

Electrical Quantities

Question Paper 4

Level	IGCSE
Subject	Physics
Exam Board	CIE
Topic	Electricity and Magnetism
Sub-Topic	Electrical Quantities
Paper Type	Alternative to Practical
Booklet	Question Paper 4

Time Allowed: 42 minutes

Score: /35

Percentage: /100

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

The circuit is shown in Fig. 3.1.

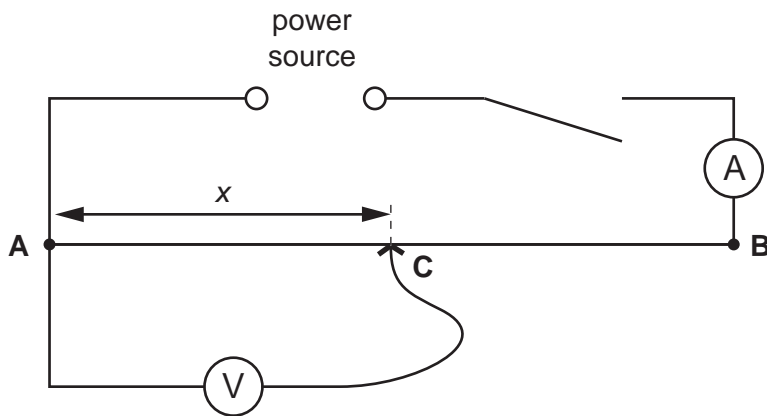


Fig. 3.1

AB is a resistance wire. The students place the sliding contact **C** on the resistance wire **AB** at a distance $x = 0.100\text{m}$ from **A**. They switch on and measure the p.d. V across the wire between **A** and **C**. They also measure the current I in the wire. The value of I is 0.38 A .

They repeat the procedure several times using different values of x . The readings are shown in Table 3.1. The current I is 0.38 A for each value of x .

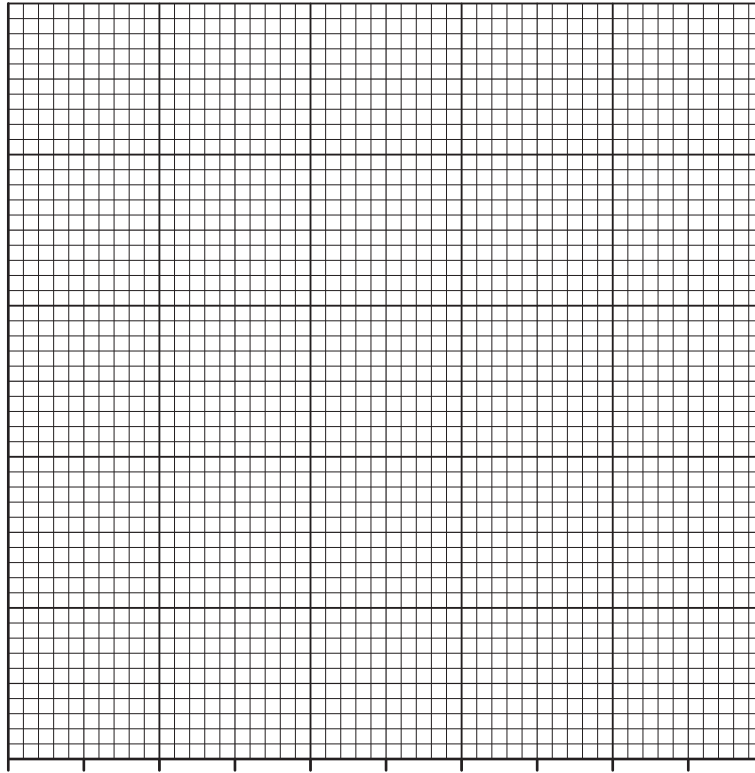
Table 3.1

x/m	V/V	R/Ω
0.100	0.21	
0.300	0.59	
0.500	1.04	
0.700	1.42	
0.900	1.87	

[2]

(a) Calculate the resistance R of the section **AC** of the wire for each value of x using the equation $R = \frac{V}{I}$. Record the values of R in the table.

