AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.2.2 SERIES AND PARALLEL CIRCUITS (PACK 1)

SCORE	PERCENTAGE
/96	%

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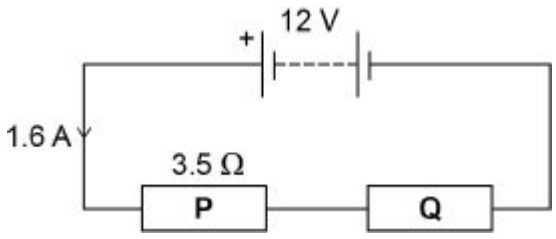
Q1.

(a) Draw a diagram to show how 1.5 V cells should be connected together to give a potential difference of 4.5 V.

Use the correct circuit symbol for a cell.

(2)

A student built the circuit shown in the diagram below.



(b) Calculate the total resistance of the circuit in the diagram above.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

_____

_____

_____

_____

Total resistance = _____ Ω

(2)

(c) The resistance of **P** is 3.5 Ω.

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Calculate the resistance of **Q**.

_____

_____

_____

_____

Resistance of **Q** = _____ Ω

(1)

(d) The student connects the two resistors in the diagram above in parallel.

What happens to the total resistance of the circuit?

Tick **one** box.

It decreases ☐

It increases ☐

It does not change ☐

(1)

Give a reason for your answer.

_____

_____

_____

_____

(1)

(Total 7 marks)

Q2.

(a) Complete the sentence. Choose answers from the box.

charge	**potential difference**	**power**	**temperature**	**time**

The current through an ohmic conductor is directly proportional to the

_____ across the component, provided

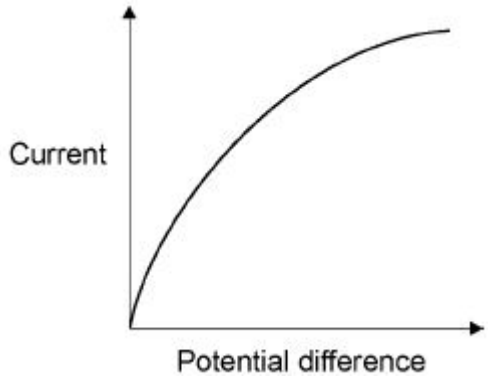
that the _____ remains constant.

(2)

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(b) **Figure 1** shows a current − potential difference graph for a filament lamp.

Figure 1



Explain how the resistance of a filament lamp changes as the potential difference across it increases.

_____

_____

_____

_____

_____

_____

(3)

(c) Many householders are replacing their filament lamps with LED lamps which are more energy efficient.

What does more energy efficient mean?

_____

_____

_____

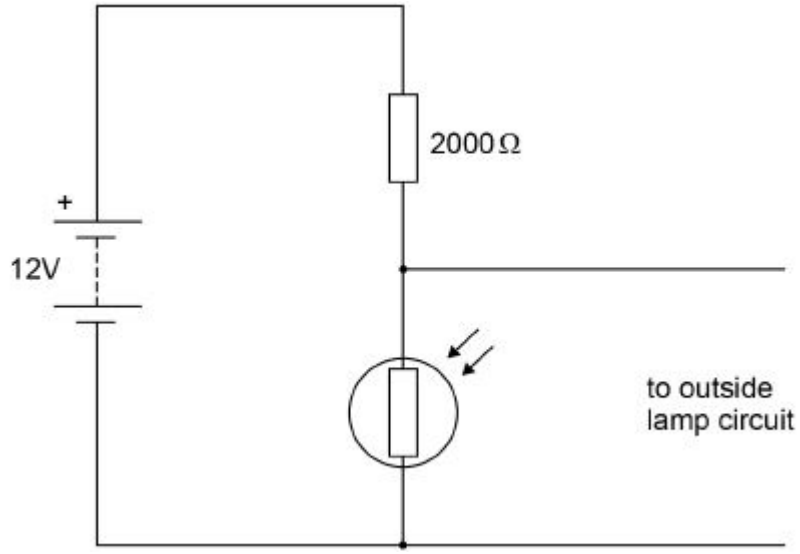
(1)

A Light Dependent Resistor (LDR) is used to turn on an outside lamp when it gets dark.

Part of the circuit is shown in **Figure 2**.

Figure 2

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(d) The light intensity decreases.

