

Combined Science - Physics - Key Stage 4 - Electricity

Review of Electrical Circuits Worksheet

Miss Walrond



Q1.

(a) George draws a current-voltage graph for five different ohmic conductors.

Look at point X on the graph for conductor B.

i. Complete the sentences.

The voltage at X is volts.

The current at X is amps.

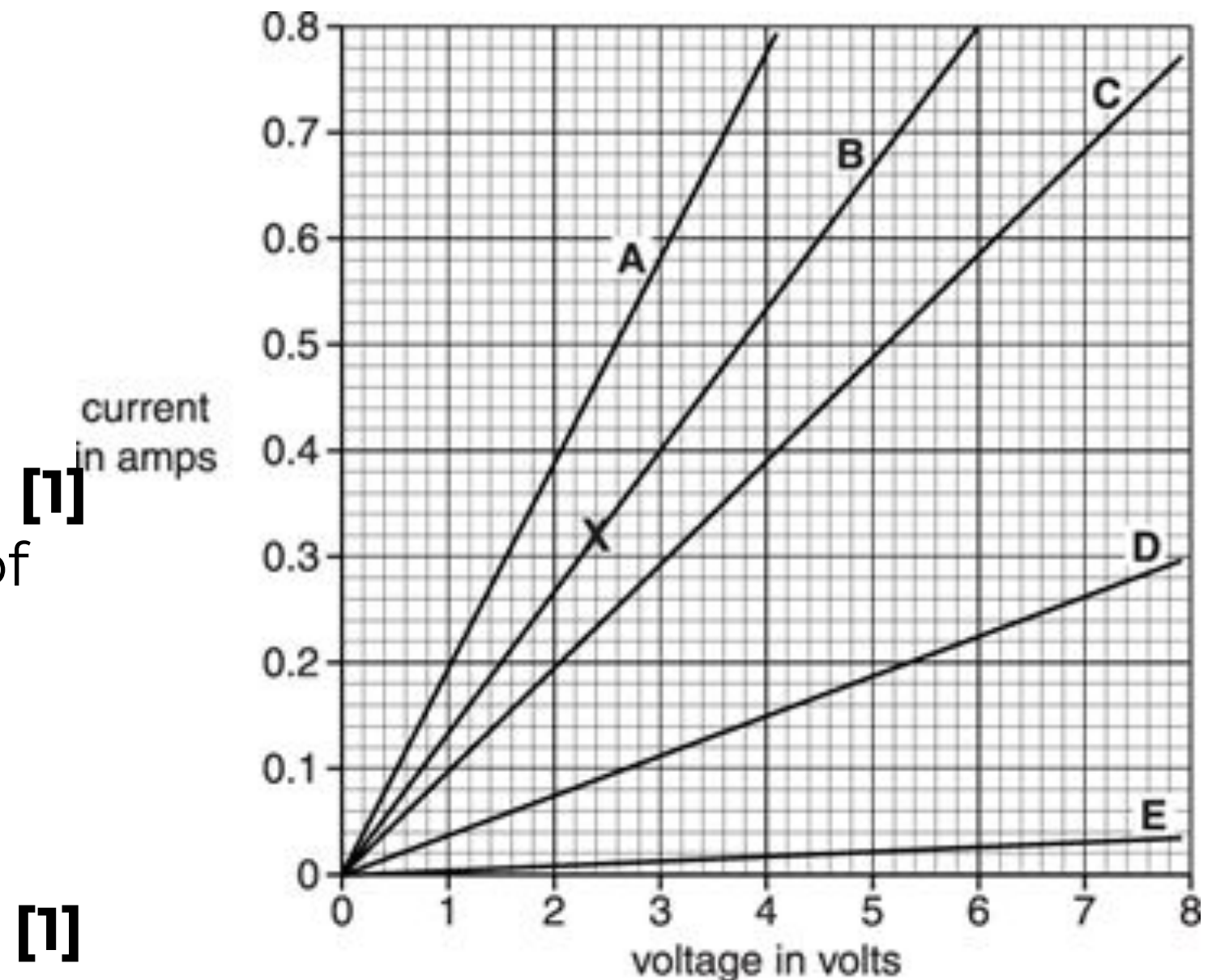
ii. Use your answers from (i) to calculate the resistance of conductor B.

