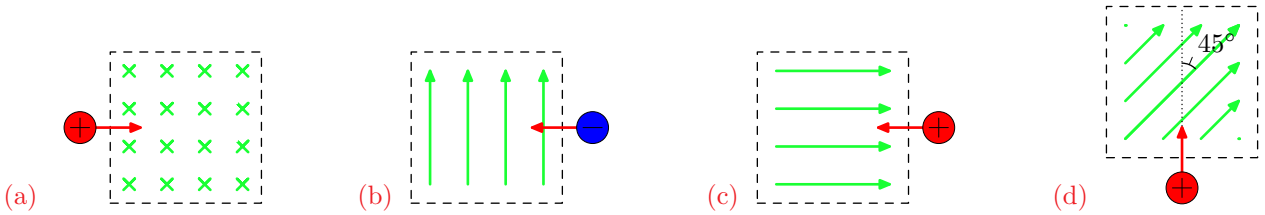
Recitation 7

Chapter 22

Problem 1. Determine the initial direction of the deflection of charged particles as they enter magnetic fields as shown in Figure P22.1.



Problem 3. A proton travels with a speed of $v = 3.00 \cdot 10^6$ m/s at an angle of $\theta = 37.0°$ with the direction of a magnetic field of $B = 0.300$ T in the $+y$ direction. What are (a) the magnitude of the magnetic force on the proton and (b) its acceleration?

Problem 4. An electron is accelerated through $V = 2400$ V from rest and then enters a uniform $B = 1.70$ T magnetic field. What are (a) the maximum and (b) the minimum values of the magnetic force this charge can experience?

Problem 10. A velocity selector consists of electric and magnetic fields described by the expressions $\mathbf{E} = E\hat{\mathbf{k}}$ and $\mathbf{B} = B\hat{\mathbf{j}}$, with $B = 15.0$ mT. Find the value of E such that a $K = 750$ eV electron moving in the $\hat{\mathbf{i}}$ direction is undeflected.

Problem 12. A cyclotron designed to accelerate protons has an outer radius of $R = 0.350$ m. The protons are emitted nearly at rest from a source at the center and are accelerated through $V = 600$ V each time they cross the gap between the dees. The dees are between the poles of an electromagnet where the field is $B = 0.800$ T. (a) Find the cyclotron frequency f. (b) Find the speed v_e at which the protons exit the cyclotron and (c) their kinetic energy K. (d) How many revolutions N does a proton make in the cyclotron? (e) For what time Δt interval does one proton accelerate?

Problem 15. A wire carries a steady current of $A = 2.40$ A. A straight section of the wire is $l = 0.750$ m long and lies in the $\hat{\mathbf{i}}$ direction within a uniform magbnetic field, $\mathbf{B} = 1.60\hat{\mathbf{k}}$ T. What is the magnetic force on the section of wire?

Problem 21. A rectangular coil consists of $N = 100$ closely wrapped turns and has dimensions $a = 0.400$ m and $b = 0.300$ m. The coil is hinged along the y axis, and its plane makes an angle $\theta = 30.0°$ with the x axis (Fig. P22.21). What is the magnitude of the torque exerted on the coil by a uniform magnetic field $B = 0.800$ T directed along the x axis whwn the current is $I = 1.20$ A in the direction shown? What is the expected direction of motion of the coil?