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Quiz & Worksheet - Physics Lab on Momentum Conversion

- What is momentum?
  - A quantity of motion equal to the product of the mass and the velocity of the object.
  - A quantity of motion equal proportional only to the mass of an object.
  - A quantity of motion equal proportional only to the velocity of an object.
  - The same as the mass of an object.
  - The motion energy an object has.
- What is conservation of momentum?
  - It says that momentum is neither created nor destroyed, it only moves from one place to another.
  - It says that momentum is created, but cannot be destroyed.
  - It says that momentum is destroyed, but cannot be created.
  - It says that energy is neither created nor destroyed, it only moves from one place to another.
  - It says that you should save momentum as much as possible, because it's valuable.
- Why does momentum seem to disappear when you push a shopping cart and let it stop on its own?
  - Because momentum can be absorbed by the Earth and ground.
  - Because conservation of momentum doesn't apply when friction is present.
  - Because momentum isn't always conserved.
  - Because physics isn't perfect.
  - Because the surface has friction.

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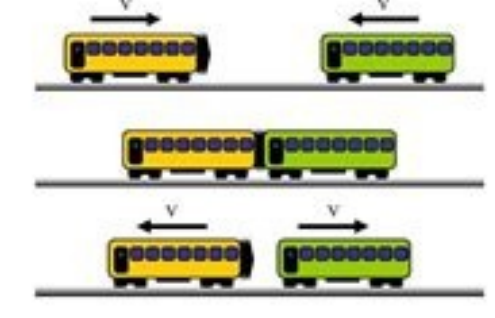
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Collisions! (Momentum Worksheet #4)

Momentum  $P = mv$       Elastic Collision  $m_1v_{1i} + m_2v_{2i} = m_1v_{1f} + m_2v_{2f}$       Inelastic Collision  $m_1v_{1i} + m_2v_{2i} = (m_1 + m_2)v_f$

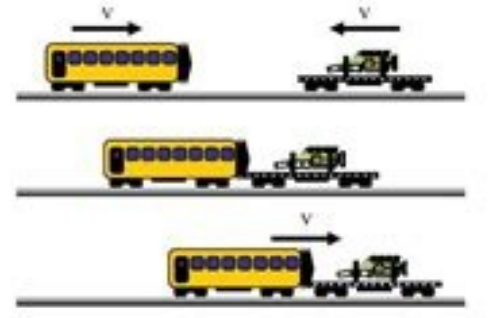
1. Two train cars of identical mass ( $m = 10.0 \text{ kg}$ ) collide and move off as shown. The left car was initially traveling at  $2.0 \text{ m/s}$  right and the right car was initially traveling at a velocity of  $3.0 \text{ m/s}$  left. After the collision, the left car is traveling at a velocity of  $2.5 \text{ m/s}$  to the left.

- What type of a collision is depicted here?
- What was the initial momentum of the right car?
- What was the initial momentum of the left car?
- What was the final momentum of the left car?
- What was the final momentum of the right car?



2. A Passenger car ( $m = 10.0 \text{ kg}$ ) and a flat car ( $m = 7.5 \text{ kg}$ ) collide and move off as shown. The left car was initially traveling at  $3.5 \text{ m/s}$  right and the right car was initially traveling at a velocity of  $2.2 \text{ m/s}$  left.

- What type of a collision is depicted here?
- What was the initial momentum of the right car?



Name: \_\_\_\_\_  
Period: \_\_\_\_\_

Types of Collisions/Impulse Graphs

There are 4 different types of collisions. In elastic collisions, momentum energy is lost. Sometimes the objects stick together. In an inelastic collision, momentum is conserved, but kinetic energy is not.

**Elastic:** In elastic collisions, objects collide and bounce off each other. Kinetic energy is conserved.  $\Sigma p_i = \Sigma p_f$  and  $\Sigma K_i = \Sigma K_f$ .

**Inelastic:** In inelastic collisions, the two objects collide, may separate, but kinetic energy is not conserved.  $\Sigma p_i = \Sigma p_f$  but  $\Sigma K_i \neq \Sigma K_f$ .

**Perfectly Inelastic:** In perfectly inelastic collisions, the two objects collide and stick together.  $\Sigma p_i = \Sigma p_f$  but  $\Sigma K_i \neq \Sigma K_f$ .

Type of collision	Momentum	Kinetic Energy	Objects Combine?
Elastic	Conserved	Conserved ( $\Sigma K_i = \Sigma K_f$ )	No
Inelastic	Conserved	Not conserved	No
Perfectly Inelastic	Conserved	Not conserved	Yes

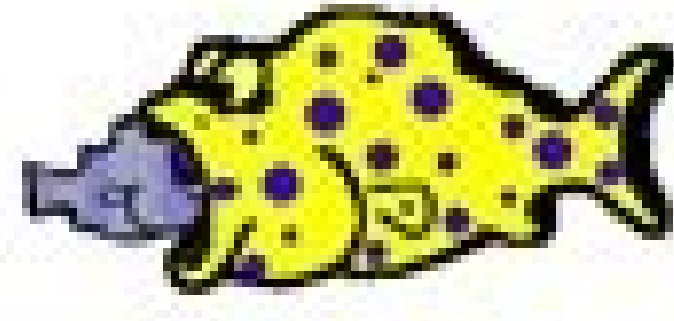
**Impulse Graphs:** Impulse graphs show the force applied to an object over time. Do not mistake the slope of an impulse to mean the direction the object is moving, because it shows force, not distance.

**Graph 1:** Shows a positive linear increase in force over time. Area =  $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 4 \times 20 = 40 \text{ kg}\cdot\text{m/s}$ .

**Graph 2:** Shows a negative linear decrease in force over time. Area =  $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 4 \times (-20) = -40 \text{ kg}\cdot\text{m/s}$ .

# Fish Catch

A little fish with a mass of 20 grams and a velocity of 80 cm/s is eaten by a big fish that has a mass of 80 grams and is initially at rest. The two fish move with the same speed after the collision (i.e., after lunch).



	Before Lunch			After Lunch	
	Mass (g)	$v$ (cm/s)	$p$ (g-cm/s)	$v$ (cm/s)	$p$ (g-cm/s)
Big Fish	80	0.0	0.0		
Little Fish	20	80.0	1600		
Total	—	—	1600		





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