Choose from

0.13 ohms 0.77 ohms 2.72 ohms 7.50 ohms

iv. answer

OCR, Gateway Physics A, Paper B752/01, June 2014.



Q1.

(b). Ohmic conductors obey Ohm's Law.

Complete the sentence.

All five conductors are ohmic because the lines pass through the origin and
.....[1]



Q2.

A component in a circuit is a thermistor.

Tanya measures the resistance of this thermistor at different temperatures.

Describe, in detail, how the resistance of this thermistor varies with temperature.

Temperature in °C	Resistance in ohms
15	15.8
20	12.4
25	10.0
30	8.0
35	6.5
40	5.3

[2]

OCR, Gateway Physics A, Paper B752/02, June 2017.



Q3.

Susan builds a circuit with three resistors in series.

i. Here are statements about the current in the circuit.
Put a tick in the box next to the correct statement

There is no current in the circuit.

☐

The largest current is in the $3\text{ k}\Omega$ resistor.

☐

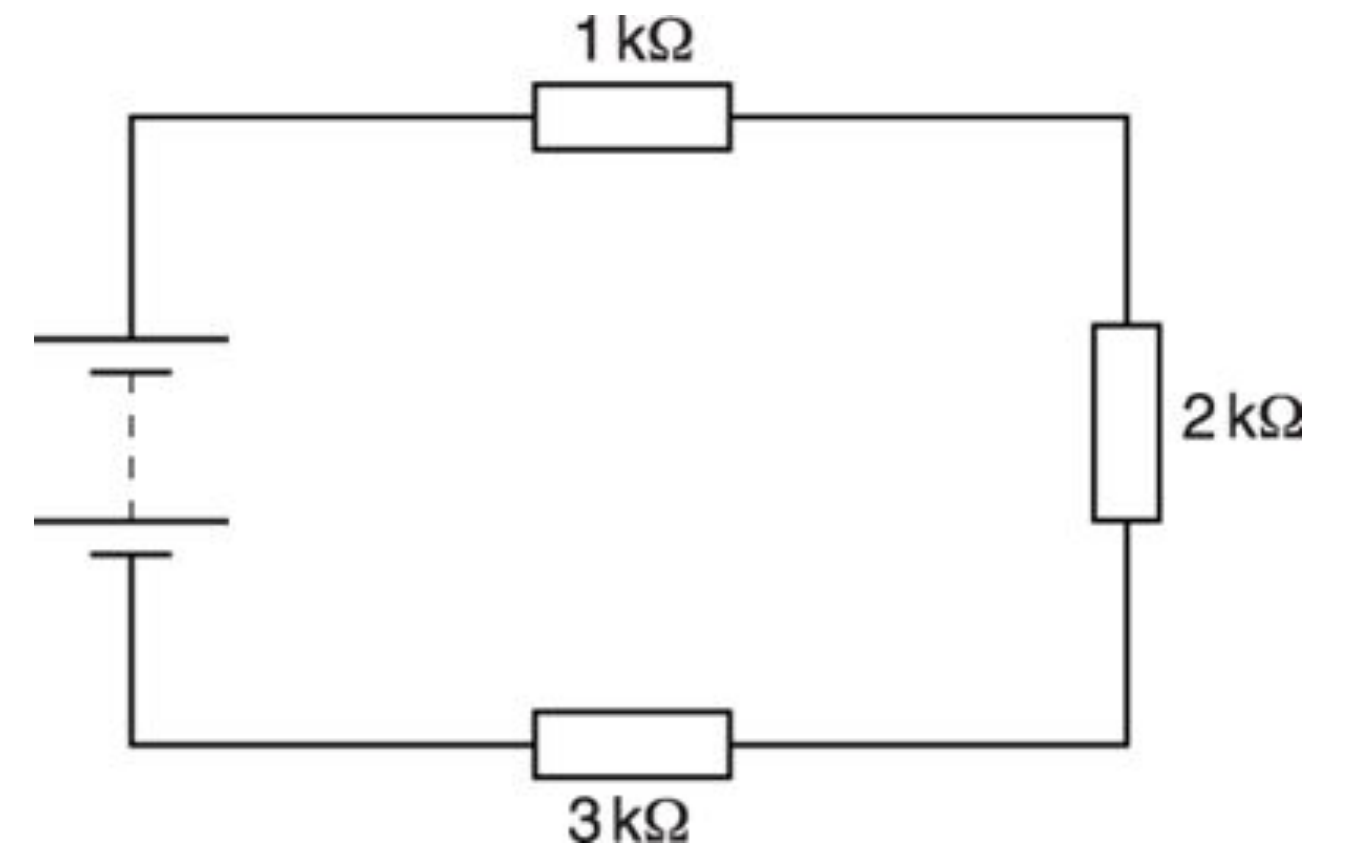
The smallest current is in the $3\text{ k}\Omega$ resistor.