What happens to the potential difference across the LDR and the current in the LDR?

Potential difference _____

Current _____

(2)

(e) What is the resistance of the LDR when the potential difference across it is 4 V?

Give a reason for your answer.

Explain your answer.

Resistance = _____ Ω

Reason _____

_____

_____

(2)

(f) Calculate the current through the LDR when the resistance of the LDR is 5000 Ω.

Give your answer to 2 significant figures.

_____

_____

_____

_____

Current = _____ A

(4)

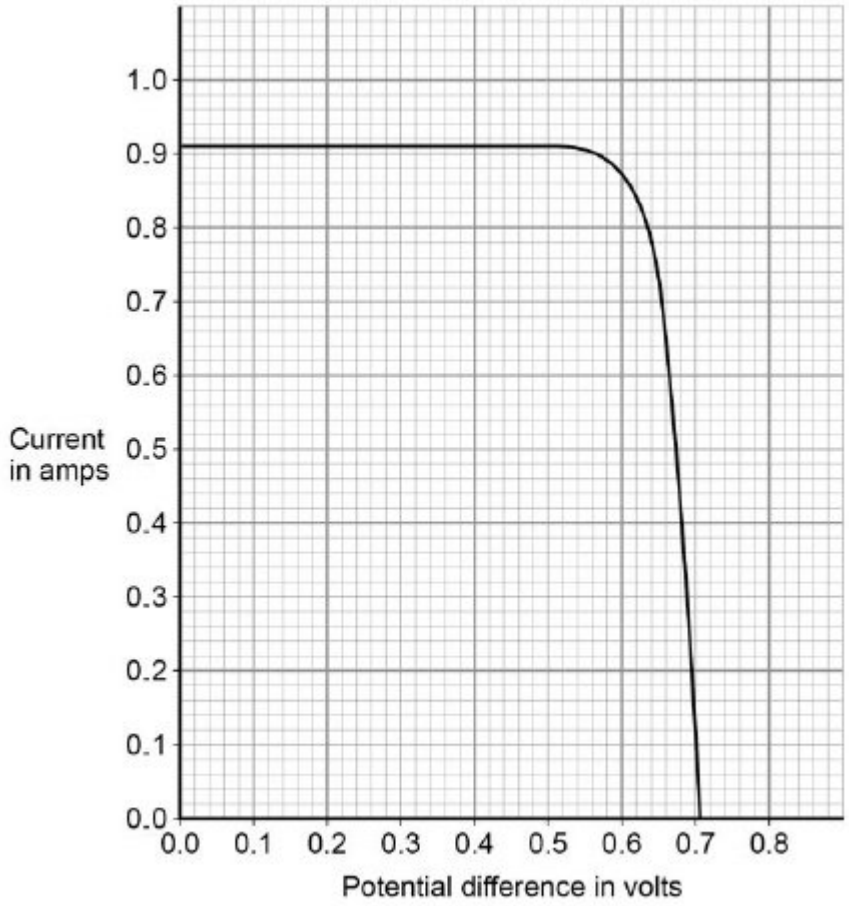
(Total 14 marks)

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Q3.

Figure 1 shows a graph of current against potential difference for a solar cell when light of intensity 450 W/m^2 is incident on it.

Figure 1



(a) Determine the power output of the solar cell when the potential difference is 0.5 V

Use data from **Figure 1**.

_____

_____

_____

_____

_____

Power = _____ W

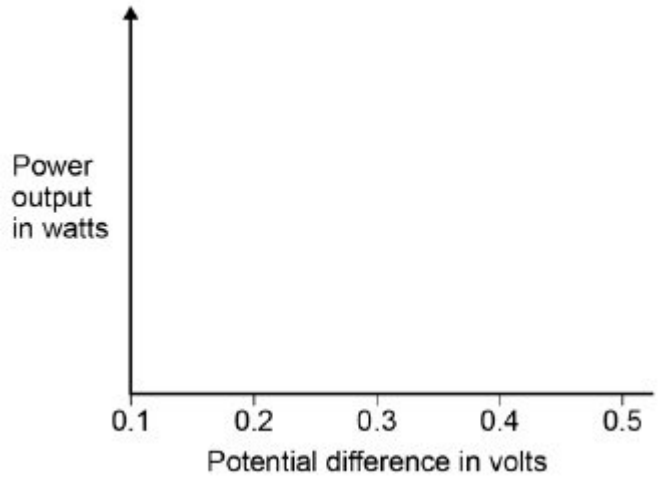
(3)

(b) Draw a sketch graph on **Figure 2** to show how the power output of the solar cell varies with potential difference between 0.1 V and 0.5 V

No values need to be included on the vertical axis.

