1. A tall cylinder with a cross-sectional area $12cm^2$ is partially filled with mercury; the surface of the mercury is 5cm above the bottom of the cylinder. Water is slowly poured in on top of the mercury, and the two fluids don't mix. What volume of water must be added to double the gauge pressure at the bottom of the cylinder?

2. A hollow plastic sphere is held below the surface of a freshwater lake by a cord anchored to the bottom of the lake. The sphere has a volume of $0.65m^3$ and the tension in the cord is 900N.
    a) Calculate the buoyant force exerted by the water on the sphere.
    b) What is the mass of the sphere?
    c) The cord breaks and the sphere rises to the surface. When the sphere comes to rest, what fraction of its volume will be submerged?

3. A rock is suspended by a light string. When the rock is in air, the tension in the string is 39.2N. When the rock is totally submerged in water, the tension is 28.4N. When the rock is totally submerged in an unknown liquid, the tension is 18.6N. What is the density of the unknown liquid?

4. A U-shaped tube open to the air at both ends contains some mercury. A quantity of water is carefully poured into the left arm of the U-shaped tube until the vertical height of the water column is 15cm.
    (a) What is the gauge pressure at the water-mercury interface?
    (b) Calculate the vertical distance h from the top of the mercury in the righthand arm of the tube to the top of the water in the left-hand arm.

5. A hot-air balloon has a volume of 2200m^3. The balloon fabric (the envelope) weighs 900N. The basket with gear and full propane tanks weighs 1700N. If the balloon can safely lift and additional 3200N of passengers, breakfast, and champagne when the outside air density is 1.23 kg/m3, what is the average density of the heated gases in the envelope?