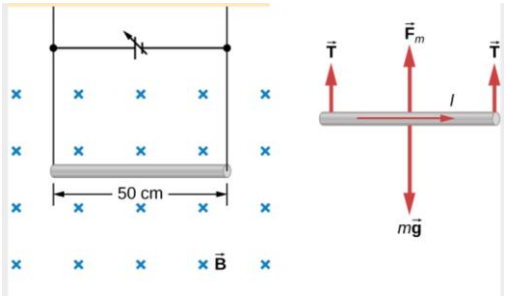
Sources of Magnetic Field

1. Estimate the maximum magnetic force per meter that Earth's magnetic field could exert on a current-carrying wire in a 20-A circuit in your house.

2. A straight segment of a current-carrying wire has a current element $I\vec{L}$ where I =2.7A and $\vec{L} = 3.0\ cm\ \hat{\imath} + 4.0\ cm\ \hat{\jmath}$. The segment is in a region with a uniform magnetic field given by $1.3\ T\ \hat{\imath}$. Find the force on the segment of wire.

3. A wire of length 50 cm and mass 10 g is suspended in a horizontal plane by a pair of flexible leads. The wire is then subjected to a constant magnetic field of magnitude 0.50 T, which is directed as shown. What are the magnitude and direction of the current in the wire needed to remove the tension in the supporting leads?



4. What is the maximum torque on a 400-turn circular coil of radius 0.75 cm that carries a current of 1.6 mA and is in a region with a uniform magnetic field of 0.25 T?

5. In a loudspeaker, a permanent magnet creates a magnetic field of 0.12 T directed radially outward from the z-axis. The voice coil of the speaker has 60 turns and a radius of 0.013 m and is positioned in the *xy* plane. What force acts on the coil when it carries a current of 1.5 A?

6. A small current element at the origin has a length of 2.0 mm and carries a current of 2.0 A in the +*z* direction. Find the magnetic field due to the current element: (*a*) on the *x* axis at x = 3.0 m, (*b*) on the *x* axis at x = –6.0 m, (*c*) on the *z* axis at z = 3.0 m, and (*d*) on the *y* axis at y = 3.0 m.

7. Parallel wires 1 and 2 carry currents I_1 and I_2 respectively, where $I_2 = 2I_1$. The two currents are in the same direction. The magnitudes of the magnetic force by current 1 on wire 2 and by current 2 on wire 1 are F_{12} and F_{21} respectively. Find the relation between the forces.

8. A solenoid has 300 turns wound around a cylinder of diameter 1.20 cm and length 14.0 cm. If the current through the coils is 0.410 A, what is the magnitude of the magnetic field inside and near the middle of the solenoid?

9. What is the field inside a 2.00-m-long solenoid that has 2000 loops and carries a 1600-A current?