Ch. 4 Homework

Questions	1, 5, 6, 8, 11, 13, 14, 16, 20, 22, 23, 25
Problems	1-3, 5, 6, 8

Questions:

(1) a) Pitcher throws a fast ball

Force of ground on pitcher — Force of pitcher on ground
Force of ball on pitcher — Force of pitcher on ball

b) Pencil on desk

Force of gravity pushing pencil down — Force of table pushing up in response

c) car hits a tree

Force of engine seen in tires pushing against ground — Force of grnd on tires pushing forward
Force of gravity creating friction between tires & ground - Force of ground on tires
Force of car hitting tree - force of tree on car
Force of gravity pulling tree into ground - force of ground up on tree

d) Wind pushing sailboat

Force of wind on sail - Force of sail on wind
Force of sailboat on water (gravity) - Force of water on boat

Q5 (cont)

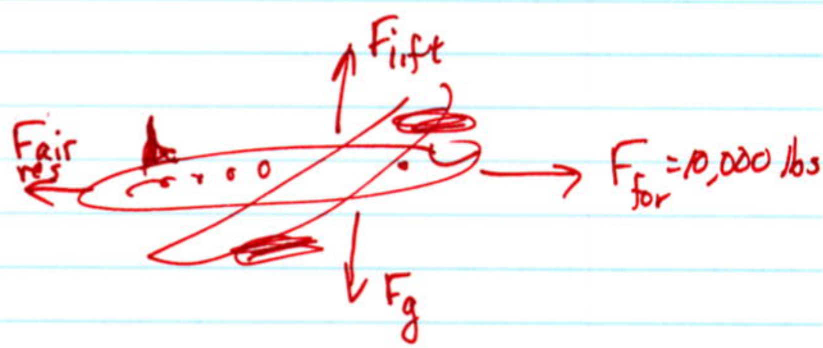
⑤ 

The Feris wheel is moving in a circle. This means it is accelerating (Δdirection).

The person sitting in the seat is kept from falling downward or from flying outward by the seat constraints.

Gravity's force down countered by seat up.
Centripetal force outward countered by seat bar.

⑥
W = 28,000 lbs
v = 500 mi/hr
height = 35,000 ft.
F_{for} = 10,000 lb



Forward thrust balances air resistance (drag)

F_{air} = −10,000 lbs.

Lift force balances weight.

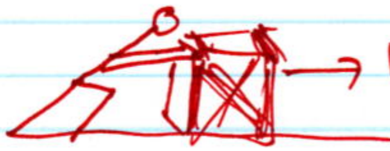
$F_g = -F_{lift}$ = +, 28,000 lbs

Its moving at a constant speed, (& height) so forces must balance each other.

Ch. 4 HW

Q5 (cont.)

(8.)



$v = \text{constant}$, $F = 500N$

If v = constant, then $\vec{a} = 0$ & $\Sigma F = F_{NET} = 0$

$$F_{push} + F_{friction} = 0$$

$$\boxed{F_{push} = -F_{friction} = 500N}$$

Note: It did take more than 500N push to get crate started however!

(11.) Car – straight track, constant speed

No $\Delta\vec{v}$, ∴ No $\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$, ∴ $\Sigma F = 0$

(13.)

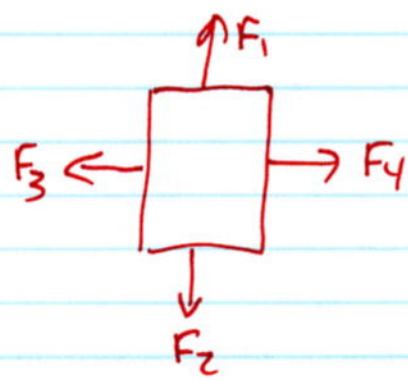


Fig. for Q 13,14

(13.) If box accelerates to right, how do 4 forces compare?

$F_1 = F_2$, $F_4 > F_3$

(14.) a) If box accelerates upward?

