Resistance & Ohm's Law – IGCSE Physics Worksheet

Reading Comprehension: Resistance & Ohm's Law

Resistance is a measure of how much a component opposes the flow of electric current. When electrons move through a conductor, they collide with atoms inside the material. These collisions slow the electrons down, creating resistance. Resistance is measured in ohms (Ω).

A component with high resistance allows only a small current to flow, while a component with low resistance allows a larger current to flow. Factors that affect resistance include:
- Length of the wire (longer wires → more resistance)
- Thickness of the wire (thicker wires → less resistance)
- Material (metals like copper have low resistance)
- Temperature (higher temperature → higher resistance in metals)

Ohm's Law describes the relationship between voltage, current, and resistance. It states that the current through a conductor is directly proportional to the potential difference across it, as long as the temperature remains constant. The equation is:

$$V = IR$$

where
V = potential difference (V),
I = current (A),
R = resistance (Ω).

A component that obeys Ohm's Law is called an ohmic conductor. Its voltage–current graph is a straight line through the origin. Some components, such as filament lamps and diodes, do not obey Ohm's Law because their resistance changes with temperature or direction of current.

Understanding resistance and Ohm's Law helps explain how circuits behave, how electrical devices are designed, and why some components heat up when current flows through them.

Section A: Multiple-Choice Questions

1. Resistance is measured in: [1 mark]
A. Amperes
B. Volts
C. Ohms

D. Coulombs

2. According to Ohm's Law, if voltage increases and resistance stays the same, the current: [1 mark]
A. Decreases
B. Stays the same
C. Increases
D. Becomes zero

3. Which graph shape represents an ohmic conductor? [1 mark]
A. A curve that gets steeper
B. A straight line through the origin
C. A horizontal line
D. A vertical line

Section B: Short-Answer Questions

4. A resistor has a resistance of 8 Ω. A current of 0.5 A flows through it.
Calculate the voltage across the resistor. [2 marks]

5. Explain why resistance increases when the length of a wire increases. [2 marks]

6. A 12 V supply causes a current of 3 A to flow.
Calculate the resistance of the component. [2 marks]

Section C: Application Questions

7. A filament lamp does not obey Ohm's Law.
Explain why its resistance increases as the current increases. [3 marks]

8. A wire has a resistance of 5 Ω. If the current is doubled, what happens to the voltage across the wire?
Assume the wire obeys Ohm's Law. [3 marks]

Section D: Longer-Answer Question

9. Describe how the voltage–current graph of an ohmic conductor differs from that of a filament lamp.
Explain what these differences show about resistance. [4 marks]

Answer Key

Section A

1. C
2. C
3. B

Section B

4.
V = IR = 0.5 × 8 = 4 V

5.
A longer wire means electrons travel further and collide with more atoms.
More collisions increase resistance.

6.
R = V / I = 12 / 3 = 4 Ω

Section C

7.
As current increases, the filament gets hotter.
Higher temperature causes atoms to vibrate more.
This increases resistance, so the graph curves.

8.
If current doubles and resistance stays constant:
V = IR
Voltage must also double.

Section D

9. (Model answer)
An ohmic conductor has a straight-line V–I graph through the origin, showing constant resistance.
A filament lamp has a curved graph that gets shallower as voltage increases.
This shows that resistance increases as the lamp heats up.
The changing gradient indicates non-ohmic behaviour.