Chapter 5

Question 3

(a) Which situations could have a stationary block?

A stationary block requires $\sum F = 0$.

Pictures (2) and (4) could have $\sum F = 0$
$\Rightarrow$ a stationary block

(b) Which situations could have a block moving w/ a constant velocity?

Constant velocity $\Rightarrow$ acceleration $= 0$

$\Rightarrow \sum F = 0$

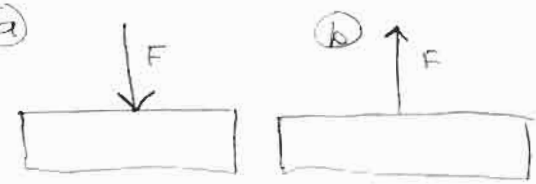
Again, Pictures (2) and (4) could have $\sum F = 0$
$\Rightarrow$ a stationary block.

Chpt 5

Question 4

The lunchbox slides w/ constant velocity $(a=0)$ before we change the angle of F_1. If we decrease θ, then we increase the size of the $F_{1x} = F_1 \cos\theta$ component that F_2 is opposing. To maintain $a=0$, we must increase the magnitude of F_2 when we decrease θ.

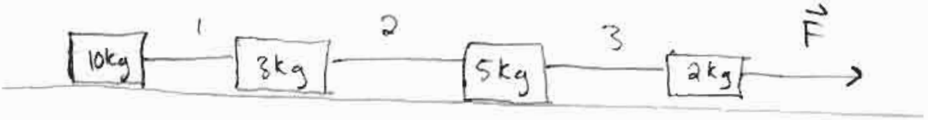
chpt 5
Question 8



(a) The normal force from the floor <u>increases</u> when a vertical force pushes down on the block

(b) The normal force from the floor <u>decreases</u> when a vertical force pulls the block up.

chpt 5
Question 9



(a) The total mass accelerated by $\vec{F}$ is

$$10 + 3 + 2 + 5 = 20 \text{ kg}$$

(b) The total mass accelerated by cord 3 is

$$10 + 3 + 5 = 18 \text{ kg}$$

(c) The total mass accelerated by cord 1 is

$$10 \text{ kg}$$

chpt 5 (cont'd)

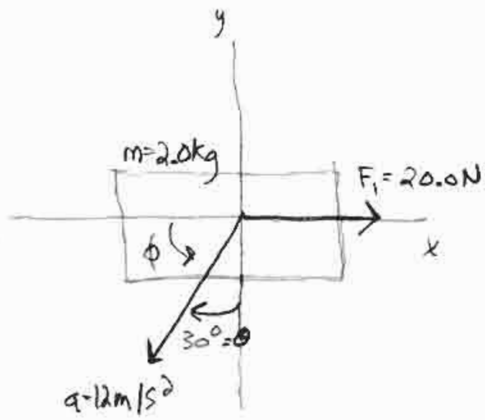
Question 9

(d) The blocks all have the same acceleration.

(e) $T_3 > T_2 > T_1$

Chpt 5

Problem 7



(a) Find the Force that would produce a w/o F_1

$F = ma$, $F_x = ma\sin\theta$, $F_y = ma\cos\theta$

$F_x = -12\,N$ $\quad F_y = -20.8\,N$

We must add $-20N$ to the x component of F to "cancel" F_1

in unit vector notation

$$F = F_x\hat{i} + F_y\hat{j} - 20\hat{i}$$

$$F = 12\hat{i} + 20.8\hat{j} - 20\hat{i} = (-32\hat{i} - 20.8\hat{j})\,N$$

(b) The magnitude of F is

$$|F| = \sqrt{32^2 + (20.8)^2} = 38\,N$$

(c) The direction of F is

$$\phi = \tan^{-1}\left(\frac{20.8}{32}\right) = 33^\circ$$ from the (-x) axis.

PHYSICS 131 HOMEWORK # 3

Chpt 5
Problem 11

$$\omega = mg = 22N$$

$$m = \frac{(22N)}{(9.8\, m/s^2)} = 2.2\,kg$$

(a) What is ω when $g = 4.9\, m/s^2$?

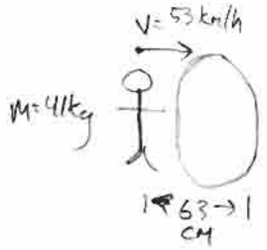
$$\omega = mg = (2.2)(4.9) = 11N$$

(b) mass is always 2.2 kg

(c) when g is 0, $\omega = 0$

(d) mass is always 2.2 kg

Chpt 5
Problem 22



$X_o = 0$

$X_f = .63\,m$

$V_{ox} = 53\,km/h \cdot \frac{1000m}{1km} \cdot \frac{1h}{3600s} = 14.7\,m/s$

$V_{fx} = 0$

$*\ a = ?$

$t = ?$

The best (quickest) eqn is:

$$V_{fx}^2 = V_{ox}^2 + 2a\Delta x \Rightarrow a = -\frac{V_o^2}{2\Delta x} = \frac{14.7^2}{2(0.65)} = -167\, m/s^2$$

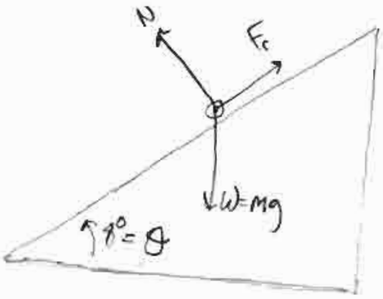
Chpt 5
Problem 22
(cont'd)

The average force is

$$F = ma = (41\,kg)(167\,m/s^2)$$

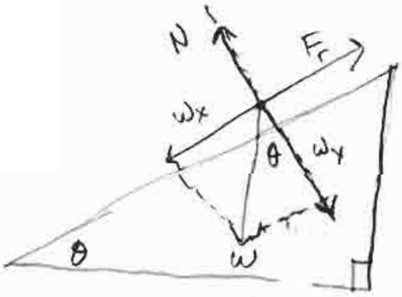
$$\boxed{F = 6.8 \times 10^3\,N}$$

Chpt 5
Problem 24



(a) What is the magnitude of the force of the rope on the skier when the rope is moving at a <u>constant velocity</u> of 2.0 m/s?

Constant velocity $\Rightarrow a = 0 \Rightarrow \Sigma F = 0$



m = 50 kg

Rotate coordinate system
(just like Sample Problem)

$$\Sigma F_x = F_r - W_x = 0$$

$$F_r = w_x = mg\sin\theta$$

$$\boxed{F_r = 68\,N}$$

Chpt 5 Problem 24 (Cont'd)

(b) What is F_r when $a = .1\ m/s^2$?

Same analysis, but this time:

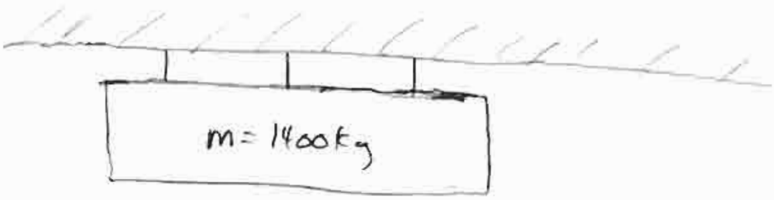
$$\sum F = ma = F_r - mg\sin\theta$$

$$F_r = ma + mg\sin\theta$$

$$\boxed{F_r = 73N}$$

Chpt 5 Problem 32

(a)



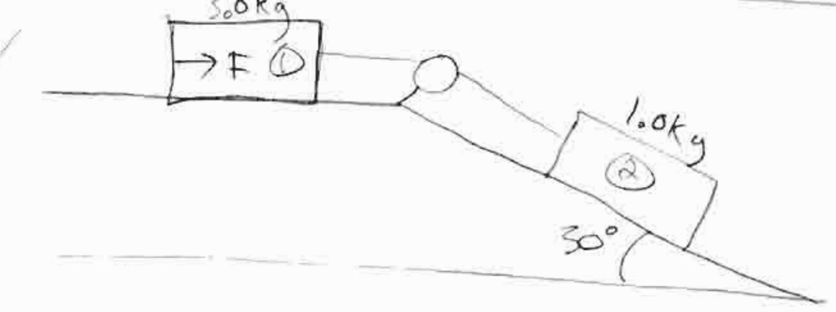
What is the force on each bolt? (plane is at rest)

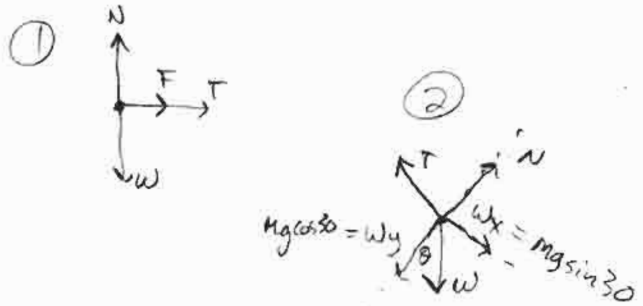
$$F = \tfrac{1}{3}mg = 4.6\times10^3 N$$

(b) What is the force on each during turbulence ($a = 2.6\ m/s^2$ down)

$$F = \tfrac{1}{3}mg + \tfrac{1}{3}ma = 5.8\times10^3 N$$

Chpt 5
Problem #44





ⓐ What is T?

