Physics 370 Homework #5
5 problems
Due by Monday, September 26th

▷ **1.**

For the Compton effect as outlined in the notes, write the equations for conservation of energy and momentum in units where $h = c = 1$, and derive the equation

$$\lambda' - \lambda = \frac{1}{m}(1 - \cos\theta)$$

▷ **2.**

(a) What are the SI units for h/c and h/c^2?

(b) In the units where $h = c = 1$, you can write mass in terms of inverse meters or in terms of inverse seconds. How many kilograms are equivalent to $1\,/\text{m}$?

(c) How many kilograms are equivalent to $1\,/\text{s}$?

▷ **3.**

A $0.057\,\text{nm}$ X-ray photon "bounces off" an initially stationary electron and scatters with a wavelength of $0.061\,\text{nm}$. Find the directions of scatter of

(a) ...the photon

(b) ...the electron

(c) How fast is the electron moving after the collision?

▷ **4.**

A stationary muon μ^- annihilates with a stationary antimuon μ^+ (same mass, $1.88\times10^{-28}\,\text{kg}$, but opposite charge). The two disappear, replaced by electromagnetic radiation.

(a) Why is it not possible for a single photon to result?

(b) Suppose two photons result. Describe their possible directions of motion and wavelengths.

▷ **5.**

How fast would you have to run to have a wavelength of $10^{-10}\,\text{m}$? If the speed is relativistic, don't forget to use relativistic quantities!