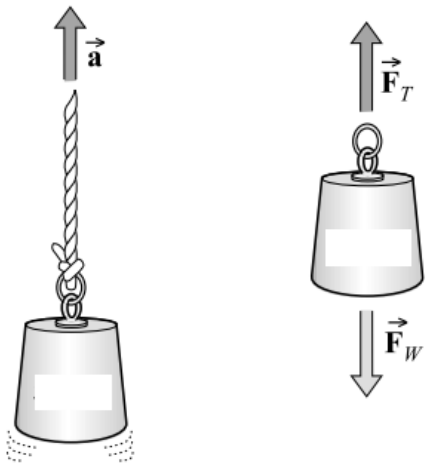
Answer on Question #72208, Physics / Other

A 20 kg crate hangs at the end of a long rope. Find its acceleration when the tension on the rope is 250 N.

Solution:



The free-body diagram is shown in figure.

The tension in the rope is F_T and the weight of the object is

$$F_w = mg = (20.0\ kg)(9.8\ m/s^2) = 196\ N$$

After drawing the free-body diagram, we apply the equation of motion in the y-direction with up taken as positive to get

$$\sum F_y = ma$$

$$F_T - F_w = ma$$

So

$$a = \frac{F_T - F_w}{m} = \frac{250 - 196}{20} = 2.7\ m/s^2$$

Answer: $a = 2.7\ m/s^2$ upward.