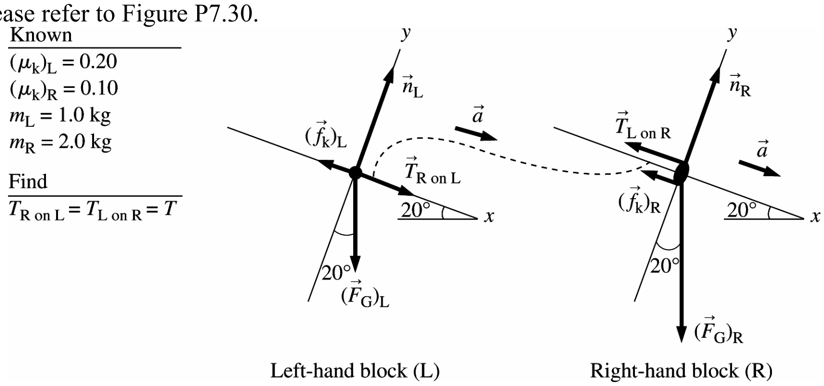
7.30. Model: The two blocks form a system of interacting objects.

Visualize: Please refer to Figure P7.30.



Solve: It is possible that the left-hand block (Block L) is accelerating down the slope faster than the right-hand block (Block R), causing the string to be slack (zero tension). If that were the case, we would get a zero or negative answer for the tension in the string.

Newton's first law applied to the y-direction on Block L yields

$$\left(\sum F_L\right)_y = 0 = n_L - (F_G)_L \cos 20° \Rightarrow n_L = m_L g \cos 20°$$

Therefore

$$(f_k)_L = (\mu_k)_L m_L g \cos 20° = (0.20)(1.0 \text{ kg})(9.80 \text{ m/s}^2)\cos 20° = 1.84 \text{ N}$$

A similar analysis of the vertical forces on Block R gives $(f_k)_R = 1.84$ N as well. Using Newton's second law in the x-direction for Block L,

$$\left(\sum F_L\right)_x = m_L a = T_{R\text{ on }L} - (f_k)_L + (F_G)_L \sin 20° \;\; \Rightarrow m_L a = T_{R\text{ on }L} - 1.84 \text{ N} + m_L g \sin 20°.$$

For Block R,

$$\left(\sum F_R\right)_x = m_R a = (F_G)_R \sin 20° - 1.84 \text{ N} - T_{L\text{ on }R} \Rightarrow m_R a = m_R g \sin 20° - 1.84 \text{ N} - T_{L\text{ on }R}$$

These are two equations in the two unknowns a and $T_{L\text{ on }R} = T_{R\text{ on }L} \equiv T$. Solving them, we obtain $a = 2.12 \text{ m/s}^2$ and $T = 0.61$ N.

Assess: The tension in the string is positive, and is about 1/3 of the kinetic friction force on each of the blocks, which is reasonable.