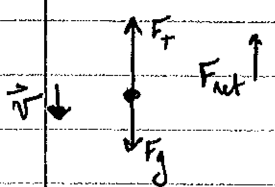
Chapter 6 Conceptual Questions (4, 5, 7, 8, 11, 13, 18, 21, 22)

(4) Disagree - forces cause acceleration

(5) No. All forces could cancel, ~~not~~ no net Force, no accel., but Cannot tell which direction $\vec{v}$.

(7) $F_T > F_g$



(8) $F_{a_x} = F_{b_x} = F_{c_x} = \varnothing$

horizontal forces all zero, (after arrow left bow)

(11) $d > c = b > a$

only gravity is affecting them → so ranked in order of weight

(13) Too little - Scale will read a larger force & you will assume there is more salt on pan than actually is.

(18) a. Normal force & frictional force would be doubled, acceleration would be doubled

$\cancel{v_f^2}^{0} = v_0^2 + 2a\,\Delta x$

$-v_0^2 = 2a\,\Delta x$

$2(2a)(\tfrac{1}{2}(\Delta x))$

a. so distance is halved.

18 b. if v_0 is doubled to $2v_0$ (Friction & accel. the same)

$\cancel{v_f^2}^{0} = v_0^2 + 2a\Delta x$

$(2v_0)^2 = 2ax$

$4v_0^2 = 4(2ax)$

so distance would quadruple

(21) $D \approx \tfrac{1}{4}Av^2$

a. $.0600(6)^2$ 2.16

b. $.0400(6)^2$ 1.44

c. $.0900(4)^2$ 1.44

$D_a > D_b = D_c$

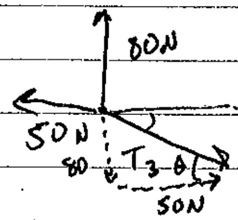
(22) ~~a = b > c = d = e~~

(accelerations) - since more drag on ones moving

$a = b > d > c = e$ - F_{net} on d more than on c & e

AP Physics
Chap 6 EP (2, 3, 7b, 15, 18, 24)

(2)



$\Sigma F = 0 = ma = 0$

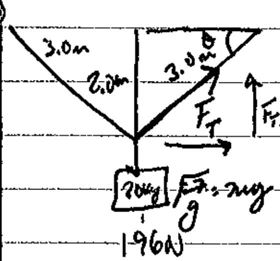
$T_3 = \sqrt{80^2 + 50^2}$

$T_3 = 94.34\,N$

$\theta = \tan^{-1} 80/50 = 58°$

$T_3 = 94N$ @ 58° below +x

(3)



$\sin^{-1}$ ~~$\tan^{-1}$~~ $2/3 = \theta$

~~33.69°~~

41.81°

$F_{Ty} = \frac{196N}{2} = 98N$

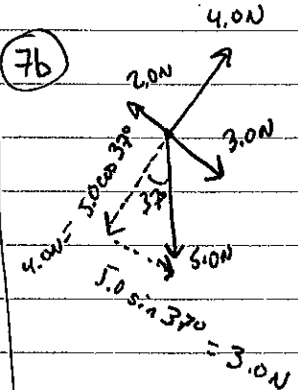
$\sin$ ~~33.69~~ $41.81° = \frac{98}{F_T}$

~~$F_T = 176.67$~~

~~$F_T = 180N$~~

$F_T = 147N$

(7b)



$\Sigma F_y = 4 + -4 = 0$

$a_y = 0$

$\Sigma F_x = 3 + 3 - 2 = 4N$

$\Sigma F_x = m a_x$

$4N = (5kg)(a_x)$

$a_x = .80\,m/s^2$

(15) $a = \frac{\Delta v}{t} = \frac{10\,m/s}{4.0\,s} = 2.5\,m/s^2$

60kg passenger

a) $F_g = mg = (60)(9.8) = 588N = 590N$

b) $mg + ma = (60)(9.8) + 60(2.5) = 738 = 740N$

c) 590N

(18) $F_{s.f.} = \mu_s F_N = 0.8(120kg)(9.8) = 941N$

if farmer only pulls with 800N, cannot move mule

(24) estimate sliding distance ≈ 3m (10ft)

running speed/sliding speed ≈ 3 m/s (6mi/hr)

so maybe sliding for 1 sec.

acceleration = $-3\,m/s^2$

mass of player ≈ 90kg

so...

