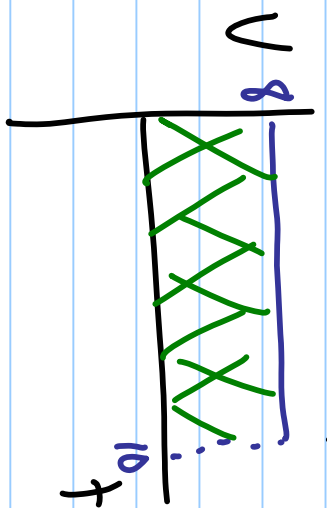
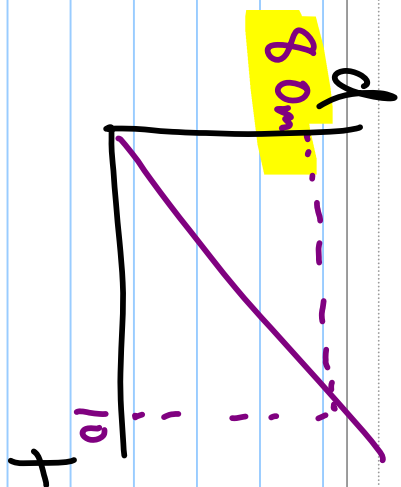
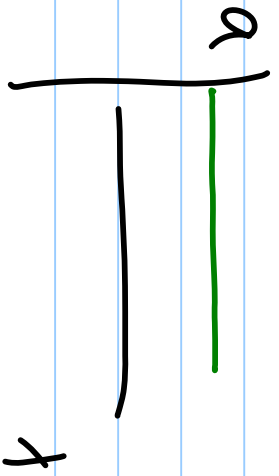
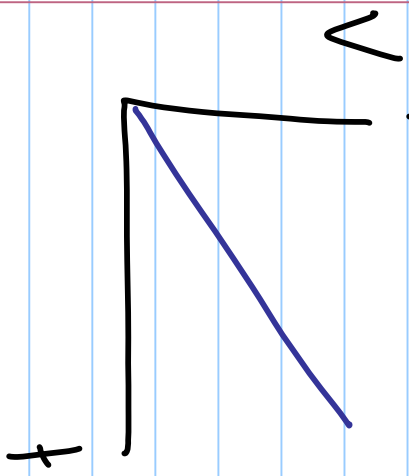
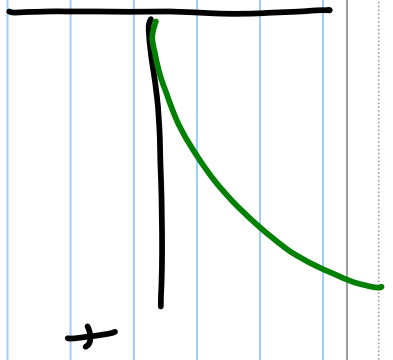
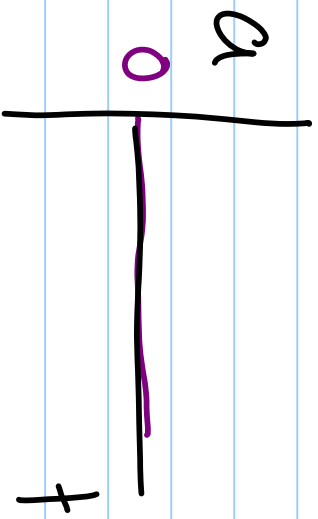


w

① d



$$\begin{aligned} \text{Area} &= l \times w \\ &= 8 \times 10 \\ &= 80m \end{aligned}$$



$$\textcircled{2} \quad V = 220 \text{ km/h} \div 3.6 = 61.1 \text{ m/s}$$

$$V_0 = 0$$

$$a = 6.0 \text{ m/s}^2$$

$$d = ?$$

+

$$a.) \quad V^2 = V_0^2 + 2ad$$

$$d = \frac{V^2 - V_0^2}{2a}$$

$$= \frac{(61.1)^2 - (0)^2}{2(6)}$$

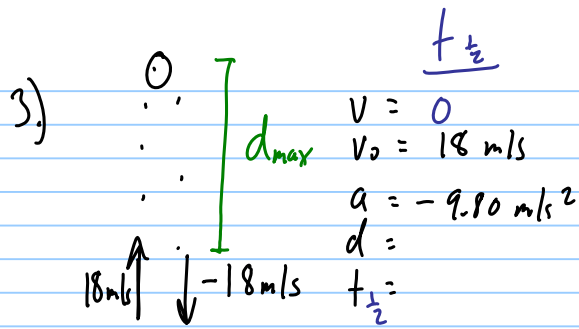
$$= \boxed{310 \text{ m}}$$

b.)

