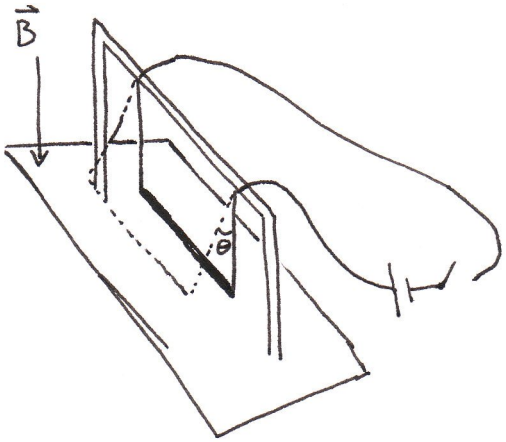
PHY 122 HW 7

1. An electron enters a region of uniform magnetic field, $\vec{B}$, which is perpendicular to the particle's velocity, $\vec{v}$. Will its kinetic energy increase, decrease, or stay the same? Explain.

2. The same electron as above spends a time of Δt in the region. Estimate the angle θ through which it will be deflected during Δt assuming θ to be small.

3. In your basement you decide to do test the Lorentz force using Earth's magnetic field and your household current. You follow the diagram below, a thick copper wire of length 0.8 m and mass 70 g is attached to two thin wires and suspended so that it is horizontal. You can assume Earth's magnetic field is $5 \cdot 10^{-5}$ T and is pointing only in the downward direction. What angle will the supporting wires make with the vertical if a current of 10 A is turned on through the wire? How will the supporting wire contribute to the displacement of the thick copper wire?



4. A rectangular wire loop of height h and width w consist of N turns and carries a current of I. What are the magnitude and direction of the magnetic dipole moment, μ? If a uniform magnetic field of $\vec{B}$ is applied to the loop, and the field's direction makes an angle of θ degrees with the normal to the current loop, what is the torque τ (magnitude and direction) that acts on the loop?

5. An electron, of charge $-1.6 \cdot 10^{-19}$ C, has a "size" of about $3 \cdot 10^{-15}$ m , called its classical radius. The magnetic dipole moment of the electron is roughly 10^{-23} Am^2. a) Suppose that this magnetic moment were due to the entire charge q orbiting at the classical radius. What would the speed of the charge be to generate this magnetic moment? b) Suppose that the electron's magnetic moment were perpendicular to a magnetic field of magnitude 1 T, what is the torque on the electron?