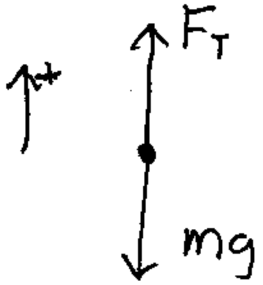
ch 4 7, 15, 19, 23, 31, 41

7) $V^2 = V_0^2 + 2a\Delta x$ $\qquad (155 m/s)^2 = 2a(.70m)$

$F = ma$

$a = 1.716 \times 10^4 m/s^2$

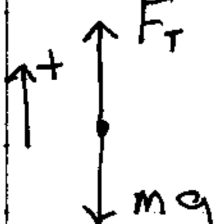
$F = (6.25 \times 10^{-3} Kg)(1.72 \times 10^4 m/s^2) = 109 N$

15) 

$ma = F_T - mg$

$a = \frac{F_T - mg}{m} = -1.41 m/s^2$

(downward)

19. 

$ma = F_T - mg$

$a = \frac{F_T - mg}{m} = .547 m/s^2$

23) on ground 

$\Delta y = .2m$

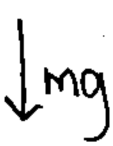
$ma = F_N - mg$

$V_{y0} = 0$

$\Delta y = \frac{1}{2}at^2$

$V_y = at$

** $V_y^2 = 2a\Delta y$

in air 

$V_y = 0$

$V_{y0} = V_{y\,ground}$

$a = g$

$\Delta y = .8m$

$.8m = +V_y t - \frac{1}{2}gt^2$

$0 = V_y - gt$

* $0 = V_y^2 - 2g\Delta y$

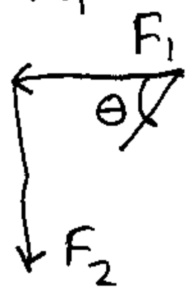
* $V_y = 3.96 m/s$

** $a = 39.24 m/s^2$

$F_N = ma + mg = 2990 N$

ch4)

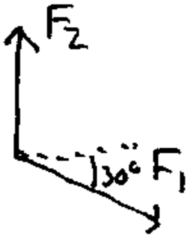
31) a)



$F_T = \sqrt{F_1^2 + F_2^2} = 32.92N$

$\theta = \tan^{-1} \frac{F_2}{F_1} = 52°$ south of west

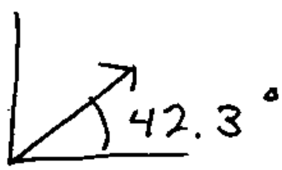
b)



$F_{Tx} = F_1 \cos 30° = 17.49N$

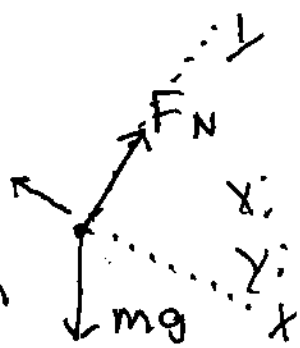
$F_{Ty} = F_2 - F_1 \sin 30° = 15.90N$

$\theta = \tan^{-1} \frac{15.90N}{17.49N} = 42.3°$



$F_T = \sqrt{F_x^2 + F_y^2} = 23.64N$

41) up and down



x: $ma = mg\sin\theta$

y: $0N = F_N - mg\cos\theta$

$a = g\sin\theta = 3.67 \, m/s^2$

(down the plane)

