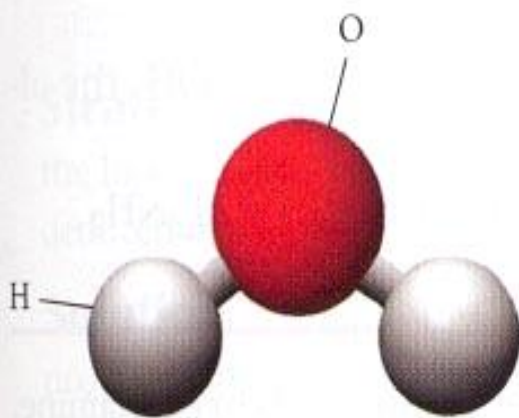
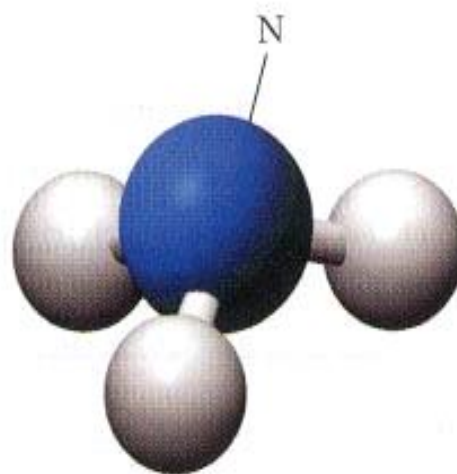


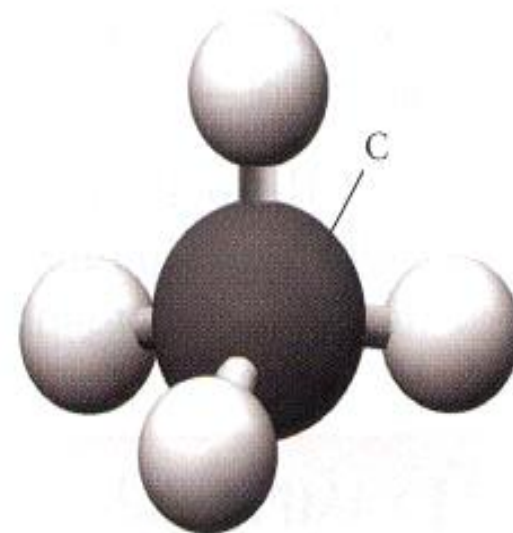
# Chemical Names & Formulas



**Water**



**Ammonia**



**Methane**

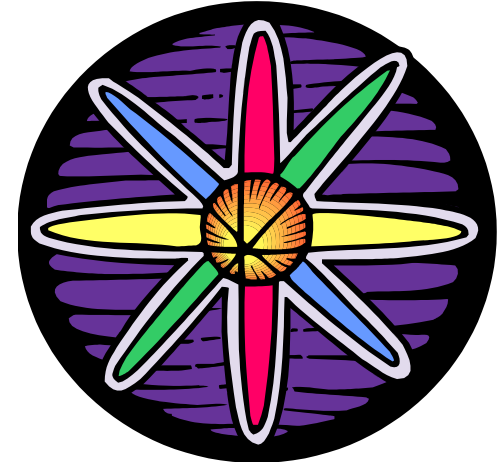
# Why “Systematic Names” ?

<b># atomic particles</b>	<b>3 (p, n, e)</b>
<b># elements</b>	<b>110+</b>
<b># elements in earth's crust (99%)</b>	<b>8</b>
<b># elements in all living things</b>	<b>25</b>
<b># compounds</b>	<b>&gt;14,000,000</b>

# Why “Systematic Names” ?

Water	$\text{H}_2\text{O}$
Lime	$\text{CaO}$
Lye	$\text{NaOH}$
Potash	$\text{K}_2\text{CO}_3$
Table Salt	$\text{NaCl}$
Laughing Gas	$\text{N}_2\text{O}$
Baking Soda	$\text{NaHCO}_3$

