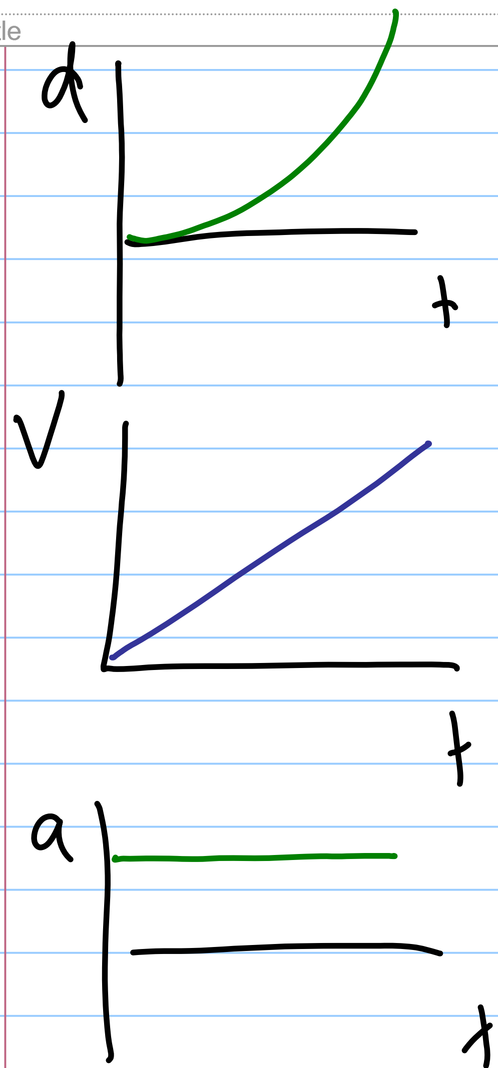
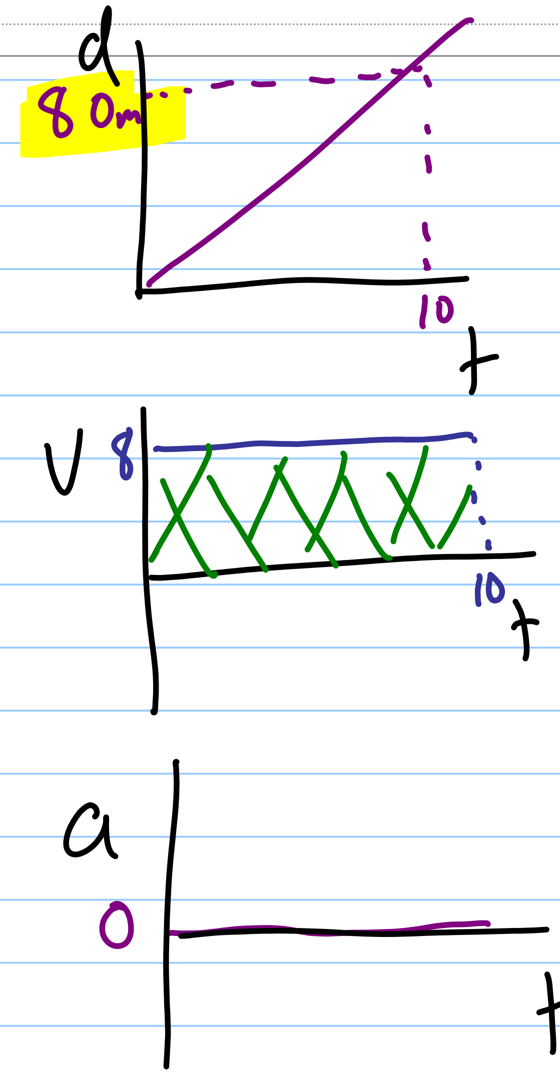
Note Title 16/06/2010

w

1





Area = $l \times w$
$= 8 \times 10$
$= 80m$

2

$v = 220\ km/h \div 3.6 = 61.1\ m/s$

$v_0 = 0$

$a = 6.0\ m/s^2$

$d = ?$

t

a) $v^2 = v_0^2 + 2ad$

$$d = \frac{v^2 - v_0^2}{2a}$$

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

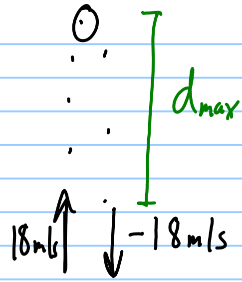
$$= \boxed{310\ m}$$

b) $v = v_0 + at$

$$t = \frac{v - v_0}{a} = \frac{61.1 - 0}{6.0} = \boxed{10.2\ s}$$

$t_{\frac{1}{2}}$

3)



