Teacher's Tools® Chemistry

**Prerequisites: The Atom: Student Review Notes**

Dalton's Atomic Theory

Prior to 1800, the particulate nature of matter was strictly intutitive. In 1808, John Dalton developed an explanation of several laws of experimental chemistry and it became know as Atomic Theory.

3 Postulates:

1. **Elements consist of atoms.** These are pure substances that cannot be broken down into 2 or more other pure substances. All atoms of a particular element are identical and have the same properties.

2. In ordinary chemical reactions, **no atom disappears or is changed into another atom.** For example

3. A **compund** is formed when 2 or more elements combine and in a given compound, **the relative numbers of atoms of each element are definite and constant.**

Structure of the Atom

Atom → electrons (-)
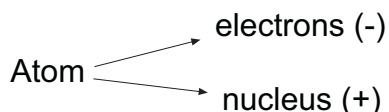
Atom → nucleus (+)

-- contains more than 99.9% of the total mass of the atom
-- has a diameter only 0.01% of the atom. If an atom were the size of a stadium, the nucleus is the size of a marble.
-- The nucleus is incredibly dense. Density ~ 10^{15} g/cm^3

Subatomic particles	Mass Number	Charge
proton, p$^+$	1	+1
neutron, n	1	0
electron, e$^-$	0	-1

nucleus { proton, p$^+$; neutron, n

(an insignificant mass compared to a proton or neutron)

Atomic number: Number of protons in an atom. All atoms of a particular element have the same number of protons in the nucleus. In a neutral atom, the number of protons = the number of electrons. An ion is a charged atom and you form it by adding or removing electrons. Understand that if you add or remove protons, you have not made an ion, you would change to a different element.

Mass number or atomic mass or molar mass (all mean the same thing): The mass number is the sum of the protons and neutrons. The mass number for an element is the weighted average of the masses of all the isotopes of a particular element. Isotopes have the same number of protons (they are the same element) but different numbers of neutrons. Isotopes therefore have different molar masses. For example, you calculate the molar mass (the one that is reported on the periodic table) in the following way:

Isotope	Molar Mass	% present
^{28}Si	27.98	92.23
^{29}Si	28.98	4.67
^{30}Si	29.97	3.10

Standard Notation

Molar Mass — Charge

X

Atomic No.
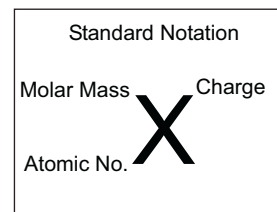
Molar Mass Silicon = (27.98)(.9223) + (28.98)(.0467) + (29.97)(.0310)

Molar Mass Silicon = 28.09