4.2 Electrical quantities

01. 0625_m20_qp_62 Q: 3

A student is investigating a power supply.
She is using the circuit shown in Fig. 3.1.

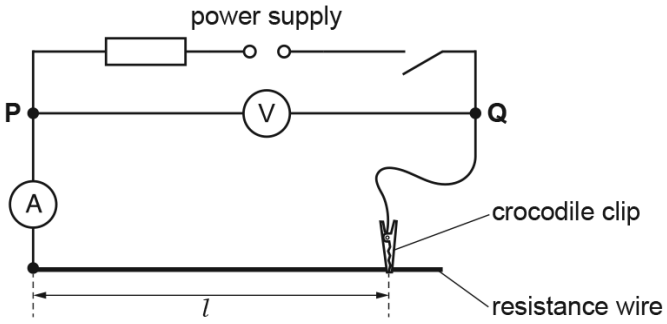


Fig. 3.1

(a) The student connects the crocodile clip to a length l = 100.0 cm of the resistance wire and measures the potential difference V_0 across terminals **P** and **Q** and the current I_0 in the circuit.

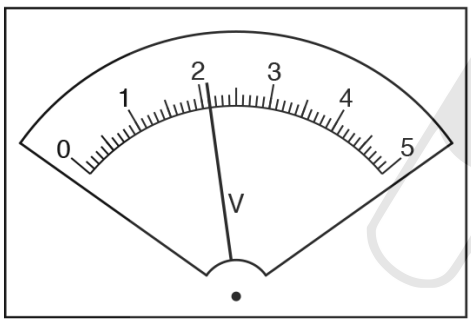


Fig. 3.2

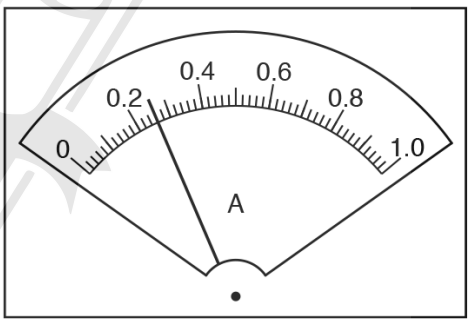


Fig. 3.3

(i) Record the values of V_0 and I_0 shown on the meters in Fig. 3.2 and Fig. 3.3.

V_0 = ... V

I_0 = ... A
[1]

(ii) Calculate the resistance R_0 of 100.0 cm of the wire. Use your values of V_0 and I_0 and the equation $R_0 = \frac{V_0}{I_0}$.

R_0 = ... Ω
[1]

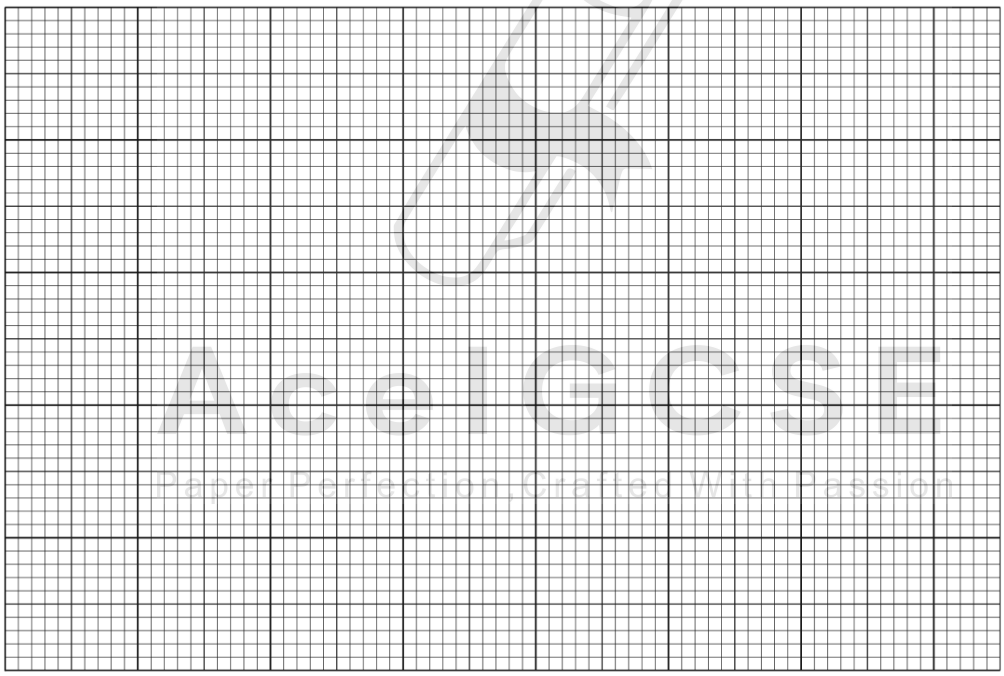
(b) The student then connects the crocodile clip to lengths l = 70.0 cm, 60.0 cm, 50.0 cm, 40.0 cm and 30.0 cm of the resistance wire. She measures the current I in the circuit for each length. Her readings are shown in Table 3.1.

Table 3.1

l/cm	I/A	$\frac{1}{I}\Big/\frac{1}{\text{A}}$
70.0	0.35	
60.0	0.40	2.50
50.0	0.44	2.27
40.0	0.53	1.89
30.0	0.65	1.54

Calculate, and record in Table 3.1, the value of $\frac{1}{I}$ for length l = 70.0 cm of the wire. [1]

(c) Plot a graph of l/cm (y-axis) against $\frac{1}{I}\Big/\frac{1}{\text{A}}$ (x-axis). You do **not** need to start your axes at the origin (0,0).



[4]

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

G = ... [1]

(ii) Calculate the electromotive force (e.m.f.) E of the power supply. Use your value of R_0 from **(a)(ii)** and the equation $E = \frac{G \times R_0}{k}$, where k = 100 cm.

E = ...V [1]

(e) The ammeter in this circuit has a small resistance which affects the current. The effect of this resistance on the measured current I will be different for each measured length l of the resistance wire.
State and explain which length l will be most affected by the resistance of the ammeter.

statement .....

explanation .....

.....
[2]

[Total: 11]

02. 0625_p20_qp_60 Q: 3

A student is investigating the effect of the length of resistance wire in a circuit on the potential difference across a lamp.

(a) Fig. 3.1 shows the circuit without a voltmeter.

Complete the circuit diagram to show a voltmeter connected in the circuit to measure the potential difference across the lamp. [2]

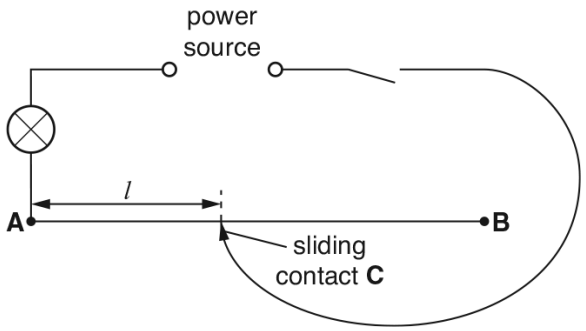


Fig. 3.1

(b) The student switches on and places the sliding contact **C** on the resistance wire at a distance l = 0.200 m from end **A**.

The voltmeter reading is shown in Fig. 3.2.

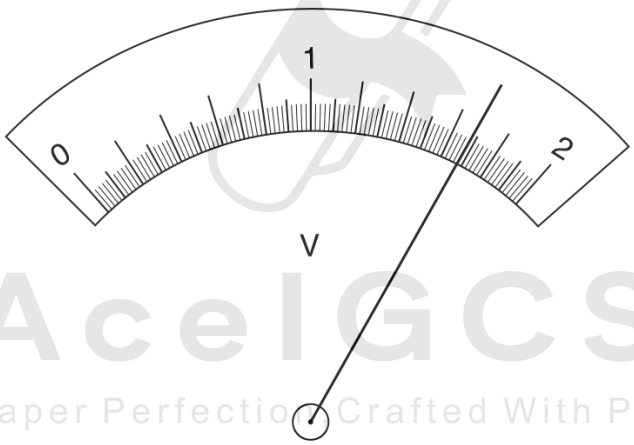


Fig. 3.2

Record the voltmeter reading in Table 3.1.

Table 3.1

l/m	V/V
0.200	
0.400	1.43
0.600	1.25
0.800	1.11
1.000	1.00

[1]

(c) The student repeats the procedure using a range of values of l. Table 3.1 shows the readings.

Use the results for the potential difference across the lamp to predict how increasing the length l affects the brightness of the lamp.

..... [1]

(d) The student suggests that the potential difference V across the lamp is directly proportional to the length l of resistance wire in the circuit.

State whether you agree with this suggestion. Justify your answer by reference to the results.

statement .....

justification .....

.....

.....

[2]

(e) The student repeats the experiment.

Suggest a practical reason why the repeat readings may be slightly different from those recorded in Table 3.1.

.....

..... [1]

(f) State one safety precaution that you would take when carrying out experiments like this with resistance wires.

..... [1]

[Total: 8]

03. 0625_s20_qp_62 Q: 2

A student determines the resistance of a resistance wire.

Fig. 2.1 shows the circuit he uses.

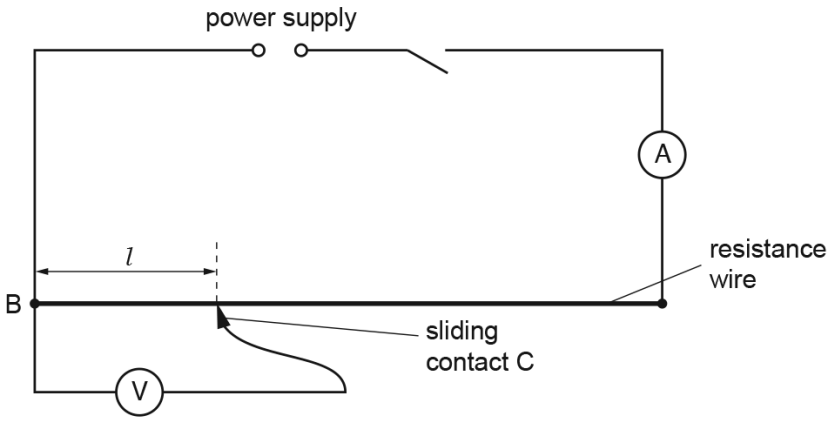


Fig. 2.1

(a)

- The student places the sliding contact C on the resistance wire at a distance l = 10.0 cm from B.
- Record, in the first row of Table 2.1, the potential difference V across the length l = 10.0 cm of resistance wire, as shown on the voltmeter in Fig. 2.2.

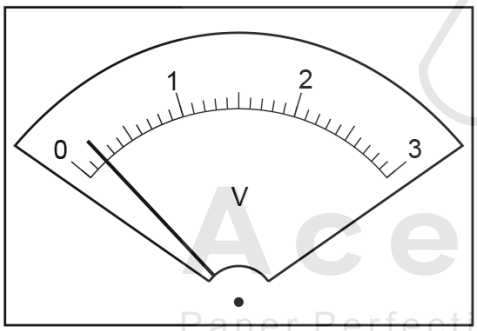


Fig. 2.2

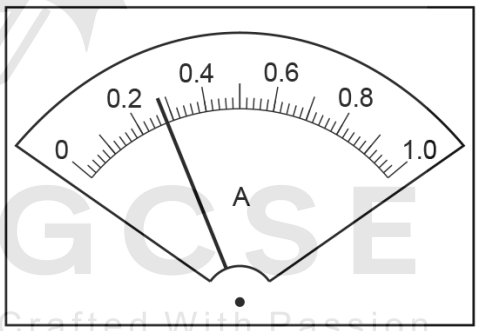


Fig. 2.3

- Record, in the first row of Table 2.1, the current I in the circuit as shown in Fig. 2.3.
- Complete the column headings in Table 2.1.

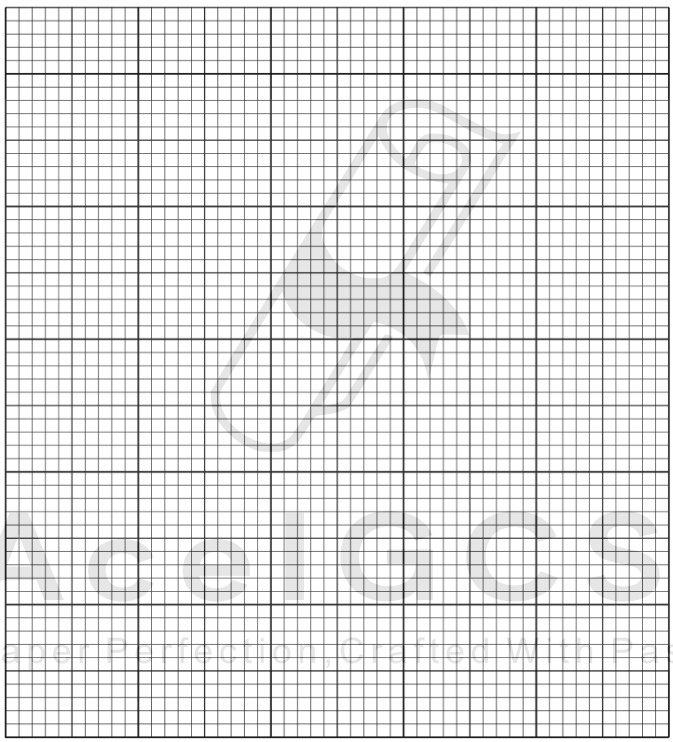
Table 2.1

l/	V/	I/
10.0		
30.0	0.7	0.30
50.0	1.1	0.27
70.0	1.5	0.28
90.0	2.1	0.29

[3]

(b) The student repeats the procedure using l = 30.0 cm, 50.0 cm, 70.0 cm and 90.0 cm. The readings are shown in Table 2.1.

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



[4]

(c) **(i)** Write a conclusion about the value of the current I in the circuit as the position of the sliding contact C is changed.

.....

..... [1]

(ii) Justify your conclusion by reference to your results.

.....

..... [1]

(d) Using the graph, determine the potential difference V_L when the length l = 60.0 cm.

Show clearly on the graph how you obtained your result.

V_L = ... [2]

[Total: 11]

04. 0625_m19_qp_62 Q: 3

A student is investigating a resistance wire. She uses the circuit shown in Fig. 3.1.

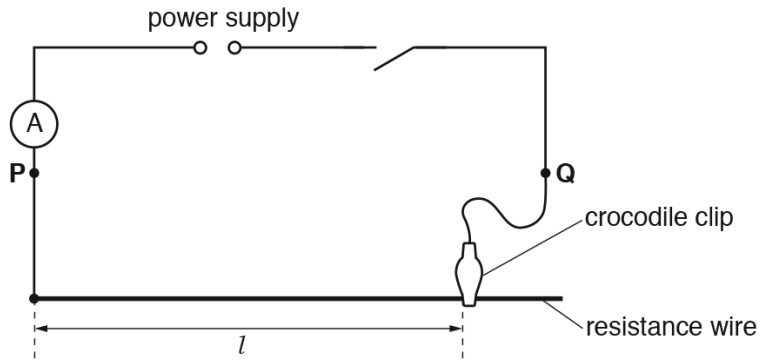


Fig. 3.1

(a) (i) On Fig. 3.1, draw a voltmeter connected to measure the potential difference V across terminals **P** and **Q**. [1]

(ii) The student connects the crocodile clip to a length $l = 90.0\,\text{cm}$ of the resistance wire and measures the potential difference V across terminals **P** and **Q** and the current I in the circuit.

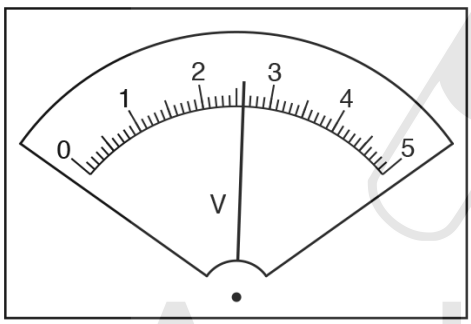


Fig. 3.2

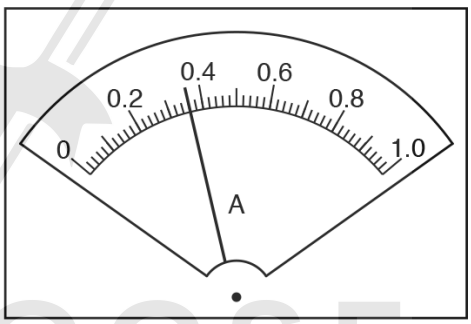


Fig. 3.3

Read, and record in Table 3.1, the values of V and I shown on the meters in Fig. 3.2 and Fig. 3.3. [2]

(b) The student then connects the crocodile clip to lengths l = 60.0 cm and l = 40.0 cm of the resistance wire. She measures the potential difference V across terminals **P** and **Q** and the current I in the circuit. Her readings are shown in Table 3.1.

Complete the column headings in Table 3.1. [1]

Table 3.1

l/cm	V/	I/	R/Ω	$\frac{R}{l}$/$\frac{\Omega}{\text{cm}}$
90.0				
60.0	2.5	0.52		
40.0	2.3	0.71		

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

[2]

(ii) Calculate, and record in Table 3.1, the value of $\frac{R}{l}$ for each length of the wire.

[1]

(d) Use your results in Table 3.1 to calculate the resistance R_{25} of a 25.0 cm length of the resistance wire.
Show your working.

R_{25} = ... Ω [1]

(e) Suggest **one** reason why different students, carrying out the experiment carefully with the same equipment, may **not** obtain identical results.

.....

.....

..... [1]

(f) The student finds that, during the experiment, the wire becomes hot because of a high current.

She decides to use a variable resistor to prevent this.

Complete the circuit in Fig. 3.4 to show a variable resistor used for this purpose in the experiment.

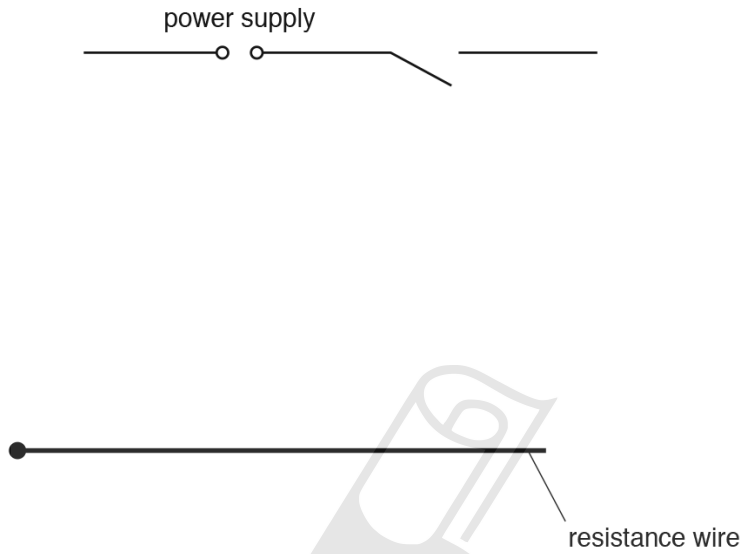


Fig. 3.4

[2]

[Total: 11]

05. 0625_s19_qp_61 Q: 2

A student is determining the resistance of a resistance wire.

The circuit is shown in Fig. 2.1.

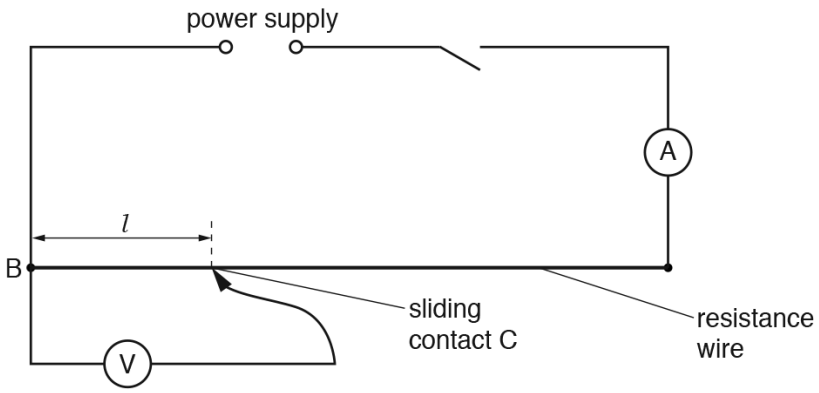


Fig. 2.1

(a) Record the current I in the circuit, as shown on the ammeter in Fig. 2.2.

