TH-GP General Physics Week 28 4/18

Momentum

$p = mv$

$m = 220\,kg$ $v = 8.00\,m/s$

$p = mv$

$(220\,kg)(8.00\,m/s) = \boxed{1760\,kg\,m/s}$

Bullet $m = 0.015\,kg$ $v = 900\,m/s$

Football player $m =$ $v = 8.34\,m/s$ $\frac{40y}{4.38s} \rightarrow \frac{36.576}{4.38}$

$229\,lbs \rightarrow 103.873$

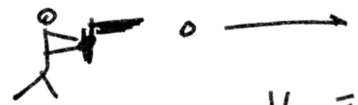
Bullet $(0.015\,kg)(900\,m/s) = 13.5\,kg\,m/s$

Football player $(103.87\,kg)(8.34\,m/s) = 866\,kg\,m/s$

Momentum is conserved.

$m_2 = 0.040\,kg$

$m_1 = 80\,kg$



$v_2 = 1200\,m/s$

What is the velocity of the recoil?

$$m_1 V_1 = m_2 V_2$$

$$\frac{m_1 V_1}{m_1} \qquad \frac{m_2 V_2}{m_1}$$

$$V_1 = \frac{m_2 V_2}{m_1} = \frac{(0.040\,kg)(1200\,m/s)}{80\,kg} = \boxed{0.6\,m/s}$$

Elastic collision – kinetic energy and momentum is conserved.

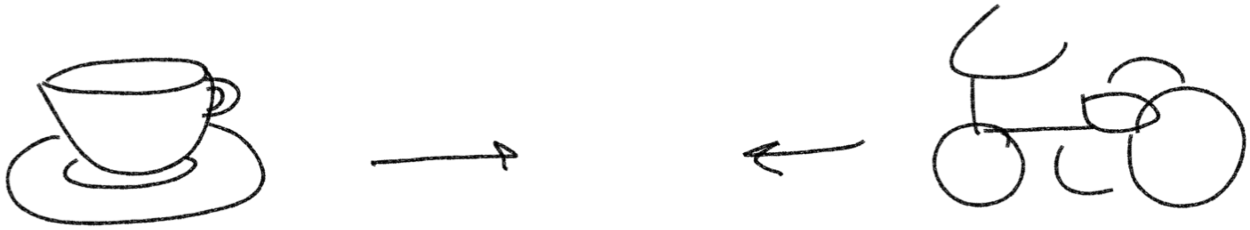
$$m_1 V_{1i} + m_2 V_{2i} = m_1 V_{1f} + m_2 V_{2f}$$

Only exists with molecules

Perfectly Inelastic Collisions

Two mass collide and form a single mass

$$m_1 V_1 + m_2 V_2 = (m_1 + m_2) V_f$$



$m_1 = 9{,}123\text{ kg}$ $m_2 = 4{,}989\text{ kg}$

$V_1 = +500\text{ m/s}$ $V_2 = -90\text{ m/s}$

$$\frac{m_1V_1 + m_2V_2}{(m_1+m_2)} = \frac{(m_1+m_2)\boxed{V_f}}{(m_1+m_2)}$$

$$V_f = \frac{m_1V_1 + m_2V_2}{m_1+m_2} = \frac{(9123\text{kg})(500\text{ m/s}) + (4989\text{kg})(-90\text{ m/s})}{(9123 + 4989)\text{kg}}$$

$$\boxed{292\text{ m/s}}$$

Mr. Sister

$m_1 = 91\ kg$

$v = 18\ m/s$

$m_2 = 80{,}700\ kg$

$v = 13\ m/s$

X direction

$$p_x\ (91\ kg)(18\ m/s)$$
$$= 1638\ kg\ m/s$$

y directim

$$p_y : (80{,}700\ kg)(13\ m/s)$$
$$1{,}049{,}100\ kg\ m/s$$

$$r = \sqrt{x^2 + y^2}$$

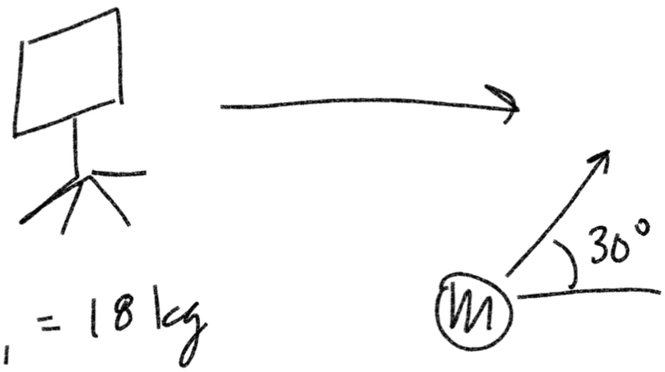
$$\sqrt{(1638)^2 + (1{,}049{,}100)^2} = 1{,}049{,}101$$

$$\frac{\text{tot. momentum}}{\text{tot. mass}} = \frac{1{,}049{,}101}{91\ kg + 80{,}700} = \boxed{13\ m/s}$$

$$\theta : \tan^{-1}\frac{y}{x} = \tan^{-1}\frac{1{,}049{,}100}{1638} \approx \boxed{90^\circ}$$

$$\boxed{13\ m/s,\ 90^\circ}$$

TV Stand



$m_1 = 18\,kg$

$V_1 = 30\,m/s$

$m_1 = 25\,kg$

$V = 100\,m/s$

x-momentum

$p_{x\,tv}$ $(18\,kg)(30\,m/s)$

$540\,kg\,m/s$

$p_{x\,cannon}$ $(25\,kg)(100\,m/s)\cos 30$

$2165\,kg\,m/s = X$ comp

y-momentum

$p_{y\,can}$: $(25\,kg)(100\,m/s)(\sin 30)$

$1250\,kg\,m/s = y_{comp}$

$$r = \sqrt{x^2 + y^2} = \sqrt{(2705)^2 + (1250)^2} = \boxed{2980\ kg\,m/s}$$

tot. momentum

$$\theta = \tan^{-1}\frac{y}{x} = \tan^{-1}\left(\frac{1250}{2705}\right) : 24.8° \quad \boxed{69.3\,m/s,\ 24.8°}$$

$$V_f = \frac{\text{tot. momentum}}{\text{tot. mass}} = \frac{2980\,kg\,m/s}{(18+25)\,kg} = \frac{2980}{43}\,m/s \quad 69.3\,m/s$$