Density, Mass, Volume Notes
Review-Just Read

- **Matter**: anything that has **mass** and takes up space (**volume**)
- **Everything** in the universe is made of matter
- Made of tiny particles called atoms
Physical Properties

All forms of matter have chemical and physical properties.

**Physical Property** is anything that can be observed without changing the identity of the substance. Examples are melting point, boiling point, freezing point, color, odor, hardness and **density**.
Density

• **Density**: A measure of how much mass is contained in a given volume. Density is a physical property.

• Density = Mass

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  Volume
Density is IMPORTANT

• **Physical property** that can be used to identify a substance.
• Floating, objects float if LESS dense than the liquid it is placed in

Discussion:
Is a life preserver more dense than your body?
Density Notes Continued

• Density is made up of two measurements
  1. Mass
  2. Volume

• Units are:
  – Solid object: grams per cubic centimeter (g/cm³) OR
  – Liquid: grams per milliliter (g/mL).

• 1 cm³ = 1 mL

• Water’s density is 1 g/mL (or 1 g/cm³)
Think about it...

• Which is more dense: Salt water or fresh water?

• Talk with your elbow buddy and come up with an explanation
Calculating Density
Show your work

• **(1)** What is the density of a wood block with a volume of 100 cm$^3$ and a mass of 25 g?
Rule 1: If you pack more mass into the same volume, it’s more dense

• How does this relate to you?
  – Think about packing your suitcase for vacation full of clothes. You are able to close it easily but you go shopping while on vacation and you have to stuff everything into your suitcase. It still closes, but it is heavier.
    • Did the mass change? Talk to your table
      – YES
    • Did the volume change?
      – NO
    • Is it more or less dense?
      – More dense
Rule #2: If you pack the same mass into a smaller volume, it’s more dense

• How does this relate to you?
  – Think of a styrofoam cup. You jump on the cup until it’s crushed a bit.
    • Did the volume change?
      – Yes, it’s squished and it’s smaller now
    • Did the mass change?
      – No, it would still weight the same
    • Is it more or less dense?
      – It is more dense
Rule #3: Just because something has more mass does not mean it’s more dense

- Scenario: I have a bag of sytrofoam packing chips and I have a paper clip.
  - Which is more dense?
    - The paper clip
  - How could you tell if some substance was denser than another substance?
    - Depends on how much mass is packed into a volume
Measuring Mass

• Mass is usually measured with a balance.
• Quick Facts about Mass
  – Mass is the measure of the amount of “stuff in something”
  – Your mass will not change even if you went to outer space
Measuring Weight

• Weight is measured using a weight scale.
• Weight is interrelated with mass. The weight of mass (or matter) is the force that the earth pulls on the mass (or matter)
  – Quick Facts about Weight
    • Your weight will change based on the gravitational pull. For example, your weight will change if you go to the moon because gravity is different then on Earth.
Practice

A cube has a mass of 2.8g and occupies a volume of 3.67mL. Would this object float or sink in water?

• This object would ________________ in water because its density is ________________ than water whose density is ________________.
More Practice

1. Blocks A, B, C, D were placed in water (D=1.0 g/mL). One of the blocks floated while the other sank. Which block floated? Justify your answer.
More practice

2. A student is given 3 solid samples to identify. He measures the mass and volume of each sample. The data is recorded in the table below. He then uses a chart of densities of known substances (shown in the chart below) to identify the solids. According to his data, what are the identities of the unknown substances?

<table>
<thead>
<tr>
<th>Solid Samples</th>
<th>Mass</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>0.50 g</td>
<td>0.29 mL</td>
</tr>
<tr>
<td>Sample 2</td>
<td>2.81 g</td>
<td>0.36 mL</td>
</tr>
<tr>
<td>Sample 3</td>
<td>3.54 g</td>
<td>1.31 mL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Densities of Known Substances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Aluminum</td>
</tr>
<tr>
<td>Copper</td>
</tr>
<tr>
<td>Zinc</td>
</tr>
<tr>
<td>Gold</td>
</tr>
<tr>
<td>Iron</td>
</tr>
<tr>
<td>Lead</td>
</tr>
<tr>
<td>Magnesium</td>
</tr>
</tbody>
</table>