$$\frac{15000000\,s}{} \left| \frac{1\ ks}{1000\ s} \right. \quad 15000\,ks$$

$$\frac{275\,cm}{} \left| \frac{1\ m}{100\ cm} \right. \quad 2.75\,m$$

$$\frac{12.5\,m}{s} \left| \frac{1\ km}{1000\,m} \right| \frac{3600\,s}{1\ h} = 45\,km/h$$

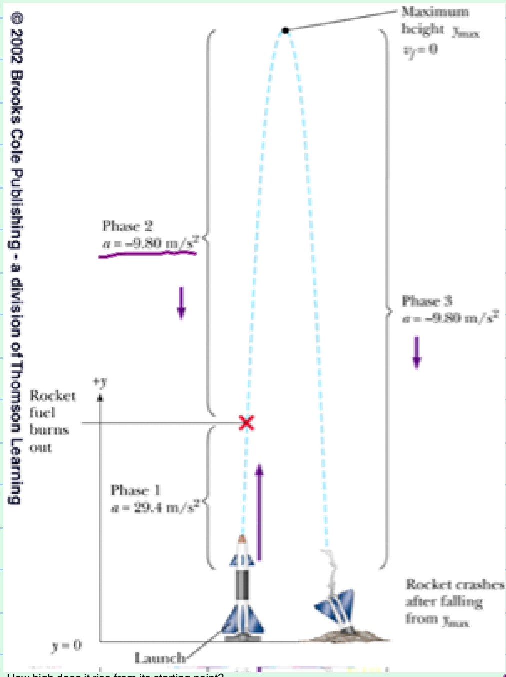
$$\frac{15.25\,m}{s^2} \left| \frac{1\ km}{1000\,m} \right| \frac{(3600\,s)^2}{1\ h^2} = 54.9\,km/h^2$$

$$\frac{25\,cm^2}{} \left| \frac{1\ m^2}{100^2\,cm^2} \right. = .0025\,m^2$$

Chapter 2-Vertical Motion Review

1. A rocket moves straight upward, starting from rest with an i
29.4 m/s2 for 6 s. It runs out of fuel at the end of this 6s an
while.

a)



How high does it rise from its starting point?

b) What is its velocity the instant before it hits the ground?

phase I - $v_{iy}=0$, $a_y=29.4\frac{m}{s}$ $t=6s$

$d=\cancel{v_{iy}}^{0}t+\frac{1}{2}a_yt^2$

$=\frac{1}{2}(29.4)6^2=\boxed{529m}$

$v_{fy}^2=\cancel{v_{iy}^2}^{0}+2a_yd_y$

$=\sqrt{2(29.4)529}$

$v_f=176\frac{m}{s}$

phase II $v_i=176\frac{m}{s}$ $a=-9.8\frac{m}{s^2}$ $v_f=0$

$\cancel{v_f}^{0}=v_i+at$

$t=\frac{-v_i}{a}=\frac{-176}{-9.8}=\boxed{18s}$

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

$=176(18)+\frac{1}{2}(-9.8)18^2$

$=1587m$

a) $529+1587=2116m$

b) phase III $v_i=0$ $v_f=?$ $a=-9.8\frac{m}{s^2}$ $d=-2116m$

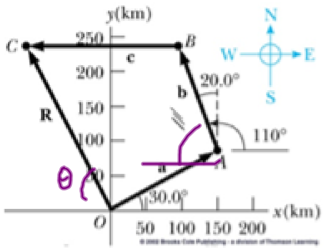
$v_f^2=\cancel{v_i^2}^{0}+2ad$

$v_f=\sqrt{2(-9.8)(-2116)}$

$v_f=203\frac{m}{s}$ down

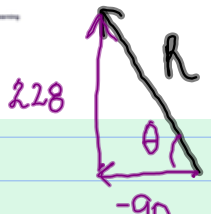
Chapter 3-Vectors

2. A commuter airplane starts from an airport and takes the route shown in Figure P3.17. It first flies to city A located at 175 km in a direction 30.0° north of east. Next, it flies 150 km 20.0° west of north to city B. Finally, it flies 190 km due west to city C. Find the location of city C relative to the location of the starting point.