☐

The current is the same in all three resistors.

☐

[1]

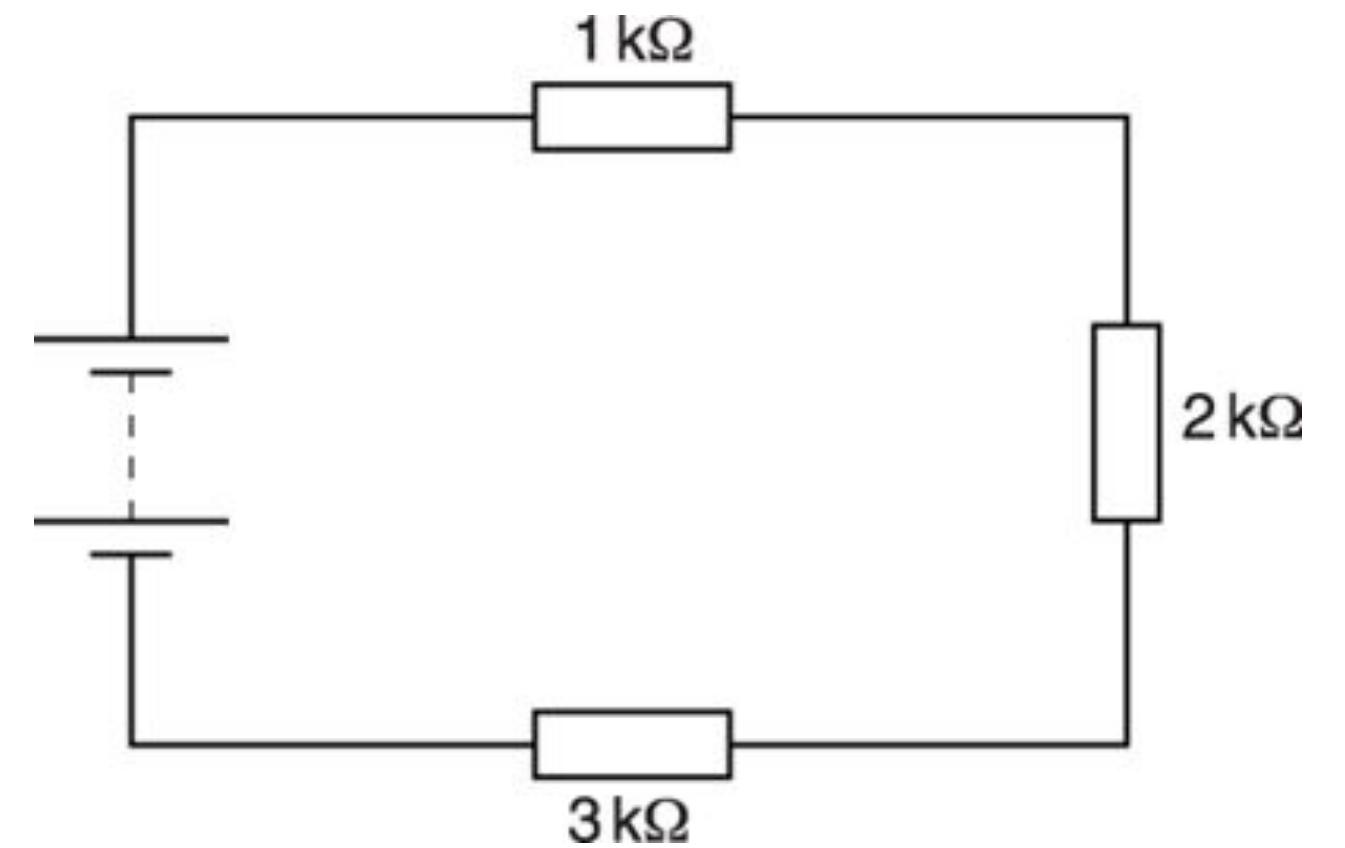


Q3.