$$V = V_0 + at$$

$$t = \frac{V - V_0}{a} = \frac{61.1 - 0}{6.0} =$$

$$\boxed{10.2 \text{ s}}$$



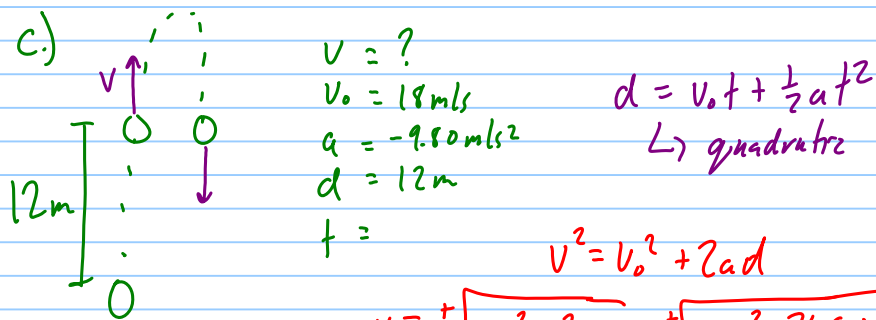
a.) $V = V_0 + at_{\frac{1}{2}} \quad t_{\frac{1}{2}} = \frac{V - V_0}{a} = \frac{0 - 18 \text{ m/s}}{-9.80 \text{ m/s}^2}$

$= 1.836 \text{ s}$

$t_{\text{total}} = 2(t_{\frac{1}{2}}) = \boxed{3.7 \text{ s}}$

b.) $V^2 = V_0^2 + 2ad \quad d = \frac{V^2 - V_0^2}{2a} = \frac{0^2 - (18)^2}{2(-9.80)}$

$= \boxed{17 \text{ m}}$



$V^2 = V_0^2 + 2ad$

$V = \pm \sqrt{V_0^2 + 2ad} = \pm \sqrt{(18)^2 + 2(-9.80)(12)}$

$= \pm 9.42 \text{ m/s}$

$V = +9.42 \text{ m/s}$

$V_0 = 18 \text{ m/s}$

$a = -9.80 \text{ m/s}^2$

$t = ?$

$V = V_0 + at$

$t = \frac{V - V_0}{a}$

$= \frac{9.42 - 18}{-9.80} = \boxed{0.88 \text{ s}}$

$V = -9.42 \text{ m/s}$

$V_0 = 18 \text{ m/s}$

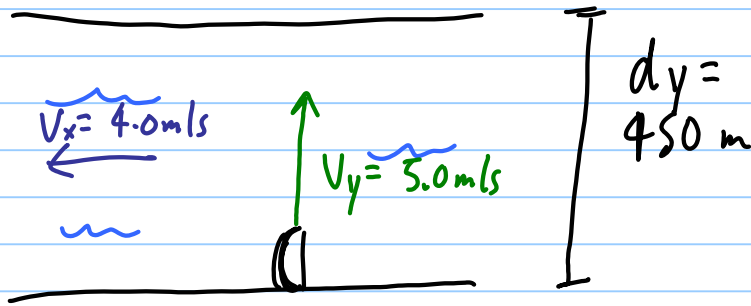
$a = -9.80 \text{ m/s}^2$

$t = \frac{V - V_0}{a}$

$= \frac{-9.42 - 18}{-9.80}$

$= \boxed{2.80 \text{ s}}$

4.)

