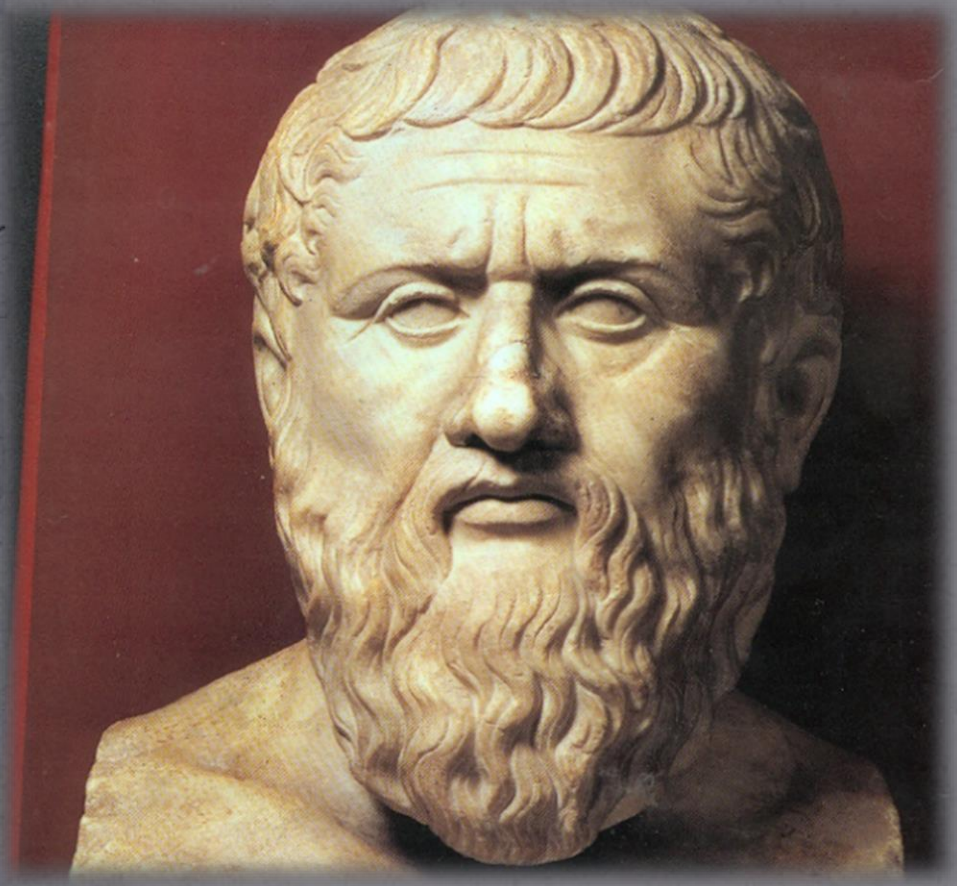
Historical Ideas About the Nature of Matter

Chemistry

- Chemistry is the science that studies ***matter***.
- Matter is anything that has ***mass***.
- What is matter made of???

Ancient Greek Philosphers



The ancient Greek philosophers wondered why matter behaves as it does and manipulated ideas in their minds but did almost no experimentation.

Empedocles 450 BCE

Empedocles proposed that matter was composed of four elements: Earth, Water, Air, Fire.

Consider wood…

When you burn wood you see ***fire***.

When you leave wood alone, it dries out, so there must be ***water*** present.

