Magnetic Fields and Moving Charges

Fields · 4 questions · step-by-step answers at the end

Name: Date: Score: / 4

USEFUL EQUATIONS

$F = BIL\sin\theta$ $F = BQv\sin\theta$ $r = mv / (BQ)$ $V_H = BI / (ntq)$

Questions

Show your working in the space under each question.

1. What speed of particle passes undeflected through crossed fields E = 6.0 × 10^4 V m^{-1} and B = 0.30 T?

2. An electron moving at 2.0 × 10^7 m s^{-1} enters a uniform field of 5.0 mT at right angles. Find the radius of its path.

3. Find the force per metre on a wire carrying 5.0 A at 30° to a field of 0.020 T.

4. Why does a magnetic field not change the speed of a charged particle?

Step-by-step answers

Magnetic Fields and Moving Charges

1. $v = E/B = \mathbf{2.0 \times 10^{5}\ m\ s^{-1}}$.

2. 1. The magnetic force provides the centripetal force: $BQv = mv^2/r$.
2. $r = mv/(BQ) = (9.11 \times 10^{-31})(2.0 \times 10^{7})/((5.0 \times 10^{-3})(1.6 \times 10^{-19}))$.
3. $r = \mathbf{2.3\ cm}$.
Answer: 2.3 cm

3. $F/L = BI \sin\theta = 0.020 \times 5.0 \times 0.50 = \mathbf{0.050\ N\ m^{-1}}$.

4. The force is always **perpendicular to the velocity**, so it does no work.