Figure 2

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(2)

(c) The maximum power output of this solar cell is 0.52 W

When the light intensity is 450 W/m^2 the cell has an efficiency of 0.15 at the maximum power output.

Calculate the area of the solar cell.

_____

_____

_____

_____

_____

_____

Area = _____ m^2

(4)

(d) A householder has four solar cells.

Each of the solar cells has a resistance of 0.78 Ω

Explain how the solar cells should be connected so that the total resistance is as low as possible.

_____

_____

_____

_____

(2)

(Total 11 marks)

Q4.

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The image shows a battery-powered drone.



(a) The battery in the drone can store 97.5 kJ of energy.

When the drone is hovering, the power output of the battery is 65.0 W

Calculate the time for which the drone can hover.

Time = _____ seconds

(3)

(b) The battery powers 4 motors in the drone.

Each motor has a resistance of 1.60 Ω when the power input to each motor is 19.6 W

The 4 motors are connected in parallel with the battery.

Calculate the current through the battery.

Current = _____ A

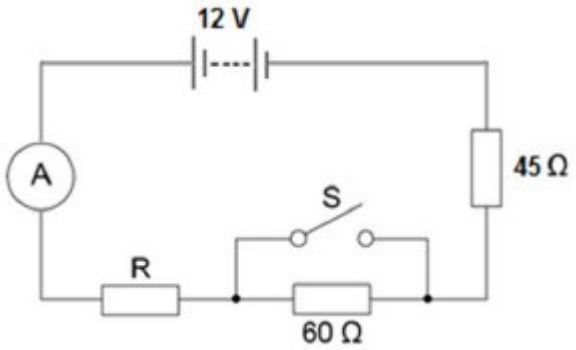
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(4)

(Total 7 marks)

Q5.

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)

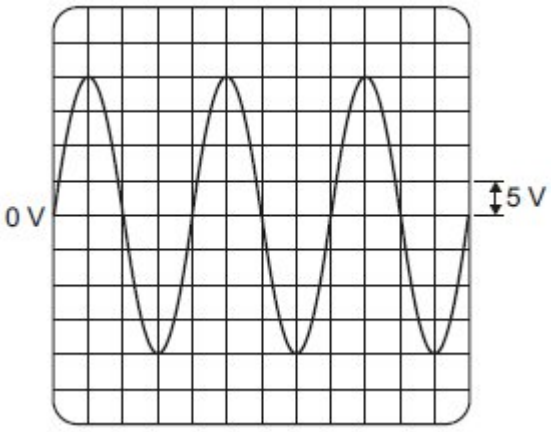
(Total 7 marks)

Q6.

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(a) **Figure 1** shows the oscilloscope trace an alternating current (a.c.) electricity supply produces.

Figure 1



One vertical division on the oscilloscope screen represents 5 volts.

Calculate the peak potential difference of the electricity supply.

_____

Peak potential difference = _____ V

(1)

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

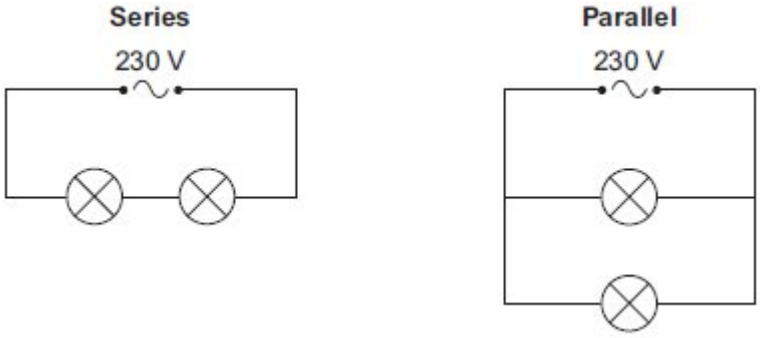
40	**50**	**60**

In the UK, the frequency of the a.c. mains electricity supply is _____ hertz.