$\Sigma F_{x_1} = m_2 g \sin 30 - T = m_2 a \Rightarrow T = m_2 g \sin 30 - m_2 a$

$\Sigma F_{x_2} = F + T = m_1 a$

$= F + m_2 g \sin 30 - m_2 a = m_1 a$

$= F + m_2 g \sin 30 = (m_1 + m_2) a$

$\Rightarrow a = 1.8 \text{ m/s}^2$

Plug back into T eqn

$T = 3.1 \text{ N}$

Chpt 5 / Problem 44

(b) Consider case where $T=0$

In that case, block (1) is accelerating exactly as block (2)

Looking at our eqns

$$\Sigma F_{x1} = m_2 g \sin 30 - 0 = m_2 a \Rightarrow a = g \sin 30$$

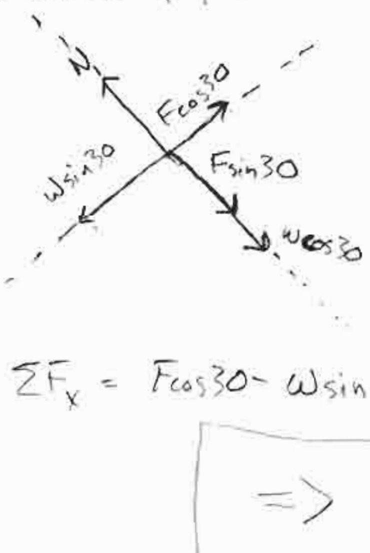
$$\Sigma F_{x2} = F + 0 = m_1 a$$

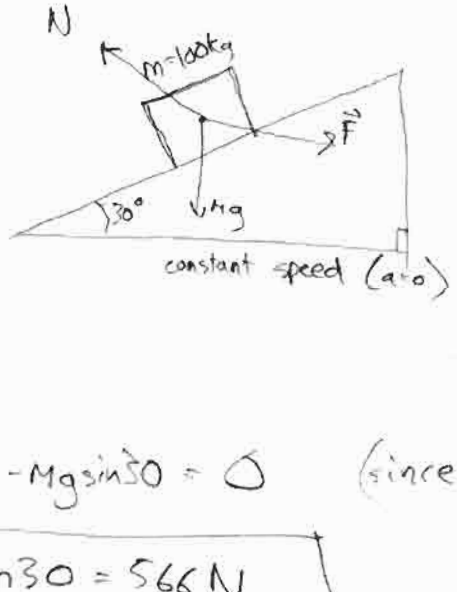
$$F = m_1 g \sin 30 = 14.7\ N$$ in the critical case.

Any force greater than 14.7N will make the rope go slack

Chpt 5 / P.52

(a) What is $|\vec{F}|$?





$$\Sigma F_x = F\cos 30 - w\sin 30 = F\cos 30 - Mg\sin 30 = 0$$ (since $a=0$)

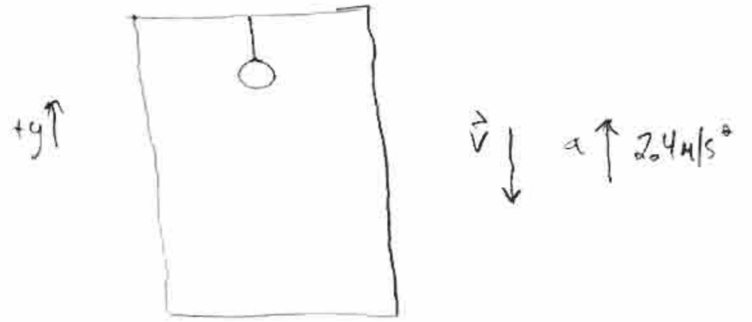
$$\Rightarrow F = Mg \tan 30 = 566\ N$$

(b) What is the Force on the crate from the ramp? The Normal force. Its magnitude is

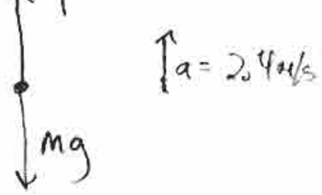
$$\Sigma F_y = N - F\sin 30 - mg\cos 30 = 0$$

$$\Rightarrow N = 1.13 \times 10^3\ N$$

chpt 5 / P.56



(a) If the tension in the cord is 89 N, what is the lamp's mass?



$$\sum F_y = T - mg = ma$$

$$\Rightarrow m = \frac{T}{(a+g)} = 7.3\ kg$$

(b) What is tension if $\vec{v}$ is upward?

$$\sum F_y = T - mg = ma$$

$$\Rightarrow T = 89N$$

Our equations never used $\vec{v}$, so this is what we expect.