance R of the lamp filament for each set of readings. Use the equation $R = \frac{V}{I}$. [2]

(ii) Complete the column headings in the table. [1]

Table 3.1

d /	V /	I /	R /	appearance of lamp filament
0.200	1.6	1.00		very bright
0.400	1.3	0.86		bright
0.600	1.0	0.74		dim
0.800	0.8	0.66		does not glow

(b) The student notices that the lamp does not glow when he takes the final set of readings. He thinks that the filament has broken.

State whether the student is correct and give a reason for your answer.

statement .....

reason .....

.....

[1]

(c) A student suggests that the resistance *R* of the lamp filament should be constant.

Suggest, referring to the observations, a reason why the resistance *R* may not be constant in this experiment.

.....

.....

.....

..... [2]

(d) **(i)** Name an electrical component that could be used, instead of the resistance wire **AB** and sliding contact, to vary the current *I*.

..... [1]

(ii) Draw a diagram of the circuit including this component instead of the resistance wire and sliding contact.

[2]

[Total: 9]

2 Some students are investigating the relationship between potential difference and current for a resistor. They are using the circuit shown in Fig. 1.1.

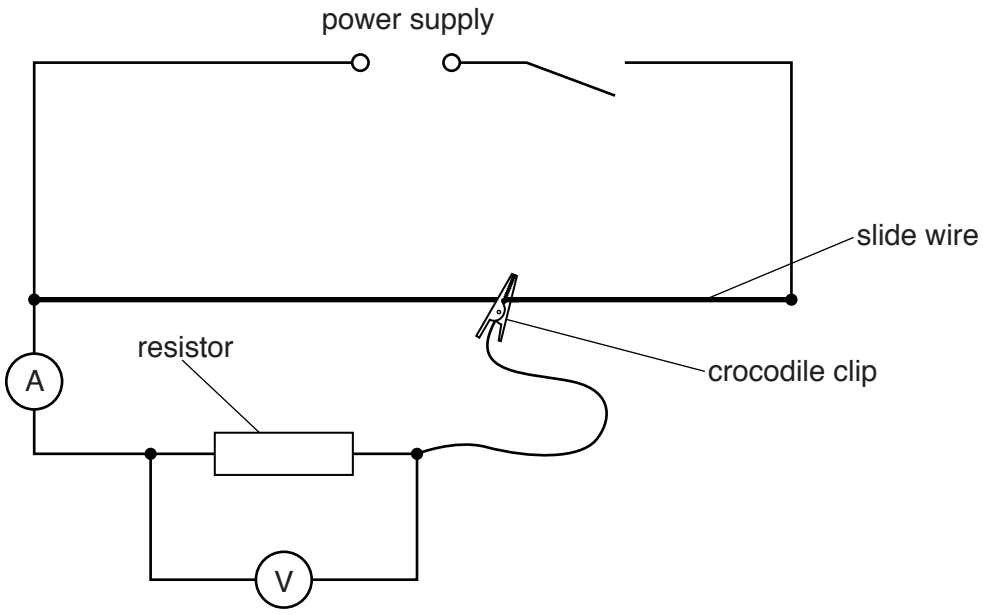


Fig. 1.1

The crocodile clip is connected at various positions on the slide wire, and the current and potential difference for the resistor are measured.

(a) The readings of potential difference V and current I for various positions of the crocodile clip are shown in Table 1.1.

Draw arrows on Figs. 1.2 and 1.3 to show the meter readings for the values of V and I in the first row of the table.

