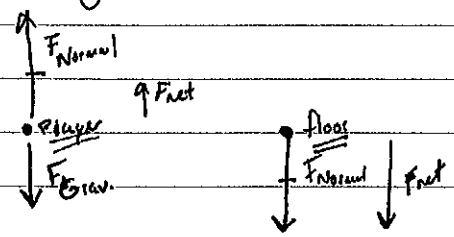
AP Physics Chapter 7 Conceptual Questions (4-7, 11, 12, 15)

(4) 

(5) Equal to. 3rd law → forces equal – accelerations don't have to be equal though!

(6) Larger. Same force but less mass so larger accel.

(7) Equal forces

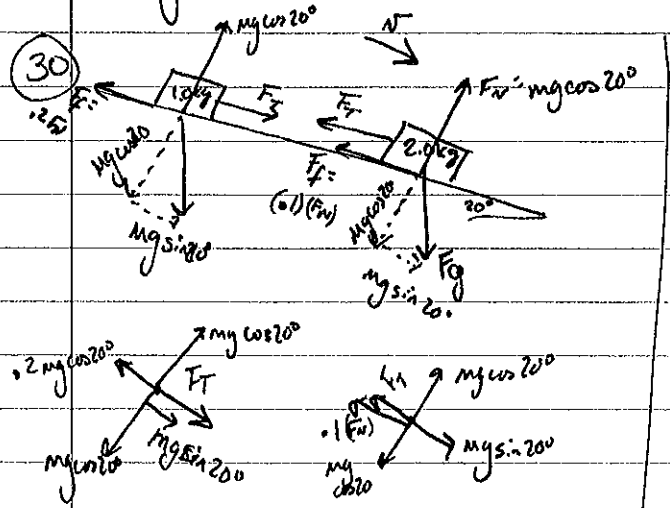
(11) ~~5 kg~~ 5 kg – same free body diagram for ~~each~~ scale as if it were attached to ceiling.

(12) 5 kg

(15) Case b acceleration is greater b/c less mass being accelerated by same force

AP Physics Chapter 7 E&P (30, 33-36)

(30)



$m = 1kg$ $\quad \Sigma F = ma$

$F_T + g\sin 20° - .2g\cos 20° = a$

$m = 2kg$ $\quad 2g\sin 20° - F_T - .1(2g\cos 20°) = 2a$

Substitution a →

see last page

$2g\sin 20° - F_T - .2g\cos 20° = 2(F_T + g\sin 20° - .2g\cos 20°)$

$g\sin 20° - \frac{1}{2}F_T - .1g\cos 20° = F_T + g\sin 20° - .2g\cos 20°$

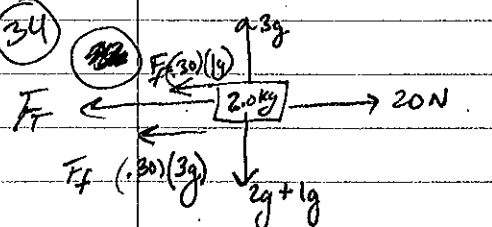
$\frac{1}{2}F_T + .1g\cos 20° = 0$

$F_T = 2(.1g\cos 20°)$

$F_T = 1.8N$

oops ↓

(34)



$\Sigma F = ma$

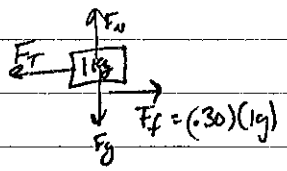
$20N - (.30)(3g) - (.30)(1g) = 2a$

$8.24 = 2a$

$a = 4.1 m/s^2$ doh!

I forgot the Tension backward!

(33) cont. $\quad 20N - (.30)(3g) - .30(1g) - F_T = 2a$



$F_T - .30(1g) = 1a$

$F_T = a + .30(1g)$

$20N - .30(3g) - .30(1g) - a - .30(1g) = 2a$

$20 - .30(5g) = 3a$

$5.3 = 3a$

$a = 1.76$

$1.8 m/s^2$

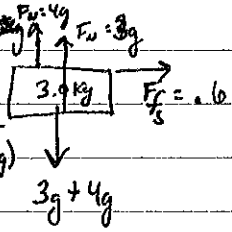
(33) $\quad \Delta x = v_i t + \frac{1}{2}at^2$

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

$\frac{2x}{t^2} = a \qquad x = 5$

$\frac{10}{t^2} = a$

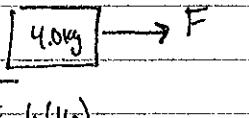
Lower Block



$-.2(7g) = 3a$

(remember $F_{f_{s\max}} = \mu F_N$ but it may not be at max. – at max. since want time to be small.)

Upper Block



$F - .6(4g) = 4a$

if no slip

if

if

→

33 cont

L.B. $.6(4g) - .2(7g) = 3a$

$9.8 = 3a \quad a = 9.8/3$

U.B. $F - .6(4g) = 4a$

$F - 23.52 = 4a$

$F - 23.52 = 4(9.8/3)$

$F = 36.586\overline{6}\ N$

If $F = \nearrow$ then

$36.586\overline{6} - 23.52 = 4a$

$a = 3.26\overline{6}$

If $a = \nearrow$

$a = \frac{10m}{t^2} = 3.26\overline{6}$

$t = 1.75 sec$

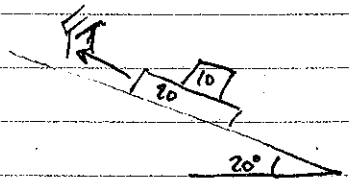
Whew!

(35) Recognize box will slip when static friction just beyond max.

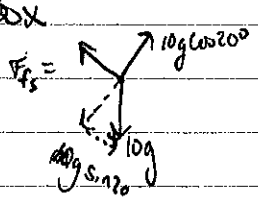
so $F_{f_s} = F_{s_{max}} = \mu_s F_N$

$\mu_s = .50$ wood on wood pg 163

$\mu_k = .06$ wood on snow pg 163



Box

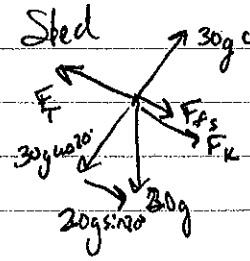


$\Sigma F = ma$

$F_{f_{s_{max}}} - 10g\sin 20° = 10a$

$(.50)(10g\cos 20°) - 10g\sin 20° = 10a$

Sled



$\Sigma F = ma$

$F_T - 30g\sin 20° - F_{f_s} - F_k = 20a$

$F_T - 30g\sin 20° - .50(10g\cos 20°) - .06(30g\cos 20°) = 20a$

$67.036 \quad 16.576$

$F_T - 100.554 - 46.045 - 55.254 = 20a$

129.657

$F_T - 201.853 = 20a$

Sled

Box

$12.527 = 10a$

$a = 1.2527 m/s^2$

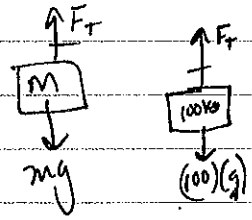
$F_T = 201.7N \quad 155N$

I made two errors 1) wrong μ_k for snow & wood

2) assuming downhill weight for sled was 30(9.8) ... box does push sled downhill, but through F_{f_s} → I sort of counted it twice the first go around

(36) $v_i = 0 \quad v_{AVE} = 1/6 m/s \quad t = 60s$

$v_f = ? \ 1/3 m/s \quad x = 8m \quad a = 0.0\overline{5} m/s^2$



$100(g) - F_T = 100(.0\overline{5})$

$F_T - mg = m(.0\overline{5})$

$100(g) - mg = 100(.0\overline{5}) + m(.0\overline{5})$

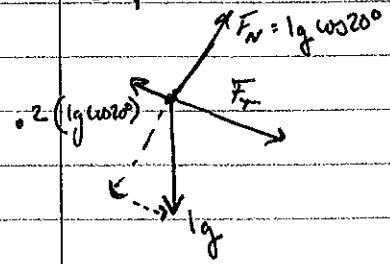
$974.\overline{4} = mg + m(.0\overline{5})$

$974.\overline{4} = m(9.8\overline{5})$

$m = 98.87$

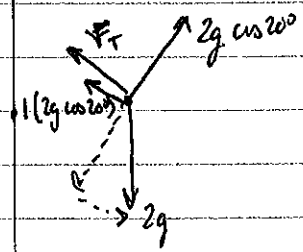
99kg

Chap 7 #30



$F_T + 1g\sin 20° - .2(1g\cos 20°) = 1a$

$F_T + 1.51 = a$



$2g\sin 20° - F_T - .1(2g\cos 20°) = 2a$

$4.8618 - F_T = 2a$

$F_T + 1.51 = a$

$6.3718 = 3a$

$a = 2.12 m/s^2$

$F = 0.614 N$