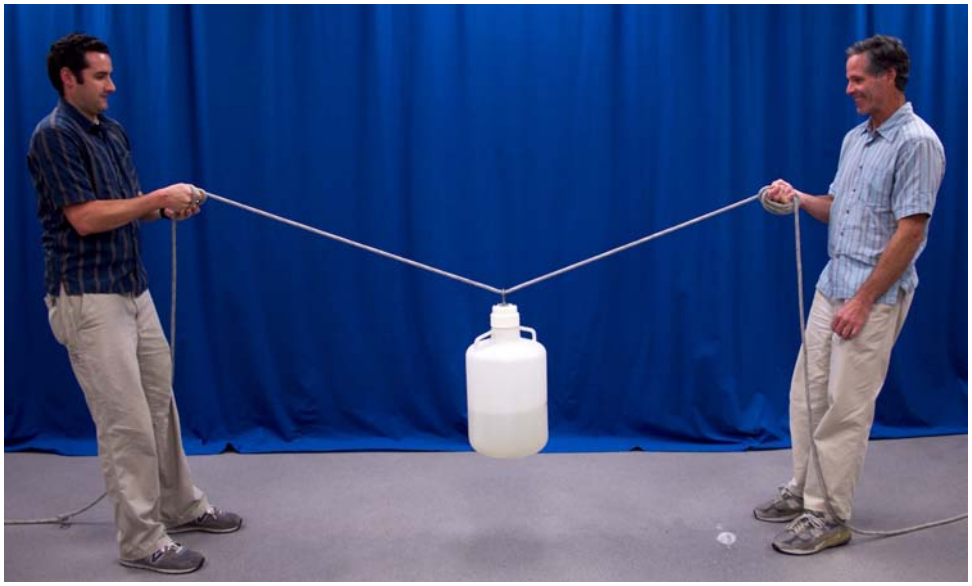
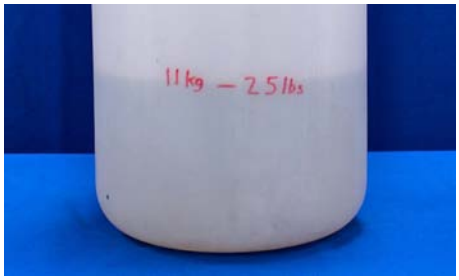
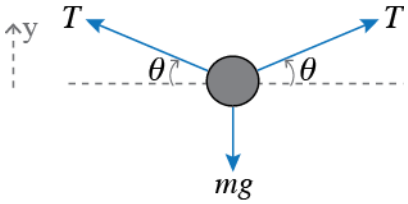




Concept:



Application of Newton's Law to the free-body diagram shown above, where T = tension, gives

$$\sum F_y = T\sin\theta + T\sin\theta - mg = ma_y = 0 \qquad (1)$$

$$T = \frac{mg}{2\sin\theta} \qquad (2)$$

Eq. 2 indicates that for $\theta \approx 30°$ as in the photograph, $T \approx mg \approx (11\text{ kg})(9.8\text{ m/s}^2) \approx 110\text{ N}$.

Eq. 2 also shows that as $\theta \to 0$, i.e., the rope approaches the horizontal, that $T \to \infty$. Thus, it is impossible for the rope to be horizontal, even if the only weight to be supported is the rope's own weight.

Equipment:

1. Thick Rope
2. Large Water Bottle (11 kg)

Procedure:

1. Ask the audience for two strong volunteers.
2. Ask them if they think they can apply enough tension to the rope to make the rope horizontal.
3. Have each volunteer pull on opposite sides of the rope trying to make the rope as horizontal as possible.
4. Estimate the rope's minimum angle with respect to the horizontal that they are able to make.
5. Calculate the maximum tension that the volunteers were able to apply to the rope.