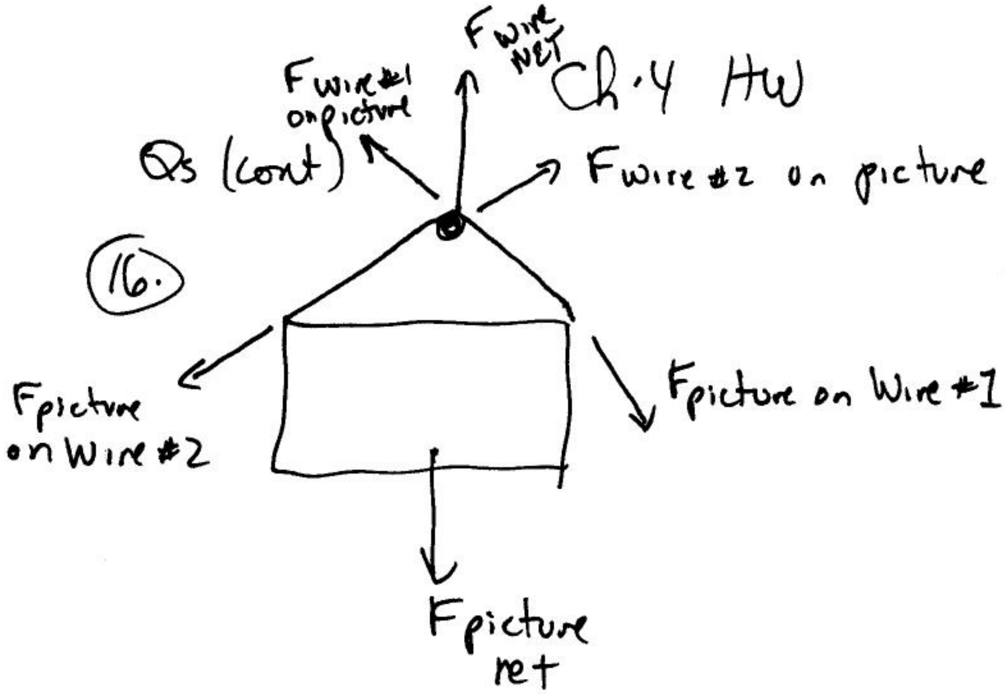
$F_1 > F_2$, $F_3 = F_4$

b) If box accelerates upward & right? $\left\{ F_1 > F_2 \text{ \& } F_4 > F_3 \right.$

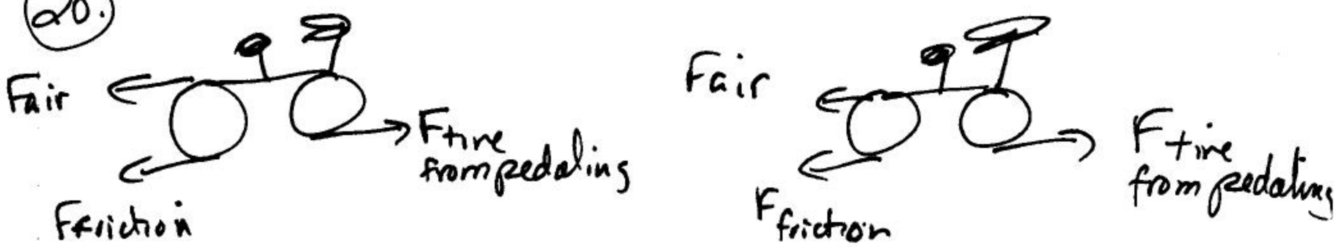
Ch. 4 HW

Qs (cont)

(16.)



(20.)



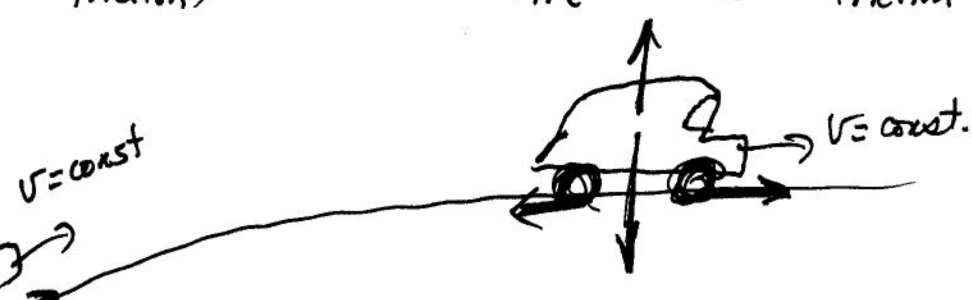
Accel.

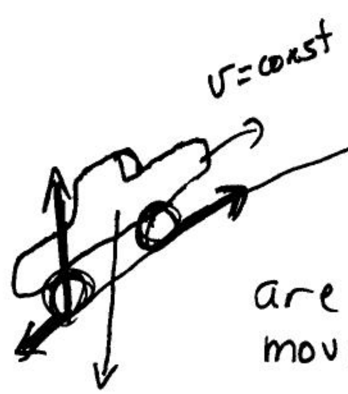
$F_{tire} > (F_{air} + F_{friction})$

Const. speed

$F_{tire} = F_{air} + F_{friction}$

(22.)





