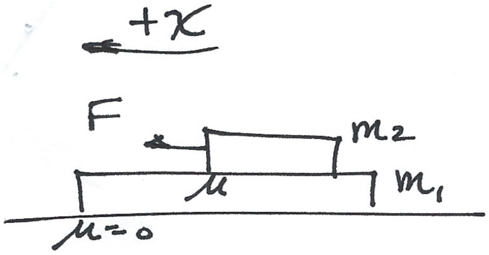
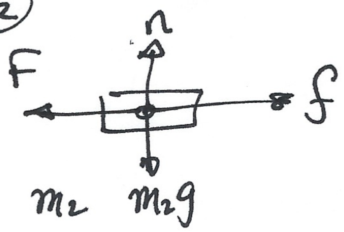
AW3 PH125
F2014

1.



m_2



$n = m_2 g$

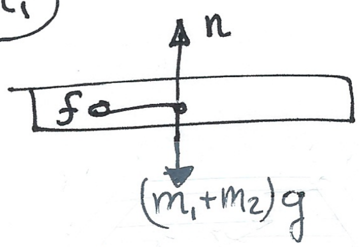
$F - f = F - \mu m_2 g = \begin{cases} 0 & \text{if } \mu_s m_2 g > F \text{ no motion} \\ ma & \text{if } \mu_s m_2 g < F \text{ motion} \end{cases}$

here: $\mu_s = 0.6$ $m_2 = 10\,kg$ $F = 100\,N$

$\Rightarrow \mu_s m g < F$ motion occurs

$\Rightarrow$ $F - \mu_k m_2 g = m_2 a_2$ $\boxed{a_2 = \frac{F}{m_2} - \mu_k g}$

m_1

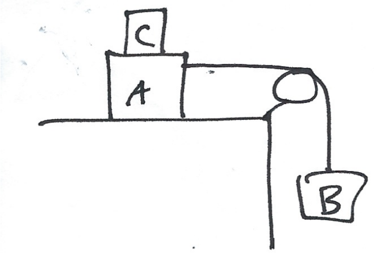


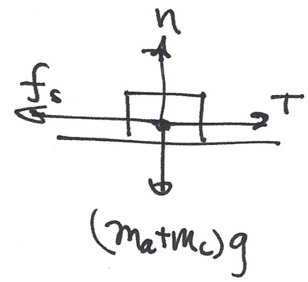
$m_1 a_1 = f = \mu_k m_2 g$

$\boxed{a_1 = \mu_k \left(\frac{m_2}{m_1}\right) g}$

Same f pulls m_2 and m_1!

2.

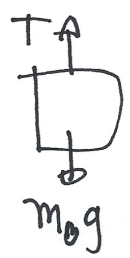




$n = (m_a + m_c)g$

A+C

$\sum F_x = T - f_s = T - \mu_s(m_a+m_c)g = 0 \qquad T = \mu_s(m_a+m_c)g$



B

$T = m_b g = \mu_s(m_a+m_c)g \Rightarrow m_c = \frac{m_b - \mu_s m_a}{\mu_s}$

$W_c = m_c g = \frac{m_b g}{\mu_s} - m_a g = \frac{W_b}{\mu_s} - W_a$

$\boxed{W_c \simeq 66N}$

W/o C: A $T - f_k = T - \mu_k m_a g = m_a a \qquad T = m_a a + \mu_k m_a g$

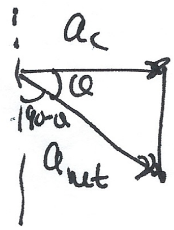
B $T - m_b g = -m_b a \qquad T = m_b g - m_b a$

$m_a a + \mu_k m_a g - m_b g + m_b a = 0$

$a(m_a + m_b) = -\mu_k m_a g + m_b g$

$a = \frac{-\mu_k m_a g + m_b g}{m_a + m_b} = g\left(\frac{-\mu_k W_a + W_b}{W_a + W_b}\right) \simeq \underline{\underline{2.3 \frac{m}{s^2}}}$

3.



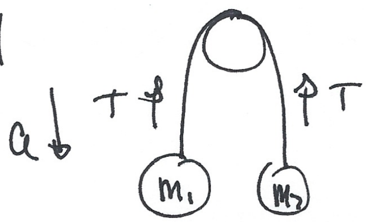
$$\tan\theta = \frac{g}{a_c} = \frac{g}{v^2/R} = \frac{gR}{v^2}$$

$$\tan(90-\theta) = \frac{a_c}{g} = \frac{v^2}{gR}$$

$16\,km/h \rightarrow 4.44\,m/s$

$$\text{angle wrt vert} = 90-\theta = \tan^{-1}\left(\frac{v^2}{gR}\right) \simeq \underline{\underline{12^\circ}}$$

4



$$T - m_1 g = -m_1 a$$
$$T - m_2 g = m_2 a$$

$$m_1 g - m_2 g = m_1 a + m_2 a \Rightarrow a = \left(\frac{m_1 - m_2}{m_1 + m_2}\right) g$$

to go through Δx starting w/ $v_i = 0$

$$v_f^2 = v_i^2 + 2a\Delta x = 2g\Delta x\left(\frac{m_1 - m_2}{m_1 + m_2}\right)$$

$$\underline{v = \sqrt{2g\Delta x\left(\frac{m_1 - m_2}{m_1 + m_2}\right)}} \simeq \underline{5.11\,m/s}$$