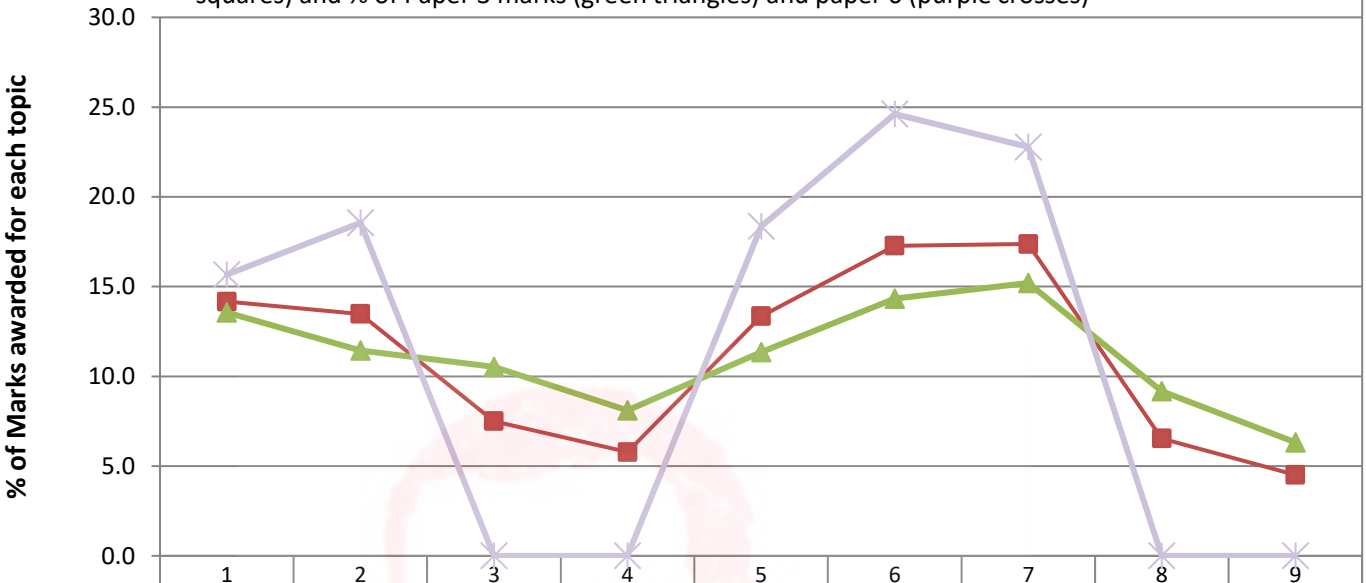
iG Phx 7 EQ 15w to 02s P6 4Students 237marks

For these stats only papers 3 (which after 2016 became paper 4) and paper 6 were used to investigate these topics.

iG Phx CIE 0625 PAPERS 3 and 6

Percentage of all WEIGHTED marks awarded for P3 & 6 each topic from s2002 to w2014 (red squares) and % of Paper 3 marks (green triangles) and paper 6 (purple crosses)

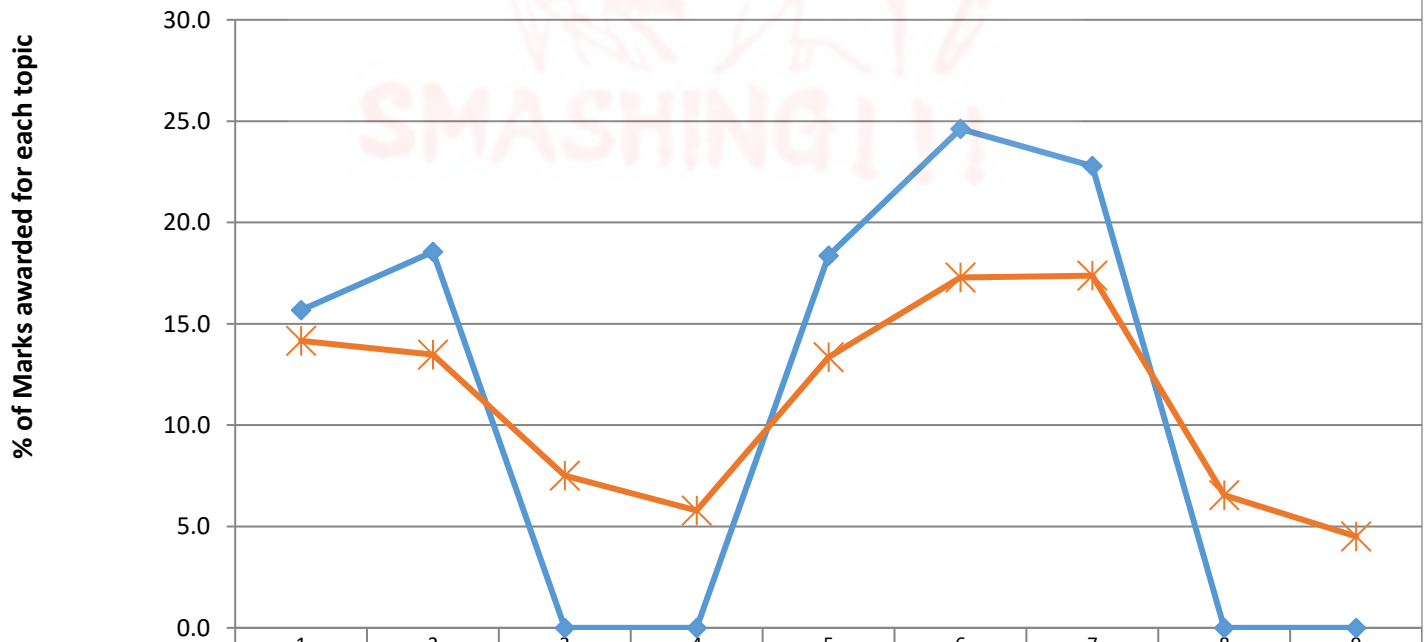


	1	2	3	4	5	6	7	8	9
PhxBoth P3&6	14.2	13.5	7.5	5.8	13.4	17.3	17.4	6.5	4.5
PhxP3	13.6	11.4	10.5	8.1	11.3	14.3	15.2	9.2	6.3
PhxP6	15.7	18.6	0.0	0.0	18.4	24.6	22.8	0.0	0.0

Papers 3 and 6 Topic Number

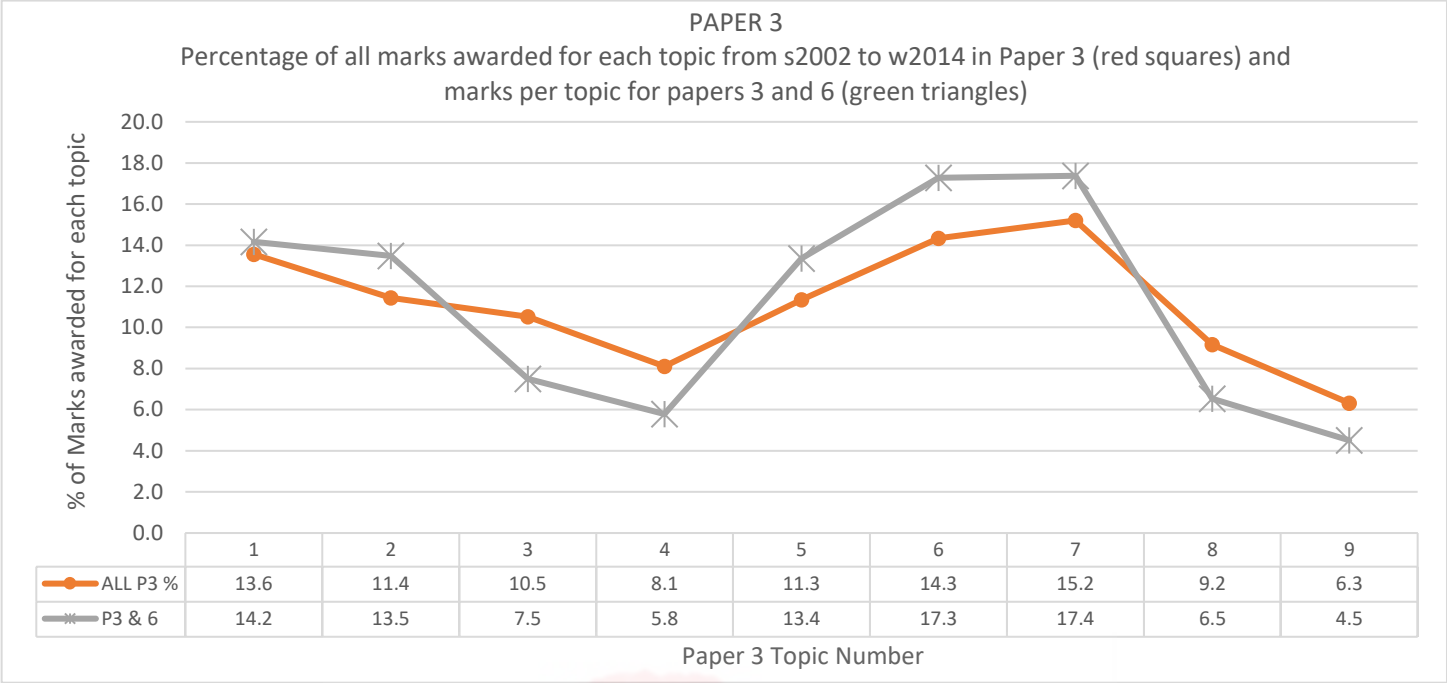
PAPER 6

Percentage of all marks awarded for each topic from s2002 to w2015 in Paper 6 (blue diamonds) and marks per topic for both papers 3/4 and 6 (red squares)



	1	2	3	4	5	6	7	8	9
PhxP6	15.7	18.6	0.0	0.0	18.4	24.6	22.8	0.0	0.0
PhxP3&6 weighted	14.2	13.5	7.5	5.8	13.4	17.3	17.4	6.5	4.5

Paper 6 Topic Number



Papers covered in this sample:

	1st Paper	Last Paper	Marks/ paper	Theor. All Papers	Actual All Marks	Difference	Difference %	Weight per paper	Weight per mark
Paper 3	2002w	2014w	80	2000	2072	72	3.6	50	0.63
Paper 6	2002s	2015w	40	1120	1040	-80	-7.1	20	0.50

There are a few missing: Got all Paper 31s (except 2014w Paper 31), and got 2014w 33. So papers in time zones 2 and 3 are not covered.

All topics ranked by frequency of marks in exams (P3 and 6 only):

Topic	PhxBoth P3&6	PhxP3	PhxP6
7	17.4	15.2	22.8
6	17.3	14.3	24.6
1	14.2	13.6	15.7
2	13.5	11.4	18.6
5	13.4	11.3	18.4
3	7.5	10.5	0.0
8	6.5	9.2	0.0
4	5.8	8.1	0.0
9	4.5	6.3	0.0

Other statistics that might be of interest:

	Topics:	1	2	3	4	5	6	7	8	9
P3/4 marks	2072	281	237	218	168	235	297	315	190	131
P3/4 %		13.6	11.4	10.5	8.1	11.3	14.3	15.2	9.2	6.3
P6	1040	163	193	0	0	191	256	237	0	0
P6 %		15.7	18.6	0.0	0.0	18.4	24.6	22.8	0.0	0.0
Total Marks (WIEGHTED)	1815	257	245	136	105	242	314	315	119	82
% of Marks (Weighted)	1815	14.2	13.5	7.5	5.8	13.4	17.3	17.4	6.5	4.5
# of Questions		63	64	35	16	63	74	70	26	20
Average marks per Q		**4.1**	**3.8**	**3.9**	**6.6**	**3.8**	**4.2**	**4.5**	**4.6**	**4.1**

Final note:

My iG and IB chemistry papers were broken down more carefully than these were, so there may be a mark or two in the wrong topic especially in topics 3 to 5, but if you learnt or taught these topics in sequence than you shouldn't have a problem with seeing material from an earlier topic.

Defining the Topics: Why not use the units given in the syllabus?

Artificial topics have been created for the physics syllabus by me so that each topic is roughly the same size. Topics go in syllabus order. I have decided to use the number of marks allocated in previous exams to each syllabus point to determine how many go into each topic.

1. General physics

Topic 1

1.1 Length and time
1.2 Motion
1.3 Mass and weight
1.4 Density

Topic 2

1.5 Forces
1.6 Momentum (Extended candidates only)

Topic 3

1.7 Energy, work and power
1.8 Pressure

2. Thermal physics

Topic 4

2.1 Simple kinetic molecular model of matter

Topic 5

2.2 Thermal properties and temperature
2.3 Thermal processes

3. Properties of waves, including light and sound

Topic 6

3.1 General wave properties
3.2 Light
3.3 Electromagnetic spectrum
3.4 Sound

4. Electricity and magnetism

Topic 7

4.1 Simple phenomena of magnetism
4.2 Electrical quantities
4.3 Electric circuits
4.4 Digital electronics (Extended candidates only)
4.5 Dangers of electricity

Topic 8

4.6 Electromagnetic effects

5. Atomic physics

Topic 9

5.1 The nuclear atom
5.2 Radioactivity

3 The class is investigating the resistance of lamp filaments in series and parallel circuits.

Fig. 3.1 shows the first circuit used.

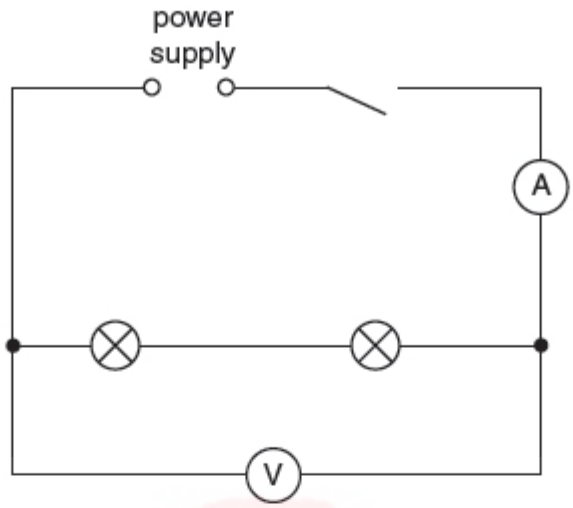
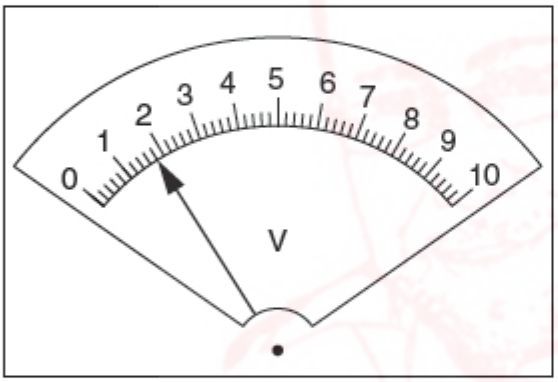


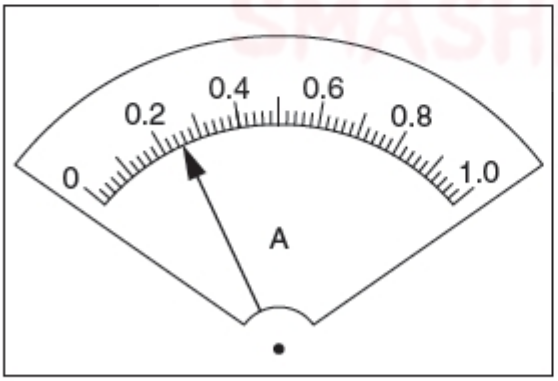
Fig. 3.1

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



V_S = ...

