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QUESTION WORKBOOK

Magnetic flux density and the force on a wire

Magnetic fields · Year 13

AQA 3.7.5.1 · CIE 20.1, 20.2 · OCR A 6.3.1

10 questions · 30 marks

NAVY SCREEN EDITION

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SECTION A · Warm-up

A1 State the equation for the force on a current-carrying wire in a magnetic field, and the condition under which it applies. [2]

A2 A wire of length 0.15 m carrying a current of 3.0 A lies perpendicular to a magnetic field of flux density 0.20 T. Calculate the force on it. [2]

A3 Define magnetic flux density, and state the tesla in terms of other units. [2]

SECTION B · Standard

B1 A 0.25 m length of wire carrying 4.0 A experiences a force of 0.50 N when perpendicular to a magnetic field. Calculate the flux density. [3]

B2 A wire of length 0.10 m carrying 2.0 A is placed at 30° to a field of flux density 0.30 T. Calculate the force on it, using $F = BIl \sin\theta$. [3]

B3 A wire of length 0.080 m perpendicular to a 0.45 T field experiences a force of 0.18 N. Calculate the current in the wire. [4]

B4 Explain why the force on a current-carrying wire is greatest when it is perpendicular to the field and zero when it is parallel to it. [3]

SECTION C · Stretch

C1 A horizontal wire of length 0.050 m carrying 8.0 A lies perpendicular to a 0.60 T field so that the force on it is vertical. Calculate the force, and the mass that would have the same weight ($g = 9.81\ \text{m s}^{-2}$). [4]

C2 A wire of length 0.12 m carries a current of 6.0 A in a field of 0.25 T. Calculate the force when the wire is (a) perpendicular to the field and (b) at 45° to it. [4]

C3 Describe how you would measure the force on a current-carrying wire in the laboratory using a top-pan balance. [3]