B13 · Extra practice

Electric and magnetic fields together | 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 $m_p = 1.67 \times 10^{-27}$ kg, $g = 9.81$ m/s².

Easy · B13-X01. An electron is in a uniform electric field of 800 N/C. Use $e = 1.60 \times 10^{-19}$ C. Find the size of the electric force on it, in newtons.

Response: _____

Easy · B13-X02. A velocity selector has an electric field of 2400 N/C and a magnetic field of 4.00×10^{-3} T at right angles. Find the speed of the particles that go straight through, in m/s.

Response: _____

Easy · B13-X03. Which particles go straight through a velocity selector set to E and B?

A. Only particles with the same mass as a proton
B. Only positive particles
C. Only particles with a charge of 1.60×10^{-19} C
D. Those with speed v = E/B, whatever their mass or charge

Response: _____

Medium · B13-X04. A proton enters a region with an electric field of 900 N/C and a magnetic field of 1.00×10^{-3} T. It moves at 3.00×10^{5} m/s at right angles to the magnetic field. The two forces act in opposite directions. Use $e = 1.60 \times 10^{-19}$ C. Find the size of the net force on it, in newtons.

Response: _____

Medium · B13-X05. A velocity selector is set to pass speed v. A particle enters faster than v. Which force is larger, and what happens?

A. The electric force is larger, so the particle bends toward the side that the magnetic force pushes.

B. The magnetic force is larger, so the particle bends toward the side that the magnetic force pushes.

C. The two forces stay equal, so it goes straight.

D. The magnetic force is zero, so it follows the electric force.

Response: _____

Medium · B13-X06. The plates of a velocity selector are 0.0200 m apart with 500 V across them. The magnetic field is 0.0500 T. Find the speed of the particles that go straight, in m/s.

Response: _____

Challenging · B13-X07. An electron starts from rest and is accelerated through 400 V, then enters a velocity selector with a magnetic field of 2.00×10^{-3} T. Use $e = 1.60 \times 10^{-19}$ C and $m_e = 9.11 \times 10^{-31}$ kg. Find the electric field that lets it go straight through, in N/C.

Response: _____

Challenging · B13-X08. A velocity selector passes a proton of speed v. Explain why an electron of the same speed v also goes straight through, even though the forces on it point the other way.

Response: _____