

Chapter 2 Section 2: Properties of Matter (pages 45-52)

Define the following terms using section 2:

melting point

boiling point

density

reactivity

flammability

physical properties (pg 45)

chemical properties (pg 50 second paragraph)

state (*italics* bottom of 46)

common states of matter (bottom of 46)

equation for density (pg 47)

common density measurement for liquids and solids (pg 48)

Density Worksheet

Name _____ Section _____
Chemistry 101

Density is the **ratio** of the **mass** of the substance to the **volume** of the substance at a given temperature. Density has units of g/cm^3 or g/mL for liquids and solids, and g/L for gases.

1. A gold-colored ring has a mass of 18.9 grams and a volume of 1.12 mL. Is the ring pure gold? (The density of gold is 19.3 g/mL.)
2. What volume would a 0.871 gram sample of air occupy if the density of air is 1.29 g/L?
3. Pumice is volcanic rock that contains many trapped air bubbles. A 225 gram sample occupied 236.6 mL. What is the density of pumice?

Will pumice float on water? The density of water is 1.0 g/mL.

4. A cup of sugar has a volume of 237 mL. What is the mass of the cup of sugar if the density is 1.59 g/mL?
5. Which has the greater mass, 1 liter of water or 1 liter of gasoline? The density of water is 1.00 g/mL and that of gasoline is approximately 0.68 g/mL.
6. A crumpet recipe calls for 175 grams of flour. According to Julia Child's data, the density of flour is 0.620 g/mL. How many mL of flour are needed for this recipe?

Density

Density: The amount of matter ("stuff") in a given volume (amount of space). To calculate the density of an object, you need to divide the mass of the object by its volume.

$$\text{Density} = \frac{M}{V}$$

(Common) Units of Density: g/cm³, g/mL.

Mass:

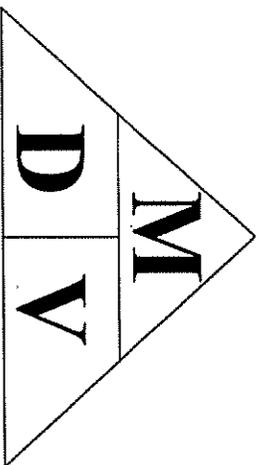
With many objects, mass can be measured using a balance or a scale. If the material is a liquid, you would need to subtract the mass of the container.

Volume:

To measure volume of a regular sized object measure the height, width and length of the object and multiply these three dimension. For a irregularly shaped object, use a graduated cylinder and find the displacement of the object.

Formulas for Density, Mass and Volume:

The triangle of mass, density and volume allows for you to solve for any one of these



$$\text{Density} = \frac{\text{mass}}{\text{volume}} \quad D = \frac{m}{v}$$

$$\text{Mass} = \text{density} \times \text{volume} \quad M = d \times v$$

$$\text{Volume} = \frac{\text{mass}}{\text{density}} \quad v = \frac{m}{d}$$

Density of Water = 1 g/cm³
 if an object's density < 1 g/cm³, it will **float**
 if an object's density > 1 g/cm³, it will **sink**

Fill in the blanks with the proper formula and then its proper number.

Place an X in the column if the substance will float or sink in water. Give proper units for each answer (g, cm³, g/cm³). Round answers to the tenths place.

Formula	Mass	Volume	Density	Sink?	Float?
d = m/v	12 g	0.5 cm ³			
v = m/d	16 g		0.2 g/cm ³		
m = d x v		5 cm ³	20 g/cm ³		
v = m/d	0.9 g		0.3 g/cm ³		
d = m/v	6 g	4 cm ³			
d = m/v	8 g	1.8 cm ³			
m = d x v		13 cm ³	9 g/cm ³		
d = m/v	14.7 g	15 cm ³			
m = d x v		2 cm ³	1.1 g/cm ³		
v = m/d	17 g		3 g/cm ³		

Chapter 2 Section 2 Properties of Matter

Physical Properties

- Mass, volume, and density are _____ of matter.
- Matter can also be described in terms of the _____ of a physical property.
Example: A physical property of air is that it is colorless.

Physical properties describe matter

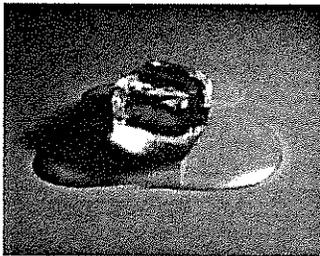
- Physical properties can be observed or measured to help identify a substance.

You can use your senses to observe:

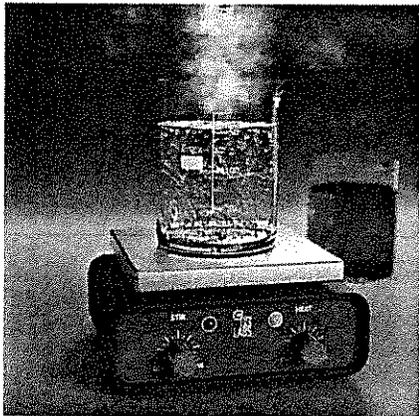
- _____
- _____
- _____
- _____

Other physical properties are measurable (not by your senses)

- _____: the temperature and pressure at which a solid becomes a liquid.
Example: Ice



- _____: the temperature at which a liquid becomes a gas.



More Physical Properties...

- strength
- hardness

ability to conduct:

- _____
- _____
- _____

Many physical properties remain constant for *pure substances*

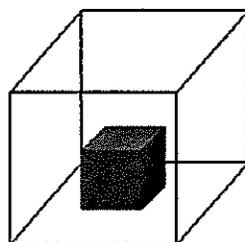
- You can use _____ or _____ of these properties to identify a substance.

Example:

At room temperature and atmospheric pressure, all samples of pure water are colorless and liquid; pure water is never a powdery green solid.

- _____ : the physical form in which a substance exists is a physical property.

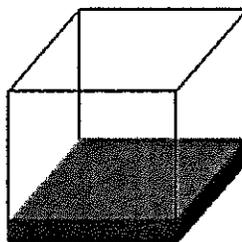
States of Matter



Solid

Holds Shape

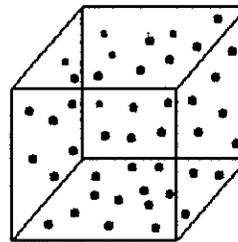
Fixed Volume



Liquid

Shape of Container
Free Surface

Fixed Volume



Gas

Shape of Container

Volume of Container

Density is a physical property

- _____ is the ratio of the mass of a substance to the volume of a substance.
 - The amount of "stuff" (mass) in a certain amount of space (volume).

Formula for Density is $D = m/V$

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Density is often measured in units of _____

- Water has a density of 1 g/cm^3**
 - Anything that is below 1 g/cm^3 will float.
 - Ice that weighs $.92 \text{ g/cm}^3$ will float because .97 is less than 1.
 - Anything above 1 g/cm^3 will sink.
 - Iron with 7.86 g/cm^3 will sink because 7.86 is greater than 1.
- A cubic centimeter (cm^3) contains the same volume as a _____ (mL).**
- You may see the density of water also expressed as 1 g/mL .**

Chapter 2 Sec 2 Review Questions:

1. Classify the following as either chemical or physical properties.

- a. is shiny and silvery
- b. has a density of 2.3 g/cm^3
- c. melts easily
- d. tarnishes in moist air

2. Identify which of the following properties *are not* chemical properties.

- a. reacts with water
- b. boils at 100°C
- c. is red
- d. does not react with hydrogen

3. Describe several uses for plastic, and explain why plastic is a good choice for these purposes.

4. Describe characteristic properties, and explain why they are important. List some characteristic properties.

5. Calculate the density of a rock that has a mass of 454 g and a volume of 100 cm^3 .

6. Calculate the density of a substance in a sealed 2500 cm^3 flask that is full to capacity with 0.36 g of a substance.

7. Critical Thinking Suppose you need to build a raft. Write a paragraph describing the physical and chemical properties of the raft that would be important to ensure your safety.

Skills Worksheet

Concept Review

Section: Properties of Matter

1. Classify each of the following as a physical or chemical property of sulfur.

- _____ a. Its density is 2.97 g/cm^3 .
- _____ b. It reacts with hydrogen to form a gas.
- _____ c. It is a yellow solid.
- _____ d. Its melting point is 112°C .
- _____ e. It combines with oxygen.

2. Classify each of the following as a physical or chemical property of phosphorus.

- _____ a. It is a white, waxy solid.
- _____ b. It burns in air.
- _____ c. Its melting point is 44.1°C .
- _____ d. It has a density of 1.82 g/cm^3 .
- _____ e. Its boiling point is 280.3°C .

3. Explain how aluminum is a suitable material to use in making cans based on its physical and chemical properties.

4. Calculate the mass of a sample of pure silver (density = 10.49 g/cm^3) that has a volume of 12.99 cm^3 .

5. Compute the density of an 820 g sample of pure silicon occupying a 350 cm^3 container.

6. Describe how the characteristic properties of a piece of ice are different from its other properties.

