



PHYS143

Physics for Engineers

Tutorial - Chapter 29

Question 1

A proton moves perpendicular to a uniform magnetic field \vec{B} at a speed of 1.00×10^7 m/s and experiences an acceleration of 2.00×10^{13} m/s² in the positive x direction when its velocity is in the positive z direction. Determine the magnitude and direction of the field. ($m_p = 1.67 \times 10^{-27}$).

Question 2

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

Question 3

A velocity selector consists of electric and magnetic fields described by the expressions $\vec{E} = E\hat{k}$ and $\vec{B} = B\hat{j}$ with $B = 15.0$ mT. Find the value of E such that a 750-eV electron moving in the negative x direction is undeflected. ($m_e = 9.11 \times 10^{-31}$)

Question 4

A wire having a mass per unit length of 0.500 g/cm carries a 2.00-A current horizontally to the south. What are (a) the direction and (b) the magnitude of the minimum magnetic field needed to lift this wire vertically upward?

Question 5

A wire is formed into a circle having a diameter of 10.0 cm and is placed in a uniform magnetic field of 3.00 mT. The wire carries a current of 5.00 A. Find (a) the maximum torque on the wire and (b) the range of potential energies of the wire-field system for different orientations of the circle.