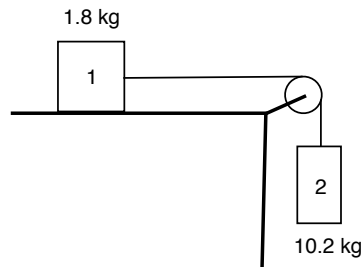


## Problem: Pulley with weights



Two weights are attached to a frictionless, massless pulley.

(a) Find the magnitude of acceleration of the blocks

(b) Find the tension in the string.

Equation of motion for block 1:

- forces in vertical direction sum to zero (no acceleration in vertical direction)

- in horizontal direction

$$F_1 = T = m_1 a$$

Equation of motion for block 2:

- no horizontal forces

- in vertical direction

$$F_2 = W_2 - T = m_2 a$$

Hence

$$m_1 a + m_2 a = T + W_2 - T$$

so

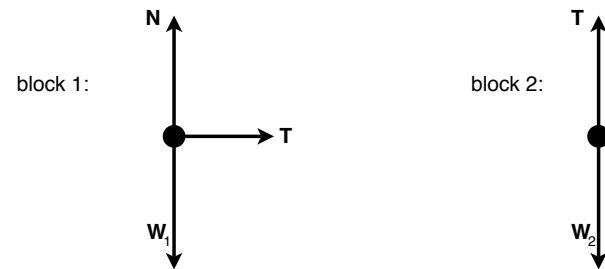
$$(m_1 + m_2) a = W_2 = m_2 g$$

Hence

$$\begin{aligned} a &= m_2 g / (m_1 + m_2) \\ &= 10.2 \times 9.8 / (1.8 + 10.2) \\ &= 8.33 \text{ ms}^{-2} \quad (= 0.85g) \end{aligned}$$

$$T = m_1 a = 1.8 \times 8.33 = 15 \text{ N}$$

**Solution:** Draw free-body diagrams for the two blocks:



Because the blocks are linked by the string, the tension is the same for both blocks, and the acceleration is the same for both blocks.

Because block 2 is heavier, we predict it will accelerate downwards, in which case block 1 will accelerate to the right. So take the positive direction to be *down* for block 2 and *right* for block 1.