$$\Sigma d_x = 175\cos 30 - 150\cos 70 - 190 = \underline{-90\text{ km}}$$

$$\Sigma d_y = 175\sin 30 + 150\sin 70 = \underline{228\text{ km}}$$



$$R^2 = 228^2 + (90)^2$$

$$R = \underline{245\text{ km}}$$

$$\frac{1}{x} = x^{-1}$$

$$\tan\theta = \frac{opp}{adj}$$

$$\theta = \tan^{-1}\frac{opp}{adj} = \tan^{-1}\frac{228}{90} = 69^\circ$$

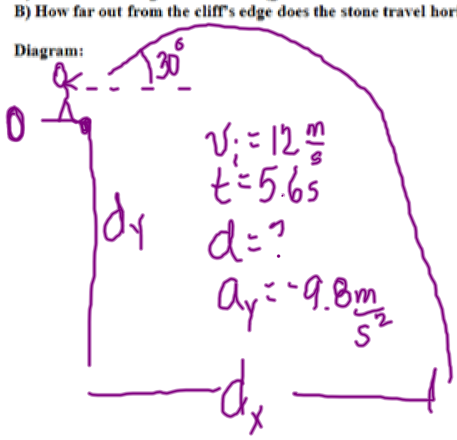
245 km [69° N of W]

$v_{ix} = v_i \cos\theta$
$v_{iy} = v_i \sin\theta$

Chapter 3-Projectile Motion

3. A stone is thrown at an angle of 30° above the horizontal from the top edge of a cliff with an initial speed of 12 m/s. A stop watch measures the stone's trajectory time from top of cliff to bottom to be 5.6 s.
A) What is the height of the cliff? (g = 9.8 m/s2 and air resistance is negligible)
B) How far out from the cliff's edge does the stone travel horizontally?

Diagram:

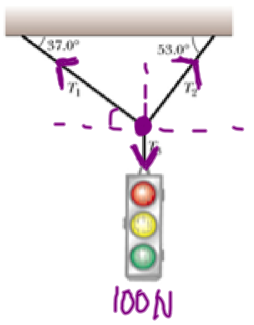


$v_i = 12\ \frac{m}{s}$
$t = 5.6s$
$d = ?$
$a_y = -9.8\ \frac{m}{s^2}$

a) $d_y = ?$

$d_y = v_{iy}t + \frac{1}{2}a_y t^2$
$= (12\sin 30)(5.6) + \frac{1}{2}(-9.8)(5.6)^2$
$\boxed{d_y = -120m}$

b) $d_x = ?\ v_{ix}t$
$= (12\cos 30)5.6 = \boxed{58.2m}$



Tension F in cables

① FBD (arrows on F)

② x-y axis

degree mode

③ $\Sigma F_x = -T_1 \cos 37 + T_2 \cos 53 = m\cancel{a}^0$ static

$$T_2 = T_1 \frac{\cos 37}{\cos 53} = 1.3 T_1$$

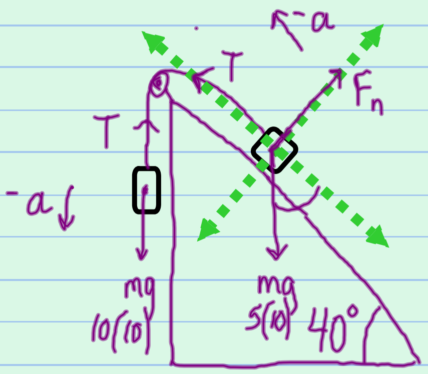
$$\Sigma F_y = T_1 \sin 37 + T_2 \sin 53 - 100 = m\cancel{a}^0$$

$$T_1 \sin 37 + 1.3 T_1 \sin 53 = 100$$

$$.6 T_1 + 1 T_1 = 100$$

$$T_1 = 62 \text{ N}$$

$$T_2 = 1.3(62) = 81 \text{ N}$$



5kg

$$\sum F_x = -T + mg\cos 50 = -ma$$
$$-T + 5(10)\cos 50 = -5a$$
$$\underline{50\cos 50 + 5a = T}$$

