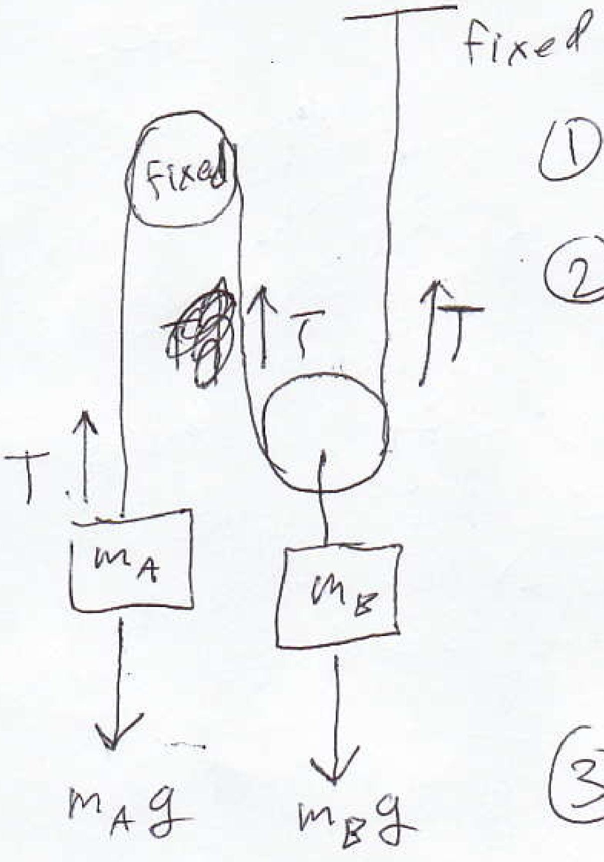


$$① \quad m_A a_A = T - m_A g$$

$$② \quad m_B a_B = 2T - m_B g$$

$$m_A = 5.0\,kg$$
$$m_B = 3.0\,kg$$
$$g = 9.8\,m/s^2$$

$$③ \quad a_A = -2a_B$$

$$m_A a_A = T - m_A g \rightarrow 2m_A a_A = 2T - 2m_A g$$

$$m_B a_B = 2T - m_B g \longrightarrow m_B a_B = 2T - m_B g$$

$$a_A = -2a_B \qquad 2m_A a_A - m_B a_B = -2m_A g + m_B g$$

