Reminders 02-16-10:

-3rd POW due Tuesday by 5PM

-4th POW due Thursday by 5PM

-Quiz 4 in lecture Thursday.

-Homework 5 Due Wednesday the 17th.

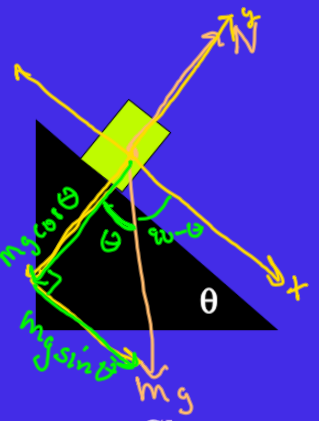
Objectives:

-Examples, Examples, Examples

-Friction

-Newton's Laws Applied to Circular Motion

Incline Plane I



A 10 kg mass starts from rest at the top of a frictionless plane inclined at an angle of 30° to the horizontal (see textbook Example 5.6). How fast is the block moving after it has travele a distance of 1 m?

Choose your reference frame wisely.

$\Sigma F_x = mg\sin\theta = ma$

$a = g\sin\theta$

$\Sigma F_y = N - mg\cos\theta = 0$

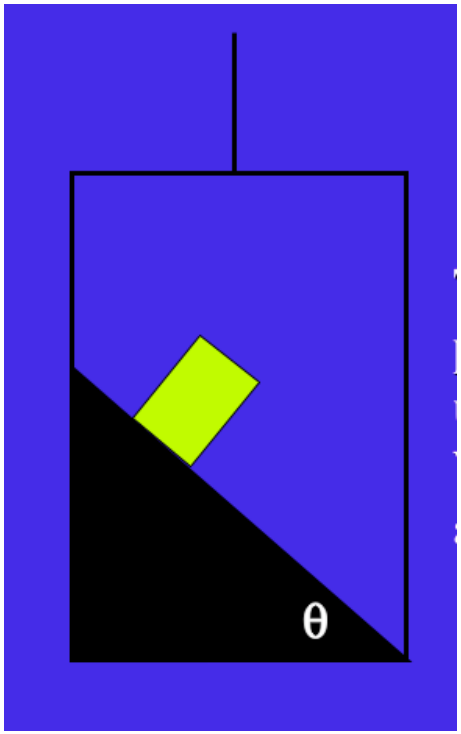
$N = mg\cos\theta$

$V_f^2 - V_i^2 = 2a\Delta x$

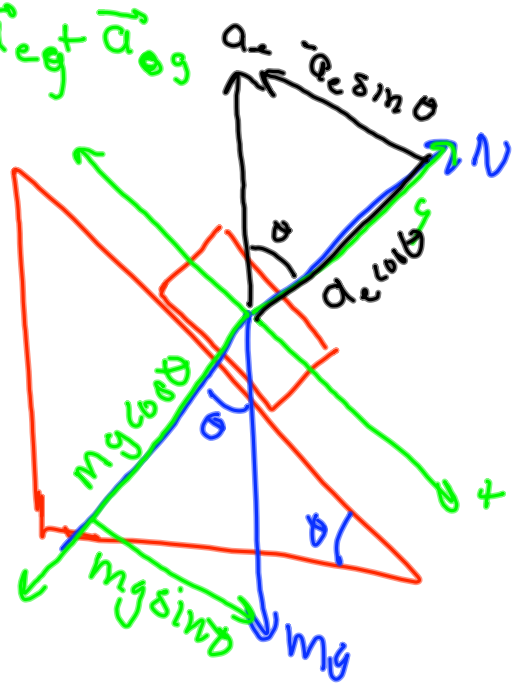
$V_i = 0$

$a = g\sin\theta = g\sin 30^\circ = 4.9\,m/s^2$

$V_f = \sqrt{2(4.9\,\frac{m}{s^2})(1m)} = 3.13\,m/s$



$\vec{a} = \vec{a}_{eg} + \vec{a}_{og}$



$$\Sigma F_x = mg\sin\theta = ma = m(a_e\sin\theta + a_{oe})$$

$$g\sin\theta = -a_e\sin\theta + a_{oe}$$

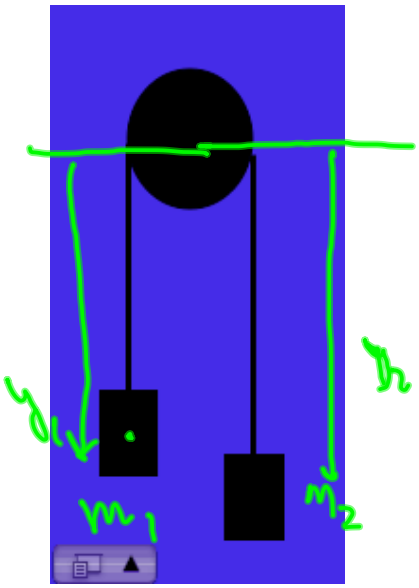
$$a_{oe} = g\sin\theta + a_e\sin\theta$$

$$\Sigma F_y = N - mg\cos\theta = m a_e \cos\theta$$

$$N = m a_e \cos\theta + mg\cos\theta$$

if $\theta \to 0$

$$N = m(g + a_e)$$



$m_1 > m_2$

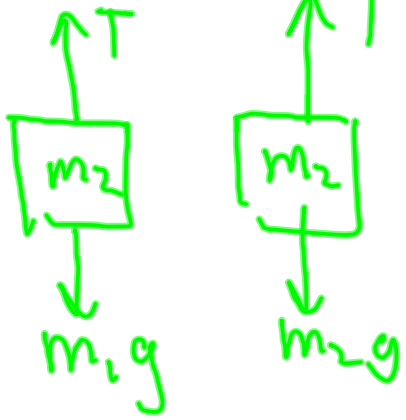
$y_1 + y_2 + \pi R = l$

$0 = \frac{dy_1}{dt} + \frac{dy_2}{dt} + 0 = \frac{dl}{dt}$

$\frac{d^2y_1}{dt^2} + \frac{d^2y_2}{dt^2} = 0$

$a_{y_1} + a_{y_2} = 0$

$a_{y_1} = -a_{y_2}$



$\Sigma F_{y m_1} = T - m_1 g = -m_1 a$

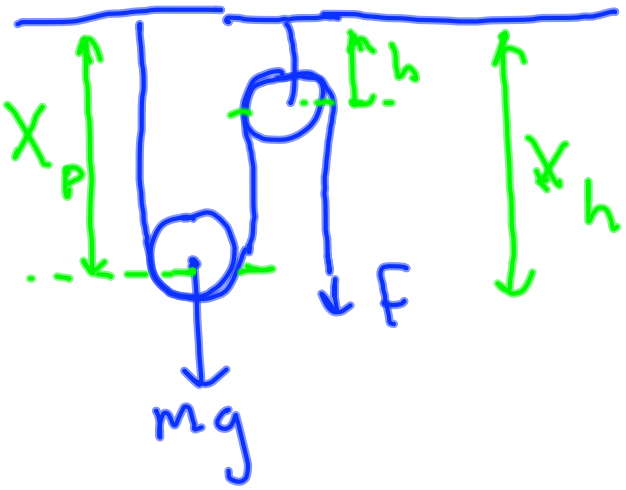
$\Sigma F_{y m_2} = T - m_2 g = m_2 a$

$-m_1 g + m_2 g = -m_1 a - m_2 a$

$m_1 g - m_2 g = m_1 a + m_2 a =$

$g(m_1 - m_2) = a(m_1 + m_2)$

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

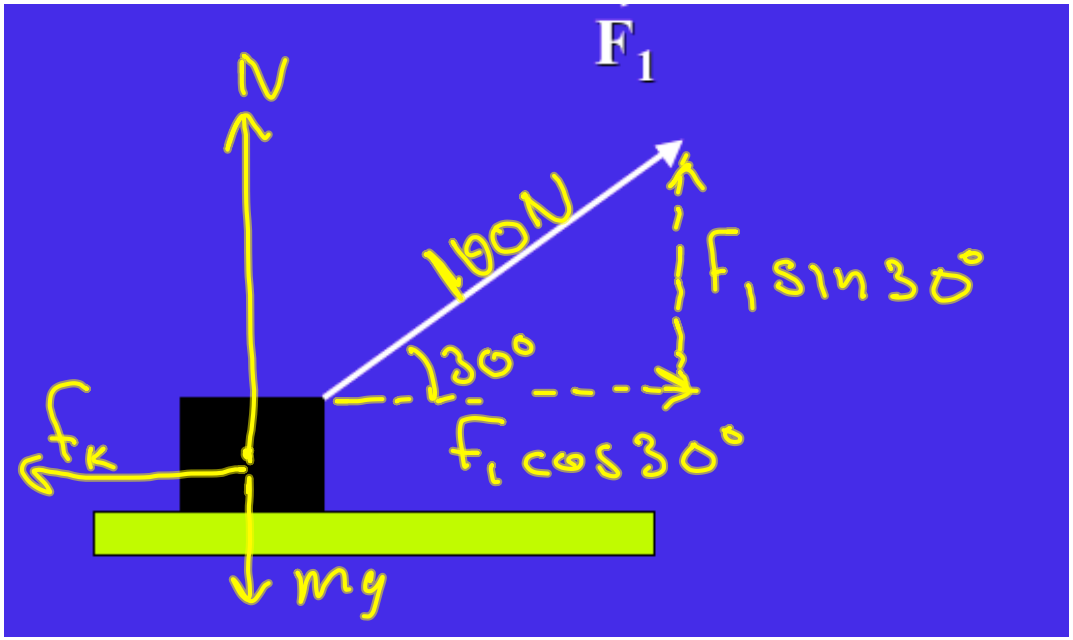


$$l = x_p + \pi R_1 + \pi R_2 + (x_p - h) + x_{hand} - h$$

$$l = 2x_p + x_{hand} + \pi R_1 + \pi R_2 - 2h$$

$$0 = 2\frac{d^2 x_p}{dt^2} + \frac{d^2 x_{hand}}{dt^2}$$

$$0 = 2a_p + a_{hand} \qquad -a_{hand} = 2a_p$$



$f_k = \mu_k N$

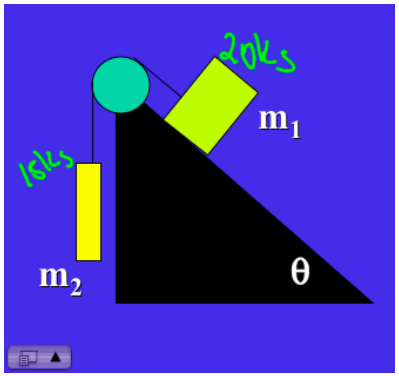
$$\Sigma F_y = F_1 \sin 30 + N - mg = 0$$

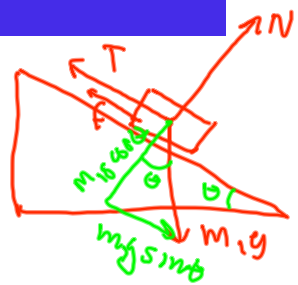
$$N = mg - F_1 \sin 30$$

$$= (10)(9.8) - 100 \sin 30^\circ$$

$$= 48\,N$$

$$f = (0.3)(48N) = 14.4N$$





$\sum F_{x_1} = m_1 g \sin\theta - T \pm f = m_1 a$

$\sum F_{y_1} = N - m_1 g \cos\theta = 0$

$N = m_1 g \cos\theta$

$\sum F_{y_2} = T - m_2 g = m_2 a$

$m_1 g \sin\theta = (20)(9.8)(\sin 60) = 170\,N$

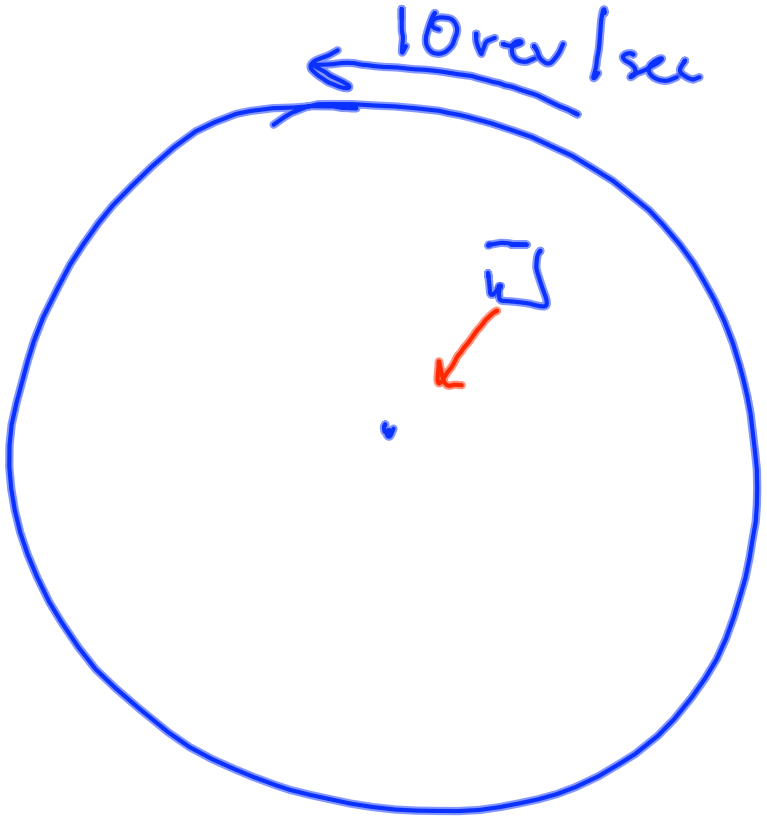
$m_2 g = (15)(9.8) = 147\,N$

$317\,N$

$N = 20(9.8)\cos 60 = 98\,N$

$f = (.25)(98N) = 24.5\,N$

System doesn't move.


10 rev / sec
frictional force keeps it going in a circle