$v = 0$
$v_0 = 18\ m/s$
$a = -9.80\ m/s^2$
$d =$
$t_{\frac{1}{2}} =$

a) $v = v_0 + at_{\frac{1}{2}}$ $\qquad t_{\frac{1}{2}} = \dfrac{v - v_0}{a} = \dfrac{0 - 18\ m/s}{-9.80\ m/s^2}$

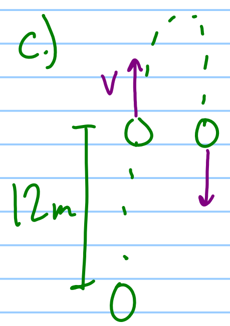
$= 1.836\ s$

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

b) $v^2 = v_0^2 + 2ad$ $\qquad d = \dfrac{v^2 - v_0^2}{2a} = \dfrac{0^2 - (18)^2}{2(-9.80)}$

$= \boxed{17\ m}$

c)



$v = ?$
$v_0 = 18\ m/s$
$a = -9.80\ m/s^2$
$d = 12\ m$
$t =$

$d = v_0 t + \frac{1}{2}at^2$
↳ quadratic

$v^2 = v_0^2 + 2ad$

$v = \pm\sqrt{v_0^2 + 2ad} = \pm\sqrt{(18)^2 + 2(-9.80)(12)}$

$= \pm 9.42\ m/s$

$v = +9.42\ m/s$
$v_0 = 18\ m/s$
$a = -9.80\ m/s^2$
$t = ?$

$v = v_0 + at$

$t = \dfrac{v - v_0}{a}$

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

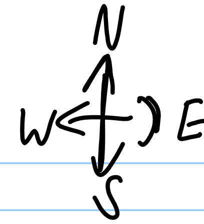
$v = -9.42\ m/s$
$v_0 = 18\ m/s$
$a = -9.80\ m/s^2$

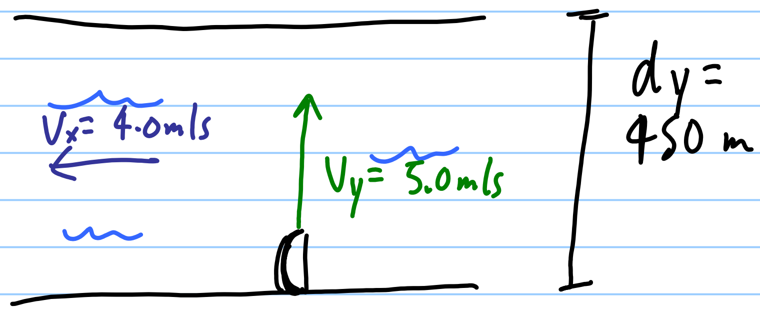
$t = \dfrac{v - v_0}{a}$

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

$\boxed{= 2.80\ s}$

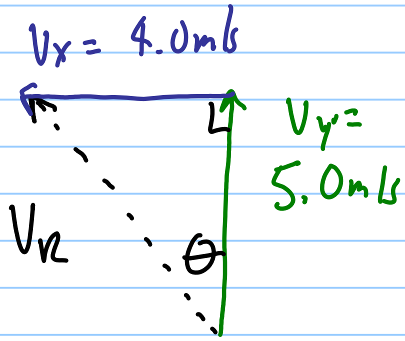
4)





a. $V_y = \frac{d_y}{t}$ $\quad t = \frac{d_y}{V_y} = \frac{450\text{ m}}{5.0\text{ m/s}} = \boxed{90.\text{ s}}$ $\quad$ 1

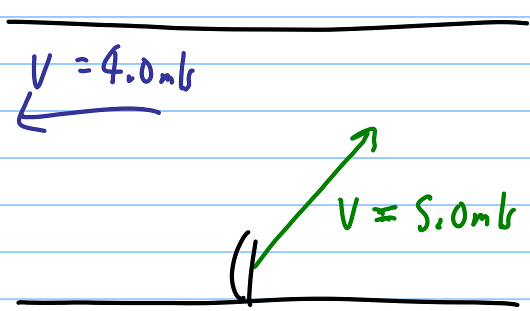
b.