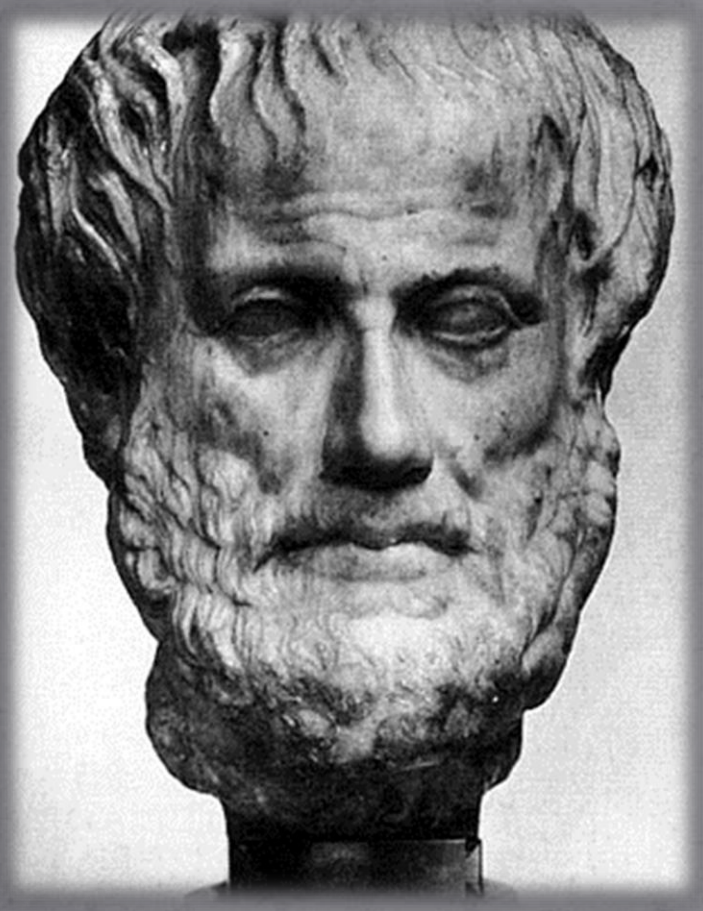
After wood is burned, ashes are left (***earth***).

While it burns, smoke is released (***air***).

Democritus 400 BCE

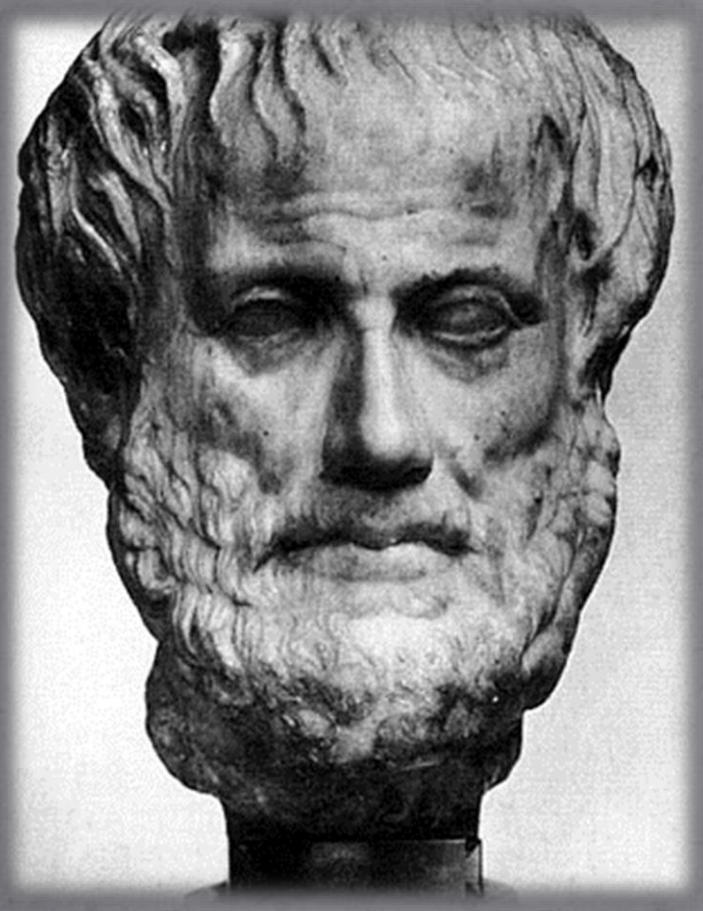
Democritus suggested matter was made of tiny particles that could not be broken down further. He called these particles "atomos", which means indivisible.

Aristotle 350 BCE



After the death of Democritus, Aristotle and Socrates rejected the atomic model and adopted Empedocles' "four element" model. This model influenced and dominated scientific thinking for almost 2000 years.

Aristotle 350 BCE

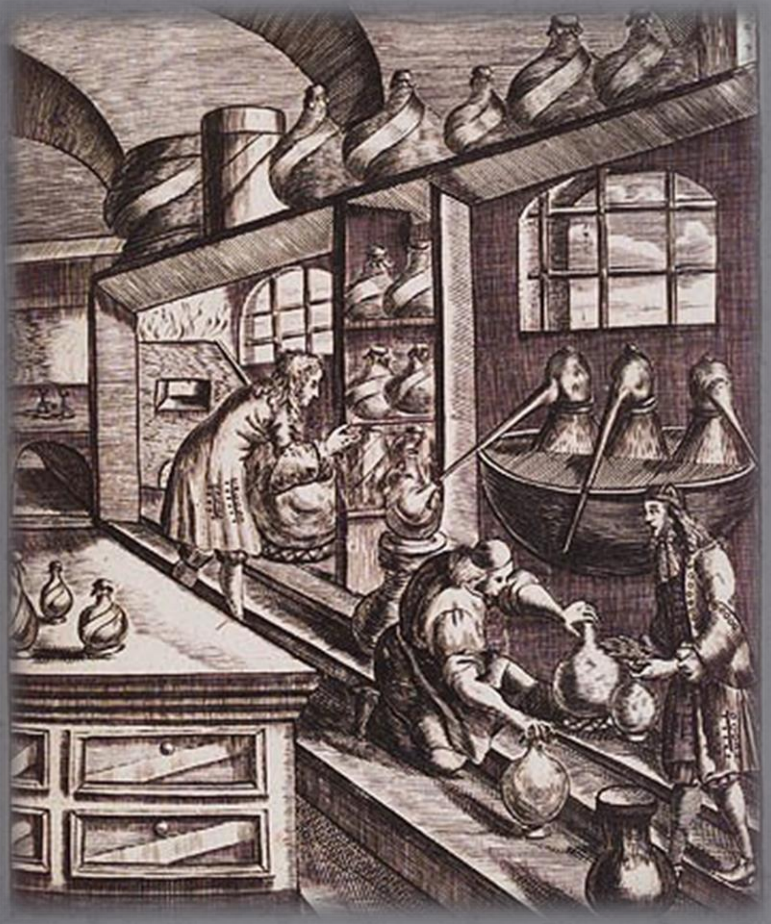


Aristotle also came up with a theory called ***transmutation*** – one form of matter could be turned into another. This paved the way for the alchemists…

Alchemists 500-1600 AD

The alchemists were the first people to perform hands-on experimentation. They were part philosopher, mystic, magician, and chemist.

Alchemists 500-1600 AD



They had three main beliefs/ goals:

1. Some elements could be changed into others. They tried to change base metals (lead, tin) into valuable ones like gold.
2. To find the 'elixir of life' – a substance that would give them eternal life.
3. To produce a universal solvent that would dissolve all substances.

Alchemists 500-1600 AD

- None of their goals were ever reached, but they made two important contributions:
  - They discovered many new elements and their properties, and devised symbols for them
  - They invented lab tools that we still use today (beakers, filters…)

Modern Chemists 1600-Present

These chemists used the scientific method to investigate the physical world. This began in the 17th and 18th centuries where the focus was on determining the properties of pure substances and attempting to explain their composition.

Sir Francis Bacon 1600s

Bacon was one of the first scientists to develop new knowledge as a result of experimentation.

