

# GCSE Combined Science: Trilogy

## Worksheet: Resistors

|                       |                          |                              |                                   |
|-----------------------|--------------------------|------------------------------|-----------------------------------|
| TIME<br><b>35 min</b> | TOTAL<br><b>31 marks</b> | CALCULATOR<br><b>Allowed</b> | DIFFICULTY<br><b>Easy, Medium</b> |
|-----------------------|--------------------------|------------------------------|-----------------------------------|

**Topics:** Resistors

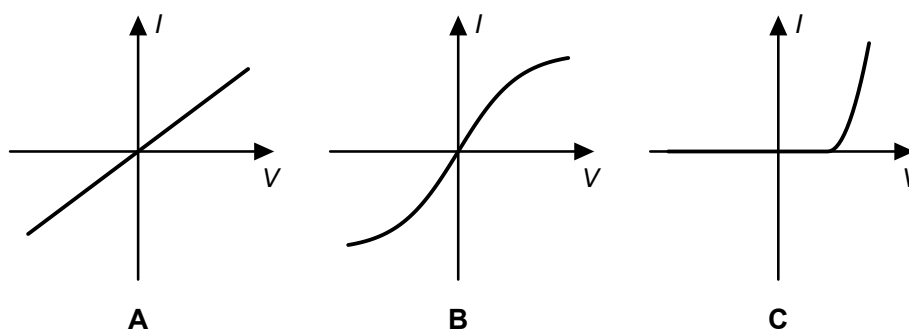
**NAME** \_\_\_\_\_ **CLASS** \_\_\_\_\_ **DATE** \_\_\_\_\_

- 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

Figure 1 shows sketch graphs of current ( $I$ ) against potential difference ( $V$ ) for three components, A, B and C.

**Figure 1**



0 1 . 1

Which graph is for a filament lamp?

Tick (✓) **one** box.

A

☐

B

☐

C

☐

**[1 mark]**

0 1 . 2

Name the component that has graph C.

.....

.....

.....

.....

[1 mark]

0 1 . 3

Graph A is for a resistor at a constant temperature.

What does graph A show about the current in the resistor?

.....

.....

[1 mark]

0 1 . 4

Which component has a very high resistance when the potential difference is reversed?

Tick (✓) **one** box.

A

☐

B

☐

C

☐

[1 mark]

---

0 2

A student investigates how the current in a filament lamp depends on the potential difference across it, using a lamp, a variable resistor, a battery, an ammeter and a voltmeter.

0 2 . 1

Write a hypothesis for this investigation.

.....

.....

[1 mark]

0 2 . 2

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

.....

.....

.....

.....

.....

[3 marks]

0 2 . 3

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

.....

.....

.....

.....

[2 marks]

0 3

A student sets the potential difference across a resistor to 4.0 V and takes five repeat readings of the current: 0.81 A, 0.83 A, 0.80 A, 0.82 A and 0.84 A, using an ammeter with a resolution of 0.01 A. Before starting, with the switch open (no current flowing), the student notices the ammeter reads 0.02 A rather than 0.00 A.

0 3 . 1

What type of error does the 0.02 A reading with the switch open show?

Tick (✓) **one** box.

A random error

☐

A zero error

☐

An anomalous result

☐

[1 mark]

0 3 . 2

Explain how the student should deal with this error when processing all of their current readings.

.....

.....

.....

.....

[2 marks]

0 3 . 3

Calculate the mean of the five readings and correct it for the zero error.

.....

.....

.....

.....

Corrected mean current = ..... A

[2 marks]

0 3 . 4

State the uncertainty in the mean current, using the range of the (uncorrected) readings.

.....

.....

.....

Uncertainty = ..... A

[1 mark]

.....

0 4

A student measured the current in a component, X, for different values of potential difference across it.  
Table 1 shows the results.