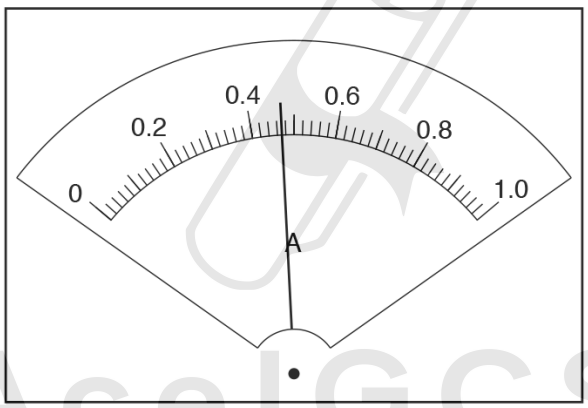


Fig. 2.2

I = ... [1]

(b) The student places the sliding contact C at a distance $l = 20.0\,\text{cm}$ from B.

She records the potential difference V across the length l of the resistance wire.

She repeats the procedure using l values of 40.0 cm, 60.0 cm, 80.0 cm and 100.0 cm. All the readings are shown in Table 2.1.

Calculate, and record in Table 2.1, $\frac{V}{l}$ for each value of l.

Complete the $\frac{V}{l}$ column heading.

Table 2.1

l/cm	V/V	$\frac{V}{l}$/
20.0	0.50	
40.0	0.92	
60.0	1.62	
80.0	2.08	
100.0	2.40	

[3]

(c) Look carefully at the values of $\frac{V}{l}$ in Table 2.1.

(i) Tick the box to show your conclusion from the results.

- ☐ $\frac{V}{l}$ is approximately constant.
- ☐ $\frac{V}{l}$ is decreasing as V increases.
- ☐ $\frac{V}{l}$ is increasing as V increases.
- ☐ There is no simple pattern for $\frac{V}{l}$ in the results.

[1]

(ii) Justify your conclusion by reference to your results.

.....

..... [1]

(d) Calculate the resistance of 100 cm of the resistance wire using the equation $R = \frac{V}{I}$, where V is the potential difference across 100 cm of the resistance wire. Use the value of current I from part **(a)**. Give your answer to a suitable number of significant figures for this experiment and include the unit.

R = ... [3]

(e) In this type of experiment, it is sensible to keep the temperature of the resistance wire as close to room temperature as possible. Suggest **one** way to minimise the rise in temperature of the resistance wire.

.....

..... [1]

(f) Draw the circuit symbol for a variable resistor.

[1]

[Total: 11]

06. 0625_s19_qp_62 Q: 3

A student is investigating electrical resistance.

She uses the circuit shown in Fig. 3.1.

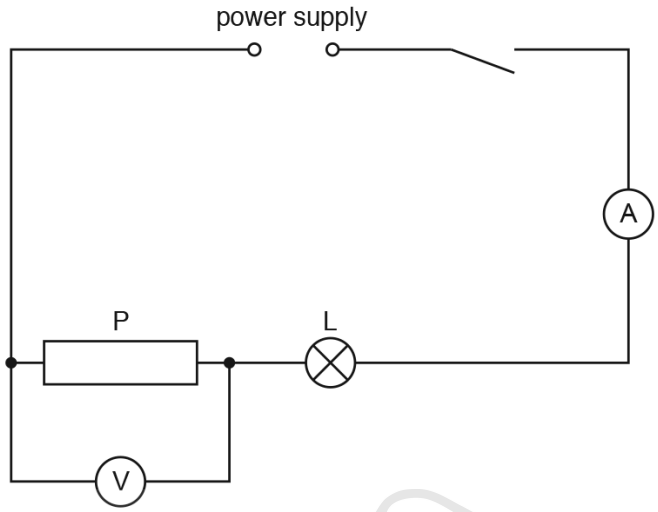


Fig. 3.1

(a) Write down the readings shown on the meters in Figs. 3.2 and 3.3.

V_1 = ...

I_1 = ...

[2]

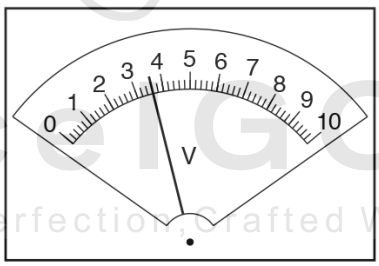


Fig. 3.2

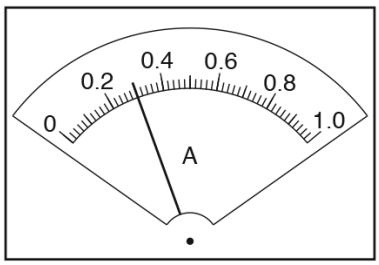


Fig. 3.3

(b) Calculate the resistance R_1 of the resistor P using the equation $R_1 = \frac{V_1}{I_1}$.

R_1 = ... [1]

(c) The student connects the voltmeter across the lamp L.

She records the potential difference V_2 across the lamp L.

V_2 = 2.4 V

Calculate the resistance R_2 of the lamp L using the equation $R_2 = \frac{V_2}{I_1}$.

R_2 = ... [1]

(d) The student replaces the resistor P with the resistor Q.

She records the potential difference V_3 across the resistor Q and the current I_2 in the circuit.

V_3 = 3.5 V

I_2 = 0.31 A

(i) Calculate the resistance R_3 of the resistor Q using the equation $R_3 = \frac{V_3}{I_2}$.

R_3 = ... [1]

(ii) State whether the results R_1 and R_3 suggest that resistor P and resistor Q have the same value of resistance, within the limits of experimental accuracy. Justify your statement by reference to your results.

statement .....

justification .....

.....

.....

[2]

(e) The student connects the voltmeter across the lamp L.

She records the potential difference V_4 across the lamp L.

V_4 = ... 2.5 V .....

She calculates the resistance R_4 of the lamp L.

R_4 = ... 8.1 Ω .....

She suggests that the change in resistance of the lamp from part **(c)** is due to a change in temperature of the lamp filament. Suggest an observation that she could make to confirm that the temperature of the lamp filament changes.

..... [1]

(f) Complete the circuit diagram in Fig. 3.4 to show that:

- the two resistors and the lamp are all connected in parallel
- the voltmeter is connected to measure the potential difference across the resistors and the lamp.

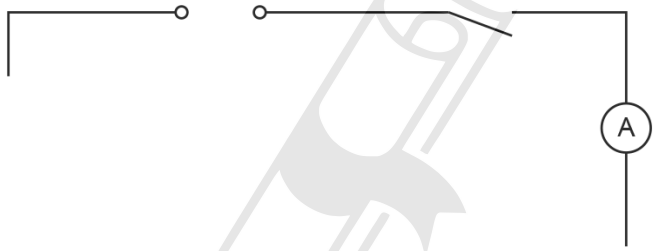


Fig. 3.4

[2]

(g) State the name of the circuit component that you would add to the circuit you have drawn to control the current in the circuit.

..... [1]

[Total: 11]

07. 0625_w19_qp_62 Q: 2

A student determines the resistance of a resistance wire.

She uses the circuit shown in Fig. 2.1.

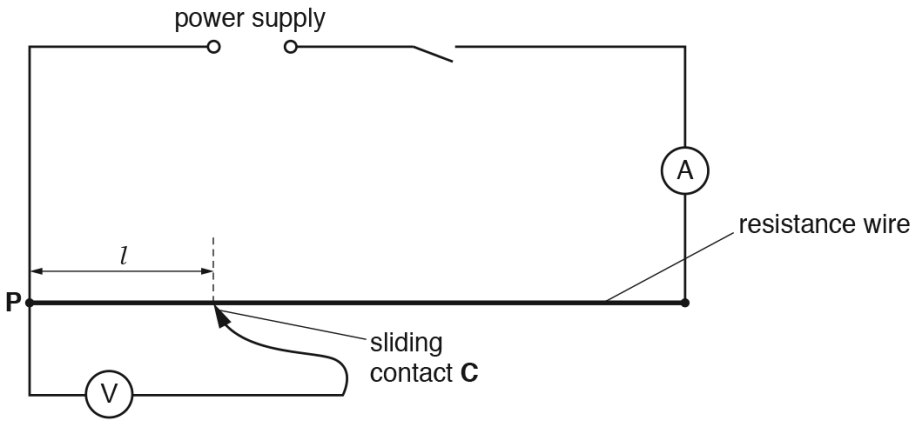


Fig. 2.1

(a) She measures the current I in the circuit. Write down the current reading shown in Fig. 2.2.

I = ... [2]

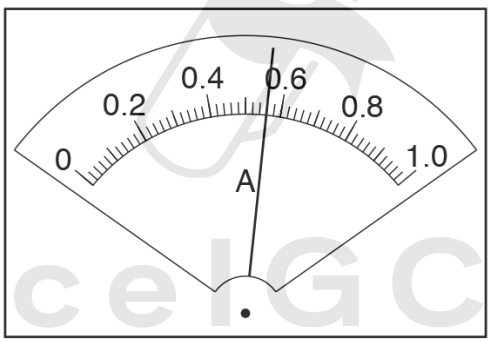


Fig. 2.2

(b) She places the sliding contact **C** at a distance $l = 20.0\,\text{cm}$ from **P**.

She records the potential difference V across the length l of the resistance wire.

She repeats the procedure using l values of 40.0 cm, 60.0 cm, 80.0 cm and 100.0 cm.

The readings are shown in Table 2.1.

Table 2.1

l/cm	V/	R/
20.0	0.60	
40.0	1.10	1.96
60.0	1.71	3.05
80.0	2.30	4.11
100.0	2.78	4.96

(i) Calculate, and record in Table 2.1, the resistance R of 20.0 cm of the resistance wire. Use the equation $R = \frac{V}{I}$.

[2]

(ii) Complete the column headings in Table 2.1. [1]

(c) Look carefully at the values of l and R in Table 2.1.

(i) Tick **one** box to show your conclusion from the results.

- ☐ R is constant within the limits of experimental accuracy.
- ☐ R is directly proportional to l within the limits of experimental accuracy.
- ☐ R decreases as l increases.
- ☐ There is no simple relationship between R and l.

[1]

(ii) Justify your conclusion by reference to the results.

.....

.....

..... [1]

(d) **(i)** Use the values in Table 2.1 to estimate the potential difference V_e across 50.0 cm of the resistance wire.

V_e = ... [1]

(ii) Calculate the resistance of 50.0 cm of the resistance wire using the equation $R = \frac{V_e}{I}$.

Use the value of current I from part **(a)**. Give your answer to a suitable number of significant figures for this experiment and include the unit.

R = ... [2]

(e) In this type of experiment, it is sensible to keep the temperature of the resistance wire as close to room temperature as possible. Suggest **one** simple way to minimise the rise in temperature of the resistance wire.

.....

..... [1]

[Total: 11]

08. 0625_w19_qp_63 Q: 1

A student investigates how the resistance of a filament lamp changes with the potential difference (p.d.) across it.
He uses the circuit shown in Fig. 1.1.

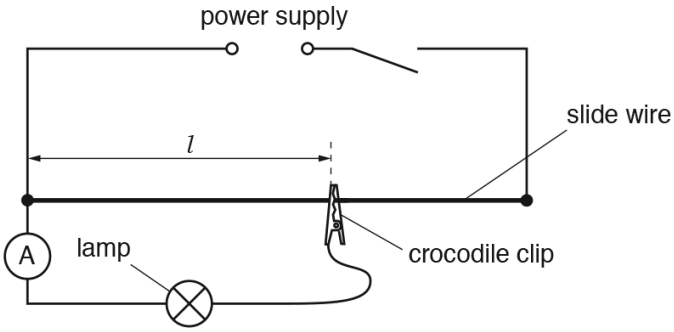


Fig. 1.1

(a) On Fig. 1.1, draw the symbol for a voltmeter connected to measure the potential difference across the lamp. [1]

(b) The student connects the crocodile clip to a length $l = 20.0\,\text{cm}$ of the slide wire.
He measures the potential difference V and the current I for the lamp.

(i) Record the voltmeter and ammeter readings shown in Fig. 1.2 for a value of $l = 20.0\,\text{cm}$.

$V =$ .....

$I =$ .....
[1]

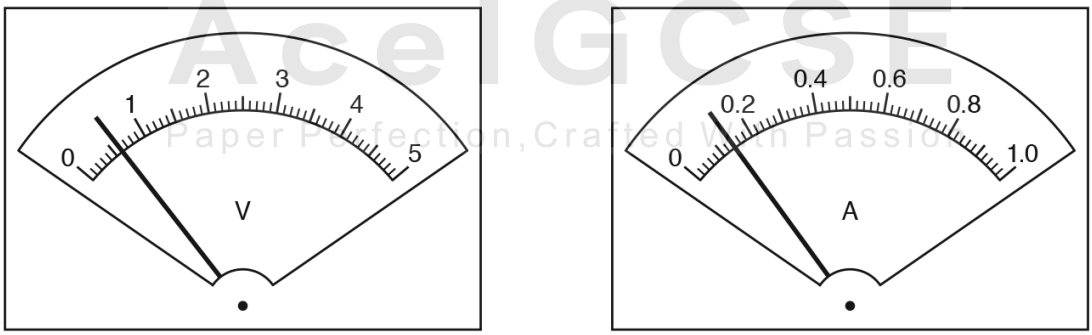


Fig. 1.2

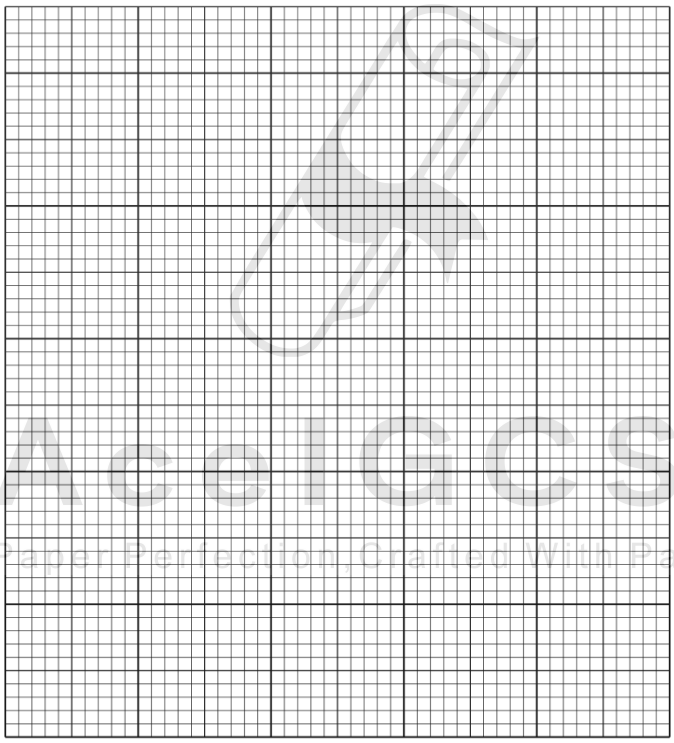
(ii) Calculate, and record in Table 1.1, the resistance R of the lamp at $l = 20.0\,\text{cm}$.
Use your readings from **(b)(i)** and the equation $R = \frac{V}{I}$. [1]

Table 1.1

l/cm	R/Ω
20.0	
40.0	7.5
60.0	10
80.0	12
100.0	13

(c) The student connects the crocodile clip to other lengths l of the slide wire.
He measures the potential difference V and the current I for the lamp and calculates the resistance each time. His results are shown in Table 1.1.

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



[4]

(d) The student notices that the lamp is very dim when $l = 20.0\,\text{cm}$ but becomes very bright when $l = 100.0\,\text{cm}$.

State what the shape of the graph tells you about how the resistance of the lamp changes with the temperature of the filament.
Justify your statement using your results from the graph.

statement .....

justification .....

.....

[2]

(e) In this type of experiment, it is possible to change the current in the lamp by using a variable resistor instead of a slide wire.

On Fig. 1.3, complete the circuit diagram to show a variable resistor used for this purpose.

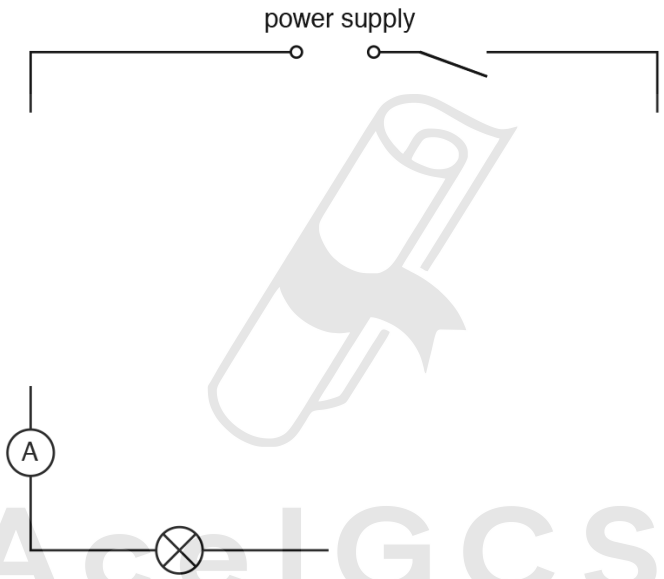


Fig. 1.3

[2]

[Total: 11]

09. 0625_s18_qp_63 Q: 2

A student is investigating a circuit containing resistors.

He is using the circuit shown in Fig. 2.1.
Resistor **X** has a resistance $R = 1\,\Omega$.

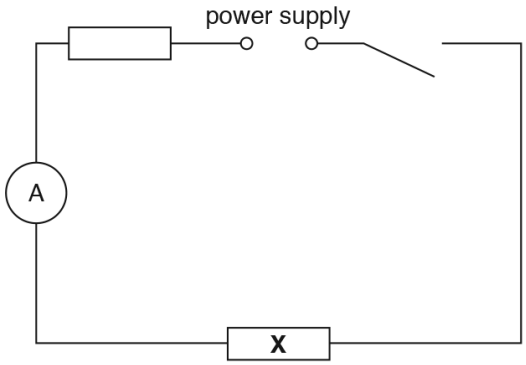


Fig. 2.1

(a) On Fig. 2.1, draw a voltmeter connected so that it measures the potential difference (p.d.) across resistor **X**. [1]

(b) The student uses the ammeter to measure the current in the circuit and uses the voltmeter to measure the potential difference (p.d.) across resistor **X**. The readings are shown in Fig. 2.2 and Fig. 2.3.

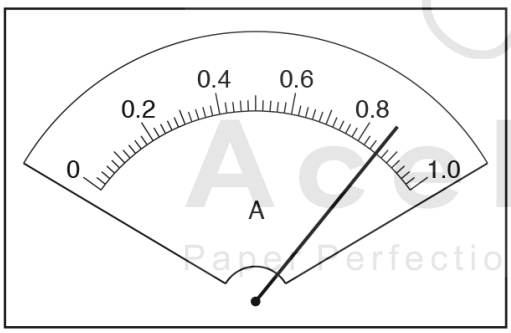


Fig. 2.2

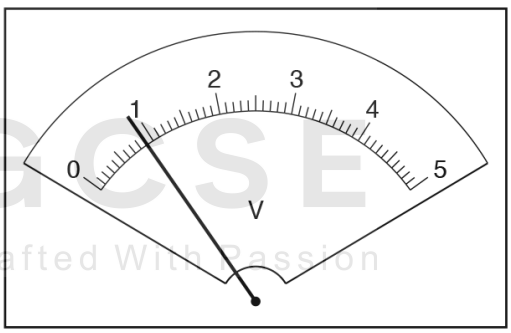


Fig. 2.3

(i) The student repeats the procedure using resistors **Y** and **Z**.
His readings are shown in Table 2.1.

Record, in Table 2.1, the value of the current I in the circuit and the value of the potential difference (p.d.) V across resistor **X** shown in Fig. 2.2 and Fig. 2.3.

Table 2.1

resistor	R /	I /	V /
X	1		
Y	3	0.55	1.7
Z	10	0.24	2.4

[2]

(ii) Add units to the column headings in Table 2.1. [2]

(c) Calculate the power P supplied to each of the resistors **X**, **Y** and **Z**.

Use the readings from Table 2.1 and the equation $P = I \times V$.
Give your answers to a suitable number of significant figures.

power P supplied to resistor **X** = ... W

power P supplied to resistor **Y** = ... W

power P supplied to resistor **Z** = ... W
[2]

(d) Describe how the value of the power P changes as R increases.

.....

.....

..... [2]

(e) Another student plans to investigate the relationship between P and R in more detail.
Suggest **two** modifications to the procedure that will enable her to do this.

1. .....

.....

2. .....