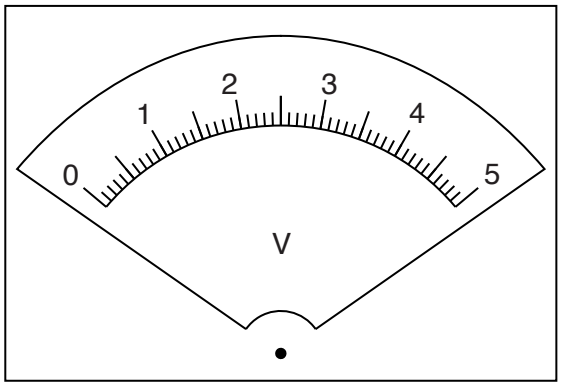


Fig. 1.2

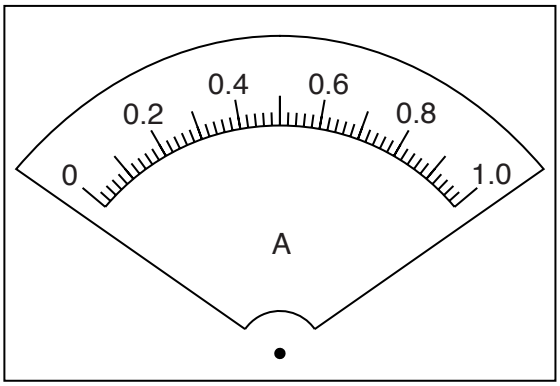


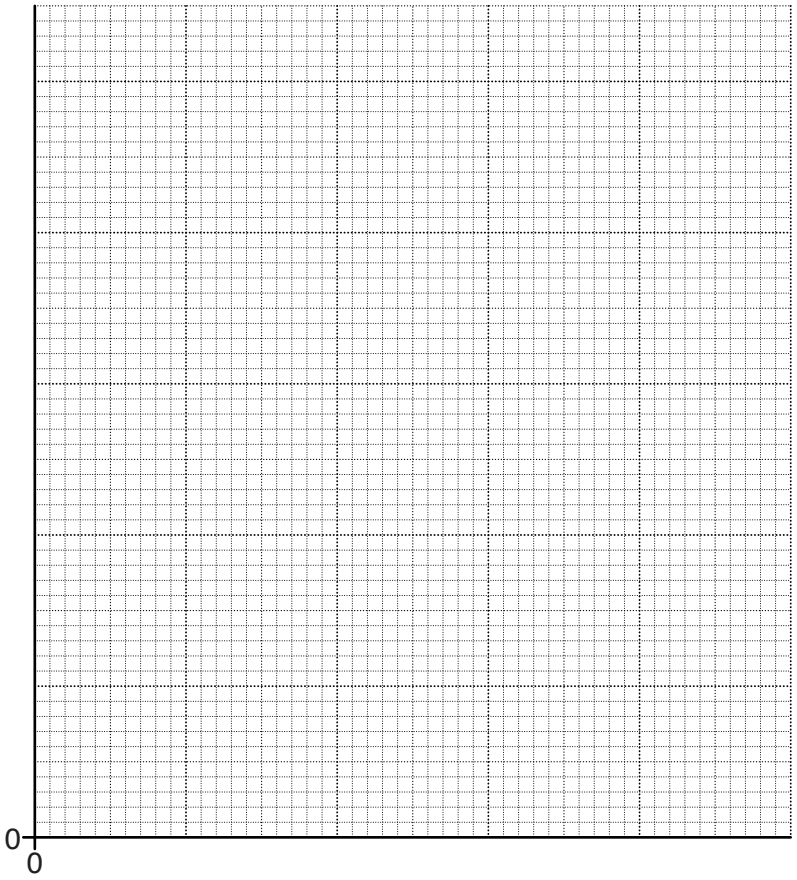
Fig. 1.3

[2]

Table 1.1

V/V	I/A
0.4	0.08
0.8	0.17
1.2	0.25
1.6	0.34
2.0	0.41

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



[4]

(c) (i) Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G = ...[1]

(ii) The resistance value R of the resistor is numerically equal to G.

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

R = ...[2]

(d) A student suggests that potential difference and current for this resistor should be proportional.

State whether your graph supports this suggestion. Justify your statement by reference to your graph.

statement .....

.....

justification .....

.....

.....

[2]

(e) The students notice that the slide wire becomes very hot during the experiment.

Suggest a change to the apparatus or procedure that might prevent this.

.....

.....

.....[1]

[Total: 12]

3 Some students are determining the resistance per unit length of a wire.

They are using the circuit shown in Fig. 3.1.

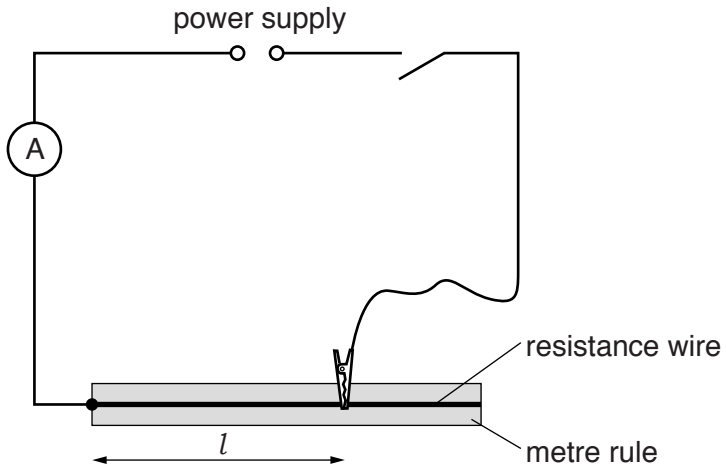


Fig. 3.1

The crocodile clip is connected to a length l of the wire and the current and potential difference are measured.

