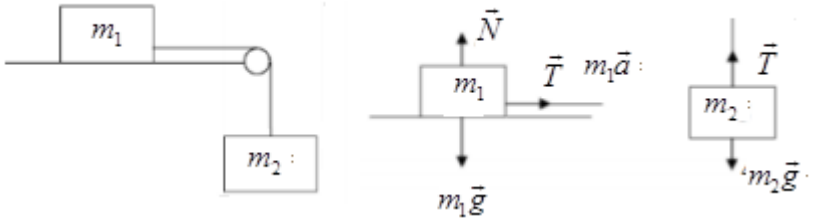
Answer on Question #51066, Physics, Mechanics | Kinematics | Dynamics

A block of mass 2 kg is connected to a freely hanging block of mass 4 kg by a light and inextensible string which passes over pulley at the edge of a table. The 2 kg mass is on the surface of the table assumed to be smooth. Calculate the acceleration of the system and the tension in the string.

Solution



The blocks are connected by a string. The tension due to the string is the same at both ends. According with Newton's second law

for $m_1 = 2kg$ mass:

$$m_1\vec{a} = m_1\vec{g} + \vec{N} + \vec{T} \tag{1}$$

where $g = 10m/s^2$ is the acceleration of gravity; $\vec{N}$ is the reaction force; $\vec{T}$ is strength thread tension; a is the acceleration.

for $m_2 = 4kg$ mass:

$$m_2\vec{a} = m_2\vec{g} + \vec{T} \tag{2}$$

than

$$\begin{cases} m_1 a = T \\ m_2 a = m_2 g - T \end{cases} \Rightarrow \begin{cases} a = g \cdot \dfrac{m_2}{m_1 + m_2} = 10 \cdot \dfrac{4}{2+4} = 6.67m/s^2 \\ T = g \cdot \dfrac{m_1 m_2}{m_1 + m} = 10 \cdot \dfrac{2 \cdot 4}{2+4} = 13.33N \end{cases}$$

Answer: $a = g \cdot \dfrac{m_2}{m_1 + m_2} = 6.67m/s^2;\ T = g \cdot \dfrac{m_1 m_2}{m_1 + m} = 13.33N$