Name: Due Date

Assignment 5.02: Magnetic Force on Wires

1. The magnetic field due to a long wire carrying current is 0.2 T at a distance of 1 cm from the wire. What would the magnetic field be at a distance of 3 cm from the wire?

2. A horizontal power line of length 58 m carries a curent of 2200A toward the north. The earth's magnetic field at this location is 5 x 10^{-5} T directed toward the north, 65 below horizontal.

   (a) Find the magnitude of the magnetic force on the power line.

   (b) What is the direction of the force on the power line?

3. The average nerve impulse has a current of approximately 16 pA. You are standing in a magnetic field directed to the left. You want to move your small toe, a distance of 1.75 meters from your brain. What strength of magnetic field would cause a barely-noticable force of 0.1 N to be exerted on your nerve?

4. A 10-meter long conductor carrying a current of I=15A is directed along the positive x-axis, perpendicular to a uniform magnetic field. The force on the conductor is 1.2 N in the negative y direction. Determine the magnitude and direction of the magnetic field.

5. Two horizontal wires carry current to the right. The top wire carries a current of 8A, and the bottom wire carries a current of 2A. How far below the top wire is the magnetic field zero?

6. A wire has a mass of 0.1 kg, and a length of 3 meters, and is carrying a current of 25 amps. It is placed on top of a table, oriented in the X direction, carrying current in the positive X direction. The coefficient of kinetic friction is 0.2. The wire slides horizontally to the north at a constant speed. Calculate the magnitude and direction of the magnetic field needed for this to happen.

7. A current-carrying wire is placed in a magnetic field of 2T. The wire experiences a force of 0.4 N. The length of the wire is 2 meters.

   (a) Calculate the minimum possible amount of current the wire could be carrying.

   (b) Calculate the maximum possible amount of current the wire could be carrying.