Table 1

| Potential difference in V | 0 | 2.0  | 4.0  | 6.0  | 8.0  |
|---------------------------|---|------|------|------|------|
| Current in A              | 0 | 0.10 | 0.20 | 0.30 | 0.40 |

0 4 . 1

Describe the relationship between the current in X and the potential difference across X.

.....  
.....

[1 mark]

0 4 . 2

Calculate the resistance of X.

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

Resistance = .....  $\Omega$

[2 marks]

0 4 . 3

Which component could X be?

Tick (✓) **one** box.

a diode

a filament lamp

a resistor at constant temperature

a thermistor that is warming up

☐  
☐  
☐  
☐

[1 mark]

0 4 . 4

When the potential difference was increased to 10.0 V, the current was 0.45 A, not 0.50 A as the student expected.  
Suggest why.

.....

.....

.....

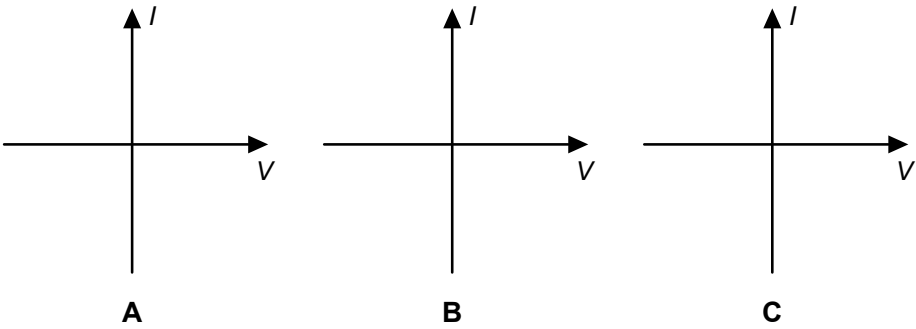
.....

[2 marks]

0 5

Figure 2 shows three pairs of blank axes, A, B and C.

Figure 2



0 5 . 1

On Figure 2, sketch the shape of the current–potential difference graph for: a resistor at constant temperature on axes A; a filament lamp on axes B; a diode on axes C.

[3 marks]

0 6

Table 2 shows how the resistance of a light-dependent resistor (LDR) changes with light intensity.

Table 2

| Light intensity in lux | Resistance in $\Omega$ |
|------------------------|------------------------|
| 10                     | 12 000                 |
| 50                     | 3200                   |
| 100                    | 1800                   |
| 500                    | 450                    |
| 1000                   | 250                    |

0 6 . 1

Describe how the resistance of the LDR changes as the light intensity increases.

.....

.....

[1 mark]

0 6 . 2

The LDR is connected to a 3.0 V supply. The light intensity is 100 lux. Calculate the current in the LDR. Give your answer in milliamps (mA).

.....

.....

.....

.....

.....

Current = ..... mA

[3 marks]

0 6 . 3

LDRs are used in circuits that switch on street lights automatically when it gets dark.  
Explain how the LDR allows the circuit to detect that it is getting dark.

.....

.....

.....

.....

[2 marks]

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: Resistors · 31 marks

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### Question 1 (4 marks)

01.1 [1 mark]

**Correct:** B

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01.2 [1 mark]

**Answer:** Diode

- diode / LED (1)
- 

01.3 [1 mark]

**Answer:** The current is directly proportional to the potential difference.

- current is directly proportional to potential difference / resistance is constant (1)
- 

01.4 [1 mark]

**Correct:** C

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## Question 2 (6 marks)

### 02.1 [1 mark]

**Answer:** As the potential difference across the lamp increases, the current increases, but not in direct proportion, because the resistance of the filament increases as it gets hotter.

- as potential difference increases, current increases, but resistance also increases (so current is not directly proportional to potential difference), because the filament gets hotter (1)

**Notes:** Allow any testable prediction about how the current changes with the potential difference, e.g. 'the current will increase as the potential difference increases, but by smaller amounts each time' or 'the current will not be directly proportional to the potential difference'.

