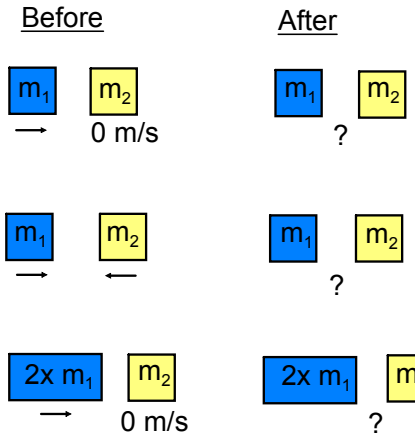
Conservation of Momentum

Objective:

Apply conservation of momentum to elastic collisions.

Identify characteristics of elastic collisions.

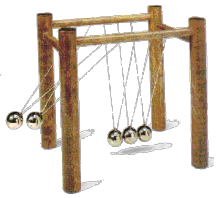
Calculate final momentum or velocity of objects in an elastic collision.



Conservation of Momentum

- total momentum is constant in a system
- applies to elastic & inelastic

$$\Sigma P_b = P_a$$



Elastic Collisions – bounce

- objects follow separate paths
- momentum is transferred between objects

$\Sigma P_b = P_a$

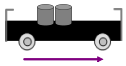
total p before = total p after

$$p_1 + p_2 = p_1' + p_2'$$

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

Elastic Collision Problem

m_1 = .4 kg



v_1 = 6 m/s

v_1' = 2 m/s

m_2 = .2 kg

v_2 = 0 m/s

v_2' = ?

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

$(.4 \cdot 6) + (.2 \cdot 0) = (.4 \cdot 2) + (.2) v_2'$

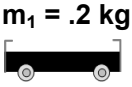
$2.4 + 0 = .8 + .2 v_2'$

$1.6\ kg \cdot \frac{m}{s} = .2 v_2'$

$8 \frac{m}{s} = v_2'$

Elastic Collision Problem

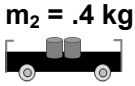
m_1 = .2 kg



v_1 = 6 m/s

v_1' = -2 m/s

m_2 = .4 kg



v_2 = 0 m/s

v_2' = ?

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

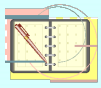
$(.2)(6) + (.4)0 = (.2)(-2) + (.4) v_2'$

$1.2 + 0 = -.4 + .4 v_2'$

$1.6 = .4 v_2'$

$v_2' = 4 \frac{m}{s}$

Assignments . . .



- Ch 6 Homework # 11 - 14

Homework Question # 11

m_1 .165 kg → $v_1 = 3.2\ m/s$, $v_1' = 0$

m_2 .165 kg, $v_2 = 0$, $v_2' = ?$

$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$

$(.165)(3.2) + 0 = 0 + (.165)v_2'$

$.528 = .165\,v_2'$

$v_2' = 3.2\ m/s$

Homework Question # 12

m_1 300 kg → $v_1 = 10\ m/s$, $v_1' = 4.12\ m/s$

m_2 175 kg, $v_2 = 0$, $v_2' = ?$

a) $p = m_1v_1$

b) $p = m_1v_1'$

c)

$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$

$3000\ kg\cdot\frac{m}{s} + 0 = 1236\ kg\cdot\frac{m}{s} + 175v_2'$

$= 175v_2'$