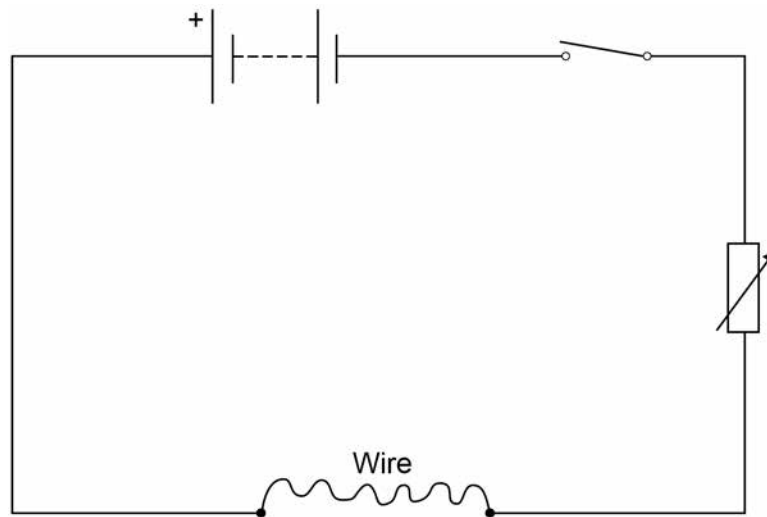


0 3

A student investigated how the resistance of a piece of nichrome wire varies with length.

Figure 3 shows part of the circuit that the student used.

Figure 3



0 3 . 1

Complete **Figure 3** by adding an ammeter and a voltmeter.

Use the correct circuit symbols.

[3 marks]

Turn over ►



0 3 . 4

The student used crocodile clips to make connections to the wire.

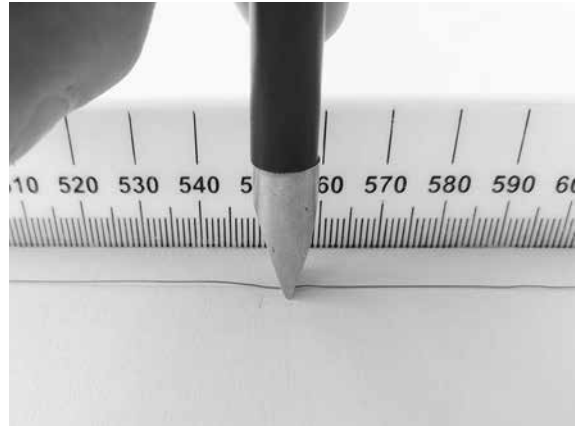
They could have used a piece of equipment called a 'jockey'.

Figure 4 shows a crocodile clip and a jockey in contact with a wire.

Figure 4



Crocodile clip



Jockey

How would using the jockey have affected the accuracy and resolution of the student's results compared to using the crocodile clip?

Tick **two** boxes.

[2 marks]

The accuracy of the student's results would be higher.

The accuracy of the student's results would be lower.

The accuracy of the student's results would be the same.

The resolution of the length measurement would be higher.

The resolution of the length measurement would be lower.

The resolution of the length measurement would be the same.



0 5 . 1 Complete the sentence. Choose answers from the box.

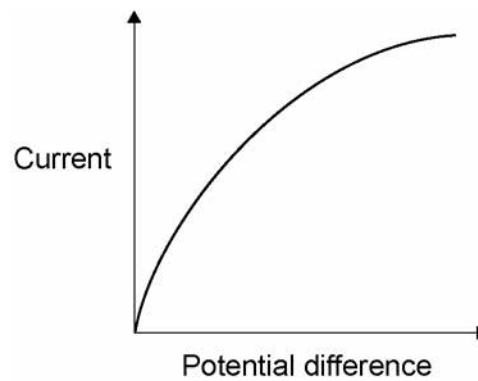
[2 marks]

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.

0 5 . 2 **Figure 7** shows a current – potential difference graph for a filament lamp.

Figure 7



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

[3 marks]



0	5	.	3
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Many householders are replacing their filament lamps with LED lamps which are more energy efficient.

What does more energy efficient mean?

