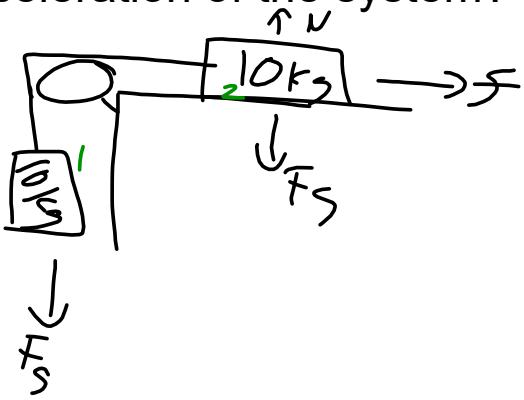
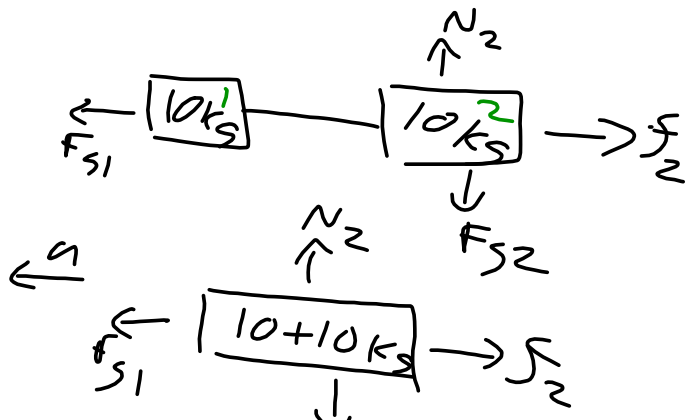
Pulley

A 10 kg mass is tied to a second 10 kg mass. The masses are hung over a pulley on the edge of the table with one mass hanging over the edge and the other mass sitting on the table. If the coefficient of friction is 0.2 what is the acceleration of the system?





$\Sigma F = ma$

$m_1 g - f_2 = ma$

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

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

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

$= \left(\frac{10kg - (0.2)(10kg)}{20kg}\right)(9.81 m/s^2)$

$= 3.92 m/s^2$

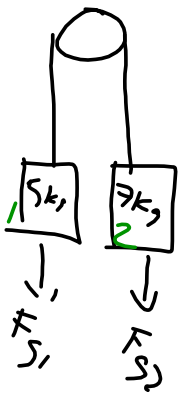
$f_2 = \mu N_2$

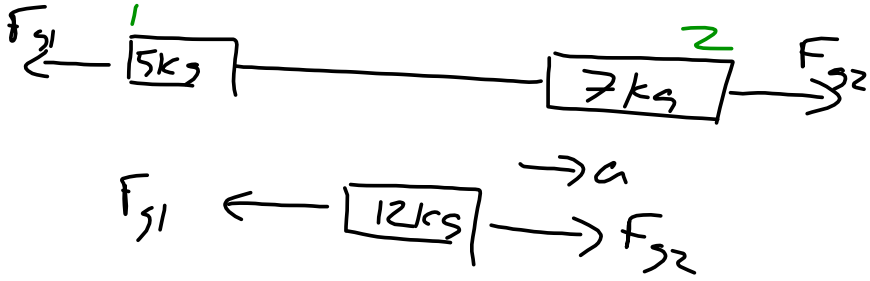
$(N_2 = F_{g2})$

$f_2 = \mu m_2 g$

Another Pulley

A 5 kg mass is tied to a 7 kg mass. The the masses are then hung over a pulley. After the masses are released, what will be the acceleration of each mass?





$$\Sigma F = ma$$

$$F_{g2} - F_{g1} = (m_1 + m_2)a$$

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

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

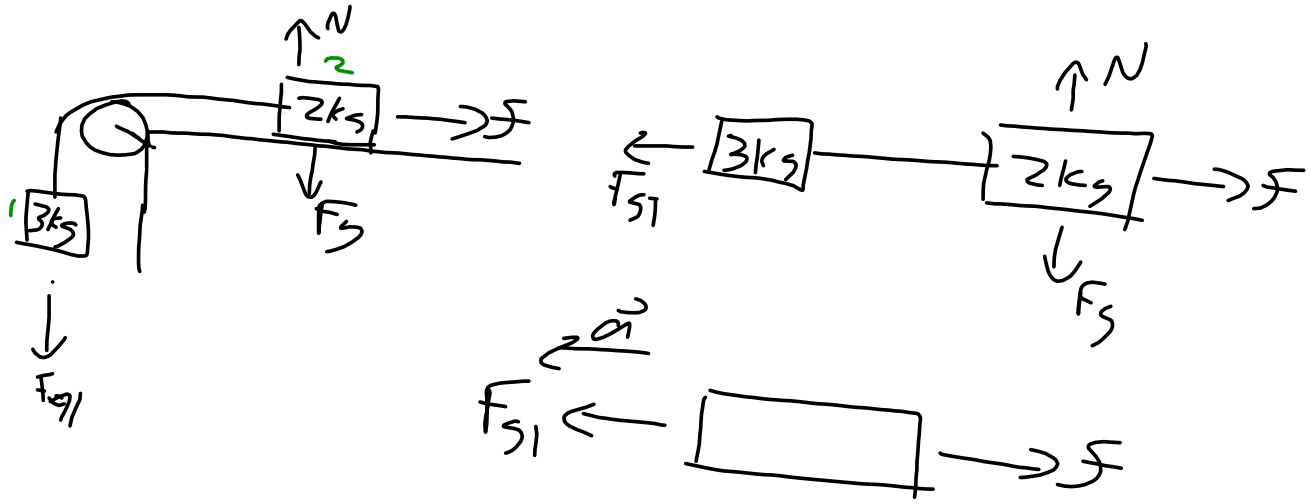
$$= \left(\frac{m_2 - m_1}{m_1 + m_2}\right) g$$

$$= \frac{(7\,kg - 5\,kg)}{(7\,kg + 5\,kg)}\ 9.81\ \frac{m}{s^2}$$

$$= 1.64\ m/s^2$$

Try This!

A 3 kg block is tied to a 2 kg block. The two blocks are hung over a pulley as shown below. If the coefficient of friction between the 2 kg block and the table is 0.1, what is the acceleration of the system?



$$\sum F = ma$$

$$F_{s1} - f = ma$$

$$m_1 g - f = ma$$

$$(3kg)(9.8m/s^2) - 1.962N = (3kg + 2kg)a$$

$$a = \frac{29.24N - 1.962N}{5kg}$$

$$= 5.46 m/s^2$$

$f = \mu N$

$f = \mu m_2 g$

$f = (0.1)(2kg)(9.81)$

$= 1.962N$

Mechanical Advantage

The use of a machine to exert a greater force than you (or an input) can apply.

A simple machine is the most basic machine that manipulates a force by changing the magnitude or direction.

There are 6 simple machines:

The wheel/axle

The pulley

The lever

The wedge

The incline

The screw