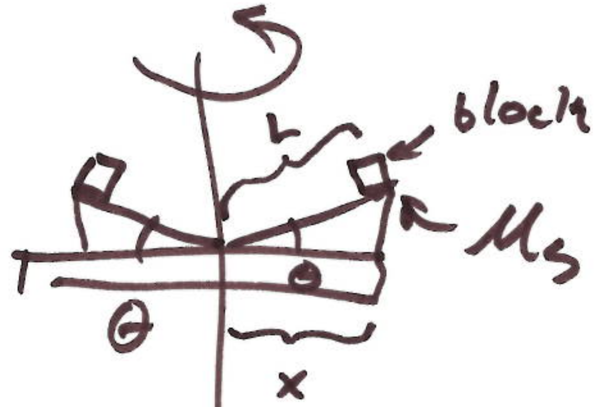
Tues Oct 24 5pm Extra P200 Review Session



Forces

Circular Motion

Work

Energy

Given

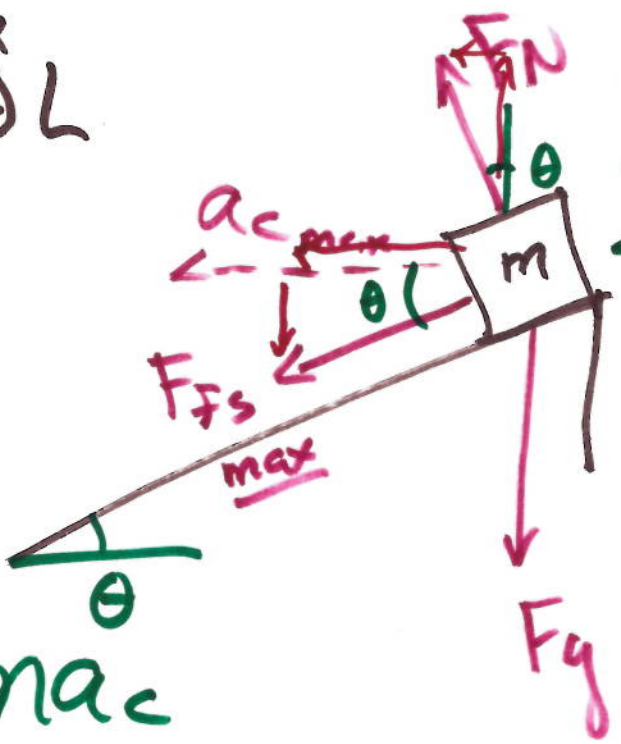
θ ~~[illegible]~~

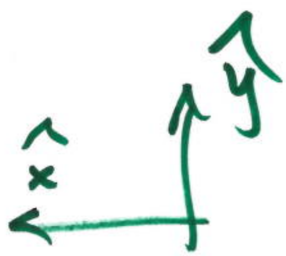
m block

x and L

μ_s.

How fast can platform go before m falls off (out).





$$F_{N_x} = F_N \underline{\sin} \theta$$

$$F_{N_y} = F_N \underline{\cos} \theta$$

$$F_{fs_x} = F_{fs} \underline{\cos} \theta$$

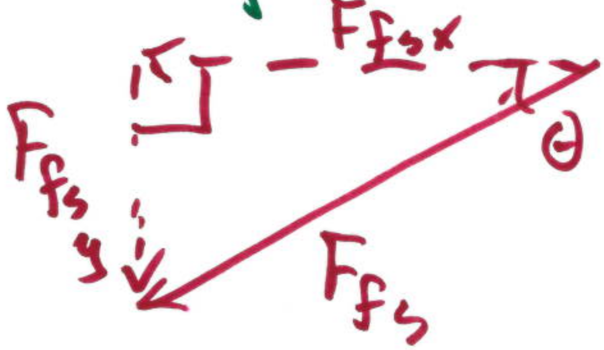
$$F_{fs_y} = -F_{fs} \underline{\sin} \theta$$

$$\Sigma F_x = ma_c$$

$$F_N \sin\theta + F_{fs}\cos\theta = ma_c$$

$$\Sigma F_y = 0$$

$$F_N \cos\theta - F_{fs}\sin\theta - mg = 0$$



$F_{Fs} = \mu_s F_N$ because we're solving for $\underline{\text{max}}$ v thus $\underline{\text{max}}$ F_{Fs}.