$$2m_A(-2a_B) - m_B a_B = -2m_A g + m_B g$$

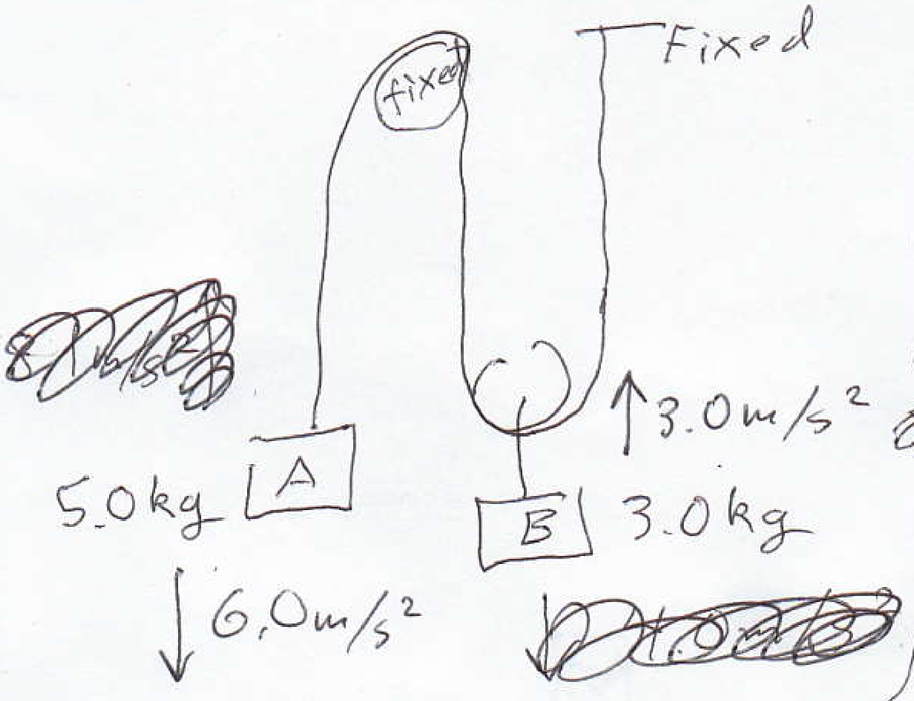
$$(-4m_A - m_B)a_B = (m_B - 2m_A)g$$

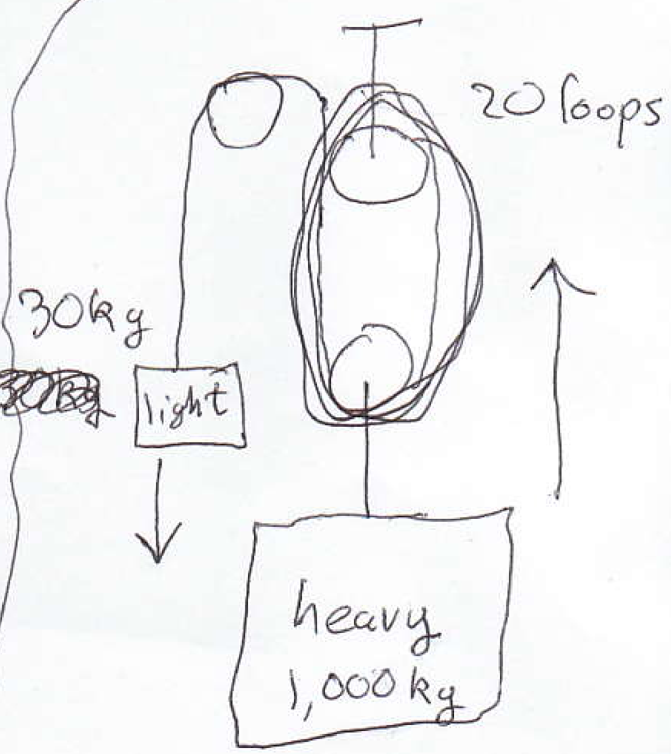
$$a_B = \frac{-m_B + 2m_A}{4m_A + m_B}\, g$$

$$a_A = -2a_B = \frac{+2m_B - 4m_A}{4m_A + m_B}\, g$$

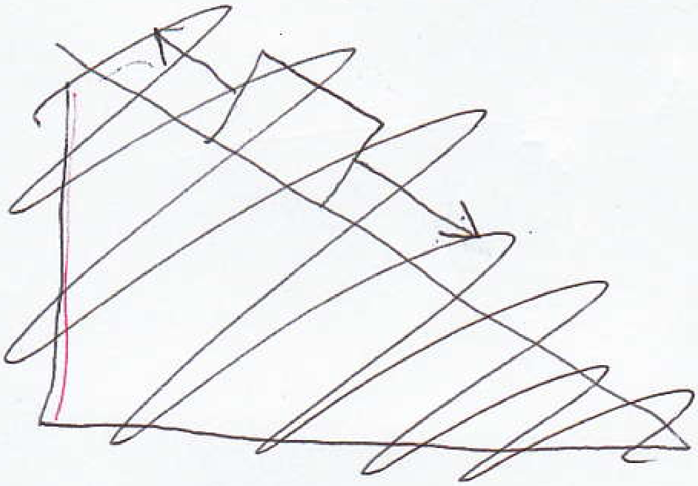
$$a_B = \frac{-3+2(5)}{4(5)+3}\,\frac{kg}{kg}\,9.8\,m/s^2 = +3.0\,m/s^2$$

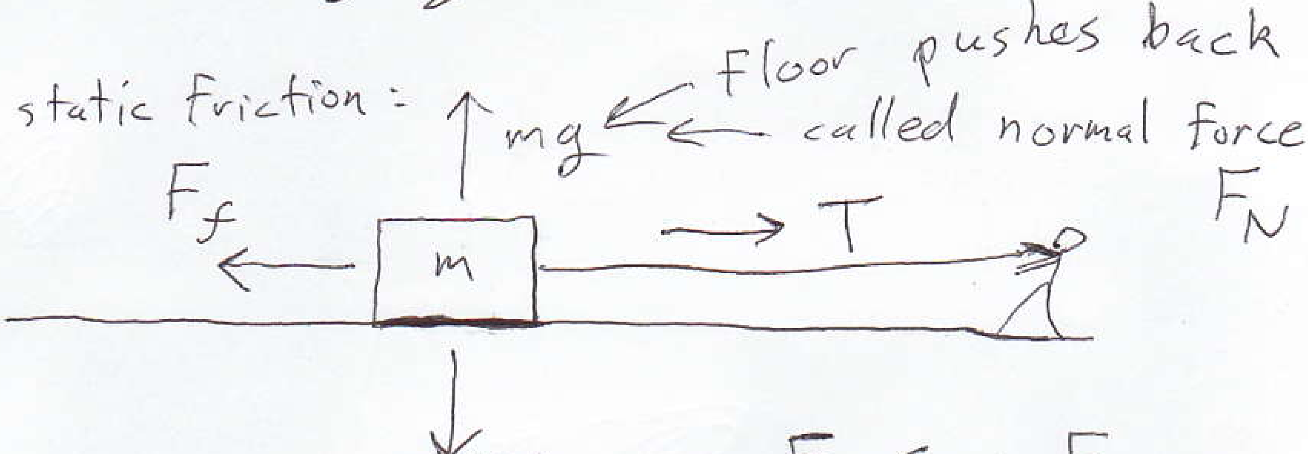
$$a_A = \frac{+2(3)-4(5)}{4(5)+3}\,\frac{kg}{kg}\,9.8\,m/s^2 = -6.0\,m/s^2$$





HW #1 Find the accelerations of the light & heavy blocks.





$F_f \le \mu_s F_N$

μ_s = "mu s"
= coefficient of static friction

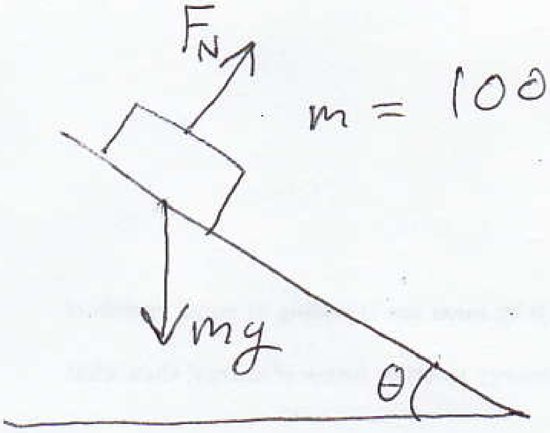
E.g.

$\mu_s = 0.2$ $m = 100kg$

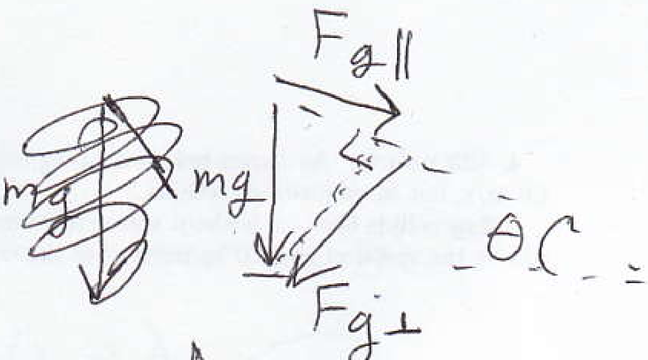
$F_f \le (0.2)(980N)$

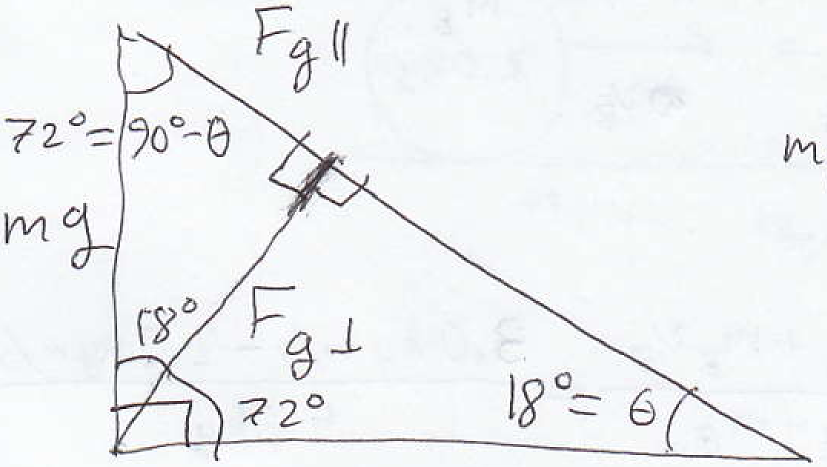
$kg \cdot m/s^2$

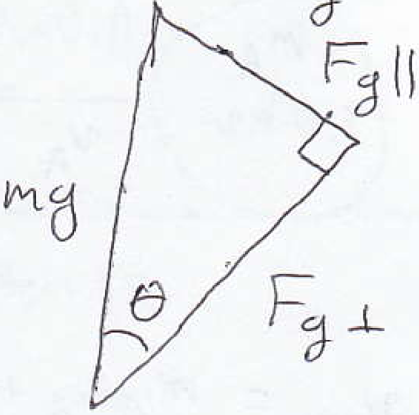
If $T > \mu_s F_N$, then it will move, otherwise not.



$m = 100\,g = 0.100\,kg$





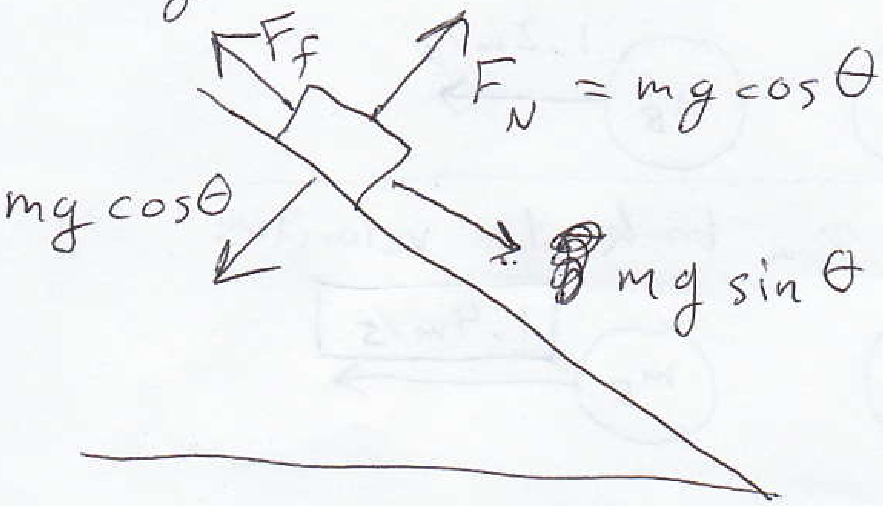


$$\cos\theta = \frac{F_{g\perp}}{mg}$$

$$F_N = F_{g\perp} = mg\cos\theta$$

$$\sin\theta = \frac{F_{g\parallel}}{mg}$$

$$F_{g\parallel} = mg\sin\theta$$



$mg\sin\theta \le F_f$?

At critical angle:

$$F_f = mg\sin\theta$$

$$F_f = \mu_s F_N = \mu_s mg\cos\theta$$

$$\frac{\cancel{mg} \sin\theta}{\cancel{mg} \cos\theta} = \frac{F_f}{mg\cos\theta} = \frac{\mu_s \cancel{mg} \cos\theta}{\cancel{mg} \cos\theta}$$

