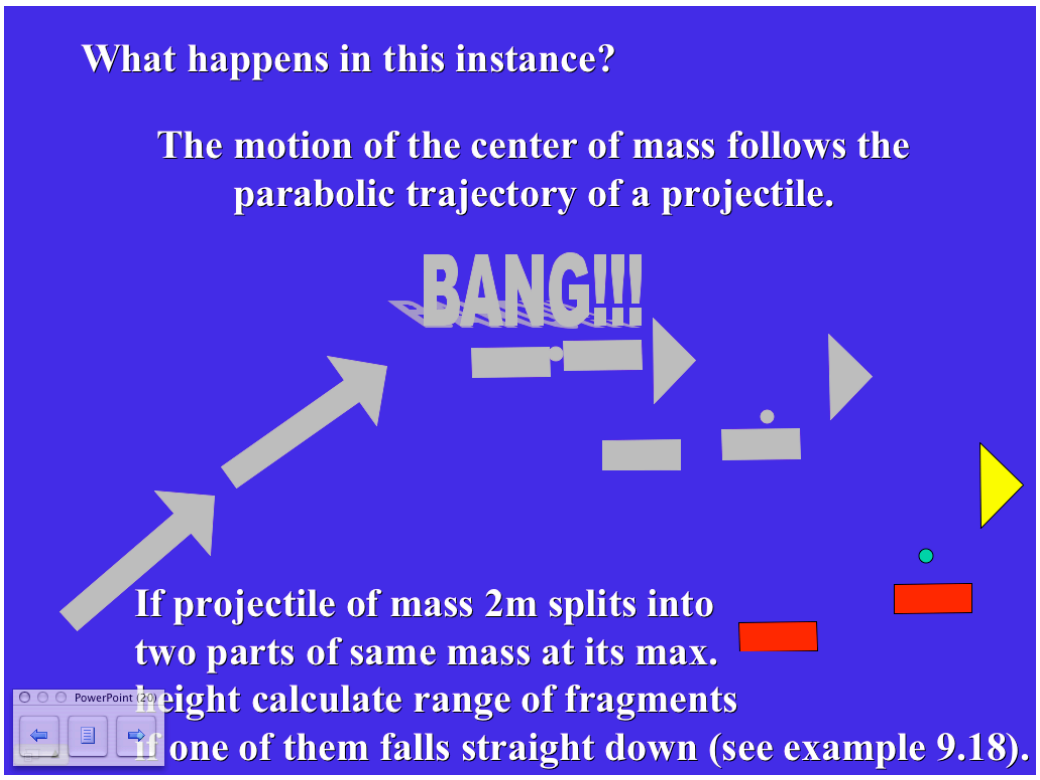
Reminders 03-18-10:

-POW 8 Due Next Thursday
-Short Quiz Today on Energy Level Diagrams.
-Exam 3 Ch 7,8, and 9 March 25. No Makeups.

Objectives:

-Conservation of Momentum
-Types of Collisions



If we say projectile would have traved R if it didn't break up, the the c.m of projectile still travels R because $F_{ext_x} = 0$

$$m_1 x_1 + m_2 x_2 = 2mR$$

$$m\frac{R}{2} + m x_2 = 2mR$$

$$\frac{R}{2} + x_2 = 2R$$

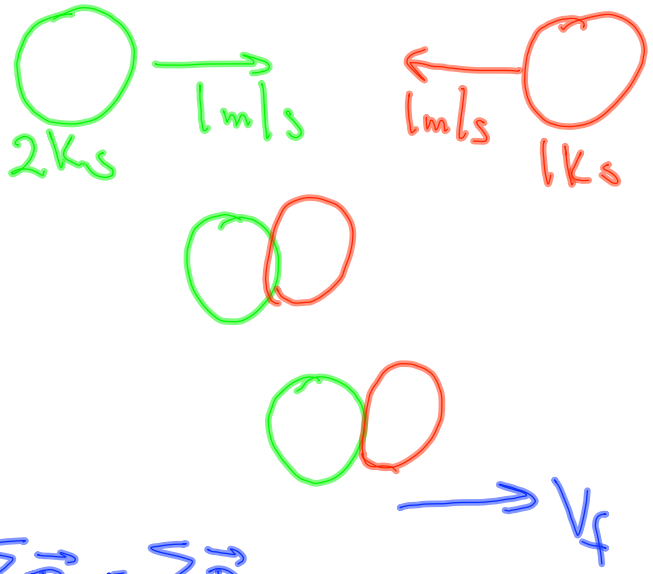
$$x_2 = \frac{3}{2}R$$

Example 1:
Two particles of equal mass and speed travel in opposite directions have a head-on collision, and stick together. What is the speed of the system after the collision? (tech)

$P_{i\,system} = 0$

$V_f = 0$ because both objects move with same velocity

Example 2:
A green particle has a mass of 2 kg and an initial velocity of 1 m/s to the right. It collides with a 1 kg red particle traveling to the left at 1 m/s and they stick together. What is the velocity of the system after the collision?



$$\sum \vec{p}_i = \sum \vec{p}_f$$

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$v_f = \frac{m_1 v_{1i} + m_2 v_{2i}}{m_1 + m_2}$$

$$= \frac{(2\,kg)(1\,m/s) + (1\,kg)(-1\,m/s)}{3\,kg}$$

$$= \frac{1}{8}\,m/s \text{ to right}$$

Elastic collisions

2 objects equal mass
equal speed
opp. dir.

$$\sum p_i = 0 = m_1 v_{1f} + m_2 v_{2f} = 0$$

$$v_{1f} + v_{2f} = 0$$

Kinetic Energy Cons.

$$\frac{1}{2} m v^2 + \frac{1}{2} m v^2 = \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2$$

$$m v^2 = \frac{1}{2} m v_{1f}^2 + \frac{1}{2} m v_2^2$$

$$2v^2 = v_{1f}^2 + v_{2f}^2$$

$$v_{1f} + v_{2f} = 0$$

$$v_{1f} = -v_{2f} = v$$

Example (with problem solving steps):
A 2 kg mass is traveling to the right with a speed of 2 m/s and runs head-on into a 1 kg mass traveling to the left at 1 m/s. The collision is elastic. What are the speeds of the masses after the collision?

$\Sigma p_i = 3 kg\,m/s$

$3 = m_1 v_{1f} + m_2 v_{2f}$

$(v_{1i} - v_{2i}) = -(v_{1f} - v_{2f})$

$3 = -(v_{1f} - v_{2f})$ $\quad -3 = v_{1f} - v_{2f}$

$v_{1f} = v_{2f} - 3$

$3 = m_1 (v_{2f} - 3) + m_2 v_{2f}$

$3 = m_1 v_{2f} + m_2 v_{2f} - m_1 3$

$3 + m_1 3 = (m_1 + m_2) v_{2f}$

$$v_{2f} = \frac{3 + 3m_1}{m_1 + m_2} = \frac{9}{3}$$

$v_{2f} = 3 \qquad v_{1f} = 0$