$\hat{y}$:

$$F_N \cos\theta - \mu_s F_N \sin\theta = mg$$

$$F_N (\cos\theta - \mu_s \sin\theta) = mg$$

$$F_N = \frac{mg}{\cos\theta - \mu_s \sin\theta}$$ plug this into $\hat{x}$:

$\hat{x}$:

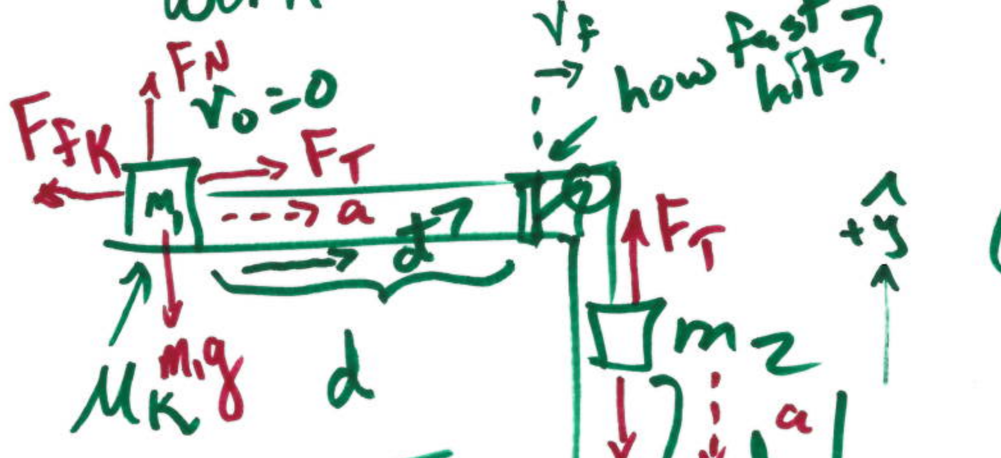
$$F_N \sin\theta + \underbrace{\mu_s F_N \cos\theta}^{F_{Fs}} = m a_c$$ max

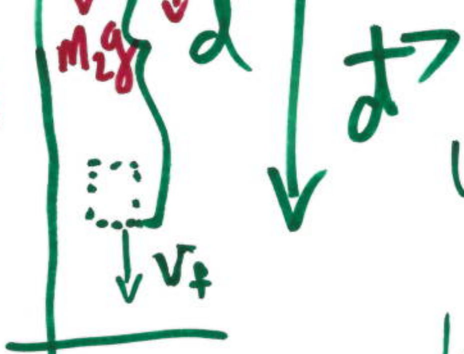
$$F_N (\sin\theta + \mu_s \cos\theta) = m a_c$$

$$\cancel{m} g \frac{(\sin\theta + \mu_s \cos\theta)}{\cos\theta - \mu_s \sin\theta} = \cancel{m} a_c$$

This is more advanced than actual exam problem. But may use some part of this.

Work:





Given: $d \;\mu_K \; m_1 g$

$m_2 \quad v_0 = 0$

find v_f by work - energy.

(a) Find W by each F.

$W_{F_N} = 0$

$W_{m_1 g} = 0$

on ①

$W_{F_T} = F_T d \cdot 1$

?