$$\sum F_y = F_n - mg\sin 50 = m\cancel{a}^{\,0}$$
$$F_n = 5(10)\sin 50$$

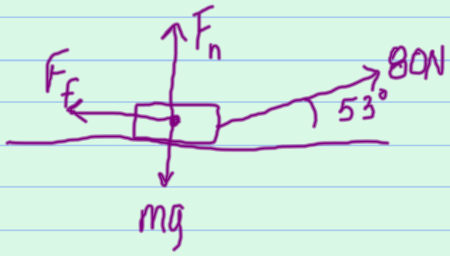
10kg

$$\sum F_y = T - mg = -ma$$
$$T - 10(10) = -10(a)$$
$$T = \underline{100 - 10a}$$

$$T = 100 - 10(4.5)$$
$$T = 55N$$

$$50\cos 50 + 5a = 100 - 10a$$
$$\frac{15a}{15} = \frac{100 - 50\cos 50}{15}$$
$$a = 4.5\,\frac{m}{s^2}$$

6.



$\Sigma F_x = -F_f + 80\cos 53 = m\cancel{a}^{\,0}$

$80\cos 53 = F_f$

$F_f = 48\text{ N}$

$\Sigma F_y = F_n - mg + 80\sin 53 = m\cancel{a}^{\,0}$

$F_n = 100(10) - 80\sin 53$

$F_n = 916\text{ N}$

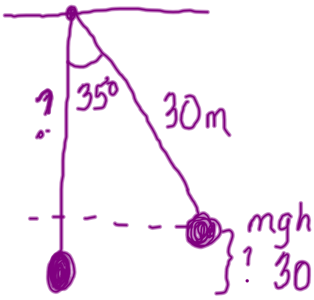
7.

$\cos\theta = \frac{adj}{hyp}$

$adj = hyp\cos\theta$

$= 30\cos 35$

$= 24.6\,m$



$30 - 24.6 = 5.4\,m$

a) $\cancel{m}gh = \frac{1}{2}\cancel{m}v^2$

$\sqrt{2gh} = v$

$v = \sqrt{2(10)(5.4)} = \boxed{10.4\,\frac{m}{s}}$

b) $\cancel{m}gh_i + \frac{1}{2}\cancel{m}v_i^2 = \frac{1}{2}\cancel{m}v_f^2$

$\sqrt{2\left(gh_i + \frac{1}{2}v_i^2\right)}$

$\sqrt{2(10)(5.4) + \frac{1}{2}(4)^2}$

$= \boxed{11.1\,\frac{m}{s}}$

omit #8

#9 - Ch6 #20

#10 p167 Ex6.11

#11 Ch7 #18

#12 Ch8 #20

momentum

$$\#10 \quad \overset{1}{m_2}\overset{0}{v_{2i}} + \overset{.005}{m_1}\underline{v_{1i}} = (\overset{1}{m_1} + \overset{.005}{m_2}) v_{ff}$$

$$.005\, v_{1i} = 1.005(.99)$$

$$v_{1i} = \frac{1.005(.99)}{.005} = 199 \frac{m}{s}$$

2

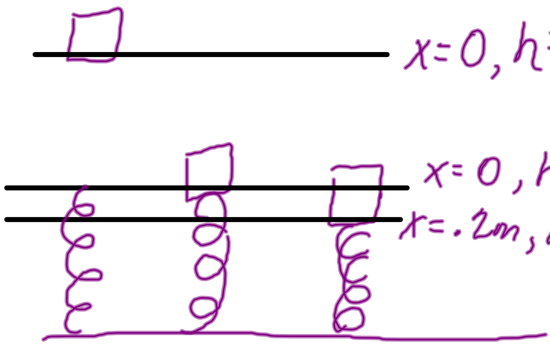
energy

$$\frac{1}{2}\cancel{m}v^2 = \cancel{m}g\overset{.05}{h}$$

$$v \sqrt{9.8(.05)2}$$

$$v = 0.99 \frac{m}{s}$$

#8



$x=0, h=?$ final

$x=0, h=.2m$

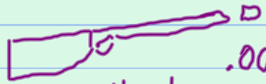
$x=.2m, h=0$ ← picked as initial

$$\cancel{mgh_i}^{\,0}+\frac{1}{2}kx_i^2=mgh_f+\cancel{\frac{1}{2}kx_f^2}^{\,0}$$