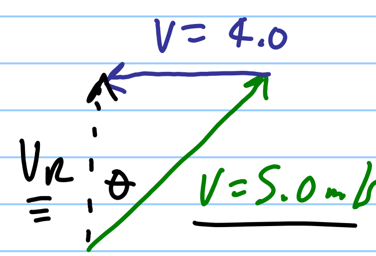


$$V_R^2 = V_x^2 + V_y^2$$
$$V_R = \sqrt{5.0^2 + 4.0^2}$$
$$= \underline{6.4 \text{ m/s}}$$

$$\tan\theta = \frac{V_x}{V_y} \qquad \theta = \tan^{-1}\left(\frac{4.0}{5.0}\right)$$
$$= 39° \ \underline{W} \text{ of } \underline{N}$$

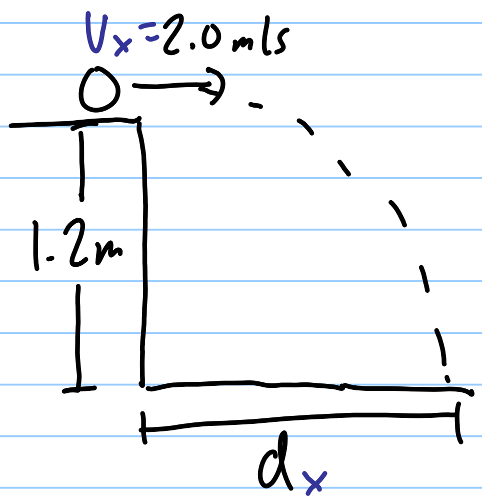
c.)





$$\sin\theta = \frac{4.0}{5.0} \qquad \theta = \sin^{-1}\left(\frac{4.0}{5.0}\right)$$
$$= 53° \text{ E of N}$$

5)



x	y
$V_x = 2.0\,m/s$	V_y
$d_x = ?$	$V_{y0} = 0$
$t =$	$a_y = -9.80\,m/s^2$
	$d_y = -1.2\,m$
	$t = 0.495$

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

$$d_x = V_x \cdot t$$

$$= (2.0\,m/s)(0.495)$$

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

$$d = \cancel{v_0 t}^{\,0} + \frac{1}{2}at^2$$

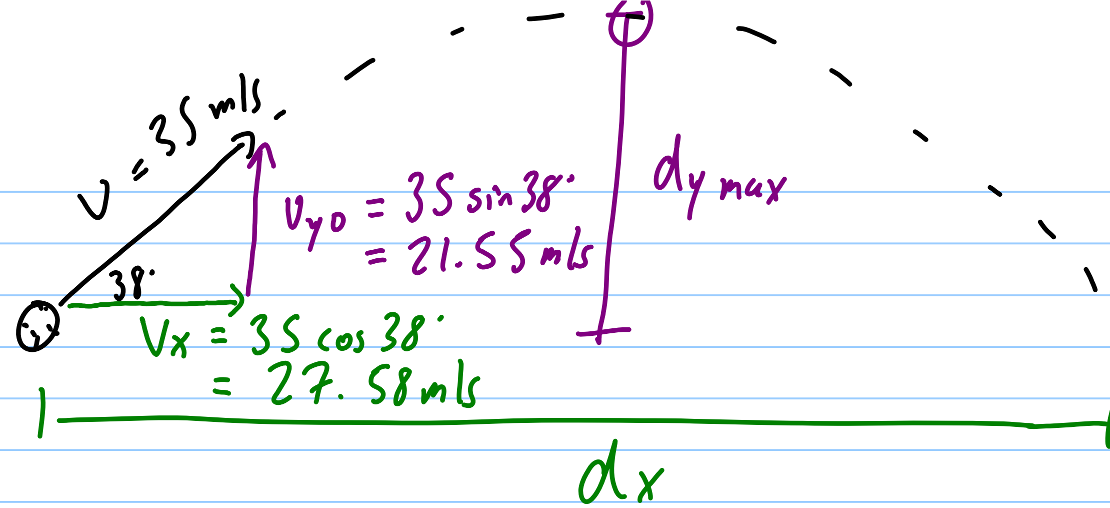
$$d = \frac{1}{2}at^2$$

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

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

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

6.)



x	y @ $t_{\frac{1}{2}}$
$v_x = 27.58$	$v_y = 0$
$d_x = ?$	$v_{y0} = 21.55$ m/s
$t = 4.40$s	$a_y = -9.80$ m/s^2
	$d_y =$
	$t_{\frac{1}{2}} =$

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

$$t_{\frac{1}{2}} = \frac{v - v_0}{a} = \frac{0 - 21.55}{-9.80} = 2.20\text{ s}$$

a.) $v_x = \dfrac{d_x}{t}$

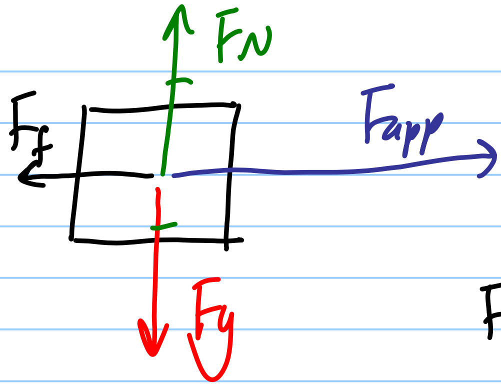
$$d_x = v_x \cdot t = (27.58)(4.40) = \boxed{120\text{ m}}$$

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

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

$$d = \frac{\cancel{v^2}^{\,0} - v_0^2}{2a} = \frac{-(21.55)^2}{2(-9.80)} = \boxed{24\text{ m}}$$

7.)



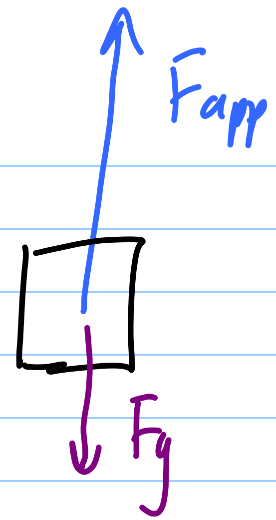
$$F_{net} = \boxed{F_{app} - F_f = ma}$$

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

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

$$= \boxed{800\,N}$$

8)



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

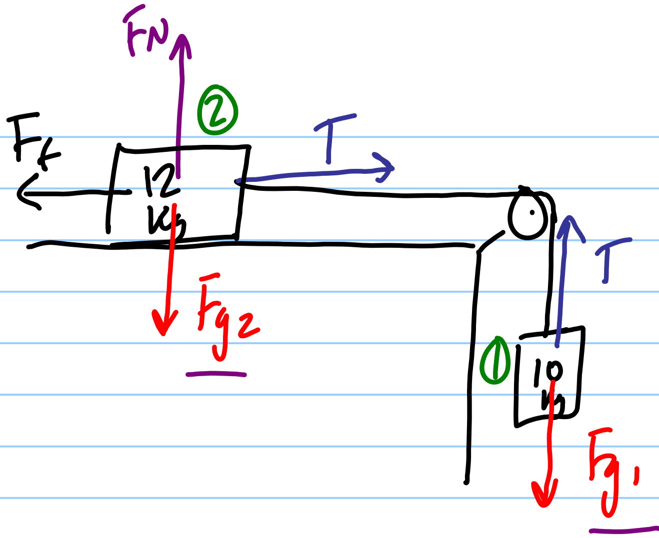
$$F_{app} = F_g + ma$$

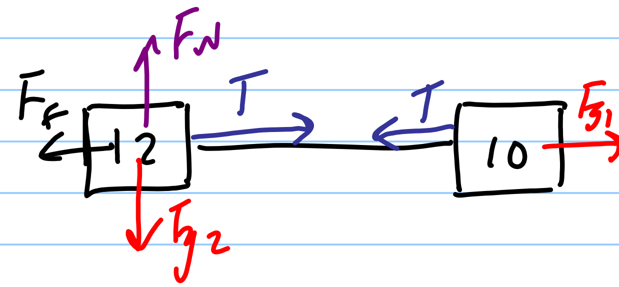
$$= mg + ma$$

$$= (5.0\,kg)(9.80\,m/s^2) + (5.0\,kg)(15\,m/s^2)$$

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

9.)





