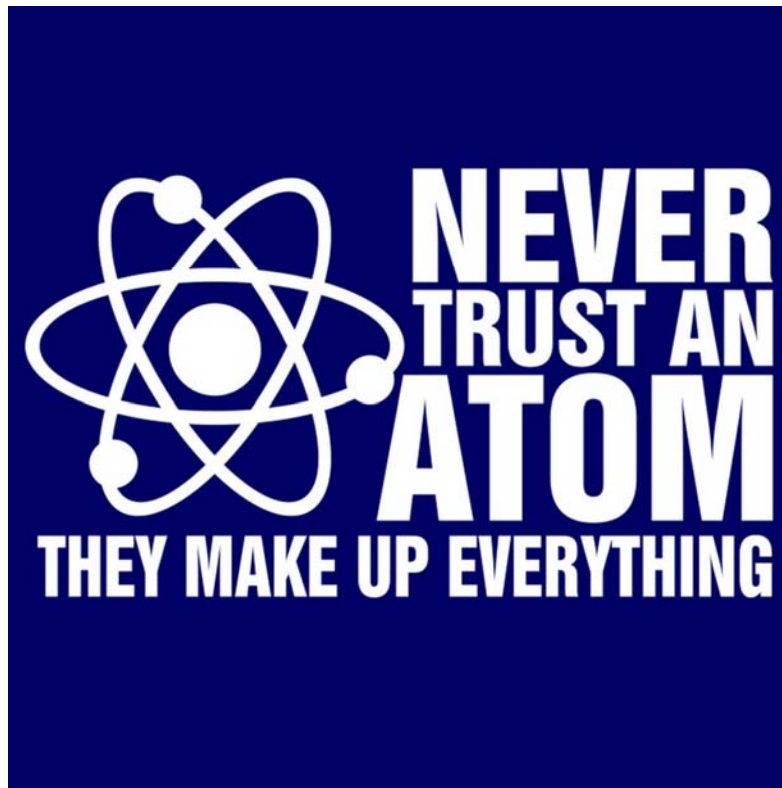


# History of the Nature of Matter



S1-2-01

Describe how historical ideas and models furthered our understanding of the nature of matter. Include: Greek ideas, alchemy, Lavoisier

# What is Chemistry?

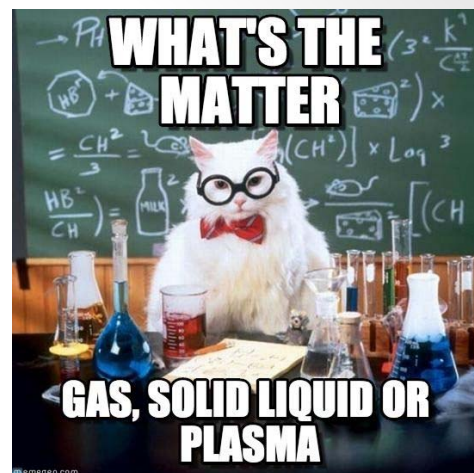
**Chemistry** is the science that studies MATTER,

What is MATTER?

- MATTER is anything which has MASS!
  - Note that MASS and WEIGHT are NOT the same thing!!!
- Something with mass weighs something, **and** takes up VOLUME. Mass is CONSTANT.

A text book has MASS, therefore it is made of MATTER, but what is matter made of?

The ancient GREEK PHILOSOPHERS wanted to answer this question, so they looked at how matter behaves, then speculated about what it's made of.



# A bit of history...

**450 B.C.**

The Greeks did not have the capability, or desire to do any complicated **EXPERIMENTS**, so they focused on what happens on the **SURFACE** of **MATTER**.