$W_{F_{f_K}} = F_{f_K} \cdot d \cdot (-1)$

$= \mu_K F_N \cdot d \cdot (-1)$

$\sum F_{1y} = 0$

$F_N - m_1 g = 0$

$F_N = m_1 g$ ✓

For Work $= F d \cos\theta$

F	θ	$\cos\theta$	
F_T	0	1	on ①
$m_1 g$	90°	0	
F_N	90°	0	
F_{f_K}	180°	-1	
F_T	180°	-1	on ②
$m_2 g$	0°	1	

$$\sum F_{2y} = -m_2 a$$

$$F_T - m_2 g = -m_2 a$$

$$F_T^{?} = m_2 g - m_2 (a^{?})$$

must solve a to get F_T and W_{F_T}.

$$\sum F_{1x} = m_1 a$$

$$F_T - \underbrace{F_{f_K}}_{\mu_K m_1 g} = m_1 a \longrightarrow a = \frac{F_T - \mu_K m_1 g}{m_1}$$

$$a = \frac{F_T}{m_1} - \mu_K g$$

$$F_T = \mu_K m_1 g + m_1 a$$

$$F_T = m_2 g - m_2 \overbrace{\left(\frac{F_T - \mu_K m_1 g}{m_1}\right)}^{a}$$

$$F_T = m_2 g + \mu_K \frac{\cancel{m_1} m_2 g}{\cancel{m_1}} - \frac{m_2 F_T}{m_1}$$

$$F_T + \frac{m_2}{m_1} F_T = m_2 g + \mu_K m_2 g$$

$$F_T\left(1+\frac{m_2}{m_1}\right)=m_2 g(1+\mu_K)$$

$$F_T=m_2 g\,\frac{(1+\mu_K)}{1+\frac{m_2}{m_1}}\times\frac{m_1}{m_1}$$

$$\boxed{F_T=\frac{m_1 m_2 g(1+\mu_K)}{m_1+m_2}}$$

$$E_{K_f}-\overset{\cdot\cdot 0}{E_{K_0}}$$

$$\Sigma W=\Delta E_K$$

on ① $W_{F_{T_1}}+W_{F_f}=\Delta E_{K_1}$

cancel

on ② $W_{F_{g_2}}+W_{F_{T_2}}=\Delta E_{K_2}$

+

$$m_2 g d-\mu_K m_1 g d=$$

$$\frac{1}{2}m_1 v_f^{*2}+\frac{1}{2}m_2 v_f^{*2}-0$$

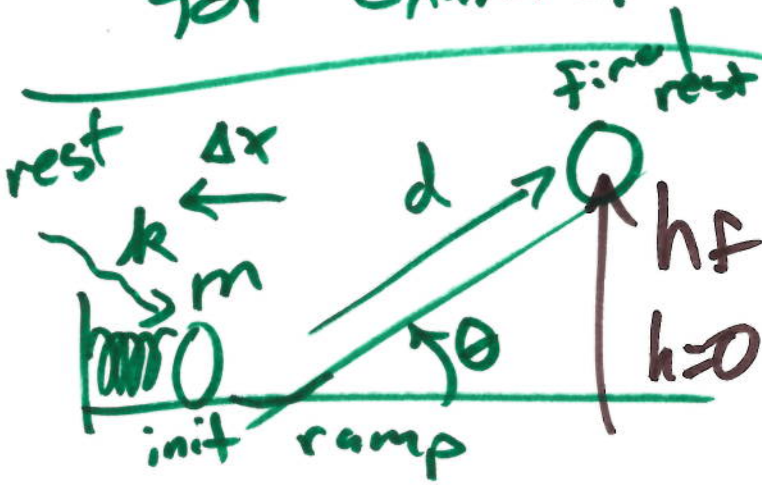
$V_0=0$

$$m_2 g d-\mu_K m_1 g d=\frac{v_f^2}{2}(m_1+m_2)$$

$$\frac{(m_2 - \mu_K m_1)\, g d \times 2}{m_1 + m_2} = v_f^2$$

☆

This problem is also too complex for exam2.



find: d up ramp before rest.