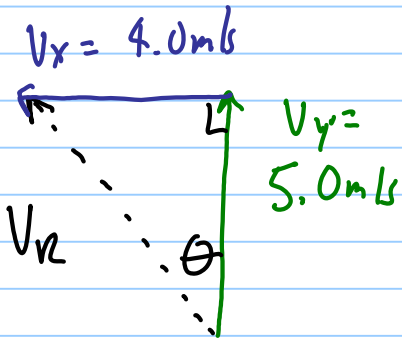


a.

$$V_y = \frac{d_y}{t}$$

$$t = \frac{d_y}{V_y} = \frac{450 \text{ m}}{5.0 \text{ m/s}} = \boxed{90.0 \text{ s}}$$

b.



$$V_R^2 = V_x^2 + V_y^2$$

$$V_R = \sqrt{5.0^2 + 4.0^2}$$

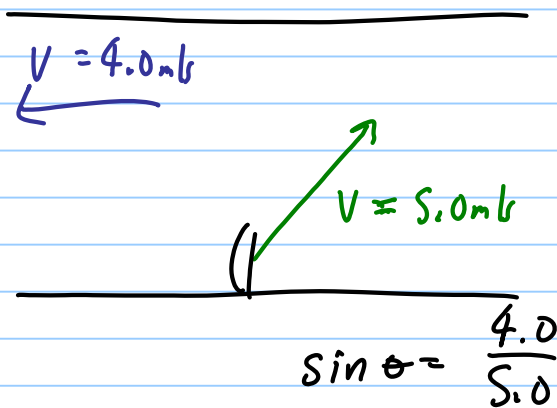
$$= \underline{6.4 \text{ m/s}}$$

$$\tan \theta = \frac{V_x}{V_y}$$

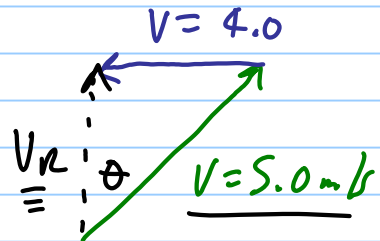
$$\theta = \tan^{-1}\left(\frac{4.0}{5.0}\right)$$

$$= 39^\circ \text{ W of N}$$

c.)



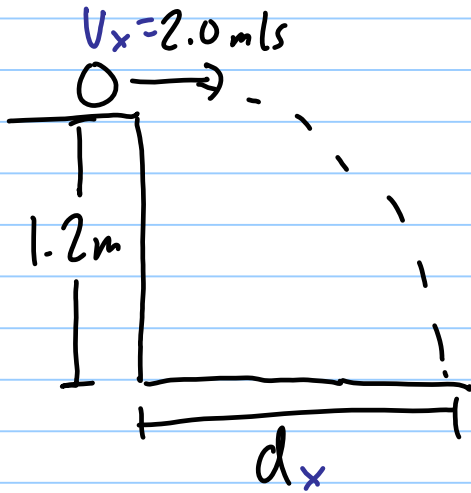
$$\sin \theta = \frac{4.0}{5.0}$$



$$\theta = \sin^{-1}\left(\frac{4.0}{5.0}\right)$$

$$= 53^\circ \text{ E of N}$$

5.)



| X | Y |
|-------------------------|-----------------------------|
| $v_x = 2.0 \text{ m/s}$ | v_y |
| $d_x = ?$ | $v_{y0} = 0$ |
| $t =$ | $a_y = -9.80 \text{ m/s}^2$ |
| | $d_y = -1.2 \text{ m}$ |
| | $t = 0.495$ |

$$v_x = \frac{d_x}{t}$$

$$d_x = v_x \cdot t$$

$$= (2.0 \text{ m/s})(0.495 \text{ s})$$

$$= \boxed{0.99 \text{ m}}$$

$$d = v_0 t + \frac{1}{2} a t^2$$

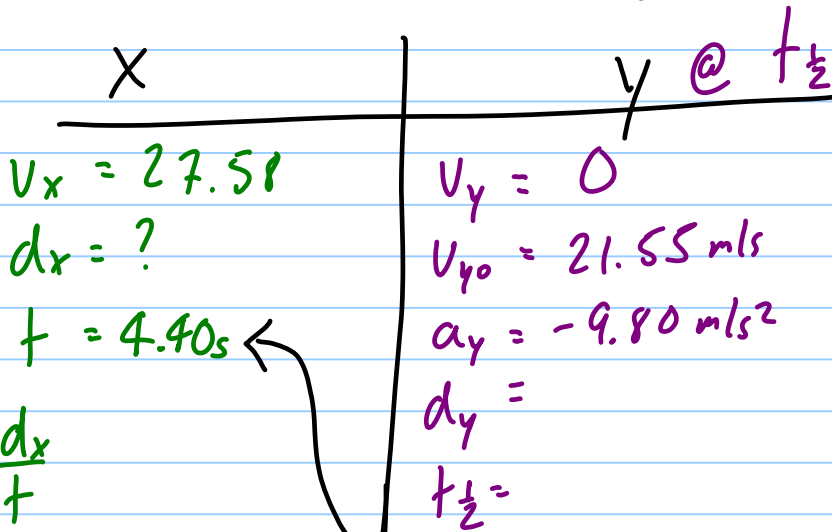
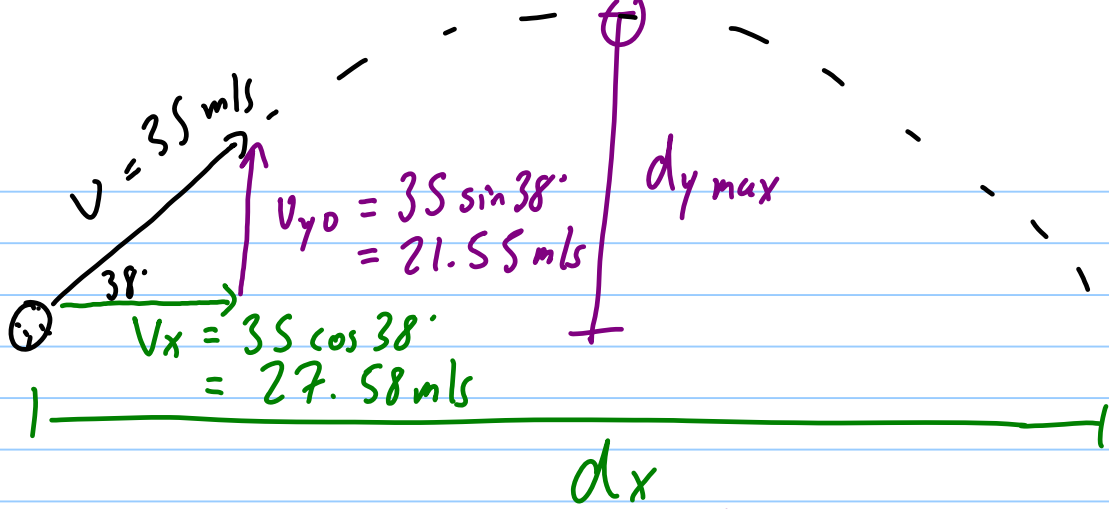
$$d = \frac{1}{2} a t^2$$

$$t = \sqrt{\frac{2d}{a}}$$

$$= \sqrt{\frac{2(-1.2)}{-9.80}}$$

$$= \underline{0.495 \text{ s}}$$

6.)



a.) $v_x = \frac{dx}{t}$

$$dx = v_x \cdot t$$

$$= (27.58)(4.40)$$

$$= \boxed{120 \text{ m}}$$

$$v = v_0 + a t_{\frac{1}{2}}$$

$$t_{\frac{1}{2}} = \frac{v - v_0}{a} = \frac{0 - 21.55}{-9.80}$$

$$= 2.20 \text{ s}$$

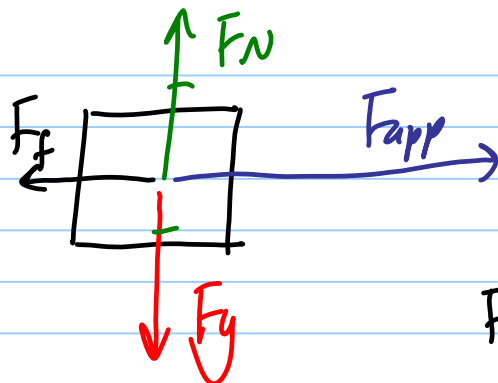
$$t_{\text{total}} = 2(t_{\frac{1}{2}}) = \underline{4.40 \text{ s}}$$

b.) $v^2 = v_0^2 + 2ad$

$$d = \frac{v^2 - v_0^2}{2a} = \frac{0 - (21.55)^2}{2(-9.80)}$$

$$= \boxed{24 \text{ m}}$$

7.)



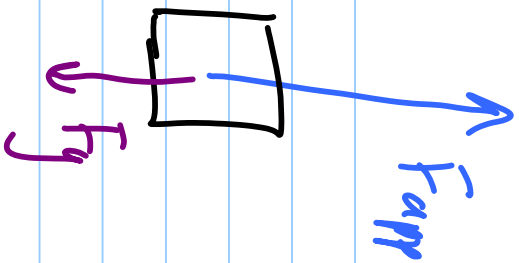
$$F_{net} = F_{app} - F_f = ma$$

$$F_f = F_{app} - ma$$

$$= 9600 \text{ N} - (1100 \text{ kg})(8.0 \text{ m/s}^2)$$

$$= 800 \text{ N}$$

8)



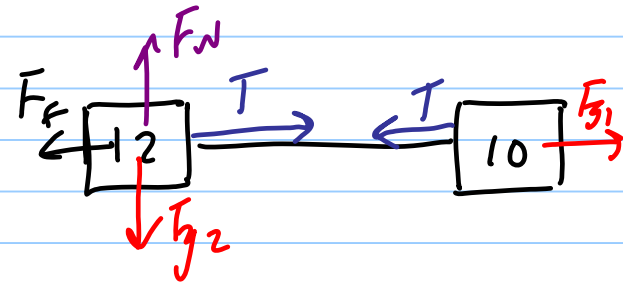
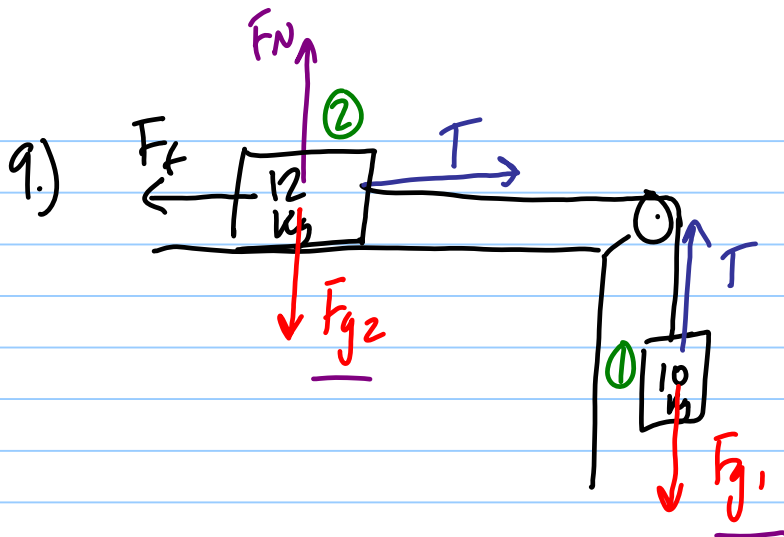
$$F_{net} = F_{app} - F_g = ma$$

$$F_{app} = F_g + ma$$

$$= mg + ma$$

$$= (5.0 \text{ kg})(9.80 \text{ m/s}^2) + (5.0 \text{ kg})(15 \text{ m/s}^2)$$

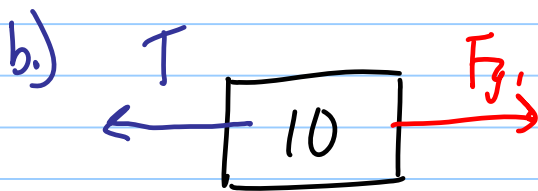
$$= \boxed{124 \text{ N}}$$



$$\begin{aligned}
 \text{a) } F_{\text{net}} &= F_{g_1} + \cancel{T} - \cancel{T} - F_f \\
 &= F_{g_1} - F_f = m_+ a
 \end{aligned}$$

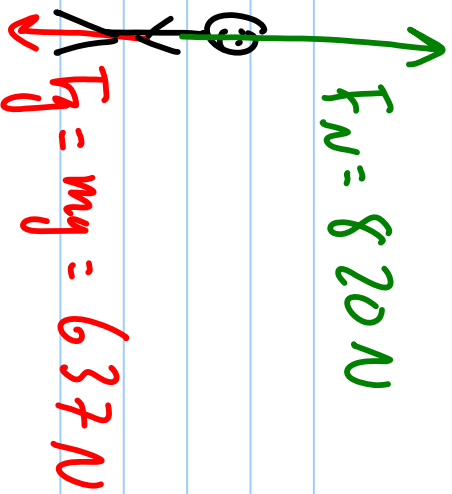
$$F_{g_1} = m_1 g = 98 \text{ N}$$

$$\begin{aligned}
 a &= \frac{F_{g_1} - F_f}{m_+} \\
 &= \frac{98 \text{ N} - 45 \text{ N}}{(10 + 12)} \\
 &= \underline{\underline{2.41 \text{ m/s}^2 \text{ right}}}
 \end{aligned}$$



$$\begin{aligned}
 F_{\text{net}} &= F_{g_1} - T = m_1 a \\
 T &= F_{g_1} - m_1 a = 98 \text{ N} - (10)(2.41) \\
 &= \boxed{73.9 \text{ N}}
 \end{aligned}$$

10.)

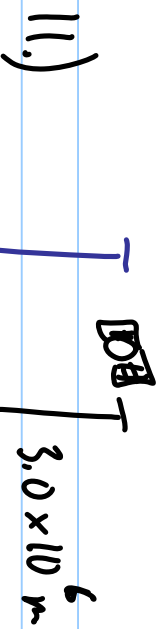


$$F_{\text{net}} = F_N - F_g = ma$$

$$a = \frac{F_N - F_g}{m}$$

$$= \frac{820 - 637}{65}$$

$$= 2.81\text{ m/s}^2$$



$$F_g = \frac{G M m}{r^2}$$

$$= \frac{(6.67 \times 10^{-11}) (5.98 \times 10^{23}) (3500)}{(6.38 \times 10^6 + 3.00 \times 10^6)^2}$$

don't forget this!

total distance between centers

$$= \boxed{15900}$$

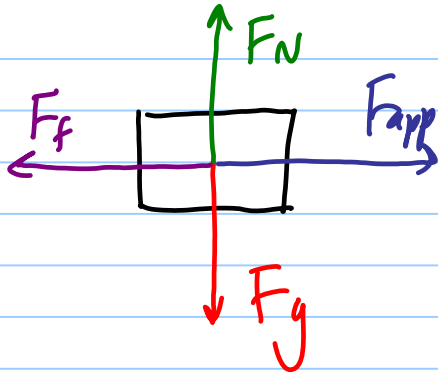
12.)

$$g = \frac{GM}{r^2} = \frac{(6.67 \times 10^{-11}) (8.00 \times 10^{24})}{(7.1 \times 10^6)^2}$$
$$= 10.6 \frac{N}{kg} \quad \text{or} \quad m/s^2$$

Remember:

Gravitational Field Strength \equiv Acceleration Due to Gravity

13.)



const $v \therefore a = 0$

$$F_{app} = F_f \\ = 750 \text{ N}$$

$$F_N = F_g = mg \\ = (1200)(9.80) \\ = 11760 \text{ N}$$

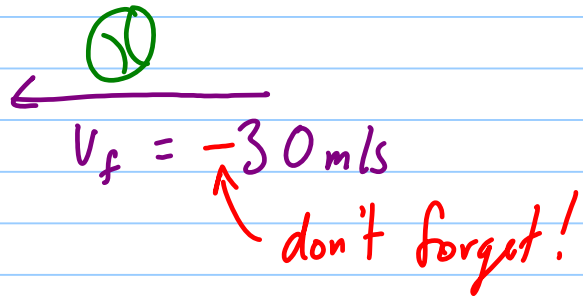
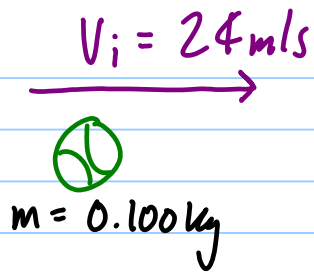
$$F_f = \mu F_N$$

$$\mu = \frac{F_f}{F_N} = \frac{750 \text{ N}}{11760 \text{ N}} = \boxed{0.064}$$

14.)

$$p = mv = (90.0 \text{ kg})(12.0 \text{ m/s}) \\ = 1080 \text{ kg m/s}$$

15.)



a.) $\Delta p = m \Delta v = m(v_f - v_i) = (0.100 \text{ kg})(-30 \text{ m/s} - 20 \text{ m/s})$
 $= -5.0 \text{ kg m/s}$ or 5.0 kg m/s backwards

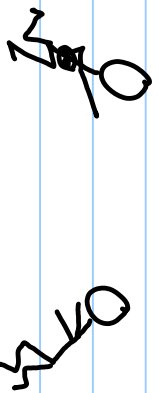
b.) Impulses must be equal and opposite

$\therefore \Delta p_{\text{racket}} = -\Delta p_{\text{ball}} = \underline{5.0 \text{ kg m/s}}$

c.) $\Delta p = F_{\text{net}} t$ $F_{\text{net}} = \frac{\Delta p}{t} = \frac{5.0 \text{ kg m/s}}{0.010 \text{ s}} = \boxed{100 \text{ N}}$

16.)

Before



After



$$m_1 = 95 \text{ kg}$$

$$m_2 = 115 \text{ kg}$$

$$m_f = 210 \text{ kg}$$

$$v_{1i} = 12.0 \text{ m/s}$$

$$v_{2i} = -9.0 \text{ m/s}$$

$$v_f =$$

AHA!

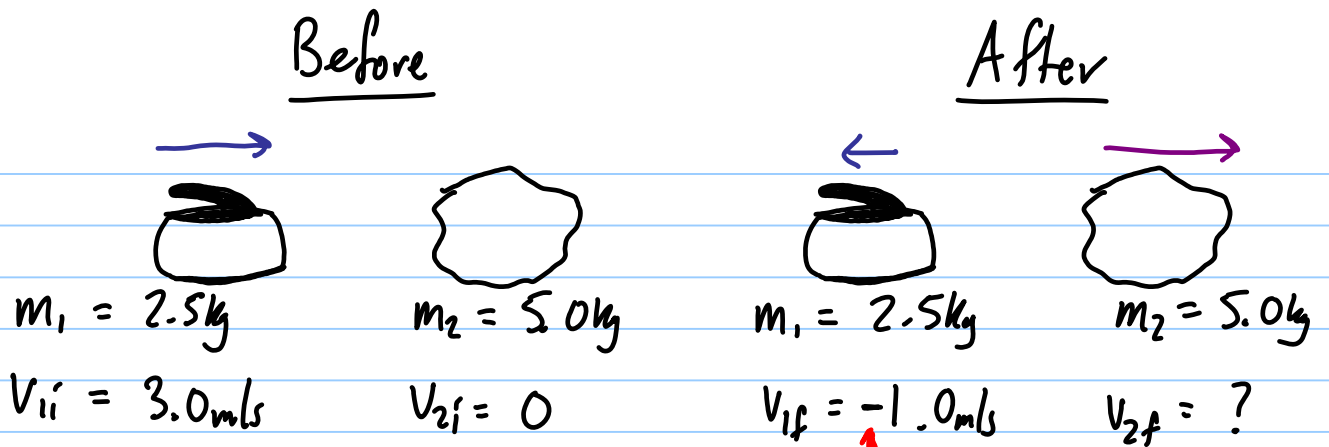
$$m_1 v_{1i} + m_2 v_{2i} = m_f v_f$$

$$v_f = \frac{m_1 v_{1i} + m_2 v_{2i}}{m_f} = \frac{(95)(12.0) + (115)(-9.0 \text{ m/s})}{210}$$

$$= 0.50 \text{ m/s East}$$

answer is positive so

17.)



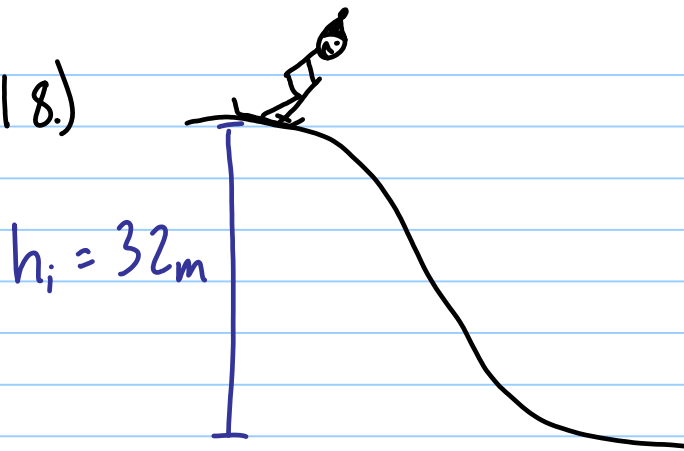
↑ ACHTUNG!

$$m_1 V_{1i} + m_2 \overset{0}{V_{2i}} = m_1 V_{1f} + m_2 V_{2f}$$

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

$$V_{2f} = \frac{m_1 V_{1i} - m_1 V_{1f}}{m_2} = \frac{(2.5)(3.0) - (2.5)(-1.0)}{5.0}$$
$$= \boxed{2.0 \text{ m/s}}$$

18.)



$$a.) \cancel{E_{k_i}} + E_{p_i} = E_{k_f} + \cancel{E_{p_f}}$$

$$E_{p_i} = E_{k_f}$$

$$E_{k_f} = mgh_i = (55)(9.80)(32) \\ = 17200 \text{ J}$$

$$b.) E_k = \frac{1}{2}mv^2$$

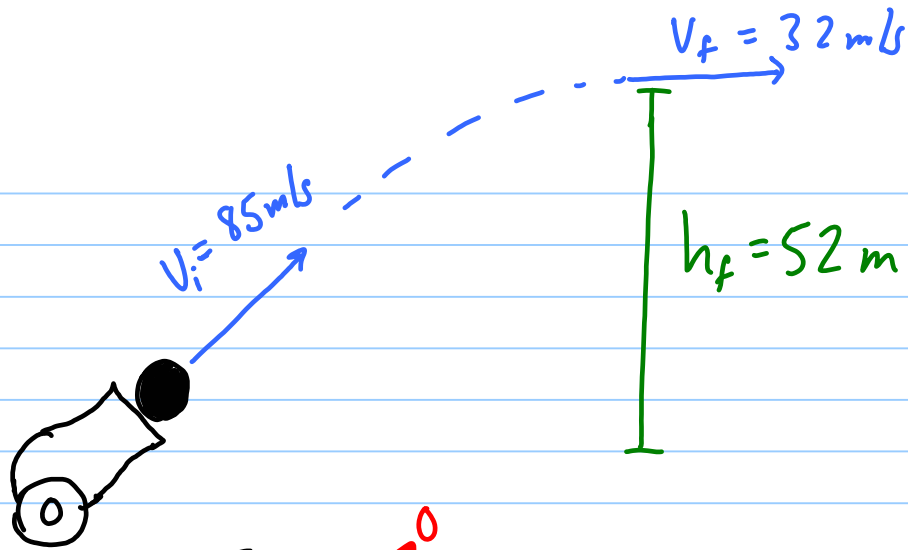
$$v = \sqrt{\frac{2E_k}{m}} = \sqrt{\frac{2(17200)}{55}} = \boxed{25 \text{ m/s}}$$

$$c.) E_{k_f} = E_{p_i}$$

$$\cancel{\frac{1}{2}mv_f^2} = \cancel{mgh_i}$$

$$v_f = \sqrt{2gh_i} = \boxed{25 \text{ m/s}} \quad \text{Yowza!}$$

19.)



Note:
This is not a projectile problem because we are generating heat due to air friction!

a.) $E_{ki} + E_{pi} = E_{kf} + E_{pf} + E_H$

$$E_H = E_{ki} - E_{kf} - E_{pf}$$

$$= \frac{1}{2} m v_i^2 - \frac{1}{2} m v_f^2 - m g h_f$$

$$= \frac{1}{2} (9.0) (85)^2 - \frac{1}{2} (9.0) (32)^2 - (9.0) (9.80) (52)$$

$$= \boxed{23300 \text{ J}}$$

b.) $E_H = m c \Delta T$

$$\Delta T = \frac{E_H}{m c} = \frac{23300}{(9.0)(130)} = 20.^\circ \text{C}$$

$$\Delta T = T_f - T_i \quad T_f = T_i + \Delta T = \boxed{41^\circ \text{C}}$$