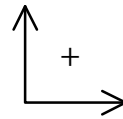


P11 - 5.1 - Momentum



What is the momentum of a 15kg object moving at $2 \frac{m}{s}$.

$p = ? = 30Ns$
 $v = 2 \frac{m}{s}$
 $t = 3$

$p = mv$
 $p = 15 \times 2$
 $p = 30 \frac{kgm}{s}$

$p = mv$
 $\frac{kgm}{s} = Ns$

A 1kg ball with a $v = 12 \frac{m}{s}$ is thrown at a wall. Find Impulse (Change in Momentum Δp)

$v = 12 \frac{m}{s}$ $v = 0$

$\Delta p = m\Delta v$
 $\Delta p = m(v_f - v_i)$
 $\Delta p = 1(0 - 12)$
 $\Delta p = -12 \frac{kgm}{s}$

$\Delta p = m\Delta v$
 Notice the Δp is Negative.

A 2kg ball with a $v = 11 \frac{m}{s}$ is thrown at a wall where bounces off the wall at $8 \frac{m}{s}$. Find Δp .

$v = 11 \frac{m}{s}$ $v = 0$ $v = -8 \frac{m}{s}$

Before **After**

$\Delta p = m\Delta v$
 $\Delta p = m(v_f - v_i)$
 $\Delta p = 2(-8 - (11))$
 $\Delta p = -38 \frac{kgm}{s}$

$\Delta p = m\Delta v$

A 0.1kg piece of Gum is thrown directly at a wall at $v = 5 \frac{m}{s}$ where it sticks to the wall and smushes in 0.2s. Find the Net Force exerted on the Wall by the Gum.

$\Delta p = F_{net}t$
 $m\Delta v = F_{net}t$
 $F_{net} = \frac{m\Delta v}{t}$
 $F_{net} = \frac{0.1(0 - 5)}{0.2}$
 $F_{net} = -2.5 N$

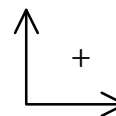
$\Delta v = v_f - v_i$
 $F_{net} = ma$
 $F_{net} = m \frac{\Delta v}{t}$
 $F_{net} \times t = m\Delta v$
 $F_{net}t = \Delta p$
 $a = \frac{\Delta v}{t}$

$\Delta p = F_{net}t$

A Pitcher throws a 0.15 kg Ball at a $v = 21 \frac{m}{s}$ directly at a Catcher who Stops the Ball exerting a Force of 25 N on the Ball. How long does it take the ball to stop?

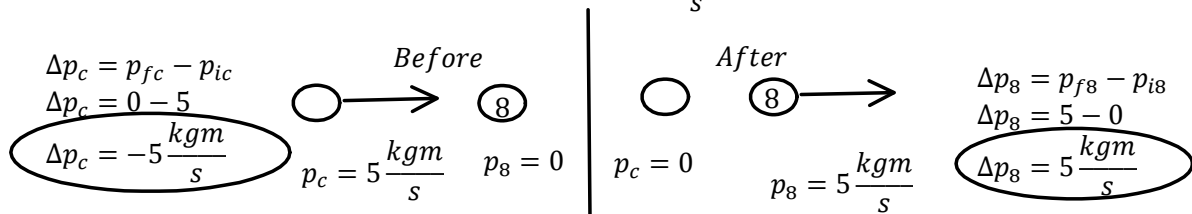
$\Delta p = F_{net}t$
 $m\Delta v = F_{net}t$
 $t = \frac{m\Delta v}{F_{net}}$
 $t = \frac{0.15 \times (0 - 21)}{-25}$
 $t = 0.126 s$

P11 - 5.2 - Conservation of Momentum Notes



The Law of the Conservation of Momentum: Momentum must be conserved!

A Cue Ball is shott with a $p = 5 \frac{kgm}{s}$ at the Eight Ball at Rest. The Cue Ball comes to a Stop, the Eight ball will continue with a $p = 5 \frac{kgm}{s}$. Find Δp of Eight ball and Cue ball?



Momentum Before = Momentum After

Equal and Opposite

$\Delta p_c = \Delta p_8$
 $p_{fc} - p_{ic} = p_{f8} - p_{i8}$
 $0 - 5 = 5 - 0$
 $-5 \frac{kgm}{s} = 5 \frac{kgm}{s}$

