§10-2 Multiple Masses

Assumptions:

- string does not stretch
- tension is uniform throughout string
- string has negligible mass
- pulley is frictionless (pulley changes direction of the tension)

A Basic Elevator Problem:

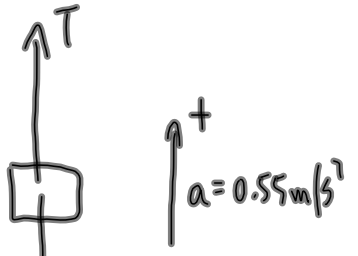
MP/477

$m = 2245\,kg$

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

$T = ?$

FBD:



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

$T - F_g = ma$

$F_g = (2245kg)(9.81(m/s^2))$

$F_g = 22023.45\,N$

$T - 22023.45N = (2245kg)(0.55m/s^2)$

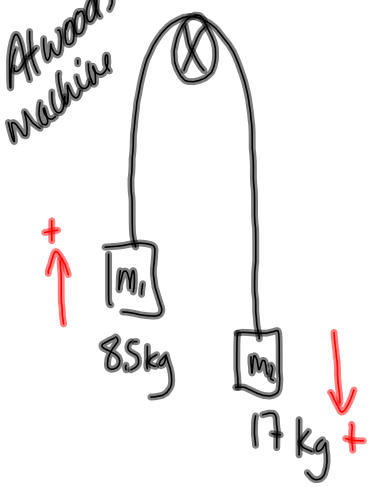
$T - 22023.45N = 1234.75N$

$T = 23258.2\,N$

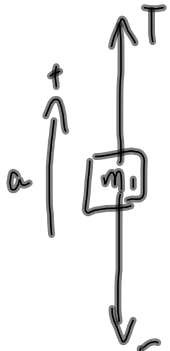
$\boxed{T = 2.33 \times 10^4\,N}$

MP 4.83

Atwood's machine



Consider m_1: $\vec{F}_{net} = m\vec{a}$

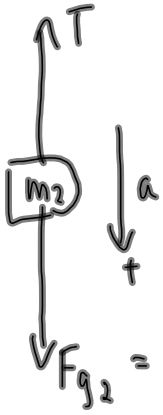


$T - F_{g_1} = m_1 a$

$T - 83.385N = (8.5kg)a$

$F_{g_1} = (8.5kg)(9.81m/s^2) = 83.385N$

Consider m_2: $\vec{F}_{net} = m\vec{a}$



$F_{g_2} - T = m_2 a$

$166.77N - T = (17kg)a$

$F_{g_2} = 166.77N$

Using Elimination:

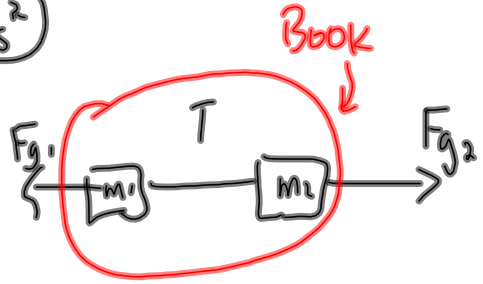
$T - 83.385N = (8.5kg)a$

$-T + 166.77N = (17kg)a$

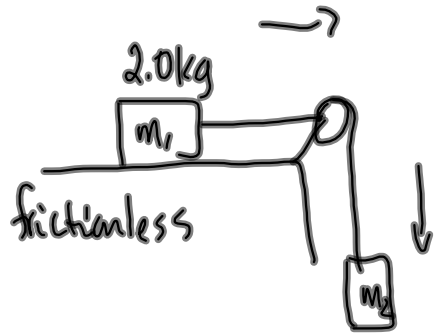
$83.385N = (25.5kg)a$

$a = 3.27 m/s^2$

$a = 3 m/s^2$

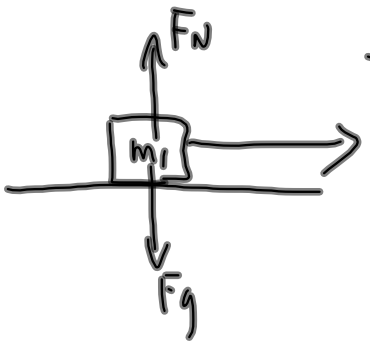


Example



"Fletcher's Trolley"

Consider m_1:

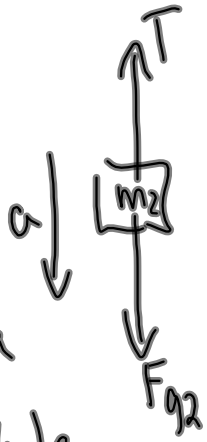


$\vec{F}_{net} = m\vec{a}$

$T = m_1 a$

$T = (2.0kg)\,a$

Consider m_2:



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

$F_{g_2} - T = m_2 a$

$49.05N - T = (5.0kg)\,a$

$49.05N - T = (5.0kg)\,a$

$49.05N - (2.0kg)a = (5.0kg)a$

$49.05N = (7.0kg)a$

$a = 7.0m/s^2$

$T = (2.0kg)\,a$

$T = (2.0kg)(7.0m/s^2)$

$T = 14N$

TO DO

PP|478

PP|485