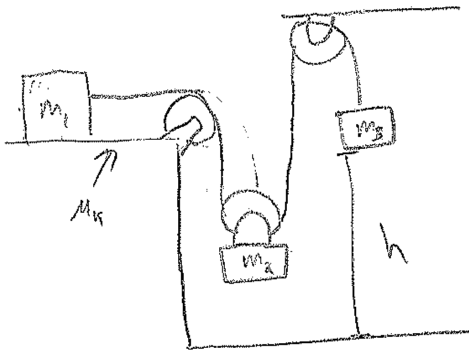
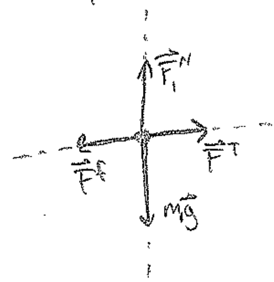
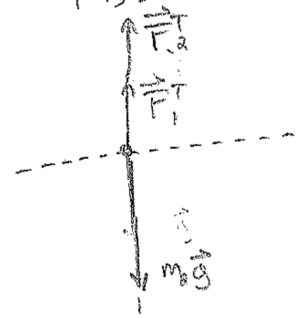


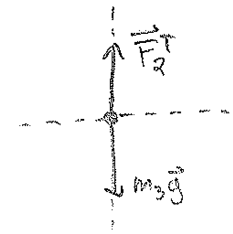
FBD 1



FBD 2



FBD 3



What is μ_K, if m_3 is released from rest and m_2 does not move?

Constraints

$$|\vec{F}^T_1| = |\vec{F}^T_2| = |\vec{F}^T_3| = |\vec{F}^T_4|$$

$$|\Delta x_1| = |\Delta x_3|$$

$$|a_1| = |a_3|$$

$$|v_1| = |v_3|$$

for m_1

$$\sum F_x = ma_x \qquad \sum F_y = ma_y$$

$$F^T_1 - F^f = ma_x \qquad N - m_1 g = 0$$

$$N = m_1 g$$

$$F^T_1 - \mu_K m_1 g = ma_x$$

$$F^T_1 = ma_x - \mu_K m_1 g$$

for m_2

$$\sum F_y = ma_y$$

$$F^T_1 + F^T_2 - m_2 g = 0$$

$$F^T_1 + F^T_2 = m_2 g$$

for m_3

$$\sum F_y = m_3 a_y$$

$$F^T_2 - m_3 g = m_3 a_y$$

$$F^T_2 = m_3 a_y - m_3 g$$

know

$$|a_x| = |a_y| = a$$

$$a_x = a \Rightarrow a_y = -a$$

(from m_2) $$(m_1 a_x - \mu_K m_1 g) + (m_3 a_y - m_3 g) = m_2 g$$

$$\Rightarrow m_1 a - \mu_K m_1 g - m_3 a - m_3 g = m_2 g$$

$$\Rightarrow (m_1 - m_3) a - (\mu_K m_1 + m_3) g = m_2 g$$

$$a = \frac{\mu_K m_1 + m_2 + m_3}{m_1 - m_3} g$$

For m_3 motion

$$\Delta y = v_{iy} \Delta t + \tfrac{1}{2} a_y \Delta t^2$$

$$\Rightarrow -h = \frac{1}{2} \frac{\mu_K m_1 + m_2 + m_3}{m_1 - m_3} g \Delta t^2$$

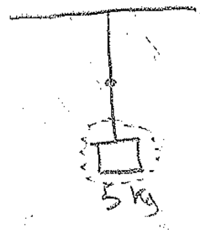
$$2h(m_3 - m_1) = (\mu_K m_1 + m_2 + m_3) g \Delta t^2$$

$$\frac{2h(m_3 - m_1)}{g \Delta t^2} = \mu_K m_1 + m_2 + m_3$$

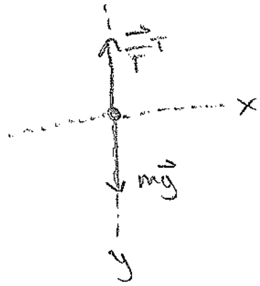
$$\mu_K = \frac{1}{m_1}\left[\frac{2h(m_3 - m_1)}{g \Delta t^2} - m_2 - m_3\right]$$

Determine tension in the rope @ the point indicated

Strings/pullys are massless



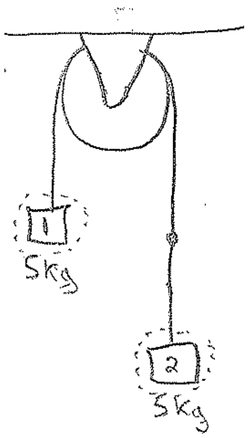
FBD



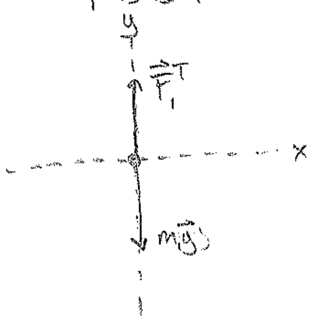
$\sum F_y = ma_y$

$F^T - mg = 0$

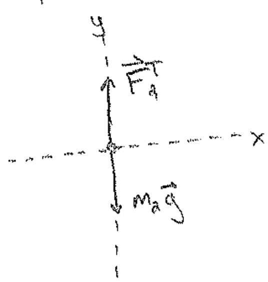
$F^T = mg \approx 50\ N$



FBD1



FBD2



Constraints

$|F_1^T| = |F_2^T|$

$|a_{y_1}| = |a_{y_2}|$

$|v_{y_1}| = |v_{y_2}|$

$|\Delta y_1| = |\Delta y_2|$

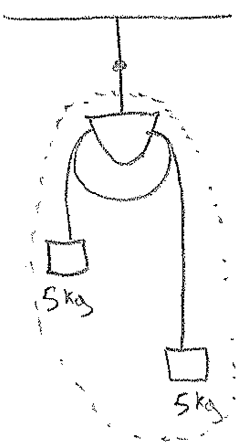
$\sum F_y = ma_y$

$F_1^T - m_1 g = 0$

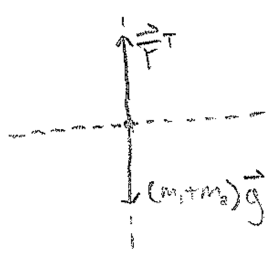
$\sum F_y = ma_y$

$F_2^T - m_2 g = 0$

$F_2^T = m_2 g \approx 50\ N$



FBD

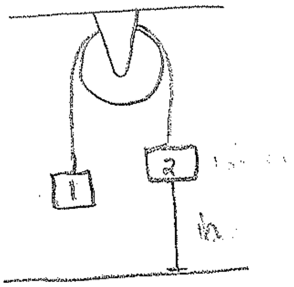


$\sum F_y = ma_y$

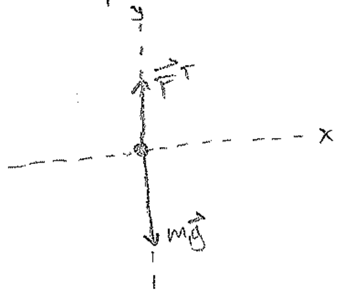
$F^T - (m_1 + m_2) g = 0$

$F^T = (m_1 + m_2) g \approx 100\ N$

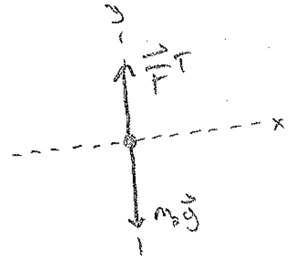
Released from rest, takes Δt to reach the floor. Find m_1.



FBD1



FBD2



$$\sum F_y = m a_y$$

$$F^T - m_1 g = m_1 a_y$$

$$F^T = m_1 a_y + m_1 g$$

$$\sum F_y = m_2 a_y$$

$$F^T - m_2 g = -m_2 a_y$$

$$\Rightarrow \quad m_1 a_y + m_1 g - m_2 g = -m_2 a_y$$

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

$$a_y = \frac{m_2 - m_1}{m_1 + m_2} g$$

$$\Delta y = \cancelto{0}{v_{iy}} \Delta t + \frac{1}{2} a_y \Delta t^2$$

$$= \frac{1}{2} \frac{m_2 - m_1}{m_1 + m_2} g \Delta t^2$$

$$\Delta y (m_1 + m_2) = \frac{1}{2} (m_2 - m_1) g \Delta t^2$$

$$m_1 \Delta y + m_2 \Delta y = \frac{1}{2} m_2 g \Delta t^2 - \frac{1}{2} m_1 g \Delta t^2$$

$$m_1 \left(\Delta y + \frac{1}{2} g \Delta t^2 \right) = m_2 \left(\frac{1}{2} g \Delta t^2 - \Delta y \right)$$

$$m_1 = \frac{\frac{1}{2} g \Delta t^2 - \Delta y}{\frac{1}{2} g \Delta t^2 + \Delta y} m_2$$

$$\Rightarrow \quad \frac{m_1}{m_2} = \frac{\frac{1}{2} g \Delta t^2 - \Delta y}{\frac{1}{2} g \Delta t^2 + \Delta y}$$