- (b) Use the results in Table 3.1 to plot a graph of R/Ω (y -axis) against x/m (x -axis). Draw the best fit line.



[5]

- (c) Within the limits of experimental accuracy, what do you conclude about the variation of resistance with distance along the wire? Justify your conclusion by reference to your graph.

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..... [2]

- (d) Using your graph, determine the value for R when $x = 0.750\text{m}$. Show clearly on your graph how you obtained the necessary information.

$R =$ [2]

- (e) A variable that may be difficult to control in this experiment is the heating effect of the current, which affects the resistance of the wire. Suggest how you would minimise the heating effect.

.....

..... [1]

[Total: 12]

- 2 The IGCSE class is comparing the combined resistance of lamps arranged either in series or in parallel.

The circuit shown in Fig. 3.1 is used.

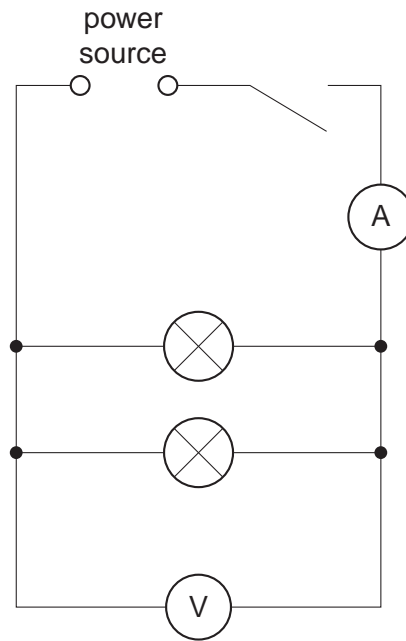


Fig. 3.1

A student measures and records the current I in the circuit and the p.d. V across the two lamps.

Fig. 3.2 shows the readings on the two meters.

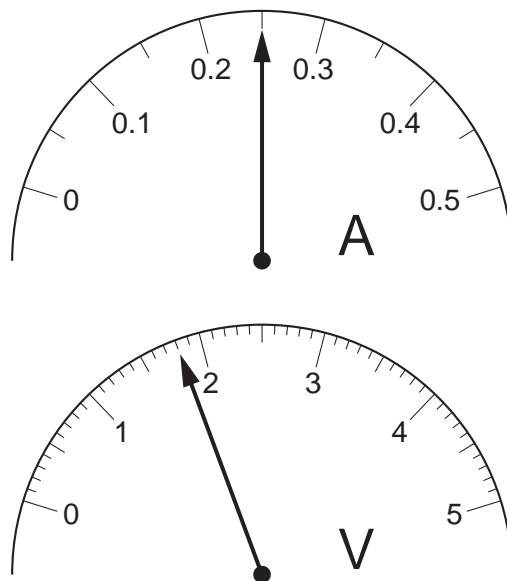


Fig. 3.2

- (a) (i) Write the voltage and current readings in Table 3.1, below.
 (ii) Complete the column headings in Table 3.1.

[3]

- (b) The student then sets up the circuit shown in Fig. 3.3 and records the readings. These readings have already been entered in Table 3.1.

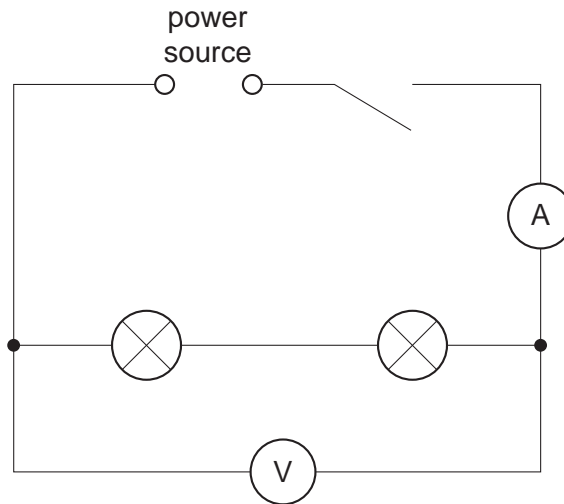


Fig. 3.3

For each set of readings in the table, calculate the combined resistance R of the two lamps using the equation $R = V/I$. Record the values of R in Table 3.1. [2]

Table 3.1

	$V/$	$I/$	$R/$
Circuit of Fig. 3.1			
Circuit of Fig. 3.3	1.8	0.52	

- (c) Using the values of resistance you have obtained, calculate the ratio y of the resistances using the equation

$$y = \frac{\text{resistance of lamps in series}}{\text{resistance of lamps in parallel}}$$

$y = \dots\dots\dots$

[2]

(d) Fig. 3.4 shows a circuit including two motors A and B.

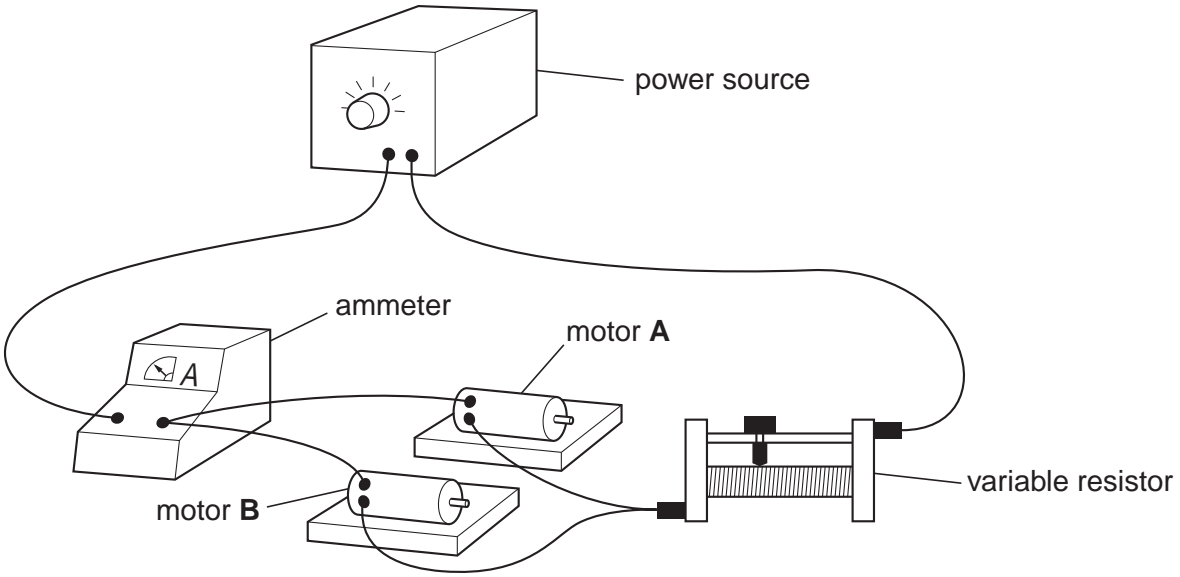
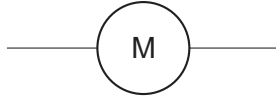


Fig. 3.4

(i) Draw a diagram of the circuit using standard circuit symbols. The circuit symbol for a motor is:



(ii) An engineer wishes to measure the voltage across motor **A**.

1. On Fig. 3.4, mark with the letters **X** and **Y** where the engineer should connect the voltmeter.
2. State the purpose of the variable resistor.

.....
.....

[3]

[Total: 10]

- 3 The IGCSE class is comparing the combined resistance of resistors in different circuit arrangements. The first circuit is shown in Fig. 2.1.