Susan builds a circuit with three resistors in series.

ii. Which resistor has the largest voltage across it?

iii. Justify your answer.



[2]



Q4.

Pat and Chris set up an experiment to find the relationship between the current and voltage for a filament lamp.

When they increase the voltage, the lamp glows brighter.

They record the voltage across the lamp for different values of the current.

Here are their results:

Voltage (V)	0	1.0	2.3	4.2	8.0
Current (A)	0	0.20	0.40	0.60	0.80

Pat says: 'There is no correlation between the voltage and the current.'

Chris says: 'The resistance of the lamp filament does not change because it is the same piece of wire all the time.'

Comment on their statements.

Use the data to justify your answer.

 *The quality of written communication will be assessed in your answer.*

OCR, Twenty First Century Physics B, Paper A182/02, June 2015.

[6]



Q5.

(a) Judy is investigating three different electrical components, A, B and C. She changes the temperature of each component and measures the resistance. She then changes the amount of light on each component and measures the resistance.

Use the data to decide what type of component A, B and C are.

component A
.....

component B
.....

component C
.....

Temperature in °C	Resistance in Ω		
	component A	component B	component C
0	403	52	101
10	199	50	98
20	100	49	102
30	53	51	100
40	26	51	99
50	13	50	98
60	6	48	100

Light intensity in lux	Resistance in Ω		
	component A	component B	component C
0	101	76	102
100	100	50	101
200	102	32	99
300	98	21	98
400	99	14	101
500	101	19	102
600	102	8	101

OCR, Twenty First Century Physics B, Paper A182/02, June 2013.

[3]



Q5.

(b). Complete the following table to show whether each statement about Judy's experiment is **true**, **false** or you **cannot tell**.

Put ticks (✓) in the correct boxes. [4]

Temperature in °C	Resistance in Ω		
	component A	component B	component C
0	403	52	101
10	199	50	98
20	100	49	102
30	53	51	100
40	26	51	99
50	13	50	98
60	6	48	100

Light intensity in lux	Resistance in Ω		
	component A	component B	component C
0	101	76	102
100	100	50	101
200	102	32	99
300	98	21	98
400	99	14	101
500	101	19	102
600	102	8	101

	True	False	Cannot tell
Judy repeated her tests three times.			
Judy had an outlier in her results in the temperature experiment.			
Judy had an outlier in her results in the light intensity experiment.			
The temperature in the light intensity experiment was approximately 20°C.			
The light intensity in the temperature experiment was approximately 200 lux.			

OCR, Twenty First Century
Physics B, Paper A182/02, June
2013.



Answers



Q1. & Q2. Answers

- | | |
|---|---|
| 1. a. i. The voltage at X is 2.4 volts. | 1 |
| ii. The current at X is 0.32 amps. | 1 |
| b. ... are all straight lines. | 1 |
| 2. As temperature increases the resistance decreases. | 1 |
| The change in resistance decreases as the temperature increases | 1 |



Q3. Answers

3. a. i. The current is the same in all three resistors.

1

ii. 3 kilohms ($3\text{ k}\Omega$)

1

iii. The largest resistance

1



Q4. Answers

(5-6 marks): Valid comment on Pat's statement **and** on Chris's statement, with use of data to justify **both** of the comments:

- Pat is wrong
- Larger voltage gives a larger current
- There is a correlation as both increase
- Not linear
- Would not give a straight line graph
- E.g. between 4.2 and 8.0 V the current should nearly double and it does not.
- Chris is wrong
- Use of $V=IR$ to show that resistance increases with current.
- Lamp filament gets hotter
- A hotter wire has more resistance.



Q4. Answers

(3-4 marks) Validate comment on Pat's statement **and** on Chris's statement with use of data to justify one of the comments.

- Pat is wrong
- Larger voltage gives a larger current
- There is a correlation as both increase
- Not linear
- Would not give a straight line graph
- E.g. between 4.2 and 8.0 V the current should nearly double and it does not.
- Chris is wrong
- Use of $V=IR$ to show that resistance increases with current.
- Lamp filament gets hotter
- A hotter wire has more resistance.



Q4. Answers

(1-2 marks) Valid comment on Pat's statement and on Chris's statement.

- Pat is wrong
- Larger voltage gives a larger current
- There is a correlation as both increase
- Not linear
- Would not give a straight line graph
- Chris is wrong
- Lamp filament gets hotter
- A hotter wire has more resistance.



