

Answer on Question #51957, Physics, Other

Question:

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

Answer:

Newton's second law for first block:

$$T - m_1g = m_1a \quad \Rightarrow \quad T = m_1(a + g)$$

Newton's second law for second block:

$$m_2g - T = m_2a$$

$$m_2g - m_1(a + g) = m_2a$$

$$a = \frac{(m_2 - m_1)}{(m_2 + m_1)}g = \frac{4 - 2}{4 + 2} 10 = 3.3 \frac{m}{s^2}$$

Tension in the string equals:

$$T = m_1(a + g) = m_1g \left(\frac{(m_2 - m_1)}{(m_2 + m_1)} + 1 \right) = \frac{2m_1m_2g}{(m_2 + m_1)} = \frac{16}{6} 10 = 26.7 \text{ N}$$