

**Bell Work, Oct 7 - 10, 2013**

**Mass and Volume (Density), Science  
Project**

# Bell Work, Monday, Oct 7, 2013

## 1. Define Density

Density is the amount of mass that occupies 1 unit of volume. If our unit of volume is milliliters, then density the amount of mass that occupies 1 mL.

Mathematically:  $\text{Density} = \frac{\text{mass}}{\text{volume}}$  or  $D = \frac{m}{v}$

Example: 1 g of water occupies 1 mL. The density is 1 g per mL and is written  $1 \frac{g}{mL}$  or 1 g/mL or  $\frac{1 g}{1 mL}$

## 2. What is the relationship between mass, density and particles?

Mass is the amount of particles that make up a particular sample of matter.

Density is the number of particles that occupies one unit of volume.

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## 3. Define characteristic properties.

Characteristic properties are properties that are unique to each substance and can be used to i.d. a substance. Some examples of these properties are:

- Density – amount of mass per unit volume.
- Boiling Point – temperature that the stuff boils.
- Melting/ Freezing Point- temperature that the stuff melts/ freezes.

## 4. For a given substance, such as aluminum, does density change when the size of the sample changes or is the density the same for all samples of a substance?

Why?

Density is always the same for each unique substance. Example: density of aluminum always 2.70 g/ mL, water always = 1 g/mL for all masses of water & aluminum. This is because density is a characteristic property unique to each substance.

# Bell Work, Tues Oct 8, 2013

**1. Below is a list of substances and their densities:**

**water            1.00 g/mL**

**iron             7.87 g/mL**

**lead            11.34 g/mL.**

**You are given a 1.00 kilogram sample of each.**

**Which sample has the greatest mass?**

**a.     The water**

**c.     The iron**

**b.     The lead**

**d.     They all have the same mass.**

**2. Which sample has the greatest volume?**

**(leave space to answer this question later this week)**

# #2, Tues Oct 8, 2013

You are given a 1.00 kilogram sample of each.

water 1.00 g/mL

iron 7.87 g/mL

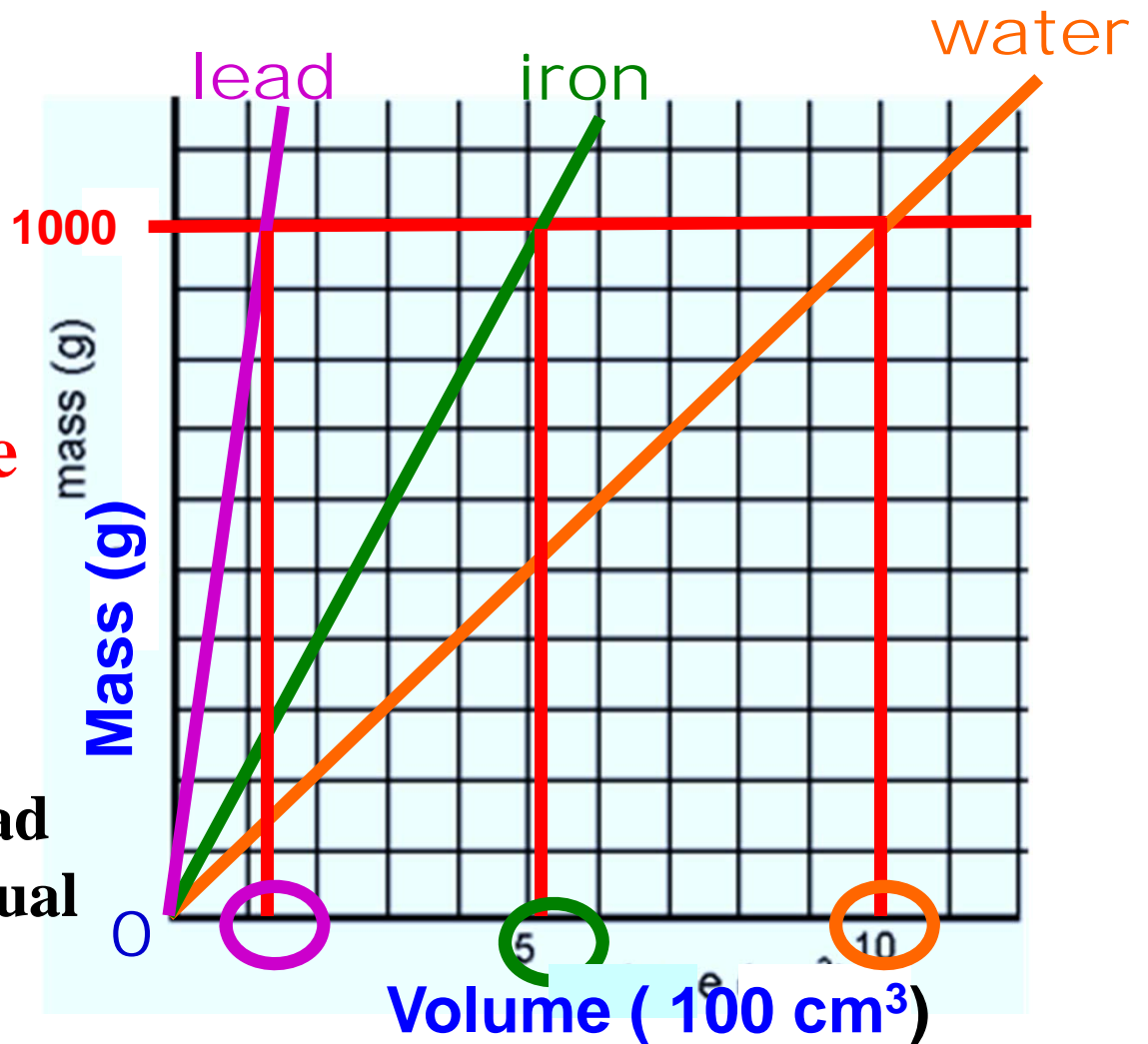
lead 11.34 g/mL

2. Which sample has the greatest volume?

Density is the slope of the line.

1 kg of water has the greatest volume.

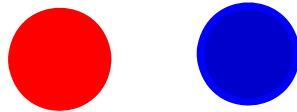
(note: the slopes of iron & lead are not plotted with their actual slopes. Their positions are shown relative to water.)



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**3. List some important properties of the particle model that help explain the different densities of different substances.**

**a) matter is comprised of particles that have mass and take up space.**



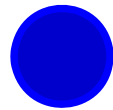
Mass is a measure of the number of particles present.



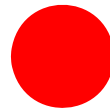
Volume is a measure of the space the particles take up.

**b) The particles cannot be divided.**

**c) Some particles have more mass than others particles,**

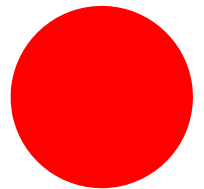


**1 mass unit**



**5 mass unit**

**d) and some particles take up more space.**



## Bell Work, Wednesday, Oct 9

1. What is the relationship between mass and volume?

**Density.** You convert can between mass & volume using density.

2. The mass of a 5.00 cm<sup>3</sup> sample of clay is 11 g. What is the density of the clay?  $m = 11g$   $v = 5.00 \text{ cm}^3$

$$D = \frac{m}{v} \quad D = \frac{11g}{5.00 \text{ cm}^3} = 2.2 \text{ g} / 1 \text{ cm}^3$$

3. Find the mass of a 1.50 cm<sup>3</sup> sample of density of aluminum whose density is 2.70 g/cm<sup>3</sup>. Use density as a conversion factor.

$$m = ?g \quad v = 1.50 \text{ cm}^3$$

$$D = \frac{m}{v} \quad D = \frac{2.70 \text{ g}}{1 \text{ cm}^3}$$

Given • conversion factor = answer,

given = 1.50 cm<sup>3</sup>, density is a constant and a conversion factor.

$$1.50 \text{ cm}^3 \cdot \frac{2.70 \text{ g}}{1 \text{ cm}^3} = 1.50 \cdot 2.7 \text{ g} = 4.05 \text{ g}$$

$$\frac{1.50 \text{ cm}^3 \cdot 2.70 \text{ g}}{1 \text{ cm}^3} = 4.05 \text{ g}$$

# Bell Work, Wed, Oct 9,, 2013

4. The density of sugar is  $1.59 \text{ g/cm}^3$ . The mass of a sample is  $4.0 \text{ g}$ . Find the volume of the sample.

$$m = 4.0 \text{ g} \quad D = \frac{1.59 \text{ g}}{1 \text{ cm}^3} \quad v = ? \text{ cm}^3$$

Given  $\times$  density = answer

$$4.0 \text{ g} \cdot \frac{1.59 \text{ g}}{1 \text{ cm}^3} = 6.36 \frac{\text{g}^2}{\text{cm}^3}$$

Wrong units! Wrong answer  
Our answer should be  $\text{cm}^3$ .

Flip the density (use the reciprocal)

$$4.0 \cancel{\text{g}} \cdot \frac{1 \text{ cm}^3}{1.59 \cancel{\text{g}}} = \frac{4.0 \text{ cm}^3}{1.59} = 2.5 \text{ cm}^3$$

Correct answer



# Bell Work, Thursday, Oct 10, 2013

1. Given volume and density how do you solve for mass?

$$\text{volume} \times \text{density} = \text{mass} \qquad \text{density is } \frac{\text{mass}}{\text{volume}}$$

2. Given mass and density how do you solve for volume?

$$\text{mass} \times \frac{1}{\text{Density}} = \text{volume} \qquad \frac{1}{\text{Density}} \text{ means } \frac{\text{volume}}{\text{mass}}$$

3. Gold has a density of 19.3 g/ cm<sup>3</sup>. A cube of gold measures 4.23 cm on each edge. What is the volume of the cube?

$$4.23 \text{ cm} \times 4.23 \text{ cm} \times 4.23 \text{ cm} = (4.23 \text{ cm})^3 = 75.7 \text{ cm}^3$$

4. What is the mass of gold in #3?

$$\text{volume} \times \text{density} = \text{mass}$$

$$75.7 \text{ cm}^3 \times \frac{19.3 \text{ g}}{1 \text{ cm}^3} = 1460 \text{ g}$$

# Bell Work, Thursday, Oct 10, 2013

5. What is the volume of 1 lb. of gold. 454 g = 1 lb.

$$\text{mass} \times \frac{1}{\text{Density}} = \text{volume}$$

$$454 \cancel{\text{g}} \times \frac{1 \text{ cm}^3}{19.3 \cancel{\text{g}}} =$$

$$\frac{454 \cdot 1 \text{ cm}^3}{19.3} = 23.5 \text{ cm}^3$$

Price of gold \$1308/ 1 troy oz

1 troy ounce is equal to 31.1 g

$$454 \text{ g} / 31.1 = 14.6 \text{ troy oz}$$

$$14.6 \times \$1308 = \$19,097$$