

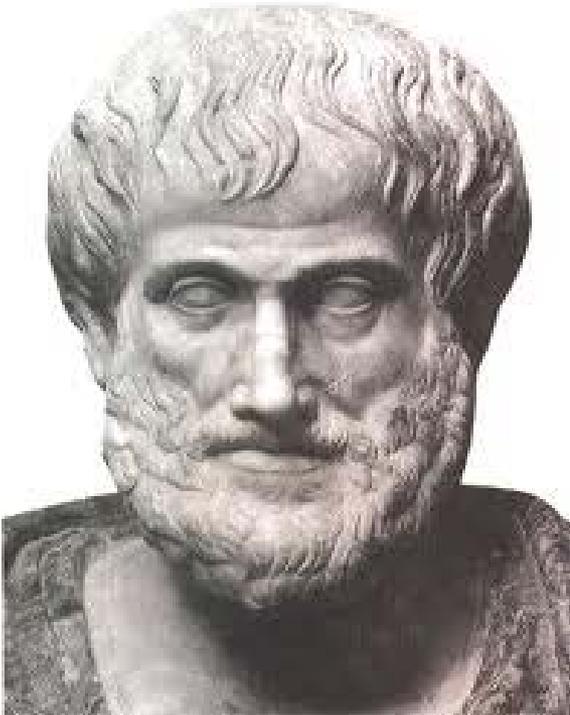
Understanding Matter

Ancient Ideas

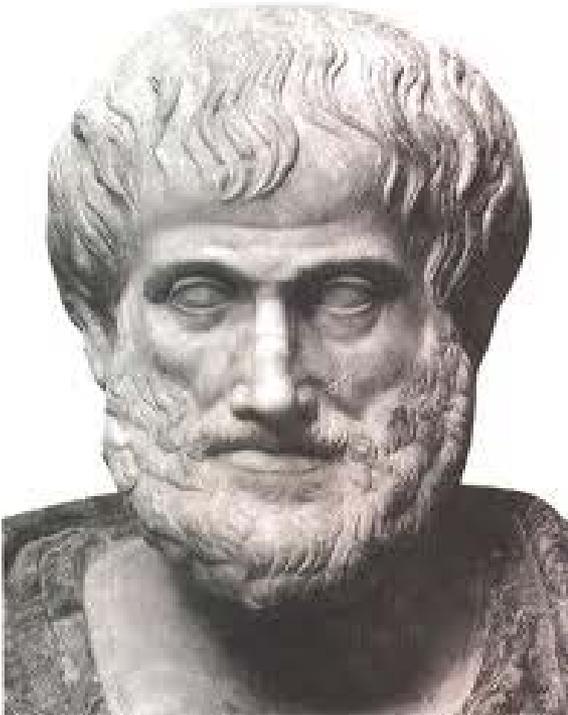
Ancient Greece

- What is the nature of matter?
 - Continuous and infinitely divisible?
 - Discrete definite particles?
- Ancient Greek philosophers debated and speculated, but did not experiment or test their ideas.

Aristotle



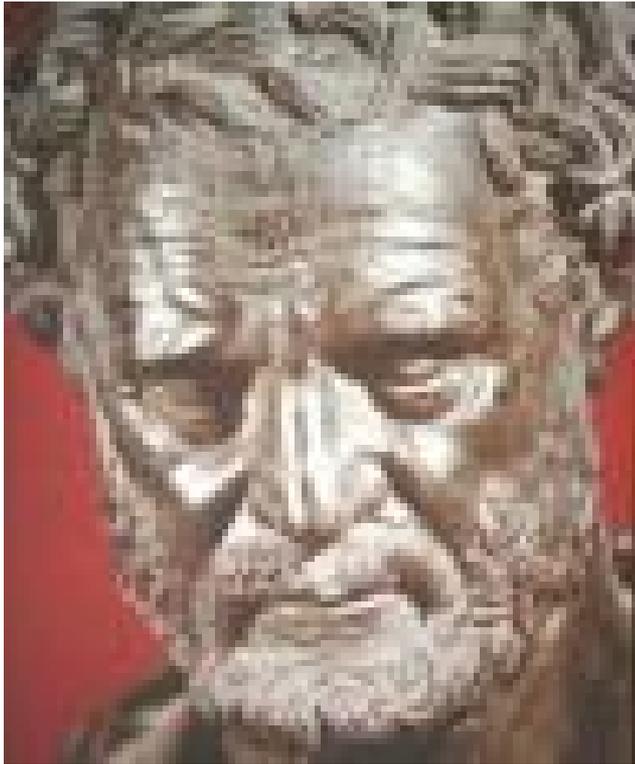
Aristotle



- 4 types of matter
 - Earth, air, fire and water



Democritus



- Argued that matter consists of small particles
- Called the particles "atoms"
 - Greek for indivisible