.....
[2]

[Total: 11]

10. 0625_w18_qp_61 Q: 2

A student is determining the resistance of a piece of wire.

Fig. 2.1 shows the circuit she uses.

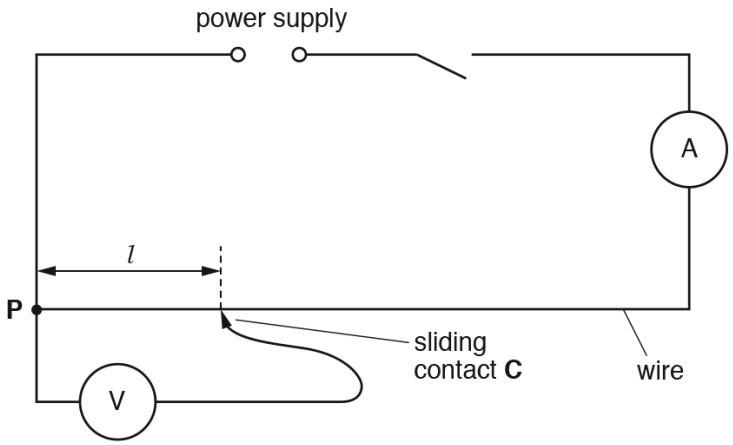


Fig. 2.1

(a) Record the current I in the circuit, as shown on the ammeter in Fig. 2.2.

I = ... [1]

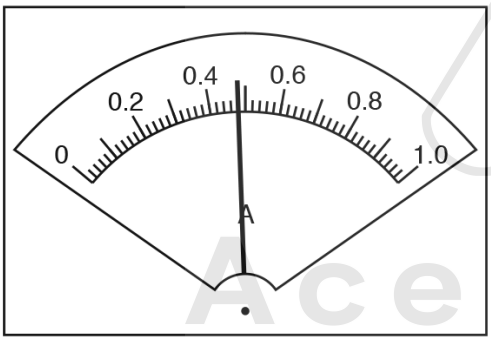


Fig. 2.2

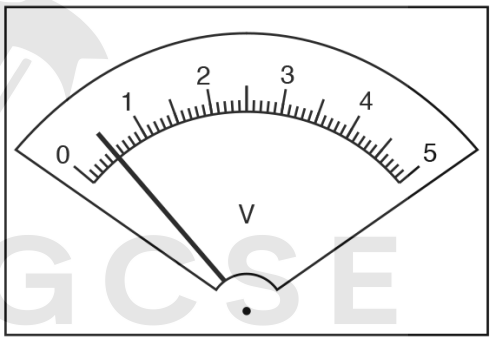


Fig. 2.3

(b) The student places the sliding contact **C** at a distance l = 20.0 cm from **P**. The voltmeter reading is shown in Fig. 2.3. Record the voltmeter reading in Table 2.1 for l = 20.0 cm. [1]

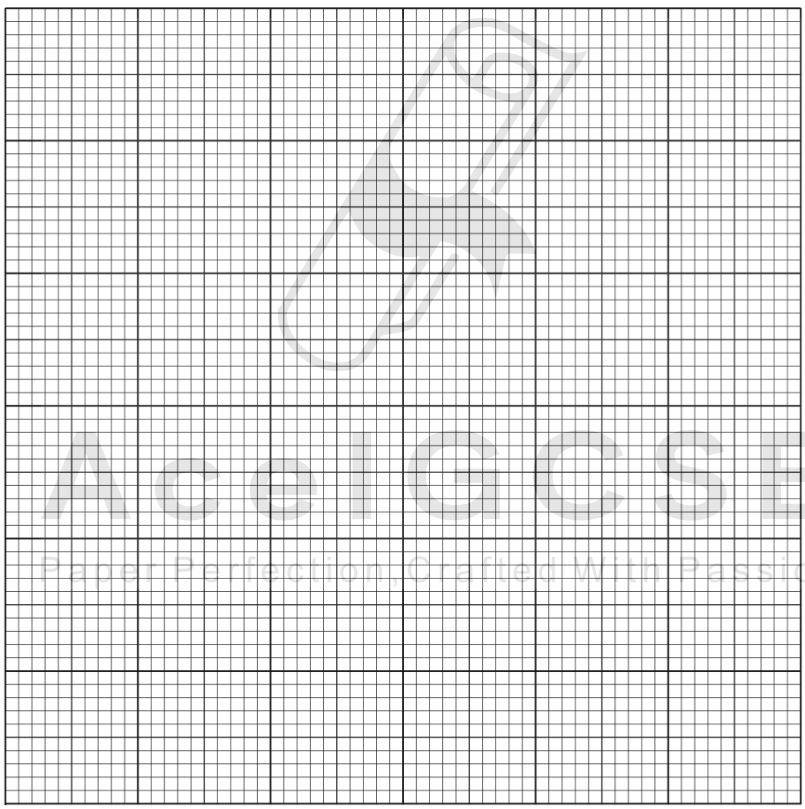
(c) The student repeats the procedure using values of $l = 40.0\,\text{cm}$, 60.0 cm, 80.0 cm and 100.0 cm. The readings are shown in Table 2.1.

Complete the column headings in the table. [1]

Table 2.1

l/	*V*/
20.0	
40.0	0.9
60.0	1.6
80.0	2.0
100.0	2.4

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



[4]

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

G = ... [2]

(ii) Calculate the resistance R of each centimetre of the wire. Use the equation $R = \frac{Gk}{I}$, where $k = 1.0\,\text{V/cm}$ and where I is the current recorded in **(a)**.

Include the unit.

R = ... [2]

[Total: 11]

11. 0625_w18_qp_63 Q: 2

Some students are determining the resistance per unit length of wire **X**.

They are using the circuit shown in Fig. 2.1.

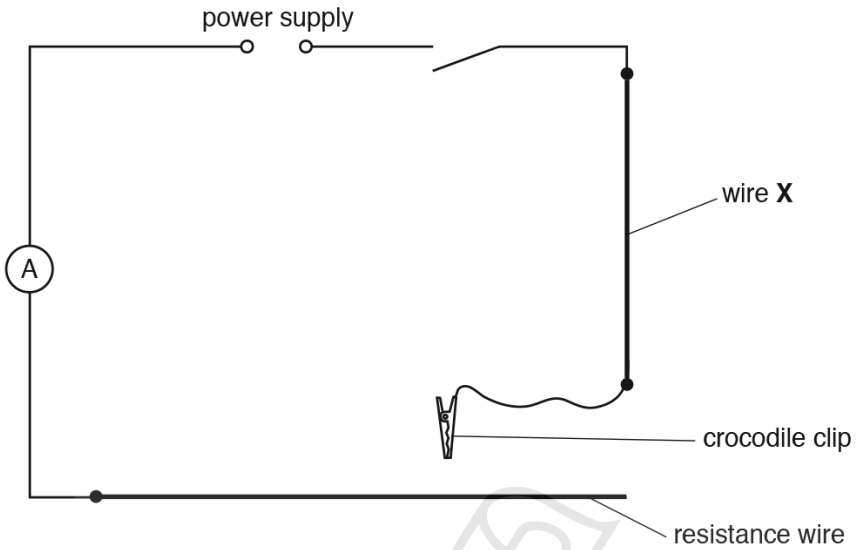


Fig. 2.1

The crocodile clip is connected to a length of the resistance wire. The current in the circuit and potential difference (p.d.) across wire **X** are measured.

(a) On Fig. 2.1, draw the symbol for a voltmeter correctly connected to measure the p.d. across wire **X**. [1]

(b) A student adjusts the position of the crocodile clip until the current in the circuit is 0.80 A.

In Table 2.1, record the value of the p.d. *V* across wire **X,** as shown in Fig. 2.2.

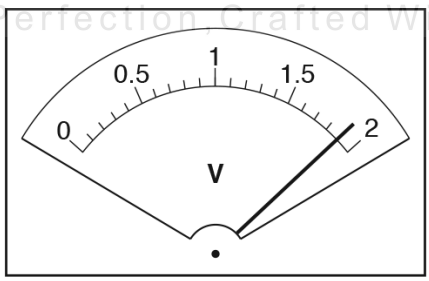


Fig. 2.2

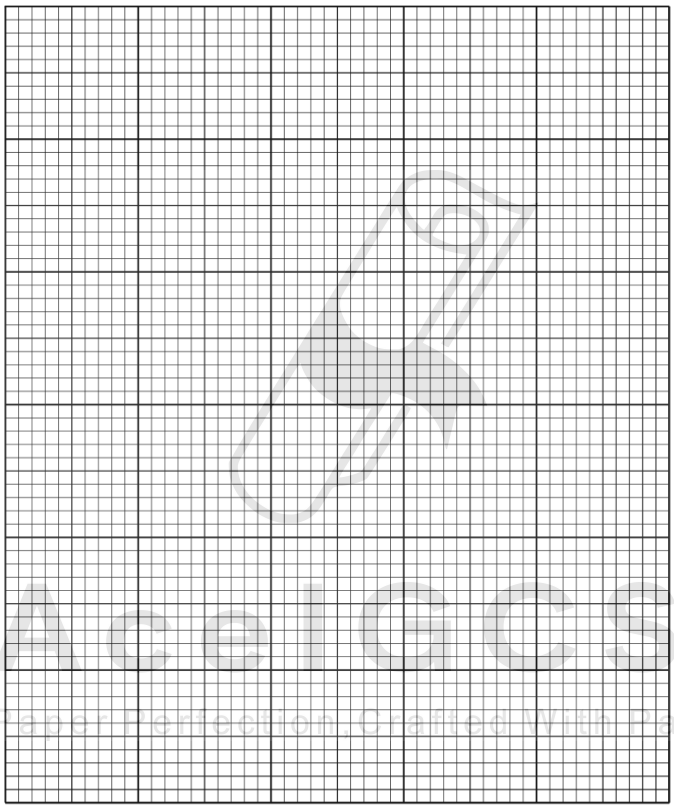
[1]

(c) The student records the p.d. V for different currents, as shown in Table 2.1.

Table 2.1

I/A	V/V
0.80	
0.70	1.58
0.60	1.34
0.50	1.03
0.40	0.81

(i) Plot a graph of V/V (y-axis) against I/A (x-axis).



[4]

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

G = ... [1]

(iii) Fig. 2.3 shows wire **X**.

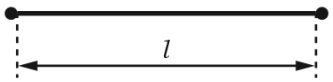


Fig. 2.3

- On Fig. 2.3, measure the length l.

l = ... cm

- The wire in Fig. 2.3 is shown to 1/3rd scale. Calculate the actual length L of wire **X**.

L = ... cm
[1]

(iv) Calculate the resistance R of each centimetre of wire **X**, using the equation

$$R = \frac{G \times k}{L},$$

where $k = 1.0\,\Omega\,\text{cm}$.

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

R = ... [2]

(d) A student notices that the resistance wire becomes very hot when the crocodile clip is connected to short lengths of the wire.

Suggest an improvement that would help to reduce this effect.

.....

.....

..... [1]

[Total: 11]

12. 0625_m17_qp_62 Q: 2

A student is investigating the resistance of three wires **A**, **B** and **C**. He is using the circuit shown in Fig. 2.1.

The circuit is set up to test wire **A**. The length, l of each wire is measured and recorded.

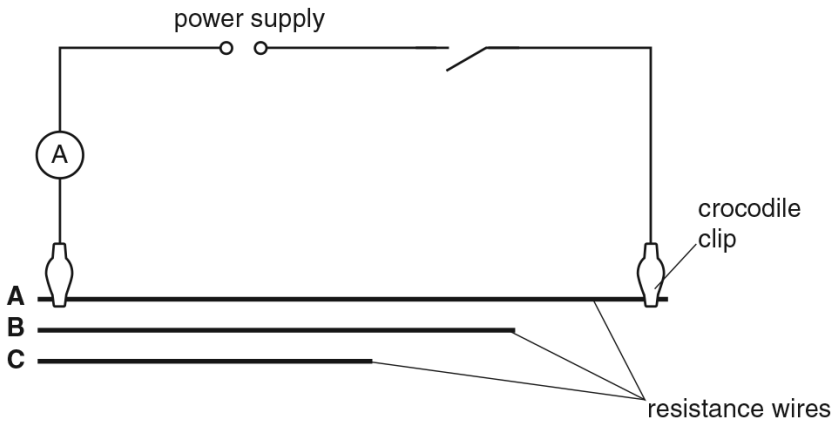


Fig. 2.1

(a) On Fig. 2.1, draw a voltmeter connected so that it will measure the potential difference across wire **A**. [1]

(b) In the first line of Table 2.1, record the potential difference V and current I for wire **A**, as shown in Figs. 2.2 and 2.3. [2]

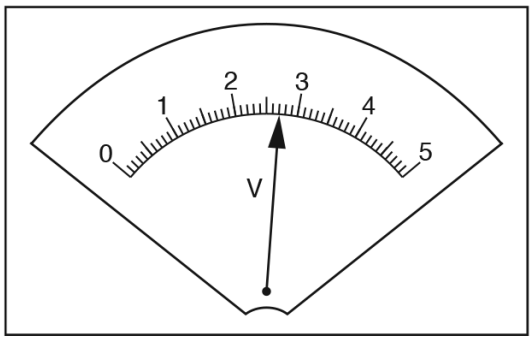


Fig. 2.2

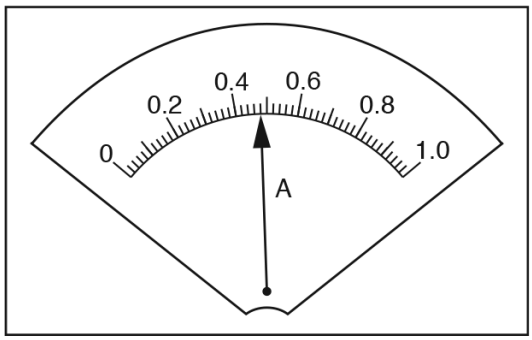


Fig. 2.3

Table 2.1

wire	l/m	V/V	I/A	R/Ω
A	0.900			
B	0.500	2.4	0.75	
C	0.400	2.2	0.85	

(c) The student connects the crocodile clips to wire **B** and then wire **C** in turn. His readings of potential difference and current are shown in Table 2.1.

Calculate, and record in Table 2.1, the resistance R of each wire.

Use the equation $R = \frac{V}{I}$.

(d) **(i)** Calculate the resistance per unit length r of each wire using the equation $r = \frac{R}{l}$. Include the unit.

r for wire **A** = ...

r for wire **B** = ...

r for wire **C** = ...

[2]

(ii) Another student suggests that r should be the same for each wire.

State whether your results support this suggestion. Justify your statement with reference to your results.

statement .....

justification .....

.....

.....[2]

(e) The student measures the length of each wire to be tested.

On Fig. 2.4, draw an arrow (◄——►) to indicate **precisely** between which two points he should measure l.

Fig. 2.4

[1]

(f) One possible problem with this type of experiment is heating of the resistance wires.

Suggest a precaution that could be taken to reduce this.

.....

.....

.....[1]

[Total: 11]

13. 0625_s17_qp_61 Q: 5

A student is investigating whether the resistance of a wire depends on the material from which the wire is made.

Resistance R is given by the equation $R = \frac{V}{I}$.

The following apparatus is available to the student:

ammeter
voltmeter
micrometer screw gauge
power supply (0–3 V)
variable resistor
switch
connecting leads
wires of different materials.

Plan an experiment to investigate whether the resistance of a wire depends on the material from which it is made.

You should:

- draw a diagram of the circuit you would use to determine the resistance of each wire
- explain briefly how you would carry out the investigation, including the measurements you would take
- state the key variables that you would control
- draw a suitable table, with column headings, to show how you would display your readings (you are **not** required to enter any readings in the table).

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[7]

[Total: 7]

14. 0625_s17_qp_62 Q: 1

The class is investigating the resistances of two resistance wires.

The circuit used is shown in Fig. 1.1.

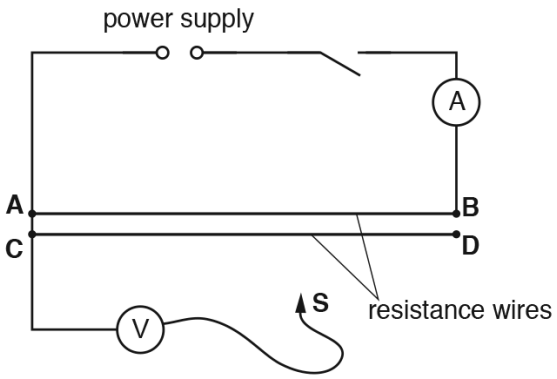


Fig. 1.1

(a) A student places a sliding contact **S** on the resistance wire **AB** at a distance $l = 0.200\,\text{m}$ from point **A**. She measures the current I in the circuit and the potential difference V across the length $l = 0.200\,\text{m}$ of resistance wire.

Figs. 1.2 and 1.3 show the voltmeter and ammeter readings.

(i) Write down the readings shown on the meters in Figs. 1.2 and 1.3.

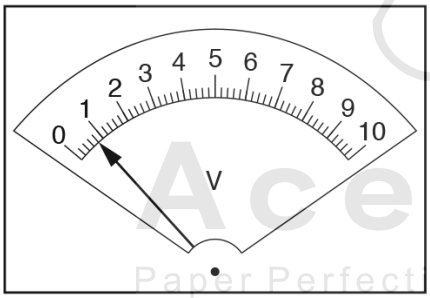


Fig. 1.2

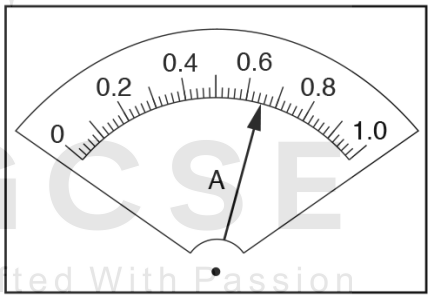


Fig. 1.3

V = ... I = ...

[2]

(ii) Calculate the resistance R of the length $l = 0.200\,\text{m}$ of resistance wire, using the equation $R = \frac{V}{I}$.

R = ...[1]

(b) The student repeats the procedure using the distance $l = 0.400\,\text{m}$. Her result is shown.

$R =$ 2.54 Ω

(i) Calculate the difference between the two values for R.

difference = ...[1]

(ii) Suggest a relationship between the length l and the resistance R of the wire that matches the results, within the limits of experimental accuracy.

.....

.....[1]

(c) Using the same method as in **(a)**, the student determines the resistance R_1 of the resistance wire **AB** of total length $l = 0.500\,\text{m}$.

$R_1 =$ 3.08 Ω

She then uses a short lead to connect points **B** and **D**. She uses the same method again to determine the combined resistance R_2 of the resistance wires **AB** and **CD** connected together.

$R_2 =$ 1.50 Ω

Use the student's results to compare the resistance R_1 of wire **AB** with the resistance R_2 of wires **AB** and **CD** connected together.

Tick the box next to the description that most closely matches the results.

- ☐ $R_1 = R_2$
- ☐ $R_1 = 2R_2$
- ☐ $2R_1 = R_2$
- ☐ There is no simple relationship between R_1 and R_2.

[1]

(d) Suggest **two** reasons why different students, all carrying out this experiment carefully, with the same apparatus, may **not** obtain identical results.

1. .....

.....

2. .....

.....

[2]

[Total: 8]

15. 0625_s17_qp_63 Q: 2

Some students are investigating the resistance of a power supply.

They are using the circuit shown in Fig. 2.1.

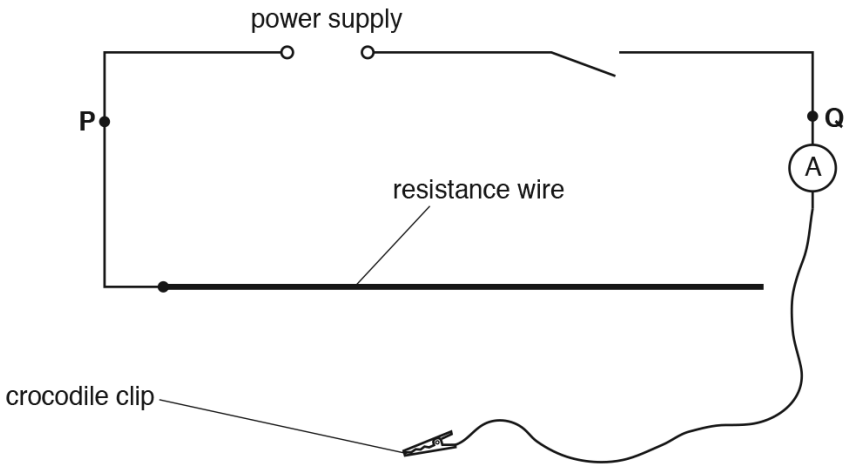


Fig. 2.1

(a) (i) A student connects the crocodile clip to the resistance wire at positions which give particular values of the potential difference V between terminals **P** and **Q**. He measures the current I in the circuit for each position.

