

§10-2 Multiple Masses

Assumptions

- strings have negligible mass
- force is constant throughout the string
- strings do not stretch
- pulley is frictionless
- pulley changes the direction of force

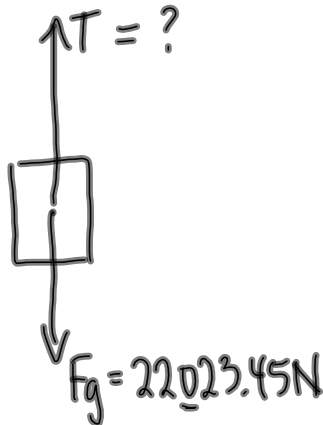
MP 477

$$m = 2245 \text{ kg}$$

$$\vec{a} = 0.55 \text{ m/s}^2 \text{ [up]}$$

$$T = ?$$

$$0.55 \text{ m/s}^2 \uparrow$$



$$\vec{F}_{\text{net}} = m\vec{a}$$

$$T - F_g = ma$$

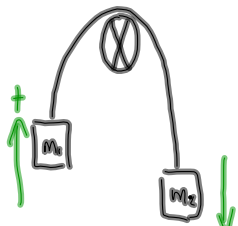
$$T - 22023.45 \text{ N} = (2245 \text{ kg})(+0.55 \text{ m/s}^2)$$

$$T - 22023.45 \text{ N} = 1234.75 \text{ N}$$

$$T = 23258.2 \text{ N}$$

$$T = 2.33 \times 10^4 \text{ N}$$

Atwood's Machine



MP/483

$$m_1 = 8.5 \text{ kg}$$

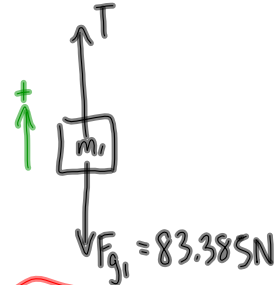
$$m_2 = 17 \text{ kg}$$

$$a = ? \quad T = ?$$

Consider m_1 alone:

$$\vec{F}_{\text{net}} = m\vec{a}$$

$$T - F_{g1} = m_1 a$$



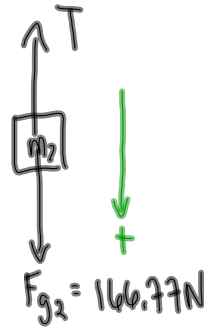
$$T - 83.385 \text{ N} = (8.5 \text{ kg}) a$$

Consider m_2 alone:

$$\vec{F}_{\text{net}} = m\vec{a}$$

$$F_{g2} - T = m_2 a$$

$$166.77 \text{ N} - T = (17 \text{ kg}) a$$



$$\begin{aligned} & \cancel{T} - 83.385 \text{ N} = (8.5 \text{ kg}) a \\ + & (166.77 \text{ N} - \cancel{T} = (17 \text{ kg}) a) \end{aligned}$$

$$83.385 \text{ N} = (25.5 \text{ kg}) a$$

$$a = 3.3 \text{ m/s}^2$$

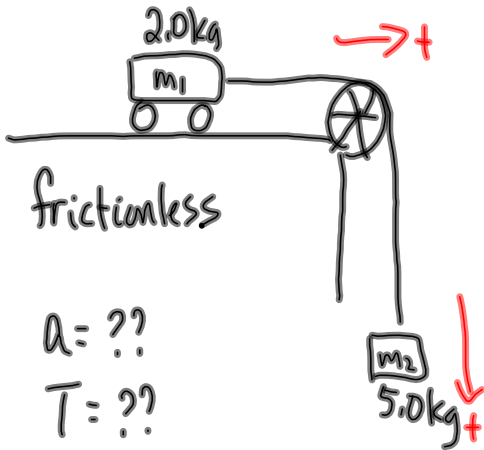
$$T - 83.385 \text{ N} = (8.5 \text{ kg}) a$$

$$T - 83.385 \text{ N} = (8.5 \text{ kg})(3.3 \text{ m/s}^2)$$

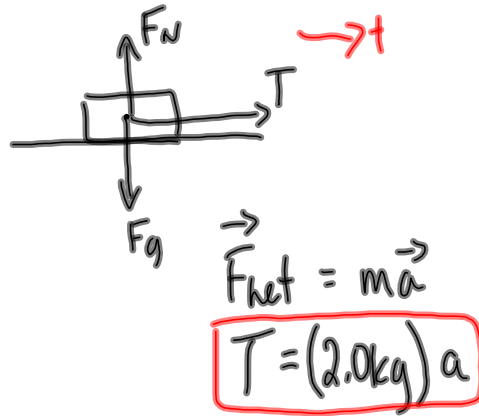
$$T - 83.385 \text{ N} = 27.795 \text{ N}$$

$$T = 111 \text{ N}$$

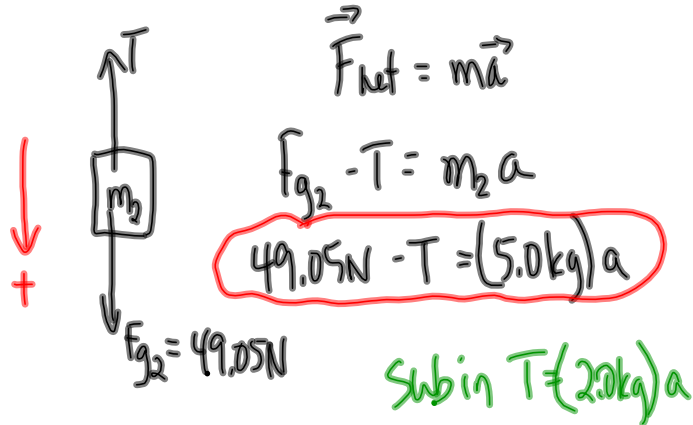
Fletcher's Trolley



Consider m₁:



Consider m₂:



$$T = (2.0\text{kg})a$$

$$T = (2.0\text{kg})(7.0\text{m/s}^2)$$

$$T = 14\text{N}$$

$$49.05\text{N} - (2.0\text{kg})a = (5.0\text{kg})a$$

$$49.05\text{N} = (7.0\text{kg})a$$

$$a = 7.0\text{m/s}^2$$

- To DO: ① PP/478
② PP/485