(1)

(c) **Figure 2** shows how two lamps may be connected in series or in parallel to the 230 volt mains electricity supply.

Figure 2



(i) Calculate the potential difference across each lamp when the lamps are connected in **series**.

The lamps are identical.

_____

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Potential difference when in series = _____ V

(1)

(ii) What is the potential difference across each lamp when the lamps are connected in **parallel**?

Tick (✔) **one** box.

115 V ☐ 230 V ☐ 460 V ☐

(1)

(iii) Give **one** advantage of connecting the lamps in parallel instead of in series.

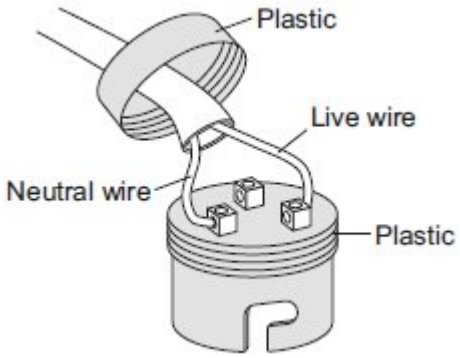
_____

_____

(1)

(d) **Figure 3** shows the light fitting used to connect a filament light bulb to the mains electricity supply.

Figure 3



The light fitting does **not** have an earth wire connected.

Explain why the light fitting is safe to use.

_____

_____

_____

_____

(2)

(e) A fuse can be used to protect an electrical circuit.

Name a different device that can also be used to protect an electrical circuit.

_____

(1)

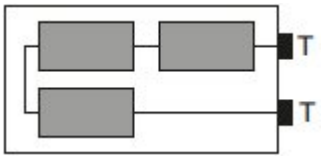
(Total 8 marks)

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Q7.

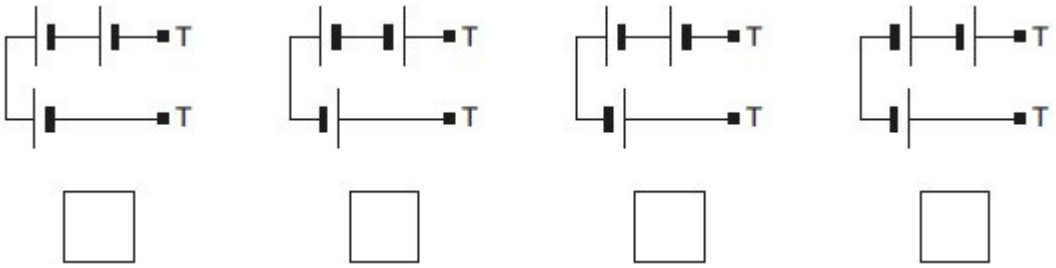
(a) **Figure 1** shows the inside of a battery pack designed to hold three identical 1.5 V cells.

Figure 1



Which **one** of the arrangements shown in **Figure 2** would give a 4.5 V output across the battery pack terminals **T**?

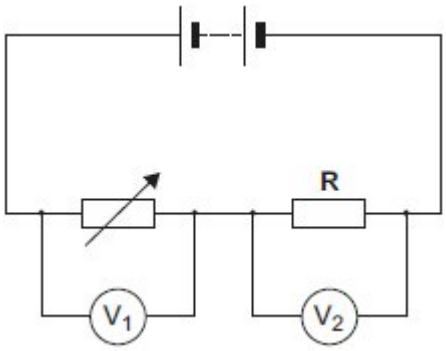
Figure 2



(1)

(b) **Figure 3** shows a variable resistor and a fixed value resistor connected in series in a circuit.

Figure 3



Complete **Figure 3** to show how an ammeter would be connected to measure the current through the circuit.

Use the correct circuit symbol for an ammeter.

