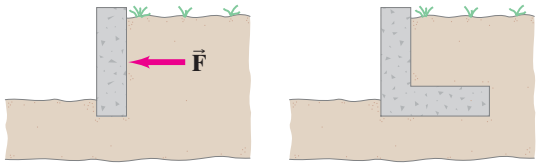
Questions

1. Describe several situations in which an object is not in equilibrium, even though the net force on it is zero.
2. A bungee jumper momentarily comes to rest at the bottom of the dive before he springs back upward. At that moment, is the bungee jumper in equilibrium? Explain.
3. You can find the center of gravity of a meter stick by resting it horizontally on your two index fingers, and then slowly drawing your fingers together. First the meter stick will slip on one finger, and then on the other, but eventually the fingers meet at the CG. Why does this work?
4. Your doctor's scale has arms on which weights slide to counter your weight, Fig. 9–35. These weights are much lighter than you are. How does this work?

FIGURE 9–35 Question 4.

5. A ground retaining wall is shown in Fig. 9–36a. The ground, particularly when wet, can exert a significant force F on the wall. (*a*) What force produces the torque to keep the wall upright? (*b*) Explain why the retaining wall in Fig. 9–36b would be much less likely to overturn than that in Fig. 9–36a.



(a) (b)

FIGURE 9–36 Question 5.

6. Can the sum of the torques on an object be zero while the net force on the object is nonzero? Explain.
7. A ladder, leaning against a wall, makes a 60° angle with the ground. When is it more likely to slip: when a person stands on the ladder near the top or near the bottom? Explain.
8. A uniform meter stick supported at the 25-cm mark is in equilibrium when a 1-kg rock is suspended at the 0-cm end (as shown in Fig. 9–37). Is the mass of the meter stick greater than, equal to, or less than the mass of the rock? Explain your reasoning.

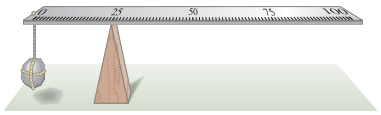


FIGURE 9–37 Question 8.

9. Why do you tend to lean backward when carrying a heavy load in your arms?
10. Figure 9–38 shows a cone. Explain how to lay it on a flat table so that it is in (*a*) stable equilibrium, (*b*) unstable equilibrium, (*c*) neutral equilibrium.

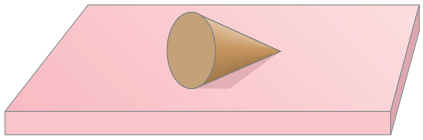
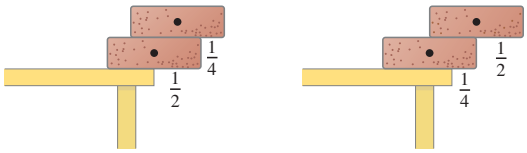


FIGURE 9–38 Question 10.

11. Place yourself facing the edge of an open door. Position your feet astride the door with your nose and abdomen touching the door's edge. Try to rise on your tiptoes. Why can't this be done?
12. Why is it not possible to sit upright in a chair and rise to your feet without first leaning forward?
13. Why is it more difficult to do sit-ups when your knees are bent than when your legs are stretched out?
14. Explain why touching your toes while you are seated on the floor with outstretched legs produces less stress on the lower spinal column than when touching your toes from a standing position. Use a diagram.
15. Which configuration of bricks, Fig. 9–39a or Fig. 9–39b, is the more likely to be stable? Why?



(a) (b)

FIGURE 9–39 Question 15. The dots indicate the CG of each brick (assumed uniform). The fractions $\frac{1}{4}$ and $\frac{1}{2}$ indicate what portion of each brick is hanging beyond its support.

16. Name the type of equilibrium for each position of the ball in Fig. 9–40.

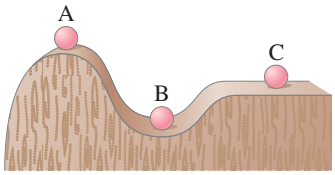


FIGURE 9–40 Question 16.

17. Is the Young's modulus for a bungee cord smaller or larger than that for an ordinary rope?
18. Examine how a pair of scissors or shears cuts through a piece of cardboard. Is the name "shears" justified? Explain.
19. Materials such as ordinary concrete and stone are very weak under tension or shear. Would it be wise to use such a material for either of the supports of the cantilever shown in Fig. 9–9? If so, which one(s)? Explain.