Homework #3

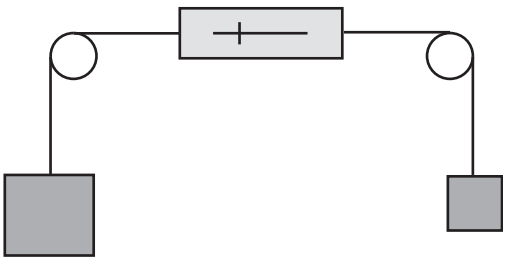
Due Friday, Feb. 11

1. (a) A spring scale is attached to a 50 g weight by a string, and is held at rest by a string, as shown below.

The spring scale weighs 10 g. The reading on the spring scale is 50 g, just as it should be. What is the tension in the string attached to the ceiling? What is the tension in the string attached to the weight?

(b) The person holding the upper string now accelerates it upward with a constant acceleration of 0.23 m/s^2. What does the scale read in this situation?

2. A spring scale is attached to a string over two pulleys, and the string is attached to two different weights, as shown below.

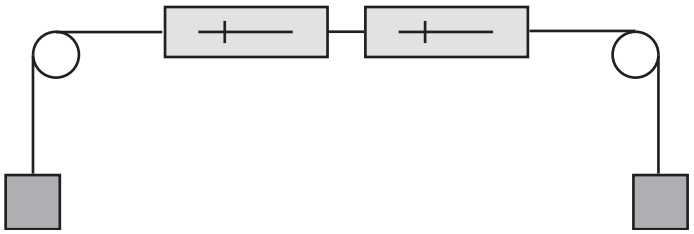


The weight on the left has a mass of 160 g, and the weight on the right has a mass of 80 g. Neglect the mass of the scale.

(a) What is the acceleration of the heavier weight?

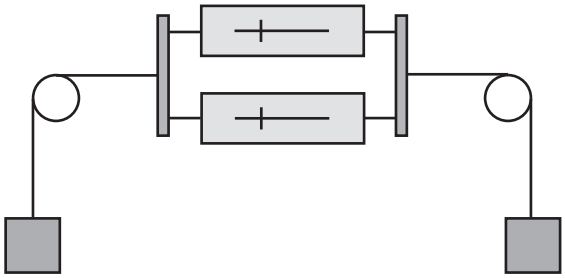
(b) What is the reading of the scale?

3. (a) Two spring scales are attached "in series" to two equal weights over pulleys, as shown:



The weights have mass of 50 g each. Neglect the mass of the scales. What do the scales read?

(b) Now suppose the scales are attached "in parallel," as shown:



The spring scales are attached to rigid vertical bars, which are attached to the strings. Neglect the mass of the scales and the bars. What do the scales read now?

4. Chapter 3, problem 50.

5. Chapter 3, problem 51.

6. Intrepid astronaut Jane Danger has heard of the idea of "effective gravity," but is skeptical and wants to understand it using just $F = ma$. She tries to determine whether there is any difference between being inside a rocket at

rest at the surface of the earth, and being in the same in outer space when it is accelerating upward at a rate of 9.8 m/s^2.

(a) Jane first drops several balls of different weights and times how long it takes for them to hit the ground. Is the result different on earth than in space? Explain.

(b) Jane weighs herself on earth and in space using a bathroom scale. Does she get the same answer on earth as in space? Explain using free-body diagrams.