Q5. Answers

- a. Component A - thermistor

1
- Component B - LDR

1
- Component C - resistor (fixed)

1
- b. 5 rows correct = 4 marks, 4 rows correct = 3 marks, 3 rows correct = 2 marks, 1 or 2 rows correct = 1 mark

	True	False	Cannot tell
Judy repeated her tests three times.			✓
Judy had an outlier in her results in the temperature experiment.		✓	
Judy had an outlier in her results in the light intensity experiment.	✓		
The temperature in the light intensity experiment was approximately 20 °C.	✓		
The light intensity in the temperature experiment was approximately 200 lux.		✓	



In lesson questions



Independent Task - Current, Potential Difference & Resistance

	Symbol	Unit of measure	Definition	Equation
Current		Amp, A		
Potential Difference	V			$E = QV$
Resistance			The opposition to the flow of current	



Independent Task - Examination Question

The rate of flow of electrical charge in a circuit is a current.

A current of 40 mA transfers a charge of 3.6 C.


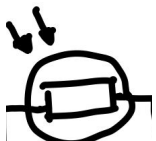
Calculate how long this takes.

Show your working.

answer: seconds **[3]**



Independent Task: Components

Component	Circuit Symbol	Description
Wire		Electrical conductor, ohmic
Resistor		Limits the flow of current
Filament lamp		Has a thin wire that heats up when a current flows and emits light.
Diode		
LED		
LDR		
Thermistor		



Independent Task - Examination Question

Vic has a sealed box containing an electronic component.

The box has lost its label.

He connects a circuit containing the component in the box.

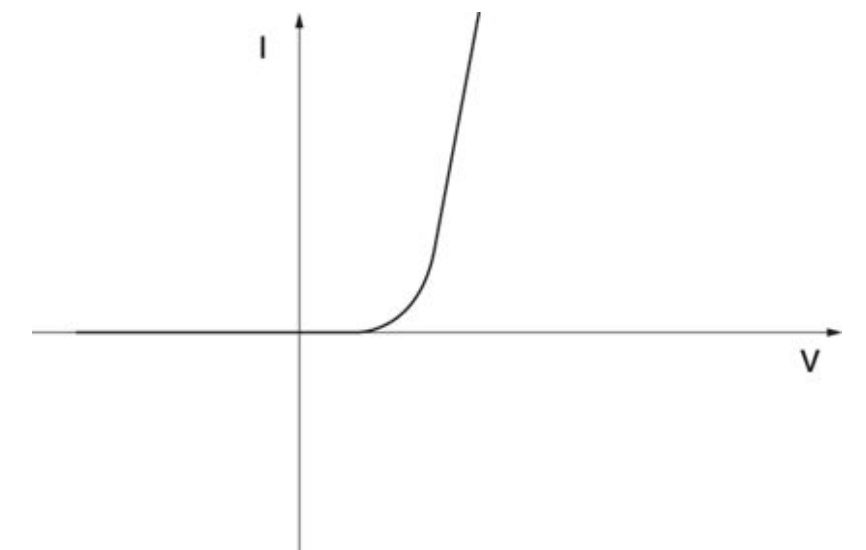
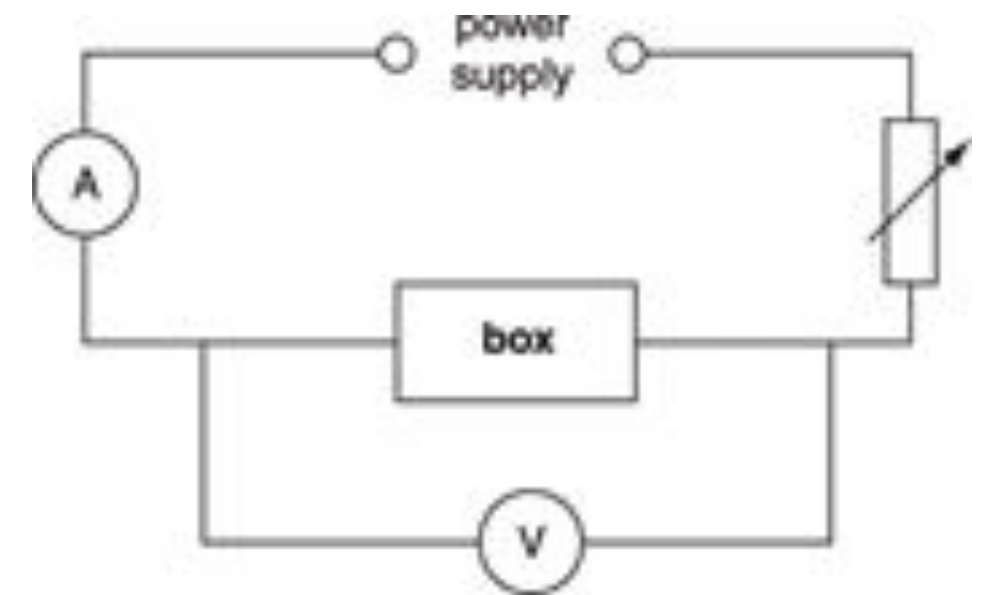
He changes the voltage across the box and measures the current.

