Phys 3330 Electricity & Magnetism II
Spring 2017
Assignment #10 - due Friday May 12th 2017

Relativity

1. Show that in the limit $v \ll c$ the relativistic formula for the KE approximates to the non-relativistic expression $\frac{1}{2}m_o v^2$.

2. An electron and a proton are both accelerated from rest through a potential difference of 250 kV (measured in the lab frame). Find their final speeds (also measured in the lab frame), and compare with the result from the non-relativistic formula for the KE.

3. A particle of rest mass m_o and charge q is accelerated from rest by a uniform (in the lab frame) electric field $E_o\mathbf{i}$. What are the velocity and position of the particle (as a function of time)
   a. in the lab frame?
   b. in the rest frame of an observer moving with a velocity $v_o\mathbf{k}$ relative to the lab?
   c. (Optional) Plot the position and speed of an electron in a uniform field of magnitude 1 MV/m for the time interval t = 0 to $t = 3m_oc/(qE_o)$.

4. Show that the ratio E/B is the same for both observers. (It should be as each observer will think that the ratio is also equal to the speed of the wave, and in a vacuum that should be c for both of them. Note: this problem is easier if you first rearrange this relationship.)