PHYSICS 2D QUIZ 1 WINTER QUARTER 2011
PROF. HIRSCH JANUARY 14th, 2011

Formulas:

Time dilation; Length contraction: $\Delta t = \gamma \Delta t' \equiv \gamma\, \Delta t_p$; $L = L_p / \gamma$; $c = 3 \times 10^8 m/s$

Lorentz transformation:

$$x' = \gamma(x - vt) \qquad\qquad x = \gamma(x' + vt')$$

$$y' = y\ ,\ \ z' = z \qquad \gamma = \frac{1}{\sqrt{1 - v^2/c^2}} \qquad y = y',\ \ z = z'$$

$$t' = \gamma(t - vx/c^2) \qquad\qquad t = \gamma(t' + vx'/c^2)$$

Spacetime interval: $(\Delta s)^2 = (c\Delta t)^2 - [\Delta x^2 + \Delta y^2 + \Delta z^2]$

Velocity transformation :

$$u_x' = \frac{u_x - v}{1 - u_x v / c^2} \qquad\qquad u_x = \frac{u_x' + v}{1 + u_x' v / c^2}$$

$$u_y' = \frac{u_y}{\gamma(1 - u_x v / c^2)} \qquad\qquad u_y = \frac{u_y'}{\gamma(1 + u_x' v / c^2)}$$

Relativistic Doppler shift: $f_{obs} = f_{source}\sqrt{1 + v/c}\ /\ \sqrt{1 - v/c}$

Momentum: $\vec{p} = \gamma m\vec{u}$; Energy: $E = \gamma mc^2$; Kinetic energy: $K = (\gamma - 1)mc^2$

Rest energy: $E_0 = mc^2$; $E = \sqrt{p^2c^2 + m^2c^4}$

Electron: $m_e = 0.511\ MeV/c^2$ Proton: $m_p = 938.26\ MeV/c^2$ Neutron: $m_n = 939.55\ MeV/c^2$