Physics 606 Homework #8 Spring '12
Dr. Drake

1. Jackson 5.27

2. Jackson 6.11
   Hint: The solar wind velocity is around $400km/s$ and the proton number density is around $10/cm^3$.

3. Jackson 6.14

4. Consider a rectangular loop of wire as shown with $L \gg w$ incident on a magnetized half space, $\mathbf{B} = B_0 H(y)\hat{z}$, where H is the Heaviside function. The wire

   has an initial velocity $\mathbf{v} = v_0\hat{y}$ with $v_0 \ll c$, a mass per unit length λ and infinite conductivity. The wire making up the loop has a circular cross section with a radius $a \ll w$. Initially the wire does not carry any current. Neglect end effects in the following.

   (a) Under the assumption that the plane of the wire is constrained to remain perpendicular to $\hat{z}$ calculate the total current flowing around the wire as the loop enters the magnetic field. Express you answer in terms of the distance y the right side of the wire has penetrated the magnetic field. Be sure to indicate the direction of the current.

   (b) Calculate the force per unit length acting on the wire and write down an equation of motion for the wire.

   (c) Solve for the motion of the wire for all possible values of v_0.
   Hint: There are two possible final states. What is the current in the wire in these two final states?