



QUESTION WORKBOOK

Resistivity and superconductivity

Electricity · Year 12

AQA 3.5.1.3 · CIE 9.3 · OCR A 4.2.4

10 questions · 30 marks

PRINT EDITION

SECTION A · Warm-up

- A1** State the equation relating the resistance of a wire to its resistivity, and give the unit of resistivity. [2]

- A2** A copper wire (resistivity $1.7 \times 10^{-8} \Omega \text{ m}$) has length 2.0 m and cross-sectional area $1.0 \times 10^{-6} \text{ m}^2$. Calculate its resistance. [2]

- A3** State what is meant by superconductivity. [2]

SECTION B · Standard

- B1** A wire of length 1.5 m and diameter 0.40 mm has a resistance of 0.50Ω . Calculate (a) its cross-sectional area and (b) the resistivity of its material. [4]

- B2** A wire of resistivity $2.8 \times 10^{-8} \Omega \text{ m}$ and cross-sectional area $2.0 \times 10^{-6} \text{ m}^2$ is to have a resistance of 0.10Ω . Calculate the length required. [3]

- B3** A wire's length is doubled and its cross-sectional area is halved. State the factor by which its resistance changes, and explain why. [3]

- B4** Describe qualitatively how the resistance of a metal wire changes as its temperature increases, and why. [3]

SECTION C · Stretch

- C1** Two wires are made of the same material. Wire B has twice the length and twice the diameter of wire A. If wire A has a resistance of $8.0 \, \Omega$, calculate the resistance of wire B. [4]

- C2** A heating element is made from wire of resistivity $1.1 \times 10^{-6} \, \Omega \, \text{m}$, length $5.0 \, \text{m}$ and cross-sectional area $2.0 \times 10^{-7} \, \text{m}^2$. Calculate its resistance and its power when connected to a $230 \, \text{V}$ supply. [4]

- C3** Describe what happens to a superconductor at its critical temperature and give one practical use of superconductors. [3]