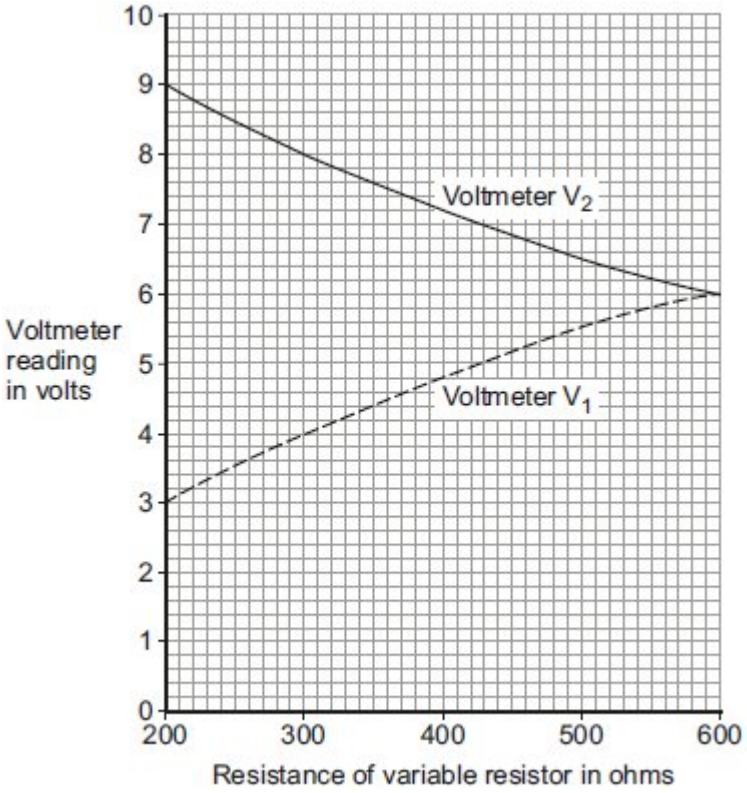
(1)

(c) The variable resistor can be adjusted to have any value from 200 ohms to 600 ohms.

Figure 4 shows how the reading on voltmeter $\mathbf{V_1}$ and the reading on voltmeter $\mathbf{V_2}$ change as the resistance of the variable resistor changes.

Figure 4

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(i) How could the potential difference of the battery be calculated from **Figure 4**?

Tick (✔) **one** box.

9 + 3 = 12 V ☐

9 – 3 = 6 V ☐

9 ÷ 3 = 3 V ☐

Give the reason for your answer.

_____

_____

(2)

(ii) Use **Figure 4** to determine the resistance of the fixed resistor, **R**.

Resistance of R = _____ Ω

Give the reason for your answer.

_____

_____

(2)

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(iii) Calculate the current through the circuit when the resistance of the variable resistor equals 200 Ω.

_____

_____

_____

Current = _____ A

(3)

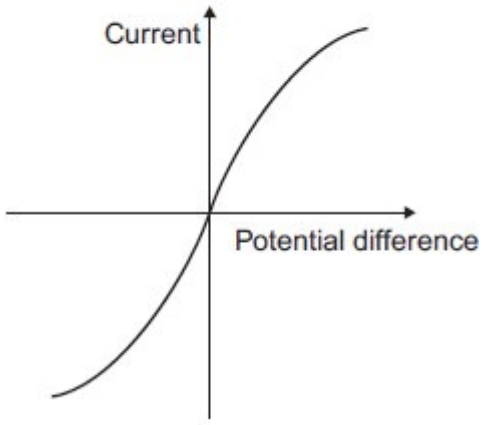
(Total 9 marks)

Q8.

The current in a circuit depends on the potential difference provided by the cells and the total resistance of the circuit.

(a) **Figure 1** shows the graph of current against potential difference for a component.

Figure 1



What is the name of the component?

Draw a ring around the correct answer.

diode **filament bulb** **thermistor**

(1)

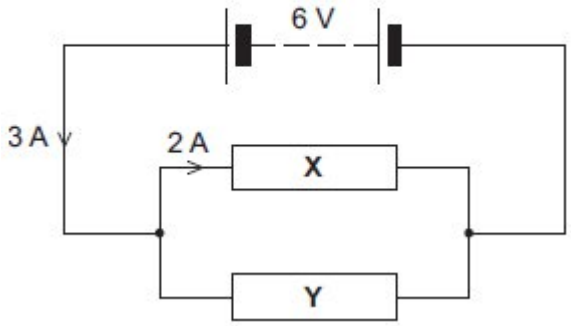
(b) **Figure 2** shows a circuit containing a 6 V battery.

Two resistors, **X** and **Y**, are connected in parallel.

The current in some parts of the circuit is shown.

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Figure 2



(i) What is the potential difference across **X**?

Potential difference across **X** = _____ V

(1)

(ii) Calculate the resistance of **X**.

