Physics 200

Chapter 29 Magnetic Fields (Homework)

1. An electron moving in a constant magnetic field, B, experiences a radial acceleration, a. What is its speed?

2. Calculate the force on a wire loop (radius is "a") that has a current, I, and is in the presence of a magnetic field, B, that lies in the same plane as the wire loop.

3. A long wire encircles the earth at the equator. The linear density of the wire is "λ" and the earth's magnetic field, B, is horizontal to the surface of the Earth. What is the current in the wire that keeps it levitated above the ground?

4. A metal rod of length, L, is suspended from vertical springs attached to each end of the rod. The mass, m, of the rod causes the springs to stretch a distance, D. When a horizontal magnetic field is introduced and a current, I, passes through the rod the springs stretch an additional distance, d. What is the strength of the magnetic field?

5. A strong magnet is placed under a horizontal conducting ring of radius, r, that carries a current, I. If the magnetic field makes an angle, θ, with the vertical at the ring's location, what are the magnitude and direction of the resultant magnetic force? (when looking down on the ring the positive charges are moving clockwise)

6. A piece of wire of length, L, is formed into a circle. There is a current, I, in the wire and there is a magnetic field, B, in the loop's location. What is the maximum torque on the wire loop?

7. A coil of "N" circular loops is made from a wire whose length is "L". What is the maximum torque the coil will feel in a magnetic field, B, if the wire carries a current, I?

8. A non-conducting sphere has a mass, m, and a radius, a. Four loops of wire are wound tightly around the sphere. The sphere rests on a plane inclined at an angle, θ, with the plane of the loops parallel to the incline. There is a uniform, vertical, magnetic field, B, that passes through the loops of wire. What must the current in the loops be if the sphere is in equilibrium?

9. What is the maximum electron kinetic energy of a cyclotron that has radius, a, and a magnetic field, B?

10. One electron collides elastically with another electron that is initially at rest. After the collision, the radii of their trajectories are "r" and "R". The trajectories are perpendicular to a magnetic field, B. Determine the energy of the initially moving electron.