Fig. 3.2



I_S = ...
[2]

Fig. 3.3

(ii) Calculate the resistance R_S of the lamp filaments using the equation $R_S = \frac{V_S}{I_S}$.

R_S = ...[1]

(b) The student rearranges the circuit so that

- the lamps are in parallel
- the ammeter will measure the total current in the circuit
- the voltmeter will measure the potential difference across the lamps.

(i) Draw a diagram of this circuit using standard circuit symbols.

[2]

(ii) The student measures the potential difference V_P across the lamps and the current I_P in the circuit.

V_P = 2.0V

I_P = 0.60 A

Calculate the resistance R_P of the lamp filaments using the equation $R_P = \frac{V_P}{I_P}$.

R_P = ...

(iii) Calculate the ratio $\frac{R_S}{R_P}$.

$\frac{R_S}{R_P}$ = ...

[1]

(c) A student wishes to investigate whether the ratio $\frac{R_S}{R_P}$ for the two lamps is the same under all conditions.

(i) Suggest a variable that you could change in order to obtain further sets of readings.

.....

(ii) Explain briefly how you would change this variable.

.....

.....

[2]

[Total: 8]

Q# 2/ iG Phx/2014/w/Paper 61/ www.SmashingScience.org :o)

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

The circuit used is shown in Fig. 3.1.

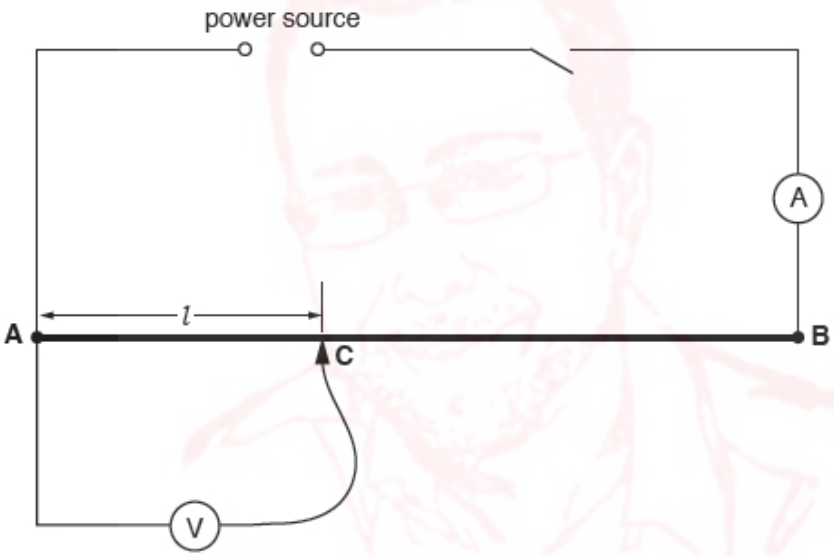


Fig. 3.1

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

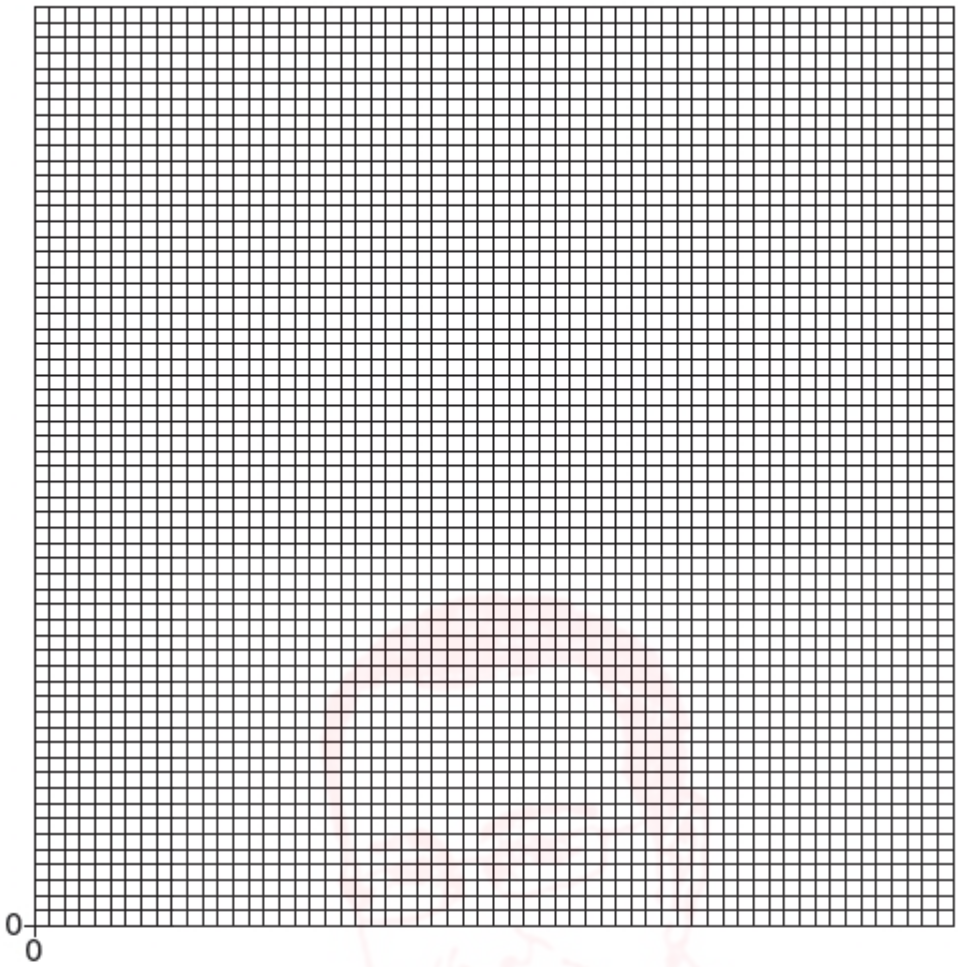
Calculate the resistance R of each length l of the wire **AB**, using the equation $R = \frac{V}{I}$. Record the values of R in the table.

Table 3.1

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

[2]

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



[5]

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

statement .....

justification .....

.....

[2]

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

.....

.....[1]

[Total: 10]

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

The circuit is shown in Fig. 4.1.

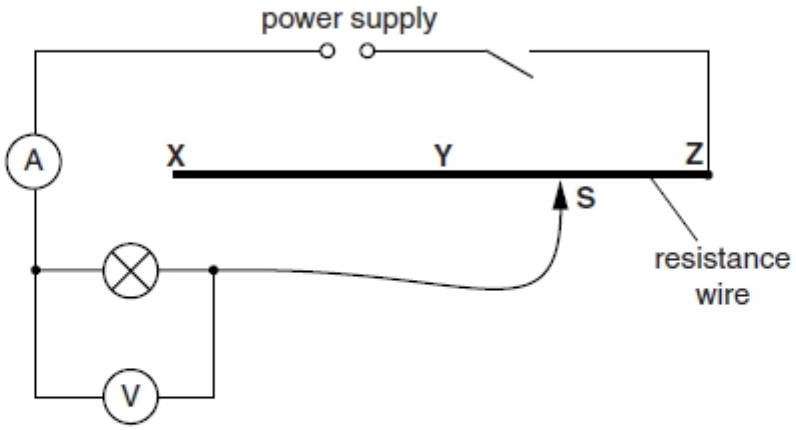


Fig. 4.1

(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.

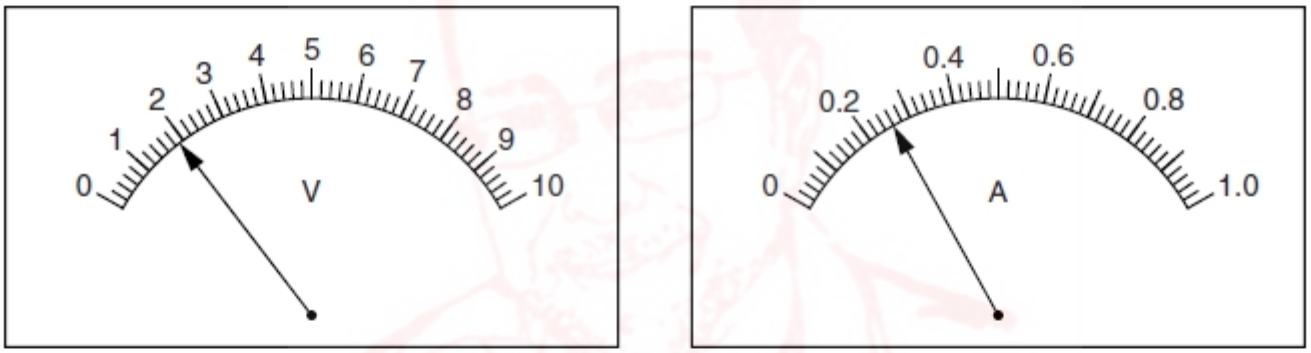


Fig. 4.2

(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.

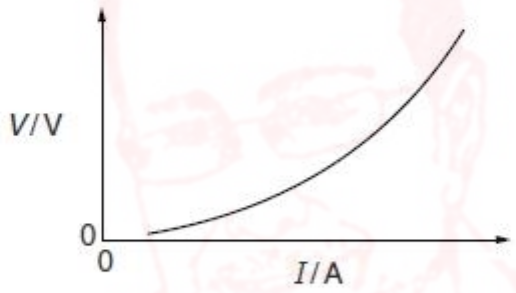


Fig. 4.3

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]

3 The IGCSE class is investigating the power of lamps in a circuit.

Fig. 3.1 shows the circuit used.

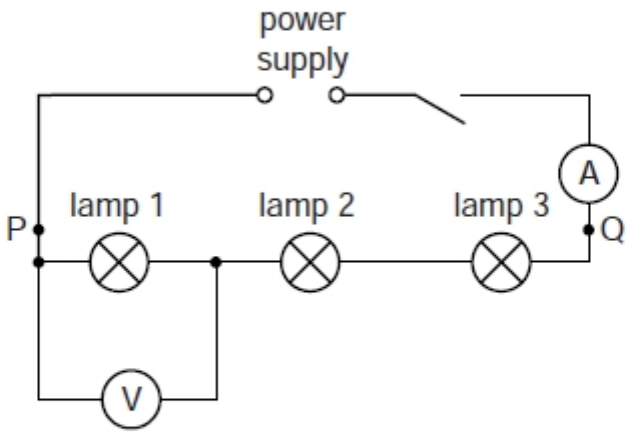


Fig. 3.1

(a) A student measures the potential difference V_1 across lamp 1 and the current I in the circuit. The meters are shown in Fig. 3.2.

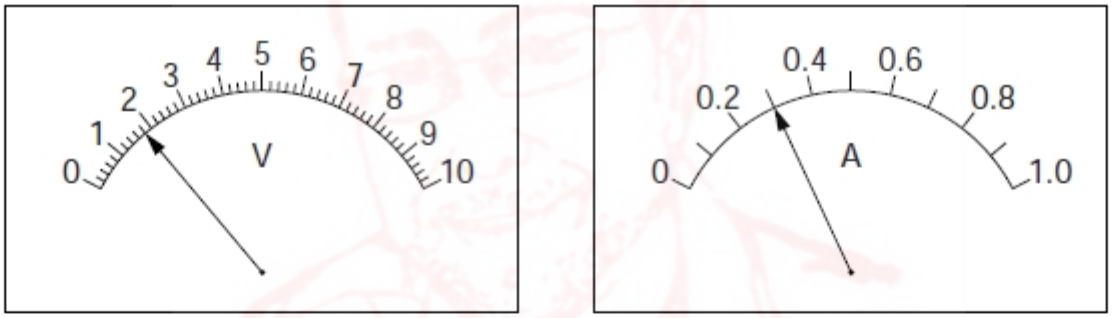


Fig. 3.2

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

V_1 = ...

I = ...

(ii) Calculate the power P_1 of lamp 1 using the equation $P_1 = IV_1$.

P_1 = ...

(iii) The student reconnects the voltmeter to measure the potential difference V_2 across lamp 2 and then V_3 across lamp 3.

Write down the readings shown on the meters in Figs. 3.3 and 3.4.

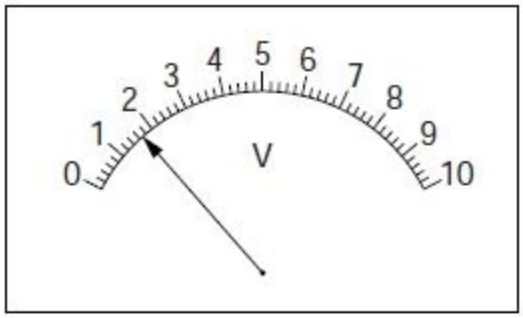


Fig. 3.3

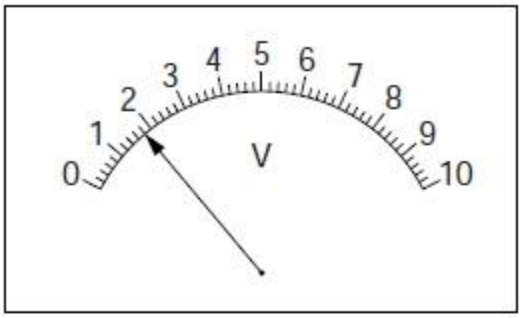


Fig. 3.4

V_2 = ... V_3 = ...

(iv) Calculate the power for each lamp using the equation $P = IV$.

P_2 = ...

P_3 = ... [3]

(v) Calculate the total power P_T for the three lamps using the equation $P_T = P_1 + P_2 + P_3$.

P_T = ... [1]

(b) The student connects the voltmeter across the three lamps and records the potential difference. He calculates the power P.

P = 1.61 W

Another student suggests that P_T should be equal to P.

State whether the results support this suggestion and justify your answer by reference to the results.

statement .....

justification .....

..... [2]

(c) (i) Draw a circuit diagram, similar to that in Fig. 3.1, to show:

- a variable resistor in series with the power supply,
- three lamps in parallel with each other between **P** and **Q**,
- a voltmeter connected to measure the potential difference across the lamps.

Use standard symbols.

[2]

(ii) State the purpose of the variable resistor in this circuit.

.....

..... [1]

[Total: 9]

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

The circuit used is shown in Fig. 3.1.

