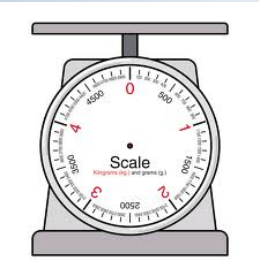
What is density?

Density has to do with the relationship between the mass and volume of an object or substance.



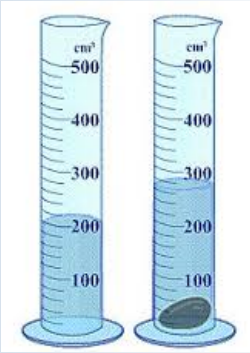
What is mass?

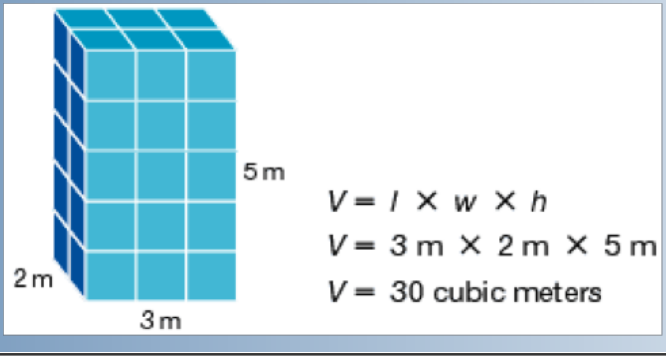
Mass is ~~how much something weighs~~.

how much matter it has.

What is volume?

Volume is how much space something takes up.





$V = l \times w \times h$

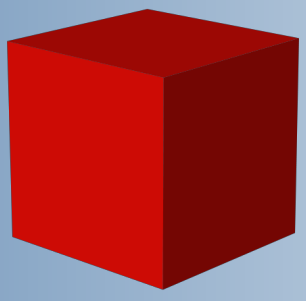
$V = 3\text{ m} \times 2\text{ m} \times 5\text{ m}$

$V = 30$ cubic meters

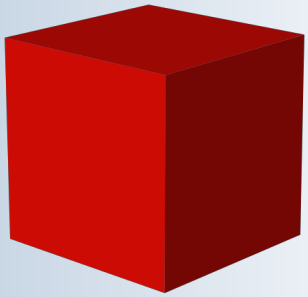
Aug 30-8:48 AM

What is density?

Cube #1 has side lengths of 2 cm, and therefore has a volume of 8 cm^3.



Cube #2 has side lengths of 2 cm, and therefore also has a volume of 8 cm^3.



Does this mean that cube #1 and cube #2 have the same density?

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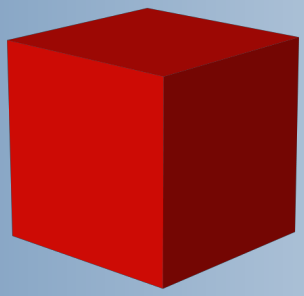
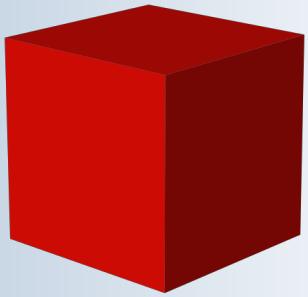
What is density?

Cube #1 has side lengths of 2 cm, and therefore has a volume of 8 cm^3.



Cube #2 has side lengths of 2 cm, and therefore also has a volume of 8 cm^3.



Does this mean that cube #1 and cube #2 have the same density?

It depends on their mass as well. If two cubes have the same volume, do they also have the same mass?

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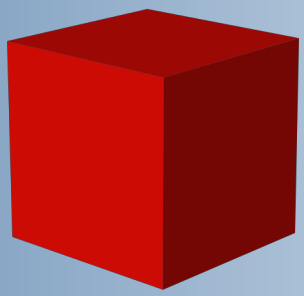
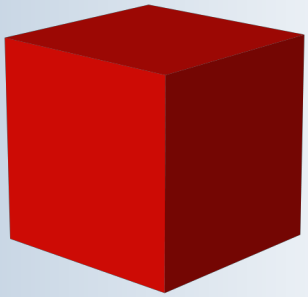
What is density?

