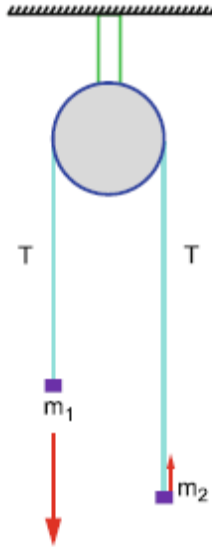


Answer on Question #49755, Physics, Other

Two masses a and b ($a > b$) are connected by massless flexible and inextensible string passed over massless and frictionless pulley. The acceleration of centre of mass is?

Solution:



The equations of motion are:

$$m_a a = m_a g - T$$

$$m_b a = T - m_b g$$

Adding

$$(m_a + m_b)a = (m_a - m_b)g$$

The acceleration is

$$a = \frac{(m_a - m_b)g}{(m_a + m_b)}$$

The heavier mass m_a will have acceleration a_1 vertically down while the lighter mass m_b will have acceleration a_2 vertically up:

$$a_2 = -a_1$$

The acceleration of the centre of mass of the system will be

$$a_{CM} = \frac{m_a a_1 + m_b a_2}{m_a + m_b} = \frac{(m_a - m_b)a}{m_a + m_b}$$

$$a_{CM} = \frac{(m_a - m_b)^2}{(m_a + m_b)^2} g$$

Answer: $a_{CM} = \frac{(m_a - m_b)^2}{(m_a + m_b)^2} g$