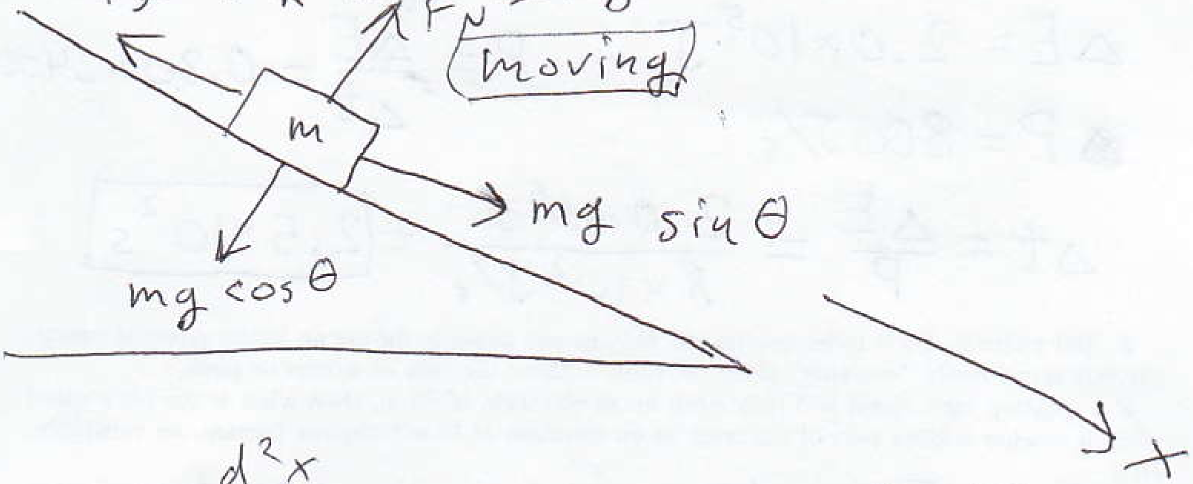
$$\tan\theta = \mu_s$$

$$\mu_s = \tan 18^\circ = \tan\frac{18\pi}{180} = 0.32$$

What about friction during motion?

"kinetic friction"

$F_f = \mu_k F_N$ $\quad F_N = mg\cos\theta$ $\quad \boxed{\text{moving}}$



$$a = \frac{d^2x}{dt^2} \qquad ma = mg\sin\theta - F_f$$

$$ma = mg\sin\theta - \mu_k mg\cos\theta$$

$$a = g(\sin\theta - \mu_k\cos\theta)$$

For constant acceleration recall $2a\Delta x = v_f^2 - v_i^2$ (final, initial)

and $\Delta x = \frac{1}{2}a(\Delta t)^2 + v_i\Delta t$

$F = -\frac{dU}{dx}$, $F = \frac{dK}{dx}$, $F = ma$, $F = \frac{dp}{dt}$

Energy lost to Friction during slide is $\int F_f \, dx$.

F_f is constant $= \mu_k mg \cos\theta$

$$\int F_f \, dx = F_f \underbrace{\Delta x}_{\text{distance slid.}}$$

Let block slide from rest $(v_i = 0)$

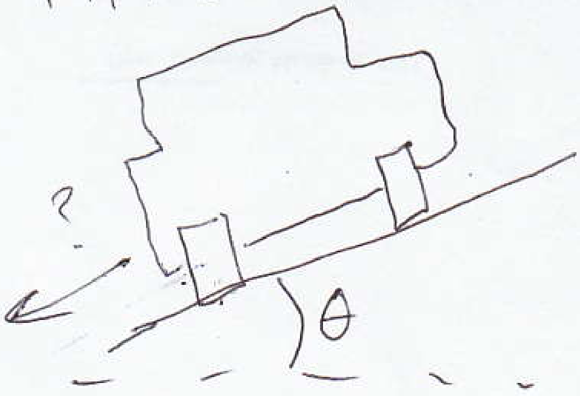
Measure length slid (say, the whole ramp), to get Δx. Measure Δt with a stopwatch. Solve for a.

Measure θ; recall $g = 9.8\,m/s^2$.

Solve for μ_k.

HW #2. If $\Delta x = 75\,cm$ and Δt is $0.85\,s$ and $\theta = 30°$, then estimate μ_k.

Tilted road



HW #3

Look up μ_s for rubber on asphault (or concrete) that is wet.
Find the maximum θ ~~before~~ that a parked car won't slide down.

HW #4 : #8 of Ch. 3.

$\boxed{\text{Read 3.4.}}$