

Elastic Collisions

objectives: Define an elastic collision
Calculate initial or final velocity



Elastic Collisions

What is an elastic collision?

Any collision where the objects do not stick together after the collision occurs is an elastic collision.



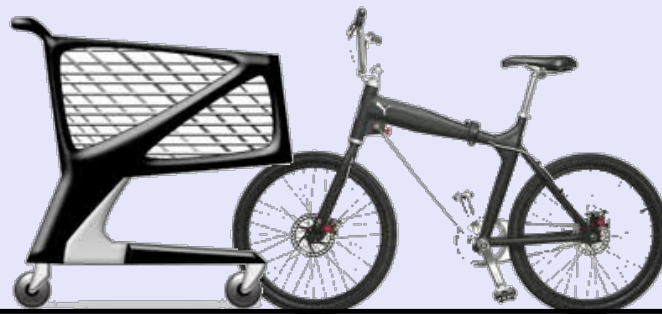
Elastic Collision Equation

$$P_1 + P_2 = P_1' + P_2'$$

$$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$$

Example #1

Use the Law of Conservation of Momentum to calculate the velocity of a 12kg cart that starts at rest but is hit by a 15kg bike traveling at 30m/s to the left. The bike moves to the left at 10m/s after the collision. the bike and the cart do not stick together.



$$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$$

$$(12)(0) + (15)(-30) = (12)v_1' + (15)(-10)$$

$$0 + (-450) = (12)v_1' + (-150)$$

$$-450 = 12v_1' + (-150)$$

$$+150 \qquad \qquad \qquad +150$$

$$-300 = \frac{12v_1'}{12}$$

$$\boxed{-25 \text{ m/s} = v_1'}$$

Example #2

Use the Law of Conservation of Momentum to calculate the velocity of 50g bullet that is shot from a 3kg gun if the gun has a recoil velocity of 25m/s.

$$\frac{50g}{1000} = 0.05kg$$



$$\begin{aligned}
 P_1 + P_2 &= P_1' + P_2' \\
 m_1 v_1 + m_2 v_2 &= m_1 v_1' + m_2 v_2' \\
 0 + 0 &= (0.05) v_1' + (3)(-25) \\
 0 &= 0.05 v_1' + (-75) \\
 +75 & \qquad \qquad \qquad +75 \\
 75 &= \frac{0.05 v_1'}{0.05} \\
 1500 \text{ m/s} &=
 \end{aligned}$$

In Review:

- 1) Inelastic Collisions -
Objects stick together**
- 2) Elastic Collisions -
Objects bounce apart**
- 3) Momentum is Conserved
The momentum you start with must
equal the momentum you end with.**

