

Fluids and Density

Textbook pages 260-271

Before You Read

Why does a hot air balloon rise up in the air? Record your ideas on the lines below.



Mark the Text

Summarize

As you read this section, highlight the main point in each paragraph. Then write a short paragraph summarizing what you have learned.



Reading Check

1. Explain what density is by comparing the particles of a gas with the particles of a liquid.

What are fluids?

A **fluid** is any form of matter that can flow. Liquids and gases are fluids. They flow because they do not have a fixed shape. Solids are not fluids because they have a fixed, rigid shape.

Why are gases less dense than liquids?

The amount of mass that is contained in a certain volume of a material is called **density**. Density describes the spacing of the particles in a material. For example, the particles of a gas are spaced very far apart. The particles of a liquid are spaced much closer together. A gas is less dense than a liquid because there is much more space between the particles in a gas than there is in a liquid.

In most cases, the liquid state of a substance is less dense than the solid state of the same substance. One exception is water. In solid water (ice), the particles are spaced farther apart than they are in liquid water. That is why ice floats on liquid water. ✓

How can you compare the density of liquids?

Less dense liquids float on top of denser liquids. For example, olive oil is less dense than water. If you add olive oil and water to a glass, the olive oil would float on top of the water.

How does temperature affect density?

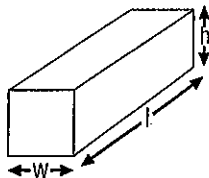
You know that the particles of a substance spread out more as the temperature rises. This means that a substance gets less dense as energy is added to it. Think of a hot air balloon. As energy is added to the air inside the balloon, the heated air gets less dense than the air outside the balloon. That is why a hot air balloon floats.

How do you find the density of an object?

Density is the amount of mass in a given volume. This means that you can find the density of a substance if you know its mass and its volume.

To measure the *mass* of a solid object, you use a balance. Measuring the *volume* of a solid object depends on its shape.

- ◆ If the object has a simple shape, for example a block, you can use math to find its volume. For a block, you multiply the length of the block by its width and by its height.



volume of a block = length \times width \times height

- ◆ If the object has an irregular shape, for example a juice bottle, you use a technique called displacement. **Displacement** is the amount of space that an object takes up when it is placed in a fluid. The amount of fluid that is displaced by an object is equal to the volume of the object. So if you put a bottle into a pail of water, and if 25 mL of water spill out (are displaced) from the pail, the volume of the bottle is 25 mL. ✓

How do you find density if you know the mass and the volume?

Density equals the mass of something divided by its volume. In other words:

$$\text{density } (D) = \frac{\text{mass } (m)}{\text{volume } (V)} \text{ or } D = \frac{m}{V}$$

The mass units for solids, liquids, and gases are often grams (g) or kilograms (kg). If the object is a solid, the volume units are often cubic centimetres (cm³). For example, lead has a density of 11 g/cm³. Water has a density of 1 g/mL.

If the object is a fluid, the volume units are often millilitres (mL).

✓ Reading Check

2. How would you use displacement to find the volume of a solid?

Use textbook pages 260–265.

Go with the flow

Vocabulary

cubic centimetres (cm ³)	g/mL
denser	mass
density	millilitres (mL)
displacement	particles
float	rise
fluids	volume
g/cm ³	water

Use the terms in the vocabulary box to fill in the blanks. Use each vocabulary term once only. You will not need to use every term.

- _____ can flow because they do not have a fixed shape.
- The _____ of an object is the amount of mass contained in a given volume.
- The key to density is the spaces between the _____. The denser an object is, the more closely packed together the particles are in the object.
- A less dense substance will _____ on a denser substance if the two substances do not mix together.
- As a rule, substances are _____ in their solid state than in their liquid state. An exception to this rule is _____.
- To calculate the density of an object, you need to divide its _____ by its _____.
- The _____ method can be used to find the volume of an irregularly-shaped object.
- The units for density can be _____ or _____.