$V_y^2 = 0 = V_{0y}^2 - 2(3.67 m/s^2)\Delta x \quad \Delta x = 2.18 m$

because "a" is the same up + down t is also same

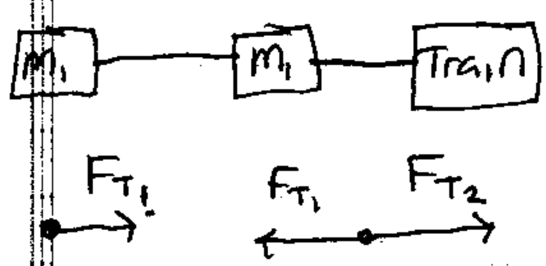
final

$0 = {}^{-}4.0 m/s + (3.67 m/s^2) t_{up}$

$t_{up} = 1.09s$ so $t_{tot} \approx 2.25$

ch 4) 45, 53

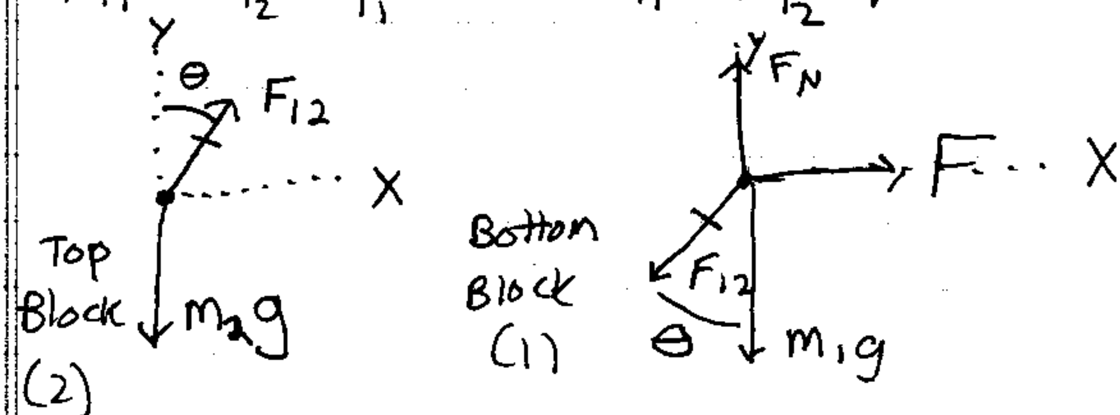
45)



$ma = F_{T_1}$ $\quad$ $ma = F_{T_2} - F_{T_1}$

$F_{T_1} = F_{T_2} - F_{T_1}$ so $2F_{T_1} = F_{T_2}$ ✓

53)



(1) x: $F_{12}\sin\theta = m_2 a$ $\quad$ (3) x: $F - F_{12}\sin\theta = m_1 a$

(2) y: $F_{12}\cos\theta - m_2 g = 0\,N$ $\quad$ (4) y: $F_N - F_{12}\cos\theta - m_1 g = 0\,N$

(1) $a = \dfrac{F_{12}\sin\theta}{m_2}$ plug into (3) $\quad$ (2) $F_{12} = \dfrac{m_2 g}{\cos\theta}$

(3) $F = m_1\left(\dfrac{F_{12}\sin\theta}{m_2}\right) + F_{12}\sin\theta$

$$F = \frac{m_1}{m_2}\left(\frac{m_2 g\sin\theta}{\cos\theta}\right) + \frac{m_2 g\sin\theta}{\cos\theta} = g\tan\theta(m_1 + m_2)$$

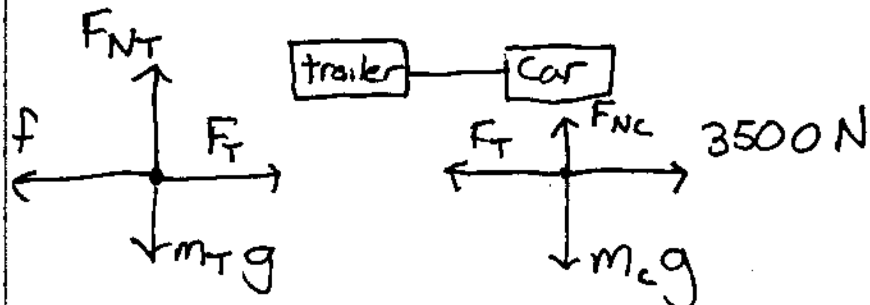
ch5) 5, 13, 19, 29, 37, 44

5) $ma = \mu_s F_N$

$ma = \mu_s mg$

$a = \mu_s g \qquad \mu_s = .20$

13)



