AP CHEMISTRY NOTES
ZUMDAHL, 6th ed.
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CH. 2 - ATOMS, MOLECULES, AND IONS

2.1 The Early History of Chemistry

The Greeks @ 400 B.C.
- air, water, earth, fire
- Democritus : *atomos* (small, indivisible particles)
- no experimentation

Alchemy @ next 2000 years
- tried to turn metals (mostly Pb) into gold
- "pseudoscience"
- advances in apparatus and techniques

Robert Boyle @ 1600's
- quantitative experiments

2.2 Fundamental Chemical Laws

Law of Conservation of Mass
- Antoine Lavoisier @ 1700's ("father of modern chemistry")
- "mass is neither created nor destroyed"

Law of Definite Proportion
- Joseph Proust @ late 1700's
- "a given compound always contains exactly the same proportion of elements by mass"

Law of Multiple Proportions
- John Dalton @ late 1700's
- "when two elements form a series of compounds, the ratios of the masses of the second element that combine with 1 gram of the first element can always be reduced to small whole numbers"

Examples:

2.3 Dalton's Atomic Theory

Dalton's theory

1. Each element is made up of tiny particles called atoms.
2. The atoms of a given element are identical; the atoms of different elements are different in some fundamental way or ways.
3. Chemical compounds are formed when atoms combine with each other. A given compound always has the same relative numbers and types of atoms.
4. Chemical reactions involve reorganization of the atoms - changes in the way they are bound together. The atoms themselves are not changed in a chemical reaction.

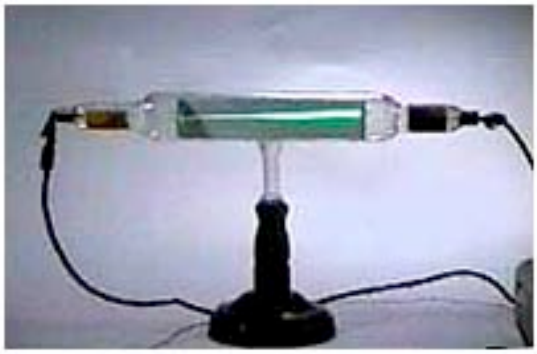
Dalton prepared the first table of atomic masses (atomic weights).

Avogadro's hypothesis –

2.4 Early Experiments to Characterize the Atom

J.J. Thomson (@ 1898-1903) English physicist

- studied electrical discharges in cathode ray tubes
- postulated that the "cathode rays" produced were negatively charged particles now called electrons
- determined a charge-to-mass ratio of the electron
- "plum pudding" model



Robert Millikan (1909) American physicist at U. of Chicago

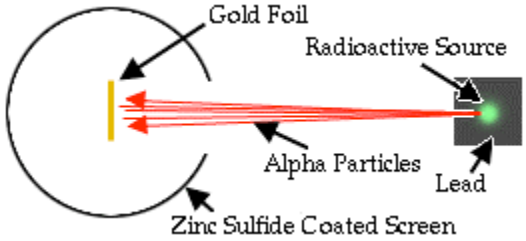
- famous oil drop experiments
- determined the charge of an electron and thus calculated its mass

Henri Becquerel (1896) French scientist

- uranium ores could produce an image on photographic plates in the absence of light
- postulated a spontaeous emission of radioactivity

Ernest Rutherford (1911) New Zealand scientist

- VERY famous gold foil experiment



- Conclusions
  - Most of the atom is empty space.
  - Their is a dense, concentrated area of positive charge in the center of the atom known as the nucleus.

2.5 The Modern View of Atomic Structure: An Introduction

Particle	Mass	Charge	Location
proton			
neutron			
electron			

** The "chemistry" of an element depends on its electronic arrangement.

Isotopes -

Atomic number -

Mass number -

Examples:

2.6 Molecules and Ions

Chemical bonds -

Type of Bond	Force Holding Atoms Together	Resulting Particle
covalent		
ionic		

Molecules can be represented by: (1) chemical formulas, (2) structural formulas, (3) space-filling models, or (4) ball & stick models.

Examples:

Ions -

- Cation -
- Anion -

2.7 An Introduction to the Periodic Table

Metals

- left side of periodic table
- good conductors of heat and electricity
- malleable and ductile
- lustrous
- tend to form cations

Non-metals

- right side of periodic table
- opposite physical properties of metals
- tend to form anions

Groups (families)

- vertical columns
- elements with similiar chemical properties

Periods

- horizontal rows

** Know the location of the following groups: alkali metals, alkaline earth metals, halogens, noble gases

2.8 Naming Simple Compounds

<u>Binary Ionic Compounds</u>

_____ _____ide

(cation) (anion)

For most of the transition metals, use the Stock system or the older system

- Stock system - use Roman numerals to indicate the charge of the cation

- older system - use *ic* for the h*i*gher charge and *ous* for the l*o*wer charge

Ternary Ionic Compounds

_____ _____

(cation) (polyatomic ion)

** THESE POLYATOMIC IONS **MUST** BE MEMORIZED !!

ammonium	nitrate	nitrite	hydroxide
phosphate	sulfate	sulfite	cyanide
carbonate	acetate	permanganate	
chromate	dichromate		

A useful mnemonic: l*a*rge number of oxygens is *ate* and t*i*ny number of oxyens is *ite.*

Examples:

Binary Covalent Compounds

_____ _____ide

(prefix - first element) (prefix - second element)

The prefixes are as follows:

mono
di
tri
tetra
penta
hexa
hepta
octa
nona
deca

<u>Acids</u>

Binary

hydro_____ic acid

Oxoacids

If the acid comes from an anion ending in *ate*

_____ic acid

If the acid comes from an anion ending in *ite*

_____ous acid

Examples: