Part I

1. A straight horizontal wire carries a conventional current of 5.0 A from west to east in a region where there is a magnetic field of 2.0 directed vertically down into the earth. The force per unit length on the wire is

   (a) 2.5 N directed south

   (b) 10 N directed north

   (c) 10 N directed south

   (d) 10 N directed vertically into the earth.

2. An alpha particle has four time the mass and twice the charge of a proton. Both particles move perpendicular to a uniform magnetic field with the same speed. The ratio of the magnetic force on the proton to the magnetic force on the alpha particle is

   (a) 1:1

   (b) 1:2

   (c) 2:1

   (d) 1:4

3. A charged particle enters a uniform magnetic field. If the angle between the velocity and field is not 90^0 the path of the particle will be

   (a) circular.

   (b) elliptical.

   (c) parabolic.

   (d) helical.

4. A current carrying loop in a uniform magnetic field always tends to rotate until the plane of the loop is

   (a) parallel to the field.

   (b) perpendicular to the field.

   (c) at a 45^o angle to the field.

   (d) it will not tend to rotate since the net force is zero.

Part II

1. Describe whether or not the following actions can be accomplished with a constant and uniform electric or a magnetic field. Explain your answers, indicating which fields can and which cannot accomplish the action and if your answer is valid for any orientation of the field(s). Must any other condition be satisfied?

   (a) move a charged particle in a circle.

   (b) exert a force on a piece of dielectric material.

   (c) increase the speed of a charged particle.

   (d) accelerate a moving charged particle.

   (e) exert a force on a charged particle which is initially at rest.

2. A proton moves with speed v perpendicular to a uniform vertical magnetic field B and follows a circular path of radius r before leaving the field. Suppose an electron enters the same field with the same speed.

   (a) What differences would you expect to observe in the path that the two particle follow?

   (b) In what way should the magnetic field be adjusted so that the electron would follow the same path that the proton did.

   (c) Suppose the field strength used for the proton was 0.50 T what should the magnitude of the field used for the electron be?