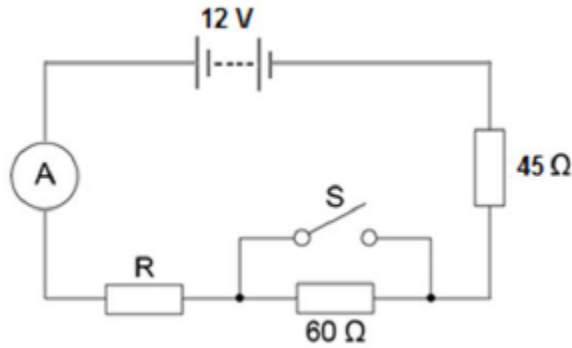


1

A student set up the electrical circuit shown in the figure below.



(a) The ammeter displays a reading of 0.10 A.

Calculate the potential difference across the 45 Ω resistor.

.....
.....

Potential difference = V

(2)

(b) Calculate the resistance of the resistor labelled R.

.....
.....
.....

Resistance = Ω

(3)

(c) State what happens to the total resistance of the circuit and the current through the circuit when switch S is closed.

.....
.....
.....
.....

(2)
(Total 7 marks)

2

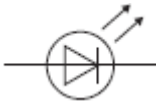
(a) Draw **one** line from each circuit symbol to its correct name.

Circuit symbol

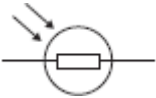
Name



Diode



Light-dependent resistor (LDR)



Lamp

Light-emitting diode (LED)

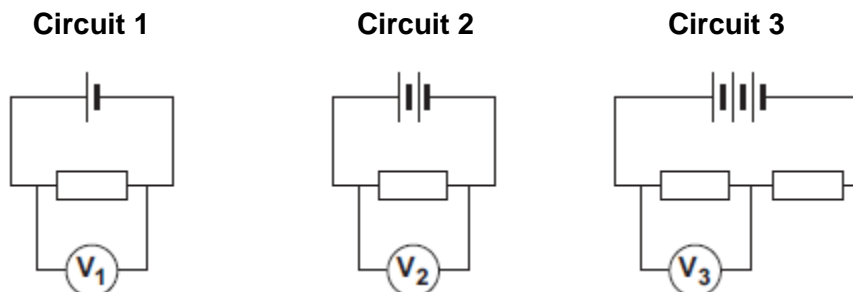
(3)

(b) **Figure 1** shows three circuits.

The resistors in the circuits are identical.

Each of the cells has a potential difference of 1.5 volts.

Figure 1



(i) Use the correct answer from the box to complete the sentence.

half	twice	the same as
-------------	--------------	--------------------

The resistance of **circuit 1** is the resistance of **circuit 3**.

(1)

(ii) Calculate the reading on voltmeter V_2 .

.....

Voltmeter reading $V_2 = \dots\dots\dots$ V

(1)

(iii) Which voltmeter, V_1 , V_2 or V_3 , will give the lowest reading?

Draw a ring around the correct answer.

V_1

V_2

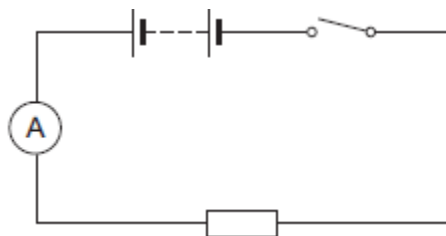
V_3

(1)

- (c) A student wanted to find out how the number of resistors affects the current in a series circuit.

Figure 2 shows the circuit used by the student.

Figure 2



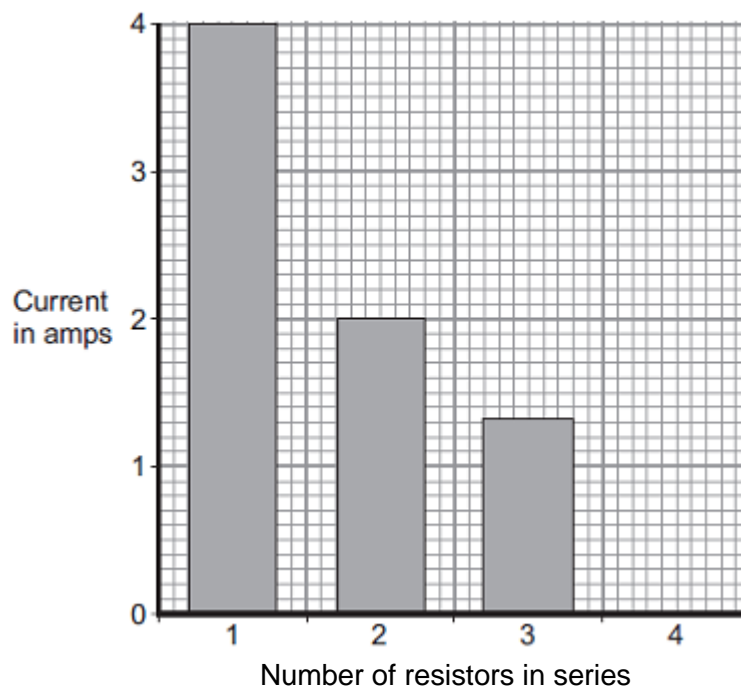
The student started with one resistor and then added more identical resistors to the circuit.