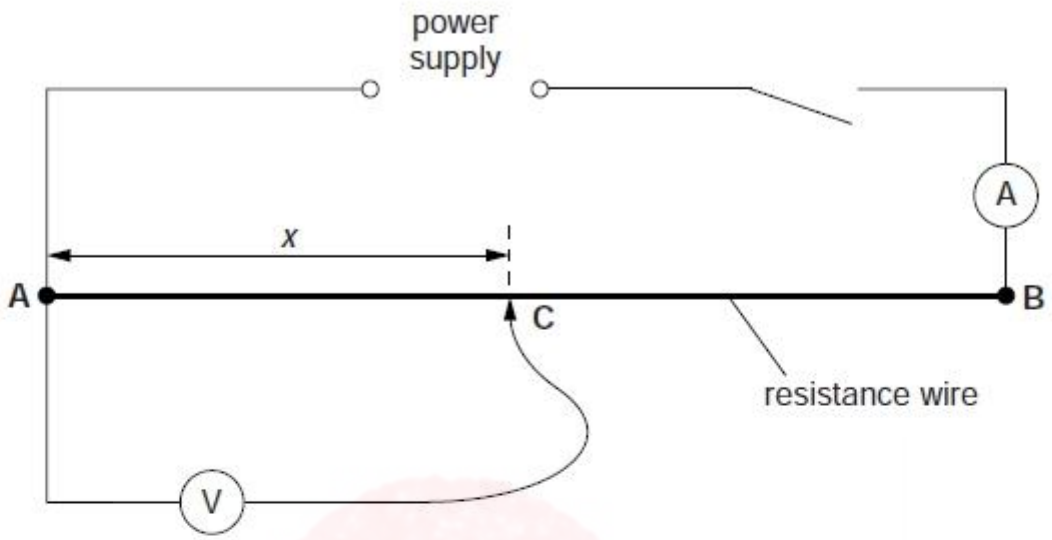


Fig. 3.1

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*.

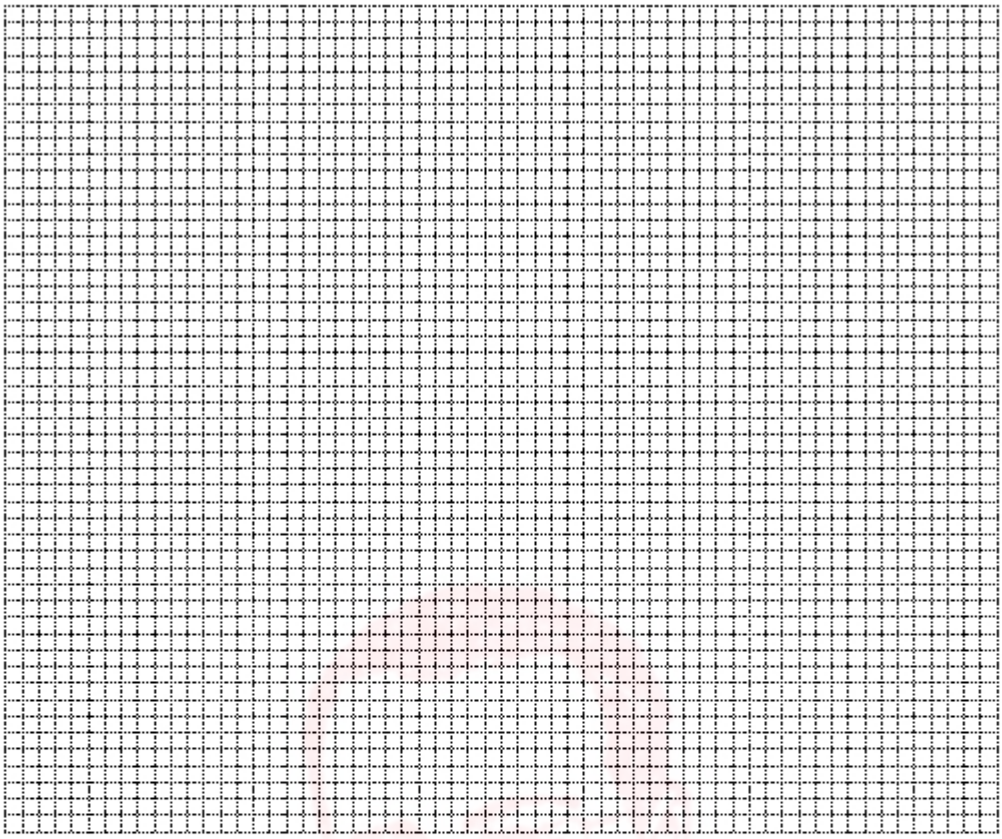
(iii) Complete the column headings in the table.

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]

3 The IGCSE class is investigating the potential differences across circuit components.

Fig. 3.1 shows the apparatus used.

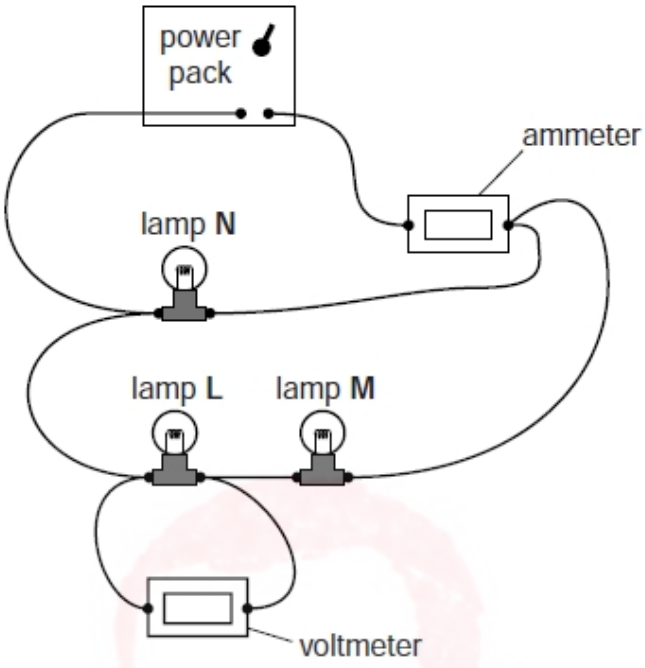


Fig. 3.1

(a) Draw a circuit diagram of the circuit shown in Fig. 3.1, using standard symbols.

[3]

(b) A student records the current I_A, the potential difference V_L across lamp **L** and the potential difference V_M across lamp **M**.

I_A = ... 0.65 A .....

V_L = ... 0.9V .....

V_M = ... 1.0V .....

(i) Calculate the potential difference V_A across lamps **L** and **M** using the equation $V_A = V_L + V_M$.

V_A = ...

(ii) Calculate R_A, the combined resistance of lamps **L**, **M** and **N**, using the equation $R_A = \frac{V_A}{I_A}$.

R_A = ...

[2]

(iii) On Fig. 3.2, draw a pointer showing the current I_A = 0.65 A.

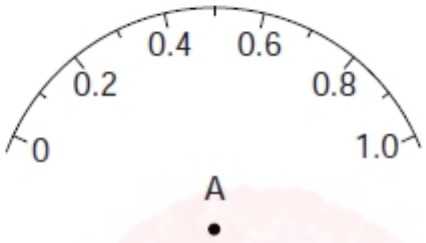


Fig. 3.2 [1]

(c) The student rearranges the circuit so that the three lamps are in **series** with each other. He records the potential difference across each lamp in turn.

V_L = 0.6V

V_M = 0.7V

V_N = 0.7V

Calculate the potential difference V_B across the three lamps using the equation $V_B = V_L + V_M + V_N$.

V_B = ...

(d) A student suggests that V_A should be equal to V_B.

State whether the results support this suggestion and justify your answer with reference to the results.

statement .....

justification .....

.....

[2]

[Total: 8]

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

The circuit is shown in Fig. 3.1.

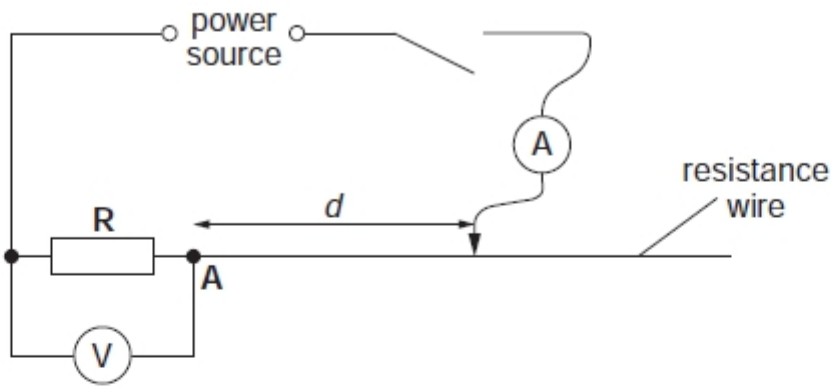


Fig. 3.1

(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.

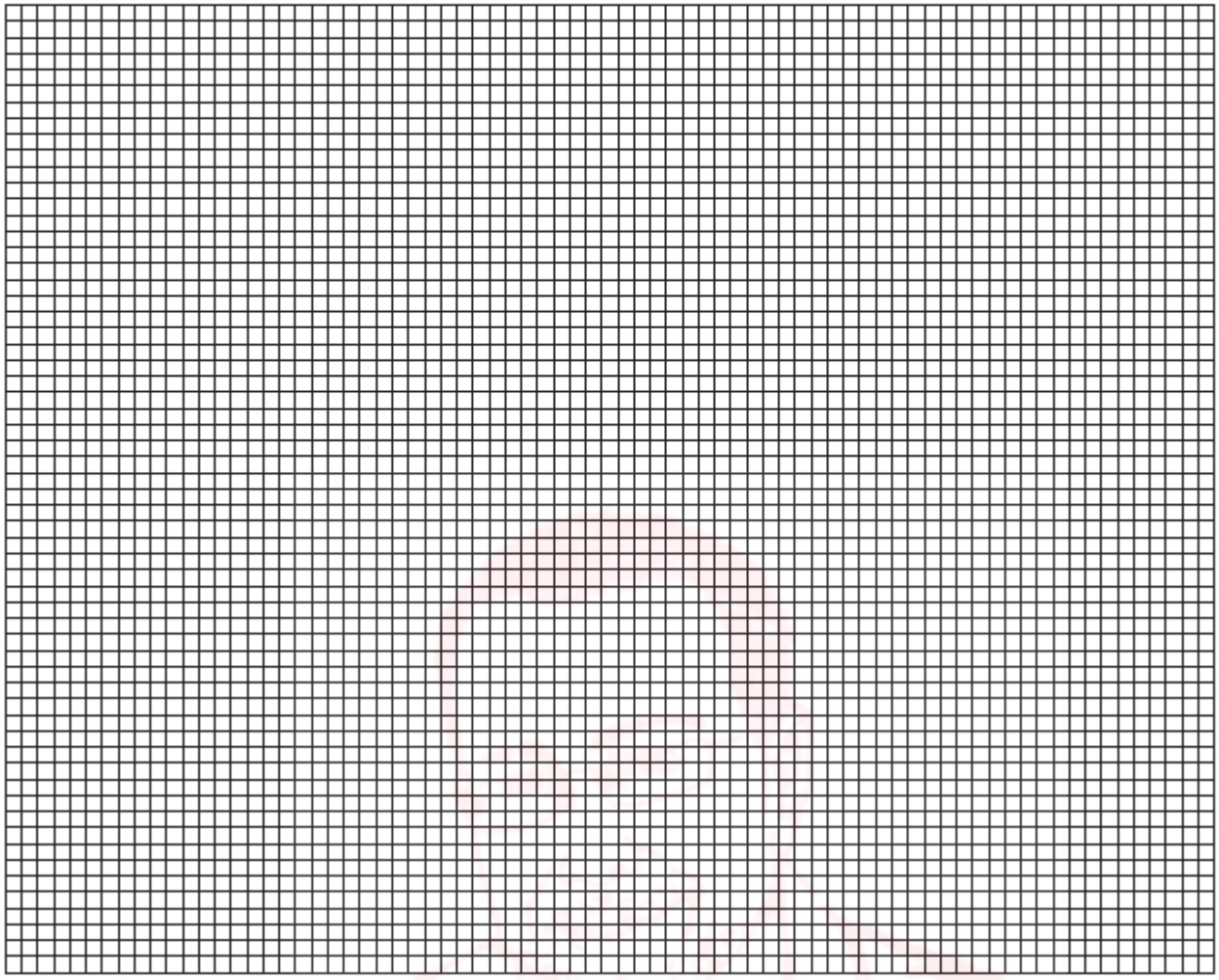
The readings are shown in Table 3.1.

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]

3 The IGCSE class is investigating the current in resistors in a circuit.

The circuit is shown in Fig. 3.1.

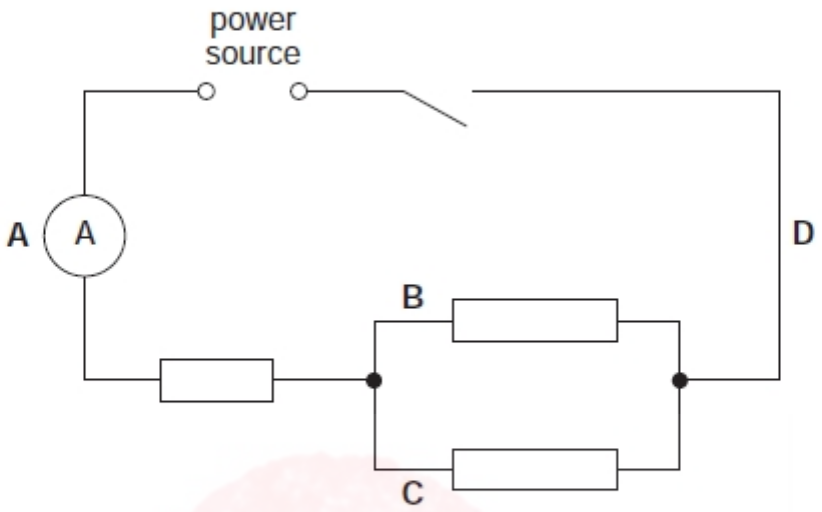


Fig. 3.1

(a) A student measures the current I_A at the position **A** shown by the ammeter, and then at positions **B** (I_B), **C** (I_C) and **D** (I_D).

The readings are:

$I_A = 0.28\,A$ $I_B = 0.13\,A$ $I_C = 0.14\,A$ $I_D = 0.27\,A$

Theory suggests that $I_A = I_B + I_C$ and $I_D = I_B + I_C$.

(i) Calculate $I_B + I_C$.

$I_B + I_C =$ .....

(ii) State whether the experimental results support the theory. Justify your statement by reference to the readings.

statement .....

justification .....

.....

.....

[3]

(b) The student suggests repeating the experiment to confirm her conclusion. She connects a variable resistor (rheostat) in series with the switch. State the purpose of the variable resistor.

.....

.....[1]

(c) The student connects a voltmeter and records the potential difference V across the combination of the three resistors.

(i) On Fig. 3.1, draw in the voltmeter connected as described, using the standard symbol for a voltmeter. [1]

(ii) Write down the voltmeter reading shown on Fig. 3.2.

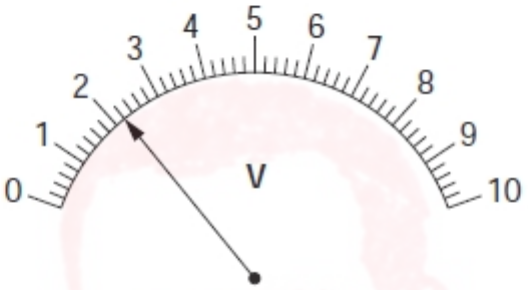


Fig. 3.2

V = ... [1]

(iii) Calculate the resistance R of the combination of the three resistors using the equation $R = \frac{V}{I}$.

R = ... [2]

[Total: 8]

3 The IGCSE class 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 the voltmeter. Complete the circuit diagram to show the voltmeter connected in the circuit to measure the potential difference across the lamp.