Alchemy



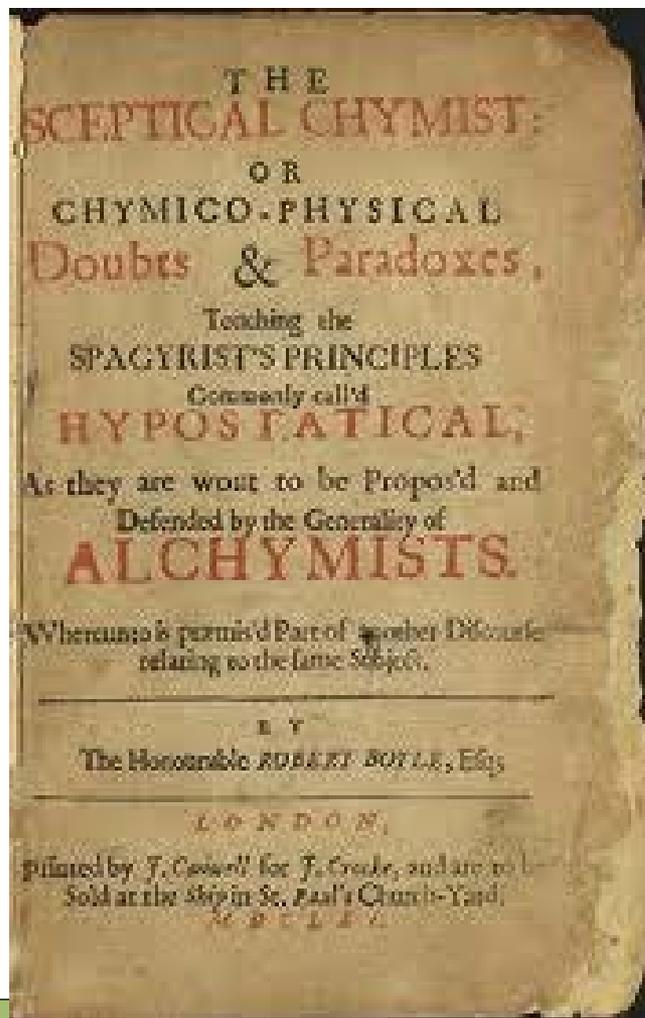
- Developed a lot of practical knowledge, but few advances in theory

Robert Boyle



- Published "The Sceptical Chymist" in 1661

Robert Boyle



- Published "The Sceptical Chymist" in 1661
- Insisted on publishing experimental detail
- Emphasized chemical analysis



Antoine Lavoisier (1743-1793)