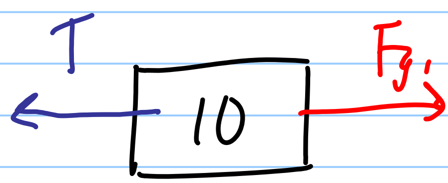
a) $F_{net} = F_{g1} + \cancel{T} - \cancel{T} - F_f$

$= F_{g1} - F_f = m_t a$

$$a = \frac{F_{g1} - F_f}{m_t} = \frac{98N - 45N}{(10+12)} = \underline{2.41\ m/s^2} \text{ right}$$

$F_{g1} = m_1 g = 98\,N$

b.)

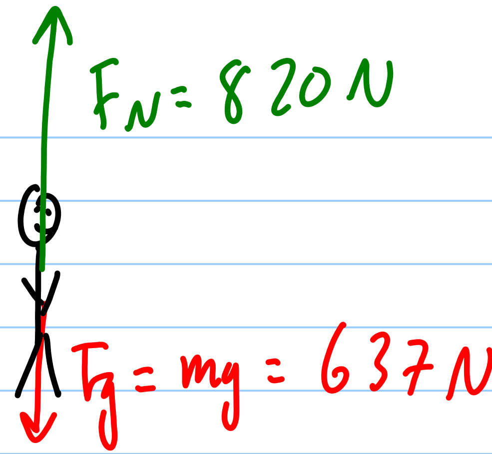


$F_{net} = F_{g1} - T = m_1 a$

$T = F_{g1} - m_1 a = 98N - (10)(2.41)$

$= \boxed{73.9\,N}$

10.)



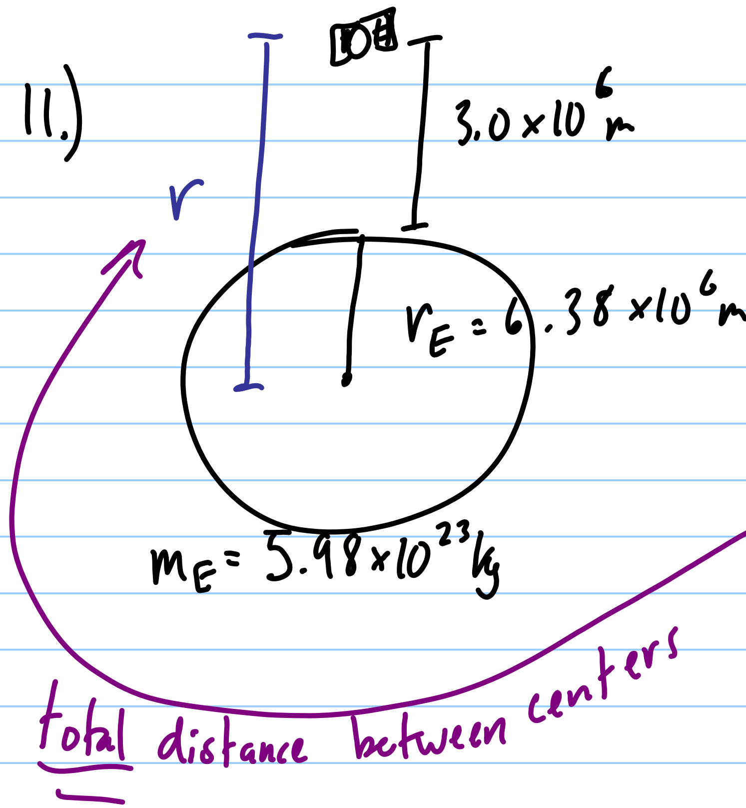
$$F_{net} = F_N - F_g = ma$$

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

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

$$= 2.81\,m/s^2$$

11.)



$$F_g = \frac{GMm}{r^2}$$

$$= \frac{(6.67\times10^{-11})(5.98\times10^{23})(3500)}{(6.38\times10^{6} + 3.00\times10^{6})^2}$$

don't forget this!

$$= \boxed{1590\text{ N}}$$

12.)