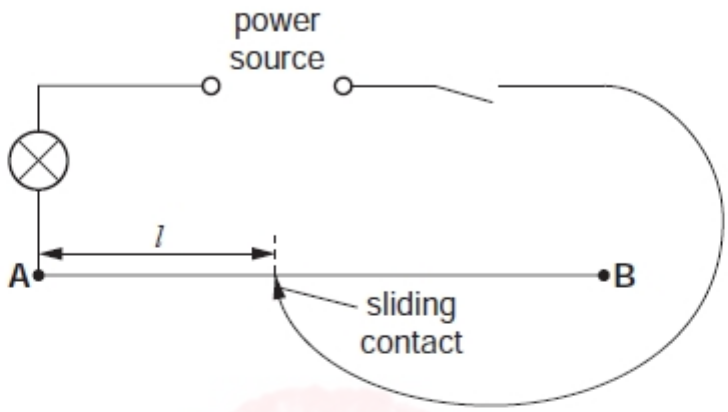


Fig. 3.1

[2]

(b) A student switches on and places the sliding contact on the resistance wire at a distance l = 0.200 m from end **A**. He records the value of l and the potential difference V across the lamp.
He then repeats the procedure using a range of values of l. Table 3.1 shows the readings.

Table 3.1

l/m	V/V	$\frac{V}{l}$/
0.200	1.67	
0.400	1.43	
0.600	1.25	
0.800	1.11	
1.00	1.00	

(i) For each pair of readings in the table calculate and record in the table the value of $\frac{V}{l}$.

(ii) Complete the table by writing in the unit for $\frac{V}{l}$.

[3]

(c) A 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 or not you agree with this suggestion and justify your answer by reference to the results.

Statement .....

Justification .....

.....[2]

(d) State one precaution that you would take in order to obtain accurate readings of V in this experiment.

.....

.....

.....[1]

3 The IGCSE class is measuring the currents in lamps in different circuits.

The first circuit is shown in Fig. 3.1.

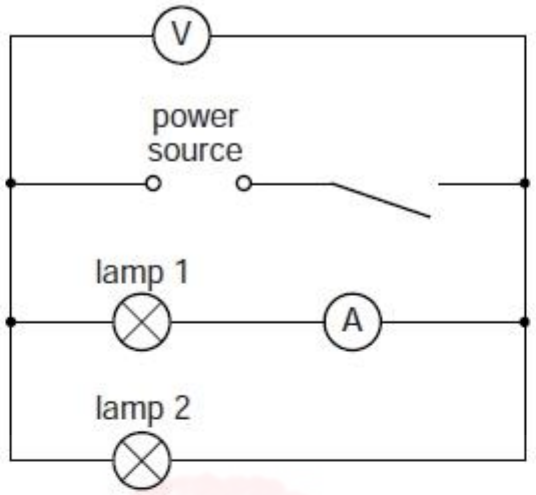


Fig. 3.1

(a) A student records the potential difference V across the lamps and the current I in lamp 1. She rearranges the circuit so that the ammeter is connected in series with lamp 2 and again records the potential difference V across the lamps and the current I in lamp 2.

The readings are shown in Table 3.1.

Table 3.1

	V/	I/	R/
lamp 1	1.9	0.35	
lamp 2	1.9	0.32	

(i) Calculate the resistance R of each lamp, using the equation $R = \frac{V}{I}$, and enter the results in the table.

(ii) Add together the two values of R to calculate R_S, the sum of the resistances of the two lamps.

R_S = ...

(iii) Complete the column headings in the table.

[3]

(b) The student rearranges the circuit so that the lamps and the ammeter are in series. She does not change the position of the voltmeter.

She records the readings on the voltmeter and the ammeter.

voltmeter reading.....1.9 V

ammeter reading.....0.23 A

(i) Draw a circuit diagram of the rearranged circuit using conventional symbols.

(ii) Use the voltmeter and ammeter readings to calculate R_T, the combined resistance of the two lamps in series.

R_T = ...[3]

(c) A student suggests that the values of R_S and R_T should be equal. State whether the results support this suggestion and justify your statement by reference to the calculated values.

statement .....

justification .....

.....[2]

(d) State, without reference to the values of resistance that you have calculated, one piece of evidence that the student can observe during the experiment that shows that the temperature of the lamp filaments changes.

.....

.....[1]

[Total: 9]

5 Table 5.1 shows some measurements taken by three IGCSE students. The second column shows the values recorded by the three students. For each quantity, underline the value most likely to be correct.

The first one is done for you.

Table 5.1

quantity measured	recorded values
the mass of a wooden metre rule	<u>0.112 kg</u> 1.12 kg 11.2 kg
the diameter of a test tube	0.15 cm 1.5 cm 15 cm
the volume of a coffee cup	10 cm^3 100 cm^3 1000 cm^3
the area of a computer keyboard	0.07 m^2 0.70 m^2 7.0 m^2
the current in a 1.5 V torch lamp at normal brightness	0.12 A 12 A 120 A
the circumference of a 250 cm^3 beaker	2.3 cm 23 cm 230 cm

[5]

[Total: 5]

3 The IGCSE class is investigating the current in a circuit when different resistors are connected in the circuit.

The circuit is shown in Fig. 3.1. The circuit contains a resistor **X**, and there is a gap in the circuit between points **A** and **B** that is used for adding extra resistors to the circuit.

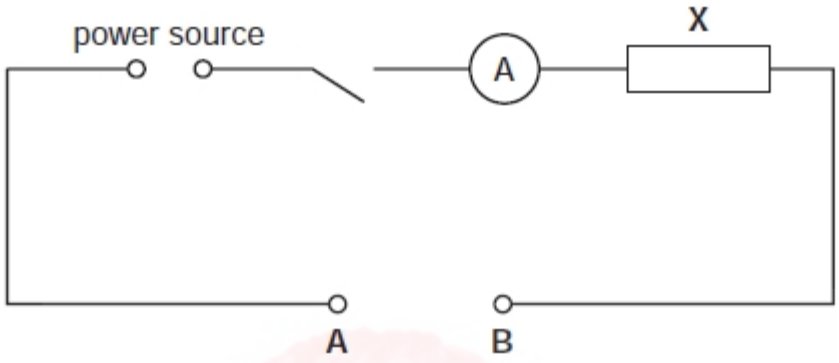


Fig. 3.1

(a) A student connects points **A** and **B** together, switches on and measures the current I_0 in the circuit.

The reading is shown on the ammeter in Fig. 3.2.

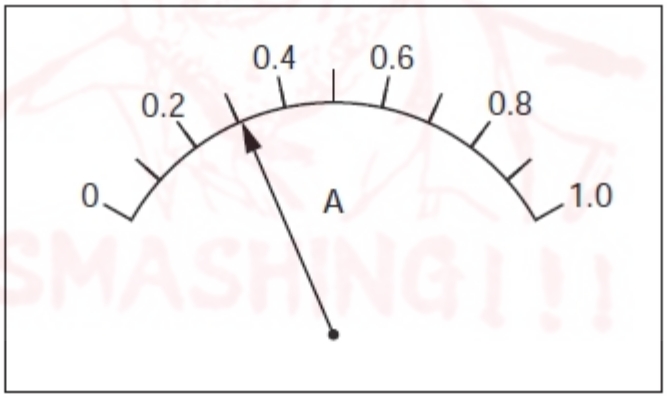


Fig. 3.2

Write down the ammeter reading.

I_0 = ... [1]

(b) The student connects a 3.3 Ω resistor between points **A** and **B**, switches on and records the current *I*. He repeats the procedure with a 4.7 Ω resistor and then a 6.8 Ω resistor.

Finally he connects the 3.3 Ω resistor and the 6.8 Ω resistor in series between points **A** and **B**, and records the current *I*.

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

R/	*I*/
3.3	0.23
4.7	0.21
6.8	0.18
	0.15

(ii) Write the combined resistance of the 3.3 Ω resistor and the 6.8 Ω resistor in series in the space in the resistance column of the table. [1]

(c) Theory suggests that the current will be 0.5 I_0 when the total resistance in the circuit is twice the value of the resistance of resistor **X**. Use the readings in the table, and the value of I_0 from **(a)**, to estimate the resistance of resistor **X**.

estimate of the resistance of resistor **X** = ... [2]

(d) On Fig. 3.1 draw two resistors in parallel connected between **A** and **B** and also a voltmeter connected to measure the potential difference across resistor **X**. [3]

[Total: 8]

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

The circuit shown in Fig. 3.1 is used.

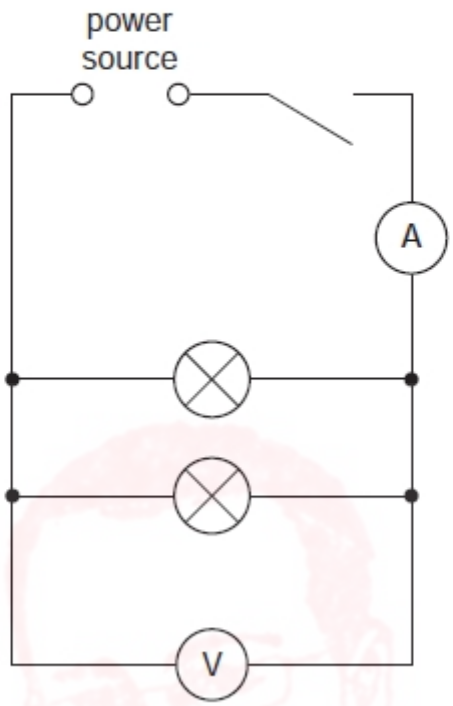


Fig. 3.1

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

Fig. 3.2 shows the readings on the two meters.

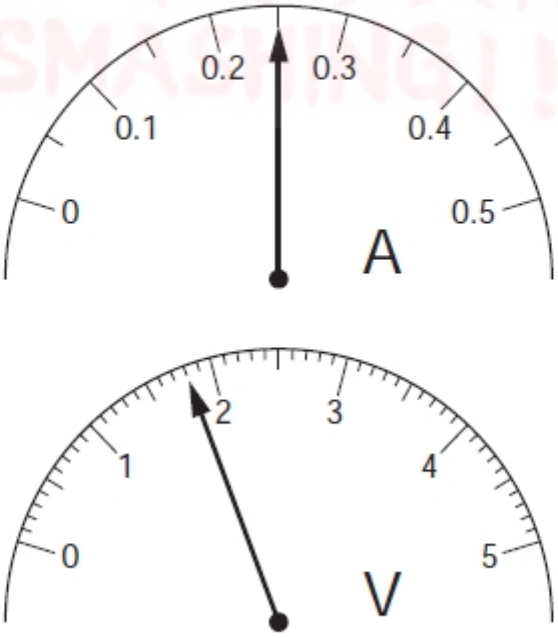


Fig. 3.2

(a) **(i)** Write the voltage and current readings in Table 3.1, below.

(ii) Complete the column headings in Table 3.1.

[3]

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

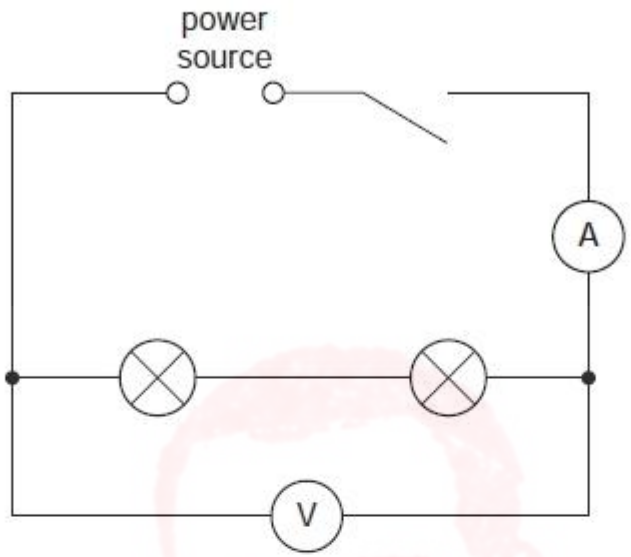


Fig. 3.3

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

Table 3.1

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

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

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

y = ...

[2]

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

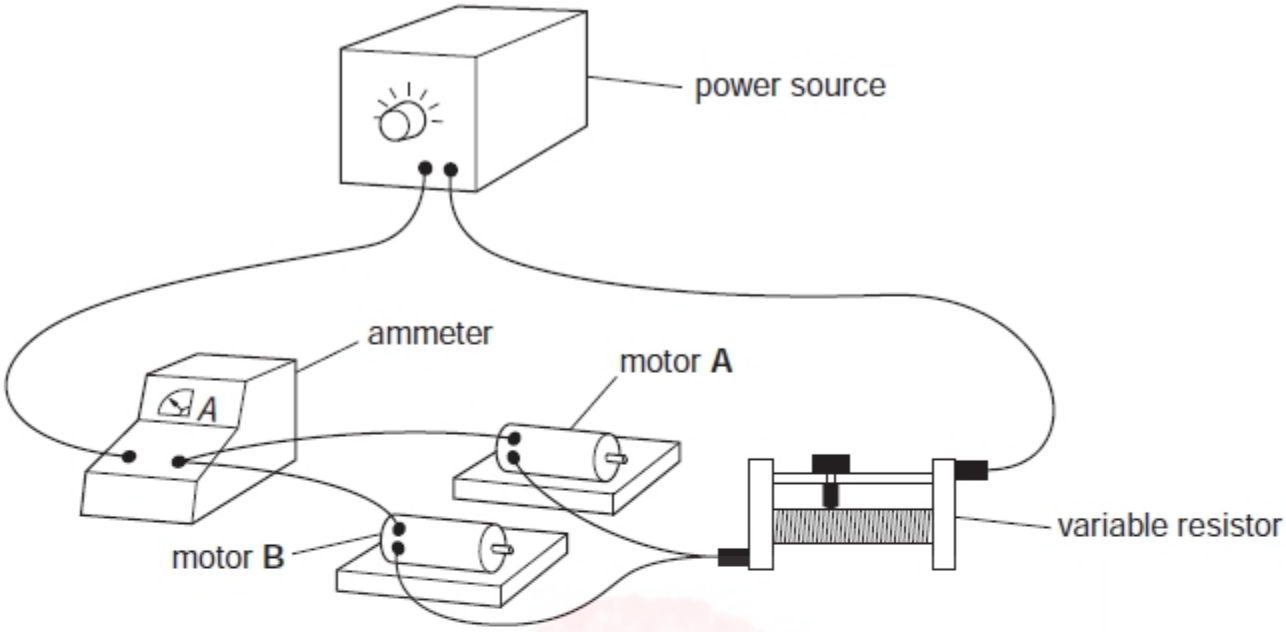
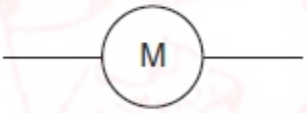


Fig. 3.4

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



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

1. On Fig. 3.4, mark with the letters **X** and **Y** where the engineer should connect the voltmeter.

2. State the purpose of the variable resistor.

.....

.....

[3]

[Total: 10]

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

The circuit is shown in Fig. 3.1.

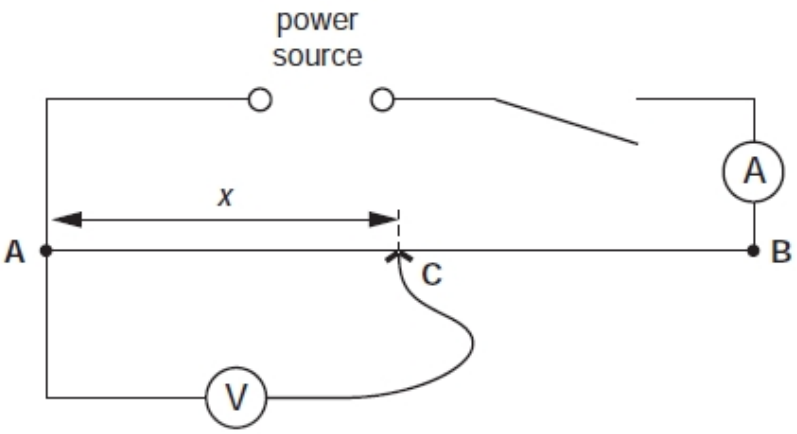


Fig. 3.1

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

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

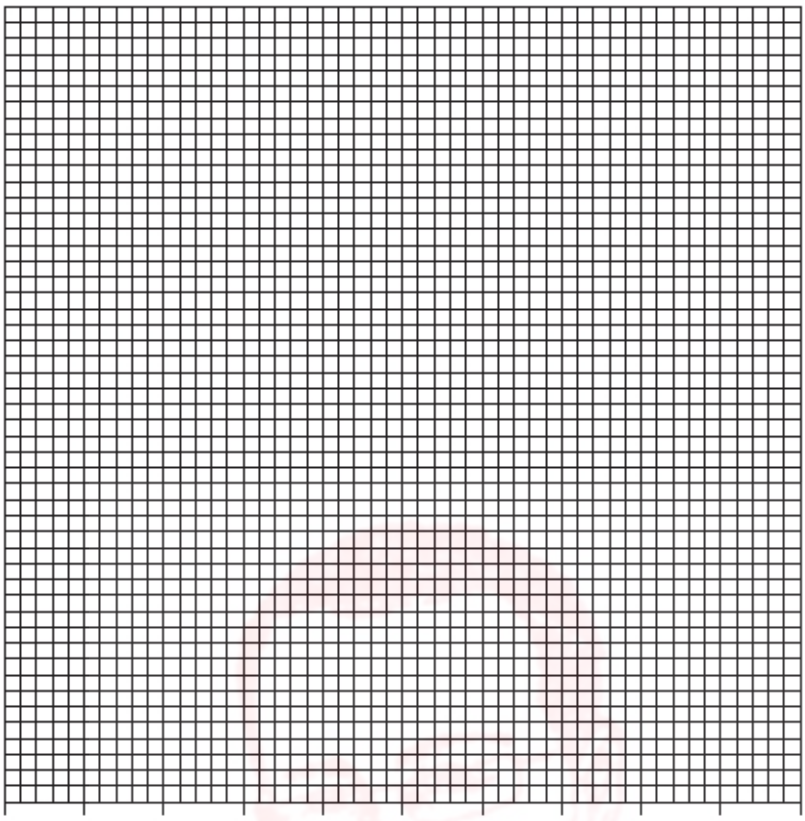
Table 3.1

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

[2]

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

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



[5]

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

statement .....

justification .....

..... [2]

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

R = ... [2]

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

.....

..... [1]

[Total: 12]

5 **(a)** Table 5.1 shows some measurements taken by three IGCSE students. The second column shows the values recorded by the three students. For each quantity, underline the value most likely to be correct.

The first one is done for you.

Table 5.1

Quantity measured	Recorded values
The mass of a wooden metre rule	<u>0.112 kg</u> 1.12 kg 11.2 kg
The weight of an empty 250 cm^3 glass beaker	0.7 N 7.0 N 70 N
The volume of one sheet of this examination paper	0.6 cm^3 6.0 cm^3 60 cm^3
The time taken for one swing of a simple pendulum of length 0.5 m	0.14 s 1.4 s 14 s
The pressure exerted on the ground by a student standing on one foot	0.4 N/cm^2 4.0 N/cm^2 40 N/cm^2

[4]

(b) **(i)** A student is to find the value of the resistance of a wire by experiment. Potential difference V and current I can be recorded. The resistance is then calculated using the equation $R = V/I$.

The student knows that an increase in temperature will affect the resistance of the wire. Assuming that variations in room temperature will not have a significant effect, suggest two ways by which the student could minimise temperature increases in the wire during the experiment.

1. .....

2. ..... [2]

(ii) Name the circuit component that the student could use to control the current.

..... [1]

[Total: 7]

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

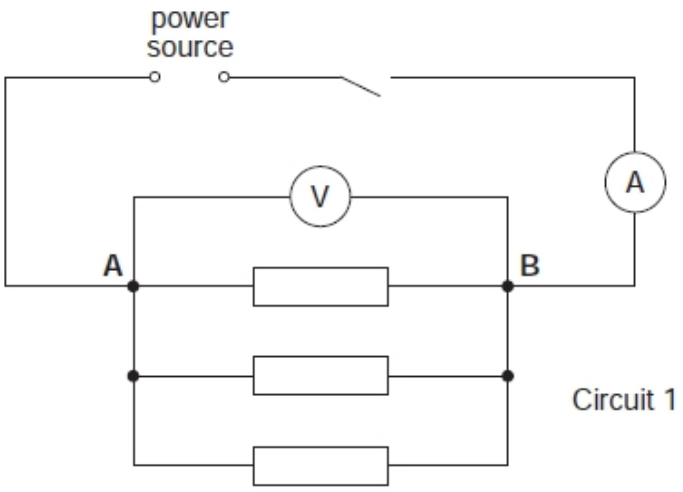


Fig. 2.1

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

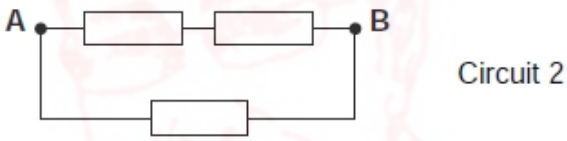


Fig. 2.2

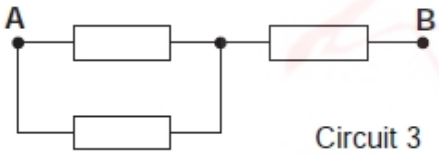


Fig. 2.3

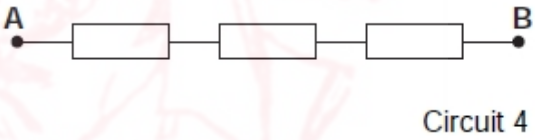


Fig. 2.4

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

Table 2.1

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

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

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

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

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

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

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

statement .....

justification .....

.....

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

.....

..... [3]

[Total: 6]

3 The IGCSE class is investigating the potential difference across lamps and the currents in the lamps.

Fig. 3.1 shows the circuit that is being used.

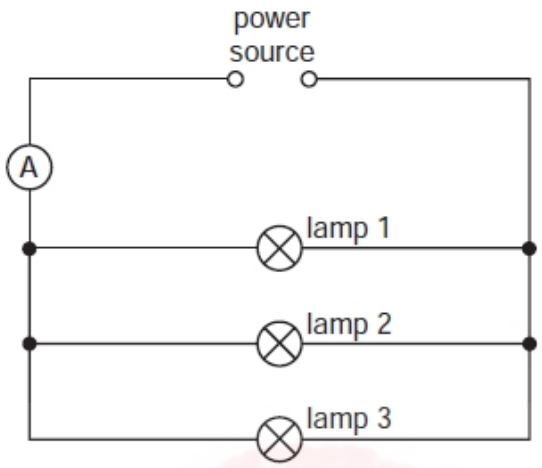
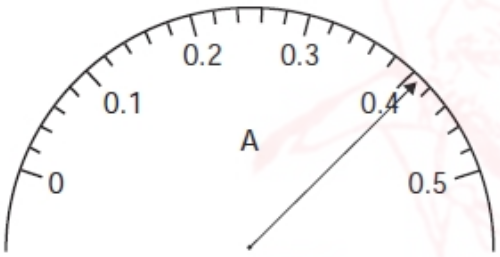


Fig. 3.1

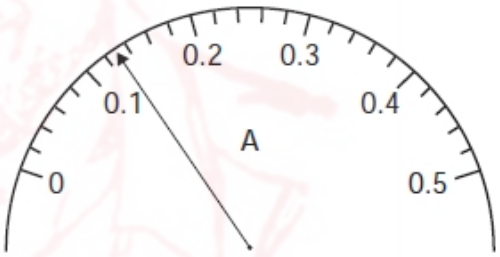
(a) A student uses the ammeter to record the current I in the wire connecting the power source to the rest of the circuit. He then moves the ammeter to new positions in the circuit and measures the current in each lamp in turn. The positions of the pointer on the ammeter scale are shown below.

(i)



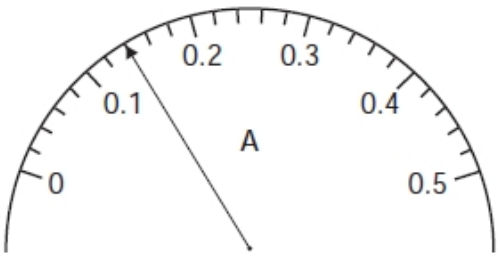
current I = ...

(ii)



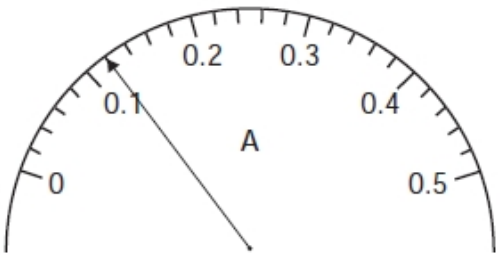
current I_1 in lamp 1 = ...

(iii)



current I_2 in lamp 2 = ...

(iv)



current I_3 in lamp 3 = ...

Write down the ammeter readings I, I_1, I_2 and I_3. [3]

(b) Theory suggests that $I = I_1 + I_2 + I_3$. State whether or not your readings support this theory. Give a reason for your answer.

Statement .....

Reason .....

.....

..... [1]

(c) To test the theory further, you would need to vary the value of I. State how you would vary I.

.....

..... [1]

(d) The student uses a voltmeter to measure the potential difference V across the lamps.

His reading is $V = 1.6\text{V}$.

(i) Calculate the resistance R of the lamps arranged in parallel, using the equation

$$R = V/I,$$

where I is the value of the current in **(a)(i)**.

R = ...

(ii) On Fig. 3.1, add the symbol for the voltmeter connected to measure the potential difference across the lamps. [3]

[Total: 8]

3 The IGCSE class is investigating the resistance of a wire. The circuit is as shown in Fig. 3.1.

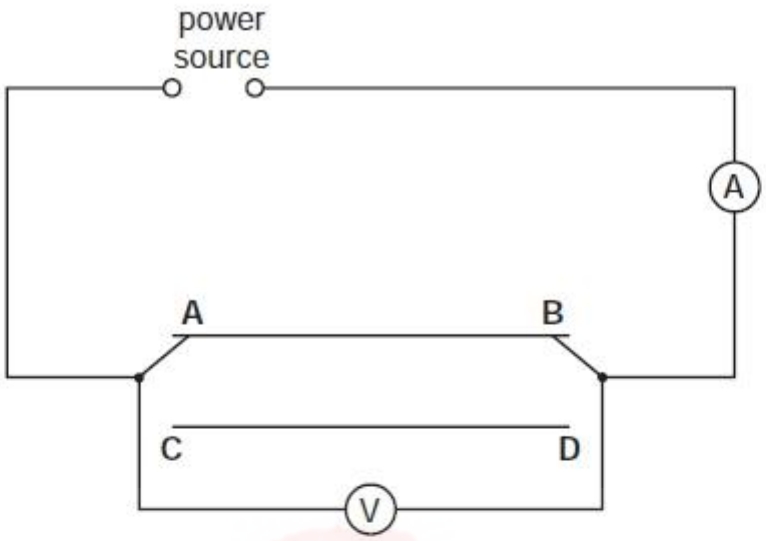


Fig. 3.1

(a) A student uses the switches to connect the wire **AB** into the circuit and records the p.d. V across the wire between **A** and **B**. He also records the current I in the wire.

The student then repeats the measurements using the wire **CD** in place of wire **AB**.

The readings are shown in the table below.

wire	V/	I/	R/
AB	1.9	0.24	
CD	1.9	0.96	

[3]

(i) Calculate the resistance R of each wire, using the equation

$$R = V/I.$$

Record the values in the table.

(ii) Complete the column headings in the table.

(b) The two wires **AB** and **CD** are made of the same material and are of the same length. The diameter of wire **CD** is twice the diameter of wire **AB**.

(i) Look at the results in the table. Below are four possible relationships between R and the diameter d of the wire. Tick the relationship that best matches the results.

R is proportional to d ☐

R is proportional to $\frac{1}{d}$ ☐

R is proportional to d^2 ☐

R is proportional to $\frac{1}{d^2}$ ☐

(ii) Explain briefly how the results support your answer in part **(b)(i)**.

.....

.....

.....

..... [2]

(c) Following this experiment, the student wishes to investigate whether two lamps in parallel with each other have a smaller combined resistance than the two lamps in series. Draw one circuit diagram showing

(i) two lamps in parallel with each other connected to a power source,

(ii) an ammeter to measure the total current in the circuit,

(iii) a voltmeter to measure the potential difference across the two lamps.

[3]

[Total: 8]

5 A student is investigating the relationship between potential difference V across a resistor and the current I in it. Fig. 5.1 shows the apparatus that the student is using.

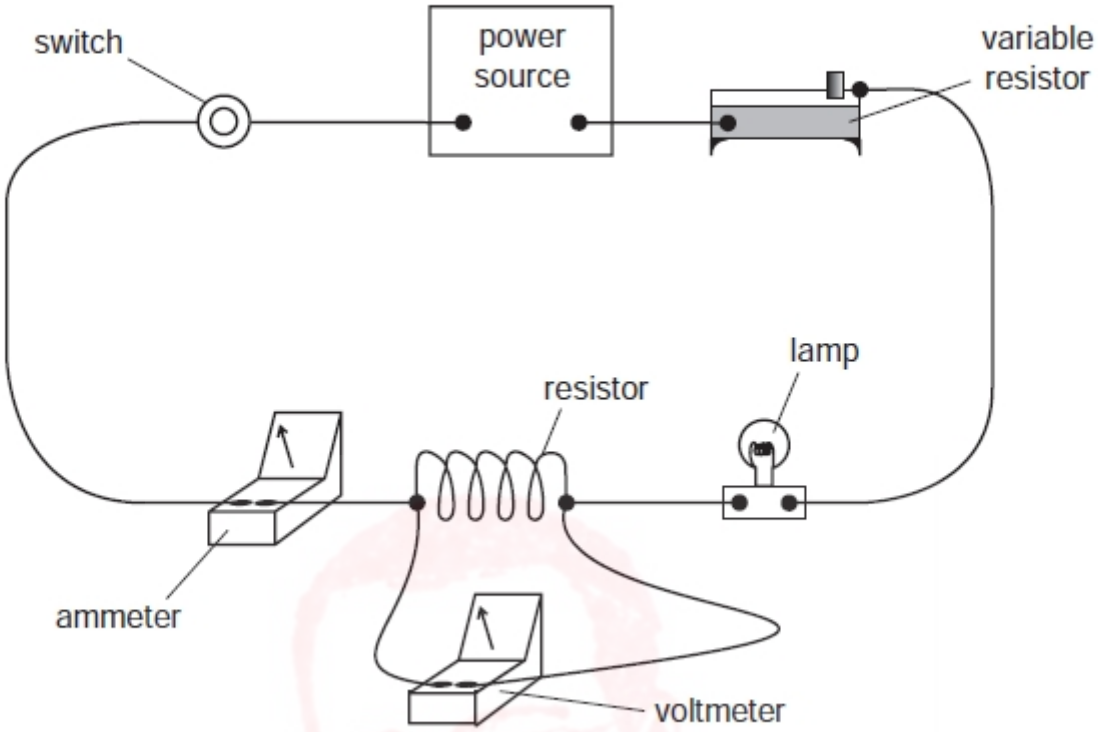


Fig. 5.1

(a) Draw the circuit diagram of the circuit shown in Fig. 5.1. Use standard circuit symbols.

