PHYSICS 160: Principles of Modern Physics
Spring 2009
Midterm Exam #1 Equation Sheet

$$x' = \gamma(x - vt)$$
$$y' = y$$
$$z' = z$$
$$t' = \gamma\left(t - \frac{vx}{c^2}\right)$$
$$\gamma = \frac{1}{\sqrt{1-\beta^2}}$$
$$\beta = \frac{v}{c}$$
$$u_x' = \frac{u_x - v}{\left(1 - \frac{u_x v}{c^2}\right)}$$
$$u_y' = \frac{u_y}{\gamma\left(1 - \frac{u_x v}{c^2}\right)}$$
$$u_z' = \frac{u_z}{\gamma\left(1 - \frac{u_x v}{c^2}\right)}$$
$$\Delta t = \gamma \Delta t_o$$
$$L = \frac{L_o}{\gamma}$$
$$(\Delta s)^2 = (\Delta x)^2 - (c\Delta t)^2$$
$$\vec{p} = \frac{m\vec{u}}{\sqrt{1-\frac{u^2}{c^2}}}$$
$$E = \frac{mc^2}{\sqrt{1-\frac{u^2}{c^2}}}$$
$$E^2 = p^2c^2 + m^2c^4$$
$$R = \sigma T^4$$
$$\lambda_{\max} T = 2.898\times10^{-3}\ \text{mK}$$
$$eV_0 = hf - \phi$$
$$\lambda f = c$$
$$E = hf = \hbar\omega$$

$$p = \frac{h}{\lambda} = \hbar k$$
$$\hbar = \frac{h}{2\pi}$$
$$\omega = 2\pi f = \frac{2\pi}{T}$$
$$k = \frac{2\pi}{\lambda}$$
$$\Delta\lambda = \frac{h}{mc}(1 - \cos\theta)$$
$$r_n = a_o n^2$$
$$E_n = \frac{-Z^2 E_0}{n^2}$$
$$\frac{1}{\lambda} = R\left(\frac{1}{n_f^{\,2}} - \frac{1}{n_i^{\,2}}\right)$$
$$\Delta p \Delta x \geq \frac{\hbar}{2}$$
$$\Delta E \Delta t \geq \frac{\hbar}{2}$$
$$a_0 = \frac{\hbar^2}{m_e k e^2} = 0.0529\ \text{nm}$$
$$E_0 = \frac{m_e k^2 e^4}{2\hbar^2} = 13.6\ \text{eV}$$
$$k = 8.99\times10^9\ \text{Nm}^2/\text{C}^2$$
$$\sigma = 5.67\times10^{-8}\ \text{W}/\text{m}^2\text{K}^4$$
$$c = 3.00\times10^8\ \text{m/s}$$
$$e = 1.60\times10^{-19}\ \text{C}$$
$$h = 6.63\times10^{-34}\ \text{Js}$$
$$hc = 1240\ \text{eV}\cdot\text{nm}$$
$$m_e = 9.11\times10^{-31}\ \text{kg}$$
$$R = 1.097\times10^7\ \text{m}^{-1}$$
$$1\,\text{eV} = 1.60\times10^{-19}\ \text{J}$$