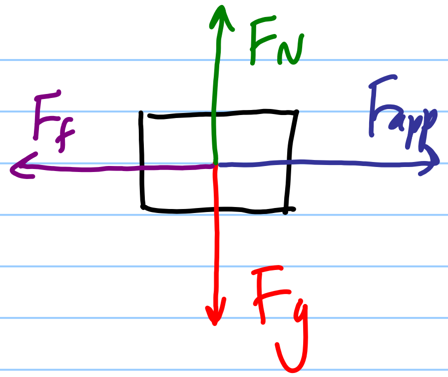
$$g = \frac{GM}{r^2} = \frac{(6.67 \times 10^{-11})(8.00 \times 10^{24})}{(7.1 \times 10^{6}]^2}$$

$$= 10.6 \ \frac{N}{kg} \text{ or } m/s^2$$

Remember:

Gravitational Field Strength $\equiv$ Acceleration Due to Gravity

13.)



const v $\therefore a = 0$

$F_{app} = F_f$

$= 750N$

$F_N = F_g = mg$

$= (1200)(9.80)$

$= 11760N$

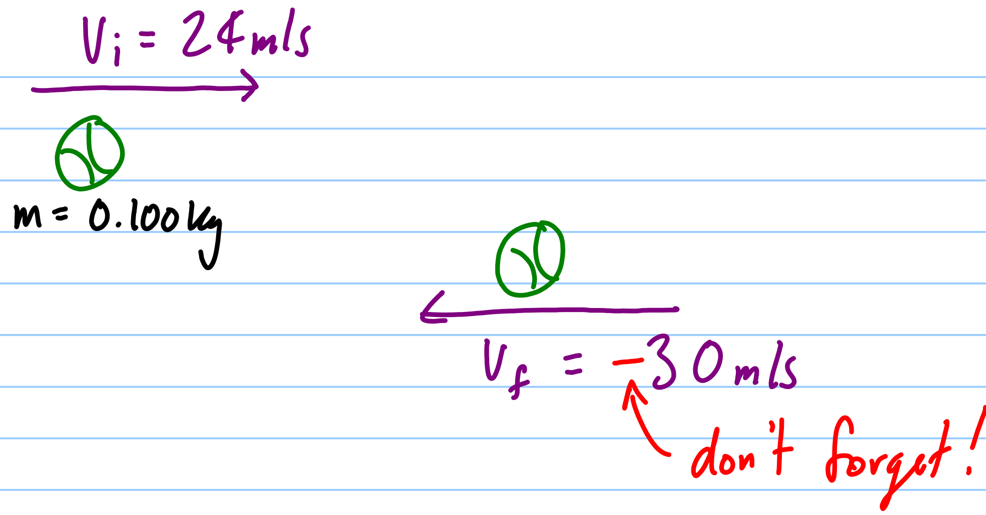
$F_f = \mu F_N$

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

14.)

$$p = mv = (90.0\,kg)(12.0\,m/s)$$
$$= 1080\ kg\,m/s$$

15.)



a.) $\Delta p = m\Delta v = m(v_f - v_i) = (0.100kg)(-30 m/s - 20 m/s)$

$\underline{= -5.0 \text{ kg m/s} \quad \text{or} \quad 5.0 \text{ kg m/s backwards}}$

b.) Impulses <u>must</u> be equal and opposite

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

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

16.)

Before

$m_1 = 95\text{ kg}$

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

$m_2 = 115\text{ kg}$

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

AHA!

After

$m_t = 210\text{ kg}$

$v_f =$

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

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

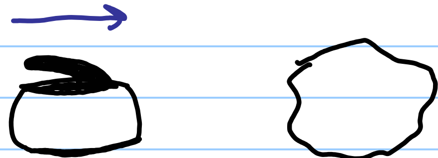
$$= 0.50\text{ m/s East}$$

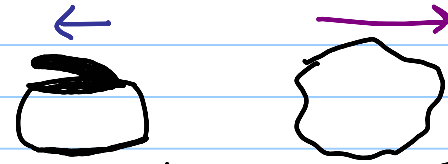
answer is positive so

Before

After

17)





$m_1 = 2.5\,kg$ $\quad$ $m_2 = 5.0\,kg$ $\quad$ $m_1 = 2.5\,kg$ $\quad$ $m_2 = 5.0\,kg$