Cube #1 has side lengths of 2 cm, and therefore has a volume of 8 cm^3.



Cube #2 has side lengths of 2 cm, and therefore also has a volume of 8 cm^3.



What if?

Cube #1 is filled with feathers.

Cube #2 is filled with rocks.

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What have we learned?

That two objects can have the same volume, but they can each have a different mass.

Objects could also have different volumes, and the same mass.

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Water has a density of 1 g/ml. Substances with a lower density then 1 g/ml will float on water. Substances with a higher density then 1 g/ml will sink.

What does that tell you about the density of an icecube?

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What if we need to know the exact density of a substance?

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$ **or** $$D = \frac{m}{v}$$

Ex #1: You have a rock with a volume of 15 cm^3 and a mass of 45 g. What is its density?

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What if we need to know the exact density of a substance?

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$ **or** $$D = \frac{m}{v}$$

Ex #2: A solution has a volume of 252 ml, and a mass of 604.8 g. What is the density?

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What if we need to know the exact density of a substance?

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$ or $$D = \frac{m}{v}$$

Ex #3: A mystery solution is 300 ml and 545 g. What is the concentration?

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How can we remember the formula?

1 - Say it over and over again (density = mass over volume)
2 - Write it down over and over again
3 - Sing it?

http://www.youtube.com/watch?v=FSupQZQqaPk

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Notes

Density

The density of a substance (solid, or a liquid) can be determined by looking at the relationship between the mass and volume of that substance.

Mass is how much something weighs. It is usually measured in g or kg.

Volume is how much space something takes up and is measured in units^3 (ex: cm^3 or m^3) or mL or L.

Density is the measurement of the compactness of an object. The units of density are g/cm^3 for solids, and g/mL for liquids.

We use this triangle to help us find out the density (or mass or volume) of a substance.

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

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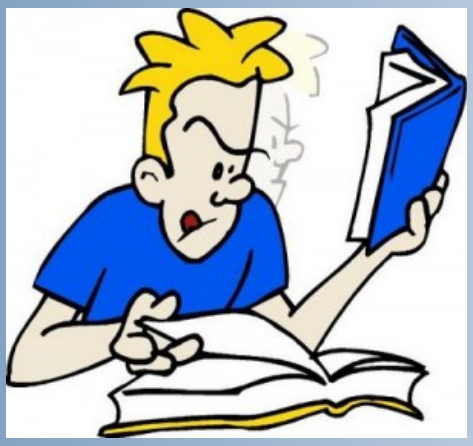
Time to look over our steps to solving Density Word Problems and to try some problems on your own.



Aug 30-8:48 AM

Density Review

1. Find the density of an object that has a mass of 600 g and a volume of 250 cm^3.

$$D = \frac{m}{v}$$

2. An object has a density of 19.3 g/cm^3. If it has a mass of 42 g, what is its volume?

3. A liquid has a volume of 1.2 L and a density of 24 g/ml, what is the mass of the liquid?

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Your turn!

Remember to use the triangle (cover what you are looking for)

Don't forget your units!

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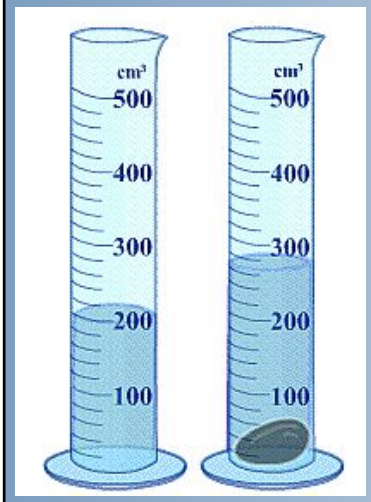
More special cases with density...