[3]

(b) The student is using a lamp to show when the current is switched on.

Why is it unnecessary to use the lamp?

.....

..... [1]

(c) State which piece of apparatus in the circuit is used to control the size of the current.

..... [1]

(d) The student removes the lamp from the circuit. He is told that the resistance of a conductor is constant if the temperature of the conductor is constant. He knows that the current in the resistor has a heating effect. Suggest two ways in which the student could minimise the heating effect of the current in the resistor.

1. .....

2. ..... [2]

(e) Fig. 5.2 shows a variable resistor with the sliding contact in two different positions.

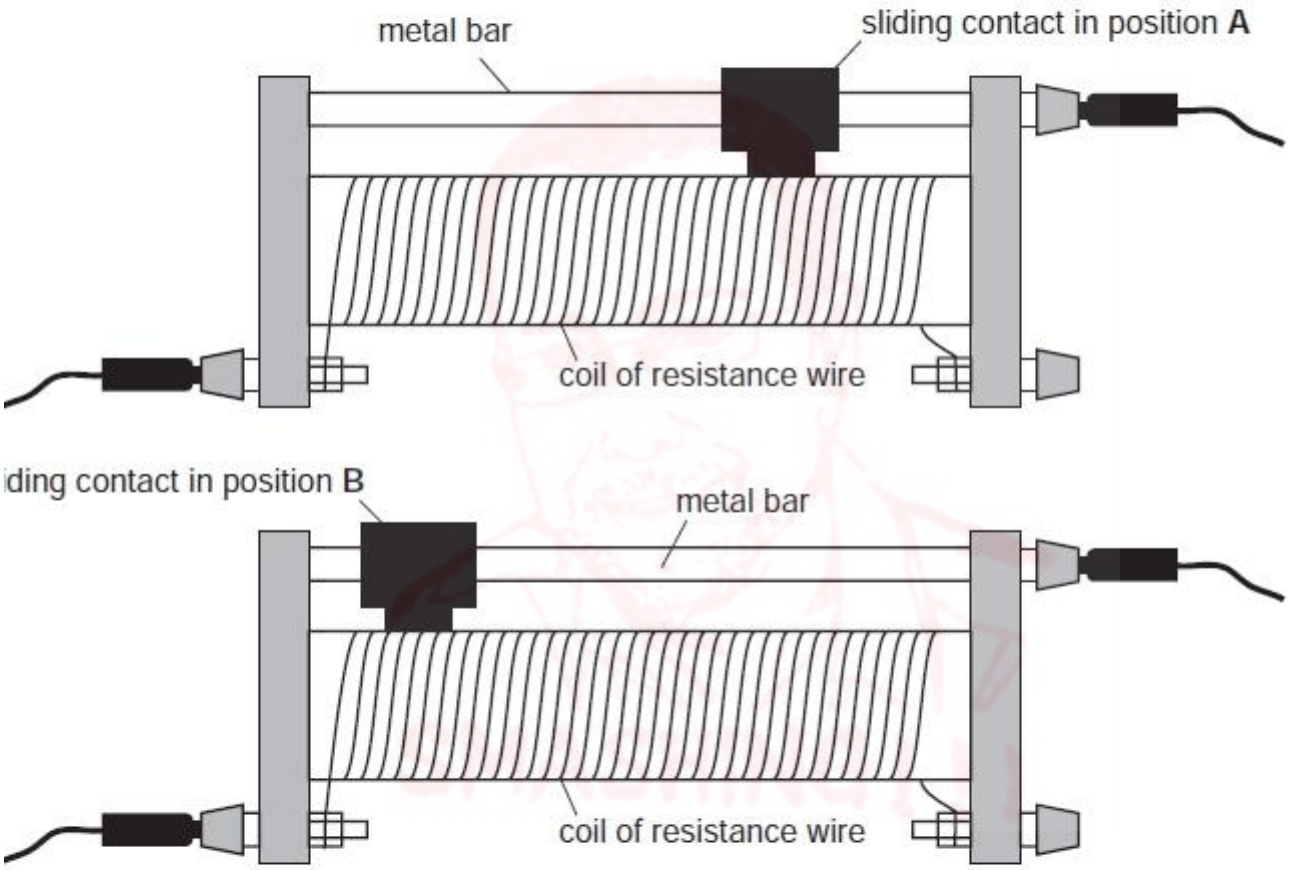


Fig. 5.2

State which position, A or B, shows the higher resistance setting. Explain your answer.

statement .....

explanation .....

..... [1]

2 The IGCSE class is investigating the resistance of lamps in different circuit arrangements.

Fig. 2.1 shows a picture of the circuit.

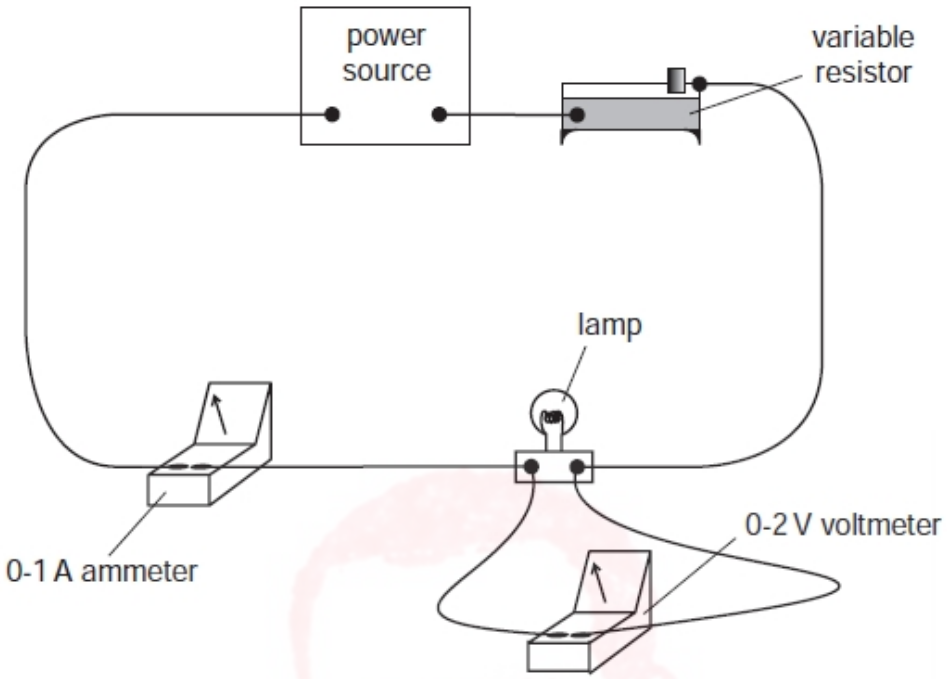


Fig. 2.1

(a) Draw a circuit diagram of the circuit shown in Fig. 2.1. Use standard circuit symbols.

[3]

(b) The current I through the lamp and the voltage V across the lamp are measured. Then a second lamp is connected in parallel with the first. The total current I in the circuit and the voltage V across the lamps are measured. The table below shows the readings.

I/	V/	R/
0.24	1.39	
0.45	1.30	

(i) Complete the column headings for each of the *I*, *V* and *R* columns of the table. [1]

(ii) Calculate the resistance *R* in each case using the equation

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

Enter the results in the table. [2]

Q# 21/ iG Phx/2005/w/Paper 61/ www.SmashingScience.org :o)

5 **(a)** The IGCSE class carries out an experiment to investigate the rate of cooling from 100 °C of a range of hot liquids. Underline any of the following variables that are likely to have a significant effect on the temperature readings. (You may underline one, two or all three of the suggested variables.)

type and size of container

volume of liquid

temperature of the surroundings [2]

(b) In an experiment to find the resistance of a wire, the students record the current in the wire and the potential difference across it. They then calculate the resistance. Underline any of the following variables that are likely to have a significant effect on the current and/or potential difference readings. (You may underline one, two or all three of the suggested variables.)

atmospheric pressure

temperature of the wire

length of wire [2]

(c) In an experiment, a short pendulum oscillates rapidly. A student is asked to find the period of oscillation *T* of the pendulum using a stopwatch. The student sets the pendulum swinging and records the time for one oscillation. A technique for improving the accuracy of the value obtained for the period *T* should be used in this experiment. State, briefly, what this technique is and any calculation involved to obtain the value of *T*.

.....

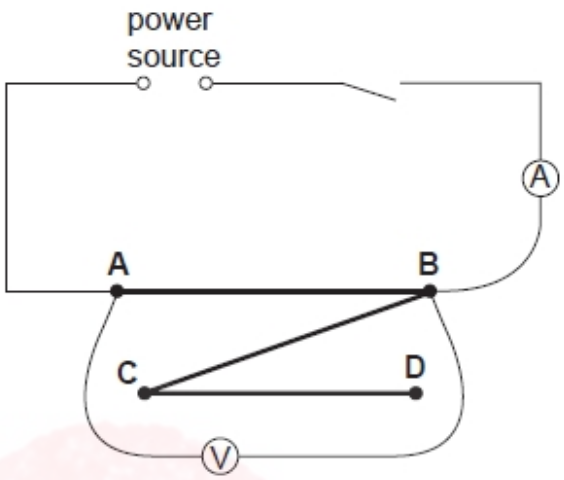
.....

..... [2]

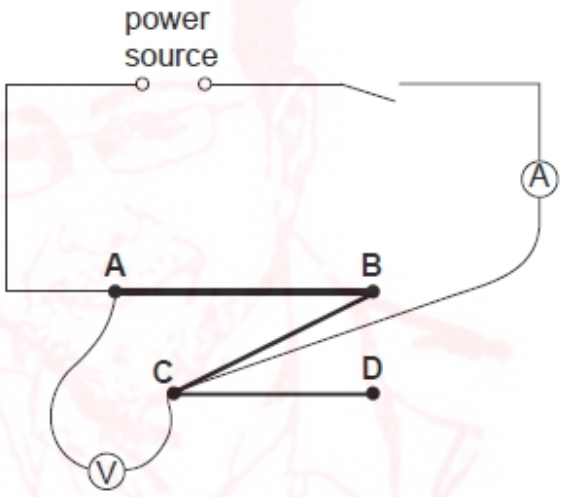
2 An IGCSE student investigates the resistance of resistance wire **ABCD** in three different circuit arrangements.

The circuits are shown in Fig. 2.1.

circuit (i)



circuit (ii)



circuit (iii)

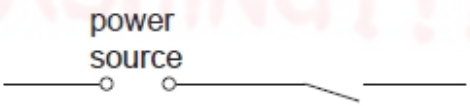


Fig. 2.1

(a) Circuit **(iii)** is the same as circuit **(ii)** but with an additional connecting lead between **A** and **D**.

On Fig. 2.1, complete the circuit diagram for circuit **(iii)** using the standard symbol for a resistor to represent each section **AB**, **BC** and **CD** of the resistance wire. [3]

(b) The student measures and records the current I and the p.d. V in each circuit. The student's readings are shown in the table.

circuit	*I*/	*V*/	*R*/
(i)	0.91	1.80	
(ii)	0.45	1.80	
(iii)	1.37	1.85	

(i) Complete the column headings for each of the I, V and R columns of the table. [1]

(ii) Calculate the resistance R for each circuit using the equation

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

Record in the table the values of R to an appropriate number of significant figures. [2]

(c) Look at the resistance values for circuits **(i)** and **(ii)**. The sections of resistance wire **AB**, **BC** and **CD** are all of the same length. Suggest a value for the resistance of the whole wire **ABCD**. Explain briefly how you obtained your value.

value .....

explanation .....

..... [2]

2 **(a)** The table below shows some measurements taken by three IGCSE students. The second column shows the values recorded by the three students. For each quantity, underline the value most likely to be correct. The first one is done for you.

quantity measured	recorded values
thickness of a metre rule	0.25 mm 2.5 mm 25 mm
volume of a test-tube	12 mm^3 12 cm^3 12 m^3
current in a 12 V ray box lamp at less than normal brightness	0.5 A 5.0 A 50 A
the surface area of the base of a 250 cm^3 beaker	0.3 cm^2 3 cm^2 30 cm^2
the mass of a wooden metre rule	0.112 kg 1.12 kg 11.2 kg
the weight of an IGCSE student	6 N 60 N 600 N

[5]

(b) A student is to find a value of the resistance of a wire by experiment. Potential difference V and current I can be recorded. The resistance is then calculated using the equation

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

State, with a reason, one example of good experimental practice that the student could use to obtain a reliable result.

statement .....

reason ..... [2]

3 A student investigates the resistance of wire in different circuit arrangements.

The circuit shown in Fig. 3.1 is used.

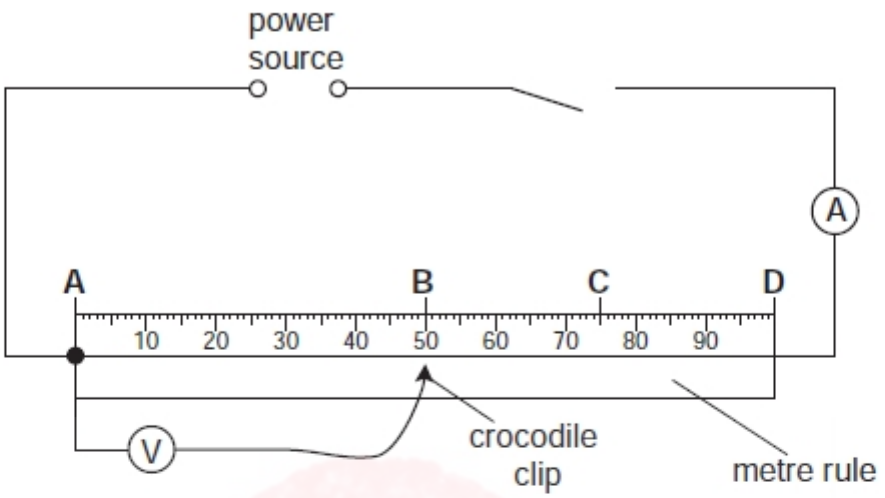


Fig. 3.1

The student measures the current I in the wire. She then measures the p.d. V across **AB**, **AC** and **AD**.

The student's readings are shown in the table below.

section of wire	l / cm	I / A	V / V	R /
AB		0.375	0.95	
AC		0.375	1.50	
AD		0.375	1.95	

(a) Using Fig. 3.1, record in the table the length l of each section of wire. [1]

(b) On Fig. 3.2, show the positions of the pointers of the ammeter reading 0.375 A, and the voltmeter reading 1.50 V.

