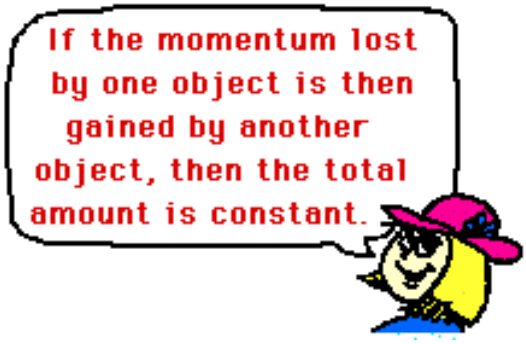
Law of Conservation of Momentum

We have learned about momentum, but how does it work in collisions? When objects collide in a closed system one thing is definite; momentum is conserved



So what's an isolated system?

You be the judge. Which of the following situations are considered isolated systems?

1. Two cars collide on a gravel roadway on which frictional forces are large.
2. Hans Full is doing the annual vacuuming. Hans is pushing the Hoover vacuum cleaner across the living room carpet.
3. Two air track gliders collide on a friction-free air track.

One way to look at conservation of momentum is in terms of money exchange between two friends, Jack and Jill

Money Conservation in a Financial Interaction

	Before	After	Change
Jack	$100	$50	-$50
Jill	$100	$150	+$50
Total	$200	$200	

Is this an isolated system? _____

What is Jill pockets $20, how does this change the system? _____

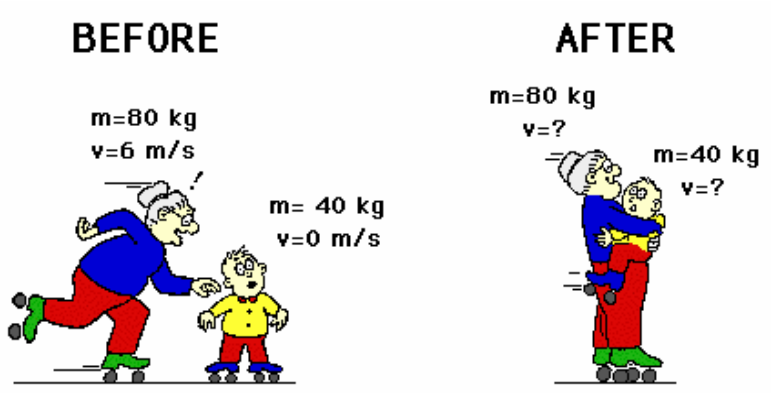
Conservation of Momentum Formula

Elastic Collisions: Elastic Collisions occur when objects strike each other and no deformation occurs. **Kinetic energy and momentum is conserved.** A good example of this is seen between billiard ball collisions.

Example: A ball is moving at 5.0 m/s with a mass of 3.0 kg strikes a second ball with a mass of 4.0 kg that is sitting motionless. What is the velocity of the second ball if the first ball stops immediately after the collision?

Inelastic Collisions: Inelastic collisions occur when objects strike each other and stick together. Momentum is conserved, but kinetic energy is not conserved since deformation occurs between the objects and energy is lost in this process.

Example: Granny is skating and scoops up her grandson. What is the final velocity of them?



Practice Problems

Directions: Answer the following questions and show all work.

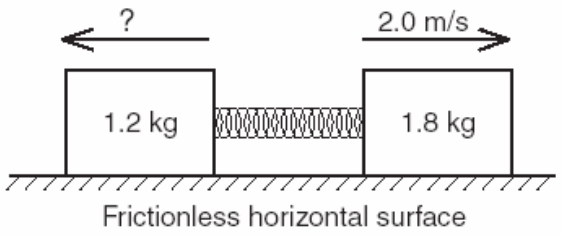
1. A billiard ball with a mass of 1.5 kg is moving at 25 m/s and strikes a second ball with a mass of 2.3 kg that is motionless. Find the velocity of the second ball if the first ball stops when it strikes the second ball.

2. A bullet (m = .005 kg) moving at 500 m/s strikes and sticks in a block of wood (m = 5 kg). What is the final velocity of the wood/bullet mass?

3 Ball *A* of mass 5.0 kilograms moving at 20. meters per second collides with ball *B* of unknown mass moving at 10. meters per second in the same direction. After the collision, ball *A* moves at 10. meters per second and ball *B* at 15 meters per second, both still in the same direction. What is the mass of ball *B*?

(1) 6.0 kg
(2) 2.0 kg
(3) 10. kg
(4) 12 kg

4 A 1.2-kilogram block and a 1.8-kilogram block are initially at rest on a frictionless, horizontal surface. When a compressed spring between the blocks is released, the 1.8-kilogram block moves to the right at 2.0 meters per second, as shown.



What is the speed of the 1.2-kilogram block after the spring is released?

(1) 1.4 m/s
(2) 2.0 m/s
(3) 3.0 m/s
(4) 3.6 m/s