(a) On Fig. 3.1, draw the symbol for a voltmeter correctly connected to measure the potential difference across the selected length l of the resistance wire. [1]

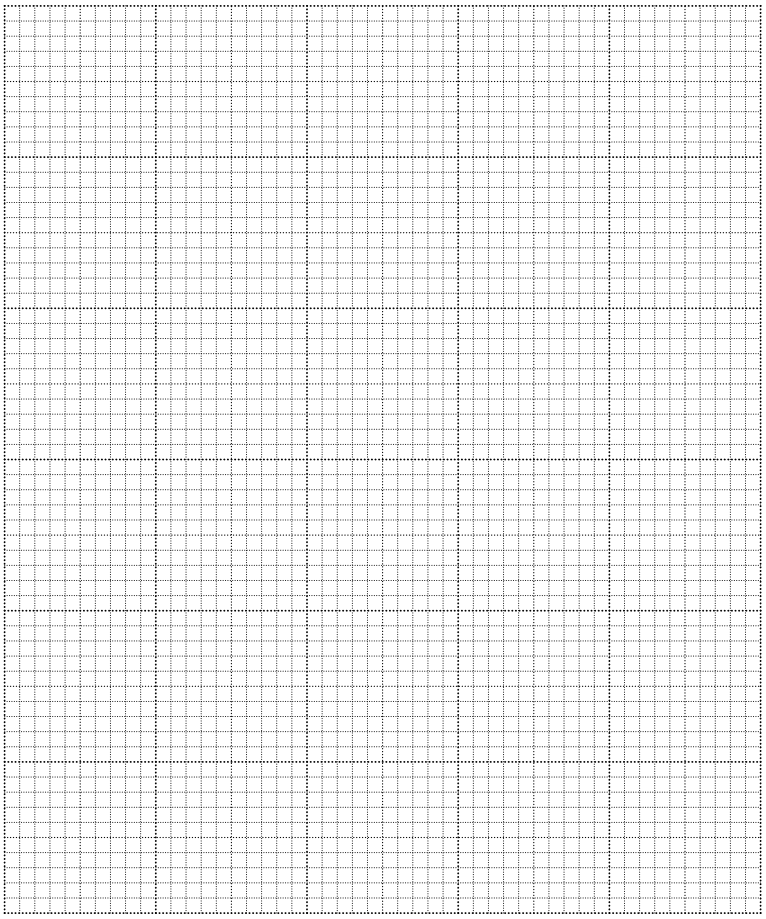
(b) The potential difference V and current I for various lengths l of the wire are shown in Table 3.1.

Table 3.1

l/m	V/V	I/A	R/Ω
0.900	2.98	0.42	
0.800	2.86	0.46	
0.700	2.89	0.53	
0.600	2.82	0.60	
0.500	2.83	0.72	

For each value of l, calculate and record in the table the resistance R of the wire, using the equation $R = \frac{V}{I}$. [1]

(c) Plot a graph of R/Ω (y-axis) against l/m (x-axis).



[4]

(d) (i) Determine the gradient G of the graph.

Show clearly on the graph how you obtained the necessary information.

$G =$ .....[1]

(ii) For this experiment and wire, the resistance per unit length r of the wire is numerically equal to G.

Give a value for r, to a suitable number of significant figures for this experiment. Include the unit.

$r =$ .....[2]

[Total: 9]

4 The IGCSE class is investigating the resistance of a lamp filament.

The circuit is shown in Fig. 4.1.

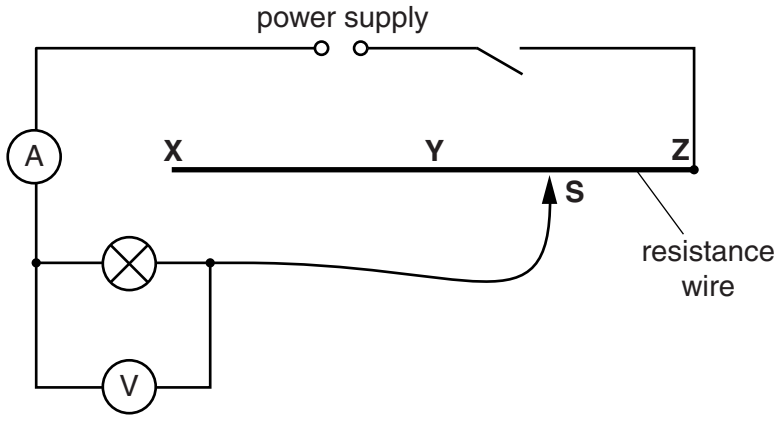


Fig. 4.1

(a) A student connects the sliding contact **S** to point **X** in the circuit. She measures the potential difference V across the lamp and the current I in the circuit. The meters are shown in Fig. 4.2.

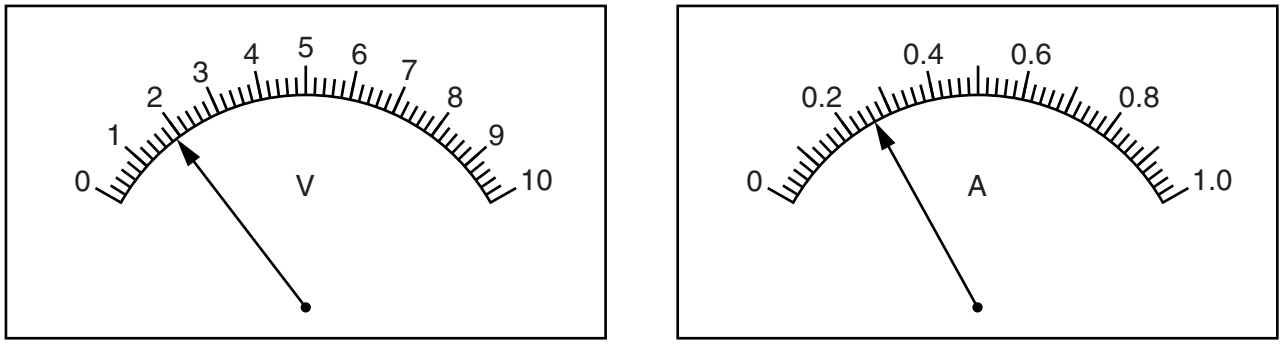


Fig. 4.2

(i) Write down the readings shown on the meters in Fig. 4.2.

V = ...

I = ...
[2]

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

R = ... [2]

(b) The student repeats the steps in **(a)** with the sliding contact **S** at point **Y** and then at point **Z**.

Comment on the effect, if any, on the brightness of the lamp that you would expect to see when the sliding contact is moved from **X** to **Y** to **Z**.

.....

.....[1]

(c) The student moves the sliding contact **S** back to point **X**.

Suggest one practical reason why the new meter readings might be slightly different from those shown in Fig. 4.2.

.....

.....[1]

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

Fig. 4.3 is a sketch of the graph.

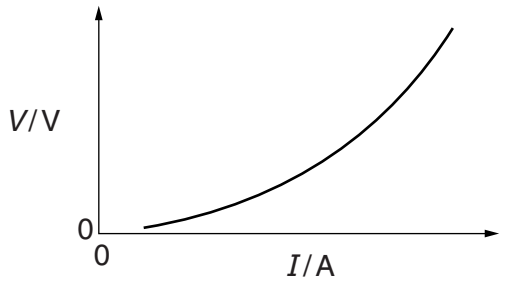


Fig. 4.3

State whether the graph shows that the resistance increases, decreases or remains constant as the current increases. Justify your conclusion by reference to the graph.

The resistance ..... .

justification .....

.....

[2]

[Total: 8]

5 The IGCSE class is determining the resistance of a fixed resistor in a circuit.

The circuit is shown in Fig. 3.1.

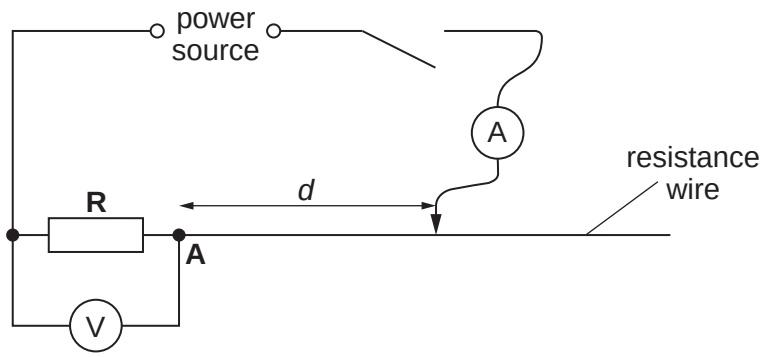


Fig. 3.1

(a) A student places the sliding contact on the resistance wire at a distance d = 10.0 cm from point **A**. He measures the current I in the circuit and the p.d. V across the resistor **R**. He repeats the procedure using d values of 30.0 cm, 50.0 cm, 70.0 cm and 90.0 cm.