_____

_____

Resistance of **X** = _____ Ω

(2)

(iii) What is the current in **Y**?

Current in **Y** = _____ A

(1)

(iv) Calculate the resistance of **Y**.

_____

Resistance of **Y** = _____ Ω

(1)

(v) When the temperature of resistor **X** increases, its resistance increases.

What would happen to the:

- potential difference across **X**
- current in **X**
- total current in the circuit?

Tick (✓) **three** boxes.

	Decrease	**Stay the same**	**Increase**
Potential difference across **X**			

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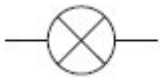
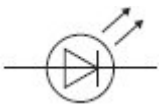
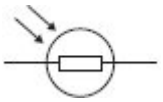
Current in **X**			
Total current in the circuit			

(3)

(Total 9 marks)

Q9.

(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)

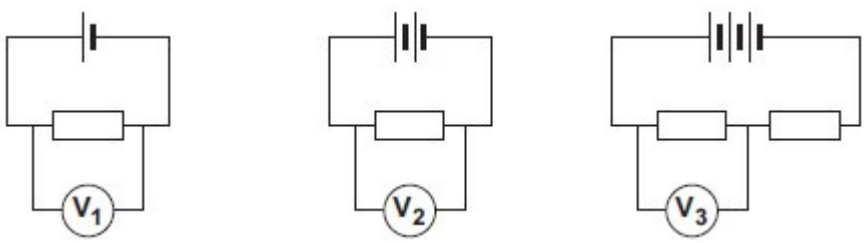
(b) **Figure 1** shows three circuits.

The resistors in the circuits are identical.

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

Figure 1

Circuit 1 **Circuit 2** **Circuit 3**



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(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 $\mathbf{V_2}$.

_____

Voltmeter reading $\mathbf{V_2}$ = _____ V

(1)

(iii) Which voltmeter, $\mathbf{V_1}$, $\mathbf{V_2}$ or $\mathbf{V_3}$, will give the lowest reading?

Draw a ring around the correct answer.

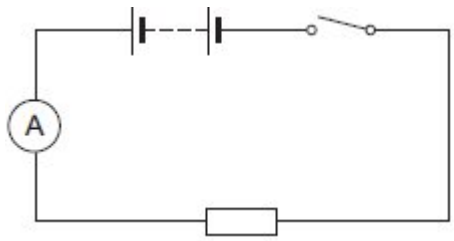
$\mathbf{V_1}$ $\mathbf{V_2}$ $\mathbf{V_3}$

(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.

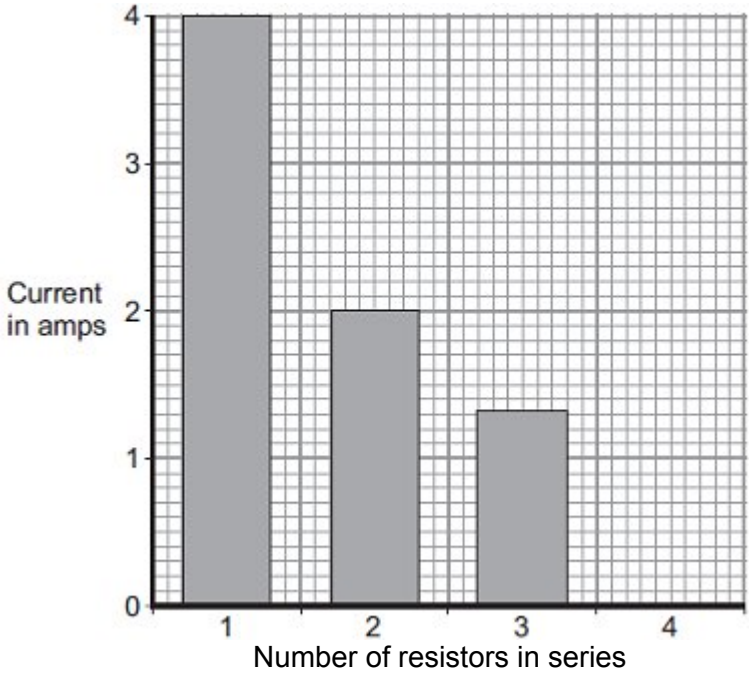
Each time a resistor was added, the student closed the switch and took the ammeter reading.