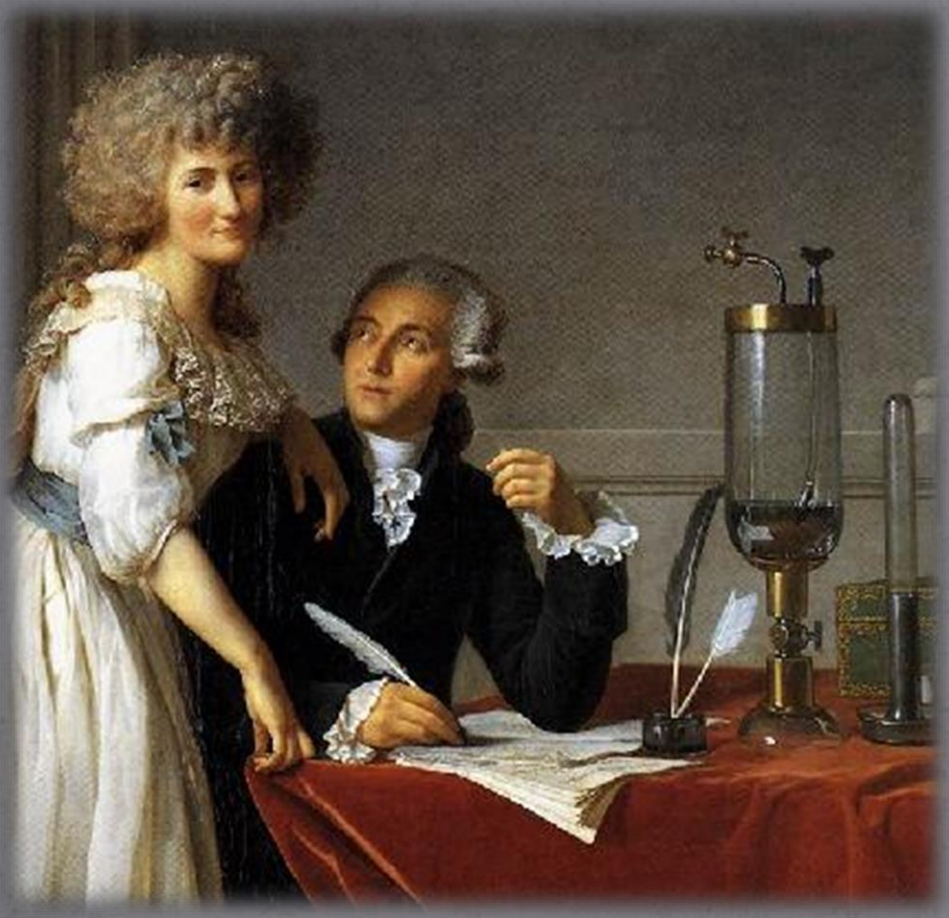
Robert Boyle 1650

Boyle helped lay the foundation for the concepts of elements and compounds. He recognized that elements could be combined to form compounds. Boyle also believed that air was not an element but a mixture.

Joseph Priestly late 1700s

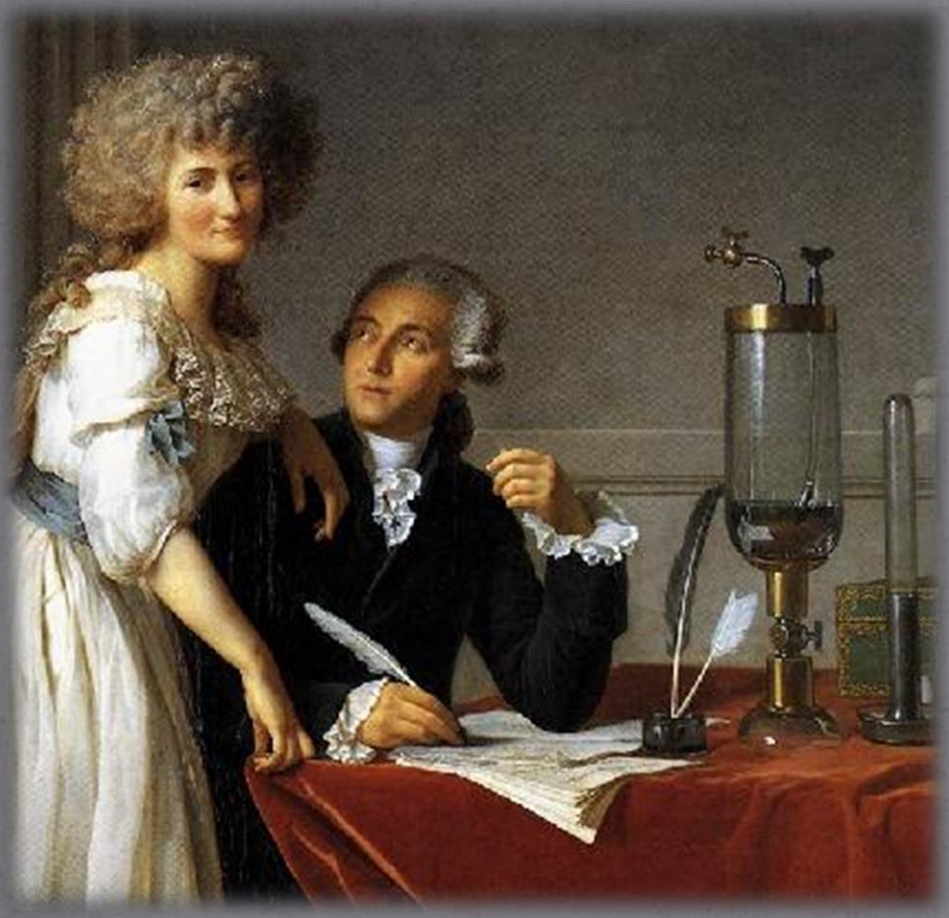
Priestly was the first person to isolate oxygen scientifically, but did not know that oxygen was an element.