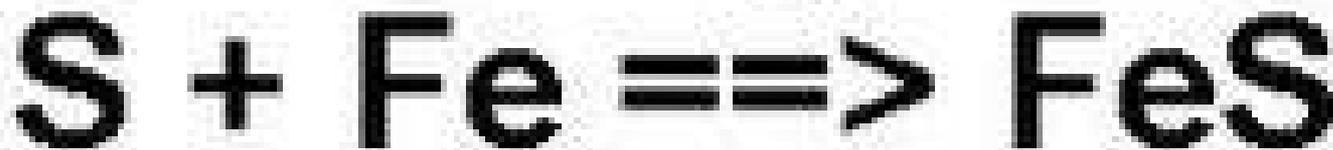
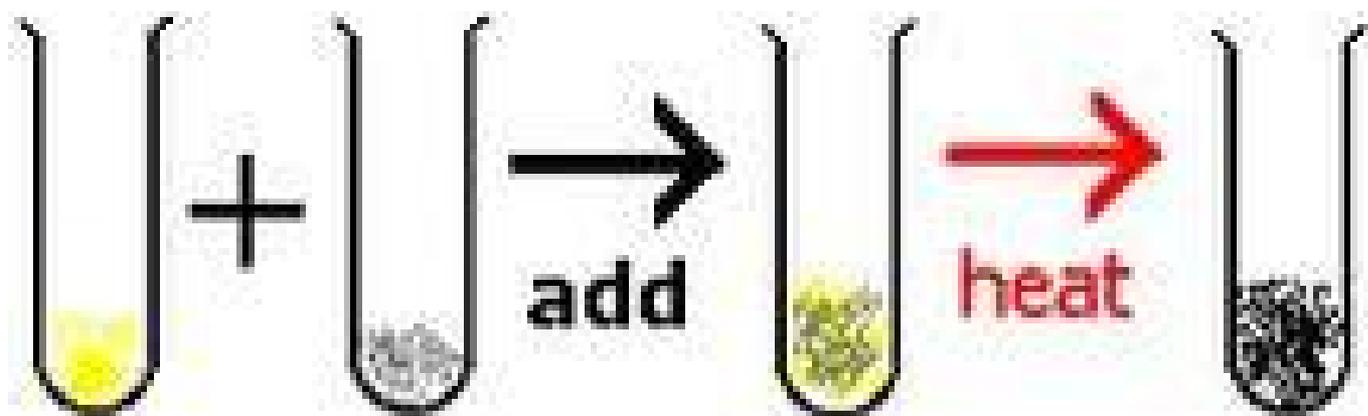
- French Chemist
- “Father of Modern Chemistry”
- Executed during Reign of Terror in French Revolution

Antoine Lavoisier (1743-1793)



Video

Conservation of mass



32g + 56g reactants \implies 88g products

Lavoisier's experiment

- **Studied decomposition of mercury(II) oxide**



Lavoisier's experiment

- **Studied decomposition of mercury (II) oxide**

- Found that mass before the reaction equaled the mass after the reaction

Lavoisier vs phlogiston

Phlogiston theory:

Metal \longrightarrow **Calx** + **Phlogiston**

Lavoisier theory:

Metal + **Oxygen** \longrightarrow **Calx**

A calx is what we call the metal oxide today.

Debunking phlogiston



Joseph Proust

- Law of Definite Composition



Joseph Proust

- Law of Definite Composition
- Compound contains same ratio of elements, regardless of source or size of sample



Definite Composition

- Water
 - Always 11% hydrogen, 89% oxygen

Definite Composition

- Water
 - Always 11% hydrogen, 89% oxygen
- Table salt
 - Always 45% sodium, 55% chlorine

John Dalton (1766-1844)

- English scientist and teacher



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- Many research interests

John Dalton (1766-1844)



- English scientist and teacher
- Many research interests
- In 1808 Dalton published A New System of Chemical Philosophy

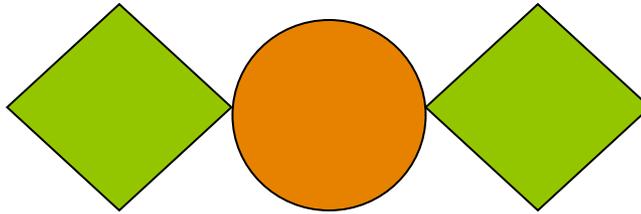
Dalton's Atomic Theory

- All matter is made of indivisible particles called atoms.
- All atoms of an element are completely identical in properties and mass.
- Atoms of each element are different from atoms of other elements.

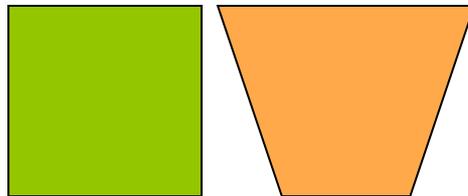
Definite Proportions

- Atoms of different elements combine in small whole number ratios to form compounds.

- Water H_2O



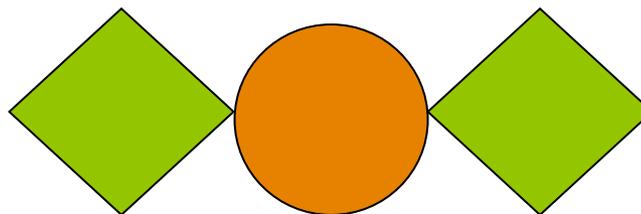
- Table salt (aka sodium chloride) NaCl



Multiple Proportions

- Atoms of different elements can combine in different whole number ratios to form different compounds.

Water H_2O
2:1 ratio



Hydrogen peroxide H_2O_2
2:2 ratio