$F_f = ma$

$= (90kg)(3)$

270N estimate of friction force

AP Physics Chapter (25, 26, 27, 42)

(25) At v_T, $F_g = F_D$

feet first ~~20.5~~ 20cm × 40cm = .2m × .4m

$mg = \frac{1}{4} A v_T^2$

$(75)(9.8) = \frac{1}{4}(.2 \times .4)(v_T)^2$

$v_T = 192 m/s$

(26) 6.5cm = diameter

3.25cm = radius

πr^2 : area = .0033183072 m^2

$mg = \frac{1}{4} A v_T^2$

$m(9.8) = \frac{1}{4}(.0033183072)(26)^2$

$m = .057 kg$

(27) $F_{x_{average}} = \frac{0 + 10N}{2} = 5N$

$\Sigma F = ma$

$5N = (5.0kg)(a)$

$a = 1 m/s^2$ for 4sec

$v_f = 4 m/s$

* Alternate Solution:

$F = ma$

$F = m\frac{dv}{dt}$

$F\,dt = m\,dv$

$\int F\,dt = \int m\,dv$

$Ft\Big|_{t_i}^{t_f} = mv\Big|_{v_i}^{v_f}$

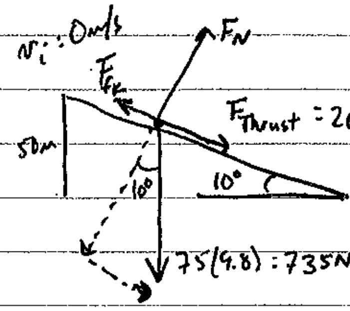
$F\Delta t = m\Delta v$

$F \cdot t = \Delta p$

$F \cdot t$ = area

$\frac{1}{2}(4s)(10N) = 5(\Delta v)$

$\Delta v = 4$

(42) 

$v_f = 40 m/s$

length of slope ⇒ $\sin 10° = \frac{50m}{l}$

$l = 288m$

$\vec{v}_f^{\,2} = \vec{v}_i^{\,2} + 2\vec{a}\vec{x}$

$40^2 = 0^2 + 2(a)(287.9385242)$

$a = 2.77837 m/s^2$

$F_N = (735N)(\cos 10°)$ $\quad \Sigma F = ma$

downhill − uphill = ma

$\left[F_{Thrust} + 735(\sin 10°)\right] - \underset{\mu F_N}{F_{f_k}} = ma$

$200N + 735N(\sin 10°) - \mu_k(735\cos 10°) = 75(2.77837)$

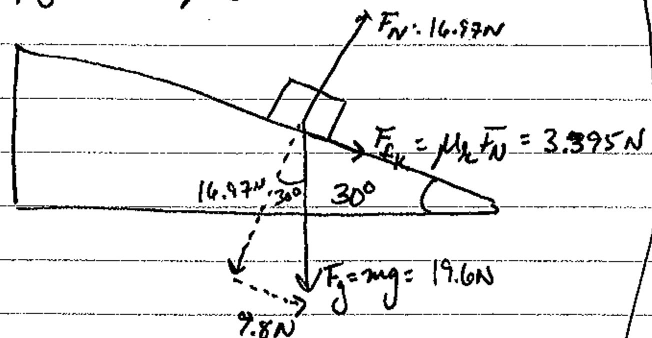
$327.6314106 - \mu_k(723.8336985) = 208.3778$

$\mu_k = .16$

AP Physics

Chapter 6 (46, 47, 51, 62)

(46) pg 163 wood on wood $\mu_k = 0.20$



$\Sigma F = ma$

$9.8N + 3.395N = (2kg)(a)$

$13.195N = (2kg)\,a$

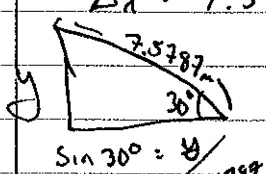
$a = 6.597\ m/s^2$

$v_i = 10m/s$

$v_f^2 = v_i^2 + 2a\Delta x$

$0 = 10^2 + 2(-6.597)\,\Delta x$

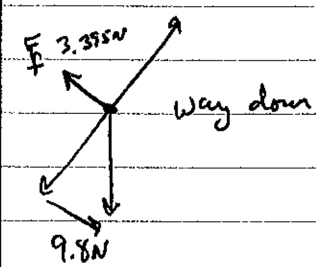
$\Delta x = 7.5787\ m$



$\sin 30° = \frac{y}{7.5787}$

a). $y = 3.8m$

b)



$\Sigma F = ma$

$9.8N - 3.395N = 2(a)$

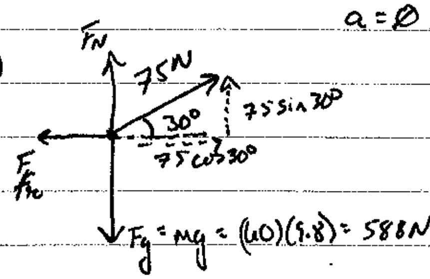
$a = 3.2025m/s^2$

$v_f^2 = v_i^2 + 2a\Delta x$

$v_f^2 = 0 + 2(3.2025)(7.5787m)$

$v_f = 7m/s$

(47) $a = 0$ so $\Sigma F = 0$



$\Sigma F_y = 0$

$F_N + 75\sin 30° - 588 = 0$

$F_N = 550.5N$

$\Sigma F_x = 0$

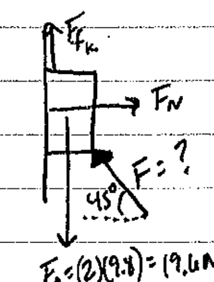
$75\cos 30° = F_{fk}$

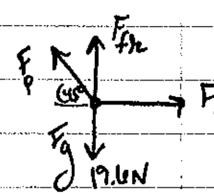
$75\cos 30° = \mu_k F_N$

$75\cos 30° = \mu_k (550.5N)$

$\mu_k = .12$ (as on page 163)

(51) wood on wood $\mu_k = 0.20$





$\Sigma F_y = 0$

$F_p \sin 45° + F_{fk} = 19.6N$

$\Sigma F_x = 0$

$F_p \cos 45° = F_N$

$F_p \sin 45° + \mu F_N = 19.6N$

$F_p \sin 45° + \mu(F_p \cos 45°) = 19.6$

$F_p \sin 45° + .20(F_p \cos 45°) = 19.6$

$.84853(F_p) = 19.6$

$F_{push} = 23N$

(62) At v_T $F_g = F_D$

$mg = b v_T$

$mg = 6\pi \eta R v_T$

a) $v_{Term} = \dfrac{mg}{6\pi\eta R}$

b) $\eta = 1.0 \times 10^{-3}\ N{\cdot}s/m^2$

$.5 \times 10^{-3}\,m = R$

$4/3\pi R^3 \times 2400\ kg/m^3$ = Mass of sand

$1.2566 \times 10^{-6}\ kg$

$$v_T = \frac{(1.2566E{-6}\ kg)(9.8)}{6\pi(1E{-3})(.5\times10^{-3})}$$

$v_T = 1.306\ m/s$

50m would take

$\frac{50}{1.306}$ ≈ 38 sec

I didn't assign it, but look at

\# 60

$F_x = ct$ find expression for $\vec{v}(t)$

(velocity as a function of time)

if Force was constant & acceleration Constant then:

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{t} \Rightarrow \vec{v}_f(t) = \vec{v}_i + \vec{a}t$$

but now $\vec{a}$ is not constant

$\Sigma F = ma$

$ct = ma$

$\frac{c}{m}t = a$

So ... $v(t) = \cancel{v_i}^{\,0} + \left(\frac{c}{m}t\right)t$

these not valid...

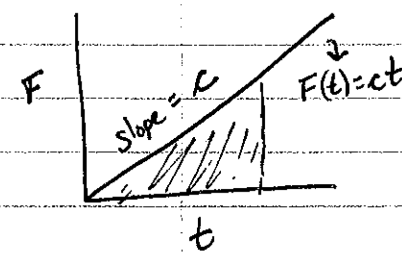
they only look at Final force & final value of $\vec{a}$, need an average over time t.

proper derivation involves a differential equation

$\Sigma F = ma$

$F_x = m\dfrac{dv}{dt}$

$ct = m\dfrac{dv}{dt}$



$ct\,dt = m\,dv$

$\int ct\,dt = \int m\,dv$

$\frac{1}{2}ct^2\Big|_i^f = mv\Big|_i^f$ $v_i = 0$ at $t = 0$

$\frac{1}{2}ct^2 = m v_f$

$\frac{1}{2}\frac{c}{m}t^2 = v(t)$

do you understand where $(\frac{1}{2})$ comes from?