$$\frac{\frac{1}{2}kx_i^2}{mg}=h_f$$

$$h_f=\frac{\frac{1}{2}(5000)(.2)^2}{.35(10)}=29\text{ m}$$

9.



$300 \frac{m}{s}$

$.0045\,kg = m_2$

$m_1 = 40\,N$

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

$$0 = \frac{\overset{4}{40}}{10} v_{1f} + 0.0045(300)$$

$$\frac{-0.0045(300)}{4} = v_{1f}$$

$$v_{1f} = {}^{-}.33 \frac{m}{s}$$

b) $0 = \frac{(40 + 600)}{10} v_{1f} + 0.0045(300)$

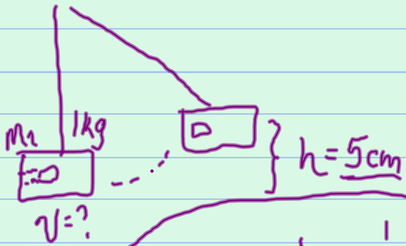
$$0 = 64 v_{1f} + 1.35$$

$$v_f = \frac{-1.35}{64} = -\ 0.02 \frac{m}{s}$$

10.

$m_1 = 5g$

$v = ?$



$$mgh = \frac{1}{2} m v^2$$

$$10(.05) = \frac{1}{2} v^2$$

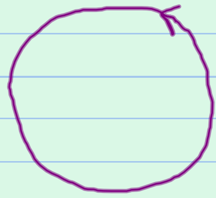
$$v = \sqrt{2(10)(.05)}$$

$$= 1 \frac{m}{s}$$

$$m_1 \overset{?}{v_{1i}} + m_2 \cancel{v_2}^{0} = (m_1 + m_2) v_f$$

$$v_{1i} = \frac{(.005+1)(1)}{0.005} = 201 \frac{m}{s}$$

11.



$r = 375\,m$

$a = 0.4\,\frac{m}{s^2}$

$a_c = a_t = 0.4 = \frac{v^2}{r}$

$a_c = \frac{v^2}{r}$

a) $v = \sqrt{.4(375)} = 12.25\,\frac{m}{s}$

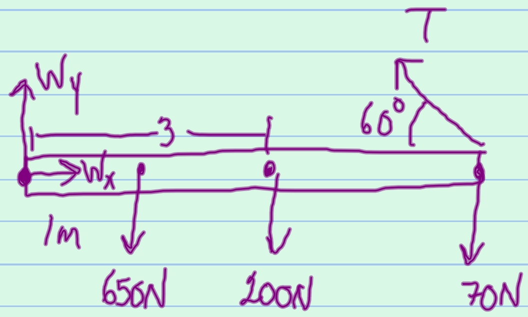
b) $v_f = \cancel{v_i}^{\,0} + at$

$t = \frac{v_f}{a} = \frac{12.25}{0.4} = 30.6\,s$

c) $d = \frac{1}{2}at^2 = \frac{1}{2}(.4)(30.6)^2$

$= 187\,m$

12)



$$\Sigma F_x = W_x - \underset{321}{T}\cos 60 = 0$$

$$W_x = \underline{161}\ N$$

$$\Sigma F_y = W_y - 650 - 200 - 70 + \underset{321}{T}\sin 60 = 0$$

$$W_y = \underline{759}\,N$$

$$\Sigma \tau_W = -650(1) - 200(3) - 70(6) + \underline{T}\sin 60)(6) = 0$$

$$T = 321\,N$$

b) $$-650(x) - 600 - 420 + \underline{950}\sin 60)(6) = 0$$

$$x = 6.2\,m$$