Look at the graph of his measurements.

Write down the name of the component in the box.

.....

Explain your answer, using ideas about resistance.



[2]

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Worked Example 1

Pat connects three resistors in a circuit.

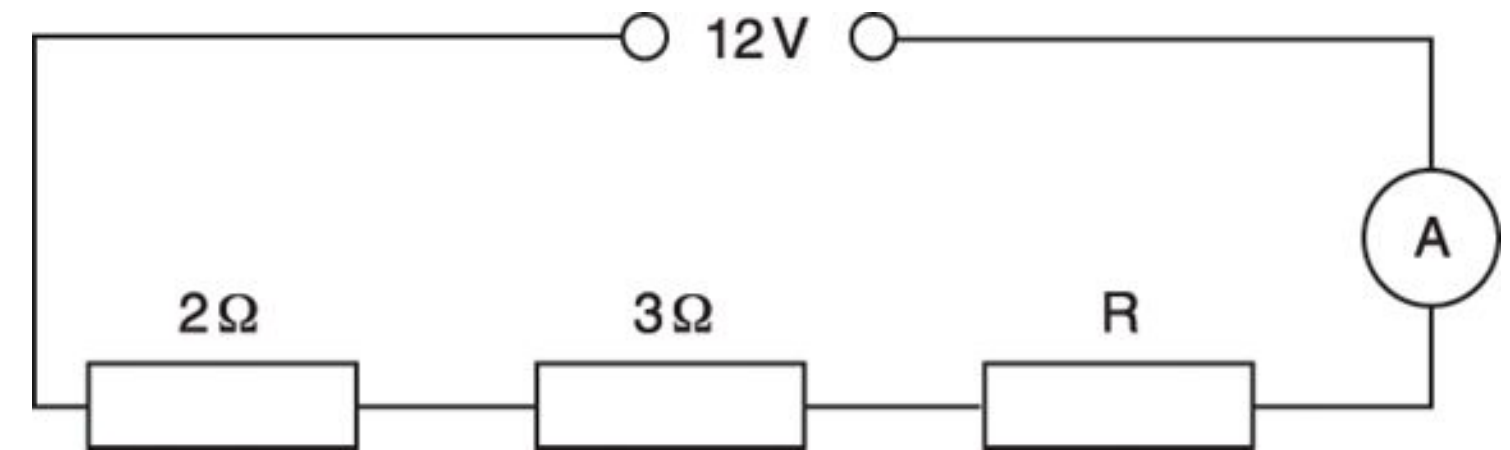
The supply voltage is 12 V.

The reading on the ammeter is 1.5 A.

i. Calculate the total resistance in the circuit.