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### 02.2 [3 marks]

**Answer:** Independent: the potential difference across the lamp (set using the variable resistor).  
Dependent: the current in the lamp. Control: the same lamp must be used throughout.

- independent variable: the potential difference across the lamp (set by the variable resistor) (1)
- dependent variable: the current in the lamp (1)
- a control variable, e.g. using the same lamp throughout, or allowing the lamp to return to the same starting temperature before each reading (1)

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### 02.3 [2 marks]

**Answer:** A high current can make the lamp and connecting wires hot enough to burn skin; switch off between readings and avoid touching the lamp while it is lit or straight after.

- a hazard, e.g. the lamp or wires become hot and could burn skin, or a short circuit could damage the power supply (1)
  - a control measure that matches the hazard, e.g. switch off between readings, avoid touching the lamp while lit, or check connections before switching on (1)
-

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### Question 3 (6 marks)

03.1 [1 mark]

**Correct:** A zero error

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03.2 [2 marks]

**Answer:** Subtract 0.02 A from every current reading taken in the investigation (or re-zero the ammeter before taking any readings).

- subtract 0.02 A from every current reading (or re-zero / adjust the ammeter before taking readings) (1)
  - so that the (systematic, zero) error is removed from all the results, not just one reading (1)
- 

03.3 [2 marks]

**Answer:** 0.80 A

- mean =  $(0.81 + 0.83 + 0.80 + 0.82 + 0.84) \div 5 = 0.82$  (A) (1)
  - corrected mean =  $0.82 - 0.02 = 0.80$  (A) (1)
- 

03.4 [1 mark]

**Answer:**  $\pm 0.02$  A

- $\pm$  half the range =  $\pm (0.84 - 0.80) \div 2 = \pm 0.02$  (A) (1)
- 

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### Question 4 (6 marks)

04.1 [1 mark]

**Answer:** The current is directly proportional to the potential difference.

- current is directly proportional to potential difference (1)
- 

04.2 [2 marks]

**Answer:** 20  $\Omega$

- $R = 2.0 \div 0.10$  (or any correct pair) (1)
  - $R = 20$  ( $\Omega$ ) (1)
- 

04.3 [1 mark]

**Correct:** a resistor at constant temperature

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04.4 [2 marks]

**Answer:** The larger current heated component X; its temperature increased, so its resistance increased and the current was smaller than expected.

- X got hotter / its temperature increased (so the temperature was no longer constant) (1)
  - (so) its resistance increased (1)
-

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## Question 5 (3 marks)

### 05.1 [3 marks]

**Answer:** A: a straight line through the origin. B: a curve through the origin that becomes less steep as the size of  $V$  increases, symmetrical for negative  $V$ . C: (almost) zero current for negative  $V$ , rising steeply only after a small positive threshold voltage — not symmetrical.

- axes A: a straight line through the origin, the same in both directions (symmetrical) (1)
  - axes B: a curve through the origin that gets less steep as the magnitude of  $V$  increases in either direction, symmetrical for positive and negative  $V$  (1)
  - axes C: (almost) zero current for negative  $V$ , staying at (almost) zero until a small positive threshold voltage, then rising steeply — not symmetrical (1)
- 

## Question 6 (6 marks)

### 06.1 [1 mark]

**Answer:** It decreases.

- resistance decreases (as light intensity increases) (1)
- 

### 06.2 [3 marks]

**Answer:** 1.7 mA

- $3.0 = I \times 1800$  (1)
  - $I = 0.001\ 67$  (A) (1)
  - $I = 1.7$  (mA) (1)
- 

### 06.3 [2 marks]

**Answer:** As it gets darker the light intensity falls, so the resistance of the LDR increases; this change in resistance (and so in current or potential difference) is used to switch on the lights.

- as it gets dark(er), the resistance of the LDR increases (1)
  - the change in resistance / current / potential difference is used to switch on the lights (1)
-