Each time a resistor was added, the student closed the switch and took the ammeter reading.

The student used a total of 4 resistors.

Figure 3 shows three of the results obtained by the student.

Figure 3



- (i) To get valid results, the student kept one variable the same throughout the experiment.

Which variable did the student keep the same?

.....

(1)

(ii) The bar chart in **Figure 3** is not complete. The result using 4 resistors is not shown.
Complete the bar chart to show the current in the circuit when 4 resistors were used.

(2)

(iii) What conclusion should the student make from the bar chart?

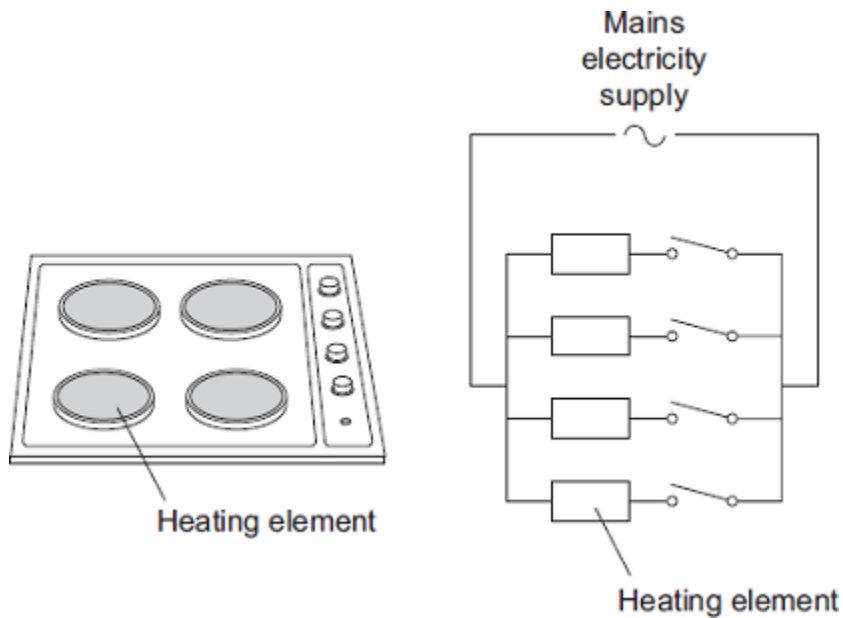
.....
.....

(1)

(Total 10 marks)

3

The picture shows an electric cooker hob. The simplified circuit diagram shows how the four heating elements connect to the mains electricity supply. The heating elements are identical.



When all four heating elements are switched on at full power the hob draws a current of 26 A from the 230 V mains electricity supply.

(a) Calculate the resistance of one heating element when the hob is switched on at full power.

Give your answer to 2 significant figures.

.....
.....
.....

Resistance = Ω

(3)

- (b) The table gives the maximum current that can safely pass through copper wires of different cross-sectional area.

Cross-sectional area in mm ²	Maximum safe current in amps
1.0	11.5
2.5	20.0
4.0	27.0
6.0	34.0

The power sockets in a home are wired to the mains electricity supply using cables containing 2.5 mm² copper wires. Most electrical appliances are connected to the mains electricity supply by plugging them into a standard power socket.

It would **not** be safe to connect the electric cooker hob to the mains electricity supply by plugging it into a standard power socket.

Why?

.....
.....
.....
.....

(2)

- (c) Mains electricity is an alternating current supply. Batteries supply a direct current.

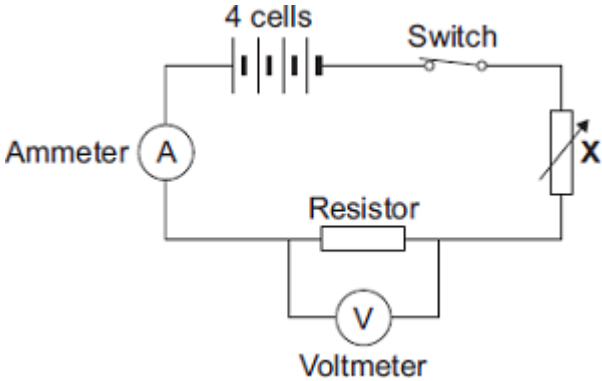
What is the difference between an alternating current and a direct current?

.....
.....
.....
.....

(2)
(Total 7 marks)

4

(a) The diagram shows the circuit that a student used to investigate how the current through a resistor depends on the potential difference across the resistor.



(i) Each cell provides a potential difference of 1.5 volts.

What is the total potential difference provided by the four cells in the circuit?

.....

Total potential difference = volts

(1)

(ii) The student uses the component labelled X to change the potential difference across the resistor.

