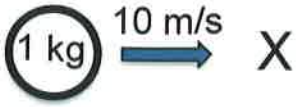
Physics F14 MT2 retake, question #3, Nov. 19, 2014 Name_____

4. (8 pts) A 1.0 kg ball moving at 10 m/s *to the right,* has an *elastic* collision with *stationary* "Ball X" of unknown mass, and *continues on in the same direction* at only 8 m/s. We want to find the mass of Ball X, and its final velocity. Is it a good idea to draw a picture?

a. Without doing any math, can you tell me if the mass of Ball "X" is more or less than 1 kg? That is: fill in the space with <, >, or = : m_X ___ 1 kg
please give a reason



Ball X $\leq$ 1 kg because the 1 kg ball does not change direction and still goes 8 m/s. to the right

b. What must be the momentum of Ball X after the collision? Include direction.

$m_1v_{1i} + m_2v_{1i} = m_1v_f + m_2v_f$

$(1\,kg)(10\,m/s) = (1\,kg)(8\,m/s) + p_x$

$2\ kg\,m/s = p_{xf}$ to the right

c. What must be the kinetic energy of Ball X after the collision?

$KE_i + KE_i = KE_f + KE_f$

$\frac{1}{2}m_1v_i^2 = \frac{1}{2}m_1v_f^2 + \frac{1}{2}m_2v_f^2$

$\frac{1}{2}(1\,kg)(100\,\frac{m^2}{s^2}) = \frac{1}{2}(1\,kg)(64\,\frac{m^2}{s^2}) + KE_{xf}$

$(50-32)\,J$

$18\,J = KE_{xf}$

d. *(extra credit)* Find the mass of ball X and the final velocity of ball X.

$18J = \frac{1}{2}mv_f^2$ $\quad 2\,kg\frac{m}{s} = mv_f$ $\quad \frac{2\,kg\frac{m}{s}}{m} = v_f$ $\quad 2\,kg\frac{m}{s}\left(9\frac{1}{kg}\right) = 18\,\frac{m}{s}$

$36\,J = \left(\frac{2\,kg\frac{m}{s}}{m}\right)^2 m = 36\,J = \frac{4\,kg\frac{m}{s}}{m} = \frac{1}{9}\,kg = m$

1. Your Statements: