Momentum: Practice Worksheet

Part A: Reviewing Conservation of momentum

We have learned that in a collision, the total momentum is conserved. This means that the total momentum before a collision is equal to the total momentum after a collision; in other words $p_{before} = p_{after}$.

Answer the following, using complete sentences.

1. How can we tell if a collision is elastic or inelastic?
2. If the Law of Conservation of Momentum is true, then how does the total momentum before a collision compare to the total momentum after a collision?

Part B: Momentum Practice

You might find the following equations helpful:

Momentum:	Conservation of Momentum:	Elastic Collision:	Inelastic Collision:
$p = mv$	$p_{before} = p_{after}$	$m_1v_1+m_2v_2 = m_1v_3+m_2v_4$	$m_1v_1+m_2v_2 = (m_1+m_2)v_{after}$

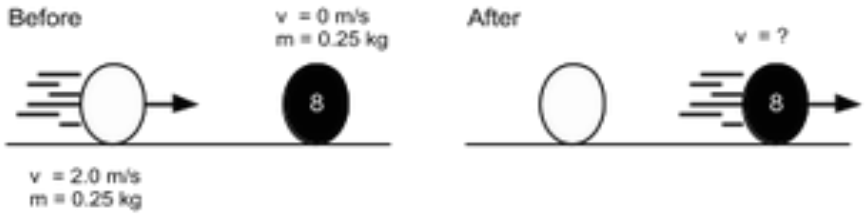
p is momentum (measured in kg*m/s), m_1 is the mass of object 1, m_2 is the mass of object 2, (measured in kg), v_1 is velocity of object 1 before the collision, and v_2 is the velocity of object 2 before the collision, v_3 is the velocity of object 1 after the collision, and v_4 is the velocity object 2 after the collision.

Be sure to show ALL of your work using the three-step process (equation, equation with values plugged in, final answer with units).

3. A 5.0 kg ball is launched with a speed of 2.0 m/s. Find the momentum of the ball.
4. A 500 kg car is driving with a speed of 4 m/s. Find the momentum of the car.
5. Two students are running in a cross country race. One has a mass of 60 kg, while the other has a mass of 70 kg. If they are both running with a speed of 7 m/s, which has more momentum? Why?
6. Which has more momentum, a car with a mass of 5000 kg moving at a speed 10 m/s or a boat with a mass of 2000 kg moving at a speed of 40 m/s?
7. How fast would a 0.40 kg football have to be thrown to have a momentum of 8.0 kg*m/s?
8. Let's say a 0.001kg bullet moves with a speed of 1500 m/s. A pitcher claims he can throw a 0.15 kg baseball with as much momentum as that bullet. How fast would he have to throw the ball for this to be true?

Part C: Conservation of Momentum

9. Someone throws a heavy ball to you when you are standing on roller skates. You catch it and roll backwards. How does your speed after the collision compare to the speed of the ball before the collision, and why?
10. A prospector finds himself holding his bag of gold and standing in the middle of a large pond of frictionless ice. Use the Law of Conservation of Momentum to explain how he can get to the side before he freezes?
11. What is the velocity of the "8" ball after the elastic collision below?



12. A 110 kg football player runs at 8.0 m/s and plows into an 80. kg referee standing on the field causing the referee to fly forward at 5.0 m/s.
    a. What is the momentum of the football player before the collision?
    b. What is the momentum of the referee before the collision?
    c. What is the total momentum before the collision? (hint: add the two above together)
    d. What is the momentum of the referee after the collision?
    e. What must the momentum of the football player be after the collision?
    f. Find the football player's speed after the collision.
13. An 80.0-kg fisherman jumps from a dock into a 100.0-kg rowboat which is not moving. If the velocity of the fisherman is 4.00 m/s when he jumps into the boat, what is the final velocity of the fisherman and the boat?
14. A train car, which has a mass of 2000 kg, is rolling along with a speed of 20 m/s. It strikes a stationary car, which also has a mass of 2000 kg, and they stick together. What is their combined speed after the collision?
15. A 1200 kg car is stopped at a traffic light. A 3000 kg truck moving at 8.0 m/s hits the car from behind. If bumpers lock, how fast will the two vehicles move?