1. A bowling alley owns a collection of bowling balls having a circumference of 27 inches and composed of a graphite core (density=2.266 g/cm^3). The weights available include 8, 10, 14 and 16 pounds. Which balls, if any, float in fresh water?

   (a) Only the 8 pound floats.

   (b) The 8 and 10 pound float.

   (c) The 8, 10 and 14 pound float.

   (d) They all float.

   (e) They all sink.

2. A 2 m long standard steel pipe has an outside diameter of 168 mm and weighs 554 N. Will the pipe float or sink in glycerin (sg=1.26) if its ends are closed? What force would be required to hold it in equilibrium?

   (a) Sinks, $F_{\text{ext}} = 6$ N

   (b) Floats, $F_{\text{ext}} = 0$ N

   (c) Floats, $F_{\text{ext}} = 6$ N

   (d) Sinks, $F_{\text{ext}} = 12$ N

   (e) Sinks, $F_{\text{ext}} = 3$ N

3. A helium balloon is filled with 0.5 cu. ft. of helium gas. If the empty balloon weighs 5 grams what is the minimum weight required to hold down the balloon. Take the specific weight of the helium gas and air to be 0.0103 lb/ft^3 and 0.075 lb/ft^3 respectively.

   (a) 2 g

   (b) 10 g

   (c) 12 g

   (d) 15 g

   (e) 17 g

4. A container for an emergency beacon is a rectangle 30.0 in wide, 40.0 in long, and 22.0 in high. Its center of gravity is 10.50 in above its base. The container weights 300 lb. Will the box be stable with the 30×40 in side parallel to the surface of plain water? Report the distance from the base to the metacenter.

(a) $y_{\text{mc}} = 10.8$ in (stable)

(b) $y_{\text{mc}} = 14.3$ in (stable)

(c) $y_{\text{mc}} = 14.3$ in (unstable)

(d) $y_{\text{mc}} = 16.0$ in (stable)

(e) $y_{\text{mc}} = 16.0$ in (unstable)

5. The following four questions consider a fresh-water buoy that is in the shape of a solid cylinder. It has an 18 in diameter, is 4 ft long and is constructed from EVA foam of density 931 kg/m^3.

   If the buoy floats upright, how much of its length is above the water's surface? Report your result in inches.

6. Compute the metacentric radius (MB) for the buoy. Report your result in inches.

7. What is the distance from the bottom of the buoy to the position of the metacenter (mc)? Report your result in inches.

8. Is the buoy stable?