M-6P General Physics Week 29 5/8

Momentum

$p = mv$ $\quad m = 220\,kg \quad v = 8\,m/s$

$= (220kg)(8\,m/s) = \boxed{1760\,kg\,m/s}$

Bullet

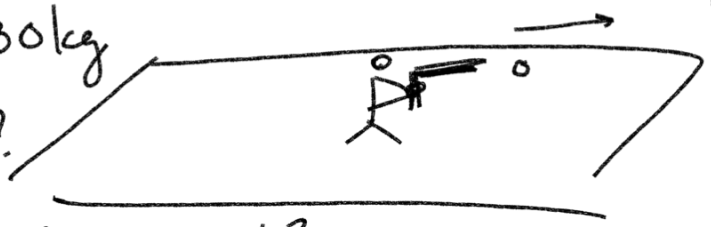
$m = 0.015\,kg \quad v = 900\,m/s$

$(0.015kg)(900\,m/s) = \boxed{13.5\,kg\,m/s}$

Momentum is conserved

$m_1 = 80kg$

$V_1 = ?$



$m_2 = 0.040\,kg$

$V_2 = 1200\,m/s$

Velocity of the recoil?

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

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

Elastic collision – kinetic energy and momentum is conserved.

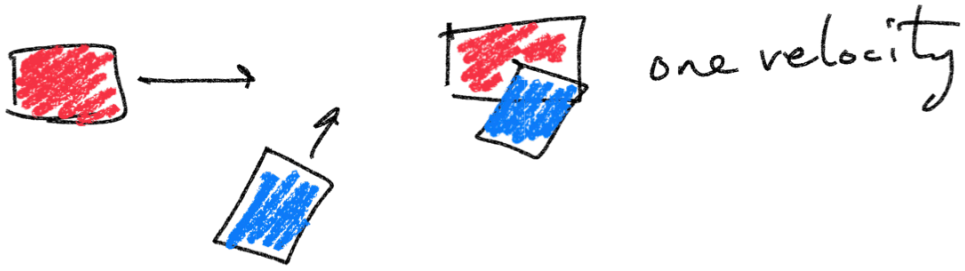
$$m_1 v_{1i} + m_2 v_{2i} = m_1 v_{1f} + m_2 v_{2f}$$

only exists with molecules.

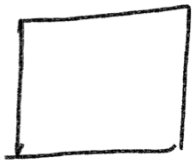
Perfectly Inelastic Collisions

Two masses collide to form a single mass.

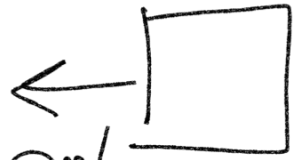
$$m_1 v_1 + m_2 v_2 = (m_1 + m_2) v_f$$



King Charles III



$\oplus$ m/s



$\ominus$ m/s

English breakfast

$m_1 = 120\,kg$

$v_1 = 300\,m/s$

$$\frac{m_1 v_1 + m_2 v_2}{(m_1 + m_2)} = \frac{(m_1 + m_2) v_f}{(m_1 + m_2)}$$

$m_2 = 300\,kg$

$v_2 = -500\,m/s$

What is the resulting velocity?

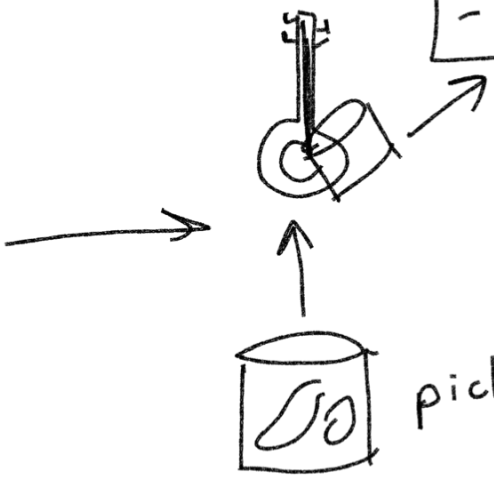
$$v_f = \frac{m_1 v_1 + m_2 v_2}{(m_1 + m_2)}$$