Name _____

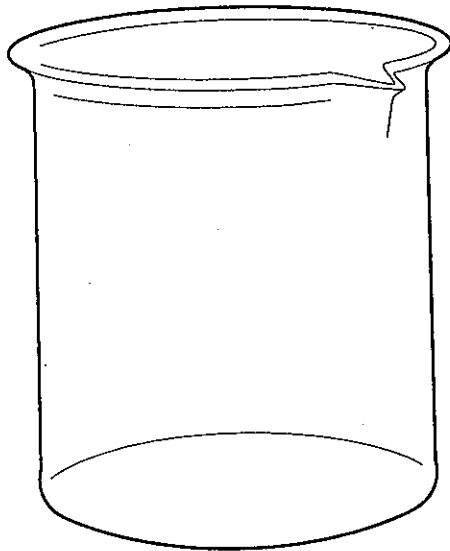
Date _____

Use with textbook pages 260–265.

Dense, denser, densest

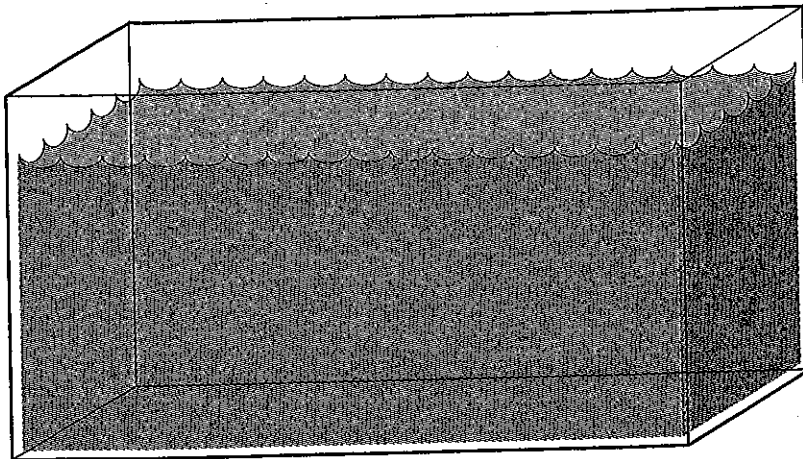
Complete and label the diagrams according to the instructions below.

1. The table below lists the densities of five different fluids. If the fluids were added to a beaker, how would they be layered? Draw and label the layers in the beaker below.



Substance	Density (g/mL)
gasoline	0.69
glycerol	1.26
corn syrup	1.40
vegetable oil	0.92
rubbing alcohol	0.79

2. Water has a density of 1.00 g/mL. Draw and label each of the following objects in the tank of water. Show whether they will sink or float.



Object	Density
cork	0.24 g/cm ³
ice	0.92 g/cm ³
gold ring	19.32 g/cm ³
block of wood	0.66 g/cm ³
marble	2.5 g/cm ³

Use textbook pages 264-265.

Density detective

Use your detective skills to find the identity of the mystery objects. First calculate the density of the object. Then use the Table of Densities to decide what the object is made of.

Table of Densities

Solids	Density (g/cm ³)	Solids	Density (g/cm ³)
marble	2.56	copper	8.92
quartz	2.64	gold	19.32
diamond	3.52	platinum	21.4

1.



While digging in the backyard, you find an old coin. Its mass is 26.76 g and its volume is 3 cm³. What is the density of the coin?

2.



You think you have found a diamond. Its mass is 5.28 g, and its volume is 2 cm³. What is the density of the object?

Calculation:

Calculation:

What is the coin made of? _____

What did you find? _____

3.



You find a ring with a mass of 107 g. You fill a graduated cylinder up with 10 mL of water and put the ring into the cylinder. The water rises up to the 15 mL mark. What is the density of the ring?

4.



There is a block on your desk that acts as a paperweight. Its measurements are: 3 cm by 4 cm by 6 cm. The block has a mass of 184.32 g. What is the density of the block?

Calculation:

Calculation:

What is the ring made of? _____

What is the block made of? _____