Before=After

$$p_i = p_f$$

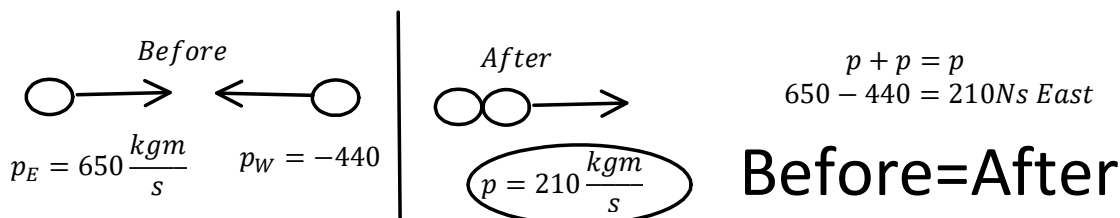
$$p_{1i} + p_{2i} = p_{1f} + p_{2f}$$

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

$$5 + 0 = 0 + 5$$

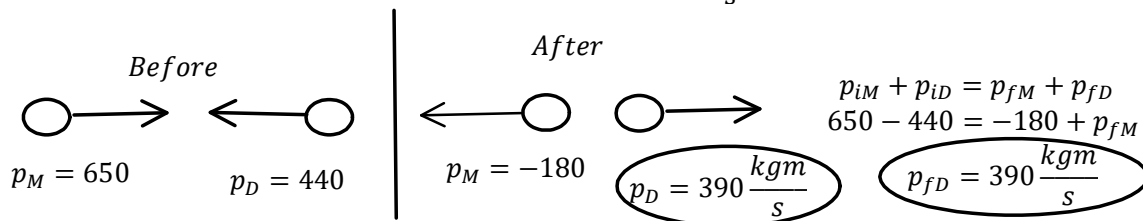
$$5 = 5 \quad \checkmark$$

A Marie with a $p = 650$ Ns moving East, collides with a Doug with a $p = 440$ Ns moving West. If they Stick together, what is their Final Momentum?

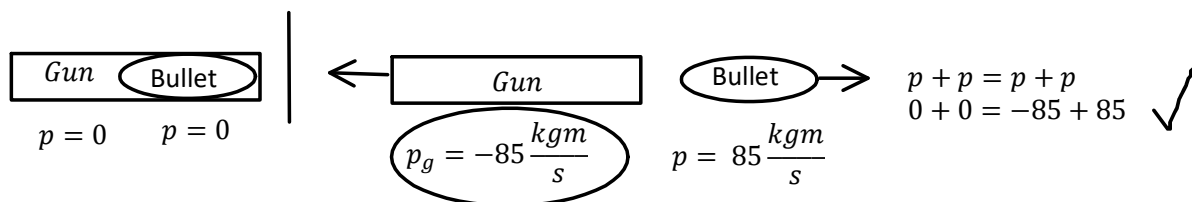


Before=After

If they Bounce off each other, and Marie's $p = -180 \frac{kgm}{s}$, Find Doug's final p ?



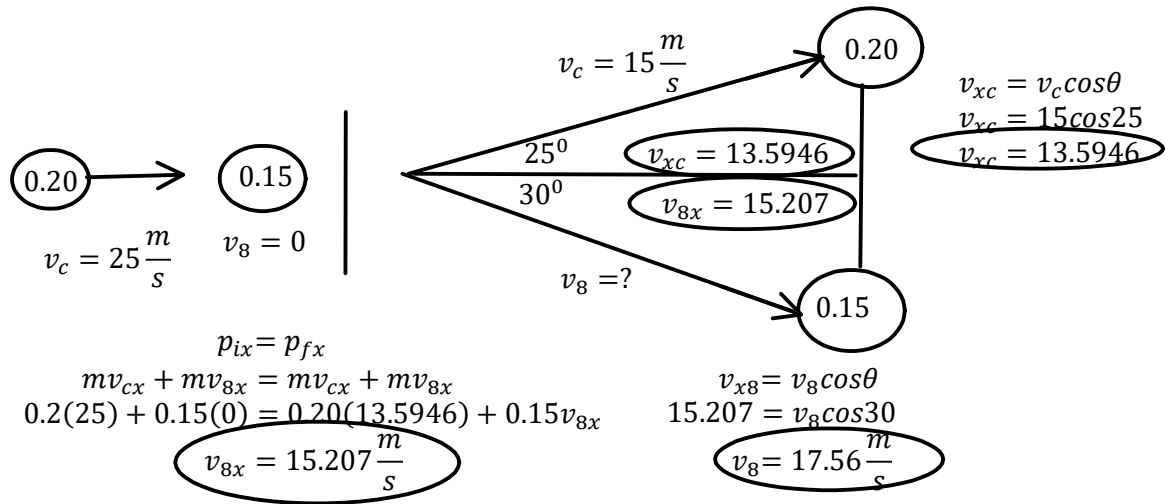
A Bullet is fired from a Gun with a $p = 85 \frac{kgm}{s}$. What is the recoil Momentum of the Gun.



Left=Right

P12 - 5.3 - Momentum Trig Notes

A pool player shoots the cue ball with a $m = 0.2 \text{ kg}$ with a $v = 25 \frac{m}{s}$ at the eight ball with a $m = 0.15 \text{ kg}$ at Rest. The cue ball deflects at a $v = 15 \frac{m}{s}$ in the diagram (see θ 's). Find v_8 .



If θ_8 is unknown, find v_8 .

Up=Down