given: m k Δx θ g picture

$\mu = 0.$ $v_0 = 0$

$$\vec{F_e} = -k\vec{\Delta x}$$

$$U_e = \frac{1}{2}k(\Delta x)^2$$

$U_e = \frac{1}{2}k\Delta x^2$

$U_g = mgh$

$E_K = \frac{1}{2}mv^2$

$$\underbrace{\sum E_f}_{} - \sum E_0 = \sum W_{N.C.}$$

$$E_{K_f} + \underbrace{\sum U_f}_{} - \left(E_{K_0} + \underbrace{\sum U_0}_{}\right) = \sum W_{N.C.}$$

$$\overset{0}{0} + U_g - \left(\overset{0}{0} + U_e\right) = 0$$

$$mgh_f - \frac{1}{2}k(\Delta x)^2 = 0$$

★

$$h_f = \frac{\frac{1}{2}k(\Delta x)^2}{mg}$$

$d = ??\ \theta$ with h_f somehow.

$\sin\theta = \frac{opp}{hyp} = \frac{h_f}{d}$ $\qquad \boxed{d = \frac{h_f}{\sin\theta}}$

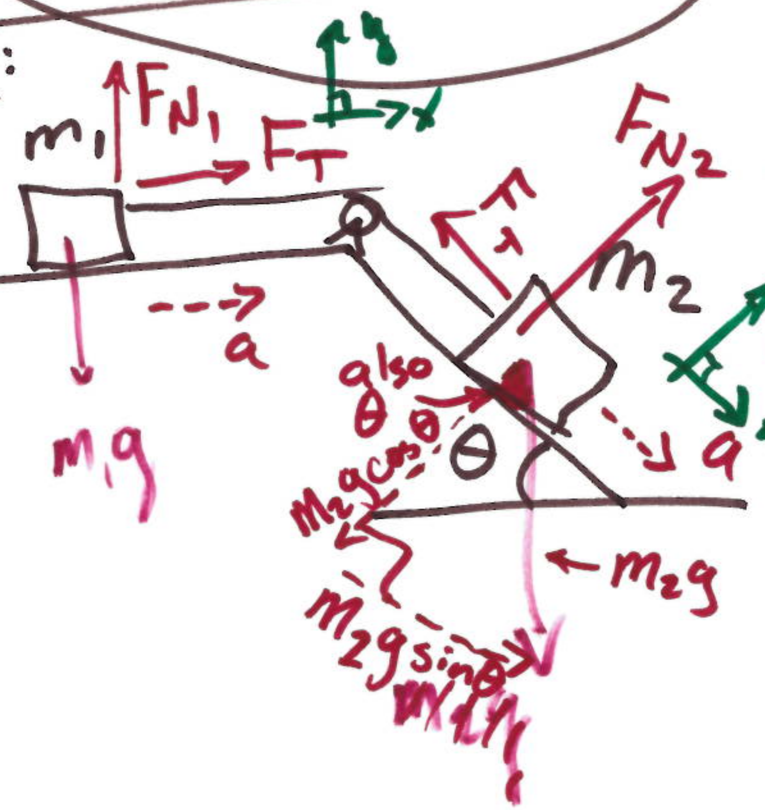
$$d = \frac{k(\Delta x)^2}{2mg\sin\theta}$$

Given: $m_1, m_2\ \theta\ g$

Force:

$\mu = 0$

Find: F_T and a.



① $\hat{x}$: $\Sigma F_x = m_1 a$

$F_T = m_1 a$

① $\hat{y}$: $\Sigma F_y = 0$

$F_{N_1} - m_1 g = 0$

$F_{N_1} = m_1 g$ (ok)

② $\hat{x}$: $m_2 g \sin\theta - F_T = m_2 a$

$m_2 g \sin\theta - m_1 a = m_2 a$

$m_2 g \sin\theta = a(m_1 + m_2)$

$$\boxed{\frac{m_2 g \sin\theta}{m_1 + m_2} = a}$$

② $\hat{y}$:

$F_{N_2} - m_2 g\cos\theta = 0$

$F_{N_2} = m_2 g\cos\theta$ (OK)

$$F_T = m_1 a = \boxed{\frac{m_1 m_2 g \sin\theta}{m_1 + m_2} = F_T}$$