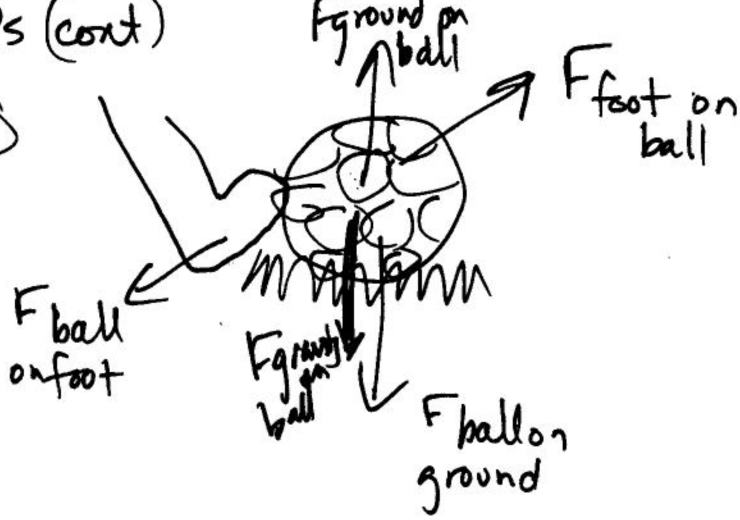
In each case, the total forces are balanced if the cars are moving at a constant speed.

The engine is working harder on the hill to counter balance the downward force along the road.

Ch. 4 HW

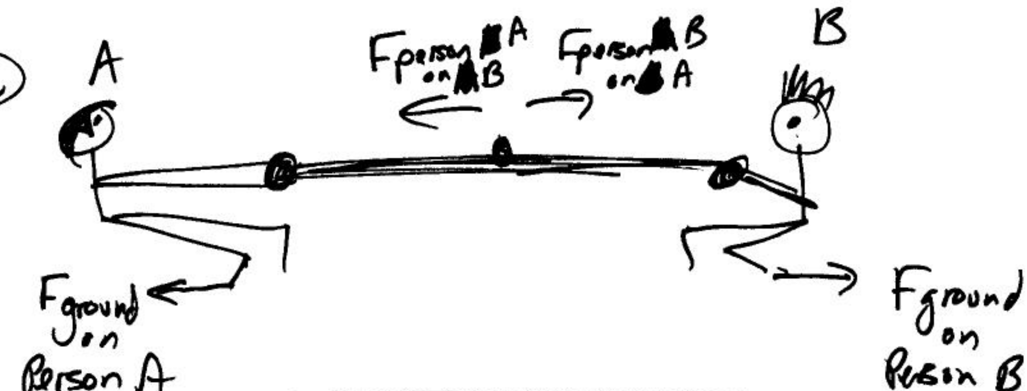
Qs (cont)

(23.)



$F_{\text{foot on ball}} > F_{\text{gravity on ball}}$

(25.)



$F_{\text{ground on Person B}} > F_{\text{person A on person B}}$

For person B to win!

Problems

(1.) $m = 20\ kg$
$a = 9.8\ m/s^2$

$F = ? = ma$

$F = 20 kg (9.8 m/s^2)$

$\boxed{F = 196\ N}$

P5 (cont)

(2.) Greatest inertia requires greatest force to change a body's motion.

greatest	ocean liner
↓	VW bug
least	mosquito

(3.) v = 55 mi/hr const.

a) Forces → gravity creating friction
→ force of ground back on tires from engine
→ drag due to air resistance

b) $\Sigma F = F_{net} = 0$ because $\vec{a} = 0$

c) To turn around a curve, direction changes, so $\Delta\vec{v} > 0$, ∴ $\vec{a} > 0$, ∴ $F_{net} \neq 0$

(5.) $m = 50$ kg
$v = 20$ mi/hr $\rightarrow \left(\frac{1600\ m}{mi}\right)\left(\frac{hr}{3600 s}\right) = 8.94$ m/s
$t = 0.5$ sec.

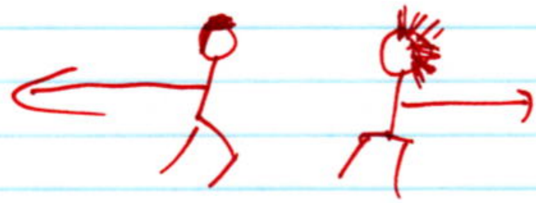
$$F = m\frac{\Delta v}{\Delta t} = \frac{50kg(0 m/s - 8.94 m/s)}{0.5 sec}$$

$$\boxed{F = 894\ N}$$

P5 (cont)

(6.) $m_m = 45kg$ $v_{f_m} = 14 ft/s$

$m_B = 65kg$ $v_{f_B} = ?$



$$F_m = -F_B$$

$$m_m a_m = -m_B a_B$$

$$m_m \frac{\Delta v_m}{\Delta t} = -m_B \frac{\Delta v_B}{\Delta t}$$ ← Δt cancel out, also same time of contact between them!

$$45kg(14ft/s - 0) = -65kg(v_{fB} - 0)$$

$$\frac{45kg(14ft/s)}{65kg} = -v_{fB}$$

$$\boxed{-9.7 ft/s = v_{fB}}$$

(8.)

a) Both bug & car experience same force, Newton's 3rd Law

b) Bug has greatest acceleration, F=ma