



QUESTION WORKBOOK

Force on a moving charge

Magnetic fields · Year 13

AQA 3.7.5.2 · CIE 20.3 · OCR A 6.3.2

10 questions · 30 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

- A1** State the equation for the magnetic force on a charge moving through a field, and the condition under which it applies. [2]

- A2** A charge of $1.6 \times 10^{-19} \text{ C}$ moves at $2.0 \times 10^6 \text{ m s}^{-1}$ at right angles to a 0.40 T field. Calculate the force on it. [2]

- A3** Explain why a charged particle moving at right angles to a uniform magnetic field follows a circular path. [2]

SECTION B · Standard

- B1** An electron moves at $3.0 \times 10^6 \text{ m s}^{-1}$ perpendicular to a 0.50 T field. Calculate the radius of its circular path ($m_e = 9.11 \times 10^{-31} \text{ kg}$, $e = 1.60 \times 10^{-19} \text{ C}$). [4]

- B2** A proton moves at $5.0 \times 10^5 \text{ m s}^{-1}$ perpendicular to a 0.80 T field. Calculate the magnetic force on it. [3]

- B3** Calculate the radius of the circular path of that proton ($m_p = 1.67 \times 10^{-27} \text{ kg}$). [3]

- B4** Explain why the magnetic force on a moving charge does no work on the charge. [3]

SECTION C · Stretch

- C1** An electron is accelerated from rest through 500 V and then enters a 0.30 T field at right angles. Calculate its speed and the radius of its path ($e = 1.60 \times 10^{-19} \text{ C}$, $m_e = 9.11 \times 10^{-31} \text{ kg}$). [4]

- C2** Show that the period of circular motion of a charge in a field is $T = 2\pi m/BQ$, and calculate the period and frequency for an electron in a 0.50 T field. [4]

- C3** Describe how a cyclotron uses magnetic and electric fields to accelerate charged particles. [3]