# Atoms and Ions



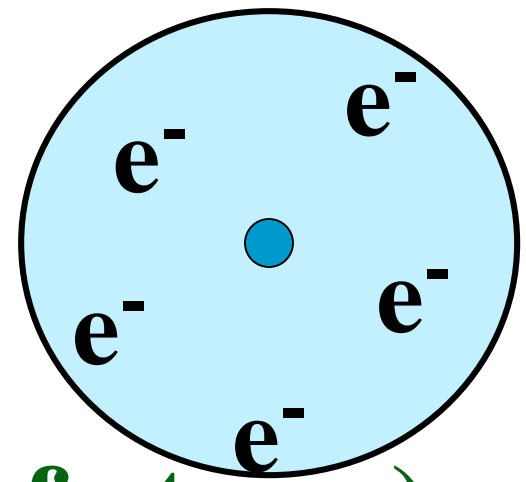
## Atom:

- neutral
- no net charge
- ( $\# p^+ = \# e^-$ )

e.g. Na  $\rightarrow$  11  $p^+$  and 11  $e^-$

Cl  $\rightarrow$  17  $p^+$  and 17  $e^-$

# Atoms and Ions



## Ion:

- atom (or group of atoms)
- has + or – charge
- has more or less  $e^-$
- only the # of  $e^-$  changes

e.g.  $\text{Na}^+ \rightarrow 11 p^+$  and  $10 e^-$

$\text{Cl}^- \rightarrow 17 p^+$  and  $18 e^-$

# Atoms and Ions



Na vs. Na<sup>+</sup>

and

Cl vs. Cl<sup>-</sup>

Very  
different

Demo: Fe vs. Fe<sup>+3</sup>



# Ions

Positive charge: “cation”



These atoms lost electrons

Negative charge: “anion”

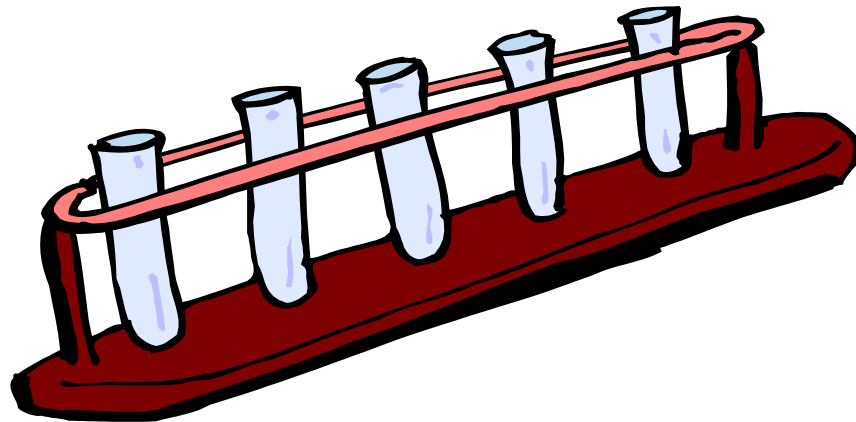


These atoms gained electrons

# Compounds

→ Substances composed of 2 or more different atoms

HCl NaCl CO<sub>2</sub>





# Chemical Formulas

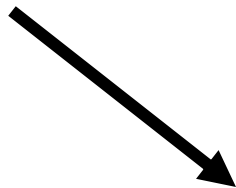
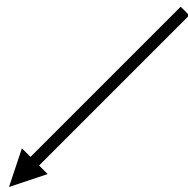
→ Shows the kinds and numbers of each type of atom in a chemical compound.



two atoms of H

one atom of O

# Compounds



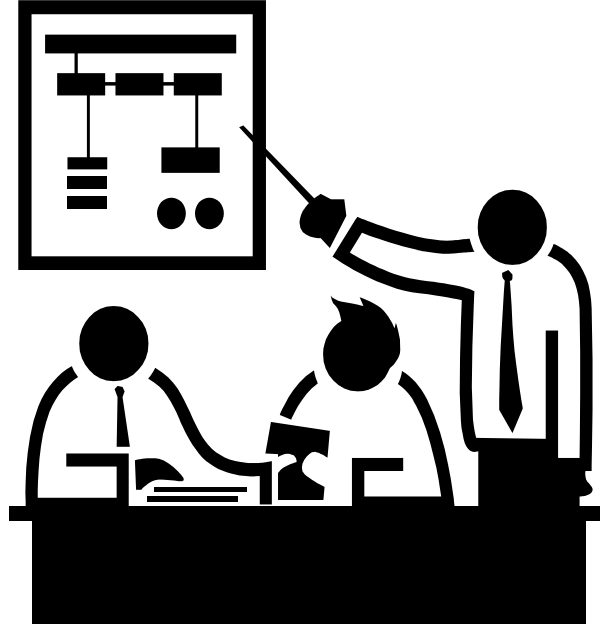
## Molecular

- Atoms bonded as a unit
- nonmetals
- e.g.  $\text{H}_2\text{O}$

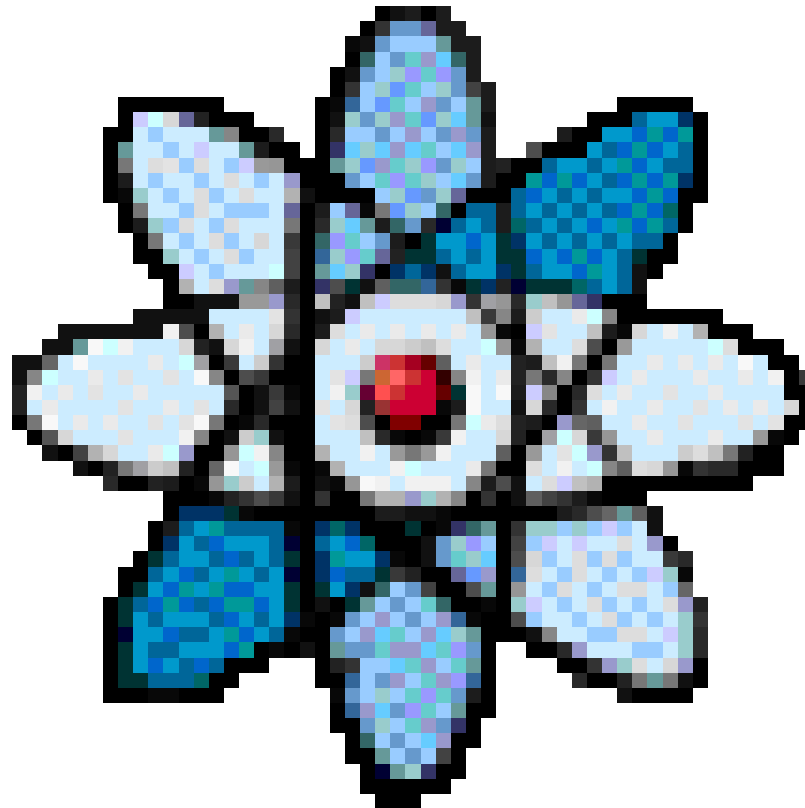
## Ionic

- Ions held together by + and - charges
- metal + nonmetal
- e.g.  $\text{NaCl}$

Charges NOT shown<sup>10</sup>



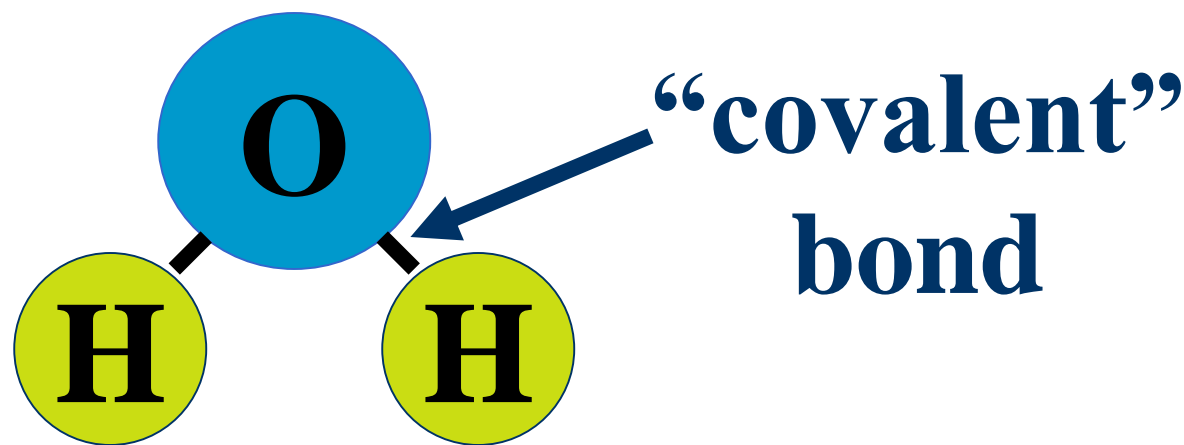
# Molecular & Ionic Compounds



# 1. Molecular Formulas

Molecules are represented by molecular formulas: discrete units of bonded nonmetals.

e.g  $\text{H}_2\text{O}$  &  $\text{CO}_2$



“structural” formula for water

# Naming Molecular Compounds

(bonded nonmetal atoms)

prefix-1<sup>st</sup> atom-prefix-2<sup>nd</sup> atom-ide

