

PhyzJob: Conservation of Momentum Number Puzzles

PART 2: SPEED



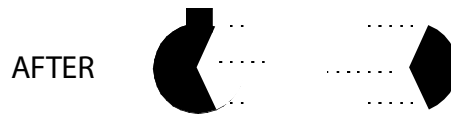
INSTRUCTIONS: In each of the scenarios below, some information regarding the system (or elements within the system) is given. Determine the missing speed based on what you know about conservation of momentum.

1. A Stationary Bomb Explodes.



$$v = 0 \text{ m/s}$$

BOOM!



$$m_1 = 7.0 \text{ kg}$$

$$v_1' = -1.43 \text{ m/s}$$

$$m_2 = 3.0 \text{ kg}$$

$$v_2' = ?$$

DON'T THINK:

$$p = p'$$

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

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

THINK:

$$v_1 = v_2 = v = 0$$

APPLY:

$$0 = m_1 v_1' + m_2 v_2'$$

SOLVE: $0 = m_1 v_1' + m_2 v_2'$

$$m_2 v_2' = -m_1 v_1'$$

$$v_2' = -m_1 v_1' / m_2$$

$$v_2' = -7.0 \text{ kg} \cdot -1.43 \text{ m/s} / 3.0 \text{ kg}$$

$$v_2' = 3.3 \text{ m/s}$$

2. A Blob of Clay Collides With a Stationary Blob of Clay.



$$m_1 = 5.0 \text{ kg}$$

$$v_1 = 8.0 \text{ m/s}$$

$$m_2 = 3.0 \text{ kg}$$

$$v_2 = 0 \text{ m/s}$$



$$v' = ?$$

DON'T THINK:

$$p = p'$$

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

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

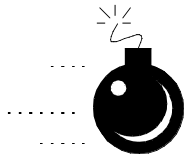
THINK:

$$v_2 = 0, v_1' = v_2' = v'$$

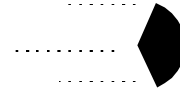
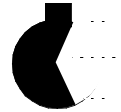
APPLY:

$$m_1 v_1 = m_1 v' + m_2 v'$$

3. A Moving Bomb Explodes.



BOOM!



$m_1 = 6.0 \text{ kg}$ $m_2 = 4.0 \text{ kg}$ $v = +9.0 \text{ m/s}$

$v_1' = -7.5 \text{ m/s}$

$v_2' = ?$

DON'T THINK:

$$p = p'$$

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

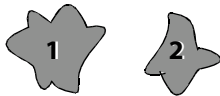
$$m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$$

THINK:

$$v_1 = v_2 = v$$

APPLY:

4. Moving Blobs of Clay Collide. (YOU draw the "speed lines.")



sklitch



$m_1 = 8.0 \text{ kg}$ $m_2 = 5.0 \text{ kg}$
 $v_1 = +4.0 \text{ m/s}$ $v_2 = -2.0 \text{ m/s}$

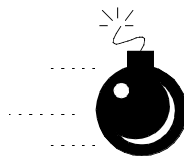
$v' = ?$

$$p = p'$$

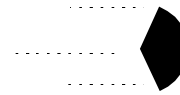
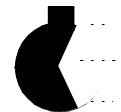
$$p_1 + p_2 = p_1' + p_2'$$

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

5. A Moving Bomb Explodes.



BOOM!



$m_1 = 4.0 \text{ kg}$ $m_2 = 3.0 \text{ kg}$
 $v = ?$

$v_1' = -5.0 \text{ m/s}$ $v_2' = +12 \text{ m/s}$