A rock has a mass of 135 g. When placed in 200 ml of water, the water level rises to 260 ml. What is the density of this rock?

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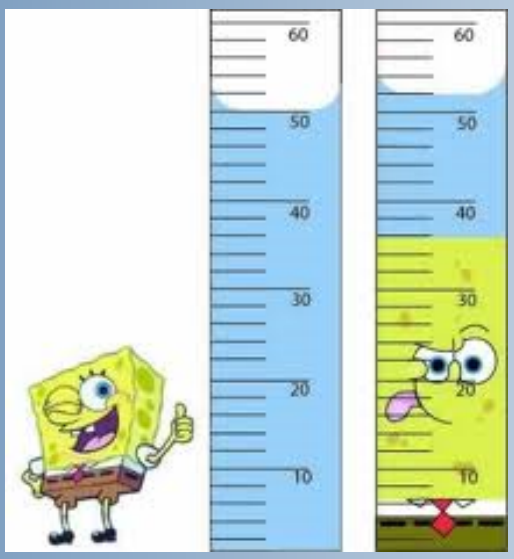
More special cases with density...



If a sponge has a density of 1.5 g/ml, what is it's mass?

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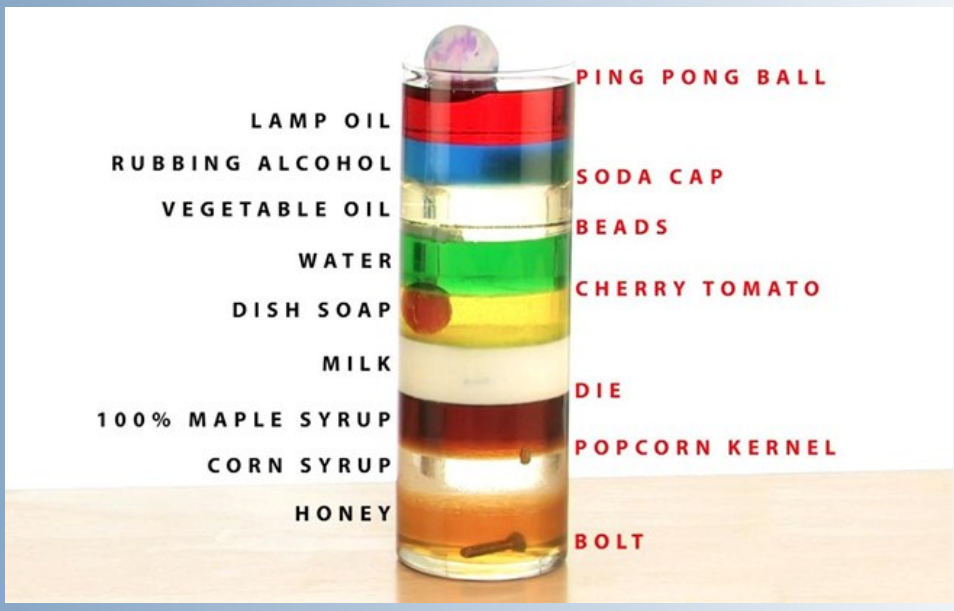
What observations can be made about the following liquids and solids?



With a partner, come up with three statements about the densities of different objects and liquids listed above. I will choose four different people to share what they and their partner came up with.

Remember, higher densities sink and lower densities float.

Aug 30-8:48 AM

Density of Matter

How tightly packed matter is. The amount of mass in a given space.

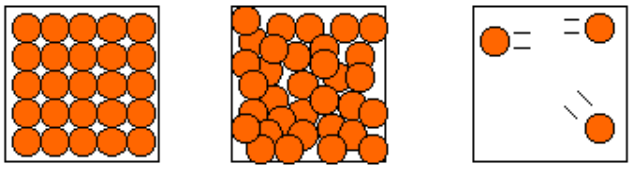
Aug 30-8:48 AM

Matter and Particles

Water, air, and those materials that make up your desk are all made of matter.

Even us, we ourselves are made of matter.

Basically anything that takes up space and has mass is matter.

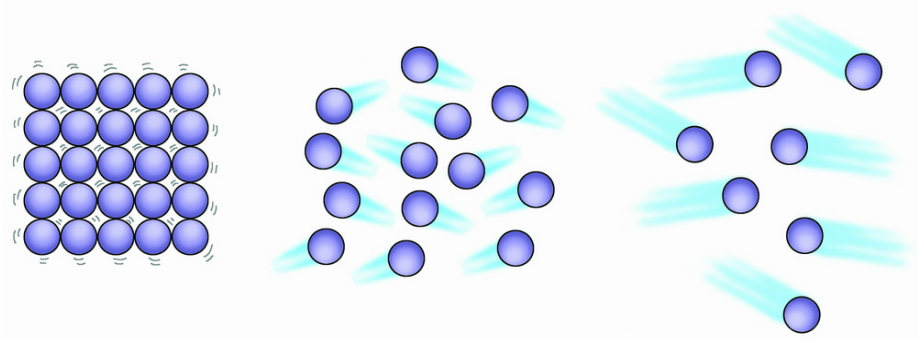


Sep 4-2:33 PM

The Particle Model

Models help us to understand how things work.

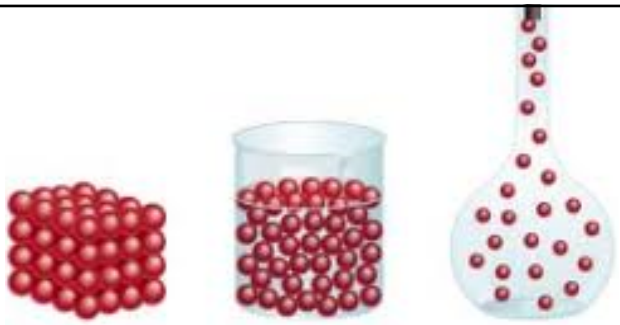
The Particle Model helps us to see that matter is:
- made up of particles that are extremely small,
- that these particles are in constant movement,
- that when there is an increase in temperature the movement of the particles increase and
- that particles may be held together by forces of attraction.



Sep 11-2:46 PM

Solids, liquids, and gases are made up of very tiny particles.

The diagrams below show how we think the particles are arranged in solids, liquids, an gases.



The particles are always moving. The particles in a gas move much faster than the particles in a solid.

These three groups are called the states of matter.

Many materials exist in all 3 states, it just depends on the temperature. Water is a good example.

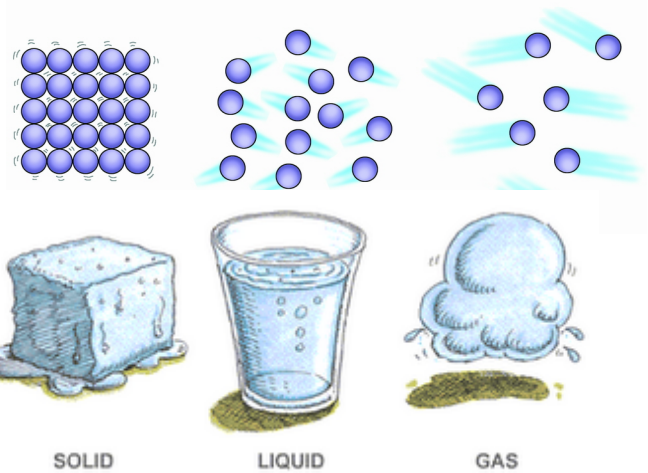
Solid: Ice Liquid: Water Gas: Steam

Sep 11-2:46 PM

Solids
The particles in a solid are very close to each other because they are bound by strong forces of attraction.

Liquids
The particles are also close together but the forces which bound them are weaker than those in solids.

