**SHOW ALL WORK!!!!**
**REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!**
Use the conversion constants and data given on the front page.

In the drawing shown the system is frictionless. The string massless. The blocks are released from rest. Clear free body and force diagrams are necessary for full credit.

(a) Find the acceleration including signs. Use the sign convention shown.
(b) Calculate the tension in the string after the system is released.

\[ m_1 = 20.0 \text{ kg} \]
\[ m_2 = 11.5 \text{ kg} \]
\[ \theta = 37^\circ \]

**Step 1: Draw Free Body \& Force Diagrams**

**mass 1**

\[ \text{FBD} \]

\[ \text{Force} \]

\[ N \]

\[ T \]

\[ m_1 g \]

\[ m_1 a \]

**mass 2**

\[ \text{FBD} \]

\[ \text{Force} \]

\[ T \]

\[ m_2 g \]

\[ m_2 a \]

(a) To find acceleration write down the sum of the forces

\[ \Sigma F_x = m_1a = T - m_1g \sin \theta \]
\[ \Sigma F_y = 0 = N - m_1g \cos \theta \]

\[ \Sigma F_x = m_2a = m_2g - T \]
\[ \Sigma F_y = 0 \] (see diagram for axes, definition)

We want acceleration so need to eliminate \( T \)

Solve eq. 2 for \( T \)

\[ T = m_2g - m_2a \]

Substitute this into eq. 1

\[ m_1a = m_2g - m_2a - m_1g \sin \theta \Rightarrow a(m_1+m_2) = m_2g - m_1g \sin \theta \]

\[ a = \frac{m_2g - m_1g \sin \theta}{m_1+m_2} = \frac{-0.1669 \text{ m/s}^2}{-1.67 \times 10^1 \text{ m/s}^2} \]

\[ a = 0.018 \text{ m/s}^2 \]

(b) \( T = ? \) now that we have \( a \) we can find \( T \)

\[ T = m_2(g - a) = 11.5 \text{ kg} \left( 9.8 \text{ m/s}^2 - 0.018 \text{ m/s}^2 \right) = 114.6 \text{ N} \]