number

$\text{N}_2\text{O}_5$  = dinitrogen pentoxide

<i>Number</i>	<i>Prefix</i>
<i>1</i>	<i>Mono</i>
<i>2</i>	<i>Di</i>
<i>3</i>	<i>Tri</i>
<i>4</i>	<i>Tetra</i>
<i>5</i>	<i>Penta</i>
<i>6</i>	<i>Hexa</i>
<i>7</i>	<i>Hepta</i>
<i>8</i>	<i>Octa</i>
<i>9</i>	<i>Nona</i>
<i>10</i>	<i>Deca</i>



*Note: don't use 'mono' for the first atom.*

Try It



**Dangerous  
chemical**

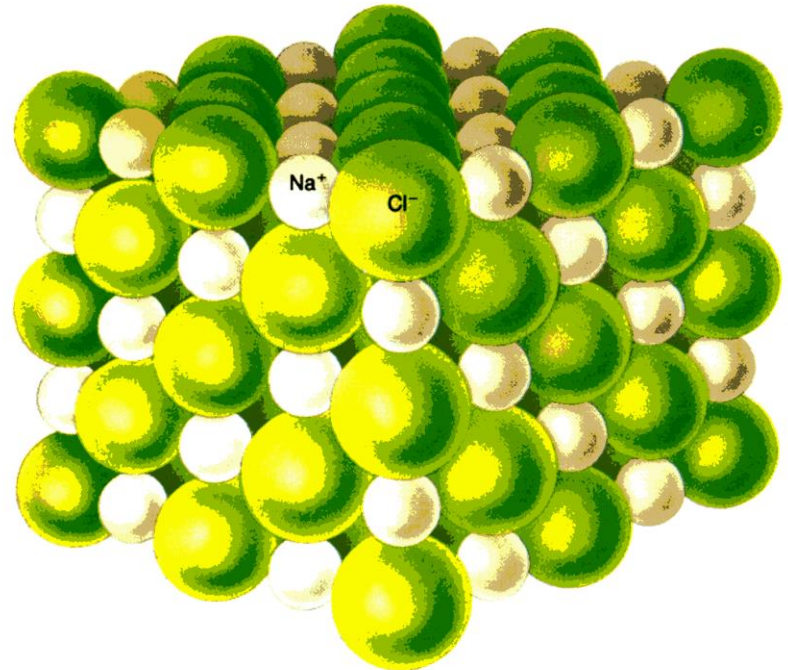


# Ionic Formulas

Ionic compound is represented by a formula unit, the lowest ratio of atoms in the compound.



“ionic” bond





# Naming Ionic Compounds

(positive metal ion +  
negative nonmetal ion)

→ First must  
learn ion  
names and  
charges!



# Monatomic Ions (single atom ions)

Metals → form cations (+)

*Mg loses two  $e^-$  to form  $Mg^{+2}$*

Nonmetals → form anions (-)

The name ends in “ide”

*Cl gains one  $e^-$  to form  $Cl^-$*

## Charge from Periodic Table

# Common Monatomic Ions

**+1      +2      +3                      -3      -2      -1**

<b>1</b>	<b>2</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>
<b>Li<sup>+</sup></b>	<b>Be<sup>2+</sup></b>			<b>N<sup>3-</sup></b>	<b>O<sup>2-</sup></b>	<b>F<sup>-</sup></b>	
<b>Na<sup>+</sup></b>	<b>Mg<sup>2+</sup></b>	<b>Al<sup>3+</sup></b>		<b>P<sup>3-</sup></b>	<b>S<sup>2-</sup></b>	<b>Cl<sup>-</sup></b>	
<b>K<sup>+</sup></b>	<b>Ca<sup>2+</sup></b>			<b>As<sup>3-</sup></b>	<b>Se<sup>2-</sup></b>	<b>Br<sup>-</sup></b>	
<b>Rb<sup>+</sup></b>	<b>Ba<sup>2+</sup></b>					<b>I<sup>-</sup></b>	

**end in --ide**



# Monatomic Ions: Try It!!!

When the following elements become ions, state:

- ion name
- charge
- number of  $e^-$  lost or gained

Ca

P

K

S

Br

Al



# Monatomic Ions:

**Some metals can form two different types of ions.**

**Iron:  $\text{Fe}^{+2}$  and  $\text{Fe}^{+3}$**

**Copper:  $\text{Cu}^{+1}$  and  $\text{Cu}^{+2}$**

**•See Periodic Table for charges.**

# Multiple Charges: Names

• Stock System:  
“atom (charge)”

$\text{Fe}^{2+}$  is Iron(II) ion

$\text{Fe}^{3+}$  is Iron(III) ion



# Multiple Charges: Names

- Classical System:

Latin name ending in

“ous” for lower charge

“ic” for the higher charge

$\text{Fe}^{2+}$  is Ferrous ion

$\text{Fe}^{3+}$  is Ferric ion

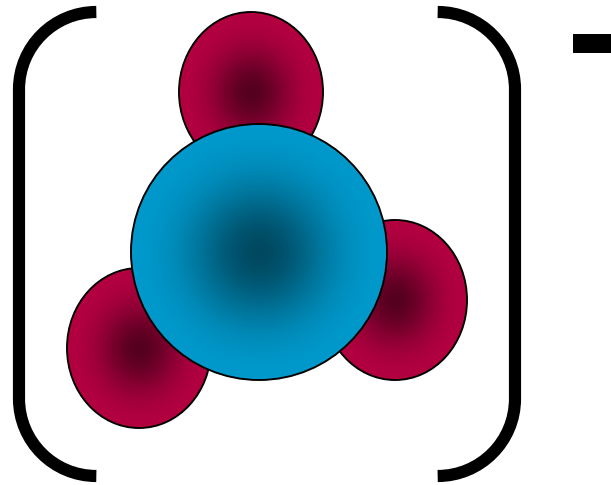
# Others

Ion	Stock	Classic
$\text{Cu}^+$	Copper(I)	Cuprous
$\text{Cu}^{2+}$	Copper(II)	Cupric
$\text{Pb}^{2+}$	Lead(II)	Plumbous
$\text{Pb}^{4+}$	Lead(IV)	Plumbic
$\text{Sn}^{2+}$	Tin(II)	Stannous
$\text{Sn}^{4+}$	Tin(IV)	Stannic

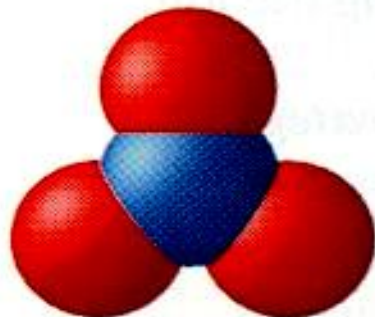


# Polyatomic Ions

Some atoms group together as a unit to form an ion.



# Polyatomic Ion: Charged group of atoms acting as a unit



**nitrate ion**



**phosphate ion**



**sulfate ion**



**ammonium ion**

# Regents Table 'E'

Note "ite" & "ate" pairs

--ite	--ate
sulfite: $\text{SO}_3^{2-}$	sulfate: $\text{SO}_4^{2-}$
nitrite: $\text{NO}_2^-$	nitrate: $\text{NO}_3^-$
chlorite: $\text{ClO}_2^-$	chlorate: $\text{ClO}_3^-$

Be able to recognize them !!!<sup>27</sup>

# Ionic Formulas

**Name: cation then anion name**

- Potassium chloride



**Charges must “balance”  
But don’t write charges!**

# Ionic Formulas

- Calcium bromide

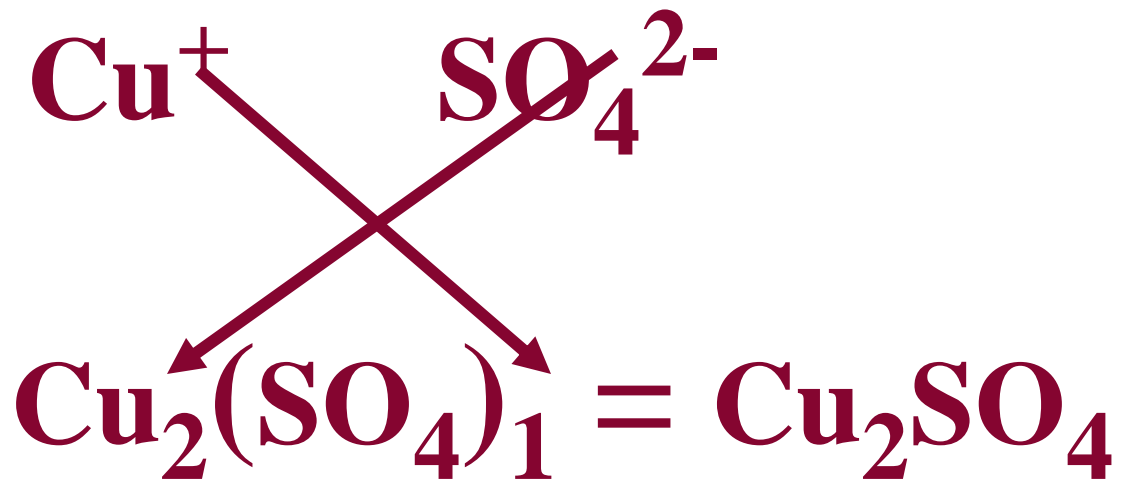


- Copper(I) sulfate



# Shortcut → “Criss Cross”

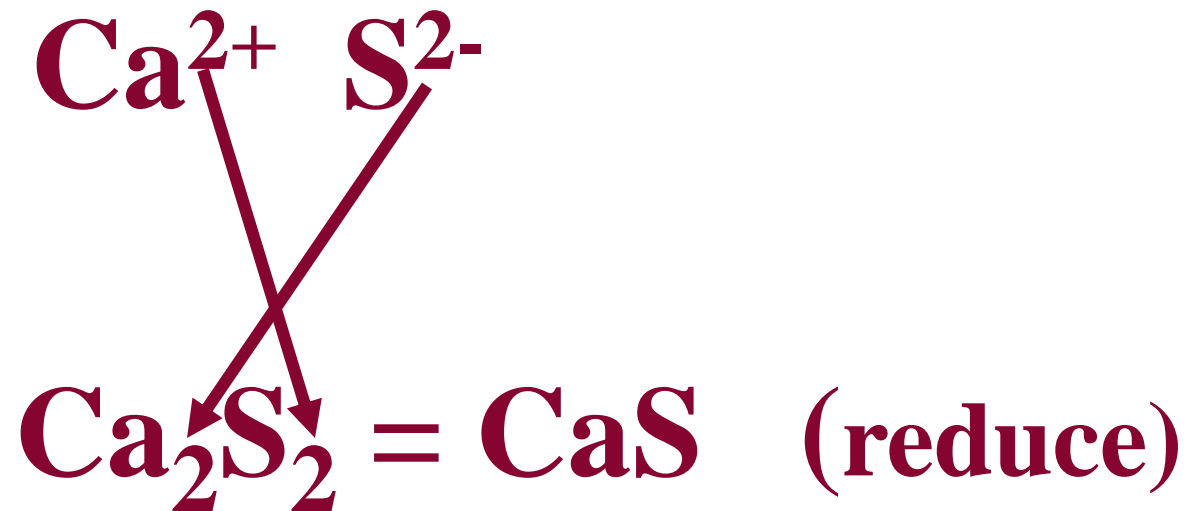
Copper(I) sulfate



**Need to recognize polyatomic ions**

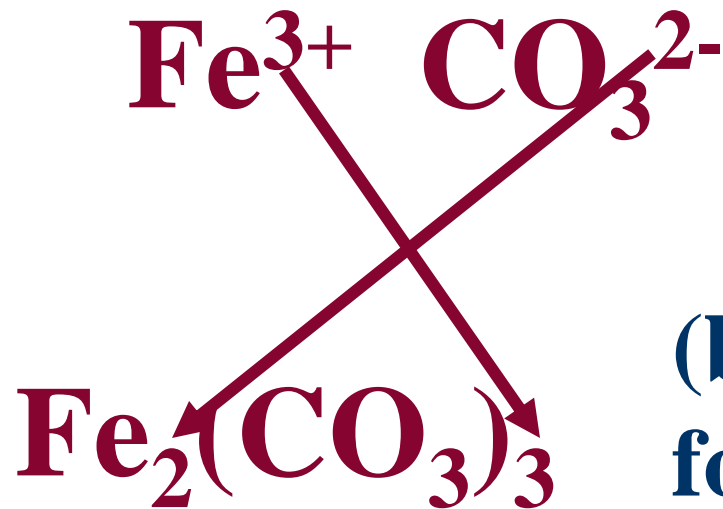
# Shortcut → “Criss Cross”

## Calcium sulfide



# Shortcut → “Criss Cross”

## Iron(III) Carbonate

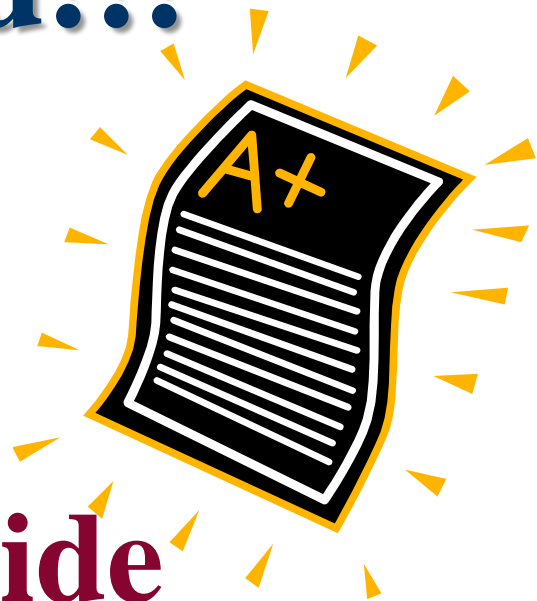


(brackets needed  
for polyatomic ion  
with subscript)



# Name or Give the Formula of That Compound!!!

- ✓ Silver chloride
- ✓  $\text{CuBr}_2$
- ✓ Ammonium bromide
- ✓  $\text{Mg}_3(\text{PO}_4)_2$
- ✓ Calcium chromate



