

GCSE Combined Science: Trilogy

Worksheet: Current, resistance and potential difference

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Current, resistance and potential difference

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

A student investigates how the length of a wire affects its resistance, using a length of nichrome wire taped to a metre ruler, a low-voltage power supply, an ammeter and a voltmeter connected with crocodile clips.

0 1 . 1

Write a hypothesis for this investigation.

.....

.....

[1 mark]

0 1 . 2

Identify the independent variable and the dependent variable, and state one variable that must be controlled.

.....

.....

.....

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.....

.....

[3 marks]

0 1 . 3

Explain why the variable you named must be controlled.

.....

.....

.....

.....

[2 marks]

0 1 . 4

Give one hazard in this investigation and a suitable control measure.

.....

.....

.....

.....

[2 marks]

0 2

The current in the coil of an electromagnet is 1.5 A. The resistance of the coil is 8 Ω .

0 2 . 1

Calculate the potential difference across the coil.

Use the equation:

potential difference = current $\times$ resistance

.....

.....

.....

.....

Potential difference = V

[2 marks]

0 3

A resistor is connected to a battery.

0 3 . 1

What is the unit of resistance?

Tick (✓) **one** box.

ampere

☐

ohm

☐

volt

☐

watt

☐

[1 mark]

0 3 . 2

The current in the resistor is 0.50 A. The resistance of the resistor is 12 Ω .

Calculate the potential difference across the resistor.

Use the equation:

potential difference = current $\times$ resistance

.....

.....

.....

.....

Potential difference = V

[2 marks]

0 3 . 3

The resistor is replaced with a resistor that has a greater resistance. The potential difference across it stays the same.

What happens to the current in the resistor?

Tick (✓) **one** box.

It decreases.

☐

It increases.

☐

It stays the same.

☐

[1 mark]

0 4

0 4 . 1

Which quantity is calculated by dividing potential difference by current?

Tick (✓) **one** box.

Charge

☐

Energy

☐

Power

☐

Resistance

☐

[1 mark]

0 4 . 2

A current of 0.20 A flows through a component of resistance 25 Ω .

Calculate the potential difference across the component.

Use the equation:

potential difference = current $\times$ resistance

.....

.....

.....

.....

Potential difference = V

[2 marks]

0 5

The potential difference across the heating element of a kettle is 230 V. The resistance of the heating element is 29 Ω .

0 5 . 1

Calculate the current in the heating element.

.....

.....

.....

.....

.....

Current = A

[3 marks]

0 6

A student has two $10\ \Omega$ resistors and wants to investigate the combined resistance when they are connected first in series and then in parallel.

0 6 . 1

Describe how the student could measure the combined resistance of the two resistors when they are connected in series.

[2 marks]

0 6 . 2

State how you would expect the parallel combined resistance to compare with the series combined resistance.

[1 mark]

0 7

A student investigated how the resistance of a wire depends on its length.

The wire was fixed along a metre ruler. The student used crocodile clips to connect different lengths of the wire into a circuit containing a power supply, an ammeter and a voltmeter.

Table 1 shows the results.

Table 1

Length of wire in cm	Potential difference in V	Current in A	Resistance in Ω
20	0.60	0.50	1.2
40	1.15	0.48	
60	1.62	0.45	3.6
80	2.06	0.43	4.8
100	2.40	0.40	6.0

0 7 . 1

Calculate the resistance of the 40 cm length of wire.

Give your answer to 2 significant figures.

.....

.....

.....

.....

Resistance = Ω

[2 marks]

0 7 . 2

Describe the relationship between the length of the wire and its resistance.

Use data from Table 1 in your answer.

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[2 marks]

0 7 . 3

The student switched off the power supply between readings.
Explain why.

.....

.....

.....

.....

[2 marks]

0 7 . 4

Give **one** other control variable in this investigation.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Current, resistance and potential difference · 30 marks

Question 1 (8 marks)

01.1 [1 mark]

Answer: The longer the wire, the greater its resistance (resistance is directly proportional to length).