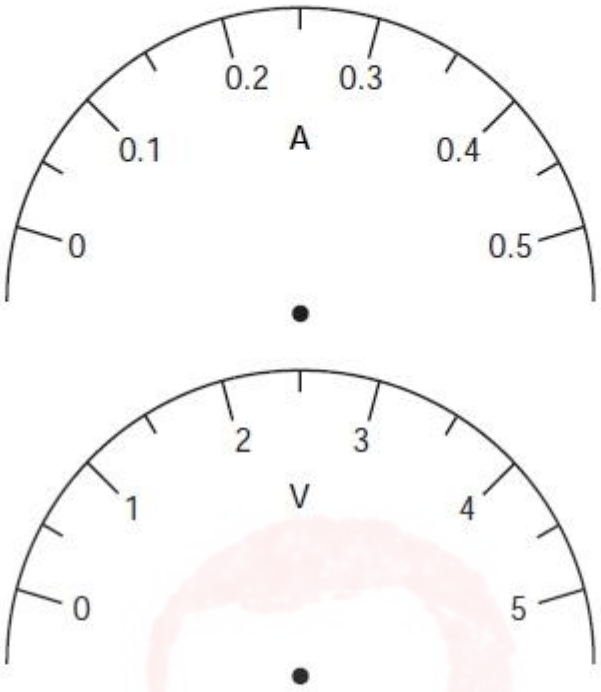


Fig. 3.2

[2]

(c) Calculate the resistance R of the sections of wire **AB**, **AC** and **AD** using the equation

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

Record these values of R, to a suitable number of significant figures, in the table. [2]

(d) Complete the column heading for the R column of the table. [1]

(e) Use your results to predict the resistance of a 1.50 m length of the same wire. Show your working.

resistance = ... [2]

5 The IGCSE class is carrying out investigations of the resistance of bare resistance wires. Fig. 5.1 shows the circuit used.

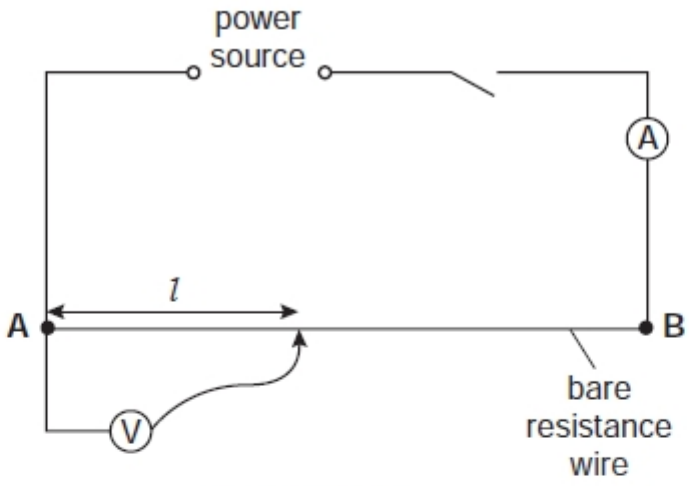


Fig. 5.1

The students record the current I in the circuit and then record the p.d. V across different lengths l of the bare resistance wire. The length of wire from **A** to **B** is 100.0 cm. The readings obtained by one student are shown in the table.

$I = 0.84$ A

V/	*l*/	*R*/
0.39	20.0	
0.82	40.0	
1.22	60.0	
1.58	80.0	
1.89	100.0	

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

(ii) Complete the column headings in the table.

[3]

(b) In a second experiment, the students use wires of the same material but with different diameters d. The p.d. is measured across the same length of wire each time. Fig. 5.2 shows the circuit used.

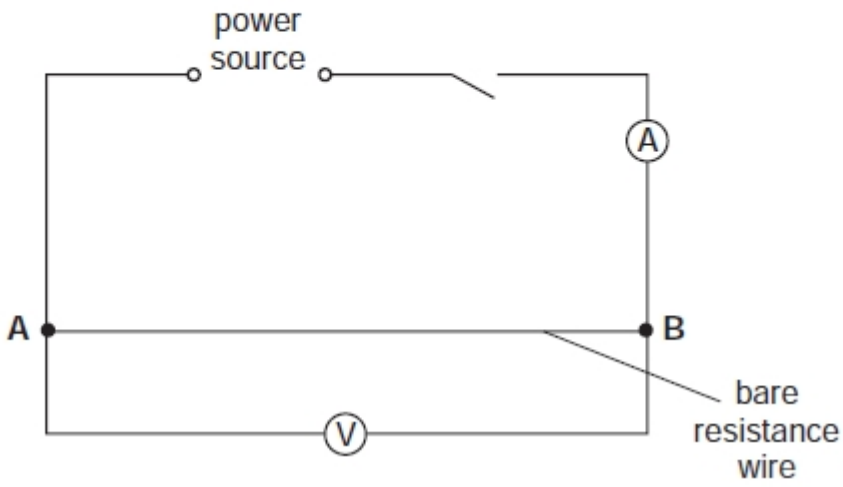


Fig. 5.2

These are the readings correctly obtained by one student.

Wire 1	$I = 0.1$ A	Wire 2	$I = 0.4$ A
	$V = 1.8$ V		$V = 1.8$ V
	$d = 0.24$ mm		$d = 0.48$ mm

(i) Calculate the resistance R of each wire, using the equation $R = \frac{V}{I}$.

wire 1, R = ...

wire 2, R = ... [1]

(ii) Based on the results for the two wires, which of the following statements is a correct conclusion? Tick one box.

A wire with half the diameter has half the resistance. ☐

A wire with half the diameter has twice the resistance. ☐

A wire with half the diameter has one quarter the resistance. ☐

A wire with half the diameter has four times the resistance. ☐

[1]

(iii) Using your answers to **(i)** and **(ii)**, calculate the expected resistance of a wire **AB** of the same material if it has a diameter of 0.12 mm.

expected resistance = ... [1]

(c) What instrument would you use to measure the diameter of the wires as accurately as possible?

..... [1]

Q# 26/ iG Phx/2004/s/Paper 61/ www.SmashingScience.org :o)

3 Fig. 3.1 shows the circuit that a student uses to find the resistance of a combination of three lamps.

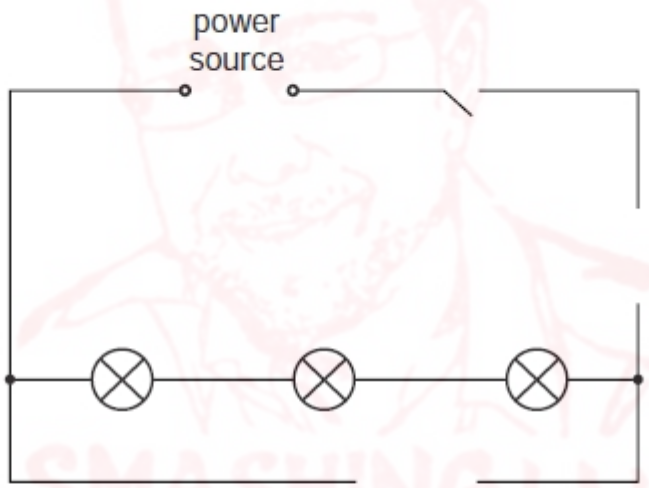


Fig. 3.1

The voltmeter and the ammeter have not been drawn in.

(a) Complete Fig. 3.1 by drawing in the voltmeter and the ammeter, using conventional symbols. [2]

(b) The student obtains these readings.

current $I = 0.54\ \text{A}$

potential difference $V = 1.8\ \text{V}$

Calculate the resistance R using the equation $R = \frac{V}{I}$.

$R =$ ..... [2]

(c) The three lamps are now connected in parallel with one another. Draw a circuit diagram of the three lamps connected to the power supply. Include in your circuit diagram

(i) an ammeter to record the total current through the lamps,

(ii) a variable resistor to vary the brightness of all three lamps,

(iii) a voltmeter to record the potential difference across the lamps.

[3]

3 **(a)** Fig. 3.1 shows the scale of an ammeter. Draw the position of the pointer when the ammeter reading is 0.35 A. [1]

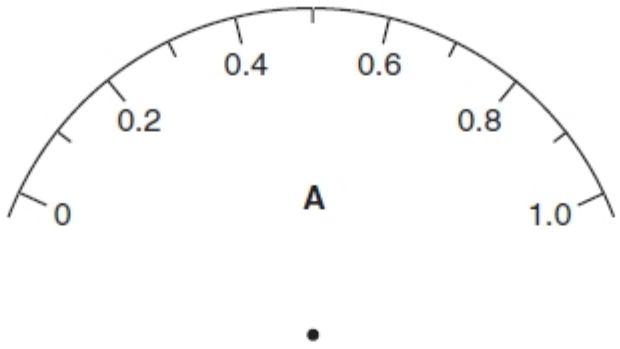


Fig. 3.1

(b) The ammeter was used in the circuit shown in Fig. 3.2 to investigate the current in a lamp.

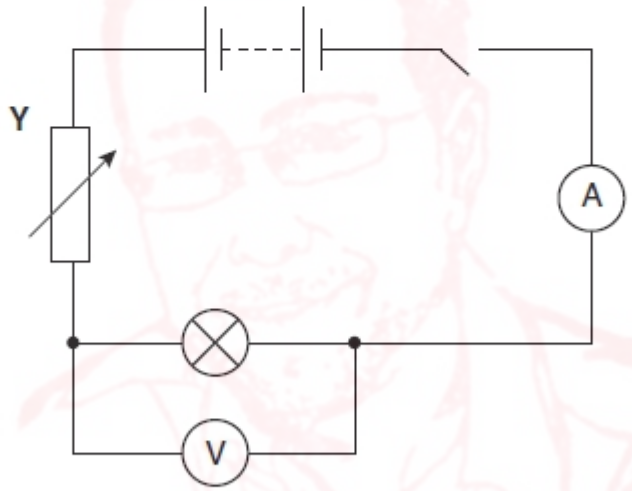


Fig. 3.2

(i) Name the component labelled **Y**.

.....

(ii) The table shows the current I in the lamp for different values of the p.d. V across the lamp.

V/	I/	R/
1.9	0.31	
1.5	0.26	
0.8	0.20	

1. Calculate the values for the resistance R of the lamp, using the equation

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

Write your answers in the table.

2. Complete the column headings in the table.

(iii) Suggest how the value of V could be varied.

.....

.....

[8]

(c) Fig. 3.3 shows a power source connected to three resistors labelled **X**, **Y** and **Z**.

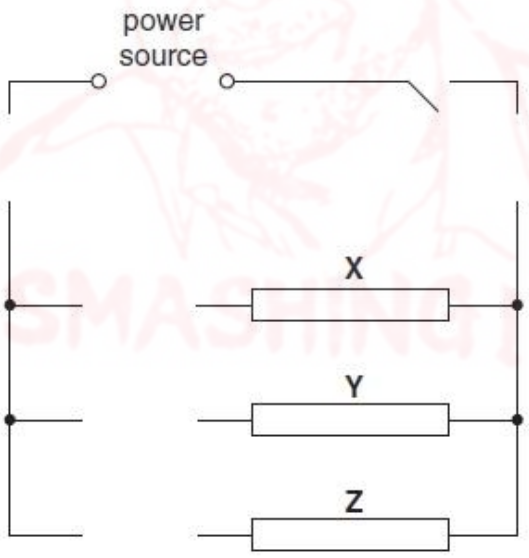


Fig. 3.3

Complete the diagram to show

(i) a voltmeter connected to measure the voltage across the resistors,

(ii) an ammeter connected to measure the current in resistor **X** only,

(iii) connecting wires to complete the circuit.

[3]

3 In an electrical experiment, a student set up a circuit to measure current and potential difference. Part of the circuit is shown in Fig. 3.1.

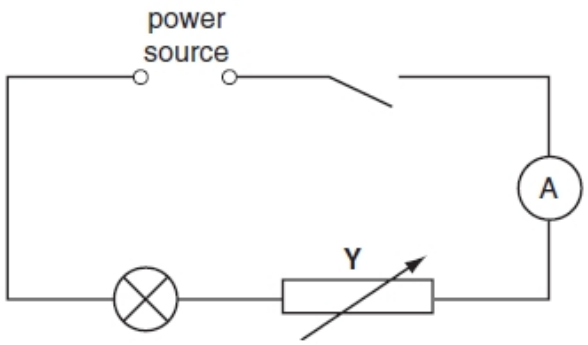


Fig. 3.1

(a) (i) Complete the circuit diagram by drawing in a voltmeter connected across the lamp.

(ii) Name the component labelled **Y**. ..... [2]

(b) The first reading on the voltmeter was 2.2 V. On the voltmeter face shown in Fig. 3.2, show the position of the pointer giving the reading 2.2 V.

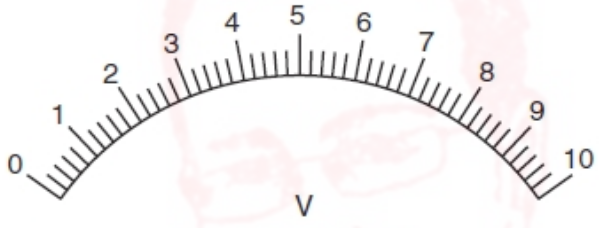


Fig. 3.2 [1]

(c) The readings of V and I obtained by the student are given in the table below.

V/	I/	R/
2.2	0.36	
4.1	0.62	
6.0	0.86	
7.9	0.98	
9.8	1.20	

(i) Calculate the resistance R of the lamp filament for each set of V and I readings and write the values in the table. Use the equation

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

(ii) Complete the column headings in the table. [6]

2 The IGCSE class is investigating electromagnets. The electromagnets are made by wrapping insulated wire around a soft-iron core. The wire is connected to a power pack. Fig. 2.1 shows the arrangement.

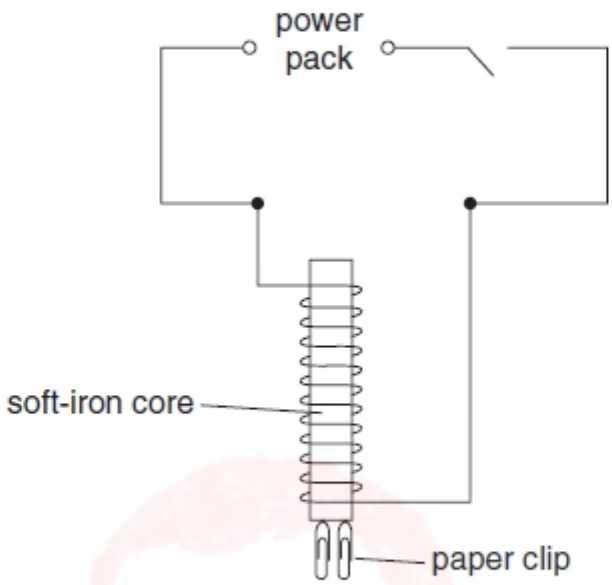


Fig. 2.1

Two students studied how the number of paper clips that an electromagnet can hold up depends on the potential difference across the coil.

(a) Complete Fig. 2.1 by adding a voltmeter, connected to measure the p.d. across the coil. [2]

(b) Student A used the control on the power pack to obtain set values of p.d. and recorded the **maximum** number of paper clips that the electromagnet could hold at each p.d. The results are shown below.

Student A

p.d./V	number of paper clips
0	0
2	0
4	1
6	2
8	3
10	4
12	5

Student B connected a variable resistor into the circuit and used it to change the
across the coil. She recorded the **minimum** p.d. required to hold 1 paper clip, th
paper clips, etc. The results are shown below.

