InkPhysics

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

PRINT EDITION


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## 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 $1.6 \times 10^{-19}$ C moves at $2.0 \times 10^{6}$ 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 $3.0 \times 10^{6}$ m s$^{-1}$ perpendicular to a 0.50 T field. Calculate the radius of its circular path ($m_e = 9.11 \times 10^{-31}$ kg, $e = 1.60 \times 10^{-19}$ C). [4]

**B2** A proton moves at $5.0 \times 10^{5}$ 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 ($m_p = 1.67 \times 10^{-27}$ 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 ($e = 1.60 \times 10^{-19}$ C, $m_e = 9.11 \times 10^{-31}$ 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]