Ph 202H/212H
W09 Homework – Due Wednesday January 7

1. A hydrogen atom ($m = 1.674 \times 10^{-27}$ kg) is moving with a velocity of 1.1250×10^{7} m/s. It collides elastically with a helium atom ($m = 6.646 \times 10^{-27}$ kg) at rest. After the collision, the hydrogen atom is found to be moving with a velocity of -6.724×10^{6} m/s (in a direction opposite to its original motion). Find the velocity of the helium atom after the collision in two different ways: (a) by applying conservation of momentum; (b) by applying conservation of energy.

   Ans.: $4.XXX \times 10^{6}$ m/s

2. A body of mass 8.0 kg is traveling at a speed of 2.0 m/s with no external forces acting on it. At a certain instant an internal explosion occurs, splitting the body into 2 chunks of 4.0 kg mass each. In the explosion, 16.0 J of energy is imparted to the system. After the explosion neither chunk leaves the line of the original motion. Determine the velocity (magnitude and direction) of each of the chunks after the explosion. Check your answers by finding the initial and final values of the momentum of the system and the energy of the system.

3. A 35.0-ton railroad car collides with and couples to a stationary caboose. After the coupling, it is found that the kinetic energy of the combination is 73% of the initial kinetic energy of the railroad car. Find the weight of the caboose.

   Ans.: 1_.9 tons