The student used a total of 4 resistors.

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

Figure 3

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(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?

_____

_____

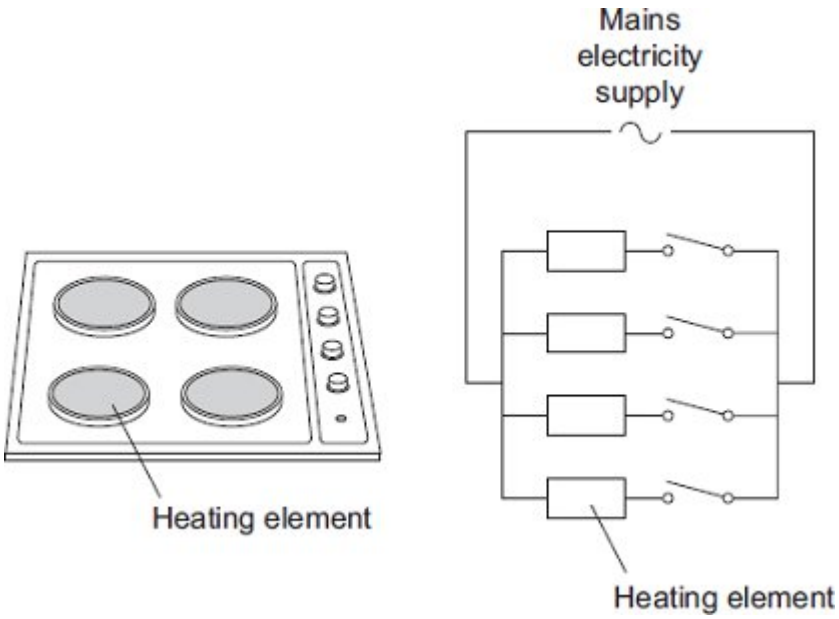
(1)

(Total 10 marks)

Q10.

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.

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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 mm^2 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.

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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?

_____

_____

_____

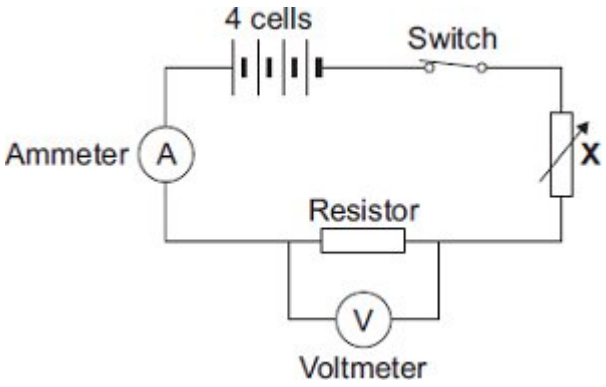
_____

(2)

(Total 7 marks)

Q11.

(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.

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light-dependent resistor **thermistor** **variable resistor**

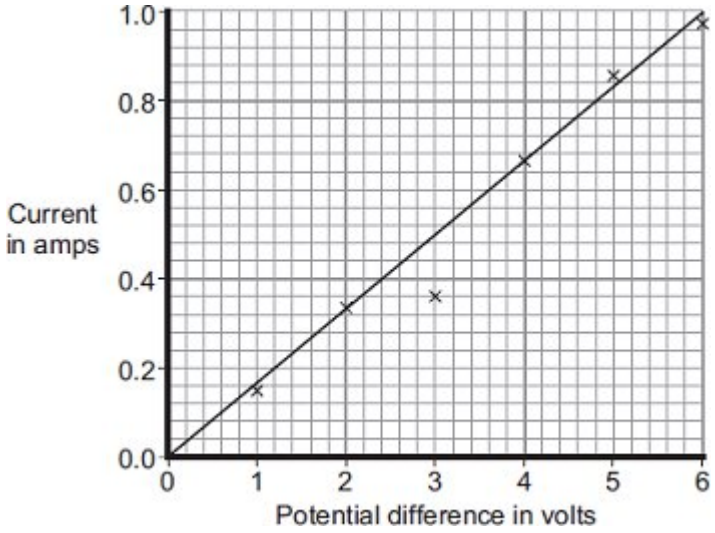
(1)

(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?

_____

_____

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(1)

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

_____

_____

(1)

(Total 7 marks)

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