① $m_T a = F_T - \mu m_T g$ ② $m_c a = 3500\,N - F_T$

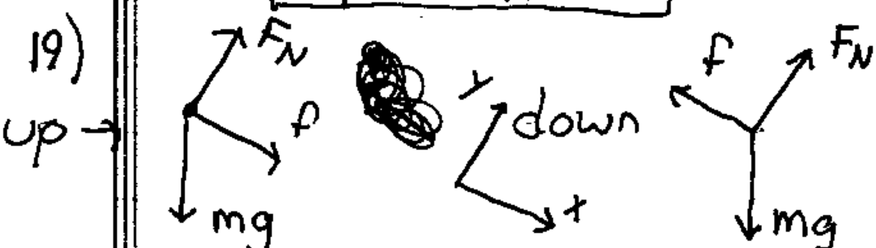
$a = \dfrac{3500\,N - F_T}{m_c}$

$(3500\,N)\dfrac{m_T}{m_c} - \dfrac{m_T}{m_c} F_T = F_T - .15 m_T g$

$(3500\,N)\dfrac{m_T}{m_c} + .15 m_T g = F_T\left(1 + \dfrac{m_T}{m_c}\right)$

$\boxed{F_T = 1290\,N}$

19)



$f = \mu F_N = \mu mg\cos\theta$

$\left(\Delta x = \dfrac{0 - V_0^2}{2a}\right) = -.862\,m$

$t_{up} = \dfrac{V_0}{a} \qquad t_{down} = \sqrt{\dfrac{2|\Delta x|}{a_d}}$

x: $ma = f + mg\sin\theta$

y: $0\,N = F_N - mg\cos\theta$

$a = \mu g\cos\theta + g\sin\theta$

$= 5.22\,m/s^2$

x: $ma_d = -f + mg\sin\theta$

y: $0\,N = F_N - mg\cos\theta$

$a_d = -\mu g\cos\theta + g\sin\theta$

$= 2.13\,m/s^2$

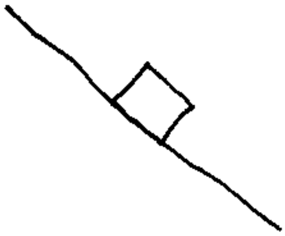
$t_{up} = .575\,s$

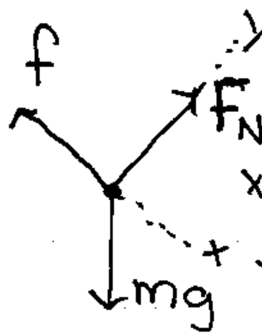
$t_d = .900\,s$

$t = 1.475\,s$

Ch5) 29, 37, 44

29)





x: $ma = mg\sin\theta - \mu F_N$

y: $0\ N = F_N - mg\cos\theta$

$v^2 = 2a\Delta x$

so $\left(\frac{1}{2}v\right)^2 = 2\left(\frac{a}{4}\right)\Delta x$

$a_{NF} = 4a$

x: $ma = mg\sin\theta - \mu mg\cos\theta$

① $a = g\sin\theta - \mu g\cos\theta$

No friction: $a_{NF} = g\sin\theta$

② $a = g\sin\theta/4$

so $\frac{g\sin\theta}{4} = g\sin\theta - \mu g\cos\theta$

so $\mu = \frac{3\sin\theta}{4\cos\theta} = \frac{3}{4}\tan\theta$

$= .399$

37) $a = \frac{v^2}{r} = \frac{(1.50\,m/s)^2}{9m} = .25\,m/s^2$ $\quad F = 6.25N$

44)

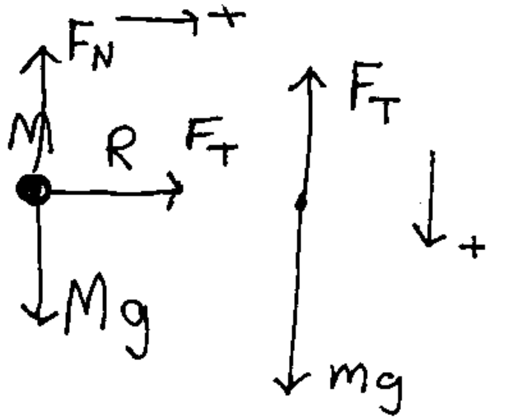
$ma = \frac{mv^2}{r} = F_T - mg$

$\left(\frac{80kg}{4.8m}\right)v^2 = 1400N - (80Kg)(9.81m/s^2)$

$V = 6.075\,m/s$

Ch5) 74. Ch6) 3,7

74)