A philosopher by the name of **EMPEDOCLES** proposed that matter was made of **FOUR ELEMENTS**:

- **EARTH**

- **WATER**

- **AIR**

- **FIRE**

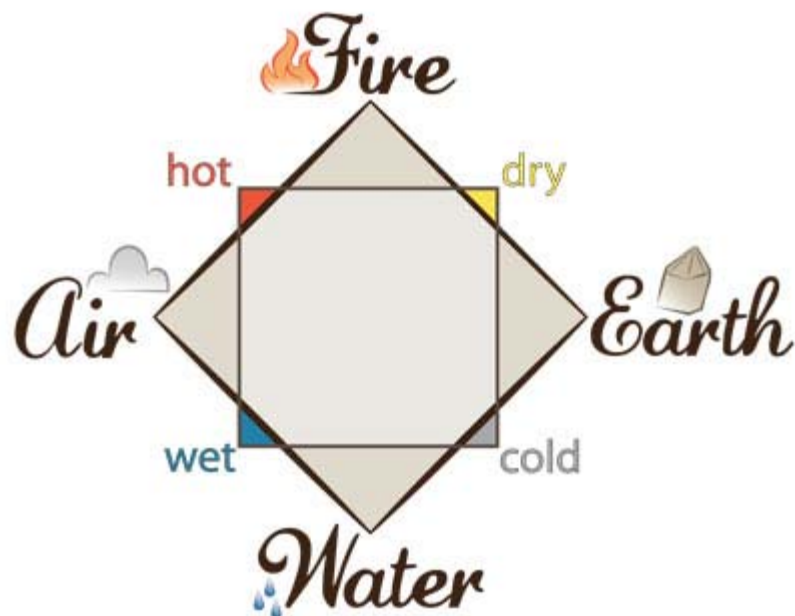


He thought that if you **MIXED** these elements together in **DIFFERENT AMOUNTS**, you would make **DIFFERENT SUBSTANCES**.

# A bit of history...

## Consider wood:

- When you burn wood you see FIRE.
- When you leave wood alone it DRIES OUT, so there must be WATER present.
- AFTER it is BURNED, ASHES are left (EARTH).
- While it burns, SMOKE is released (AIR)



# A bit of history...

400 B.C.

## Democritus

- Suggested that MATTER was made up of tiny PARTICLES, which couldn't be BROKEN DOWN any farther.
- He called these particles ATOMS, from the Greek word ATMOS meaning INDIVISIBLE.
- He also thought that DIFFERENT TYPES of MATTER were made of DIFFERENT KINDS of ATOMS.

At the time, DEMOCRITUS' idea was not accepted because SOCRATES didn't believe it was true.



Democritus on the 100 Greek Drachma



Socrates

# A bit of history...

## Aristotle (350 B.C)

- Aristotle was a very well respected scholar and philosopher who organized much of the scientific knowledge at the time.
- He believed EMPEDOCLES' theory about the FOUR ELEMENTS, and because he had such an INFLUENCE, this model, and many other theories were accepted for about 2000 YEARS.



Aristotle also came up with a theory called TRANSMUTATION:

→ *One form of matter could be turned into another.*

This was particularly exciting to the Greeks, since if it were true you could turn something WORTHLESS (say LEAD) into GOLD.

This paved the way for the ALCHEMISTS.

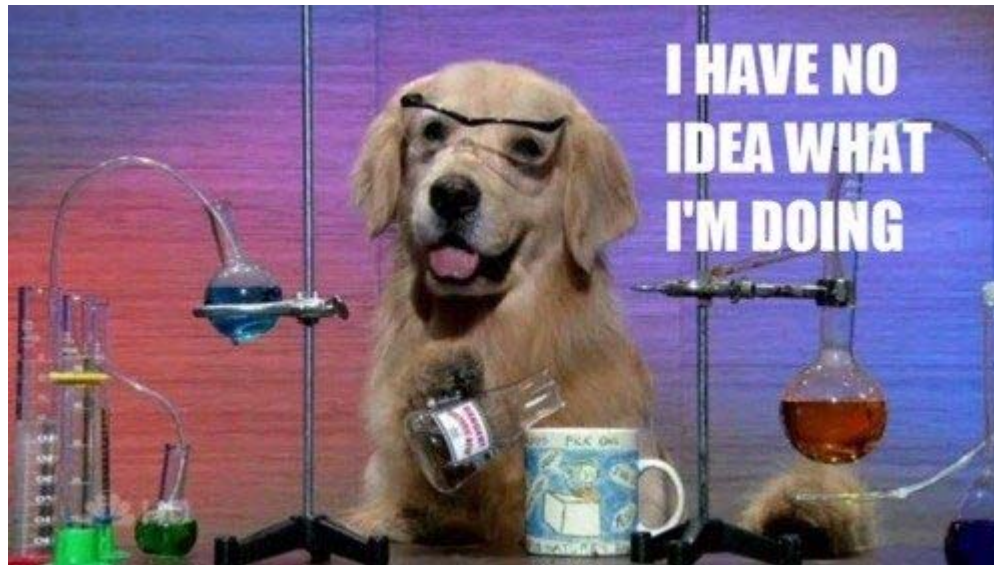
# A bit of history...

