2012/09/18

Test on Chapters 1-4 on Tuesday September 25th

→ Problem solving type questions

→ Full class

Nomenclature (Continued)

→ Column with Carbon is the most versatile

C^{+4} or C^{-4}

↳ Carbon doesn't like ionic compounds. Along with other non-metals it tends to form molecular compounds.

Naming molecular compounds

1st Rule:

We indicate the number of atoms of a particular element using Latin prefixes.

Mono - 1
Di - 2
Tri - 3
Tetra - 4
Penta - 5
Hexa - 6

Example: N_2O_5 → Di Nitrogen Pentoxide
CO_2 → Carbon Dioxide
NO → Nitrogen Monoxide
P_2O_5 → Di phosphorous Pentoxide

Hydro Carbons

Rule: Contains ONLY Carbon and Hydrogen

Simple Hydrocarbons

↳ Alkanes (single bonds)
↳ Alkenes (double bonds)
↳ Alkines (triple bonds)

Prefixes are for the number of carbons in the compound:

1 - meth
2 - eth
3 - prop
4 - but
5 - pent
6 - hex
7 - hept
8 - oct
9 - non
10 - dec

Example: 4 C's, single bonds? → butane
7 C's, double bonds → heptene
"propyne" → 3 C's, triple bonds

*Need to memorize the nomenclature ONLY

Why do we have two types of compounds and ways to name them?

Two compounds:

Ionic compound

- between ions (charged species)
- compound is formed by attraction of opposite charges
- Electrostatic interactions
- Strong bonds
- Stable solids
- Very high melting & boiling points
- ~~Crystalline~~ crystalline structure
- Formula represents the smallest whole number ratio between the elements in the crystal, but you cannot isolate one unit of Na-Cl.

Molecular compouns

- Formed between non-metals
- You can isolate 1 molecule of the compound
- Have low melting & boiling points
- Sometimes form crystals, but often forms gases, powdes, and liquids
- Weak bonds, which is why they have low melting/boiling points

How to determine what type of compound we have? ~~to use?~~

- Expensive tools can be used such as:
  - Mass Spectrometry
  - X-Ray Diffraction
  - NMR
- Or one can use simple tools, like a simple combustion analysis

STOICHIOMETRY

Definition: Fancy word for "proportions"

Example: What is the % (by mass) composition of C, H, and O in Ethanol?

~~Ethanol~~ C_2H_5OH.

Approach: Find the total mass of 1 mol of Ethanol, Find the mass of C, H, and Oxygen in 1 mol of ethanol. Percent will be individual mass / total mass.

Calculations:

$$\text{MM of Ethanol} = 2MM_C + 6MM_H + MM_O$$
$$= 2(12.01\ g/mol) + 6(1.00\ g/mol) + (15.9999\ g/mol)$$
$$= 24.02 + 6 + 15.9999$$
$$= 42.02\ g/mol$$

$$\% \text{ of Carbon} = (2MM_C) \div (MM_{Ethanol})$$
$$= 24.02 \div 42.02$$
$$= 0.57$$

$$\% \text{ of Hydrogen} = (6MM_H) \div (MM_{Ethanol})$$
$$= (6.048) \div (42.02)$$
$$= 0.14$$

$$\% \text{ of } \cancel{\text{Carbon}}\ \text{Oxygen} = (MM_O) \div (MM_{Ethanol})$$
$$= (15.9994) \div (42.02)$$
$$= 0.38$$

Given %ges, how will you find the formula?

Example: A particular compound is 92.3% Carbon and contains only C and H. What is its formula?

* Assume a 100g sample.

∴ In a 100g sample, 92.3 g is C
7.7 g is H

$$N_{carbons} = \frac{m_C}{MM_C} = \frac{92.3\ g}{12.01\ g/mol} = 7.68$$

$$N_{\text{hydrogens}} = \frac{m_H}{MM_H} = \frac{7.7\ g}{1.01\ g/mol} = 7.64$$

$$\therefore \#\ C_{\frac{7.68}{7.64}}\ H_{\frac{7.64}{7.64}} \Rightarrow C_1 H_1 = \text{Empirical Formula}$$