Momentum in collisions

Name:

Date: Period:

Assignment #

When objects collide, momentum is always conserved: The combined momentum of the two objects before the collision will be the same after the collision. This can be written as

$$mv_A + mv_B = mv_{A-after} + mv_{B-after}$$

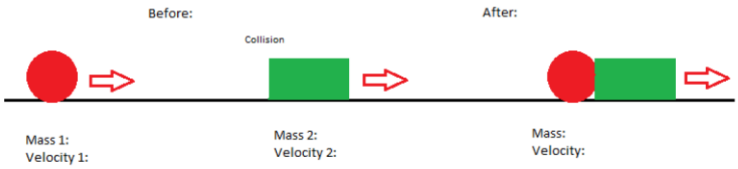
With momentum problems, you need to pay attention to the direction: One direction is **positive** velocities, and the opposite direction has **negative** values.

Energy is also conserved, but in collisions the energy stored as kinetic is often 'lost' from the kinetic storage and transferred into thermal (things bending), sound, etc.

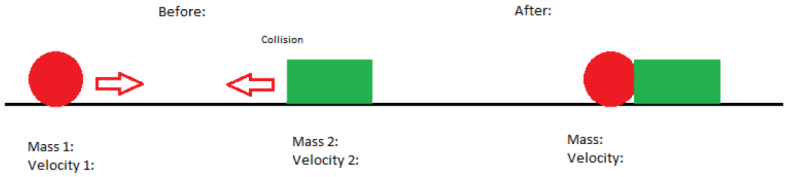
There are a few rare cases where so little kinetic energy is lost that it can be considered conserved. Examples include pool balls hitting each other, or bowling balls hitting bowling pins—usually kinetic energy is conserved only when very hard objects collide. These special cases are called elastic collisions (not to be confused with elastic energy!)

In this worksheet, you will practice with ***in***elastic collisions—ones where kinetic energy is ***not*** conserved.

1. A ball of mass 3 kg is moving to the right with a velocity of 4 m/s when it strikes a 10 kg green block at rest. The blocks experience a Perfectly Inelastic Collision, solve for the following:
   a. Momentum Before the Collision
   b. Momentum After the Collision
   c. Velocity of both masses after the collision



2. A ball of mass 3 kg is moving to the right with a velocity of 4 m/s when it strikes an 8 kg green block also moving to the right at 2 m/s. The blocks experience a Perfectly Inelastic Collision, solve for the following:
   a. Momentum Before the Collision
   b. Momentum After the Collision
   c. Velocity of both masses after the collision



3. A ball of mass 6 kg is moving to the right with a velocity of 4 m/s when it strikes a 12 kg green block moving to the left at 5 m/s. The blocks experience a Perfectly Inelastic Collision, solve for the following:
   a. Momentum Before the Collision
   b. Momentum After the Collision
   c. Velocity of both masses after the collision

4. Two grocery carts collide, a full one with a mass of 35 kg moving East at 2 m/s and an empty one with a mass of 10 kg moving West at 3 m/s. After the collision the full cart is moving East at 0.75 m/s. What is the velocity of the empty cart?

5. Two cans of **SPAM** with identical masses collide. Before the collision, the hickory-smoke flavor is moving to the left at 4 m/s, while the hot-and-spicy flavor is moving to the right at 2 m/s. After the collision, the hickory-smoke is moving to the left at 1.2 m/s. What is the velocity of the hot-and-spicy?

6. A North-going Zak has a mass of 50 kg and is traveling at 4 m/s. A South-going Zak has a mass of 40 kg and is traveling at 5 m/s. After they collide and stick together, what is their final velocity?

7. Two cars have a 'rear end' collision. A 1,200 kg Honda moving at 20 m/s strikes a 1,000 kg Ford moving at 15 m/s. Their bumpers become locked and they continue to move as one mass. What is their final velocity?

8. Two football players have a head-on collision and grab onto each other's uniforms. The 80 kg Vanden Viking was moving at 3 m/s, while the 70 kg Vacaville Bulldog player was moving in the opposite direction at 2.5 m/s. What is their final velocity after impact? Who kept moving and who got pushed back?

9. Two barges full of salted toad guts have a collision. The red barge has a mass of 150,000 kg and is traveling Northwest at 0.25 m/s. The blue barge has a mass of 100,000 kg and is traveling Southeast at 0.1 m/s. After the collision the blue barge has a velocity of 0.32 m/s to the Northwest. What is the final velocity of the red barge?

10. A 15 kg dog jumps out of a 40 kg canoe. If the dog's velocity is 1.2 m/s, what is the velocity of the canoe?

11. An 800 kg cannon mounted on wheels fires a 10 kg cannonball at 80 m/s. At what velocity does the cannon recoil?