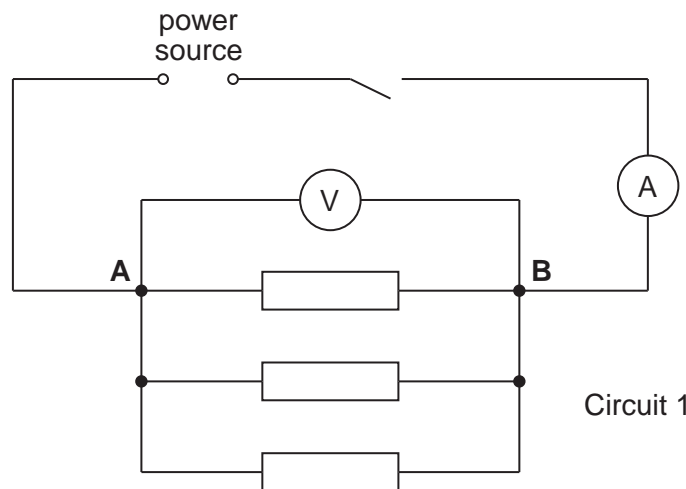


Fig. 2.1

- (a) The current I in the circuit and the p.d. V across the three resistors are measured and recorded. Three more circuit arrangements are used. For each arrangement, a student disconnects the resistors and then reconnects them between points A and B as shown in Figs. 2.2–2.4.

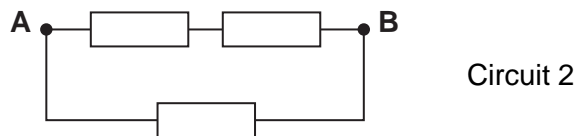


Fig. 2.2

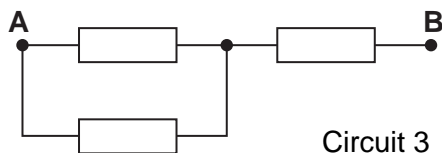


Fig. 2.3

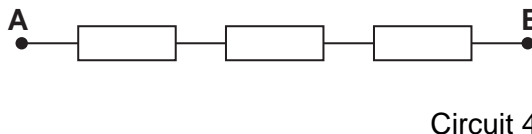


Fig. 2.4

The voltage and current readings are shown in the Table 2.1.

Table 2.1

Circuit	$V/$	$I/$	$R/$
1	1.87	1.68	
2	1.84	0.84	
3	1.87	0.37	
4	1.91	0.20	

- (i) Complete the column headings for each of the V , I and R columns of Table 2.1.

- (ii) For each circuit, calculate the combined resistance R of the three resistors using the equation

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

Record these values of R in Table 2.1. [3]

- (b) Theory suggests that, if all three resistors have the same resistance under all conditions, the combined resistance in circuit 1 will be one half of the combined resistance in circuit 2.

- (i) State whether, within the limits of experimental accuracy, your results support this theory. Justify your answer by reference to the results.

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- (ii) Suggest one precaution you could take to ensure that the readings are as accurate as possible.

.....

..... [3]

[Total: 6]

- 4 The IGCSE class is investigating the potential difference across, and the current in, wires.

The apparatus is shown in Fig. 2.1.

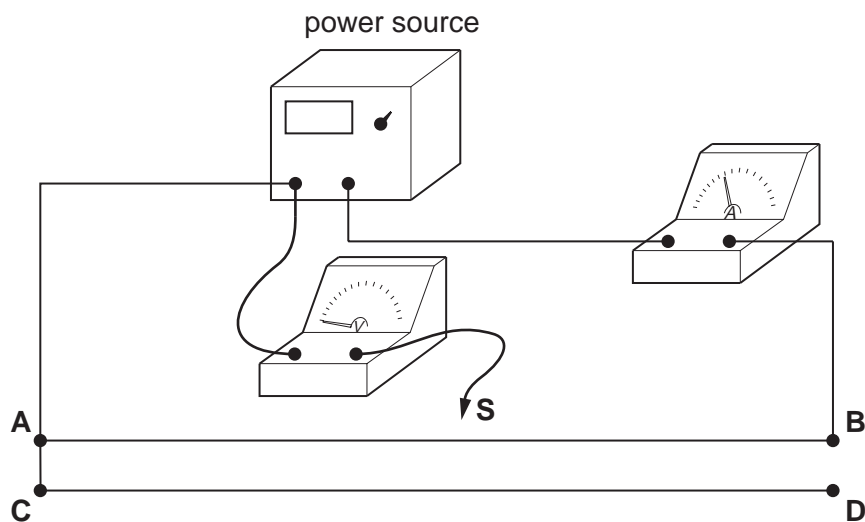
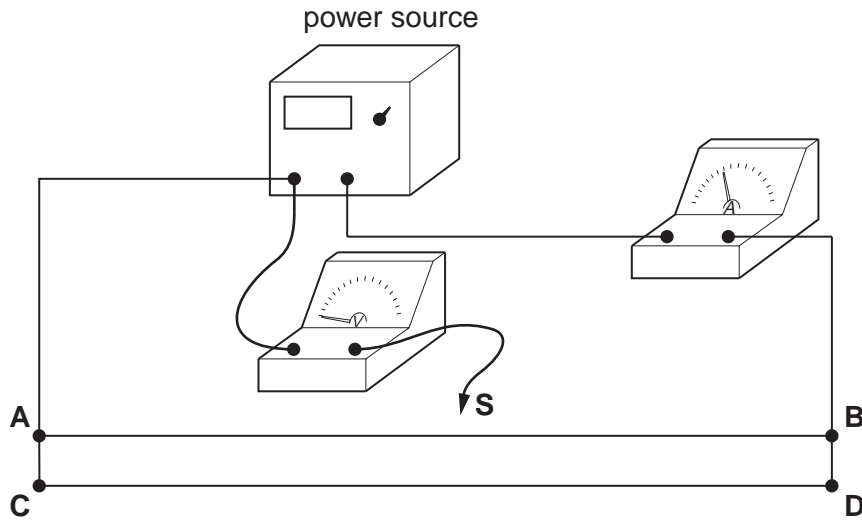