answer **[2]**

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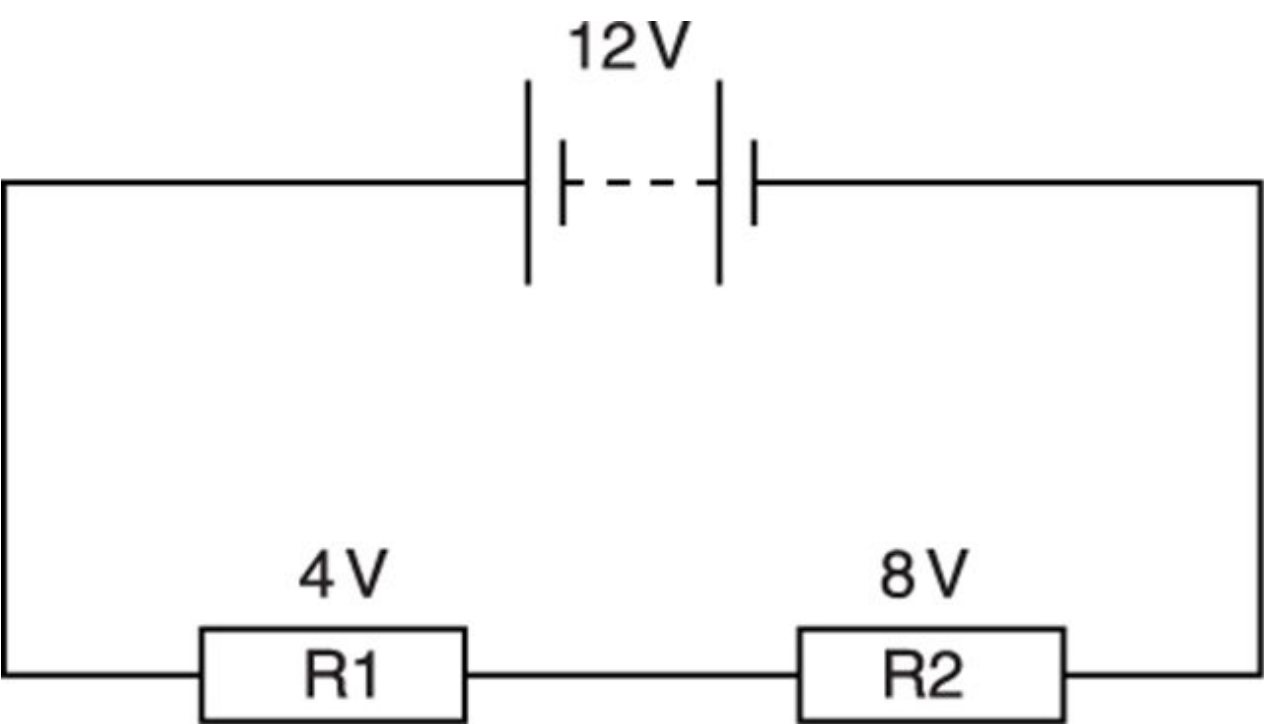
ii. Calculate the value of R .

answer **[1]**

Answers as discussed in the next slide
have not been seen or verified by
OCR.



Worked Example 2



Pairs of resistors	R1 in Ω	R2 in Ω
A	50	200
B	50	100
C	50	50
D	50	25

Kevin needs to split the output of a 12 V battery between resistor R1 and resistor R2.

He needs 4 V across R1 and 8 V across R2.
He has four different pairs of resistors, **A**, **B**, **C** and **D** to choose from.

Which pair of resistors, **A**, **B**, **C** or **D**, should he use?

.....

Explain your answer.

Answers as discussed in the next slide have not been seen or verified by OCR.

[2]



Worked Example 3

Look at the circuit diagram.

Use the formula **resistance = potential difference \div current** to calculate the resistance of bulb D.

