B12 · Extra practice

Charged particles on circular paths | Diploma-style set of 8

Constants from the Alberta Physics 30 data sheets: $k = 8.99 \times 10^{9}$ N·m²/C², $e = 1.60 \times 10^{-19}$ C, electron mass $m_e = 9.11 \times 10^{-31}$ kg, proton mass $mp = 1.67 \times 10^{-27}$ kg, $g = 9.81$ m/s².

Easy · B12-X01. A proton moves at 2.00×10^{5} m/s at right angles to a field of 0.500 T. Use $e = 1.60 \times 10^{-19}$ C and the proton's mass $mp = 1.67 \times 10^{-27}$ kg. Find the radius of its circular path, in metres.

Response: _____

Easy · B12-X02. A charged particle moves in a circle in a magnetic field. The field strength is doubled and nothing else changes. What happens to the radius?

A. It is cut in half.

B. It doubles.

C. It stays the same.

D. It becomes four times larger.

Response: _____

Medium · B12-X03. An electron moves at 1.50×10^{7} m/s at right angles to a field of 2.00×10^{-3} T. Use $e = 1.60 \times 10^{-19}$ C and the electron's mass $m_e = 9.11 \times 10^{-31}$ kg. Find the radius of its path, in metres.

Response: _____

Medium · B12-X04. A proton starts from rest, is accelerated through 1500 V, then enters a field of 0.250 T at right angles. Use $e = 1.60 \times 10^{-19}$ C and the proton’s mass $m_p = 1.67 \times 10^{-27}$ kg. Find the radius of its path, in metres.

Response: _____

Medium · B12-X05. A proton and an alpha particle enter the same magnetic field at right angles with the same speed. The alpha particle has about four times the proton’s mass and twice its charge. Which statement is correct?

A. The alpha particle’s radius is about half the proton’s radius.

B. The alpha particle’s radius is about twice the proton’s radius.

C. The radii are the same.

D. The alpha particle’s radius is about four times the proton’s radius.

Response: _____

Challenging · B12-X06. A singly charged ion ($q = 1.60 \times 10^{-19}$ C) moves at 3.00×10^{5} m/s at right angles to a field of 0.400 T. Its path has a radius of 0.0150 m. Find the mass of the ion in kilograms.

Response: _____

Challenging · B12-X07. An electron is accelerated from rest through a potential difference, then moves on a circle of radius 0.0200 m in a field of 1.00×10^{-3} T. Use $e = 1.60 \times 10^{-19}$ C and the electron's mass $m_e = 9.11 \times 10^{-31}$ kg. Find the potential difference, in volts.

Response: _____

Challenging · B12-X08. Two ions have the same charge but different masses. They are accelerated through the same potential difference and then enter the same magnetic field. Explain how the field separates them.

Response: _____