Student B

p.d./V	number of paper clips
0	0
2.2	1
4.5	2
6.6	3
8.7	4
11.0	5

(i) Which set of results gives the more accurate indication of the strength o
electromagnet at different potential differences? Tick the correct box.

Student A ☐

Student B ☐

(ii) Justify your answer to part **(b)(i)**.

.....

.....

.....

Draw the circuit symbol for a variable resistor.

Student B connected a variable resistor into the circuit and used it to change the p.d. across the coil. She recorded the **minimum** p.d. required to hold 1 paper clip, then 2 paper clips, etc. The results are shown below.

Student B

p.d./V	number of paper clips
0	0
2.2	1
4.5	2
6.6	3
8.7	4
11.0	5

(i) Which set of results gives the more accurate indication of the strength of the electromagnet at different potential differences? Tick the correct box.

Student A ☐

Student B ☐

(ii) Justify your answer to part **(b)(i)**.

.....

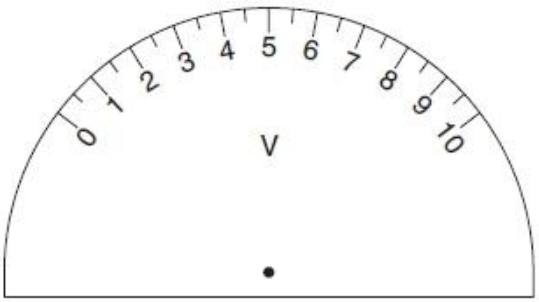
.....

.....[2]

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

[1]

(d) On the diagram below, show the position of the pointer on the voltmeter when the voltmeter reading is 8.7 V.



[1]

Q# 1/ iG Phx/2015/s/Paper 61/ www.SmashingScience.org :o)

3 (a) (i) $V = 1.8$ [1]

$I = 0.25$ AND both units correct, V and A [1]

(ii) R_S calculated correctly, e.c.f. (i), expect 7.2(Ω) [1]

(b) (i) lamps in parallel and ammeter in a correct position [1]

voltmeter in correct position, with rest of circuit and symbols correct [1]

(ii)(iii) $R_P = 3.3$ or 3.33 with unit Ω and 2 or 3 significant figures AND R_S/R_P calculated [1]

(c) (i) voltage or p.d., accept current [1]

(ii) adjust power supply OR add resistor / variable resistor [1]

[Total: 8]

Q# 2/ iG Phx/2014/w/Paper 61/ www.SmashingScience.org :o)

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]

Q# 3/ iG Phx/2014/s/Paper 61/ www.SmashingScience.org :o)

4 (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]

Q# 4/ iG Phx/2013/w/Paper 61/ www.SmashingScience.org :o)

3 (a) (i) 1.8 (V) [1]
0.3 (A) [1]

(ii) P_1 = 0.54 (W) e.c.f. allowed [1]

(iii)(iv)(v) P_T = 1.59 (or 1.6) W [1]

(b) statement matches results (expect YES) e.c.f. allowed [1]
justification in terms of within or beyond limits of experimental accuracy o.w.t.t.e. [1]

(c) (i) diagram:
lamps in parallel, variable resistor in series with power supply, with correct symbols for variable resistor, lamps and voltmeter [1]
one voltmeter correctly positioned [1]

(ii) vary current (or p.d.) [1]

[Total: 9]

Q# 5/ iG Phx/2013/s/Paper 61/ www.SmashingScience.org :o)

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]

Q# 6/ iG Phx/2012/w/Paper 61/ www.SmashingScience.org :o)

3 (a) Correct symbols for ammeter, voltmeter and lamps [1]
Ammeter and voltmeter in correct positions [1]
Correct parallel circuit [1]

(b) (i) and (ii) V_A = 1.9(V) R_A = 2.9(2) (Ω) [1]
Units V and Ω [1]

(iii) Pointer at correct position (0.65) [1]

(c) No mark awarded

(d) Statement matches readings (expect YES) [1]
Justified with idea of experimental inaccuracy [1]
(expect 'close enough', owtte)

[Total: 8]

Q# 7/ iG Phx/2012/s/Paper 61/ www.SmashingScience.org :o)

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]

Q# 8/ iG Phx/2011/w/Paper 61/ www.SmashingScience.org :o)

3 (a) (i) 0.27 (A) [1]

(ii) expect YES (ecf: no) [1]
expect close enough / within limits of experimental accuracy o.w.t.t.e.
ecf: beyond limits of experimental accuracy o.w.t.t.e. [1]

(b) vary/control current/voltage [1]

(c) (i) voltmeter symbol correct and correctly connected across all three resistors [1]

(ii) 2.2 (V) [1]

(iii) *R* correctly evaluated
ecf from (ii) [1]
2 or 3 significant figures and unit Ω [1]

[Total: 8]

Q# 9/ iG Phx/2011/s/Paper 61/ www.SmashingScience.org :o)

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

(b) table:
V / l values correct 8.35, 3.58, 2.08, 1.39, 1.00 [1]
consistent 2 or 3 significant figures [1]
unit V/m [1]

(c) statement matches readings (expect NO) [1]
justification matches statement and by reference to results
V / l not constant, as l increases V decreases [1]

(d) any one of:
check for zero error
avoidance of parallax error explained
switch off between readings
repeats [1]

[Total: 8]

Q# 10/ iG Phx/2011/s/Paper 61/ www.SmashingScience.org :o)

3. (a) (i) 5.4 or 5.43 or 5.429 AND 5.9 or 5.94 or 5.938 [1]
R values both to 2 significant figures OR both to 3 significant figures, in table [1]

(iii) V, A , Ω [1]

(b) (i) Correct series circuit [1]
Correct symbols for ammeter, voltmeter and lamps [1]

(ii) R_T = 8.26(Ω) [1]

(c) Statement: expect No (ecf available for Yes) [1]
Outside limits of experimental accuracy (owtte) [1]

(d) Brightness changes (owtte) [1]

[Total: 9]

Q# 11/ iG Phx/2011/s/Paper 61/ www.SmashingScience.org :o)

5. 1.5 cm [1]
100 cm^3 [1]
0.07 m^2 [1]
0.12 A [1]
23 cm [1]

[Total: 5]

Q# 12/ iG Phx/2010/w/Paper 61/ www.SmashingScience.org :o)

3 (a) 0.3 – 0.31 [1]

(b) Ω, A [1]
10.1 [1]

(c) correct calculation of $0.5I_o$ shown (ecf) [1]
10(Ω) [1]

(d) diagram:
resistors in parallel [1]
voltmeter symbol [1]
voltmeter position [1]

[Total 8]

Q# 13/ iG Phx/2009/w/Paper 61/ www.SmashingScience.org :o)

3 (a)–(c)

table:
V, A, Ω [1]
V 1.8 [1]
I 0.25 [1]
R values 7.20, 3.46(3.5) [1]
consistent significant figures for *R* (2 or more) [1]

(d) *y* 0.48, 0.49, 0.5 (ecf) [1]
2/3 significant figures and no unit [1]

(e) (i) correct symbols and circuit (ignore power source symbol) [1]

(ii) voltmeter position correct [1]

(iii) control current/voltage/resistance/speed of motor [1]

[Total: 10]

Q# 14/ iG Phx/2009/s/Paper 61/ www.SmashingScience.org :o)

3 (a) *R* values 0.553, 1.55, 2.74, 3.74, 4.92
(2,3,4 or more significant figures) [1]
Consistent 3 or consistent 4 significant figures for final four entries [1]

(b) Graph:
Axes labelled and scales suitable (must include origin) [1]
Plots correct to ½ square (–1 each error or omission) [2]
Well judged str. line taking account of all points and reaching an axis [1]
Thin line [1]

(c) Statement proportional (wtte) or as *x* increases, *R* increases [1]
Justification straight line through origin [1]

(d) Clear indication of method on graph [1]
Correct value to ½ square [1]

(e) low current/switch off between readings
or add (variable) resistor/lamp
or reduce voltage/power [1]

[Total: 12]

Q# 15/ iG Phx/2008/w/Paper 61/ www.SmashingScience.org :o)

5 (a) 0.7 N [1]
$6\ cm^3$ [1]
1.4 s [1]
$4.0\ N/cm^2$ [1]

(b) (i) minimum current/turn down power supply/increase resistance [1]
switch off between readings/carry out without delay [1]

(ii) variable resistor/rheostat [1]

[Total: 7]

Q# 16/ iG Phx/2008/s/Paper 61/ www.SmashingScience.org :o)

2 Table:

(a) Units V, A, Ω (symbol/word) [1]
R values 1.11, 2.19, 5.05, 9.55 [1]
Consistent 2 or consistent 3 sig fig for R [1]

(b) (i) Yes (if within 10%) No (if not) [M1]
Circuit 1 and circuit 2 compared [A1]

(ii) limit current (so temperature not increased)
OR switch off between readings
OR check for zero error
OR Repeats
OR Parallax error explained
OR Tapping meter [1]

[Total: 6]

Q# 17/ iG Phx/2007/w/Paper 61/ www.SmashingScience.org :o)

3 (a) 0.41, 0.13, 0.14, 0.12(-1 each error) [2]
I in A at least once [1]

(b) statement (yes)
Reason – correct within limits of experimental accuracy [1]

(c) variable resistor/extra cell/variable power source/potential divider/potentiometer [1]

(d) (i) correct arithmetic for *R* 3.90 (ecf) [1]
unit and 2/3 sf [1]

(ii) voltmeter correct position and symbol [1]

[Total: 8]

Q# 18/ iG Phx/2007/s/Paper 61/ www.SmashingScience.org :o)

3 (a) correct arithmetic for *R* values 7.92, 1.98 [1]
both *R* to 2sf OR both to 3sf [1]
all correct units: *V*, *A*, Ω [1]

(b) final box (ecf) [1]
second *R* (or *I*) about ¼ of first [1]

(c) lamp symbol correct [1]
ammeter and voltmeter symbols correct [1]
correct parallel circuit (ONE ammeter and ONE voltmeter, no extra components, but accept switch if present, ignore power source or lack of) [1]

[Total: 8]

Q# 19/ iG Phx/2006/w/Paper 61/ www.SmashingScience.org :o)

5 (a) correct symbols for ammeter and voltmeter [1]
correct symbols for variable resistor, lamp and resistor [1]
circuit correct [1]

(b) ammeter will show current/voltmeter shows reading [1]

(c) variable resistor [1]

(d) (i) low current/increase R of variable resistor/ lower voltage/add another lamp [1]

(ii) switch off between readings [1]

(e) A, more resistance in circuit [1]

[Total: 8]

Q# 20/ iG Phx/2006/s/Paper 61/ www.SmashingScience.org :o)

2 (a) correct ammeter and voltmeter symbols **[1]**
correct power source, variable resistor and lamp symbols **[1]**
correct circuit **[1]**

(b) (i) A; V; Ω **[1]**

(ii) 5.8 or 5.79 or 5.792; 2.9 or 2.89 or 2.889 **[1]**
consistent 2/3 sf **[1]**

TOTAL 6

Q# 21/ iG Phx/2005/w/Paper 61/ www.SmashingScience.org :o)

5 (a) 1, 2 and 3 (–1 each error or omission) 2

(b) 2 and 3 (–1 each error or omission) 2

(c) time a number (n) oscillations 1
divide time by n 1

TOTAL 6

Q# 22/ iG Phx/2005/w/Paper 61/ www.SmashingScience.org :o)

2	(a)	correct symbols for resistor, voltmeter and ammeter	1
		correct connections between resistors AB and BC in series with CD in parallel with both	1
		voltmeter and ammeter correctly positioned	1
	(b)	I in A, V in V, R in Ω	1
		1.98 or 2.0; 4.00 or 4.0; 1.06 or 1.1	1
		all to 2 sf or 3 sf	1
	(c)	5.9Ω – 6.1Ω	1
		resistance proportional to length/ doubling length, doubled resistance/ 3 x length will have 3 x resistance/ wtte	1

TOTAL 8

Q# 23/ iG Phx/2005/s/Paper 61/ www.SmashingScience.org :o)

2	(a)	$12\ cm^3$	[1]
		0.5 A	[1]
		$30\ cm^2$	[1]
		0.112 kg	[1]
		600 N	[1]
	(b)	repeats	[1]
		to spot anomalous results/to calculate average	[1]
		or series of different V and I, plot graph	
		or switch on/off, prevent temp rise	
		or low current, minimise temp rise	
		or avoidance of parallax, action and reason	
		or clean wires, resistance caused by dirt	
		or tap meter, prevent sticking	
		or check zero error, accuracy	
		(in each case the reason must support the statement to gain the second mark)	

[total: 7]

Q# 24/ iG Phx/2005/s/Paper 61/ www.SmashingScience.org :o)

3	(a)	*l* values 50, 75, 100	[1]
	(b)	1.50 V shown correctly	[1]
		0.375 A shown correctly	[1]
	(c)	2.5(3); 4.0(0); 5.2(0) all correct	[1]
		all to 2sf or all to 3sf	[1]
	(d)	Ω	[1]
	(e)	R = 7.50 - 8.00 (or R = 6.60 - 7.49)	[2]

[total: 8]

Q# 25/ iG Phx/2004/w/Paper 61/ www.SmashingScience.org :o)

5	(a) (i)	all R correct, 0.464, 0.976, 1.45, 1.88, 2.25	1
		2/3 sf for R	1
	(ii)	V, cm, Ω	1
	(b) (i)	18, 4.5 (ignore unit)	1
	(ii)	answer 4	1
	(iii)	72	1
	(c)	micrometer	1
			TOTAL 7

Q# 26/ iG Phx/2004/s/Paper 61/ www.SmashingScience.org :o)

3	(a)	Correct voltmeter	1
		Correct ammeter	1
	(b)	R = 3.3, 2/3 sf	1
		Unit Ω or ohm	1
	(c)	Circuit with correct parallel connections	1
		Ammeter and ONE voltmeter correct	1
		Variable resistor correct	1
			TOTAL 7

Q# 27/ iG Phx/2003/w/Paper 61/ www.SmashingScience.org :o)

3	(a)	pointer at 0.35 A	1
	(b) (i)	variable resistor/rheostat/potentiometer	1
	(ii)	V	1
		A	1
		Ω	1
		One R correct	1
		All R correct (6.129, 5.769, 4, correctly rounded)	1
		Consistent sf for R (either all 2 sf or all 3 sf)	1
	(iii)	variable resistor/number of cells	1
	(c)	Voltmeter in parallel with resistors (or power source)	1
		Ammeter next to X	1
		Symbols correct and all connections drawn in	1
			TOTAL 12

Q# 28/ iG Phx/2003/s/Paper 61/ www.SmashingScience.org :o)

3	(a)	(i)	Voltmeter across lamp	1
		(ii)	Variable resistor/rheostat	1
	(b)		Correct position	1
	(c)		V	1
			A	1
			Ω	1
			correct R at 9.8V = 8.16666 (any sf)	1
			all R to 2/3 sf	1
			consistent 2 sf or consistent 3 sf	1
			TOTAL	**9**

Q# 29/ iG Phx/2002/w/Paper 61/ www.SmashingScience.org :o)

2. (a) symbol	1
position	1
(b) (i) student B	
(ii) B gives exact p.d.	1
or A gives p.d. to nearest 2V	1
(c) correct symbol	1
(d) correct position (± 0.1V)	1
TOTAL	6