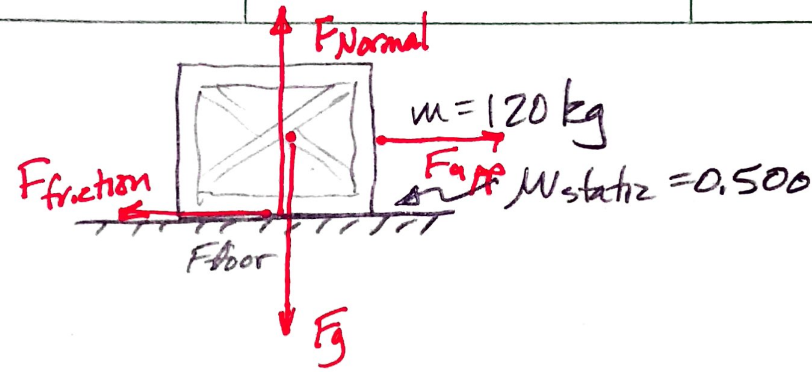
6.48



a) Maximum force without moving it?

Maximum $F_{static} = \mu_s F_N$, & $\Sigma F_y = ma = 0$

$F_{Normal} - F_g = 0$

$F_{Normal} = F_g = mg$

$F_{Normal} = (120)(9.8)$

$= 1.18e3$ kg

$F_{static} = (0.500)(1.18e3)$

$= \boxed{588 N}$

Any $F_{applied}$ greater than this will exceed the F_{static} & cause the box to start to move.

b) If we continue to apply 588 N....

$\Sigma F_x = ma_x$

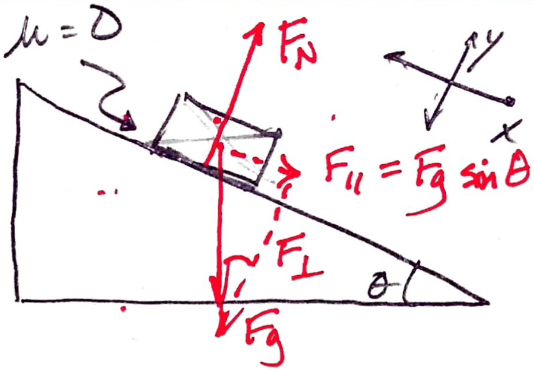
$F_{applied} - F_f = ma_x$

$F_{f\ kinetic} = \mu F_N$, where $\mu_k = 0.300$

$588 - (0.300)(1.18e3) = (120)a$

$a = \boxed{1.95\ m/s^2}$

6.52



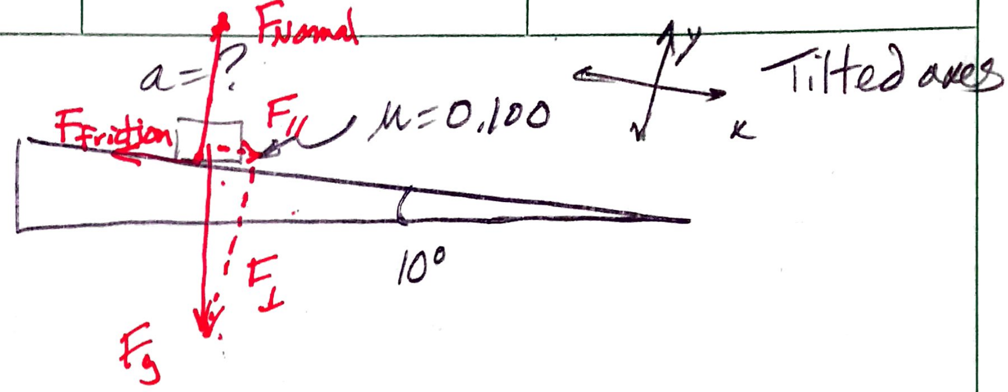
Tilt axes because acceleration is down the ramp

$$\Sigma F_x = ma_x$$

$$\cancel{m}g\sin\theta = \cancel{m}a$$

$$\boxed{a = g\sin\theta}$$ (frictionless ramp)

6.55



a)

X-axis	y-axis
$F_{net} = ma$	
$F_{\parallel} - F_f = ma$	
$mg\sin\theta - \mu F_N = ma$	Need to find FNormal. It's not mg!
	$\Sigma F_y = ma$
	$F_{Normal} - F_{\perp} = ma \leftarrow \phi$
	$F_N = F_{\perp} = mg\cos\theta$

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

$(9.8)(\sin 10) - (0.1)(9.8)(\cos 10) = a$

$a = \boxed{0.737\ m/s^2}$

b) For box to slide at constant speed, $F_{\parallel} = F_{friction}$

$mg\sin\theta = \mu mg\cos\theta$ ← Using equations developed above

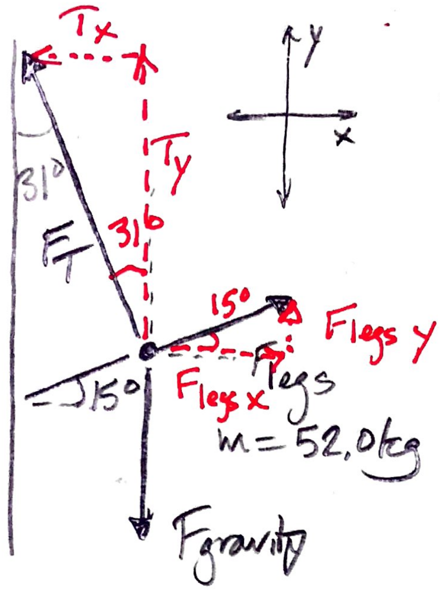
$\frac{\sin\theta}{\cos\theta} = \mu$, so

$\mu = \tan\theta$, or $\theta = \tan^{-1}\mu$

$= \tan^{-1}(0.1)$

$= \boxed{5.71°}$

6.61



Free-body diagram is a vital first step to solving this problem!

$F_T = ?$ $F_{legs} = ?$

a) $\Sigma F_x = ma_x = 0$

$F_{legs\,x} - T_x = 0$

$F_{legs} \cos 15 - T \sin 31 = 0$

$F_{legs} = T \dfrac{\sin 31}{\cos 15} = 0.533\,T$

$\Sigma F_y = ma_y = 0$

$T_y + F_{legs\,y} - F_g = 0$

$T \cos 31 + F_{legs} \sin 15 - (52)(9.8) = 0$

$T \cos 31 + 0.533T(\sin 15) = 509.6$

$0.995T = 509.6$

$T = \boxed{512\ N}$

Sub back in for Flegs

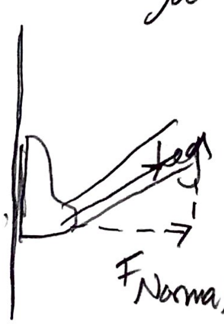
$F_{legs} = 0.533T$

$= 0.533(512\ N)$

$= \boxed{273\ N}$

b) $\mu = ?$

$\mu = \dfrac{F_f}{F_N}$



$F_{friction} = F_{legy}$
$F_{Normal} = F_{legx}$
} Tricky analysis!

$\mu = \dfrac{F_{legy}}{F_{legx}} = \dfrac{273 \sin 15}{273 \cos 15}$

$= \tan(15)$

$= \boxed{0.268}$