Gases
The particles in a gas are very far apart, they are not bound by forces of attraction.

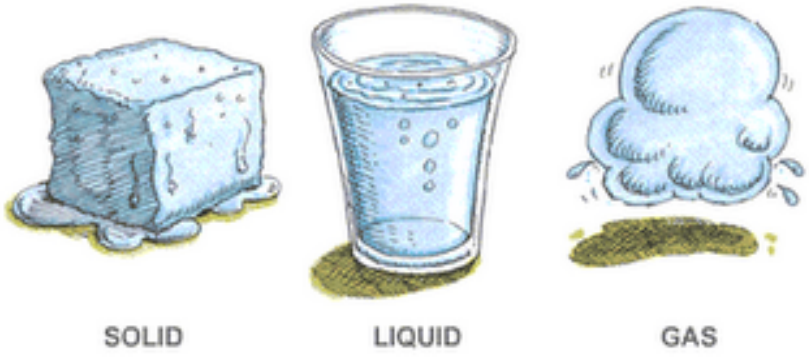


Sep 11-2:47 PM

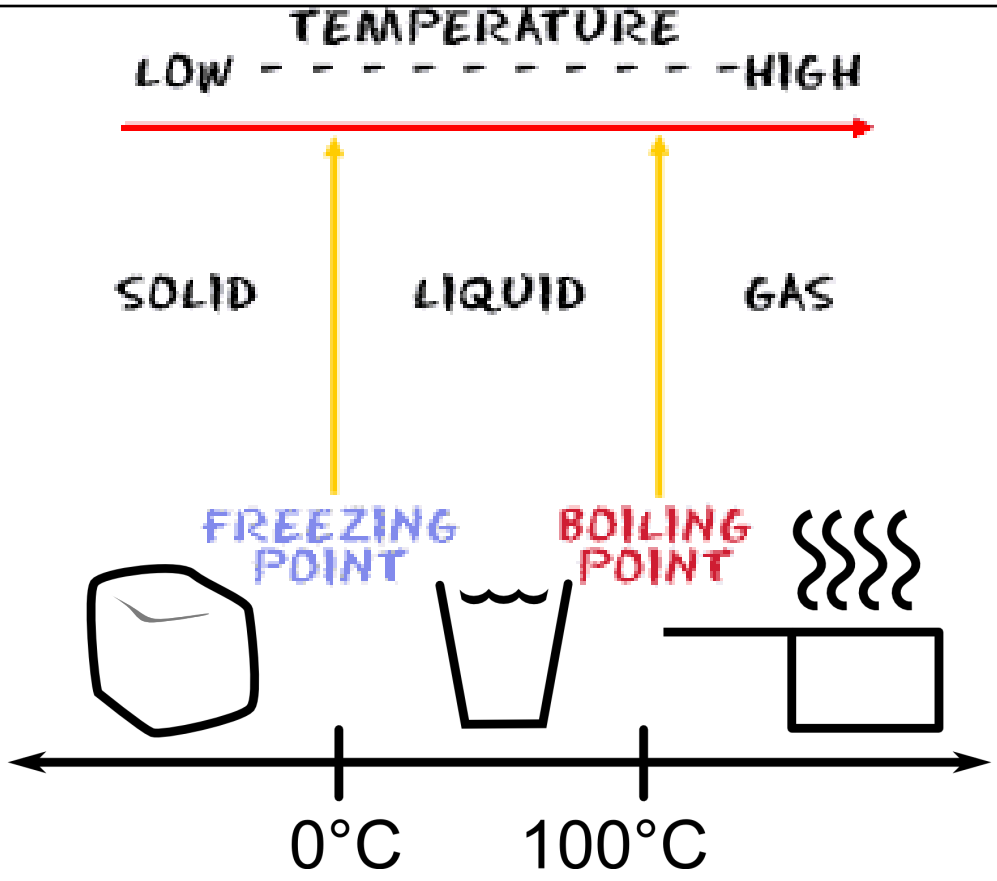
Changes of State

As the temperature changes, the particles change. Let's say we take water in liquid form. What will happen if we increase the temperature of the water?

