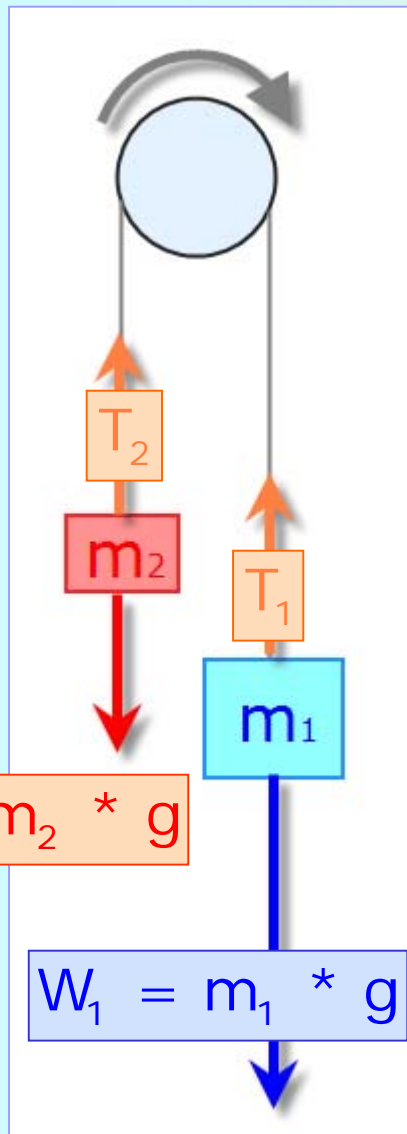


Dynamics: Atwood's machine



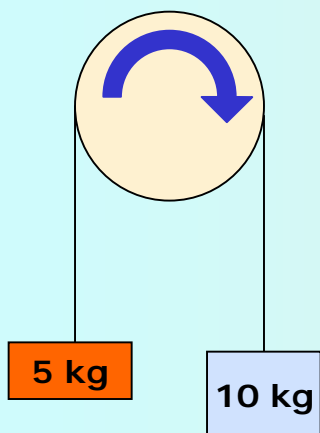
Atwood's machine

In this machine, two masses are suspended by a cord passing over a frictionless pulley.

The downward forces are due to the weight of the masses and the upward forces are due to the tension (T) in the cord.

Both tensions (T_1 and T_2) are equal in magnitude.

Dynamics: Atwood's machine



Problem

Given the Atwood's machine in the figure, do the following:

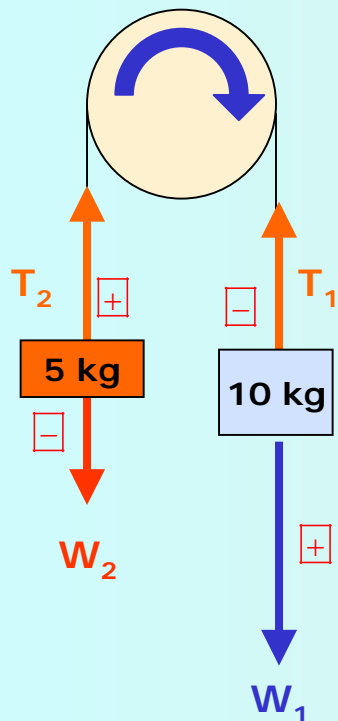
- determine the value of acceleration
- determine the value of the tension

Strategy

You need to apply the Newton's second law twice:

- first, to the whole system (to calculate the acceleration)
- then, to an isolated body (to calculate the value of the tension)

Dynamics: Atwood's machine



Problem

Given the Atwood's machine in the figure, do the following:

- determine the value of acceleration
- determine the value of the tension

The application of the Newton's second law to the whole system:

$$W_1 = 10 \text{ kg} * 10 \text{ m/s}^2 = 100 \text{ N}$$

$$W_2 = 5 \text{ kg} * 10 \text{ m/s}^2 = 50 \text{ N}$$

$$F_{\text{net}} = m_t * a$$

$$100 \text{ N} - \cancel{T_1} + \cancel{T_2} - 50 \text{ N} = (5 \text{ kg} + 10 \text{ kg}) * a$$

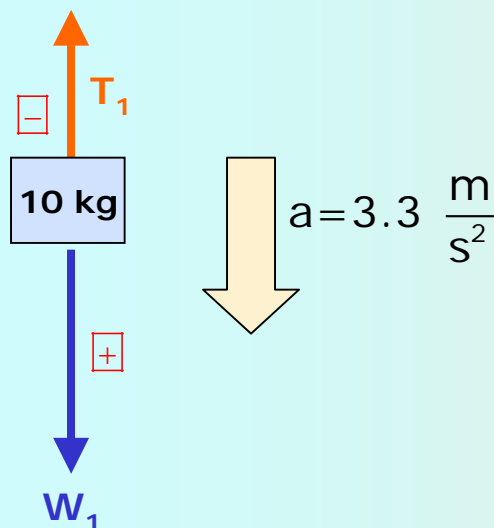
$$a = \frac{100 \text{ N} - 50 \text{ N}}{5 \text{ kg} + 10 \text{ kg}} = 3.3 \frac{\text{m}}{\text{s}^2}$$

Dynamics: Atwood's machine

Problem

Given the Atwood's machine in the figure, do the following:

- determine the value of acceleration
- determine the value of the tension



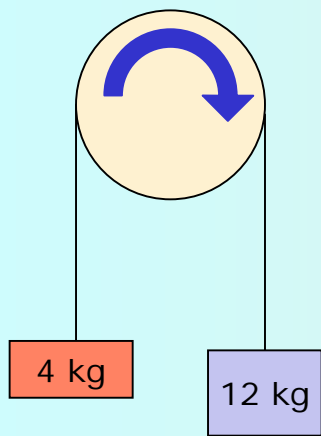
The application of the Newton's second law to an isolated body:

$$F_{\text{net}} = m * a$$

$$100 \text{ N} - T_1 = 10 \text{ kg} * 3.3 \frac{\text{m}}{\text{s}^2} = 33 \text{ N}$$

$$T_1 = 100 \text{ N} - 33 \text{ N} = 67 \text{ N} = T_2$$

Dynamics: Atwood's machine



Problem

Given the Atwood's machine in the figure, do the following:

- determine the value of acceleration
- determine the value of the tension