$V_{1i} = 3.0\,m/s$ $\quad$ $V_{2i} = 0$ $\quad$ $V_{1f} = -1.0\,m/s$ $\quad$ $V_{2f} = ?$

ACHTUNG!

$$m_1 V_{1i} + \cancel{m_2 V_{2i}}^{\,0} = m_1 V_{1f} + m_2 V_{2f}$$

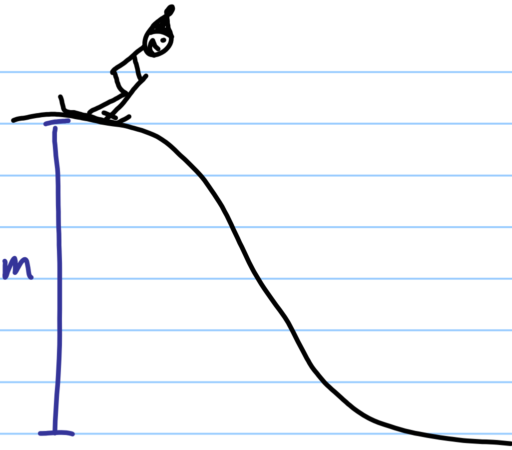
$$m_1 V_{1i} = m_1 V_{1f} + m_2 V_{2f}$$

$$V_{2f} = \frac{m_1 V_{1i} - m_1 V_{1f}}{m_2} = \frac{(2.5)(3.0) - (2.5)(-1.0)}{5.0}$$

$$= \boxed{2.0\,m/s}$$

18.)

$h_i = 32\,m$



a.) $\overset{0}{\cancel{E_{ki}}} + E_{pi} = E_{kf} + \overset{0}{\cancel{E_{pf}}}$

$E_{pi} = E_{kf}$

$E_{kf} = mgh_i = (55)(9.80)(32)$

$= 17200\,J$

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

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

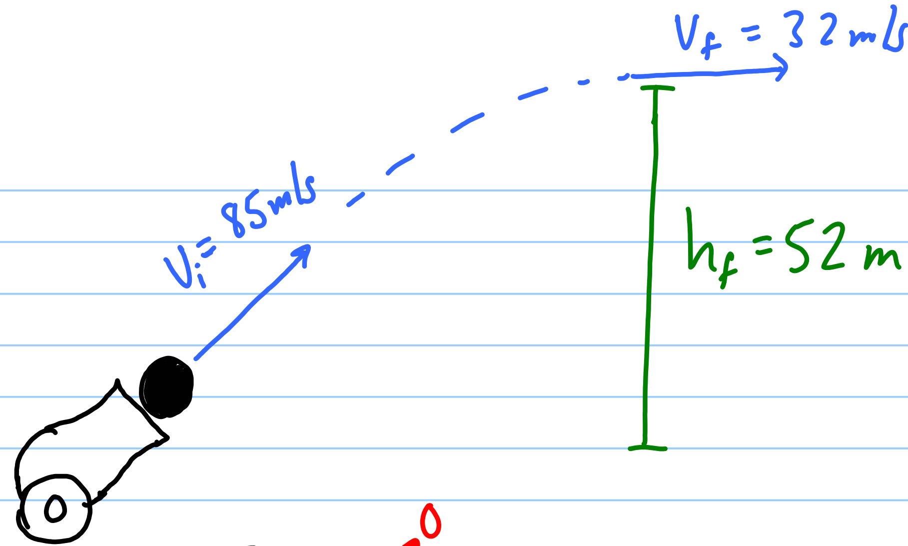
c.) $E_{kf} = E_{pi}$

$\frac{1}{2}\cancel{m}v_f^2 = \cancel{m}gh_i$

$v_f = \sqrt{2gh_i} = \boxed{25\ m/s}$

Yowsa!

19.)



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

a.) $E_{Ki} + \cancel{E_{pi}}^{\,0} = E_{Kf} + E_{pf} + E_H$

$E_H = E_{Ki} - E_{Kf} - E_{pf}$

$= \frac{1}{2}mv_i^2 - \frac{1}{2}mv_f^2 - mgh_f$

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

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

b.) $E_H = mc\Delta T$

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

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