

Problem 5.2 When a particle with charge q and mass m is introduced into a medium with a uniform field \mathbf{B} such that the initial velocity of the particle \mathbf{u} is perpendicular to \mathbf{B} (Fig. P5.2), the magnetic force exerted on the particle causes it to move in a circle of radius a . By equating \mathbf{F}_m to the centripetal force on the particle, determine a in terms of q , m , u , and \mathbf{B} .

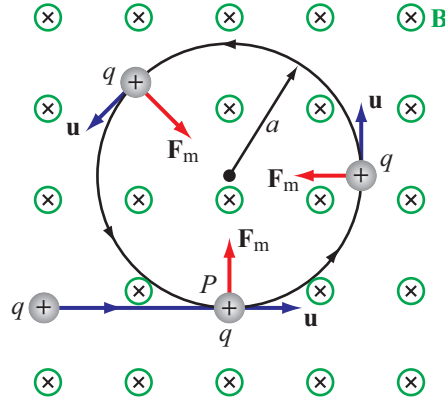


Figure P5.2: Particle of charge q projected with velocity \mathbf{u} into a medium with a uniform field \mathbf{B} perpendicular to \mathbf{u} (Problem 5.2).

Solution: The centripetal force acting on the particle is given by $F_c = mu^2/a$. Equating F_c to F_m given by Eq. (5.4), we have $mu^2/a = quB \sin \theta$. Since the magnetic field is perpendicular to the particle velocity, $\sin \theta = 1$. Hence, $a = mu/qB$.
