Name: ________________________________

You may answer the questions in the space provided here, or if you prefer, on your own notebook paper.

Some possibly useful equations.

$$\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$n_1 \sin(\theta_1) = n_2 \sin(\theta_2)$$

$$I = S_{avg} = \frac{E_{max}^2}{2\mu_0 c}$$

$$\Delta E_0 = \Delta m c^2$$

$$B = \frac{E}{c}$$

$$c = \lambda f$$

$$c^2 = a^2 + b^2$$

$$T = \frac{1}{f}$$

$$p = \frac{mu}{\sqrt{1-\frac{u^2}{c^2}}}$$

$$\mu_0 = \left(4 \times \pi \times 10^{-7} \mathrm{Tm/A}\right)$$

$$c = \left(2.99 \times 10^8\right) \frac{\mathrm{m}}{\mathrm{s}}$$

$$2nt = \left(m + \frac{1}{2}\right) \lambda, m = 0, 1, 2 \ldots$$

$$E = \frac{hc}{\lambda}$$

$$KE = E_{photon} - \phi$$

$$hc = 1240 \mathrm{eV} \cdot \mathrm{nm}$$

$$m_p = 1.672 \times 10^{-27} \text{ kg}$$

$$q_p = 1.602 \times 10^{-19} \text{ C}$$

$$m_e c^2 = 0.511 \text{ MeV}$$

$$E = \gamma m c^2$$

Please go on to the next page...

$$K = E - mc^2$$

$$c = \left(2.99 \times 10^8\right) \frac{\mathrm{m}}{\mathrm{s}}$$

$$K = (\gamma - 1)\, mc^2$$

$$E^2 = p^2c^2 + (m_pc^2)^2$$

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

$$t' = \gamma(t - \frac{vx}{c^2})$$

$$L' = \frac{L_p}{\gamma}$$

$$t' = \gamma t_p$$

$$\frac{\Delta f}{f} = \frac{\Delta U_g}{mc^2}$$

$$f = \sqrt{\frac{c+u}{c-u}} f_0$$

$$v_x' = \frac{v_x - u}{1 - \frac{uv_x}{c^2}}$$

$$v_y' = \frac{v_y}{\gamma\left(1 - \frac{v_x u}{c^2}\right)}$$

$$v_z' = \frac{v_z}{\gamma\left(1 - \frac{v_x u}{c^2}\right)}$$

$$K_{classic} = \frac{1}{2}mv^2$$

End of exam