On Fig. 2.1, draw a voltmeter connected to measure the potential difference V between terminals **P** and **Q**. [1]

(ii) Fig. 2.2 shows the ammeter reading for a value of $V = 2.2\,\text{V}$.

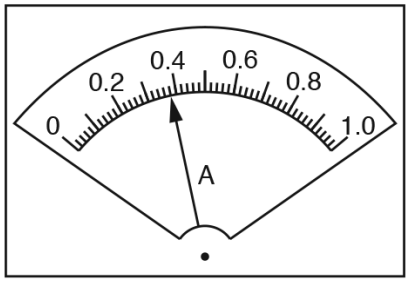


Fig. 2.2

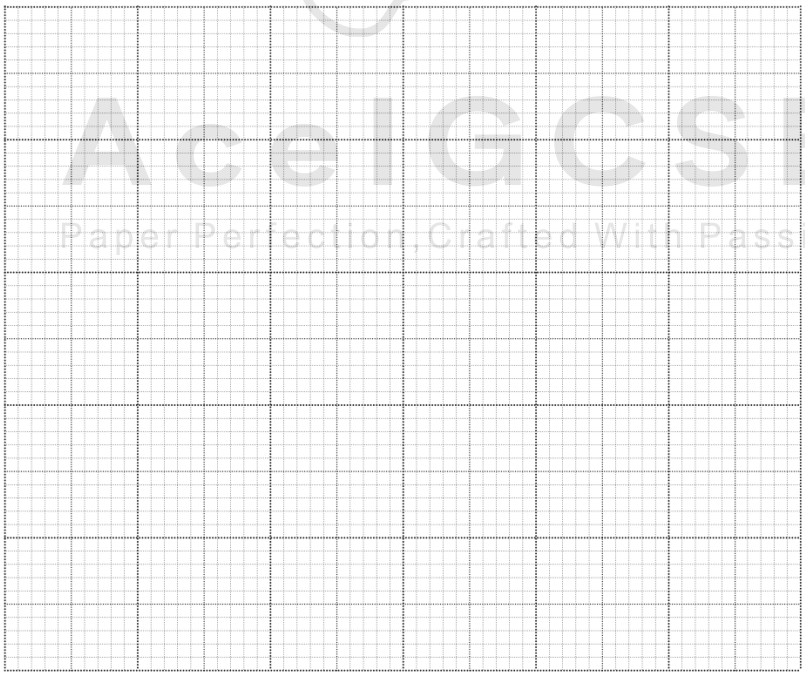
Read, and record in Table 2.1, this value of I.

Table 2.1

I/A	V/V
	2.2
0.47	2.0
0.55	1.8
0.69	1.6
0.76	1.4

[1]

(b) Plot a graph of V/V (y-axis) against I/A (x-axis).



[4]

(c) **(i)** Determine the gradient *M* of the line you have drawn.

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

M = ... [1]

(ii) The gradient *M* is numerically equal to the resistance *R* of the power supply.

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

R = ... [2]

(d) Suggest **one** practical reason why the crocodile clip should not be connected to very short lengths of resistance wire in order to obtain smaller potential differences.

.....

.....

.....[1]

(e) In this type of experiment, it is possible to change the potential difference by using a variable resistor rather than using different lengths of a resistance wire.

In the space below, draw the standard circuit symbol for a variable resistor.

[1]

[Total: 11]

16. 0625_m16_qp_62 Q: 1

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

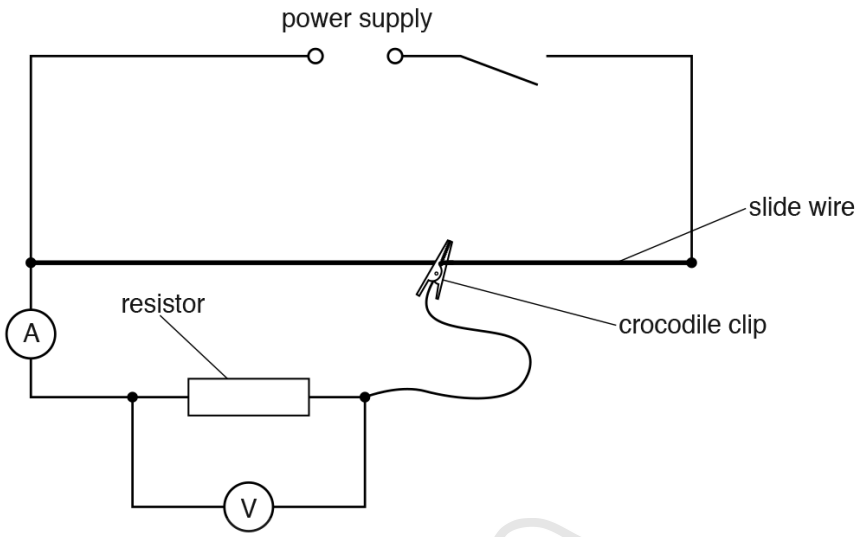


Fig. 1.1

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.

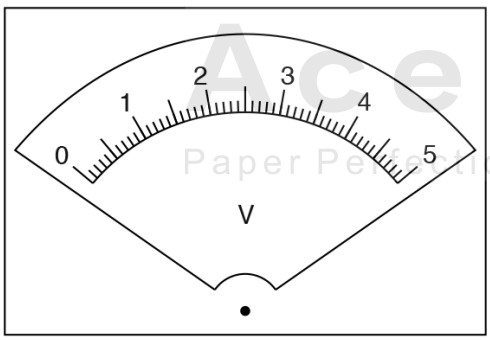


Fig. 1.2

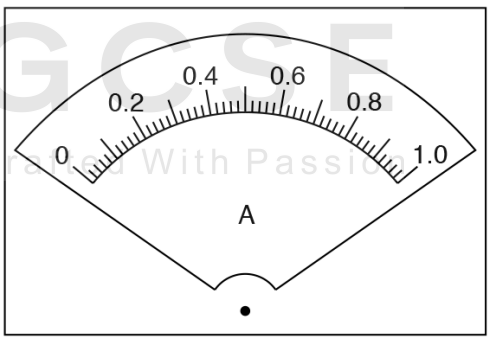


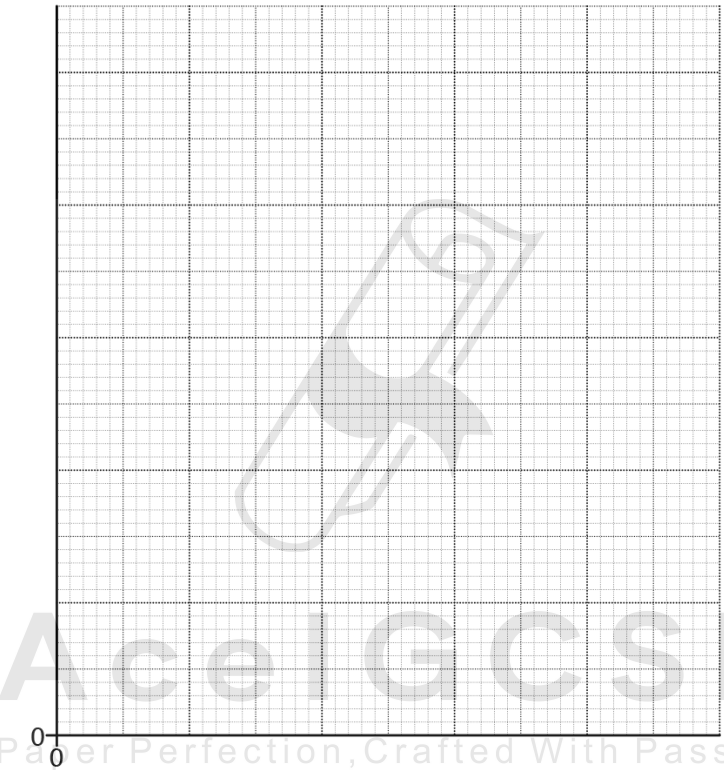
Fig. 1.3

[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]

17. 0625_p16_qp_60 Q: 3

A student is investigating the effect of the length of resistance wire in a circuit on the potential difference across a lamp.

(a) Fig. 3.1 shows the circuit without a voltmeter.

Complete the circuit diagram to show a voltmeter connected in the circuit to measure the potential difference across the lamp. [2]

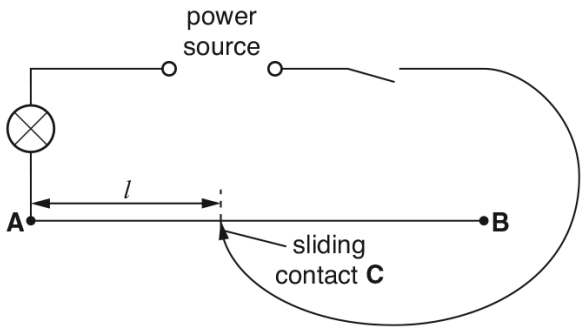


Fig. 3.1

(b) The student switches on and places the sliding contact **C** on the resistance wire at a distance l = 0.200 m from end **A**.

The voltmeter reading is shown in Fig. 3.2.

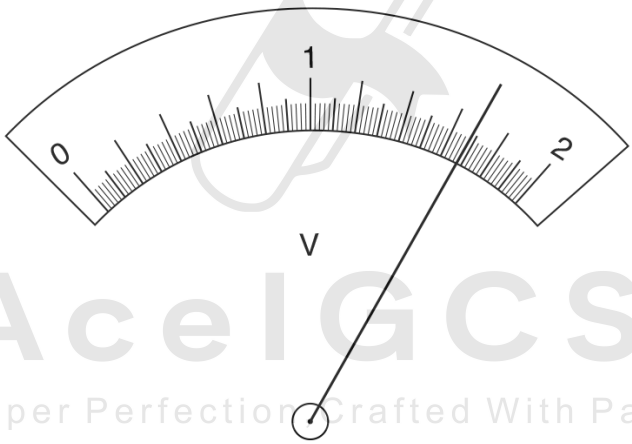


Fig. 3.2

Record the voltmeter reading in Table 3.1.

Table 3.1

l/m	V/V
0.200	
0.400	1.43
0.600	1.25
0.800	1.11
1.000	1.00

[1]

(c) The student repeats the procedure using a range of values of l. Table 3.1 shows the readings.

Use the results for the potential difference across the lamp to predict how increasing the length l affects the brightness of the lamp.

..... [1]

(d) The student suggests that the potential difference V across the lamp is directly proportional to the length l of resistance wire in the circuit.

State whether you agree with this suggestion. Justify your answer by reference to the results.

statement .....

justification .....

.....

.....

[2]

(e) The student repeats the experiment.

Suggest a practical reason why the repeat readings may be slightly different from those recorded in Table 3.1.

.....

..... [1]

(f) State one safety precaution that you would take when carrying out experiments like this with resistance wires.

..... [1]

[Total: 8]

18. 0625_s16_qp_61 Q: 2

A student is heating water in a beaker using an electrical heater.

(a) He measures the potential difference V across the heater and the current I in the heater.

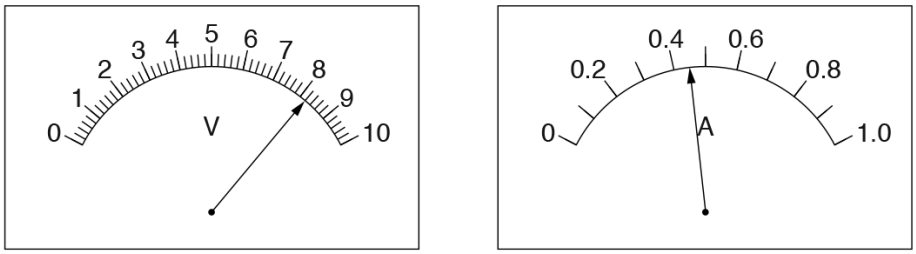


Fig. 2.1

Write down the readings shown on the meters in Fig. 2.1.

V = ...

I = ...

[3]

(b) He measures the temperature of the water before heating.

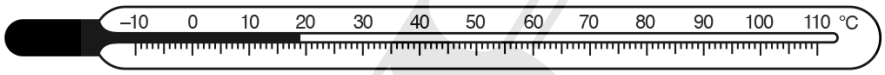
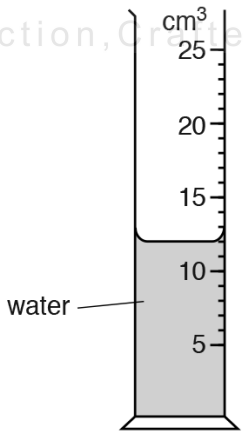


Fig. 2.2

Write down the temperature reading θ shown in Fig. 2.2.

θ = ... [1]

(c) On Fig. 2.3, draw a line and an eye to show clearly the line of sight required to read the volume of water in the measuring cylinder.



[1]

Fig. 2.3

[Total: 5]

19. 0625_s16_qp_61 Q: 3

A student is investigating the resistance of a lamp filament.

The circuit is shown in Fig. 3.1.

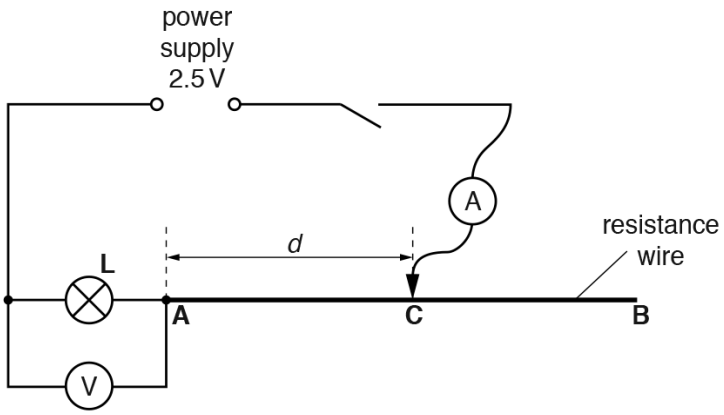


Fig. 3.1

(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]

---

20. 0625_s16_qp_62 Q: 4

A student is investigating how the resistance of a wire depends on the length of the wire. The student aims to plot a graph.

The following apparatus is available to the student:

ammeter
voltmeter
power supply
variable resistor
switch
connecting leads
resistance wires of different lengths
metre rule.

Plan an experiment to investigate how the resistance of a wire depends on the length of the wire.

You should

- draw a diagram of the circuit you could use to determine the resistance of each wire
- explain briefly how you would carry out the investigation
- suggest suitable lengths of wire
- state the key variables that you would control
- draw a table, or tables, with column headings to show how you would display your readings. You are not required to enter any readings in the table.

....[7]

[Total: 7]

21. 0625_w16_qp_62 Q: 2

A student is investigating the resistance of a resistor.

The circuit is shown in Fig. 2.1. **AB** and **CD** are lengths of resistance wire.

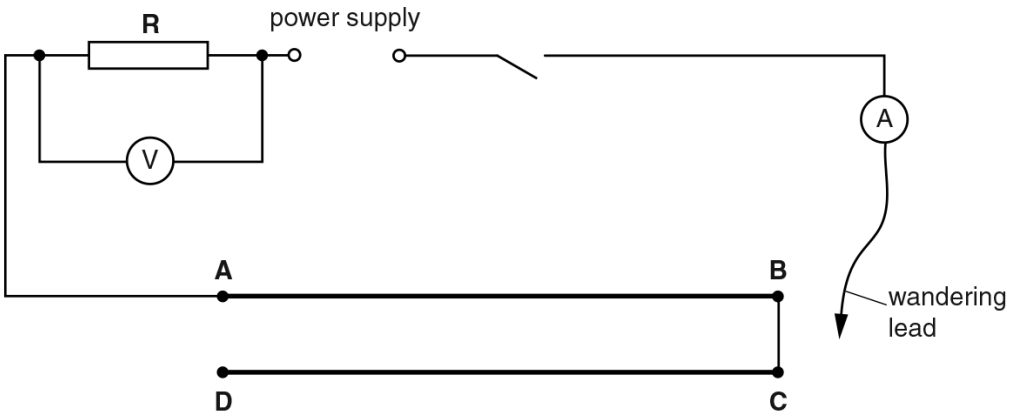


Fig. 2.1

(a) The student connects the wandering lead to point **B** in the circuit. The readings of potential difference V_1 and current I_1 are shown in Figs. 2.2 and 2.3.

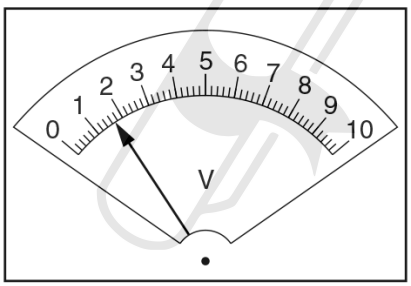


Fig. 2.2

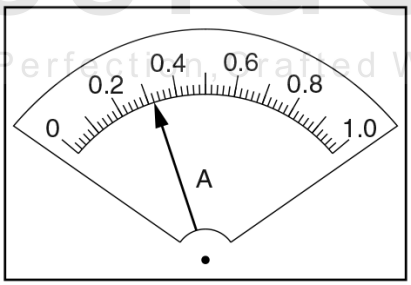


Fig. 2.3

(i) Record the readings shown on the meters.

V_1 = ...

I_1 = ...

[2]

(ii) Calculate the resistance R of the resistor **R** using the equation $R = \frac{\cdot 1}{I_1}$.

R = ...[1]

(b) The student connects the wandering lead to point **D** in the circuit and repeats the readings.

She connects points **A** and **D** together. She connects the wandering lead to point **B** and repeats the readings.

Finally, she connects the wandering lead to point **A** and repeats the readings.

The new values for the resistance R of resistor **R** that she obtains are:

R = 4.96Ω, 5.12Ω, 4.89Ω

A student suggests that the resistance R should be constant throughout the experiment.

State whether the results agree with this suggestion. Justify your answer by reference to the results.

statement .....

justification .....

.....

.....

[2]

(c) **(i)** Name a component that could be used to control the current in the circuit, in place of the wires **AB** and **CD**.

.....[1]

(ii) In the space below, draw the circuit with this component in place of the wires **AB** and **CD**. Show one end of the component connected at **A** and the wandering lead connected to the other end of the component.

[2]

[Total: 8]

22. 0625_w16_qp_63 Q: 3

A student is investigating the resistance of a lamp.

He is using the circuit shown in Fig. 3.1.

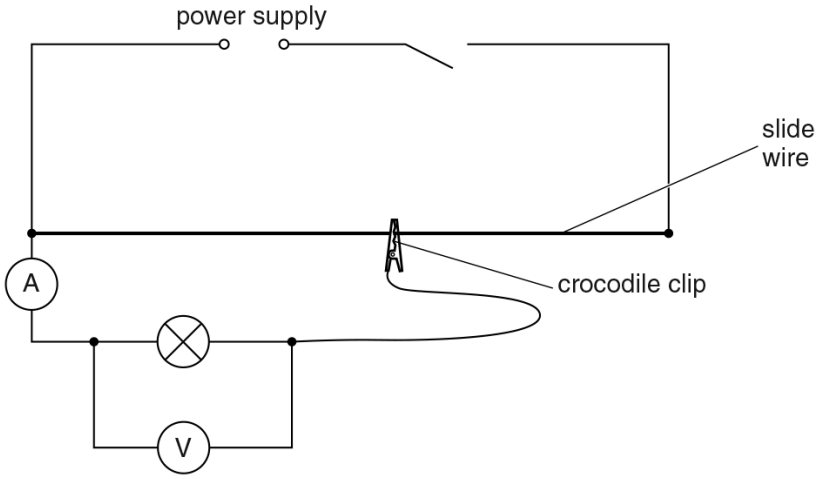


Fig. 3.1

(a) The student connects the crocodile clip on the slide wire to give particular values of the potential difference V across the lamp. He measures the current I in the lamp for each position.

Figs. 3.2 to 3.6 show the ammeter readings for values of $V = 0.5\,V$, $1.0\,V$, $1.5\,V$, $2.0\,V$ and $2.5\,V$, respectively.

Read, and record in Table 3.1, the value of I for each value of potential difference V. Record each value to 2 significant figures.