A. $2\ \Omega$

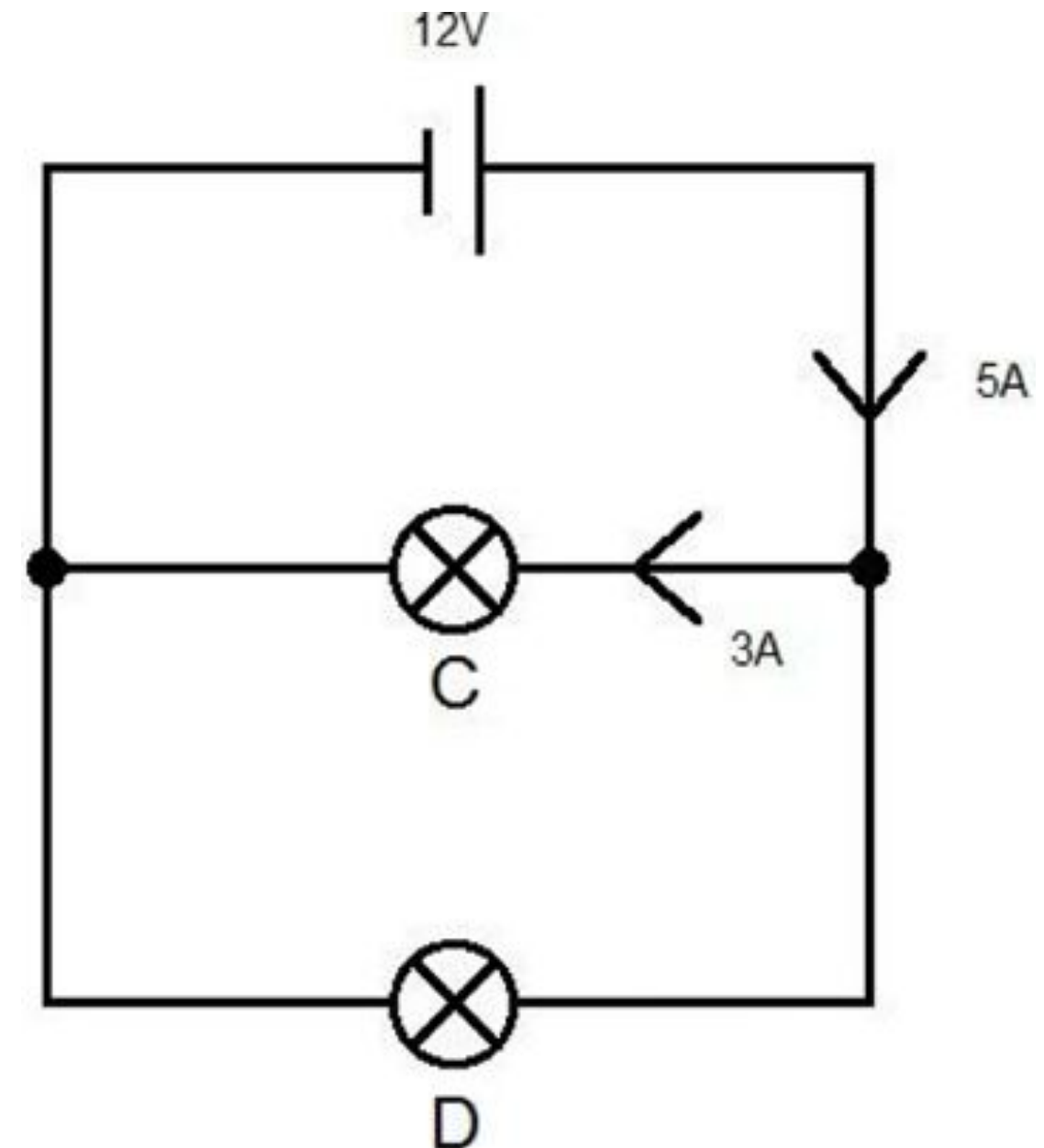
B. $4\ \Omega$

C. $6\ \Omega$

D. $8\ \Omega$

Your answer

[1]



Answers as discussed in the next slide have not been seen or verified by OCR.



Answers



Review: Independent Task - Current, Potential Difference & Resistance

	Symbol	Unit of measure	Definition	Equation
Current	I	Amp, A	The flow of charge	$Q = It$
Potential Difference	V	Volt, V	The electrical work done by each coulomb of charge	$E = QV$
Resistance	R	Ohm, Ω	The opposition to the flow of current	$V = IR$



Independent Task - Examination Question

The rate of flow of electrical charge in a circuit is a current.

A current of 40 mA transfers a charge of 3.6 C.

Calculate how long this takes.

Show your working.

Conversion of mA to A: $40\text{mA} = 0.04\text{ A}$ [1]

Use of $Q=It$





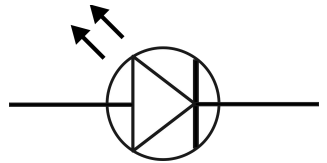
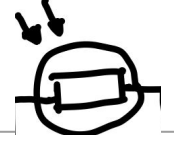

$t = 3.6/0.04$ [1]

$t = 90\text{ seconds}$ [1]

answer: seconds **[3]**



Review - Independent Task: Components

Component	Circuit Symbol	Description
Wire		Electrical conductor, ohmic
Resistor		Limits the flow of current
Filament lamp		Has a thin wire that heats up when a current flows and emits light.
Diode		Only allows current to flow in one direction
LED		Only allows current to flow in one direction and emits light
LDR		As light intensity increases, resistance decreases
Thermistor		As temperature increases, resistance decreases



Review: Independent Task - Examination Question

1. Diode

Has a high resistance in one direction and a low resistance in the other direction.

