

## Chapter 2 – Atoms, Molecules, and Ions

### 2.1 The Earth History of Chemistry

400 B.C.	Democritus- atomos
to 1600's	Alchemy- cheap metals into gold
1600's	Robert Boyle- behavior of gases combustion involved
1700's	Georg Stahl- "phlogiston"

### 2.2 Fundamental Chemical Laws

Mid 1700's	Antoine Lavoisier - law of conservation of mass
1800's	Joseph Proust- law of definite proportion - compounds always are the same proportion of elements

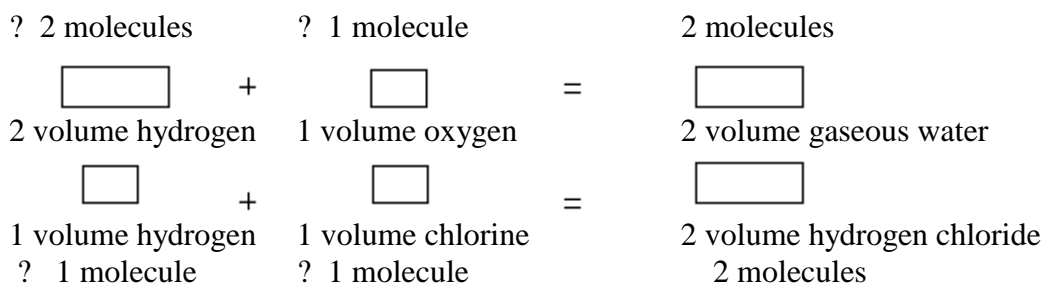
John Dalton- law of multiple proportion  
-when a series of compounds are formed by two elements, the mass ratios for the 2<sup>nd</sup> element that combines with 1 gram of the first can be reduced to small whole numbers.

### 2.3 Dalton's Atomic Theory

Dalton presented his theory of atoms in 1808:

1. Each element is made up of atoms.
2. Atoms of the same element are identical.
3. Compounds are formed when atoms combine and each compound has the same relative number and types of atoms.
4. Chemical reactions involve the reorganization of atoms.

1809 Joseph Louis Gay-Lussac- reacted volumes of gases at same temperature and pressure



1811 Amadeo Avogadro- Avogadro's hypothesis equal volumes of different gases (at same temperature and pressure) contain the same number of particles.

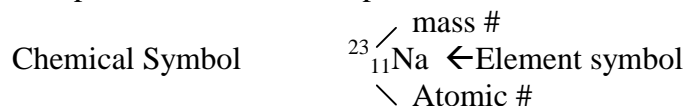
## 2.4 Early Experiments to Characterize the Atom

- 1898-1903 J.J. Thomson- experimental with the cathode ray tube (discovered electron)
- 1909 Robert Millikan- used charged oil drops to determine charge of electron
- 3 types of radiations:
- |                |                            |
|----------------|----------------------------|
| $\alpha$ alpha | particle with $2^+$ charge |
| $\beta$ beta   | $e^-$                      |
| $\gamma$ gamma | high energy EM wave        |
- 1911 Ernest Rutherford- gold foil experiment nucleus positively charged and contained most of the atom's mass.

## 2.5 The Modern View of Atomic Structure: An Introduction

Protons-	+ charge	\	same
Neutrons-	0 charge	/	mass
Electrons-	- charge	→	mass is negligible

- most mass in tiny nucleus (very dense)
- electrons take up most of atomic volume
- chemical properties of atoms depend on number of electrons
- isotopes – same number of protons, different number of neutrons

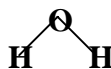


## 2.6 Molecules and Ions

**Covalent Bonding-** a type of bonding in which electrons are shared by atoms

Chemical formula- ex:  $\text{H}_2\text{O}$

Structural formula- ex:  $\text{H}-\text{O}-\text{H}$



**Ionic bonding-** the electrostatic attraction between oppositely charged ions.

Cations	+
Anions	-
Polyatomic ions	ionic or salt

## 2.7 An Introduction to the Periodic Table

**Metals-** efficient conduction of heat and electricity malleability, ductility, and often lustrous appearance.

- tend to lose electrons.

