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Warm-Up | Density

Lesson Question

Lesson Goals

Use density to identify an _____ substance.

Calculate the _____ of an object.

Determine whether an object will _____ or _____.

Explain the physical _____ of density.

Words to Know

Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.

_____ derived

_____ relative

_____ density

_____ mass

_____ volume

A. the amount of matter in an object

B. the amount of space an object takes up

C. obtained from something else

D. the amount of mass in a given volume

E. compared to something else

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Physical Properties of Matter

- A [ ] is a characteristic of a substance that can be [ ] and that does [ ] the [ ] of the substance.
- Examples of physical properties include
  - color,
  - [ ],
  - odor,
  - [ ] point,
  - [ ] point, and
  - conductivity.

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Mass

[ ] is the amount of matter in an object.

- The mass of an object is [ ].
- Mass is [ ] with a [ ].
- Common units for mass are [ ] and [ ].

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Volume

[ ] is the amount of space that an object takes up.

- Volume is [ ] for [ ] and [ ]; it varies for gases.
- The volume of an object can be measured in many ways.
  - For a [ ], use formulas like $V = lwh$ or $V = Bh$.
  - For an [ ], use the water displacement method.
  - For a [ ], use a graduated cylinder.
- Common [ ] for volume include cubic centimeters, [ ], and liters.

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Density

- [ ] is the amount of mass in a given volume.
- It is a [ ] unit of measure, meaning the measurement is obtained from a combination of two other characteristics of an object—its mass and volume.
- It is equal to mass divided by volume.

$$\square = \frac{M}{V}$$

- It is measured in units such as grams per cubic centimeter and grams per milliliter.

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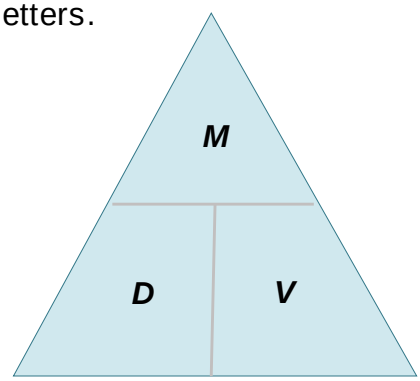
The Density Triangle: Strategy

- Use the [ ] to solve for density, mass, or volume.
  - Determine which [ ] you need to solve for.
  - Cover up the [ ] value.
  - Create the equation using the remaining letters.

$$\square = \frac{M}{V}$$

$$\square = D \times V$$

$$\square = \frac{M}{D}$$



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The Density of Gold: Example

Mass of [ ] = 154.4 g

Volume of [ ] = 8.0 cm^3

$D =$ [ ]

$D = \frac{154.4\ g}{8.0\ cm^3}$

$D =$ [ ]

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The Mass of Olive Oil: Example

Volume of [ ] = 1,000 mL

Density of [ ] = 0.9 g/cm^3 or 0.9 g/mL (1 cm^3 = [ ])

$M =$ [ ]

$M = 0.9\ g/mL \times 1{,}000\ mL$

$M =$ [ ]

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The Volume of Water: Example

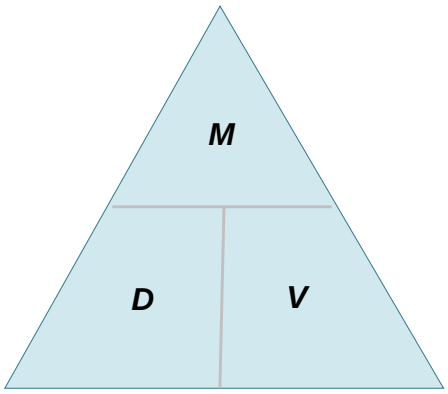
Mass of water = 357 g

Density of water = 1.0 g/cm^3 or 1.0 g/mL (☐ = 1 mL)

$V =$ ☐

$V = 357\ \text{g} \ / \ 1.0\text{mL}$

$V =$ ☐



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Gold or Iron Pyrite: Example

Complete the table to determine which sample is gold and which is iron pyrite.

Sample A	Sample B
Volume = 5.0 cm^3	Volume = 5.0 cm^3
Mass = ☐	Mass = ☐
$D =$ ☐	☐ $= \frac{M}{V}$
$D = \frac{\square}{5.0\ \text{cm}^3}$	$D = \frac{25.0\ \text{g}}{\square}$
$D =$ ☐	$D =$ ☐

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Gold or Iron Pyrite: Example, Continued

- Gold is four times denser than pyrite.
- The densities of gold and pyrite have a ratio of 4:1.
- Sample A is _____.

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Relative Density

_____ density is used to separate solids, liquids, and gases. The term *relative* means to be compared to something else. So when you look at relative density, you are comparing the densities of different substances.

- The _____ in the container rises to the _____ because it has the _____ density.
- The _____ separate into individual _____ based on their relative densities.
  - The _____ dense liquid is on _____.
  - The _____ dense liquid is on _____.
- The _____ sink to the _____ of the container because they have the _____ density.

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Sinking vs. Floating

Objects may _____ or _____ in a liquid.

- Objects sink when their density is _____ the density of the surrounding liquid.
- Objects float when their density is _____ the density of the surrounding liquid.

Sinking or Floating: Example

Density of water = 1.0 g/cm^3

Density of honey = 1.4 g/cm^3

Honey is denser than water, so it sinks in water.

Write S or F to tell whether each object will sink or float in water and honey.

Object	Density	Water	Honey
Pumice	0.7 g/cm^3		
Quarter	8.9 g/cm^3		
Rubber toy	1.2 g/cm^3		

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Summary | Density

Lesson Question	What is density?

Answer

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Review: Key Concepts

	Definition	Units
Mass	The amount of [ ] in an object	g kg
Volume	The amount of [ ] an object takes up	cm^3 mL L
Density	The amount of [ ] in a given [ ]	$D = \frac{M}{V}$

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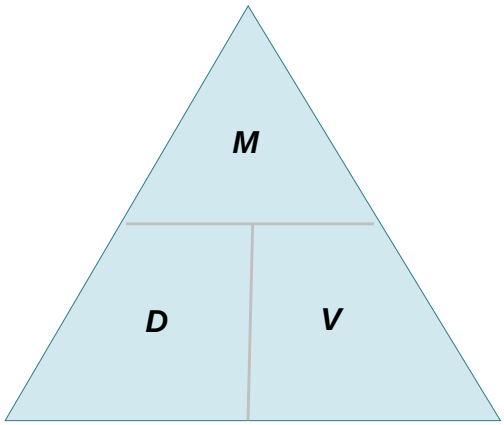
Review: Density Triangle



Use the _____ to solve for density, mass, or volume.

- Determine which _____ you need to solve for.
- Cover up the _____ value.
- Create the _____ using the remaining letters.
  - $D =$ _____
  - $M =$ _____
  - $V =$ _____

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Review: Relative Density

[ ] compares the density of one material to that of another.

Relative density can be used to determine whether an object will [ ] or [ ] in a liquid.

- An object [ ] when its density is greater than that of the surrounding liquid.
- An object [ ] when its density is less than that of the surrounding liquid.

Use this space to write any questions or thoughts about this lesson.

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