

11.3 Resistance, Resistivity, and Ohm's Law

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS resistance 电阻 • resistivity 电阻率 • ohm's law 欧姆定律

Objective

Build the skills to answer exam questions on **resistance**, **resistivity**, and **Ohm's law**.

You must be able to:

- apply **Ohm's law** 欧姆定律 $V = IR$ to a resistor
- relate **resistance** 电阻 to the **resistivity** 电阻率, length, and area, $R = \frac{\rho \ell}{A}$
- distinguish **ohmic** from non-ohmic devices using their current-voltage graphs

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Ohm's law

 $V = IR$ links the potential difference, current, and resistance.

■ Resistivity

 $R = \frac{\rho \ell}{A}$: a **longer** or **thinner** wire has more resistance.

■ Ohmic vs non-ohmic

An **ohmic** conductor has a straight-line I - V graph through the origin (constant R).
 A filament lamp is **non-ohmic** — its graph curves because R rises with temperature.

2 Practice

2.1 A 6.0 V supply drives 2.0 A through a resistor. Find its resistance. [2]

2.2 State how the resistance of a wire changes if it is made longer. [1]

2.3 Describe the current-voltage graph of an ohmic conductor. [1]

3 Exam-style questions

3.1 Ohm's law is [1]

- A $V = IR$
- B $P = IV$
- C $R = \rho \ell / A$
- D $Q = It$

3.2 The resistance of a wire increases if it is made [1]

- A shorter
- B thicker
- C longer
- D cooler

3.3 A resistor obeys Ohm's law. A voltage of 9.0 V produces a current of 0.30 A.

(a) Find its resistance. [2]

(b) Find the current when the voltage is raised to 15 V. [2]

Solutions

2.1 $R = \frac{V}{I} = \frac{6.0}{2.0} = 3.0 \, \Omega$.

2.2 it increases (resistance is proportional to length).

2.3 a straight line through the origin (constant resistance).

3.1 A.

3.2 C.

3.3 (a) $R = \frac{9.0}{0.30} = 30 \, \Omega$. (b) $I = \frac{V}{R} = \frac{15}{30} = 0.50 \, \text{A}$.