# Honors Physics Momentum HW, part 1 (Homework)

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1.
Calculate the magnitude of the linear momentum for the following cases:
(a) a proton with mass $1.67 \times 10^{-27}$ kg, moving with a speed of $5.00 \times 10^{6}$ m/s;
(b) a 15.0 g bullet moving with a speed of 300 m/s;
(c) a 75.0 kg sprinter running with a speed of 10.0 m/s;
(d) the Earth (mass = $5.98 \times 10^{24}$ kg) moving with an orbital speed equal to $2.98 \times 10^{4}$ m/s.

2.
A 0.10-kg ball is thrown straight up into the air with an initial speed of 15 m/s. Find the momentum of the ball
(a) at its maximum height and
(b) halfway to its maximum height.

3.
A 1500 kg car moving with a speed of 10 m/s collides with a utility pole and is brought to rest in 0.30 s. Find the magnitude of the average force exerted on the car during the collision.

4.
A 0.500 kg football is thrown with a speed of 25.0 m/s. A stationary receiver catches the ball and brings it to rest in 0.020 s. (Take the initial direction of motion to be the positive direction.)
(a) What is the impulse delivered to the ball?
(b) What is the average force exerted on the receiver?

5.
The force, $\mathbf{F}_x$, acting on a 2.00-kg particle varies in time as shown in Figure P6.9. (See figure next page.)
Find
(a) the impulse of the force,
(b) the final velocity of the particle if it is initially at rest, and
(c) the final velocity of the particle if it is initially moving along the *x* axis with a velocity of -2.00 m/s.

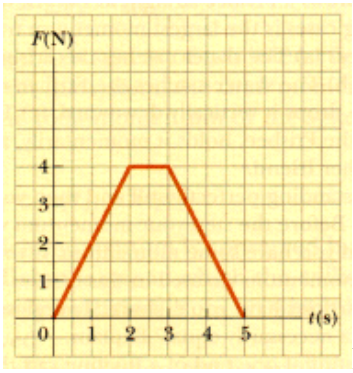

Figure P6.9.

6.
The front of a 1300 kg car is designed to absorb the shock of a collision by having a "crumple zone" in which the front 1.20 m of the car collapses in absorbing the shock of a collision. If a car traveling 25.0 m/s stops uniformly in 1.20 m,
(a) how long does the collision last,
(b) what is the magnitude of the average force on the car, and
(c) what is the acceleration of the car in *g*'s?

7.
A 0.15 kg baseball is thrown with a speed of 10 m/s. It is hit straight back at the pitcher with a final speed of 30 m/s. **Assume the initial motion of the baseball is in the positive direction.**
(a) What is the impulse delivered to the ball?
(b) Find the average force exerted by the bat on the ball if the two are in contact for $2.0 \times 10^{-3}$ s.

8.
A 755 N man stands in the middle of a frozen pond of radius 6.0 m. He is unable to get to the other side because of a lack of friction between his shoes and the ice. To overcome this difficulty, he throws his 1.2 kg physics textbook horizontally toward the north shore, at a speed of 6.0 m/s. How long does it take him to reach the south shore?

9.
A rifle with a weight of 30 N fires a 5.5 g bullet with a speed of 290 m/s.
(a) Find the recoil speed of the rifle.
(b) If a 650 N man holds the rifle firmly against his shoulder, find the recoil speed of man and rifle.

10.
A 66.0 kg person throws a 0.0410 kg snowball forward with a ground speed of 29.0 m/s. A second person, with a mass of 56.0 kg, catches the snowball. Both people are on skates. The first person is initially moving forward with a speed of 2.10 m/s, and the second person is initially at rest. What are the velocities of the two people after the snowball is exchanged? Disregard the friction between the skates and the ice.
Thrower:
Catcher: