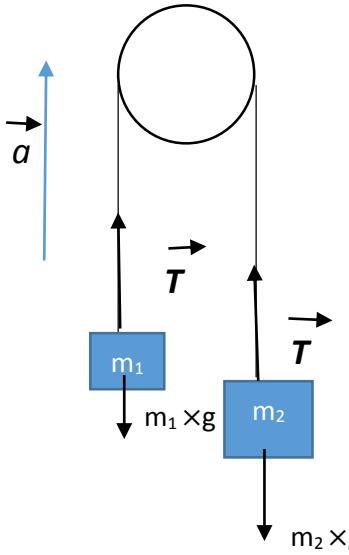
Question #50005, Physics, Mechanics | Kinematics | Dynamics | for confirmation

A light string passes over a frictionless pulley. To one of its ends a mass of 6 kg is attached. To its other end a mass of 10 kg is attached. Find tension of the string.

m_1 = 6 kg

m_2 = 10 kg

T - ?



Solution of the problem.

One end of the light string is heavier than the second end. An acceleration is directed for the first end upwards, for the second end downward. We write down forces, which operate, on both ends, in accordance with Newton's second law of motion:

$$\begin{cases} T - m_1 \times g = m_1 \times a \\ T - m_2 \times g = -m_2 \times a \end{cases}$$

We express an acceleration from the first equalization and will put in the second.

$$a = \frac{T - m_1 \times g}{m_1}$$

$$\left(T - m_2 \times g = -m_2 \times \left(\frac{T - m_1 \times g}{m_1}\right)\right.$$

$$T - m_2 \times g = \frac{-m_2 \times T + m_1 \times m_2 \times g}{m_1}$$

$$T \times m_1 - m_1 \times m_2 \times g = - - m_2 \times T + m_1 \times m_2 \times g$$

$$T \times m_1 + T \times m_2 = 2 \times m_1 \times m_2 \times g$$

$$T(m_1 + m_2) = 2 \times m_1 \times m_2 \times g$$

$$T = \frac{2 \times m_1 \times m_2 \times g}{(m_1 + m_2)}$$

We calculate the value of tension of the string.

$$T = \frac{2 \times 6\,kg \times 10\,kg \times 9.8\,\frac{N}{kg}}{16\,kg} = 73.5\,N$$

Answer: *T = 73,5 N*.