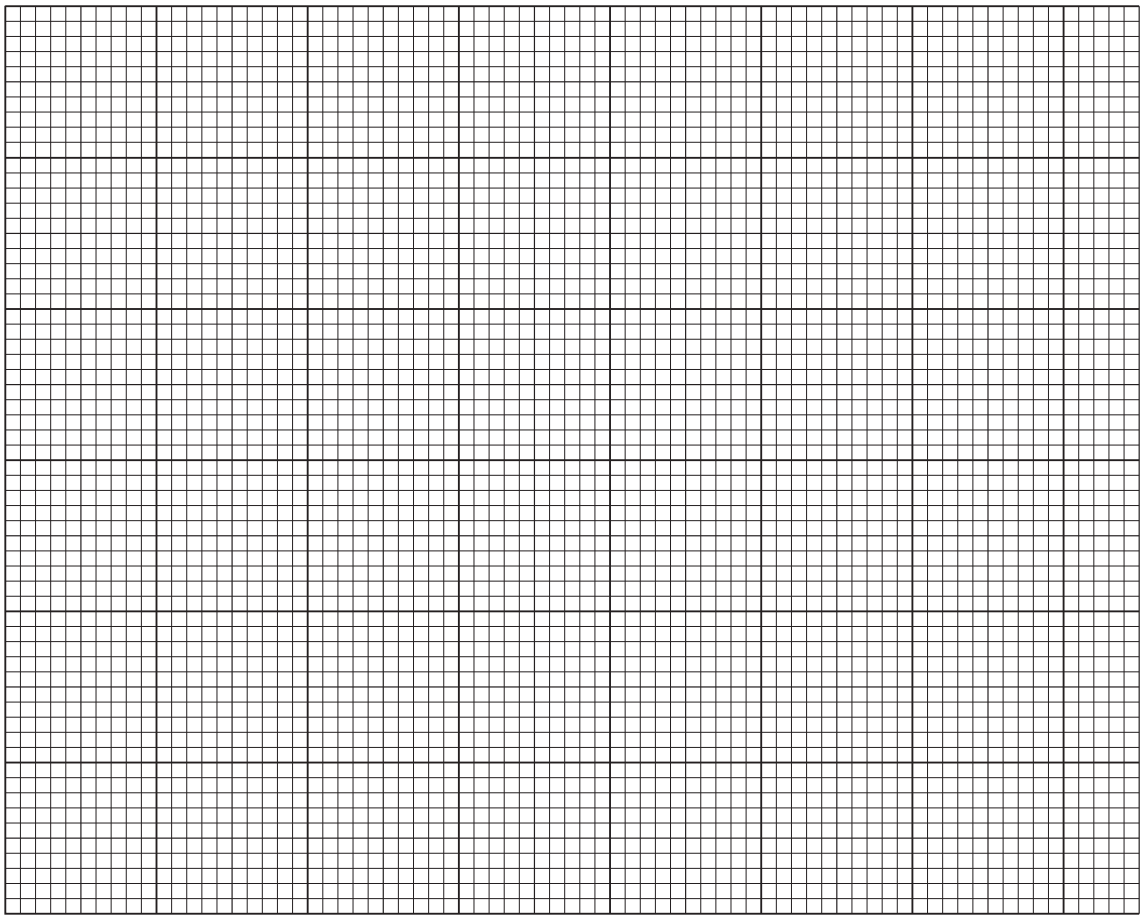
The readings are shown in Table 3.1.

Table 3.1

	V/V	I/A
10.0	1.7	1.13
30.0	1.3	0.87
50.0	1.0	0.67
70.0	0.8	0.53
90.0	0.7	0.47

(i) Complete the column headings in the table.

(ii) Plot a graph of V/V (y-axis) against I/A (x-axis). You do not need to include the origin (0, 0) on your graph.



[5]

(iii) Determine the gradient G of the graph. Show clearly on the graph how you obtained the necessary information.

G = ... [3]

(b) The gradient G of the graph is numerically equal to the resistance R of the resistor **R**.

Write a value for the resistance R to a suitable number of significant figures for this experiment.

R = ... [2]

[Total: 10]