

Relativity

1. Show that in the limit $v \ll c$ the relativistic formula for the KE approximates to the non-relativistic expression $\frac{1}{2}m_0v^2$.
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_0 and charge q is accelerated from rest by a uniform (in the lab frame) electric field $E_0\mathbf{i}$. 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 $v_0\mathbf{k}$ 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 $t = 3m_0c/(qE_0)$.