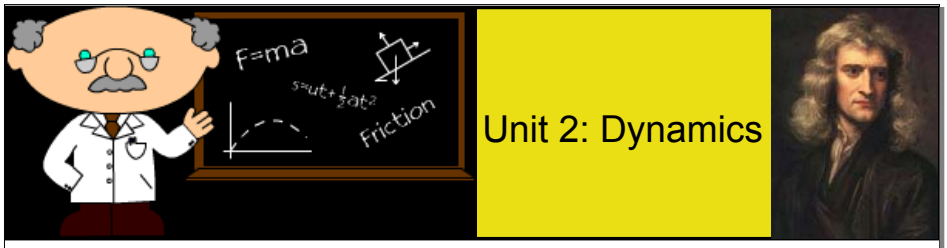
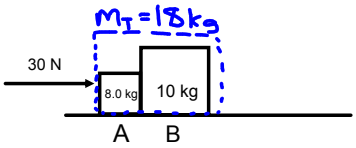


2.9 Fletcher's Trolley

Review: Two boxes, A and B, are positioned next to each other on a horizontal, frictionless surface. An applied force acting on box A causes box B to accelerate to the right. Calculate the force of box A on box B.



$m_T = 18kg$

$\vec{F} = m\vec{a}$

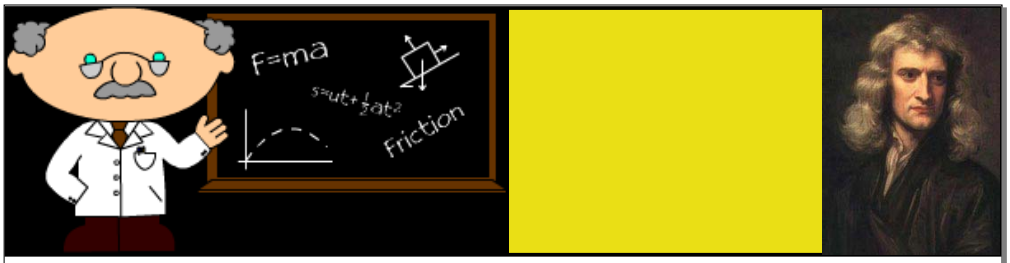
$30 = 18\vec{a}$

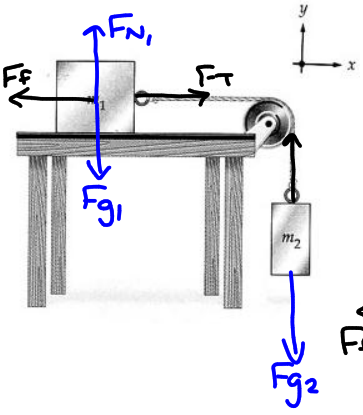
$\vec{a} = 1.67 m/s^2$

$F_{A on B} = m_B \vec{a}$

$= 10(1.67)$

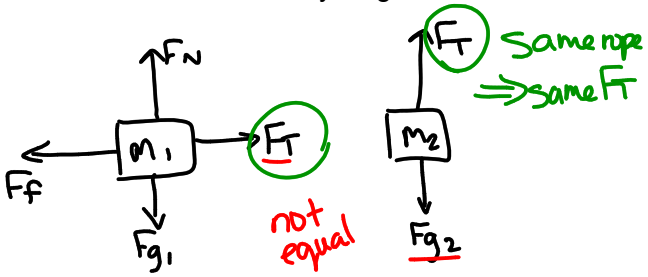
$= 17N$

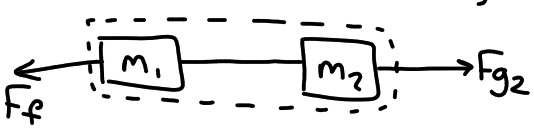


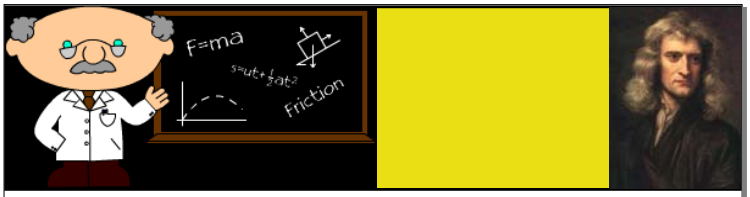


Idea Behind Fletcher's Trolley: A pulley systems attached m_1 and m_2 on a table that can experience friction.

What does the free body diagram look like?



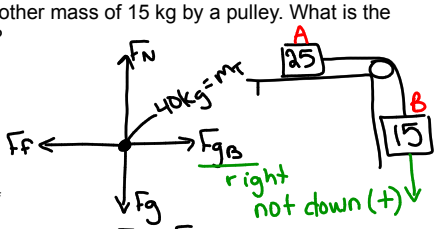




Ex.) In a Fletcher's Trolley experiment, a 25 kg block rests on a table (μ=0.20). The block is attached to another mass of 15 kg by a pulley. What is the acceleration of the system?

Steps:

1. Draw diagram and label all forces.
2. Calculate F_g, F_N, F_F, and $F_{app.}$
3. Determine the total force acting on the block. Find the accleration by using the mass of the system (total of both masses.)



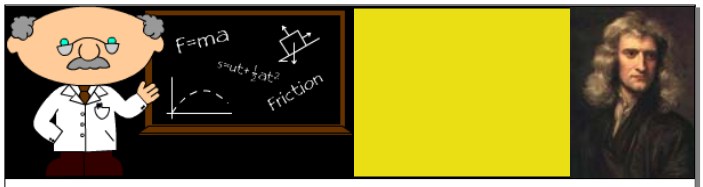
$$Fnet_x = F_f + F_{gB}$$

$$\frac{m_T\vec{a}}{m_T} = \frac{\mu F_N + m_B\vec{g}}{m_T}$$

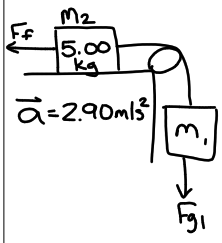
$$\vec{a} = \frac{\mu mg + m_B\vec{g}}{(m_A + m_B)}$$

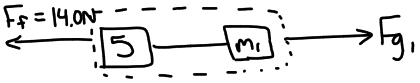
$$\vec{a} = \frac{(0.20)(25)(-9.81) + (15)(-9.81)}{40}$$

$$\vec{a} = 2.5\ m/s^2\ [right]$$



Ex.) In a Fletcher's Trolley experiment, the second block has a mass of 5.00 kg. The force of friction acting on the second block is 14.0 N and the acceleration of the system is 2.90 m/s^2. What is the mass of the first block?





$$Fnet_x = F_{g1} + F_f$$

$$(m_1 + 5.00)\vec{a} = m_1\vec{g} + -14.0$$

$$m_1\vec{a} + 5.00\vec{a} = m_1\vec{g} - 14.0$$

$$m_1\vec{a} - m_1\vec{g} = -5\vec{a} - 14.0$$

$$\frac{m_1(\vec{a} - \vec{g})}{(\vec{a} - \vec{g})} = \frac{-5\vec{a} - 14}{(a - g)}$$

Questions: Pg. 192 #1-20.

$$m_1 = \frac{-5(2.90) - 14}{(2.9 - 9.81)}$$

$$m_1 = 4.12\ kg$$