Chapter-28

1. A laboratory electromagnet produces a magnetic field of magnitude 1.50 T. A proton moves through this field with a speed of 6.00 X 106 m/s. (a) Find the magnitude of the maximum magnetic force that could be exerted on the proton. (b) What is the magnitude of the maximum acceleration of the proton? (c) Would the field exert the same magnetic force on an electron moving through the field with the same speed? (d) Would the electron experience the same acceleration? Explain.
2. A proton (charge +e, mass mp), a deuteron (charge +e, mass 2mp), and an alpha particle (charge +2e, mass 4mp) are accelerated from rest through a common potential difference ∆V. Each of the particles enters a uniform magnetic field $\vec{B}$, with its velocity in a direction perpendicular to$\vec{B}$. The proton moves in a circular path of radius rp. In terms of rp, determine (a) the radius rd of the circular orbit for the deuteron and (b) the radius rd for the alpha particle.
3. A cyclotron designed to accelerate protons has a magnetic field of magnitude 0.450 T over a region of radius 1.20 m. What are (a) the cyclotron frequency and (b) the maximum speed acquired by the protons?
4. A magnetized sewing needle has a magnetic moment of 9.70 mA. m2. At its location, the Earth’s magnetic field is 55.0 *μ*T northward at 48.0o below the horizontal. Identify the orientations of the needle that represent (a) the minimum potential energy and (b) the maximum potential energy of the needle–field system. (c) How much work must be done on the system to move the needle from the minimum to the maximum potential energy orientation?