Announcements

Wednesday, September 16, 2009

Quiz 1 answer key is available under Content in the D2L course.

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

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

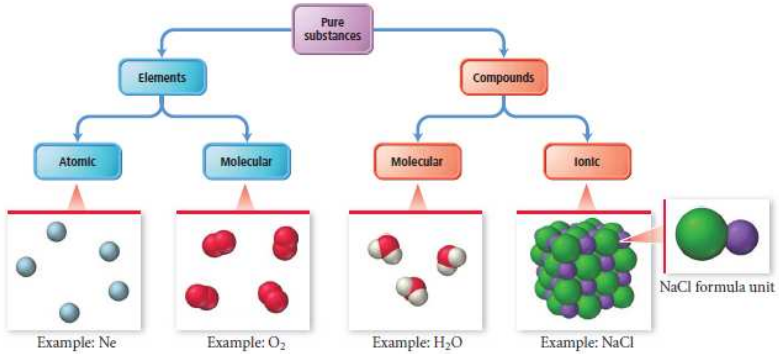
Limiting Reactants lab next week. Please prepare your book.

Written report for exp 2 is due Tuesday. See the lab report guidelines and sample lab report on the lab webpage.

Your graded spreadsheet 1 and 2 labs will be returned to your dropbox this week.

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

Elements and compounds



Atomic elements: individual atoms

(g) : far apart atoms

(s) : metallic solids are made of stacked atoms

Molecular elements: exist as groups of bonded atoms

- diatomic: pairs of covalently-bonded atoms
  H_2 , N_2 , O_2 , F_2 , Cl_2 , Br_2 , I_2
- polyatomic:

P_4

S_8

Molecular compounds: 2 or more covalently bonded nonmetals, grouped as molecules

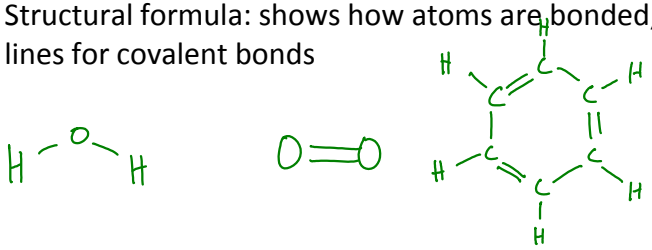
- Molecular formula: exact number of atoms per molecule

H_2O O_2 C_6H_6 = benzene C_6H_9

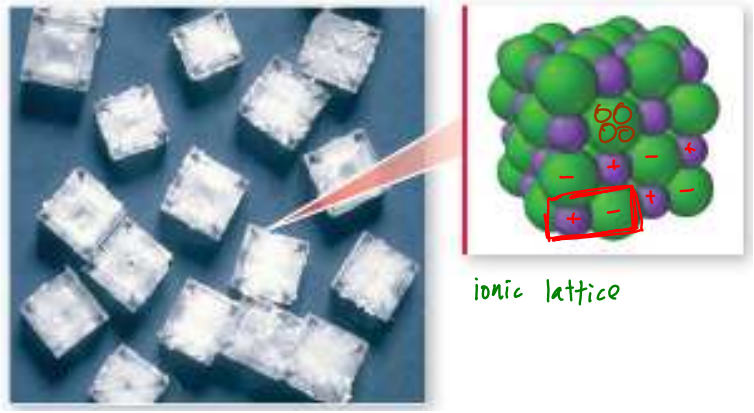
- Empirical formula: simplest ratio of atoms in compound

H_2O (2:1) "O" (1) CH (1:1) C_2H_3 (2:3)

- Structural formula: shows how atoms are bonded, with lines for covalent bonds



Ionic compounds are made from a lattice of positively and negatively charged ions



ionic lattice

Formula unit: smallest neutral collection of ions

NaCl (sodium chloride) NaCl is the formula unit

Na^+, Cl^-

Polyatomic ion: ion composed of 2 or more atoms (a charged molecule) SO_4^{2-} 1s, 4O 2- charge overall

Forms ionic compounds with an oppositely-charged ion

Na^+, SO_4^{2-} need 2:1 ratio for neutral compound Na_2SO_4 formula unit

Ionic compounds:

- positive and negative ions
- charge-neutral overall (+ charges in formula must equal - charges)
- simplest whole-number ratio of ions in formula

Formula: NaCl

Ion pair: Na^+, Cl^-

metal nonmetal

Calcium and chlorine: ion pair: Ca^{2+}, Cl^-

need 1:2 ratio for neutral compound (switch charges)

formula unit: $CaCl_2$

Fe^{3+}, O^{2-}:

ratio: 2:3

formula: Fe_2O_3

Ca^{2+}, SO_4^{2-}:

ratio: 1:1

formula: $CaSO_4$

Na^+, PO_4^{3-} ratio: 3:1 formula: Na_3PO_4

Al^{3+}, NO_3^- ratio: 1:3 formula: $Al(NO_3)_3$

$FeClO_3$ 1:1

$Fe(ClO)_3$ 1:3

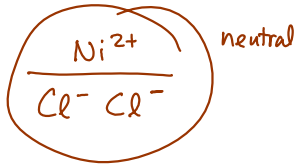
NH_4Cl

1. Is it an ionic compound? + , − charges
   binary (2 elements): metal + nonmetal
   or contains polyatomic ion(s)
2. Does the metal have fixed charge or variable charge?
   - Fixed charge: group IA, IIA, Al^{3+}, Zn^{2+}, Ag^+
   - Variable charge: all other metals
     Fe^{2+}, Fe^{3+}
3. Write the ion pair
   - If metal is variable-charge, you must figure out its charge from the formula

   $FeCl_3$ ion pair $Fe\square$, Cl^- Fe must be 3+
4. Name the compound <u>from the ion pair!</u>
   - Fixed charge metal cations are just named for the element
     Na^+: sodium
     Ag^+: silver
   - Variable charge metal cations use a roman numeral to show charge
     Fe^{2+}: iron(II) no space
     Fe^{3+}: iron(III)
   - Monoatomic nonmetal anions are named with the element root + ide
     Cl^-: chloride
     N^{3-}: nitride
     S^{2-}: sulfide
     P^{3-}: phosphide

CaO ion pair: Ca^{2+}, O^{2-}
name: calcium oxide

$NiCl_2$ ion pair: Ni^{2+}, Cl^-
1 : 2 name nickel(II) chloride



WS_3 ion pair: W^{6+}, S^{2-}
1:3 name: tungsten(VI) sulfide

vanadium(I) oxide ion pair: V^+, O^{2-}
↑ charge formula: V_2O

silver nitride ion pair: Ag^+, N^{3-}
formula: Ag_3N

calcium phosphide ion pair: Ca^{2+}, P^{3-}
formula: Ca_3P_2

$3(Ca^{2+}) = 6+$
$2(P^{3-}) = 6-$
neutral overall

(ammonia NH_3)

Polyatomic ions: charged molecules, multi-atom ions

Acetate	$C_2H_3O_2^-$
Ammonium	NH_4^+
Bicarbonate	HCO_3^-
Carbonate	CO_3^{2-}
Chlorate	ClO_3^-
Hydroxide	OH^-
Nitrate	NO_3^-
Phosphate	PO_4^{3-}
Sulfate	SO_4^{2-}

same charge as P^{3-}, S^{2-}

Removing one oxygen changes ending to -ite:

NO_2^- : nitrite
PO_3^{3-} : phosphite
ClO_2^- : chlorite
SO_3^{2-} : sulfite

Addition of H^+ reduces negative charge by 1

If >2 oxyanions in a series, use hypo- or per-