$$\frac{Mv^2}{R} = F_T \qquad 0N = -F_T + mg$$

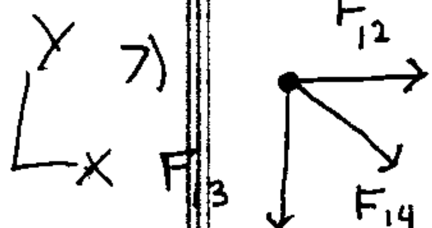
$$\text{so } F_T = mg$$

$$\frac{Mv^2}{R} = mg \Rightarrow V = \sqrt{\frac{mgR}{M}}$$

6-3 $$9.8\,m/s^2 = \frac{GM_E}{R_E^2} \qquad R^2 = 6.25\,R_E^2$$

$$\text{so } X = \frac{GM_E}{6.25\,R_E^2} = \frac{9.81\,m/s^2}{6.25} = 1.57\,m/s^2$$

7)



$$\vec{F_T} = \vec{F_{12}} + \vec{F_{13}} + \vec{F_{14}}$$

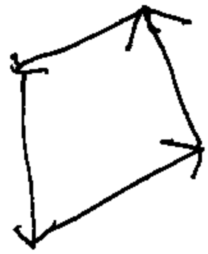
$$F_{Tx} = F_{12} + F_{14}\cos 45^\circ = 1.33\times 10^{-8}\,N$$

$$F_{Ty} = -F_{13} - F_{14}\sin 45^\circ = -1.33\times 10^{-8}\,N$$

$$F_T = \sqrt{F_x^2 + F_y^2} = 1.88\times 10^{-8}\,N$$

Java 4.2, 4.10, 5.1, 5.6

4.2

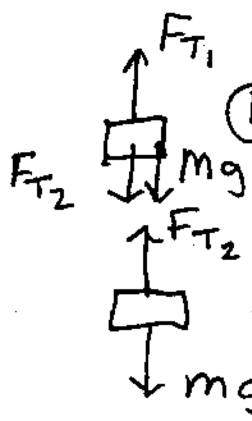


$F_{TOT} = 0$

$a = 0 \qquad V = \text{const}$

airplane could be moving only $V = \text{const}$
And with a lift and drag force it <u>must</u> be moving

4.10



① $ma = F_{T_1} - F_{T_2} - mg$

$a = .5 m/s^2$ from simulation

② $ma = F_{T_2} - mg$

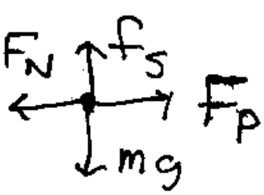
② $1N = F_{T_2} - (2kg)(9.8 m/s^2)$

② $F_{T_2} =$ 20.6N

① $1N = F_{T_1} - 19.6N - 20.6N$

$F_T = 41.2N$

5.1) $a = 0$



but $V \neq 0$

$F = 0 \quad F_p = F_N \quad f_K = mg$

$f_s \le \mu_s F_N$

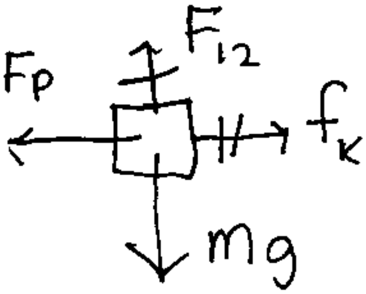
$f_s = .2 F_p = mg$

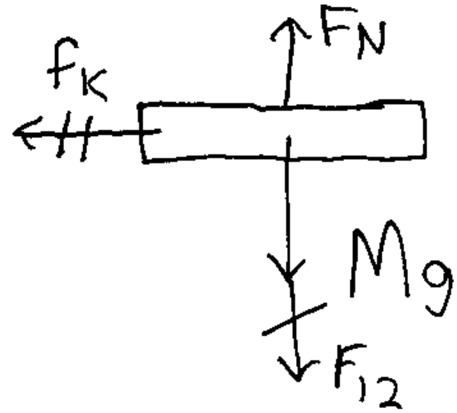
so $F_p = 5mg$

if greater then book slows down and stops

Java

5.6 $a_T = -1.80\ m/s^2$ $a_B = -.40\ m/s^2$





$m(-1.80\ m/s^2) = -F_p + f_K$

$Ma = (20\,kg)(-.4\ m/s^2) = -8N = -f_K$

$-18N = -F_p + f_K$

$F_p = 10_N$ to the left