CHEM 205 section 03

LECTURE #6 Tues. Jan.22, 2008

ASSIGNED READINGS:

TODAY'S CLASS: up to 3.2

NEXT CLASS: **3.3 - 3.4**

http://faculty.concordia.ca/rogers

CHAPTER 3: MOLECULES, IONS, AND THEIR COMPOUNDS

3.1 Molecules, Compounds & Formulas

3.2 Molecular Models

3.3 Ionic Compounds: Formulas, Names & Properties

3.4 Molecular Compounds: Formulas, Names & Properties

3.5 Formulas, Compounds & the Mole

3.6 Determining Compound Formulas

3.7 Hydrated Compounds

CHAPTER GOALS *(see p.97)*

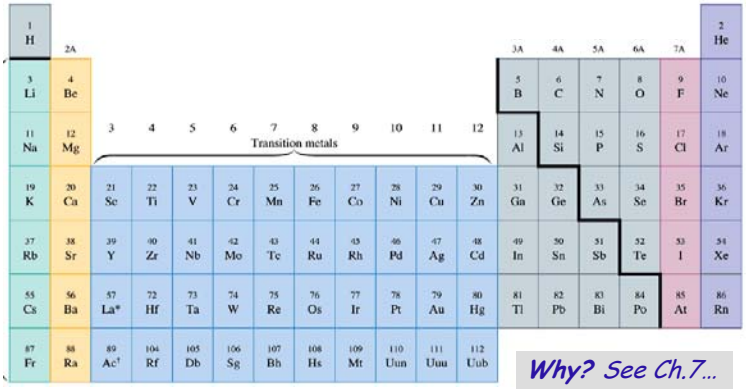
- Interpret, predict & write formulas for ionic & molecular compounds
- Name compounds
- Understand some properties of ionic compounds
- Calculate & use molar mass
- Calculate % composition & derive formulas for compounds from experimental data

Valence electrons determine chemical properties…

- **e⁻ cloud** = part of atom that interacts with surroundings
  - **valence electrons** = outermost "shell" of e⁻s on atom
  - valence shells of atoms can intermingle ⇨ form bonds
  - # valence e⁻s determines element's reactivity

Main group elements: # valence e⁻s = group # *("A/B" system)*

Valence = ?
oxygen
calcium
carbon
bromine
argon
sodium



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Why? See Ch.7…

WHY & HOW do atoms bond to each other ?

WHY: To fill their valence shell
= to have same # valence e⁻s as a NOBLE GAS
Atoms are most stable when have same # e⁻s as nearest noble gas.

Li *tends to mimic* He
O *tends to mimic* Ne
Cl *tends to mimic* Ar…

HOW: Atoms fill their valence by…
1. Sharing electrons } **COVALENT BONDING**
2. Stealing electrons
3. Giving away electrons } **FORMING IONS**

COVALENT ⇉ ***IONIC bonding***
a continuum

2e⁻s shared equally
⇨both atoms 'have' both electrons

e⁻s not shared at all
⇨ one atom has extra e⁻s, other atom missing some

Covalent bonding occurs between nonmetals

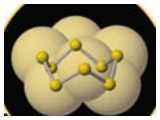
- Atoms share valence electrons: "co-valent"
- Collection of atoms joined by covalent bonds is called a MOLECULE
  = basic unit of a molecular compound
- Individual molecules move independently

Nonmetals bond covalently in elemental form & in compounds:

Seven nonmetallic ELEMENTS exist as diatomic molecules:
"I Have No Bright Or Clever Friends"
$I_2(s)$, $H_2(g)$, $N_2(g)$, $Br_2(l)$, $O_2(g)$, $Cl_2(g)$, $F_2(g)$

Fluorine F_2 

White phosphorus P_4 

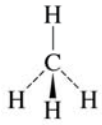
Sulfur S_8 

Ammonia NH_3 

3.1-3.2 Different ways to represent molecules (Fig.3.2)

Molecular formula: indicate elements present *using symbols*
# of atoms of each type *using subscripts*

Methane: CH_4



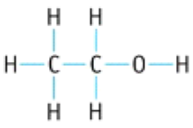
Structural formula / Perspective drawing

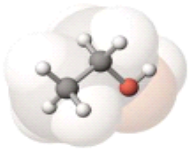
Ball-and-stick model

Space-filling model

More complicated molecules:

Ethanol C_2H_6O CH_3CH_2OH

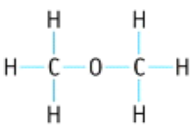


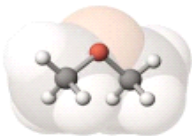


Isomers same formula, different structure

Condensed formulae: hint at connectivity of atoms

Diethyl ether C_2H_6O CH_3OCH_3





Identifying compounds (via their formulae) as MOLECULAR vs. IONIC

- formed when nonmetals react with each other
  (in more advanced courses, see transition metals too, but not now!)
- definitely molecular if FORMULA looks like:

  Nonmetal + Nonmetal

  H_2O

  PF_5

  $C_6H_{12}O_6$

- often (but not ONLY) formed when metals & nonmetals react
- definitely ionic if FORMULA looks like:

  Metal + Nonmetal

  LiF

  $NaCl$

  $MgBr_2$

ASSIGNED READINGS

- BEFORE NEXT CLASS:

  Read Ch. 3 up to 3.4

  & work on Ch.3 exercises

  Memorize the first 20 elements…
  (periodic table on exams will not include them!)