

Announcements

Wednesday, September 09, 2009

MasteringChemistry due dates (all at 11:59 pm):

- Ch 2: Fri, Sep 18
- Ch 3: Fri, Sep 25

Quiz 1: Mon, Sep 14 - Ch 1-2 (thru Sep 9 class)

- Memorize SI prefixes (M, k, d, c, m, μ , n) and their powers of 10 for the quiz

Spreadsheet 2 Excel file was due yesterday. Upload it to the Late Labs dropbox ASAP if you have not yet.

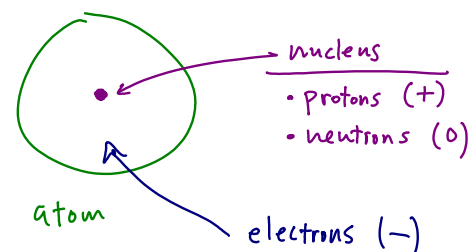
Prepare your lab notebook for experiment 2, Microscale Density for next Monday.

D2L Discussions: remember, you need one thoughtful post per chapter in the chapter discussions for your participation points.

Nuclear model

Rutherford's nuclear model:

1. Most of atom's mass is in a tiny dense nucleus
2. Most of the volume is empty space, with tiny electrons around the nucleus
3. In a neutral atom, the number of protons (+) equals the number of electrons (-)



Elements and isotopes

Atomic number (Z): # of protons in nucleus

which element (# protons)

Mass number (A): count of massive particles in atom
 $= \# \text{ protons} + \# \text{ neutrons}$

A certain nucleus contains 11 protons and 12 neutrons.

$Z = 11$
 $A = 23$ } define 1 particular atom

Nuclide: a nucleus with a certain atomic and mass number (a given number of protons and neutrons)

Isotopes: have same atomic number, different mass #'s
 (same number of protons, different number of neutrons)

Nuclide symbol:

$\begin{matrix} A \\ Z \end{matrix} \boxed{\text{element symbol}}$ $\begin{matrix} 23 \\ 11 \end{matrix} \text{Na}$

Isotope name:

mass #
 Sodium - 23
 Sodium - 24 (has 13 neutrons)

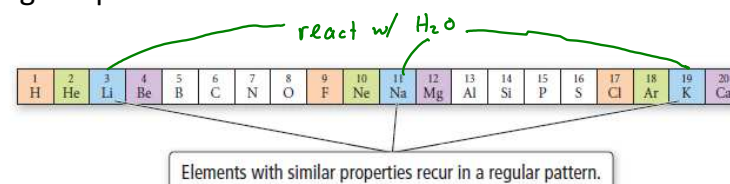
C has 3 naturally-occurring isotopes $^{12}_6\text{C}$, $^{13}_6\text{C}$, $^{14}_6\text{C}$

Periodic table

Dimitri Mendeleev, 1869
 Originally arranged elements in order of atomic weight
 (now use atomic # to order)



Periodic law: elements with similar properties recur in a regular pattern



Periodic table:

- Columns = groups or families (18 groups)
- Rows = periods (7)

A Simple Periodic Table

1 H																	2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne										
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar										
19 K	20 Ca																

Elements with similar properties fall into columns.

Group numbers: roman numeral then A/B

- A: main-group
- B: transition

Parts of the periodic table

Some important groups:

- IA: alkali metals *Li, Na, K, etc. react w/ H₂O*
- IIA: alkaline earth metals *Be, Mg, etc. bright white flame*
- VIIA: halogens *F, Cl, Br, I only grp w/ all 3 physical states*
- VIIA: noble gases *unreactive*

Metals: ductile malleable conduct electricity
shiny easily oxidized (s) except Hg

Nonmetals: insulators, dull brittle solids or gases

Metalloids (semimetals): can have properties of both
Ge, Si semiconductor

Periodic Table of the Elements

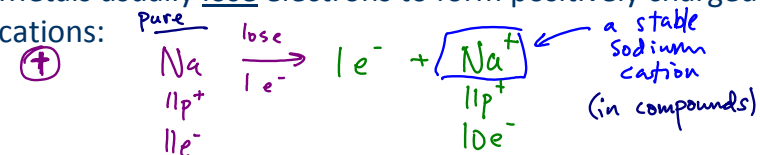
Reference: <http://www.webelements.com>

Ions and the periodic table

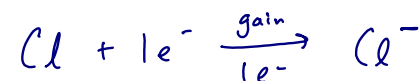
Neutral atoms have the same number of protons and electrons

Ions have a different number of p⁺ and e⁻.

Metals usually lose electrons to form positively charged cations:



Nonmetals usually gain electrons to form negatively charged anions:



Main group elements tend to form stable ions with the same # electrons as the nearest noble gas.



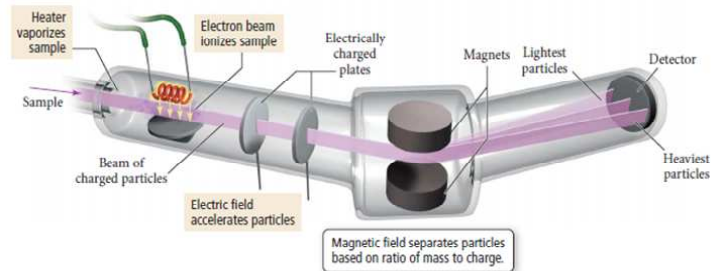
Atomic mass

Atomic mass: relative mass of an atom

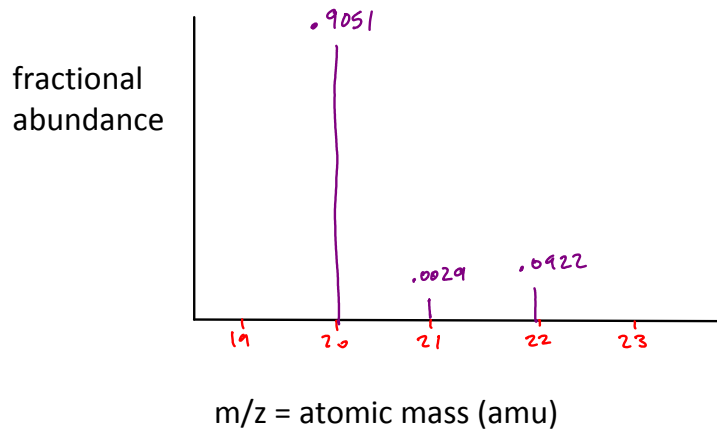
Unit = amu (atomic mass unit),
(also called Dalton, abbrev u)

Definition of amu: ^{exactly} 12 amu = mass of 1 carbon-12 atom

Mass spectrometry: measures mass/charge ratio of particles deflected by magnetic field



Sample of natural neon:



Atomic mass

isotope	atomic mass	abundance	
neon-20	19.992 amu	0.9051	= 18.0948
neon-21	20.994 amu	0.0027	= 0.056684
neon-22	21.991 amu	0.0922	= 2.02757
			+ 20.18 amu

Weighted average atomic mass
of natural isotopes of Ne
(atomic weight)
on periodic table