- the longer the length of wire (in the circuit), the greater its resistance / resistance is directly proportional to length (1)

01.2 [3 marks]

Answer: Independent: the length of wire in the circuit. Dependent: the resistance of the wire. Control: the diameter (cross-sectional area) of the wire.

- independent variable: the length of wire (in the circuit) (1)
- dependent variable: the resistance of the wire (1)
- a control variable, e.g. the diameter/cross-sectional area of the wire, the material of the wire, or the temperature of the wire (1)

01.3 [2 marks]

Answer: A thicker (or different-material) wire has a different resistance regardless of length, so if it were not controlled, any change in resistance could be caused by that variable rather than by length, making the comparison unfair.

- a correct link to the control variable named, e.g. diameter/material affects resistance independently of length (1)
- so, without controlling it, a change in resistance could not be attributed to length alone / the test would not be fair (1)

01.4 [2 marks]

Answer: A current in the wire can make it hot enough to burn skin; keep the current low and switch off the supply between readings, and avoid touching the wire while current flows.

- a hazard, e.g. the wire can become hot (especially at short lengths) and could burn skin, or a trailing wire/crocodile clip is a trip or short-circuit hazard (1)
 - a control measure that matches the hazard, e.g. use a low current and switch off between readings, avoid touching the wire while current flows, or keep connections tidy (1)
-

Question 2 (2 marks)

02.1 [2 marks]

Answer: 12 V

- $V = 1.5 \times 8$ (1)
 - $V = 12$ (V) (1)
-

Question 3 (4 marks)

03.1 [1 mark]

Correct: ohm

03.2 [2 marks]

Answer: 6.0 V

- $V = 0.50 \times 12$ (1)
 - $V = 6.0$ (V) (1)
-

03.3 [1 mark]

Correct: It decreases.

Question 4 (3 marks)

04.1 [1 mark]

Correct: Resistance

04.2 [2 marks]

Answer: 5.0 V

- $V = 0.20 \times 25$ (1)
 - $V = 5.0$ (V) (1)
-

Question 5 (3 marks)

05.1 [3 marks]

Answer: 7.93 A

- $230 = I \times 29$ (1)
- $I = 230 \div 29$ (1)
- $I = 7.93$ (A) (1)

Notes: An answer of 6670 (A) scores 0 marks.

Question 6 (3 marks)

06.1 [2 marks]

Answer: Connect the two resistors in series with a battery, a switch and an ammeter, with a voltmeter connected across both resistors together; calculate the combined resistance using $R = V \div I$.

- connect the two resistors in series with a battery and an ammeter (1)
- connect a voltmeter across both resistors together, and calculate resistance using $R = V \div I$ (1)

06.2 [1 mark]

Answer: The parallel combined resistance would be much smaller (less than either single resistor, and less than the series value).

- the parallel combined resistance would be much smaller (less than either single resistor, and less than the series value) (1)
-

Question 7 (7 marks)

07.1 [2 marks]

Answer: 2.4 Ω

- $R = 1.15 \div 0.48 (= 2.396 \Omega)$ (1)
- $R = 2.4 (\Omega)$ given to 2 significant figures (1)

Notes: An answer of 2.396 (Ω) scores 1 mark.

07.2 [2 marks]

Answer: Resistance is directly proportional to length — e.g. doubling the length from 40 cm to 80 cm doubles the resistance from 2.4 Ω to 4.8 Ω .

- resistance is directly proportional to length (1)
- supported by data, e.g. doubling the length from 40 cm to 80 cm doubles the resistance / resistance $\div$ length is constant (0.06 Ω/cm) (1)

Notes: 'As length increases, resistance increases' scores 1 mark only.

07.3 [2 marks]

Answer: To stop the wire heating up, because the resistance of the wire increases as its temperature increases (temperature must be kept constant).

- to stop the wire getting hot / to keep the temperature of the wire constant (1)
 - (because) the resistance (of the wire) increases as temperature increases (1)
-

07.4 [1 mark]

Answer: The material or the thickness (diameter) of the wire.

- material / type of wire / diameter / thickness / cross-sectional area of the wire (1)
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