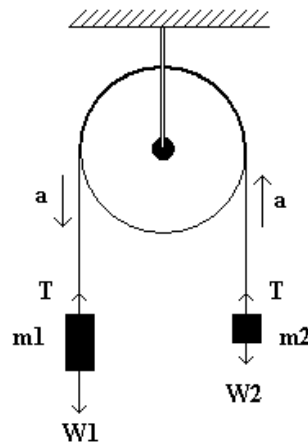


Answer on Question#41667, Physics, Mechanics

Two masses of 2kg and 4kg are connected by a light string passing over a light frictionless pulley. If the system is released from rest determine the velocity of the 4kg mass when it has descended a distance of 1.4m.

Solution:



Given:

$$m_1 = 4 \text{ kg,}$$

$$m_2 = 2 \text{ kg,}$$

$$W_1 = m_1 g \text{ (weight of first body)}$$

$$W_2 = m_2 g \text{ (weight of second body)}$$

$$h = 1.4 \text{ m,}$$

$$v_1 = ?$$

The equations of motion are:

$$m_1 a = m_1 g - T$$

$$m_2 a = T - m_2 g$$

where T is tension of the string, and it remains the same at any point.

The adding of two equations gives:

$$m_1 a + m_2 a = m_1 g - T + T - m_2 g$$

$$m_1 a + m_2 a = m_1 g - m_2 g = g(m_1 - m_2)$$

Thus, the acceleration is

$$a = \frac{g(m_1 - m_2)}{m_1 + m_2}$$

$$a = \frac{9.81 \cdot (4 - 2)}{4 + 2} = 3.27 \text{ m/s}^2$$

The kinematic equation that describes an object's motion is:

$$v_1^2 = v_0^2 + 2ah$$

The symbol h stands for the displacement of the object. The symbol a stands for the acceleration of the object. The initial velocity $v_0 = 0$.

$$\text{Thus, } v_1 = \sqrt{2ah} = \sqrt{2 \cdot 3.27 \cdot 1.4} = 3.03 \approx 3 \text{ m/s}$$

Answer. $v_1 = 3 \text{ m/s}$.