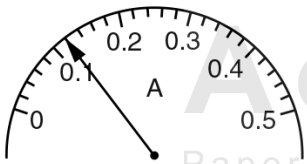


Fig. 3.2

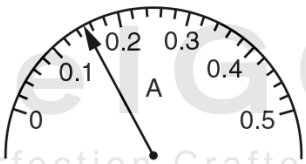


Fig. 3.3

Fig. 3.4

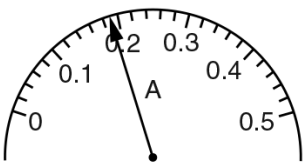


Fig. 3.5

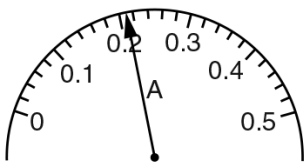


Fig. 3.6

[2]

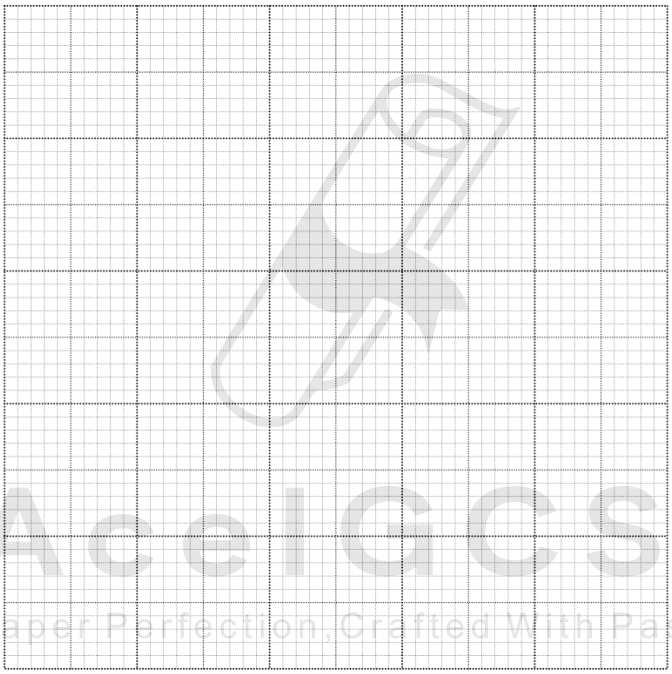
(b) Calculate, and record in Table 3.1, the resistance R of the lamp at each value of V.
Use the equation $R = \frac{V}{I}$.

[1]

Table 3.1

V/V	I/A	R/Ω
0.5		
1.0		
1.5		
2.0		
2.5		

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



[4]

(d) State what the shape of the graph tells you about the change, if any, in the resistance of the lamp during the experiment.

.....

.....

.....

.....[2]

(e) In this type of experiment, it is possible to change the current and potential difference for the lamp by using a variable resistor rather than a slide wire.

On Fig. 3.7, complete the circuit diagram to show a variable resistor used for this purpose.

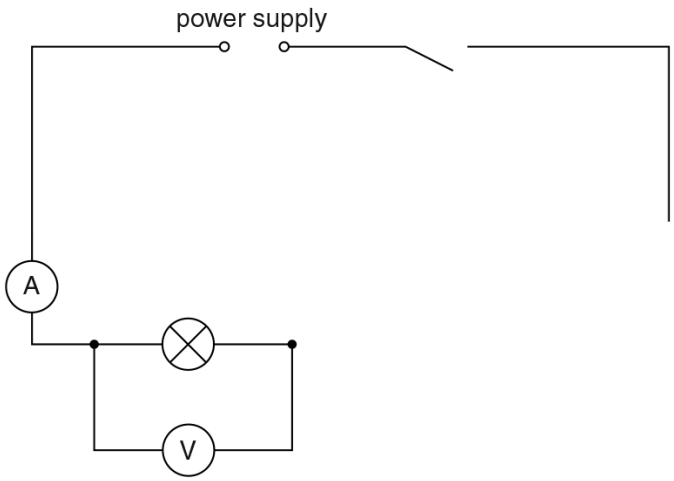


Fig. 3.7

[2]

[Total: 11]

23. 0625_m15_qp_62 Q: 3

Some students are investigating the link between the brightness of a filament lamp and its resistance.

The circuit is shown in Fig. 3.1.

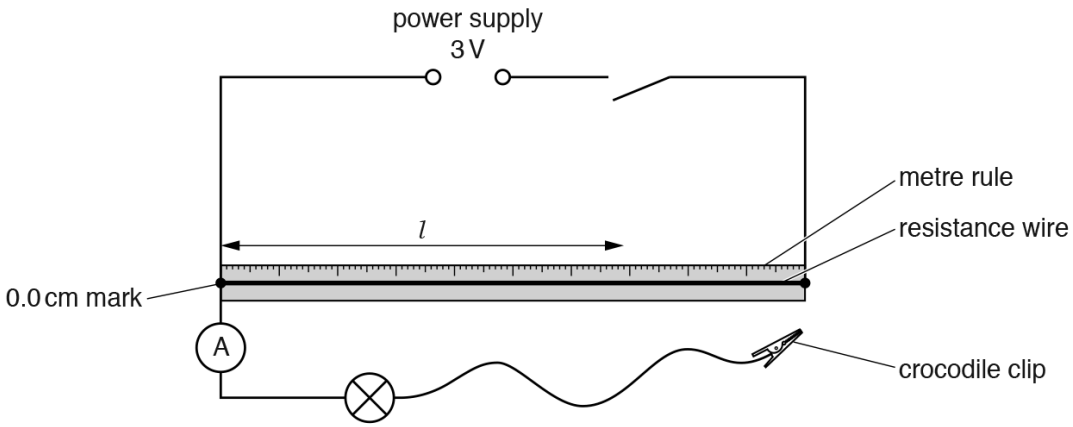


Fig. 3.1

(a) On Fig. 3.1, use standard symbols to show a voltmeter connected to measure the potential difference across the lamp. [1]

(b) The students attach the crocodile clip to various lengths l of the resistance wire and record, in Table 3.1, the potential difference V and the current I for the lamp. They also record observations of the lamp filament.

Table 3.1

l/cm	V/V	I/A	observation of lamp filament	R/Ω
100	2.5	0.26	bright	
60	1.5	0.19	dim	
20	0.5	0.11	just glowing	

Voltmeters with the ranges shown in Fig. 3.2 are available.

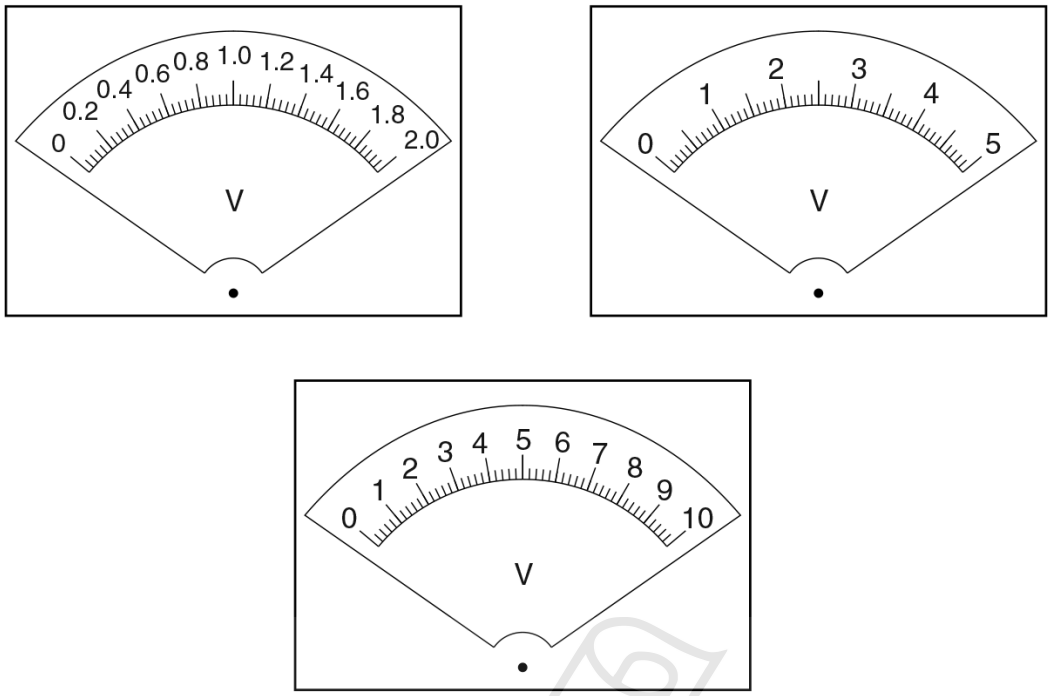


Fig. 3.2

(i) On Fig. 3.2, circle the voltmeter which is most appropriate for this experiment.

(ii) Draw an arrow on this voltmeter to show the reading when the crocodile clip is attached to a length $l = 60\,\text{cm}$ of the resistance wire.

[2]

(c) Calculate, and record in the table, the resistance R of the lamp for each value of l, using the equation $R = \frac{V}{I}$. [2]

(d) From the results and the observations of the lamp filament, state the link, if any, between the brightness of the lamp and its resistance. Explain clearly how the results support your statement.

statement .....

explanation .....

.....

.....

.....

[2]

(e) A student wishes to see if another lamp shows the same link between brightness and resistance. However, his lamp only glows dimly when a potential difference of 3V is applied across it.

The student decides that a method using a resistance wire is not suitable.

Suggest an alternative circuit and apparatus which would allow him to vary the brightness of his lamp and measure the potential difference and current for his lamp. You may draw a circuit diagram.

.....

.....

.....

.....[3]

[Total: 10]

24. 0625_s15_qp_63 Q: 3

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

They are using the circuit shown in Fig. 3.1.

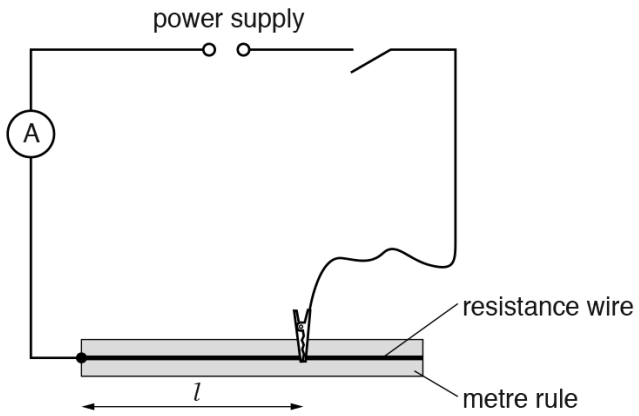


Fig. 3.1

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]

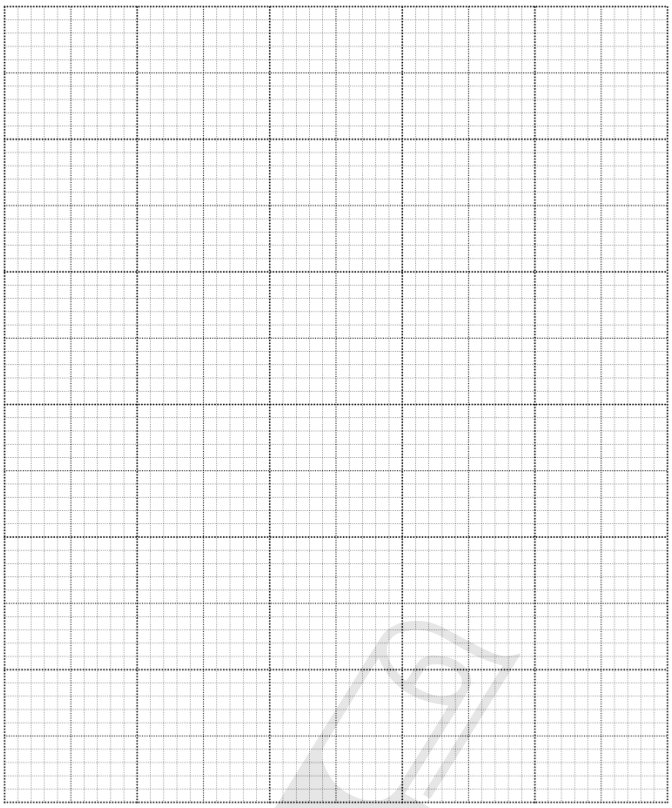
(b) The potential difference V and current I for various lengths l of the wire are shown in Table 3.1.

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]

25. 0625_w15_qp_61 Q: 2

The class is determining the resistance of a resistor.

Fig. 2.1 shows the circuit.

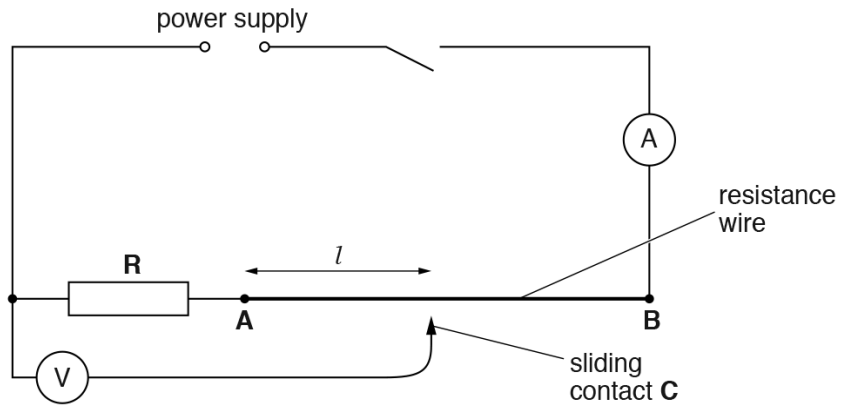


Fig. 2.1

(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 $l = 100\,\text{cm}$.

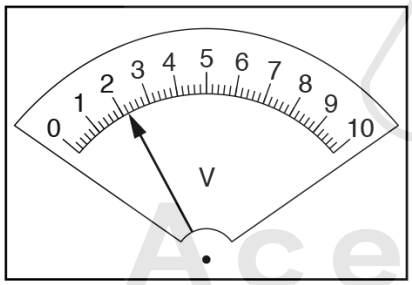


Fig. 2.2

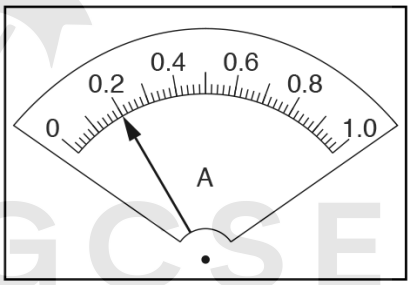


Fig. 2.3

Table 2.1

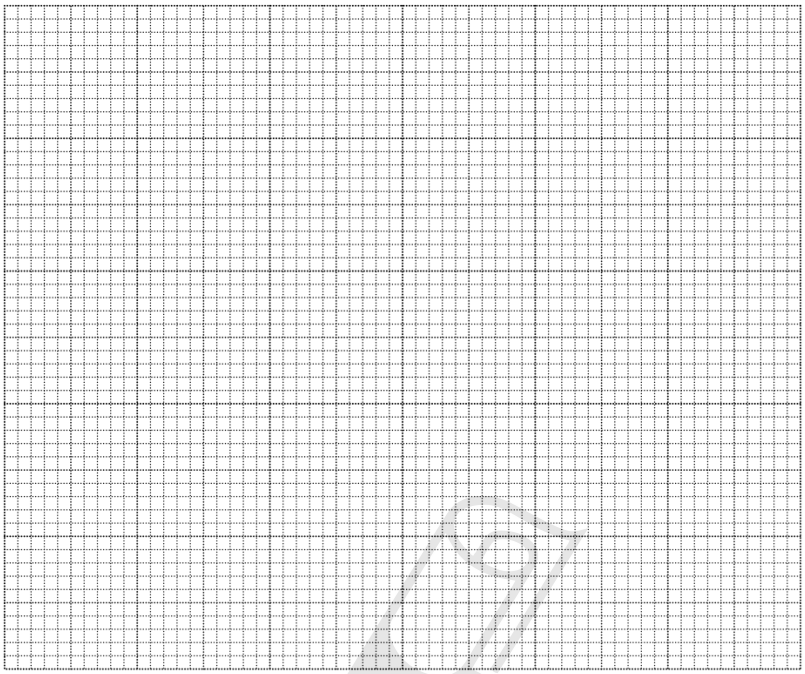
l/cm	V/V
20.0	1.1
40.0	1.4
60.0	1.6
80.0	1.9
100.0	

[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]

26. 0625_s14_qp_61 Q: 4

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

The circuit is shown in Fig. 4.1.

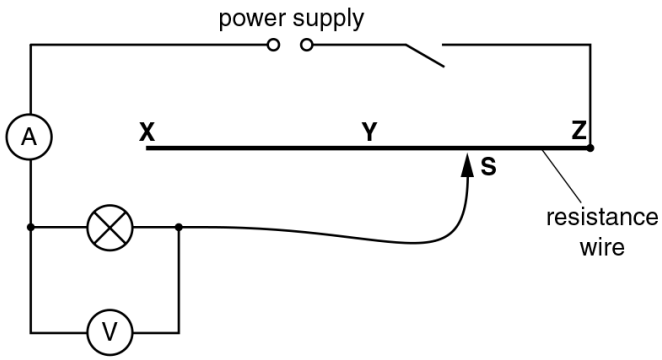


Fig. 4.1

(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.

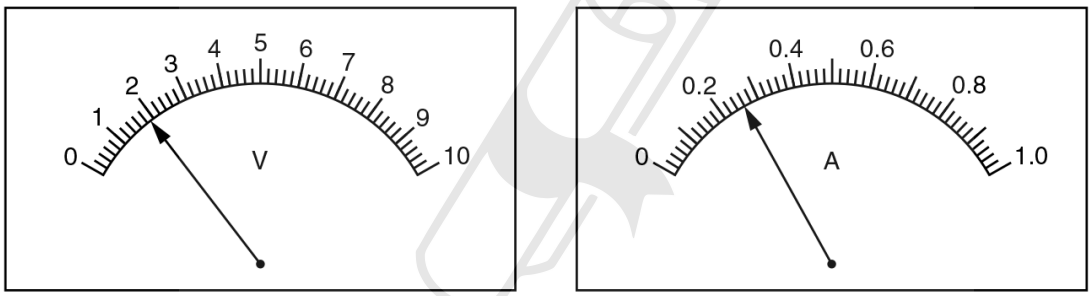


Fig. 4.2

(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.

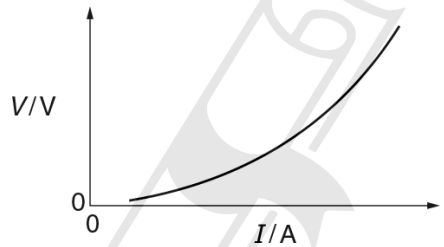


Fig. 4.3

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]

27. 0625_s14_qp_62 Q: 3

The IGCSE class is investigating the resistance of a resistor.

Fig. 3.1 shows the circuit.

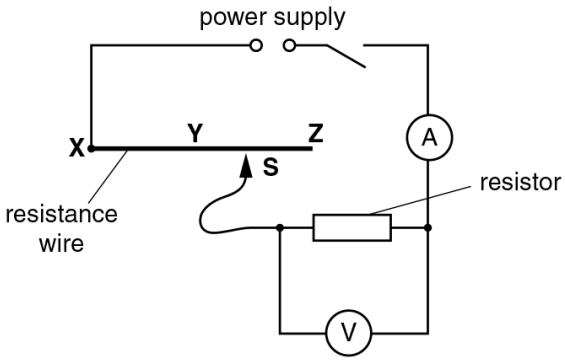


Fig. 3.1

(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.

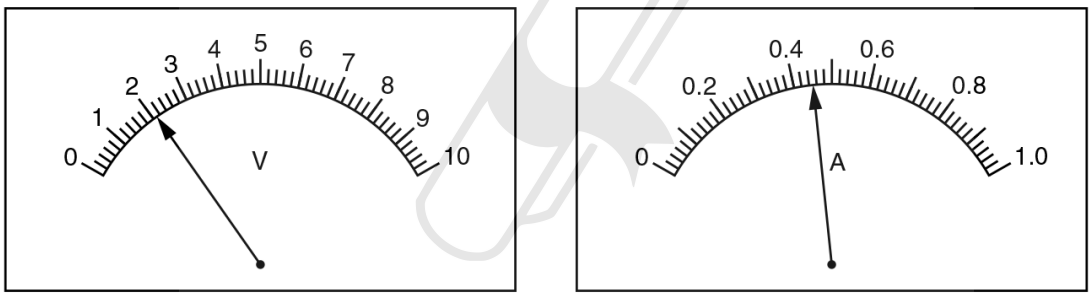


Fig. 3.2

(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.

