

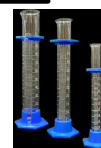
**Quantitative physical property** is something that can be **measures with an instrument of some kind.**

Some Quantitative Physical properties are:

**Volume** – **The amount of space occupied by a substance**



- **Volume of liquids can be measured using measuring cups, graduated cylinders.**



- **Volume of gases can be determined by measuring volume of the containers that hold them**

**Temperature** is a physical quantity that expresses the **degree of hotness or coldness** of a substance and the internal energy given off by a substance. **Measures with a thermometer.**



**Mass** – **The amount of matter in a substance**

- **Measured in kilograms (Kg) or grams (g)**



Density- The amount of matter (mass) per unit of volume of a substance.

Lead is denser than feathers or some may say lead is heavier than feathers.

For example: Density of water is  $1.0 \text{ g/cm}^3$ .



# Density and Buoyancy

Take a guess at what these terms mean.

You may have heard them before.



Here are a couple of hints:

Density helps explain why a piece of steel sinks in water and a beach ball floats.

Buoyancy explains why a huge piece of steel in the shape of a ship floats!



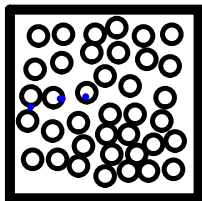
## Density

- can be described as the crowdedness of the particles in a substance
- Scientifically, it is the amount of substance that occupies a particular space.
- Can be measured (Discussed later)
- A “heavy” substance has a high density
- A “light” substance has a low density





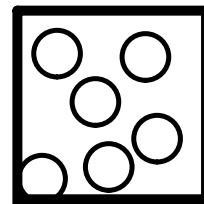
-According to the particle theory, different substances have different sized particles. The size of the particles determines the number of particles that can fit into a given space. Each substance has its own unique density, based on its particle size.



Liquid A

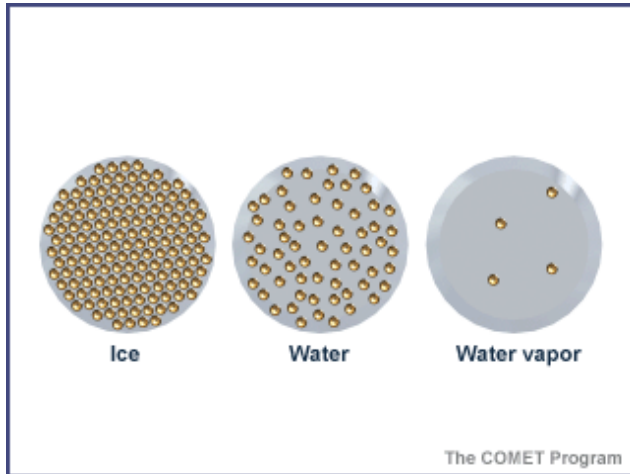
- small particles  
so many can fill  
the area

-Each substance has its own density



Liquid B

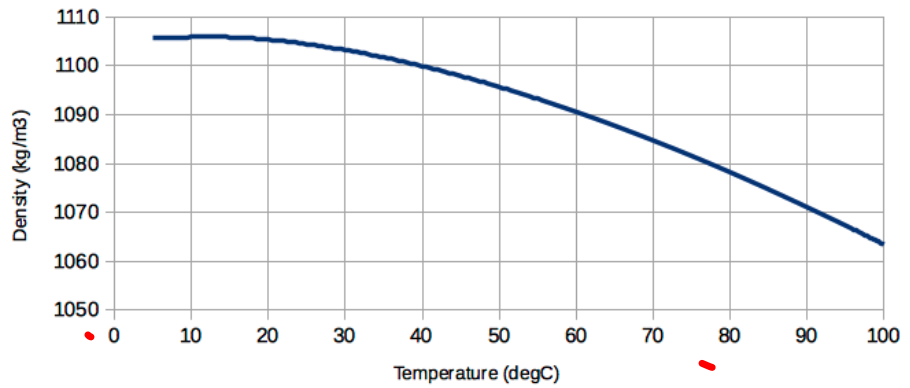
- Large particles  
so few fill the  
area



You can see with ice there is more particles bunched together in the area. Water the particles are spread out some BUT with water vapor the particles are really spread out.

Heavy Water - Temperature and Density

[www.engineeringtoolbox.com](http://www.engineeringtoolbox.com)



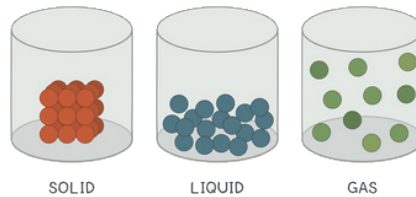
As temperature increases the density of water decreases



## Density of Solids, Liquids, and Gas

The only way the density of a substance will change is if it changed states.

Ex) Liquid water is a different density than solid water and water vapor



### Water

Both liquid water and water vapor have the same particles and the particles are all the same size.

According to the particle theory of gas, gas particles have more space between them than liquid particles. Therefore, water vapor would have fewer particles than liquid water.

The density of the water vapor is less than the density of the liquid water.