

5.17 •• A light rope is attached to a block with mass 4.00 kg that rests on a frictionless, horizontal surface. The horizontal rope passes over a frictionless, massless pulley, and a block with mass m is suspended from the other end. When the blocks are released, the tension in the rope is 10.0 N . (a) Draw two free-body diagrams, one for the 4.00-kg block and one for the block with mass m . (b) What is the acceleration of either block? (c) Find the mass m of the hanging block. (d) How does the tension compare to the weight of the hanging block?

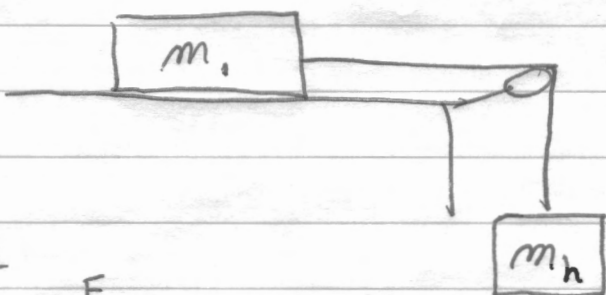
YF/13 5.17

No friction

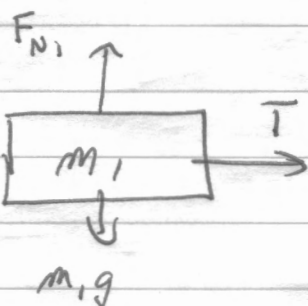
$$m_1 = 4.00 \text{ kg}$$

$$m_2 = ?$$

$$T = 10.0 \text{ N}$$



Block 1



$$T = 10.0 \text{ N}$$

$$\Sigma F_i = m_i a_i$$

$$T = m_1 a_1 \Rightarrow a_1 = \frac{10 \text{ N}}{4.00 \text{ kg}} = 2.5 \frac{\text{m}}{\text{s}^2}$$

Block 2



$$\Sigma F_h = m_h a_h$$

Call down +

$$m_h g - T = m_h a_h$$

$$\text{but } a_h = a_1$$

$$m_h (g - a_h) = T$$

$$m_h = \frac{10.0 \text{ N}}{9.8 - 2.5 \text{ m/s}^2} = 1.37 \text{ kg}$$

Note: $T = 10.0 \text{ N}$

$$m_h g = 13.4 \text{ N}$$

$$T \neq m_h g$$