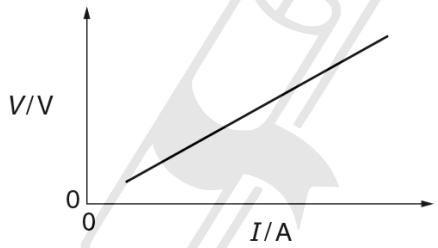


Fig. 3.3

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]

28. 0625_s14_qp_63 Q: 3

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.

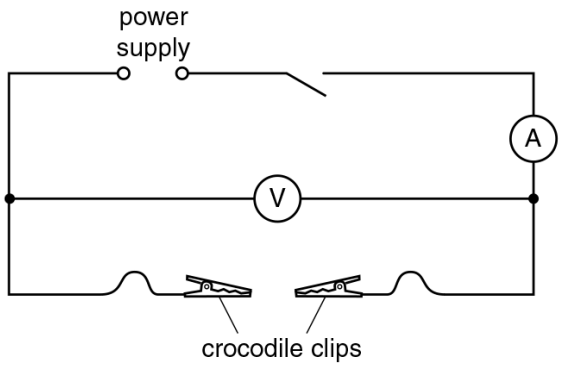


Fig. 3.1

(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.

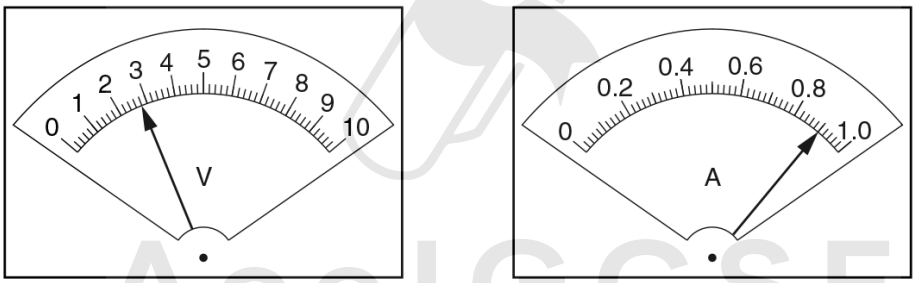


Fig. 3.2

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]

29. 0625_w14_qp_61 Q: 3

The IGCSE class is investigating the resistance of a wire.

The circuit used is shown in Fig. 3.1.

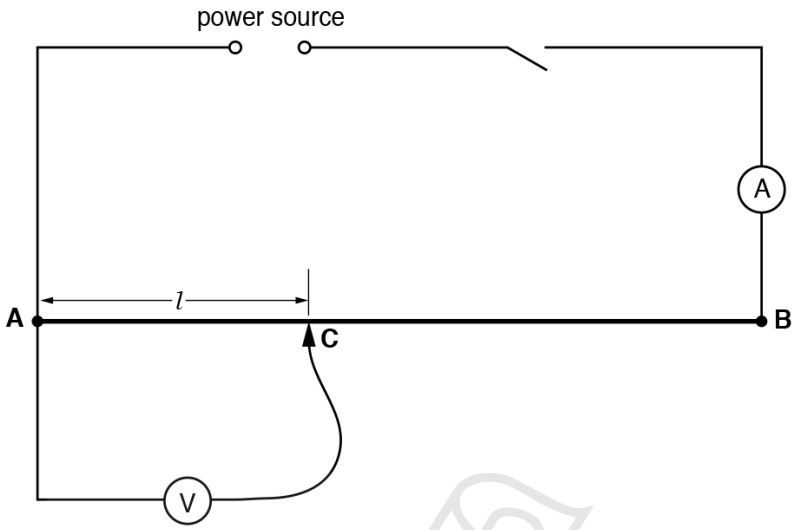


Fig. 3.1

(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 1.00m long. The readings are shown in Table 3.1.

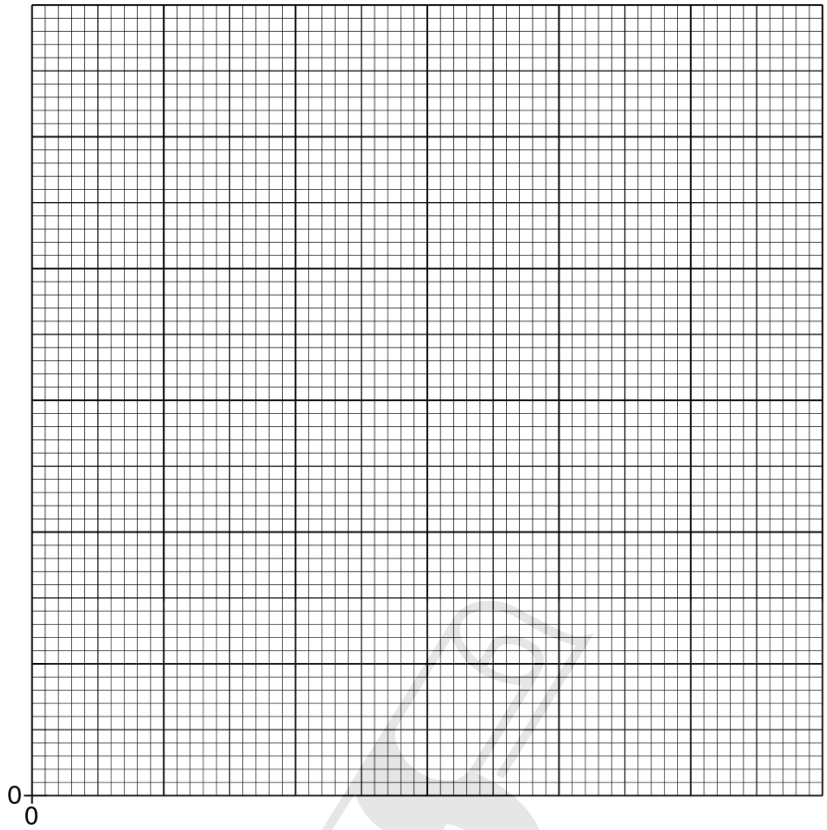
Calculate the resistance R of each length l of the wire **AB**, using the equation $R = \frac{V}{I}$. Record the values of R in the table.

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]

30. 0625_w14_qp_62 Q: 3

The IGCSE class is investigating the resistance of a wire.

Fig. 3.1 shows the circuit used.

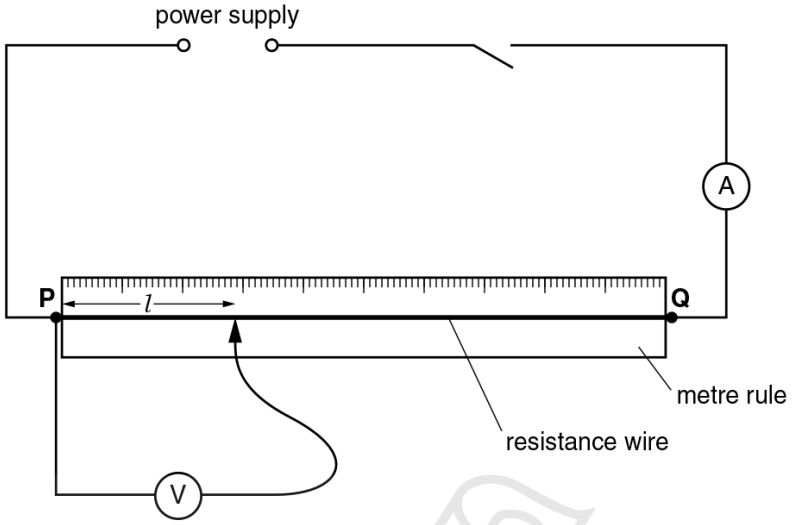


Fig. 3.1

(a) A student measures the current I in the circuit and the p.d. V across a length $l = 0.250\,\text{m}$ of the wire **PQ**.

He repeats the readings using a range of different lengths of the wire. The readings are shown in Table 3.1.

Table 3.1

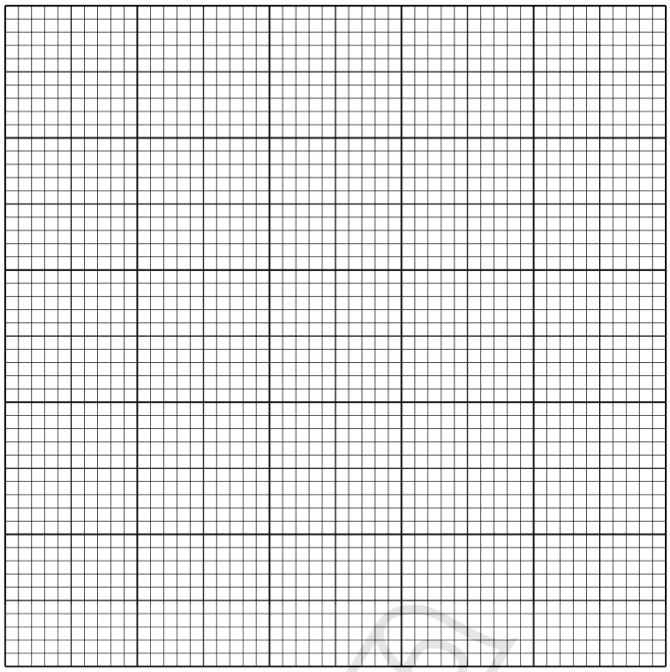
l/	V/	I/	R/
0.250	0.50	0.33	
0.350	0.69	0.36	
0.450	0.90	0.32	
0.550	1.11	0.34	
0.650	1.32	0.35	
0.750	1.50	0.33	

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

(ii) Complete the heading for each column of the table.

[1]

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



[4]

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

G = ... [2]

(d) Predict the value of the resistance R_1 of 1.00 m of the resistance wire connected between **P** and **Q**. Give your answer to a number of significant figures that is suitable for this experiment.

R_1 = ... [2]

[Total: 9]

31. 0625_w14_qp_62 Q: 5

The IGCSE class is investigating the current in copper wires.

Each student has a selection of wires and a range of apparatus that could be used, listed below.

30 cm ruler
ammeter
electrical leads
electromagnet
electronic balance
lamp
metre rule
12 V fixed-voltage power supply
switch
tape measure
variable resistor (rheostat)
voltmeter

(a) From the list, choose the most suitable device to measure the length of approximately 20 m of copper wire.

..... [1]

(b) **(i)** Draw a circuit diagram to show the circuit that you would set up to measure the current in a sample of copper wire. The current is to be measured for a range of potential differences that must also be measured. Draw the symbol for a resistor to represent the sample of copper wire.

[3]

(ii) A student replaces the copper wire with a lamp. She switches on the circuit but the lamp does not glow.

Suggest how she can check that the lamp filament is not broken by using the circuit, and without removing the lamp.

.....

.....[1]

(iii) State whether a 0 – 300 V voltmeter is suitable for measuring a potential difference in the circuit you have drawn in part **(b)(i)**. Give a reason for your answer.

statement .....

reason .....

.....

.....

[1]

[Total: 6]

---

32. 0625_s13_qp_61 Q: 3

The IGCSE class is investigating the resistance of a wire.

The circuit used is shown in Fig. 3.1.

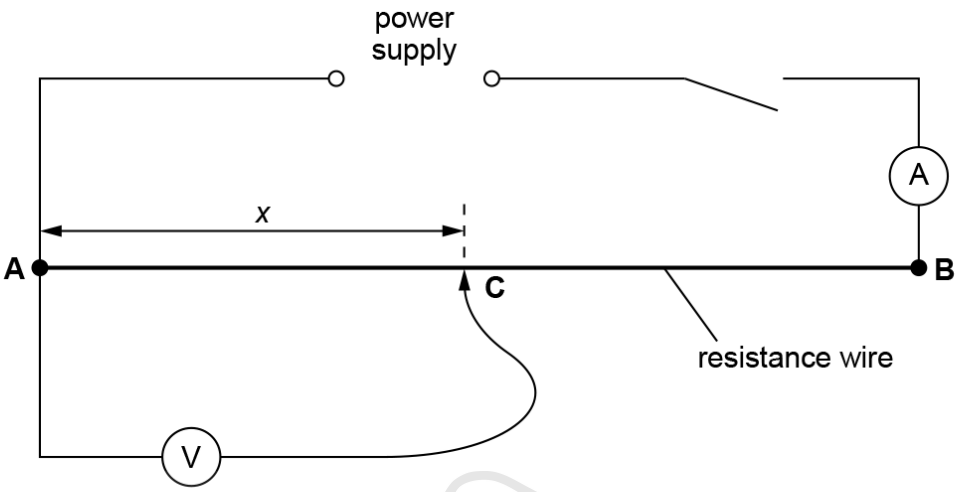


Fig. 3.1

A student moves contact **C** to give a range of values of the length *x*. For each length *x*, the current *I* and potential difference *V* are measured and recorded in Table 3.1.

(a) (i) Calculate the resistance *R* of 10.0 cm of the resistance wire using the equation $R = \frac{V}{I}$. Record this value of *R* in the table.

(ii) Repeat step **(i)** for each of the other values of *x*.

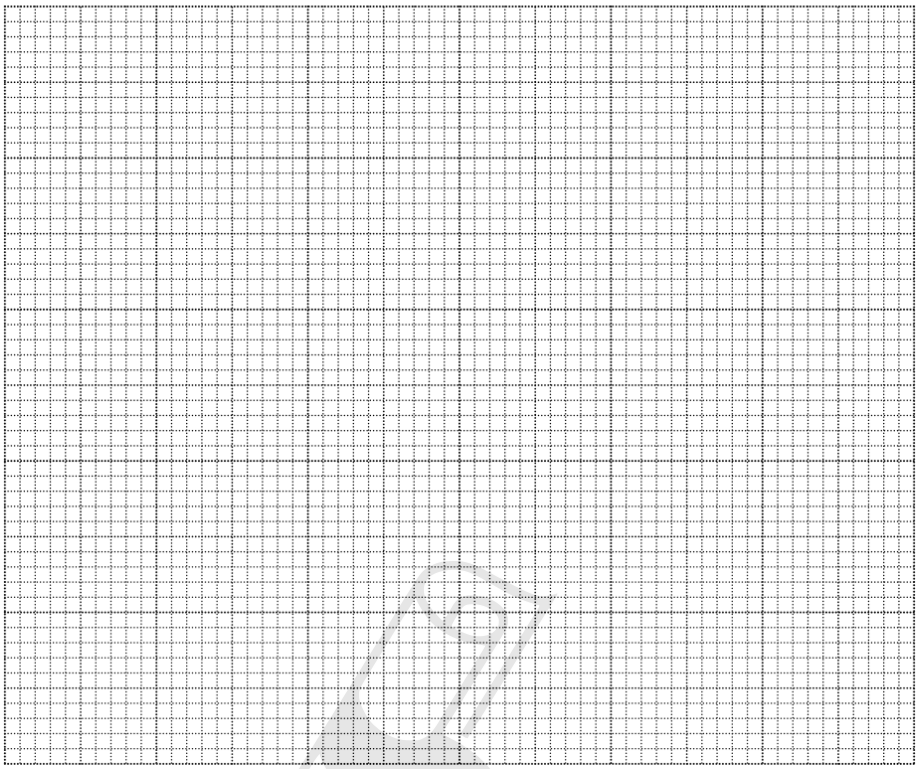
(iii) Complete the column headings in the table.

Table 3.1

x/	*V*/	*I*/	*R*/
10.0	0.20	0.33	
30.0	0.60	0.33	
50.0	1.01	0.32	
70.0	1.41	0.33	
90.0	1.81	0.33	

[3]

(b) Plot a graph of V/V (y-axis) against R/Ω (x-axis).



[5]

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

G = ...[3]

[Total: 11]

33. 0625_w13_qp_62 Q: 3

The IGCSE class is investigating the resistance of a wire.

The circuit used is shown in Fig. 3.1.

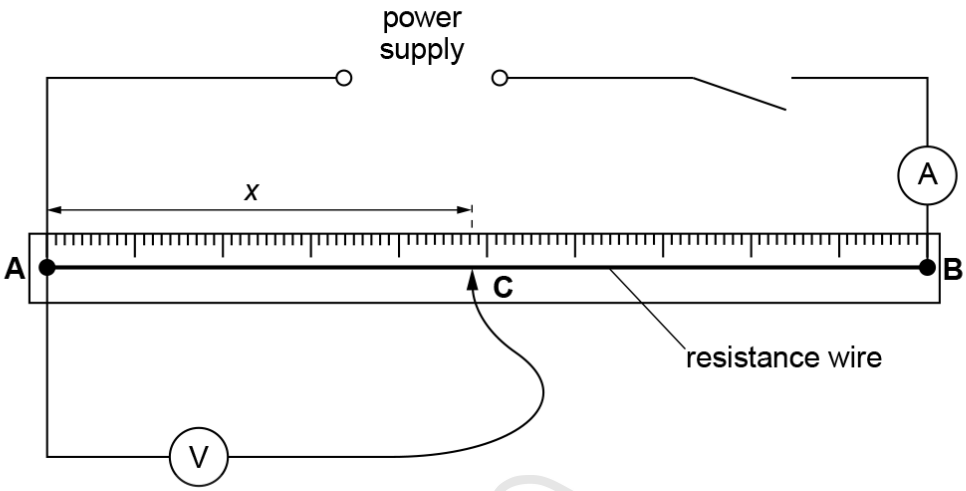


Fig. 3.1

(a) A student places the sliding contact **C** on the resistance wire **AB** at a distance x from **A**, where x = 0.200 m.

(i) He measures the current I in the wire. Fig. 3.2 shows the ammeter.

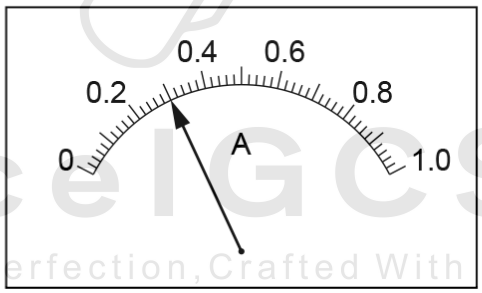


Fig. 3.2

Record the value of I.

I = ...[1]

(ii) The student measures the potential difference V across the wire between **A** and **C**. Fig. 3.3 shows the voltmeter.

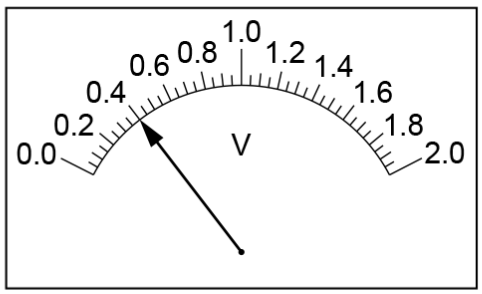


Fig. 3.3

In the first row of Table 3.1 record the value of V.

(iii) Calculate the resistance R of the section **AC** of the wire using the equation $R = \frac{V}{I}$.

Record R in the first row of the table.

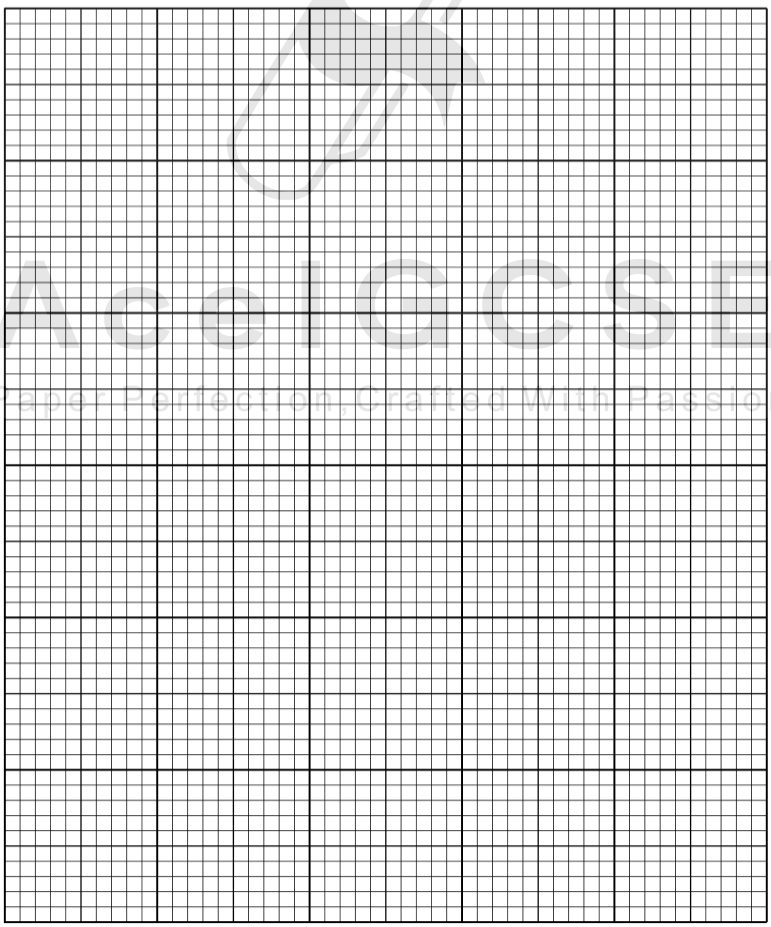
Table 3.1

x/m	V/V	R/Ω
0.200		
0.350	0.80	2.67
0.500	1.00	3.33
0.650	1.25	4.17
0.800	1.60	5.33

[2]

(b) The student records the voltmeter readings using a range of x values. The readings are shown in Table 3.1.

