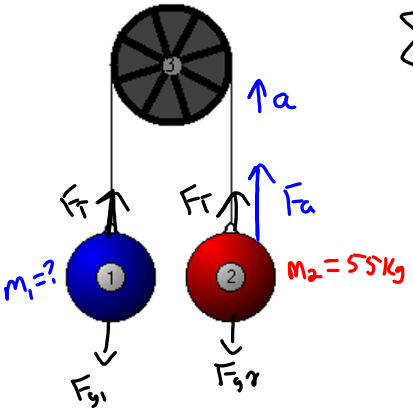
Suppose the maximum mass a person can lift is 324 N. A counterbalance is set up to help that person lift other objects. Calculate the mass of the counter weight for the person to lift 55 kg with an acceleration magnitude of 1.5 m/s^2 (M = 36 kg)



$$\sum F = \sum m \times a$$

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

$$|F_{g1}| = 9.81 m_1$$

$$|F_{g2}| = (55)(9.81) = 540\,N$$

$$|F_a| = 324\,N$$

$$|a| = 1.5\,m/s^2$$

$$-9.81m_1 + 540 + (-324) = (m_1 + 55)(-1.5)$$

$$-9.81m_1 + 216 = -1.5m_1 - 82.5$$

$$-9.81m_1 + 9.81m_1 + 216 = -1.5m_1 - 82.5 + 9.81m_1$$

$$216 + 82.5 = 8.31m_1 - 82.5 + 82.5$$

$$298.5 = 8.31m_1$$

$$\boxed{36\,kg = m_1}$$

$F_T = ?$

$$\sum F_{\text{on } m_2} = m_2 a$$

$$F_{g2} + F_a + F_T = m_2 a$$

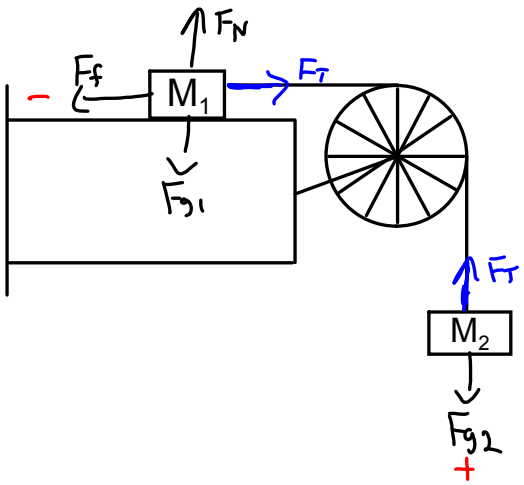
$$540 + (-324) + F_T = 55(-1.5)$$

$$216 + F_T = -82.5$$

$$\boxed{F_T = -298.5\,N}$$

Fletcher's Trolley

Calculate the acceleration of the masses if $M_1 = 5.2$ kg, $M_2 = 4.5$ kg, and $\mu_k = 0.22$. Then calculate the tension in the wire.



***Pay close attention to the direction of the forces!**

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

↑ only forces in dimension of motion

$$F_f + F_{g2} = (m_1 + m_2)\, a$$

$$|F_f| = \mu F_N \longrightarrow |F_N| = |F_{g1}|$$

$$= \mu F_{g1}$$

$$= (0.22)(5.2)(9.81)$$

$$|F_f| = 11\ N$$

$$|F_{g2}| = m_2 g = (4.5)(9.81)$$

$$= 44.1\ N$$

$$-11 + 44.1 = (5.2 + 4.5)\, a$$

$$33.1 = 9.7a$$

$$\boxed{3.4\ m/s^2 = a}$$

$F_T = ?$

Attachments

forces-and-motion-basics_all.jar

forces-1d_all.jar