What will happen if we decrease the temperature of the water?



Sep 11-2:47 PM



Sep 11-2:56 PM

Different substances have different properties.

Size and shape can help us to tell the difference between different objects.
Size and shape however are examples non-characteristic properties.

A characteristic property helps us to identify a pure substance or the group it belongs to.

Characteristic Properties

- Melting Point - What temperature will a solid become a liquid? Or will a liquid become a solid?
- Boiling Point - What temperature will a liquid become a gas? Or will a gas become a liquid?
- Density - What is the mass per unit of volume?
- Solubility - What is the maximum amount of solute that can be dissolved in a given volume of solvent.

http://www.bbc.co.uk/bitesize/ks3/science/chemical_material_behaviour/particle_model/activity/

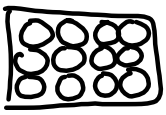
Sep 11-2:47 PM

Notes on Matter

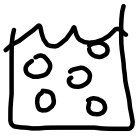
Matter: - anything that takes up space and has mass
- made up of tiny, tiny particles
- particles are constantly moving

Particle Model

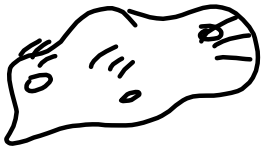
Solid - Particles are close together
- Particles move very little (slow)



Liquid - Particles are further apart
- Particles have medium movement



Gas - Particles are far apart
- Particles have lots of movement (fast)



Changes of State (Temperature Change)

Imagine water in liquid form:
- If we lower (decrease) the temperature, the particles will slow down and we have ice (solid)
- If we raise (increase) the temperature, the particles will move faster and we have steam (gas)

Sep 11-2:47 PM

Speaking of particles and the bonds that hold them together…

Have you ever wondered what happens to things like water in space where there is no gravity?

https://www.youtube.com/watch?v=lMtXfwk7PXg

Sep 13-10:49 AM

Density

1. A rock has a mass of 35 g. When the rock is placed in 25 ml of water, the water level rises to 45 ml. What is the density of the rock?

4

M = 35 g

V = 45 - 25 = 20 mL ✓

D = ?

$D = \frac{M}{V}$ ✓

$= \frac{35}{20}$ ✓

$= 1.75$ g/mL ✓

2. A piece of rock has a density of 2.5 g/cm^3. If the volume of the rock is 3.1 cm^3, what is the mass of the rock?

D = 2.5 g/cm^3

V = 3.1 cm^3 ✓

M = ?

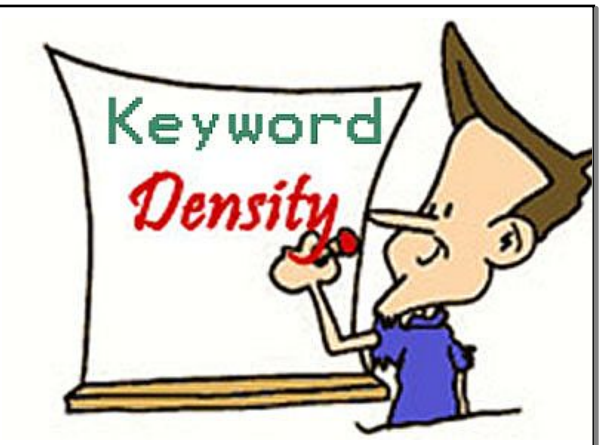
M = D x V ✓

= 2.5 x 3.1 ✓

= 7.75 g ✓

Sep 16-10:45 AM

Density Review



You need to be able to:

- find the density of a substance
- find the volume of a substance
- find the mass of a substance

- convert units if needed

- find the volume by using water displacement

- put items in order of their density (lower densities float, higher densities sink)

* and also do all of the steps as you've been shown in class *

Sep 11-2:57 PM