What is component X?

Draw a ring around your answer.

light-dependent resistor

thermistor

variable resistor

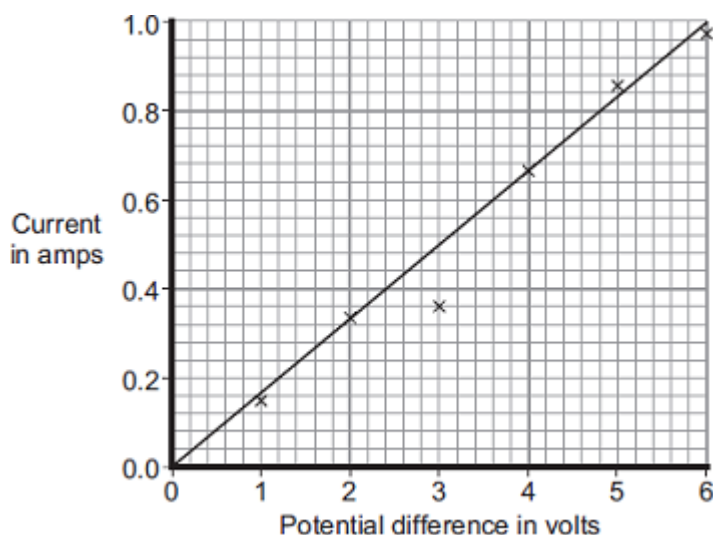
(1)

(iii) Name a component connected in parallel with the resistor.

.....

(1)

(b) The results obtained by the student have been plotted on a graph.



(i) One of the results is anomalous.

Draw a ring around the anomalous result.

(1)

(ii) Which **one** of the following is the most likely cause of the anomalous result?

Put a tick (✓) in the box next to your answer.

The student misread the ammeter.

The resistance of the resistor changed.

The voltmeter had a zero error.

(1)

(iii) What was the interval between the potential difference values obtained by the student?

.....

.....

(1)

- (c) Describe the relationship between the potential difference across the resistor and the current through the resistor.

.....

.....

(1)
(Total 7 marks)

Mark schemes

1

(a) $V = 0.10 \times 45$

1

4.5 (V)

1

(b) $R = 12 / 0.10$

1

total resistance = 120 (Ω)

1

$R = 120 - 105 = 15$ (Ω)

1

(c) (total) resistance decreases

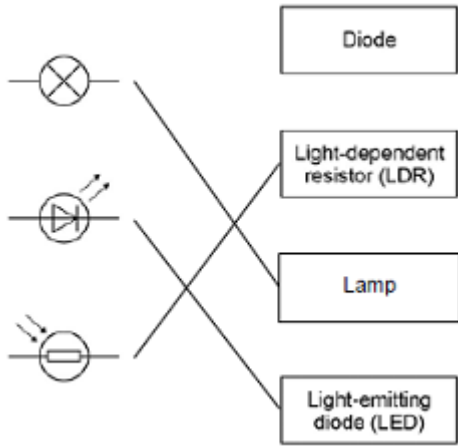
1

(so) current increases

1

[7]

2 (a)



allow 1 mark for each correct line if more than one line is drawn from any symbol then all of those lines are wrong

3

(b) (i) half

1

(ii) 3(V)

1

(iii) V_1

1

(c) (i) potential difference / voltage of the power supply

accept the power supply

accept the voltage / volts

accept number of cells / batteries

accept (same) cells / batteries

do not accept same ammeter / switch / wires

1

(ii) bar drawn – height 1.(00)A

ignore width of bar

allow 1 mark for bar shorter than 3rd bar

2

(iii) as the number of resistors increases the current decreases

1

[10]

3 (a) 35

an answer with more than 2 sig figs that rounds to 35 gains 2 marks

allow 2 marks for correct method, ie $\frac{230}{6.5}$

allow 1 mark for $I = 6.5$ (A) or $R = \frac{230}{26}$

an answer 8.8 gains 2 marks

an answer with more than 2 sig figs that rounds to 8.8 gains 1 mark

3

- (b) (maximum) current exceeds maximum safe current for a 2.5 mm² wire
accept power exceeds maximum safe power for a 2.5 mm² wire

or

- (maximum) current exceeds 20 (A)
(maximum) current = 26 (A) is insufficient

1

- a 2.5 mm² wire would overheat / melt
accept socket for wire
*do **not** accept plug for wire*

1

- (c) a.c. is constantly changing direction
accept a.c. flows in two directions
accept a.c. changes direction
a.c. travels in different directions is insufficient

1

- d.c. flows in one direction only

1

[7]

4

- (a) (i) 6

1

- (ii) variable resistor

1

- (iii) voltmeter

1

- (b) (i) point at 3 V ringed

1

- (ii) The student misread the ammeter.

1

- (iii) 1 (volt)

accept every volt

1

- (c) as one increases so does the other

or

directly proportional

or

positive correlation

accept a numerical description, eg when one doubles the other also doubles

1

[7]