

PRACTICE A

Buoyant Force

1. A piece of metal weighs 50.0 N in air, 36.0 N in water, and 41.0 N in an unknown liquid. Find the densities of the following:
 - a. the metal
 - b. the unknown liquid
2. A 2.8 kg rectangular air mattress is 2.00 m long, 0.500 m wide, and 0.100 m thick. What mass can it support in water before sinking?
3. A ferry boat is 4.0 m wide and 6.0 m long. When a truck pulls onto it, the boat sinks 4.00 cm in the water. What is the weight of the truck?
4. An empty rubber balloon has a mass of 0.0120 kg. The balloon is filled with helium at 0°C, 1 atm pressure, and a density of 0.179 kg/m^3 . The filled balloon has a radius of 0.500 m.
 - a. What is the magnitude of the buoyant force acting on the balloon?
(Hint: See **Table 1** for the density of air.)
 - b. What is the magnitude of the net force acting on the balloon?

SECTION REVIEW

1. What is the difference between a solid and a fluid? What is the difference between a gas and a liquid?
2. Which of the following objects will float in a tub of mercury?
 - a. a solid gold bead
 - b. an ice cube
 - c. an iron bolt
 - d. 5 mL of water
3. A 650 kg weather balloon is designed to lift a 4600 kg package. What volume should the balloon have after being inflated with helium at 0°C and 1 atm pressure to lift the total load? (Hint: Use the density values in **Table 1**.)
4. A submerged submarine alters its buoyancy so that it initially accelerates upward at 0.325 m/s^2 . What is the submarine's average density at this time? (Hint: the density of sea water is $1.025 \times 10^3 \text{ kg/m}^3$.)
5. **Critical Thinking** Many kayaks are made of plastics and other composite materials that are denser than water. How are such kayaks able to float in water?