

## Density

If you have ever been in a crowded movie theater or shopping mall, you are familiar with the idea of **density**. Picture your school classroom with only five students in it. Now think of that same classroom with 30 students in it. The classroom is the same size in each case, but the number of people is different. Which classroom situation has a higher density? If you said the class of 30 students, you are correct. More students in the same sized space means a higher **population** density.

In chemistry, density is a **physical property** of matter. Density depends on both **mass** and **volume**. The equation below shows this.

$$\text{Density} = \text{mass/volume}$$

Remember, mass is how much **matter** is in an object. Volume is the amount of **space** that an object occupies. Density can be calculated by taking the mass (usually measured in **grams**) and dividing it by the volume (usually measured in **cm<sup>3</sup>**).

Imagine the following experiment. You have a block that is 2 cm by 2 cm by 20 cm. This means that the volume of the block is 8 cm<sup>3</sup>. You place the block on a balance and find that its mass is 50 grams. You would calculate the density of the block by taking 50 g and dividing it by 8 cm<sup>3</sup>. The density of the block is 6.25 g/cm<sup>3</sup>.

The density of many common substances are known. For example, the density of water is **1.00 g/cm<sup>3</sup>**. The density of a substance determines whether that substance will sink or float if placed in a liquid like water. Substances that are less dense than water will float on its surface and substances that are denser will sink in it. Gold has a density of 19.3 g/cm<sup>3</sup>, which means it is much denser than water. Would gold sink or float if placed in water? If you answered sink, you are correct!

You can try a simple experiment involving the density of liquids at home. Take a glass and add some water to it. Then carefully pour some vegetable oil on top of the water. You will notice that the oil forms a layer on top of the water. Why would this be? It happens because oil is less dense than water, so it is able to float on top of it. If you were to add some other objects to this glass they would float or sink according to their densities.

Water in its liquid form is called ice. A unique property of water is that solid water is **less** dense than liquid water. This means that ice floats. You have probably observed this when drinking a glass of ice water. The density of ice is very important to living things. During the winter lakes form layers of ice on the surface, but there is still liquid water (which is more dense) below. This allows fish and other animals to survive during the winter.

Name \_\_\_\_\_

Date \_\_\_\_\_

## Density Questions

1. True or False. You can observe the concept of population density in a movie theater.
2. If there are five people in a store at the mall and then 10 more people come in, has the store become more or less dense with people?
3. What two things does density depend on?
4. Mass is usually measured in \_\_\_\_\_.
5. If you have something with a mass of 20 g and a volume of 5 cm<sup>3</sup>, what is that object's density (g/cm<sup>3</sup>)?
  - a. 25
  - b. 15
  - c. 4
  - d. .25
6. What is the density of water?
7. Would a liquid with a density of 2 g/cm<sup>3</sup> sink or float when added to water?
8. As water freezes it becomes \_\_\_\_\_ dense.
  - a. more
  - b. less
9. Ice \_\_\_\_\_ in water.
  - a. floats
  - b. sinks
10. Why is the density of ice important to living things living in a lake during the winter?

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## Density Answers

1. **True** or False. You can observe the concept of population density in a movie theater.
2. If there are five people in a store at the mall and then 10 more people come in, has the store become **more** or less dense with people?
3. What two things does density depend on? **Mass and volume**
4. Mass is usually measured in **grams**.
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8. As water freezes it becomes \_\_\_\_\_ dense.
  - a. more
  - b. less**
9. Ice \_\_\_\_\_ in water.
  - a. floats**
  - b. sinks
10. Why is the density of ice important to living things living in a lake during the winter?  
**Because ice is less dense than water it forms at the surface and living things can still survive in the water below.**