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



[5]

(c) Using your graph, determine the length l of the resistance wire necessary to make a resistor of resistance 1.20 Ω. Show clearly on your graph how you obtained the necessary information.

l = ...[1]

(d) Predict the resistance Z of 1.50 m of the resistance wire. Show your working.

Z = ...[1]

[Total: 10]

34. 0625_w13_qp_63 Q: 3

IGCSE students are investigating the current and potential difference in an electrical circuit.

The circuit is shown in Fig. 3.1.

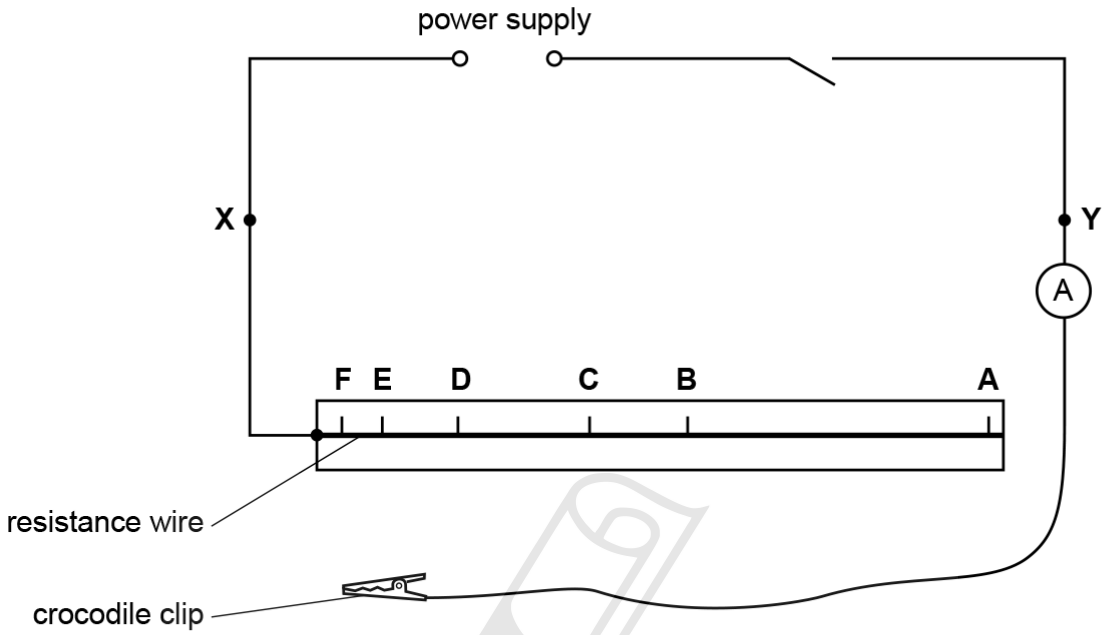


Fig. 3.1

(a) The potential difference across part of the resistance wire, and the current in the circuit are to be measured.

On Fig. 3.1, use an appropriate circuit symbol to draw a voltmeter connected to measure the potential difference between **X** and **Y**.

[1]

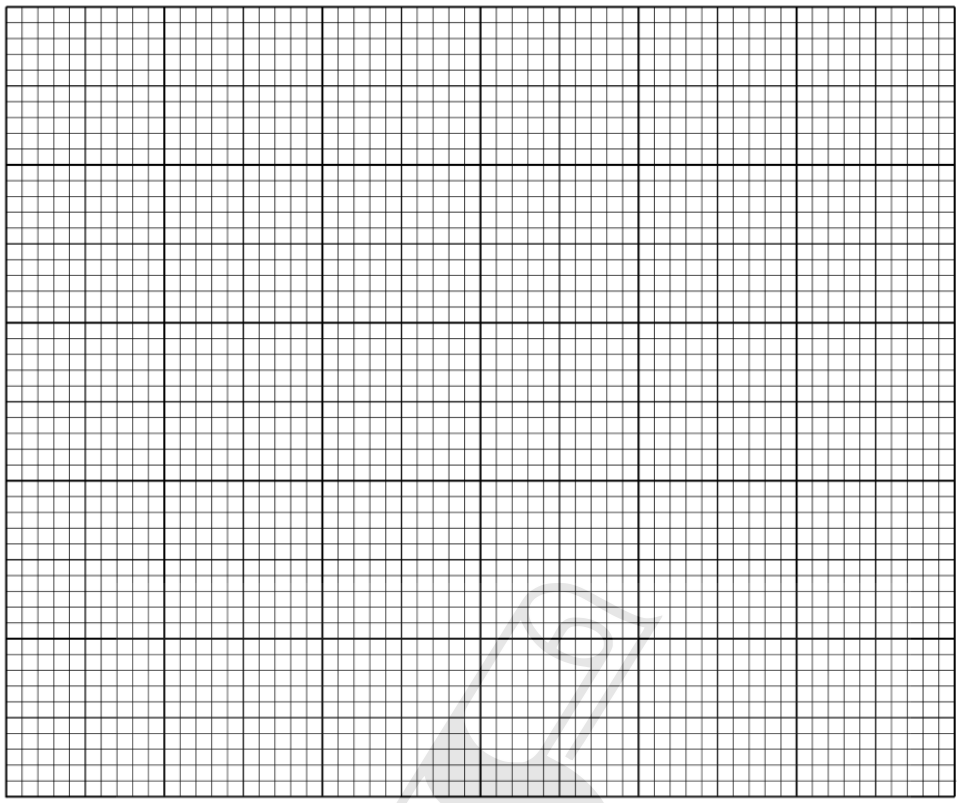
(b) The crocodile clip is connected in turn to the resistance wire at points **A**, **B**, **C**, **D**, **E** and **F**.

The potential difference V and current I are measured for each position and recorded in Table 3.1.

Table 3.1

position	V/V	I/A
A	1.3	0.20
B	1.2	0.35
C	1.1	0.46
D	0.9	0.74
E	0.8	0.87
F	0.6	1.13

(i) Plot a graph of V/V (y-axis) against I/A (x-axis).



[4]

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

M = ... [2]

(iii) The gradient M is numerically equal to the resistance R of the power supply.

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

R = ... [2]

[Total: 9]

35. 0625_s12_qp_61 Q: 3

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

The circuit is shown in Fig. 3.1.

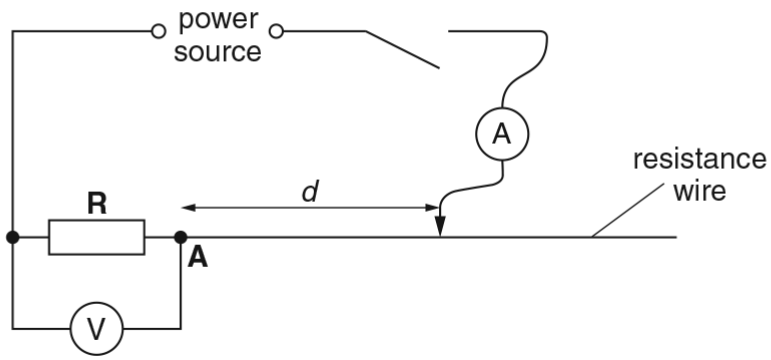


Fig. 3.1

(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.

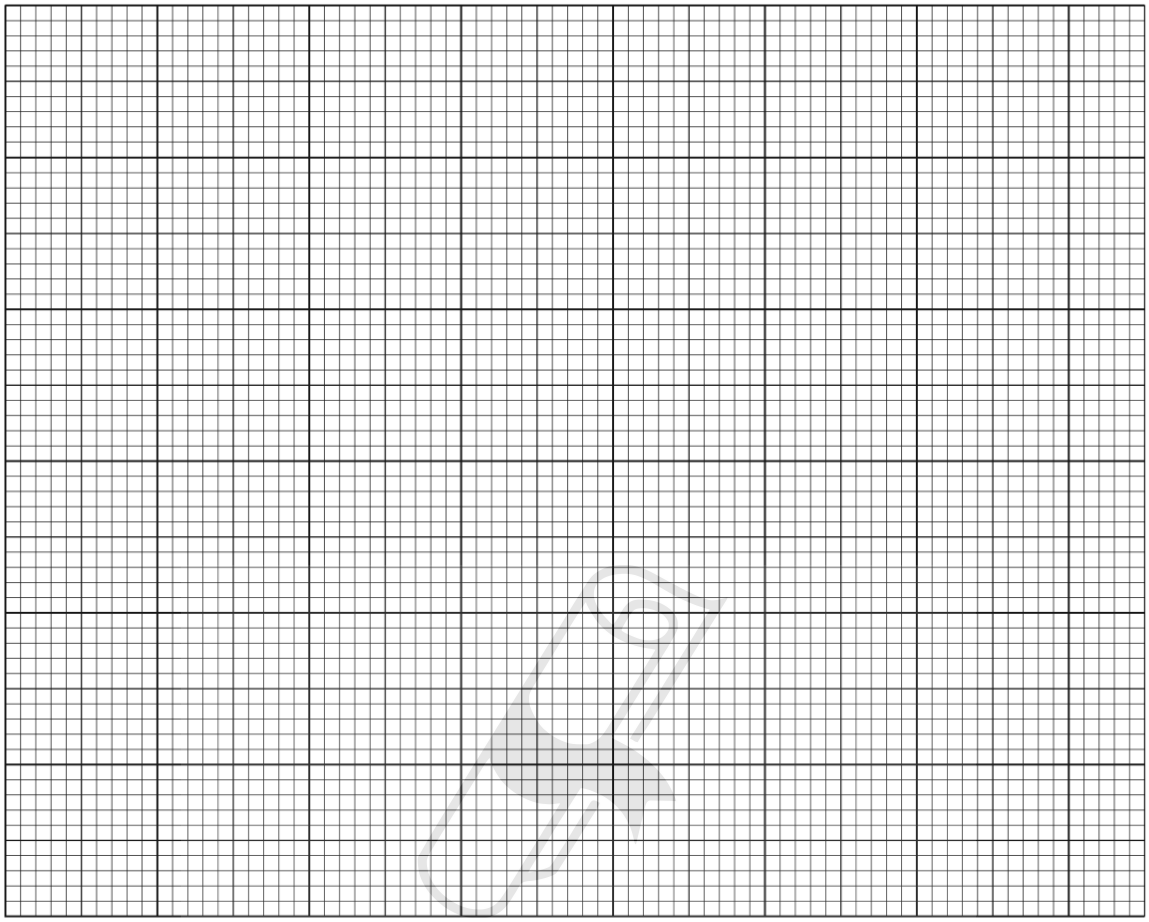
The readings are shown in Table 3.1.

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]

36. 0625_s12_qp_62 Q: 3

The IGCSE class is investigating resistor combinations in circuits.

The first circuit used is shown in Fig. 3.1.

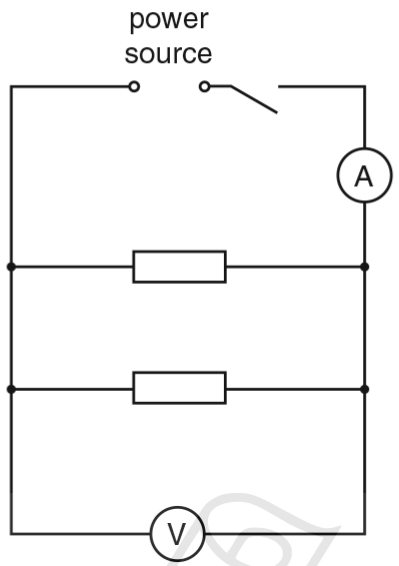


Fig. 3.1

(a) A student measures the potential difference V_1 across the resistors and the current I_1 in the circuit. The readings are shown in Figs. 3.2 and 3.3.

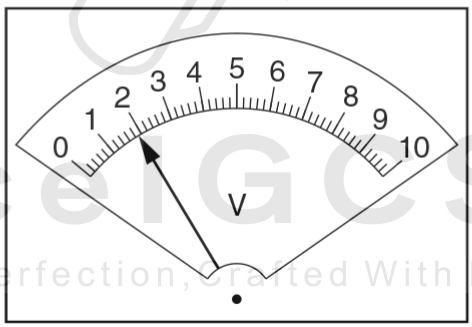


Fig. 3.2

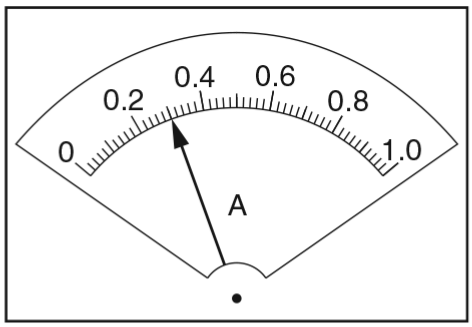


Fig. 3.3

(i) Record the potential difference V_1 and the current I_1.

V_1 = ...

I_1 = ... [3]

(ii) Calculate the total resistance R_P of the combination of the two resistors arranged in parallel using the equation $R_P = \frac{V_1}{I_1}$.

R_P = ...

(iii) Calculate $4R_P$.

$4R_P$ = ...
[2]

(b) The student rearranges the circuit so that the two resistors are connected in **series** and the voltmeter is connected to measure the potential difference across **both** resistors.

The new potential difference and current readings are $V_2 = 1.9\,\text{V}$ and $I_2 = 0.08\,\text{A}$.

Calculate the total resistance R_S of the combination of the two resistors arranged in series using the equation $R_S = \frac{V_2}{I_2}$.

R_S = ...[1]

(c) Theory suggests that $R_S = 4R_P$ if the two resistors have the same value. State whether your results indicate that the resistors have the same value. Justify your answer with reference to the results.

statement .....

justification .....

.....
[1]

(d) Using the circuit described in **(b)**, the student replaces the two series resistors with two lamps.

In the space below, draw a circuit diagram of the new circuit using standard symbols.

(e) A student suggests repeating the experiment described in parts **(a)** to **(c)**. He connects a variable resistor between the power source and the switch.

(i) State the function of the variable resistor.

.....

(ii) Explain why you might want to use a variable resistor in this way.

.....

.....

[2]

[Total: 10]

---

37. 0625_w12_qp_63 Q: 3

The IGCSE class is investigating the resistance of a lamp.

The apparatus has been set out as shown in Fig. 3.1.

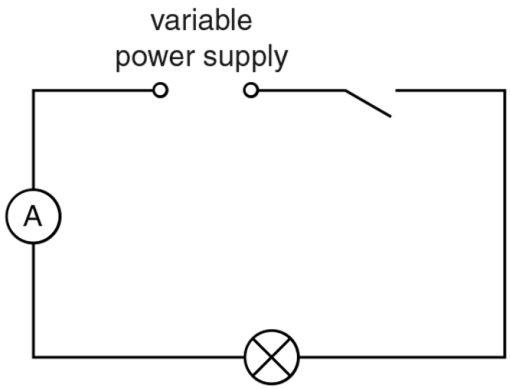


Fig. 3.1

(a) On Fig. 3.1, draw the symbol for a voltmeter correctly connected to measure the potential difference across the lamp. [2]

(b) Table 3.1 shows the values of potential difference V and current I obtained during the experiment, and observations regarding the lamp.

Table 3.1

V/	I/	R/	observation
1.5	0.15		lamp is just glowing
3.2	0.23		lamp is lit but is dim
4.7	0.26		lamp is brighter
6.5	0.31		lamp is very bright

[3]

(i) Complete the column headings in Table 3.1.

(ii) Calculate, and record in the table, the resistance R of the lamp at each potential difference V using the equation $R = \frac{V}{I}$.

(c) A student suggests that the resistance of a lamp stays the same whatever its temperature.

State whether the results support this idea. Justify your answer, using the results and the observations obtained during the experiment.

statement .....

.....

justification .....

.....

.....

.....

[3]

[Total: 8]

01. 0625_m20_MS_62 Q: 3

(a)(i)	V = 2.1 (V) and I = 0.26 (A)	1
(a)(ii)	R_0 = 8.1 / ecf	1
(b)	1 / I = 2.86	1

(c)	graph:	
	• axes labelled with quantity and unit	1
	• appropriate scales (plots occupying at least ½ grid)	1
	• plots all correct to ½ small square and precise plots	1
	• well judged line and thin line	1
(d)(i)	G present and triangle method seen on graph line	1
(d)(ii)	E in range 2.0 (V) to 2.9 (V)	1
(e)	l = 30(.0) cm	1
	reference to ammeter forming greater proportion of total resistance	1

02. 0625_p20_MS_60 Q: 3

(a) correct symbol [1]
correct position [1]

(b) table:
1.68 (V) [1]

(c) (brightness) decreases (as length increases) [1]

(d) statement: no [1]
justification matches statement and by reference to results
e.g. V / l not constant, as l increases V decreases, V does not double as l doubles [1]

(e) any one from:
width of sliding contact
achieving exact same position on wire
accept heating changes resistance of wire
accept other sensible practical reason [max 1]
NOT human error

(f) do not touch (bare/hot) wire
OR do not allow C to touch terminal between lamp and supply [1]

---

03. 0625_s20_MS_62 Q: 2

(a)	V = 0.2	1
	I = 0.28	1
	cm, V, A	1

(b)	graph: axes correctly labelled and right way round	1
	suitable scales	1
	all plots correct to $\frac{1}{2}$ small square	1
	good line judgement, thin, continuous line	1
(c)(i)	conclusion matching readings (expect I constant)	1
(c)(ii)	justification to match (i) with reference to results expect I values very close / equal	1
(d)	method shown clearly on graph	1
	V_L correct to $\frac{1}{2}$ small square	1

---

04. 0625_m19_MS_62 Q: 3

(a)(i)	correct voltmeter symbol in parallel with **P** and **Q**	**1**
(a)(ii)	V = 2.6 (V)	**1**
	I = 0.36 (A)	**1**
(b)	correct units: V, A	**1**
(c)(i)	correct calculations of R	**1**
	consistent 2 or consistent 3 sig. figs.	**1**
(c)(ii)	correct calculations or R / l	**1**
(d)	R_{25} = 2.0 (Ω) and clear method seen e.g. proportion from other value(s) of R or use of R / l value(s)	**1**
(e)	any **one** from: difficult to judge position of crocodile clip, difficult to measure wire to nearest mm, contact between wire and crocodile clip not precise, difficult to interpolate readings on meters between marks	**1**
(f)	correct symbol for variable resistor	**1**
	in series and with all circuit elements in correct arrangement	**1**

---

05. 0625_s19_MS_61 Q: 2

(a)(i)	I = 0.47(A)	**1**
(b)(i)	V/l 0.025 0.023 0.027 0.026 0.024	**1**
(b)(ii)	V/l consistent 2 significant figures or consistent 3 significant figures	**1**
	V/cm	**1**
(c)	Box 1 ticked	**1**
	Values are close OR values are within the limits of experimental accuracy	**1**
(d)	5.1(1)	**1**
	2 or 3 significant figures	**1**
	Unit Ω	**1**
(e)	Keep current low OR switch off between readings	**1**
(f)	Correct symbol	**1**

---

06. 0625_s19_MS_62 Q: 3

(a)	3.6(0) (V) 0.3(0) (A)	1 1
(b)	12 (Ω)	1
(c)	8 and unit Ω	1
(d)(i)	11/11.3/11.29 (Ω)	1
(d)(ii)	statement to match results justification to match results (with idea of within or beyond limits of experimental accuracy explained)	1 1
(e)	brightness/intensity of lamp changes	1
(f)	correct symbols with resistors and lamp in parallel one voltmeter correctly positioned – accept across power supply	1 1
(g)	variable resistor	1