Antoine Lavoisier late 1700s



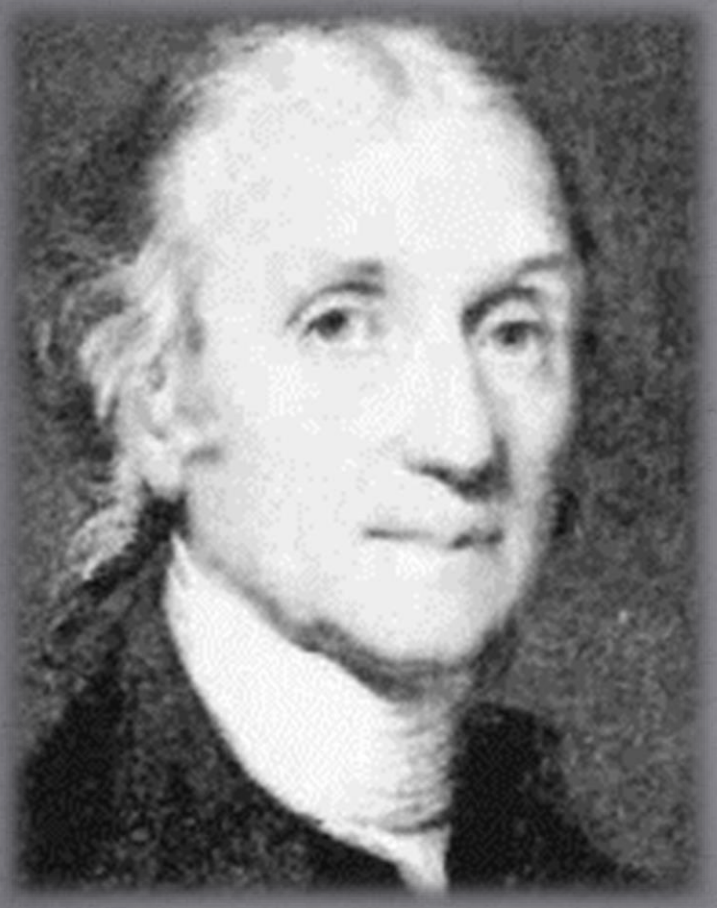
Lavoisier defined the term ‘element’ as a pure substance that cannot be chemically broken down into simpler substances.

Antoine Lavoisier late 1700s



He discovered and identified 23 elements. He recognized mixtures exist and identified air as a mixture of oxygen and some other gas (one that does not burn and one that does).

Henry Cavendish late 1700s



Cavendish experimented by mixing metal with acid, which produced a flammable gas (hydrogen). He discovered that his gas would burn in oxygen and produce water. Until that time, water was thought to be an element.

Element

- A pure substance that cannot chemically be broken down into simpler substances.