[1 mark]

Question 5 continues on the next page

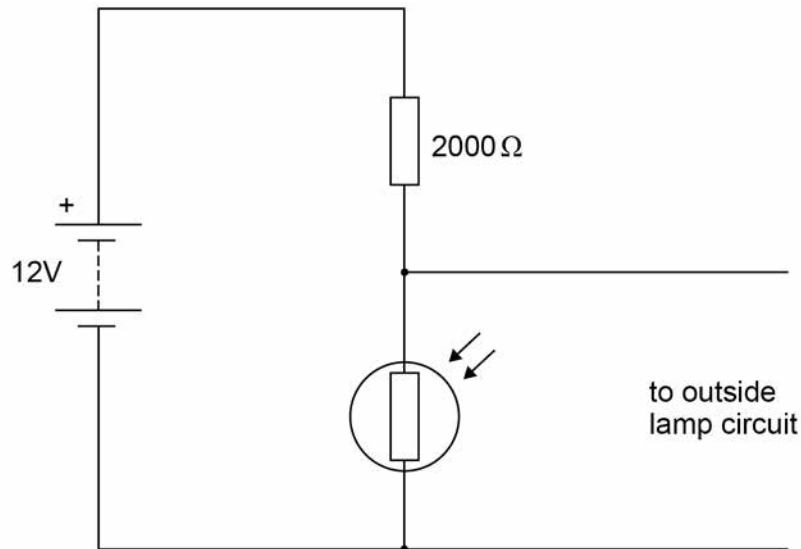
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A Light Dependent Resistor (LDR) is used to turn on an outside lamp when it gets dark.

Part of the circuit is shown in **Figure 8**.

Figure 8



0 5 . 4 The light intensity decreases.

What happens to the potential difference across the LDR and the current in the LDR? **[2 marks]**

Potential difference _____

Current _____

0 5 . 5 What is the resistance of the LDR when the potential difference across it is 4 V?

Give a reason for your answer.

[2 marks]

Resistance = _____ Ω

Reason _____



0	5	.	6
---	---	---	---

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

Give your answer to 2 significant figures.

[4 marks]

Current = _____ A

14

Turn over for the next question

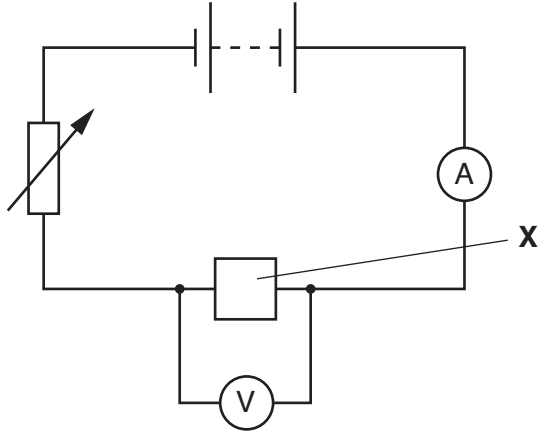
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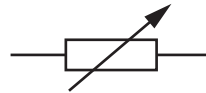
10
SECTION B

Answer **all** the questions.

16 A student builds a circuit to investigate the resistance of component **X**.



(a) (i) What is the name of this component?



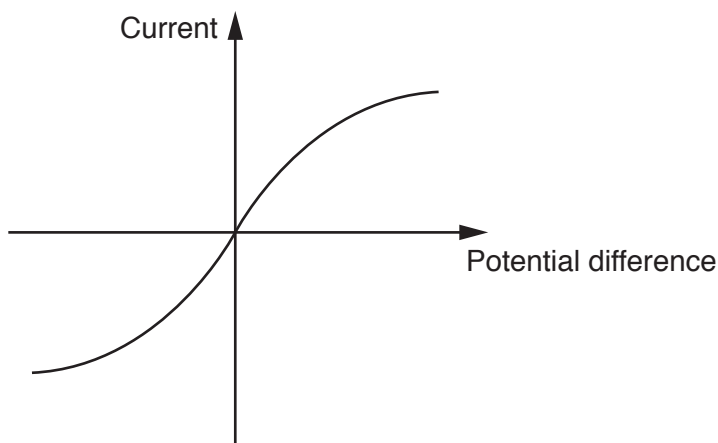
..... [1]

(ii) Why is this component needed in this circuit?

..... [1]

(b) The student uses the circuit to take current and potential difference readings.

The student plots a graph of her results.



(i) Look at the graph. What is component **X** in the circuit?

..... [1]

(ii) The resistance of component **X** varies as the potential difference changes.

Describe how the graph shows this and explain why this happens.

.....
.....
.....
..... [3]

(c) Component **X** has a resistance of $16\ \Omega$ when a current of 0.25A flows.

(i) Calculate the potential difference across component **X**.

Use the equation: Potential difference = Current \times Resistance

Answer = V [2]

(ii) Calculate the power of component **X** when a current of 0.25A flows.

Answer = W [3]

Question	Answers	Extra information	Mark	AO/ Spec. Ref
03.1	ammeter and voltmeter symbols correct		1	AO1 4.2.1.1 4.2.1.3
	voltmeter in parallel with wire		1	
	ammeter in series with wire		1	
03.2	Level 3: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	AO1 4.2.1.3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.		3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	
	No relevant content		0	
	<p>Indicative content:</p> <ul style="list-style-type: none"> • length measured • length varied • current measured • potential difference measured • repeat readings • calculate resistance for each length • resistance = $\frac{\text{potential difference}}{\text{current}}$ • plot a graph of resistance against length <ul style="list-style-type: none"> • hazard: high current • may cause wire to melt / overheat • may cause burns (to skin) • use low currents 			

Question	Answers	Extra information	Mark	AO/ Spec. Ref
03.3	the temperature of the wire would not change		1	AO3 4.2.1.3
03.4	the accuracy of the student's results would be higher		1	AO3 4.2.1.3
	the resolution of the length measurement would be higher		1	
Total			12	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
05.1	potential difference	in this order only	1	AO1 4.2.1.4
	temperature	allow p.d. allow voltage	1	
05.2	the current increases (when the potential difference increases)		1	AO1 4.2.1.4
	(which) causes the temperature of the filament to increase		1	
	(so) the resistance increases	do not accept resistance increases and then levels off	1	
05.3	a higher proportion / percentage of the (total) power / energy input is usefully transferred or higher (useful) power / energy output for the same (total) power / energy input	wastes less energy is insufficient	1	AO2 4.1.2.2
05.4	potential difference increases		1	AO2 4.2.2
	current decreases		1	AO1 4.2.2
05.5	1000 (Ω)	reason only scores if $R = 1000 (\Omega)$	1	AO2 4.2.1.3
	potential difference is shared in proportion to the resistance	allow a justification using a correct calculation	1	

Question	Answers	Extra information	Mark	AO/ Spec. Ref
05.6	$12 = I \times 7000$	an answer of 1.7×10^{-3} (A) scores 4 marks	1	AO2 4.2.1.3
	$I = \frac{12}{7000}$		1	
	$I = 1.71 \times 10^{-3}$ (A)	an answer that rounds to 1.7×10^{-3} (A) scores 3 marks	1	
	$I = 1.7 \times 10^{-3}$ (A) or $I = 0.0017$ (A)	this answer only	1	
		an answer of 2.4×10^{-3} (A) scores 2 marks if no other marks scored allow 1 mark for calculation of total resistance (7000 Ω)		
Total			14	

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	variable resistor ✓	1	1.2	ALLOW rheostat IGNORE potentiometer
		(ii)	Control / change / vary / increase / decrease / AW the resistance / current in the circuit ✓	1	1.2	DO NOT ALLOW merely 'changes the voltage or changes p.d.' BUT ALLOW: changes the potential difference or voltage across (component) X
	(b)	(i)	(filament) bulb / lamp ✓	1	3.2a	
		(ii)	gradient / slope (of graph) changes (as potential difference / voltage changes) ✓ idea of increasing resistance (with more p.d.) / ORA ✓ idea of increasing temperature / AW ✓	3	3.1a 1.2 2.2	ALLOW 'graph / line / slope levels off' / non-linear } Resistance increases with greater temperature ✓✓
	(c)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 4 (V) award 2 marks 0.25 x 16 ✓ 4 (V) ✓	2	 2.1 2.1	
		(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 1 (W) award 3 marks P = IV ✓ P = 0.25 x 4 ✓ P = 1 (W) ✓ OR P = I ² R ✓ P = 0.25 ² x 16 ✓ P = 1 (W) ✓	3	 1.2 2.1 2.1 1.2 2.1 2.1	ALLOW e.c.f. from part ci