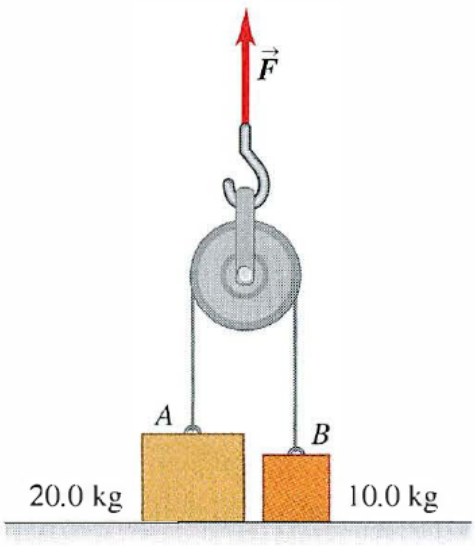
Question:

5.126. The masses of blocks A and B in Fig. 5.86 are 20.0 kg and 10.0 kg, respectively. The blocks are initially at rest on the floor and are connected by a massless string passing over a massless and frictionless pulley. An upward force $\vec{F}$ is applied to the pulley. Find the accelerations $\vec{a}_A$ of block A and $\vec{a}_B$ of block B when F is (a) 124 N; (b) 294 N; (c) 424 N.

Figure **5.86** Challenge Problem 5.126.



Solution:

5.126. **IDENTIFY:** Apply $\sum \vec{F} = m\vec{a}$ to each block. The tension in the string is the same at both ends. If $T < w$ for a block, that block remains at rest.

SET UP: In all cases, the tension in the string will be half of F.

EXECUTE: **(a)** $F/2 = 62$ N, which is insufficient to raise either block; $a_1 = a_2 = 0$.

(b) $F/2 = 62$ N. The larger block (of weight 196 N) will not move, so $a_1 = 0$, but the smaller block, of weight 98 N, has a net upward force of 49 N applied to it, and so will accelerate upwards with $a_2 = \dfrac{49\text{ N}}{10.0\text{ kg}} = 4.9\text{ m/s}^2$.

(c) $F/2 = 212$ N, so the net upward force on block A is 16 N and that on block B is 114 N, so

$a_1 = \dfrac{16\text{ N}}{20.0\text{ kg}} = 0.8\text{ m/s}^2$ and $a_2 = \dfrac{114\text{ N}}{10.0\text{ kg}} = 11.4\text{ m/s}^2$.

EVALUATE: The two blocks need not have accelerations with the same magnitudes.