---

07. 0625_w19_MS_62 Q: 2

(a)	0.56	1
	with correct unit A	1
(b)(i)	1.07 / 1.1	1
	2 or 3 significant figures	1
(b)(ii)	V, Ω	1
(c)(i)	2nd box ticked	1
(c)(ii)	justification – only award if the 2nd box is ticked	1
(d)(i)	value approximately halfway between the 40 cm and 60 cm values	1
(d)(ii)	correct *R* value from candidate's value in **(d)(i)**	1
	2 or 3 significant figures	1
(e)	use a low(er) current / voltage / switch off between readings / add a resistor in series / use a thinner wire	1

---

08. 0625_w19_MS_63 Q: 1

(a)	correct voltmeter symbol in parallel with lamp	1
(b)(i)	V = 0.6(V) and I = 0.14(A)	1
(b)(ii)	R = 4.3(Ω)	1
(c)	graph:	
	axes labelled correct orientation, with quantity and unit	1
	appropriate scales (plots occupying at least ½ grid)	1
	plots all correct to less than ½ small square and precise plots	1
	well-judged line and thin line	1
(d)	resistance increases as temperature increases	1
	temperature / resistance increases with length	1
(e)	variable resistor symbol correct (rectangle with strike-through arrow only)	1
	in series and rest of circuit correct	1

---

09. 0625_s18_MS_63 Q: 2

(a)	correct voltmeter symbol in parallel with **X**	1
(b)(i)	I = 0.86 (A)	1
	V = 0.9 (V)	1
(b)(ii)	Ω	1
	A, V	1
(c)	correct calculations of P (0.77 / ecf, 0.94, 0.58(W))	1
	consistent 2 or consistent 3 significant figures	1
(d)	increases (at first)	1
	to a maximum AND *then* decreases	1
(e)	any 2 additions from: draw a graph; different / more resistors / values of resistance / greater range of values for resistance; use (at least) 5 sets of values for resistance	2

10. 0625_w18_MS_61 Q: 2

(a)	I = 0.48	1
(b)	V = 0.5	1
(c)	cm, V	1
(d)	Graph: Axes correctly labelled and right way round	1
	Suitable scale	1
	All plots correct to ½ small square	1
	Good line judgement, single, thin, continuous line	1
(e)(i)	Triangle method seen on graph	1
	At least half of candidate's line used	1
(e)(ii)	R in range 0.040 to 0.055. No ecf allowed	1
	Unit Ω / cm OR Ω	1

11. 0625_w18_MS_63 Q: 2

(a)	correct voltmeter symbol in parallel with wire **X**	**1**
(b)	V = 1.9 (V)	**1**
(c)(i)	graph:	
	axes labelled correct orientation, with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid)	**1**
	plots all correct to ½ small square and precise plots	**1**
	well-judged line and thin line	**1**
(c)(ii)	G present and triangle method seen on graph	**1**
(c)(iii)	l = 4.5 (cm) and L = 13.5 (cm)	**1**
(c)(iv)	R in range 0.17 to 0.23	**1**
	2 / 3 sig figs and unit = Ω or Ω / cm	**1**
(d)	Any **one** from: use smaller current / potential difference; use wire with greater resistance; open switch / switch off circuit in between readings.	**1**

12. 0625_m17_MS_62 Q: 2

(a)	correct voltmeter symbol shown in parallel	**1**
(b)	V = 2.7 (V)	**1**
	I = 0.48 (A)	**1**
(c)	correct calculations of R – 5.63 / ecf, 3.20, 2.59	**1**
	consistent 2 or consistent 3 sig figs	**1**
(d)(i)	correct calculations of r – 6.26, 6.40, 6.48 or ecf from R values	**1**
	Ω / m seen at least once and not contradicted	**1**
(d)(ii)	statement matching results	**1**
	justification matching statement and results – 'within limits of experimental accuracy' / owtte	**1**
(e)	arrow on wire between the inside edge of each crocodile clip	**1**
(f)	any suitable precaution: reduce current / voltage, use longer / thinner resistance wires,	**1**
	Total:	**11**

13. 0625_s17_MS_61 Q: 5

	MP1 Diagram showing power supply, ammeter, voltmeter and resistance wire correctly connected (variable resistor optional)	**1**
	MP2 Correct symbols for ammeter and voltmeter. Variable resistor symbol correct if included.	**1**
	MP3 Measure potential difference (voltage) and current and calculate resistance.	**1**
	MP4 Repeat with other (types of) wires	**1**
	MP5 Key variables length AND diameter stated	**1**
	MP6 One of: Repeat with different voltages (or currents). Repeat and take average (voltage and current) readings. Repeat entire experiment with different length or different diameter. Use low current to prevent wire heating up. Keep temperature of wire constant / switch off between readings Use micrometer screw gauge to measure diameter / thickness of wire.	**1**
	MP7 Table with columns for type of wire, voltage, current, resistance with correct units (V, A and Ω)	**1**
	Total:	**7**

14. 0625_s17_MS_62 Q: 1

(a)(i)	V = 0.8 (V)	**1**
	I = 0.65 A both units correct	**1**
(a)(ii)	R = 1.2(3) (Ω)	**1**
(b)(i)	1.31(Ω) (e.c.f.)	**1**
(b)(ii)	length (directly) proportional to resistance/$l \propto R/l = kR$	**1**
(c)	second box down to be ticked	**1**
(d)	different heating effects on wires/wires may be at different temperatures different interpolation of readings between marks on meters/difficult to read the meter (or ammeter/voltmeter/current/voltage) accurately difficult to measure length of wire to nearest mm/to judge the position of the sliding contact cell may run down/power of cell may be less **Any 2 × 1 mark each**	**2**
	Total:	**8**

15. 0625_s17_MS_63 Q: 2

(a)(i)	correct voltmeter symbol connected in parallel across **P** and **Q**	**1**
(a)(ii)	I = 0.38(A)	**1**
(b)	graph: axes labelled with quantity and unit	**1**
	appropriate scales (plots occupying at least ½ grid)	**1**
	plots all correct to ½ small square	**1**
	well-judged straight line and thin line, precise plots	**1**
(c)(i)	M present and triangle method seen on graph	**1**
(c)(ii)	R in range 1.8 to 2.4 Ω	**1**
	2 or 3 sig figs and unit = Ω	**1**
(d)	suitable reason: wire becomes too hot, current exceeds full scale deflection(owtte) of meter / becomes too large	**1**
(e)	correct symbol for variable resistor (rectangle with strike-through arrow only)	**1**
	Total:	**11**

---

16. 0625_m16_MS_62 Q: 1

(a) arrow indicating 0.4 V [1]

arrow indicating 0.08 A [1]

(b) graph:
- axes labelled with quantity AND unit [1]
- appropriate scales (plots occupying at least ½ grid) [1]
- plots all correct [1]
- well-judged line AND thin line, neat plots [1]

(c) **(i)** G present and triangle method seen using at least ½ line [1]

(ii) R in range 4.6 Ω to 4.9 Ω [1]

to 2 / 3 significant figures and with correct unit [1]

(d) statement matching graph with reference to straight line [1]

reference to passing through origin (within limits of experimental accuracy / owtte) [1]

(e) suitable change: [1]
e.g. reduce supply voltage / current,
use thinner / longer wire,
material with greater resistivity

[Total: 12]

---

17. 0625_p16_MS_60 Q: 3

(a) correct symbol [1]
correct position [1]

(b) table:
1.68 (V) [1]

(c) (brightness) decreases (as length increases) [1]

(d) statement: no [1]
justification matches statement and by reference to results
e.g. V / l not constant, as l increases V decreases, V does not double as l doubles [1]

(e) any one from:
width of sliding contact
achieving exact same position on wire
accept heating changes resistance of wire
accept other sensible practical reason [max 1]
NOT human error

(f) do not touch (bare/hot) wire
OR do not allow C to touch terminal between lamp and supply [1]

---

18. 0625_s16_MS_61 Q: 2

(a)	8.2 0.44–0.45 Units V and A	1 1 1
(b)	19(°C)	1
(c)	Perpendicular to scale and at bottom of meniscus	1
		Total 5

---

19. 0625_s16_MS_61 Q: 3

(a)(i)	R values 1.60, 1.51, 1.35, 1.21 R values all to 2 significant figures or all to 3 significant figures.	1 1
(a)(ii)	Column headings m, V, A, Ω	1
(b)	No; there is a current reading	1
(c)	filament changes brightness, owtte increase / decrease / change in temperature of filament / lamp	1 1
(d)(i)	Variable resistor (rheostat)	1
(d)(ii)	Correct symbol for variable resistor Correct diagram, with variable resistor in series with power supply	1 1
		Total 9

---

20. 0625_s16_MS_62 Q: 4

	Circuit diagram: **MP1** Sample of wire must be clearly identifiable by a label on the diagram or by letters on the diagram with an explanation in the text **MP2** All circuit symbols correct (even if circuit is incorrect) Method: **MP3** Take readings of V and I **MP4** For 5 or more lengths **MP5** Range of lengths must be between 5 cm and 2 m **with the largest length at least twice the smallest** Table drawn with headings: **MP6** l / m, V / V, I / A, R / Ω Key variables to control: **MP7** Any one from • Material / resistivity / conductivity / type of wire • Diameter / radius / thickness / cross sectional area • Temperature of wire	**1** **1** **1** **1** **1** **1** **1**
		Total: 7

21. 0625_w16_MS_62 Q: 2

(a)(i)	V_1 = 1.7 (V) I_1 = 0.32 (A)	**1** **1**
(a)(ii)	R = 5.3125 Ω	**1**
(b)	statement YES justification to include the idea of within the limits of experimental accuracy	**1** **1**
(c)(i)	variable resistor / rheostat	**1**
(c)(ii)	correct symbol for variable resistor circuit correct	**1** **1**
	Total:	**8**

22. 0625_w16_MS_63 Q: 3

(a)	Four correct *I* values (0.12, 0.15, 0.17, 0.19 and 0.21) present The fifth one is also correct	1 1
(b)	correct calculations of *R* (4.2, 6.7, 8.8, 10.5, 11.9) or ecf from **(a)**	1
(c)	graph: axes correct way round, labelled with quantity and unit appropriate scales (plots occupying at least ½ grid) plots all correct to ½ small square well-judged line and thin line, precise plots	 1 1 1 1
(d)	simple statement matching candidate's line (e.g. resistance increases with p.d.) qualified (e.g. changes less rapidly for greater p.d. values)	1 1
(e)	correct symbol for variable resistor (rectangle with strike-through arrow only) in correct series circuit	1 1
	Total	**11**

---

23. 0625_m15_MS_62 Q: 3

(a) correct voltmeter symbol with appropriate parallel connection [1]

(b) (i) meter with 5 V range circled [1]

(ii) arrow indicating 1.5 V on circled meter [1]

(c) *R* calculations correct (9.6 or 9.62, 7.9 or 7.89, 4.5 or 4.55) [1]

consistent 2 or consistent 3 sig. figs. [1]
note: allow 1 sig. fig. fewer for l = 20 cm

(d) link consistent with results [1]
figures to support, matching statement – at least two *R* values compared [1]

(e) increased supply voltage [1]
use of variable resistor OR variable voltage supply clearly indicated as such [1]
any other suitable point, e.g. [1]

- voltmeter with larger range
- ammeter with larger range
- variable resistor symbol and connection correctly shown

[Total: 10]

---

24. 0625_s15_MS_63 Q: 3

(a) correct symbol in parallel between crocodile clip and zero end of wire [1]

(b) R = 7.1(0), 6.22, 5.45, 4.7(0), 3.93 [1]

(c) Graph:
- axes labelled correctly, right way round and with units [1]
- suitable scales, plots occupying at least half grid in both directions [1]
- plots correct to within ½ small square [1]
- well-judged straight line, thin line, precise plots [1]

(d) (i) G present and triangle method seen on graph [1]

(ii) r in range 7.4 – 8.5 [1]

2 or 3 sig. figs. AND unit Ω/m [1]

[Total: 9]

---

25. 0625_w15_MS_61 Q: 2

(a) (i) V = 2.2 (V) [1]

(ii) I = 0.2(0) (A) [1]

(b) graph:
- axes both correctly labelled, right way round and with units [1]
- suitable scales, to include origin [1]
- all plots correct to within ½ small square [1]
- good best-fit line judgement, single, thin, continuous line [1]

(c) (i) intercept correct to ½ small square [1]

(ii) ratio correct AND R value equal to ratio, ignore any unit, e.c.f. allowed [1]

(iii) 2 or 3 sig. figs. AND unit of Ω [1]

[Total: 9]

(a) **(i)** 1.9 (V) [1]

0.26 (A) [1]

(ii) R = 7.3 (7.3077) (Ω) accept any sig. figs. > 2, ecf allowed [1]

all units V, A, Ω correct, symbols or words [1]

(b) brightness increases (from X to Z) [1]

(c) one from:
- exact placement of S
- width of S
- battery running down / voltage changed
- wire/lamp getting hot
- resistance of lamp / wire changed [max 1]

(d) increases (note: if this mark is not scored, the next mark cannot be scored) [1]

V increases more quickly than I (accept greater rate)
or V increases proportionately more than I
or doubling V causes I to increase by less than double
allow gradient is increasing [1]

[Total: 8]

27. 0625_s14_MS_62 Q: 3

(a) (i) 2.1 (V) [1]

0.45 (A) [1]

(ii) R = 4.7 accept 4.67 (Ω) e.c.f. **(a)(i)** [1]

all units correct, V, A, Ω, symbols or words [1]

(b) (current) decreases [1]

(c) correct symbol for variable resistor (rectangle with strike-through arrow) [1]

(d) clear description or diagram showing triangle method with large triangle **or** taking **two** co-ordinates far apart on line [1]

how to calculate gradient, e.g. equation or rise / run, etc. [1]

[Total: 8]

---

28. 0625_s14_MS_63 Q: 3

(a)(b) 2.8 [1]

0.9(0) [1]

units both correct, symbols or words, V, A [1]

(c) (i) 3.1(1) / ecf, 2.0 / 1.95, 1.0(0) penalise rounding errors [1]

correct unit seen once and not contradicted [1]

(ii) statement matches results (expect 'Yes' but allow 'No' if ecf >10%)
with matching and correct justification (which refers to figures)
(e.g. 'within limits of experimental accuracy' owtte for 'Yes' or 'too different' for 'No') [1]

(d) any one from:
- switch off between readings
- only switch on for short time
- use smaller currents / p.d.s
- suitable means of dissipating thermal energy [1]

[Total: 7]

---

29. 0625_w14_MS_61 Q: 3

(a) *R* calculated correctly:
0.49, 0.99, 1.5(1), 1.99 or 2.0, 2.5(0)
note: accept more significant figures for this mark [1]

all *R* values expressed to suitable precision, expect 2 decimal places
OR 2 significant figures used throughout OR 3 significant figures used throughout [1]

(b) graph:
axes correctly labelled and right way round [1]
suitable scales, with plots using at least half of grid [1]
all plots correct to ½ small square [1]
good line judgement [1]
single, thin, continuous line, no large 'blobs' greater than ½ small square [1]

(c) statement to match graph (expect yes) [1]

justified by reference to straight line through the origin
OR when l doubles, *R* doubles owtte [1]

(d) additional readings with greater l values [1]

[Total: 10]

---

30. 0625_w14_MS_62 Q: 3

(a) all units correct: m, V, A, Ω – symbols and/or words [1]

(b) graph:
axes correctly labelled and correct orientation [1]
suitable scales, plots using more than half available axes [1]
all plots correct to ½ small square [1]
good line judgement, thin, continuous, [1]
note: do not allow 'blobs' greater than half square diameter

(c) triangle method shown on graph [1]
note: do not allow use of y/x if graph does not go to origin

G using large triangle/half of candidate's line used [1]
note: second mark can be given from coordinates used in equation if nothing shown on graph

(d) R_1 value to 2 or 3 significant figures – ignore unit [1]
note: this mark does not depend on actual value being correct

R_1 in range 5.8 to 6.2Ω
OR accept R_1 = *G* value if outside tolerance [1]

[Total: 9]

---

31. 0625_w14_MS_62 Q: 5

(a) tape measure [1]

(b) **(i)** symbols for ammeter, voltmeter and resistor (for copper wire) correct [1]
note: accept in wrong places for this mark

variable resistor or potential divider present with symbol [1]
NOT if labelled "copper wire"

ammeter in series and voltmeter in parallel with copper wire / resistor [1]
note: do NOT award this mark if there is no power supply

(ii) observe current shown on ammeter (ignore any reference to a voltmeter) [1]
accept change variable resistor / use rheostat (to see if it then glows)
accept 'change current' as meaning changing variable resistor
ignore checking wires or changing power supply or use of a voltmeter
accept connect lamp directly across supply

(iii) no, deflection too small / range too large (owtte) [1]
accept 'scale' for range
accept suggestion of alternative maximum meter
accept readings not precise enough / sensitivity not sufficient;
accept accurate for precision, ignore misuse of 'reliable'
ignore 'circuit voltage not large enough'

[Total: 6]

---

32. 0625_s13_MS_61 Q: 3

(a) table:
R values correct 0.61, 1.82, 3.16, 4.27, 5.48 [1]
all *R* values to 2 or 3 significant figures [1]
cm, V, A, Ω [1]

(b) graph:
axes correctly labelled [1]
suitable scales [1]
all plots correct to ½ small square [1]
good line judgement [1]
single, thin, continuous line [1]

(c) triangle method shown on graph [1]
using at least half of line [1]
G = 0.31to 0.35 2 or 3 significant figures [1]

[Total: 11]

---

33. 0625_w13_MS_62 Q: 3

(a) **(i)** 0.30 A c.a.o. unit needed (accept 0.3 A) [1]

(ii) table:
0.40 (accept 0.4) [1]
1.33 (e.c.f. **(a)(i)**) accept any significant figures > 1 and recurring decimal [1]

(b) graph:
axes correctly labelled [1]
suitable scales (*x* axis 2 cm = 0.2 m/0.25 m) [1]
all plots correct to ½ small square [1]
good line judgement [1]
thin continuous line, carefully plotted points not large 'blobs' [1]

(c) *l* correct to ½ square – must see evidence on graph paper
condone no / incorrect unit, ignore significant figures [1]

(d) 9.5 to 10.5 (Ω) ignore significant figures [1]

[Total: 10]

---

34. 0625_w13_MS_63 Q: 3

(a) correct symbol connected in parallel [1]

(b) **(i)** axes labelled, with units [1]
appropriate scales (plots occupying at least ½ grid) [1]
plots correct to ½ square [1]
best-fit line and thin, neat line, neat plots [1]

(ii) triangle method seen on graph [1]
large triangle (at least 1/2 candidate's line) [1]

(iii) *R* correct from *M* and in range 0.7 to 0.8 [1]
2 or 3 significant figures and unit Ω (symbol or word) [1]

[Total: 9]

---

35. 0625_s12_MS_61 Q: 3

(a) (i) (cm, V, A) [no mark awarded]

(ii) Graph:
Axes correctly labelled with quantity and unit and correct way around [1]
Suitable scales – plots occupy at least half the grid [1]
All plots correct to ½ small square [1]
Good line judgement (ecf for curve if *d* plotted) [1]
Single, thin, continuous line [1]

(iii) Triangle using at least half of candidate's line clearly indicated on graph [1]
Evidence of subtraction seen [1]
G value 1.5 when rounded to 2 significant figures [1]

(b) Same as *G*, rounded to 2 or 3 significant figures [1]
unit Ω/ohms [1]

[Total: 10]

---

36. 0625_s12_MS_62 Q: 3

(a) (i) V_1 = 1.9 [1]
I_1 = 0.3 [1]
Units V and A both correct [1]

(ii)/(iii) R_P = 6.33 and $4R_P$ = 25.3/25.2 to 2 or 3 sig. figs. [1]
Ω [1]

(b) R_S = 23.8 (Ω) or 24 (Ω) [1]

(c) Correct statement (from candidate's work)
with matching justification (idea of within or beyond experimental accuracy) [1]

(d) Circuit: correct symbols for ammeter, voltmeter and lamp in correct series circuit [1]

(e) (i) Change/control current/voltage [1]

(ii) To obtain range of readings (or wtte) [1]

[Total: 10]

---

37. 0625_w12_MS_63 Q: 3

(a) Correct symbol for voltmeter [1]
In parallel with lamp [1]

(b) **(i)** Units all correct [1]

(ii) R values correct (10, 14, 18, 21) [1]
Consistent 2 or 3 significant figures in R column [1]

(c) Statement matches results (expect 'No') [1]
R figures quoted appropriately and matching statement [1]
Mention of brightness related to temperature [1]

[Total: 8]