## The Alchemists (500-1600 B.C.)

- The Alchemists were the first people to perform experiments.

They had 3 main goals:

- *Change base metals (tin, lead) into valuable gold.*
- *Find the substance for eternal life.*
- *Produce a universal solvent to dissolve all substances.*



# A bit of history...

None of their goals were ever reached, but the Alchemists are important for many reasons:

- *discovered many elements and their properties, and created chemical symbols for them.*
- *invented many lab tools that we still use today. (beakers, filters, distillation apparatus, etc.)*
- *actually performed experiments.*

**CHEMISTRY**  
IS LIKE  
**COOKING**  
(Just Don't Lick the Spoon)



# Modern Chemists...

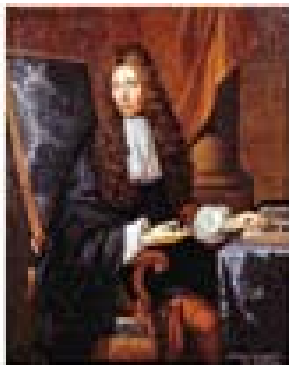
## Sir Frances Bacon (1561-1626)

- *New knowledge must be based on experimentation, and not speculation*
- *Experiments must be repeatable.*



## Robert Boyle (1627-1691)

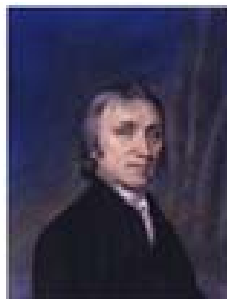
- *Did not believe the four-element theory.*
- *Showed that substances could be mixed to form compounds*



# Modern Chemists...

## Joseph Priestly (late 1700's)

- *Was the first person to isolate oxygen scientifically*



## Antoine Lavoisier (1743-1794)

- *Discovered over 23 different elements*
- *Determined air is made of oxygen and other gases.*
- *Was guillotined in the reign of terror*



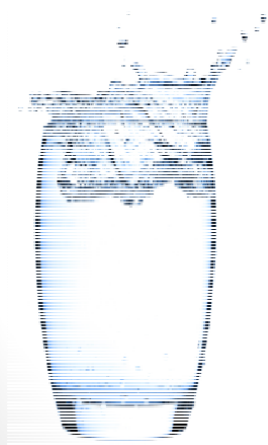
# Modern Chemists...

## Today:

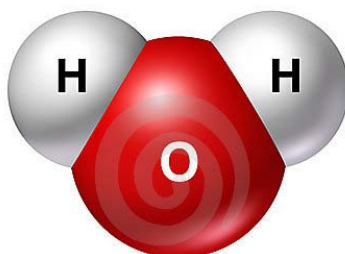
- An ELEMENT is:

*a pure substance that cannot chemically be broken down into simpler substances.*

Ex) WATER can be broken down into HYDROGEN and OXYGEN, which are ELEMENTS that CANNOT be broken down any further.



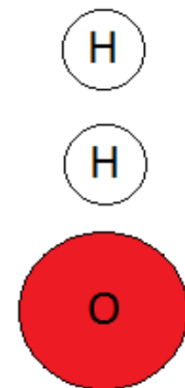
Is Made of  
→



WATER  
MOLECULE

dreamstime.com

Is Made of  
→



# History of matter timeline:

Use your notes to put the events in the order that they occurred.

Boyle shows substances can combine to form compounds

Democritus comes up with the idea of the atom

Alchemists try to turn cheap metals into gold

Lavoisier is executed

Aristotle suggests the theory of transmutation

Empedocles says everything is made of only 4-elements

Bacon says we must do experiments

Priestly discovers oxygen

Lavoisier identifies 23 different elements

Aristotle supports the 4-element theory

Boyle doesn't believe the 4-element theory

# History of matter timeline:

Answer Key:

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