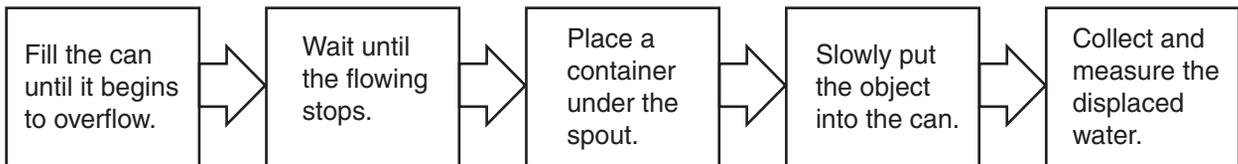


SUGGESTED ANSWERS

WHAT DO YOU REMEMBER?

- Density is the mass of a material divided by its volume. You can measure the mass of an object using an electronic balance or a triple beam balance. If the object is a rectangular solid, its volume can be calculated by measuring the length, the height, and the depth of the object, and then finding the product of the three measurements. If the object has an irregular shape, its volume can be determined using the displacement method. For a small object, about 50 mL of water can be placed in a graduated cylinder. The object can then be placed in the water, and the new volume observed. The volume of the object is the difference in the initial and final apparent volume of the liquid. For both methods of measuring volume, the density is then calculated by dividing the mass of the object by its density.
- A meniscus is the curved surface of a liquid in a container. To measure the volume of a liquid in a graduated cylinder, you should observe the meniscus from eye level and read the level of the lower curved surface of the meniscus.
- Sample answer:

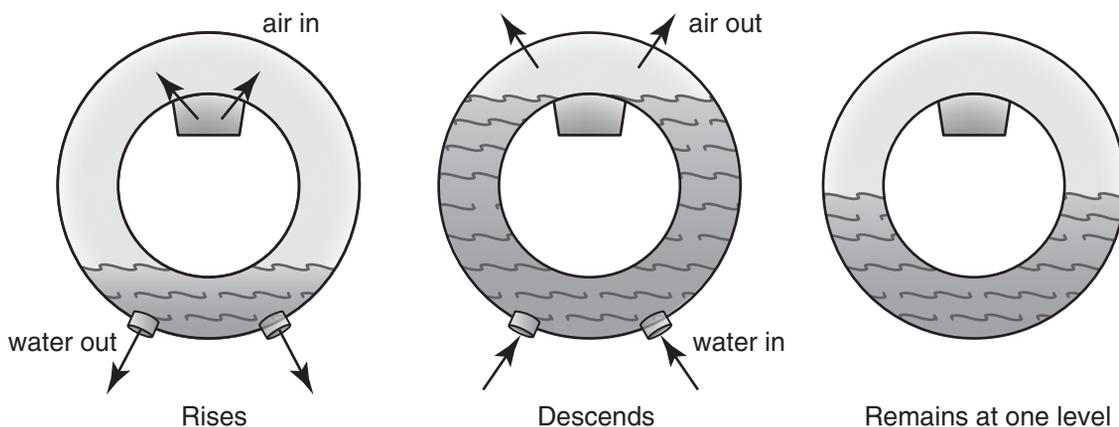


- The density of a material depends on the mass of the particles and how tightly those particles are packed in the material. Because particles of most substances in the solid state are packed more closely together than particles of the substance in the liquid state, solids generally have a greater density than liquids. Because particles of a liquid are packed closer than the particles of a gas, liquids have greater density than gases. Gases have relatively low densities because their particles can move freely.
- An object has positive buoyancy if its weight is less than the buoyant force on it. The object will begin to float upward. An object has negative buoyancy if its weight is greater than the buoyant force on it. The object will begin to sink. An object has neutral buoyancy if its weight equals the buoyant force. The object neither rises nor sinks in the fluid.
- A characteristic property of matter is a property that is specific to a particular substance and can be used to distinguish one substance from another.
- Advantages of the water displacement method include that the shape of the object does not matter and volume is easy to measure in this way. One disadvantage of this method is that it cannot be used to determine the volume of a very small object.
- No; the *Hindenburg* was filled with hydrogen, and the Goodyear blimp is filled with helium. Neither was or is filled with air like hot air balloons.
- Hot air balloons must carry a heat source with them because they must warm the air inside the balloons in order to maintain their buoyancy. The air in the balloons naturally cools off over time, so for the balloons to stay aloft, the air must be heated periodically.
- Sample answer: Two positive applications of buoyancy: blimps and life preservers. Two negative effects of buoyancy: a hole in a ship causes it to take on water, become denser overall, and ultimately sink, and oil from an oil spill floats on the surface of a body of water, harming aquatic plants and animals.

11. A ship's Plimsoll line indicates the level at which a ship will float in waters of different densities. In relatively dense water, the buoyant force will be greater and the ship floats higher. In water that is less dense, the buoyant force will be less and the ship will float lower.
12. The swim bladder of many bony fishes and the ballast tanks of submarines serve a similar function: to control buoyancy. In both cases, gases are taken in, which are less dense than the water, causing the overall density of the submarine or fish to decrease. When density decreases, the buoyant force of the surrounding water carries the submarine/fish upward. When gases are removed from the swim bladder or ballast tanks, the overall densities of the fish or submarine increase, and negative buoyancy causes the fish/submarine to sink.
13. (a) wood and ice; (b) lead; (c) The substance has a density of 1.3 kg/m^3 , so it is likely to be air.

WHAT DO YOU UNDERSTAND?

14. Because it is smaller than Earth, the planet would exert a smaller gravitational force on the block than Earth does. Because weight involves gravitational force, the weight of the block will be smaller on the other planet than on Earth. Mass, volume, and density, however, would remain the same.
15. (a) The swim bladder generally keeps a fish neutrally buoyant.
(b) The ballast in a submarine functions much like a swim bladder in a fish. Ballast tanks can take in air or water to keep the submarine neutrally buoyant.
16. Because their masses are the same, and because B displaces more water, the volume of B must be larger. So, B is more likely than A to be a boat.
17. As the ship sails into colder waters, the density of the water will increase, and the ship will float higher in the water. The ship will not need to dump some of its ballast water because the denser water will provide a greater buoyant force.
18. (a) The submarine rises when compressed air is forced into the ballast tank and water is forced out.
(b) The submarine descends when water is allowed in the ballast tank and air is forced out.
(c) The submarine remains at one level when the ballast tank has the right balance of air and water. The density of the submarine must be the same as the density of the water.



19. A ship would float higher in the water of the Atlantic Ocean than in the water of Lake Ontario. Salt water is denser than fresh water, so it exerts a greater buoyant force on a ship, pushing the ship higher in the water.

SOLVE A PROBLEM!

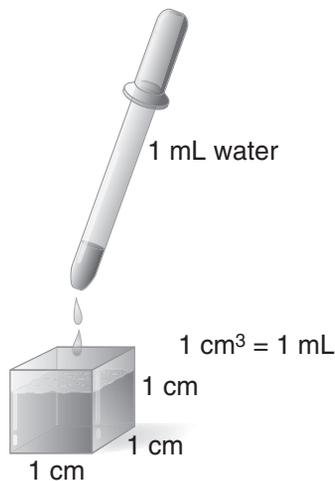
20. Density = $\frac{\text{mass}}{\text{volume}} = \frac{63 \text{ g}}{30 \text{ mL}} = 2.1 \text{ g/mL}$. Because this is greater than the density of water, 1.0 g/mL,

the fluid will sink in water.

21. Sample answer: I would use diesel oil because the density of the oil is closer than the density of air to the density of water. Air will cause the flotation bags to rise quickly, but diesel oil will cause them to rise more slowly.
22. The density of carbon monoxide is 1.45 kg/m^3 (which is greater than the density of air), so it will sink in air. The first employee is correct; the detectors should be installed close to the floor where carbon monoxide would collect.

CREATE AND EVALUATE!

23. Students' concept maps should clearly indicate their understanding of the relationships between the concepts and vocabulary presented in this chapter and those presented in Chapter 7. When students study others' concept maps, they should try to provide constructive criticisms to other students. Students should consider whether others' comments on their own concept maps are valid, and make changes as necessary.
24. Sample answer: My diagram is limited because it only shows a cube of liquid, but the liquid could be in any shape.



25. Posters might describe and illustrate how fluids that enter storm drains end up in ponds, lakes, and groundwater. Any contaminants in the water will contaminate the ponds, lakes, and groundwater. Limitations of a poster campaign are that some people will not take the time to fully study the posters, and the poster may not be located where people can see it. More effective ways of communicating might include giving a speech, handing out flyers, or creating a newsletter.

REFLECT ON YOUR LEARNING

26. Sample answer: I think the information about fish and submarines having structures with similar functions was most interesting because it shows that we can get great ideas from other living things.
27. (a) Sample answer: Density is an important property of fluids that helps determine whether another fluid or object will sink or float. Buoyancy is another important property of fluids. It is a useful property for many applications. Buoyancy allows people to make objects rise or descend in water and air. The ability to regulate buoyancy is an important adaptation for some aquatic animals as well.
- (b) Sample answer: How do marine animals without swim bladders control their buoyancy? How do density and buoyancy affect scuba divers?