SOME FUNDAMENTAL CONCEPTS, SYMBOLS, & FORMULAS

AP Chem (Ch 1&2, & 3-Sec1-6)

Important concepts: Sig Figs, accuracy & precision, metric conversions (including: temperature, volume (1 ml = 1g is because of the density of water which is 1 g/ml at 4 C), mass, length

Mass vs. weight

Density = mass/volume (units: g/mL, kg/L, g/cm^3)

Temperature: K = ^{O}C + 273

Heat: measured in J and cal 1 cal = 4.18 J

Ch. 2 **Representative Particles**

Important Concepts: Early History of Chemistry, Atomic Models (Dalton, Thomson, Rutherford, Millikan)

Law of Conversation of Mass: Total mass of reactants = total mass of products

In a combustion reaction, 46.0 g ethanol reacts with 96.0 g of oxygen to produce water and carbon dioxide. If 54.0 g of water is produced, how much carbon dioxide is produced?

46. 0 g + 96.0 g = 54.0g + g CO_2

143.0 g – 54.0 g = 88.0g of CO_2

Law of Definite Proportion: The ratios of the masses of elements in a compound are constant.

A sample of chloroform is found to contain 12.0g C, 106.4 Cl, and 1.01 g of H. If a second sample of chloroform is found to contain 30.0 g of C, how many g of Cl and g of H does it contain?

C increased by a factor of 2.5 (30.0g/12.0g)

So, g Cl = 106.4 g x 2.5 = 266 g Cl

g of H = 1.01 g x 2.5 = 2.53 g

Law of Multiple Proportions: Given a compound, the ratio of the masses of each element that combine with another mass of another will be in a small whole number ratio.

Water contains 2.02 g of H and 16.0 g of O. Hydrogen peroxide contains 2.02 g of H and 32.0 g of O.

In water, 7.92 g (16.0/2.02) of O combines with each 1.0 g of H. In hydrogen peroxide (H_2O_2), 15.84 g (32.0/2.02) of oxygen combines with each 1.0 g H. The ratio of the masses of oxygen in the 2 compounds is: 15.84g/7.92g = 2

Modern View of Atomic Structure:

$^{A}_{Z}X$

X – symbol Z - # of p+ A- mass # Hydrogen-2

Chemical Formulas:

1. molecular - actual number's of atoms of each element in a molecule.

Ex. C_6H_6 (benzene)

2. empirical - simplest (reduced) formula.

Ex. Lead (IV) oxide

2 most abundant elements:

O, Si SiO_4 (as in sand)

Nomenclature:

2 kinds of compounds:

molecular (& organic)

ionic

Naming Compounds has everything to do with which elements achieve a positive oxidation state.

Type 1 – All the cations in Group IA, IIA, IIIA (just Al+3), Ag+, and Zn+2

Type 2 – All the cations that are variably charged (mostly transition metals)

Examples of naming compounds:

1. KNO_3

(*ionic* formula- salts)

oxidation states on each element are:

K

N

O

2. SO_2

(*molecular* formula)

oxidation states on each element are:

S O

3. $[Cr(H_2O)_4Cl_2]Cl$

(coordination compound: composed of a complex ion which is a transition metal with attached ligands – Section 21.3- study guide)

tetraaquadichlorochromium (III) chloride

4. C_2H_6

(*organic* formula)

Naming straight-chain alkanes

Naming of straight chain alkanes (alkanes that do not branch) is a straightforward process. To give an alkane a name, a prefix indicating the number of carbons in the molecule is added to the suffix *ane*, identifying both the kind of molecule (an alkane) and how many carbons the molecule has (the prefix). The name pentane, for example, tells you that the molecule is an alkane (thus the *-ane* ending) and that it has five carbons (pent indicates five). Prefixes for alkanes that have 1-4 carbons are rooted historically. These are methane, ethane, propane, and butane, respectively. On the other hand, for 5 carbons and up a prefix derived from greek is given. (An easy way to remember the first four names is the anagram **M**ary **e**ats **p**eanut **b**utter, standing for methane, ethane, propane, butane). Learning the prefixes for up to twelve carbons is a good idea, and they are listed in the figure below.

Number of Carbons	**Prefix**	**Structure**
1	*Meth*ane	CH_4
2	*Eth*ane	CH_3CH_3
3	*Prop*ane	$CH_3CH_2CH_3$
4	*But*ane	$CH_3(CH_2)_2CH_3$
5	*Pent*ane	$CH_3(CH_2)_3CH_3$
6	*Hex*ane	$CH_3(CH_2)_4CH_3$
7	*Hept*ane	$CH_3(CH_2)_5CH_3$
8	*Oct*ane	$CH_3(CH_2)_6CH_3$

Naming branched alkanes:

The nomenclature becomes more complex if the alkane branches. In such a case, there are several rules that you must follow to give the alkane the correct name.

1. *Find the longest chain of carbons in the molecule. The number of carbons in the longest chain becomes the parent name (refer to the above table)*
2. *After finding the parent chain, you number the parent chain starting with the end nearest the first substituent (a substituent is any fragment that juts off the main chain).*
3. *Next, determine the names of all substituents. Substituents are named as if the piece were a separate molecule, except that the suffix of -yl is used rather than ane. Thus, a two-carbon substituent would be an ethyl substituent (not an ethane substituent).*
4. *Put the substituents in alphabetical order (ie. ethyl before methyl)* in front of the parent name.
5. *Next, identify the positions of all substituents in the name by placing the carbon number where the substituent attaches to the parent chain in front of it. For example, 2-methylheptane indicates that a methyl substituent is attached to the number 2 carbon.*