Momentum & Impulse Worksheet 1

1. A deer with a mass of 146 kg is running head on toward you with a speed of 17 m/s. You are going north. Find the momentum of the deer.

2. A .5 kg football is thrown with a velocity of 15 m/s to the right. A stationary receiver catches the ball and brings it to rest in .02 seconds. What is the force exerted on the ball by the receiver?

3. A 2500 kg car traveling to the north is slowed down uniformly from an initial velocity of 20 m/s by a 6250 N braking force acting opposite the car’s motion. (Hint – force is negative 6250 not positive). Use the impulse momentum theorem to answer the following questions:
   a. What is the car’s velocity after 2.5 s?

   b. How far does the car move during 2.5 s?

   c. How long does it take the car to come to a complete stop (final velocity now equals zero)?

4. A 63 kg astronaut is on a spacewalk when the tether line to the shuttle breaks. The astronaut is able to throw a spare 10 kg oxygen tank in a direction away from the shuttle with a speed of 12 m/s, propelling the astronaut back to the shuttle. Assuming the astronaut starts from rest with respect to the shuttle, find the astronaut’s final speed with respect to the shuttle after the tank is thrown.
5. A 1500 kg car traveling at 15 m/s to the south collides with a 4500 kg truck that is initially at rest at a stoplight. The car and truck stick together and move together after the collision. What is the final velocity of the two vehicle mass?

6. A .25 kg arrow with a velocity of 12 m/s to the west strikes and pierces the center of a 6.8 kg target.
   a. What is the final velocity of the combined mass?
   b. What is the decrease in kinetic energy during the collision?

7. A .015 kg marble sliding to the right at 22.5 cm/s on a frictionless surface makes an elastic head-on collision with a .015 kg marble moving to the left at 18 cm/s. After the collision, the first marble moves to the left at 18 cm/s.
   a. Find the velocity of the second marble after the collision.
   b. Calculate the total kinetic energy before and after the collision.