

# Introduction to Chemistry and the Properties of Matter

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Physical Science 3rd grade  
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## Matter is Around You

- Matter is anything that has mass and takes up space
  - Mass is the amount of matter an object has. Measured in grams and Kilograms. This is not the same as weight!!
- Everything you can see around you is made up of tiny molecules.

## The Phases of Matter

- There are 4 phases that matter can exist in:
  - Solid, Liquid, Gas & Plasma

How does the motion of particles and their attraction to each other



How does the energy of the particles affect their motion?

## Solids

- Retain a fixed volume and shape
  - Not easily compressible
  - Not very fluid
  - Internal particles have little free space and show only rotational motion.



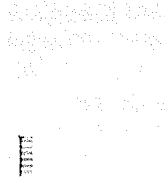
# Liquids

- Assumes the shape of the part of the container which it occupies.
- Liquids have a definite volume. Some typical measurements gallons, ounces, cups, milliliters (ml), liters (l).
  - Internal molecules have higher energy and can move around each other



# Gases

- Gases have neither a determined shape nor a definite volume. Gases assume the shape and volume of a closed container.
  - Particles have higher energy than those of a solid or liquid. They move the fastest and farthest.



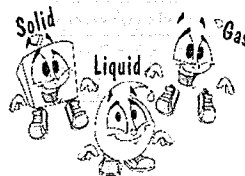
# Plasma

- Plasma is different from a gas, because it is made up of groups of **positively and negatively charged particles**.
  - The most common state of matter in the universe, but the least common found on earth.
    - Examples: The Northern Lights, bulbs



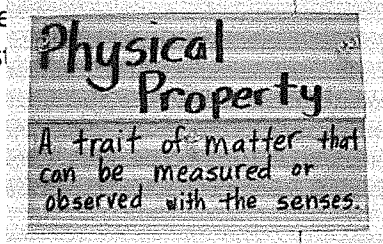
## Comparison the States of Matter

	Solid	Liquid	Gas	Plasma
<ul style="list-style-type: none"> <li><a href="http://www.ck12.org/physics/States-of-Matter/">http://www.ck12.org/physics/States-of-Matter/</a></li> </ul>	Ice $H_2O$	Water $H_2O$	Steam $H_2O$	Ionized Gas $H^+ + H^+ + 2e^-$
	Cold $T < 0^\circ C$	Warm $0 < T < 100^\circ C$	Hot $T > 100^\circ C$	Hotter $T > 100,000^\circ C$ (100,000 times hotter)
<ul style="list-style-type: none"> <li><a href="http://www.wikiup.com/wikiup/States-of-Matter/">http://www.wikiup.com/wikiup/States-of-Matter/</a></li> </ul>	Molecules Fixed in Lattice	Molecules Free to Move	Molecules Free to Move, Large Spacing	Ions and Electrons Move Independently, Large Spacing



## Physical Properties of Matter

- Substances have characteristic properties. Some of these properties include color, odor, phase at room temperature, density, solubility, heat and electrical conductivity, hardness, and boiling and freezing points.
- These physical properties identify certain substances.



## Density

- Density is the amount of matter (particles) per unit volume

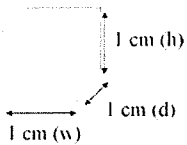
– Density = Mass / Volume (D = M/V)

Densities of Common Elements and Compounds

Substance	Density grams per mL
Pine wood	0.35 - 0.50
Water	1.00
Salt, NaCl	2.16
Aluminum, Al	2.70
Iron, Fe	7.80
Gold, Au	19.30
Mercury, Hg	13.5

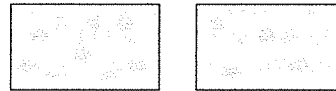
## Volume

- Volume is the amount of space something takes up

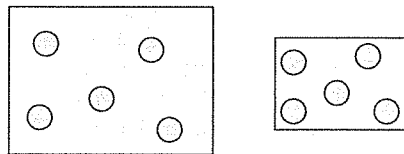


## Density

- If two objects have equal volume, but one has more mass, the one with more mass is denser.



Which is more dense?



The units for expressing density are: g/ml or g/cm<sup>3</sup>

## How to calculate density

- What is the density of a piece of wood that has a mass of 25.0 grams and a volume of 29.4 cm<sup>3</sup>?

–  $D=M/V$

–  $D= 25.0 \text{ g} / 29.4 \text{ cm}^3$

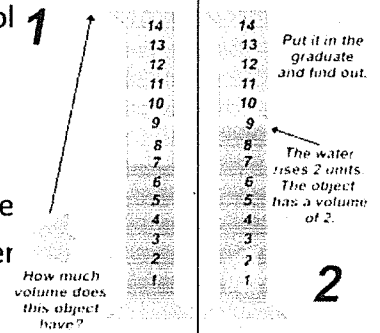
–  $= 0.85 \text{ g/cm}^3$

- A piece of wood that measures 3.0 cm by 6.0 cm by 4.0 cm has a mass of 80.0 grams. What is the density of the wood? Would the piece of

## How to Calculate Density: Water displacement method

- How do you determine the volume of an irregular shaped object **1**

- By measuring the increased height of the water in the graduated cylinder you can find the volume of the object.



## Practice Questions:

- An ice cube measuring 5.80 cm by 5.80 cm by 5.80 cm has a density of 0.917 g/mL. What is the mass?
- A cup of gold colored metal beads was measured to have a mass 425 grams. By water displacement, the volume of the beads was calculated to be 48.0 cm<sup>3</sup>. Given the following densities, identify the metal.
  - Gold: 19.3 g/ml. Copper: 8.96 g/ml.
  - Iron: 7.87 g/ml.
- The density of aluminum is 2.70 g/mL. If the mass of a piece of aluminum is 244 grams, what is the volume of the aluminum?