$$\frac{(120\,kg)(300\,m/s) + (300\,kg)(-500\,m/s)}{(120\,kg + 300\,kg)}$$

$$\frac{36{,}000\,kg\,m/s + (-150{,}000\,m/s)}{420\,kg}$$

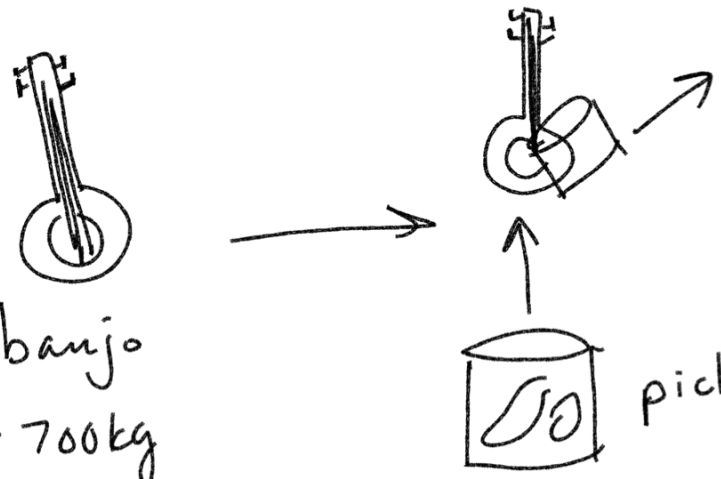
$$\boxed{-271\,m/s}$$

banjo



pickle tub

resolve this into components



banjo

$m_1 = 700\,kg$

$v_1 = 500\ m/s$

pickle tub

$m_2 = 500\,kg$

$v_2 = 200\ m/s$

momentum + momentum = total mass * final velocity
1 2

X direction

$p_x = m_1 v_1$

$= (700\,kg)(500\ m/s)$

$p_x = 350{,}000\,kg\ m/s$

$p_y = m_2 v_2$

$= (500\,kg)(200\ m/s)$

$p_y = 100{,}000\,kg\ m/s$

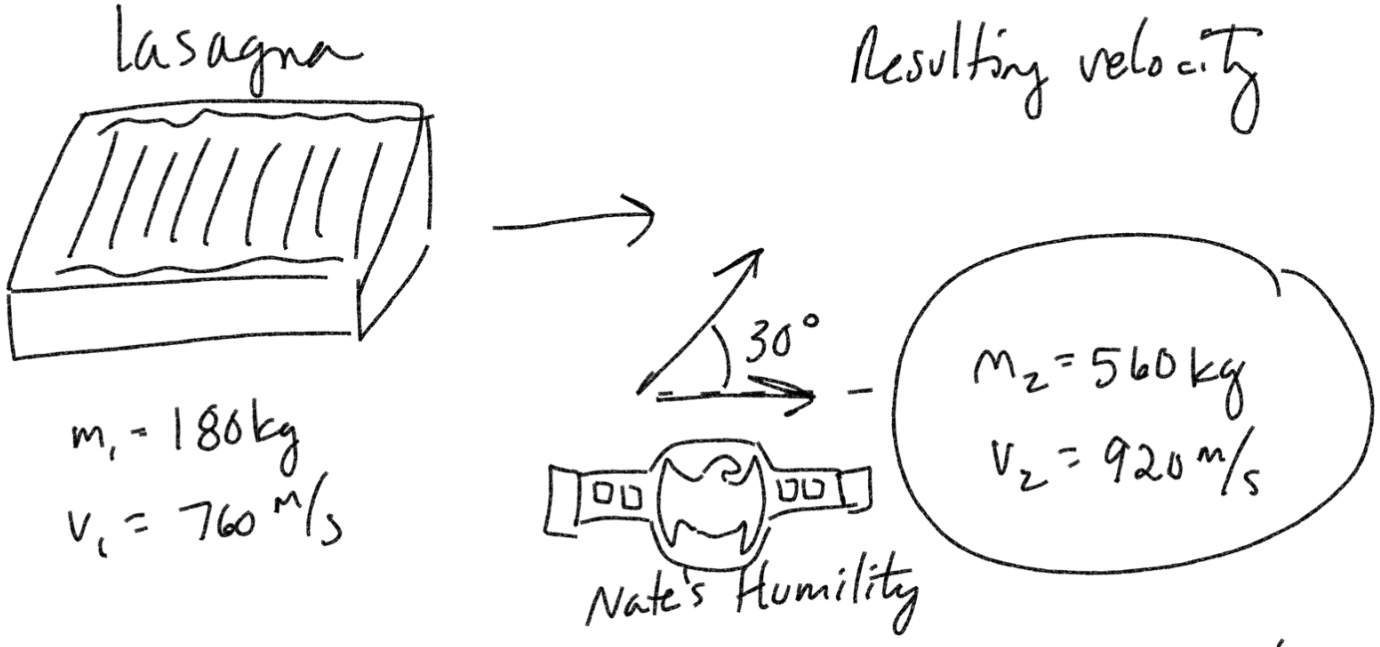
$$r = \sqrt{x^2 + y^2}$$

$$\sqrt{(350{,}000\,kg\ m/s)^2 + (100{,}000\,kg\ m/s)^2}$$

$364{,}005\,kg\ m/s$

$$= \frac{\text{total momentum}}{\text{total mass}} \qquad \frac{364{,}005\,kg\ m/s}{(700\,kg + 500\,kg)} \qquad \boxed{303.3\ m/s}$$

$\tan^{-1}\frac{100{,}000}{350{,}000} = \theta = \boxed{16^\circ}$ $\qquad \boxed{(303.\ m/s, 16^\circ)}$



X-momentum

$p_x = (180\,kg)(760\,m/s) = 136,800$

+

$(560\,kg)(920\cos 30°) = 446,176$

$582,976 = p_x$

Total momentum / total mass

$p_y = (560\,kg)(920\sin 30°) = 257,600 = p_y$

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

$= \sqrt{(582,976)^2 + (257,600)^2} = 637,352$

$\frac{637,352}{180+560} = \frac{637,352}{740} = 861\,m/s$

$\theta = \tan^{-1}\frac{257,600}{582,976} = 23.8°$

$861\,m/s, 23.8°$