Fig. 2.1

- (a) Draw a circuit diagram of the apparatus. Use standard circuit symbols.
 (The circuit includes two identical resistance wires **AB** and **CD**. Use the standard symbol for a resistance to represent each of these wires.)
 This circuit is called circuit 1.

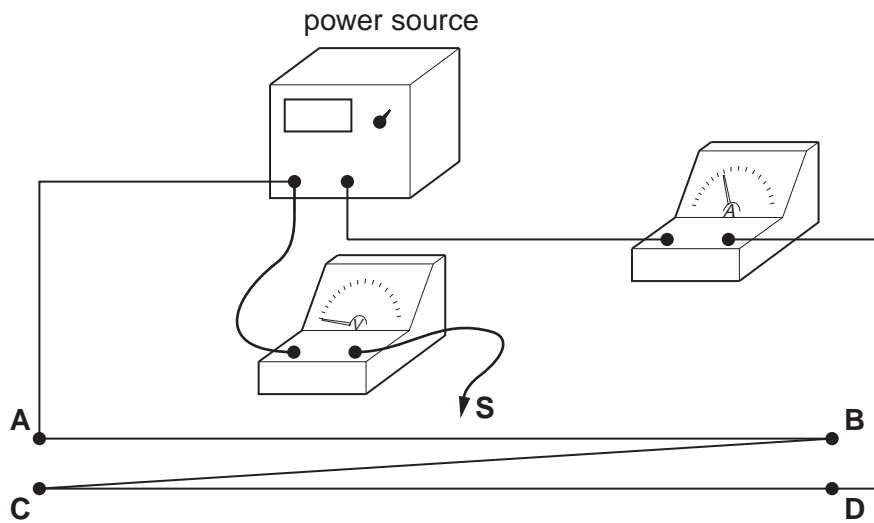
For circuit 1, the student places the contact **S** on the resistance wire **AB** at a distance of 0.500 m from **A**. He measures the p.d. V across the wire between **A** and **S** and the current I in the circuit.

The student then records the measurements for circuits 2 and 3, shown in Fig. 2.2 and Fig. 2.3.



circuit 2

Fig. 2.2



circuit 3

Fig. 2.3

The voltage V and current I for all three circuits are shown in Table 2.1.

Table 2.1

Circuit	$V/$	$I/$
1	0.83	0.53
2	0.75	0.95
3	0.41	0.28

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

(c) Theory suggests that,

1. in circuits 1 and 2, the values of potential difference V will be equal,
2. the value of potential difference V in circuit 3 will be half that in circuit 1 or circuit 2.

(i) State whether, within the limits of experimental accuracy, the results support these predictions.

Justify your statement by reference to the results.

Prediction 1

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Prediction 2

..... [2]

(ii) Suggest one reason, other than a change in temperature of the wires, why the results may not support the theory.

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..... [1]

[Total: 7]