# Try Some More!!

✓  $\text{N}_2\text{O}_5$

✓  $\text{PCl}_3$

✓  $\text{AlCl}_3$

✓ Sodium hydrogen sulfate

✓  $\text{SnO}_2$





# General Properties

## Molecular Compounds

**Weak “intermolecular forces”  
(molecular attractions)  
Low melting & boiling points**

## Ionic Compounds

**Strong ionic attractions  
High melting & boiling points**

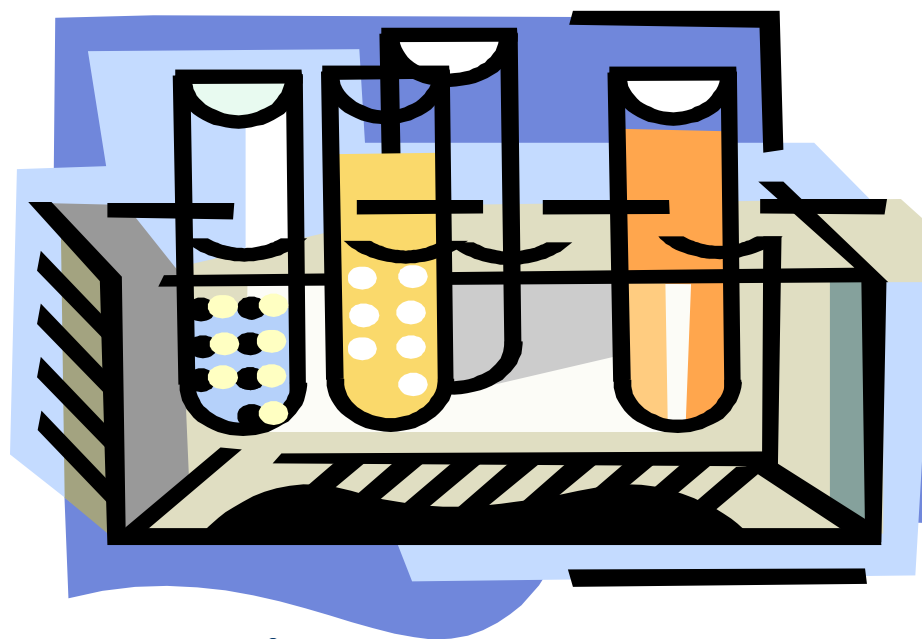
# Naming Acids

- Acids are a special class of compounds with  $\text{H}^+$  as the cation.

Example:

$\text{H}^+$  with  $\text{Cl}^-$

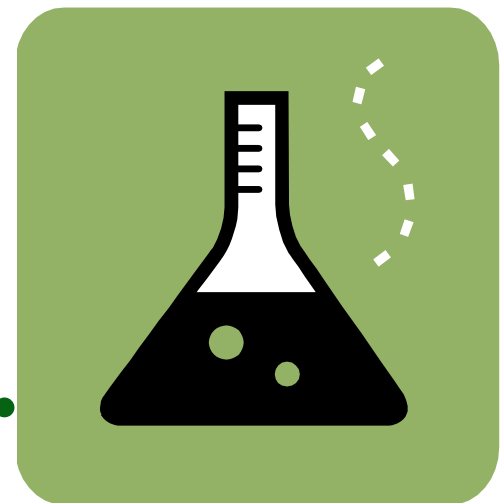
$\text{HCl}(aq)$



where  $(aq)$  = dissolved in water

# Naming Acids

Acids are named according to the anion.



1. If the anion ends in **–ide**,  
the acid is **hydro----ic acid**.

$\text{Cl}^-$  is chloride

$\text{HCl}(aq)$  is hydrochloric acid



# Naming Acids

**2. If the anion ends in –ite,  
the acid is ----ous acid.**

**$\text{SO}_3^{2-}$  is sulfite**

**$\text{H}_2\text{SO}_3(aq)$  is sulfurous acid**



# Naming Acids

**3. If the anion ends in –ate,  
the acid is –ic acid.**

**$\text{NO}_3^-$  is nitrate**

**$\text{HNO}_3(aq)$  is nitric acid**



# Naming Acids: Try It

**Name**

✓  $\text{HCN}(aq)$

✓  $\text{HClO}_4(aq)$

✓  $\text{HClO}(aq)$

✓  $\text{HCl}(aq)$





# Naming Acids: Try It

**Write the formula for:**

- ✓ carbonic acid
- ✓ nitrous acid

**Regents Table K**

# Summary:

## Names & Formulas

- **Atoms vs. ions**



- **Compounds:**

- **molecular (nonmetals)**

- **ionic (metal + nonmetal)**

↓                      ↓

**cation(+)**    **anion(-)**



# Summary:

## Names & Formulas

- **Molecular compound:**  
-prefix-atom-prefix-atom-ide

**$\text{N}_2\text{O}_5$  = dinitrogen pentoxide**

# Summary:

## Ionic compounds

- know names & charges
- monatomic ions (PeriodicTable)
- transition metals
  - stock system: iron(II)
- polyatomic ions:  $\text{NO}_3^-$
- compound name: cation+anion

# Study Guide



# Warm-up

How many  $p^+$  and  $e^-$  in Ca and  $Ca^{+2}$ ?

Is  $Ca^{+2}$  an anion or cation?

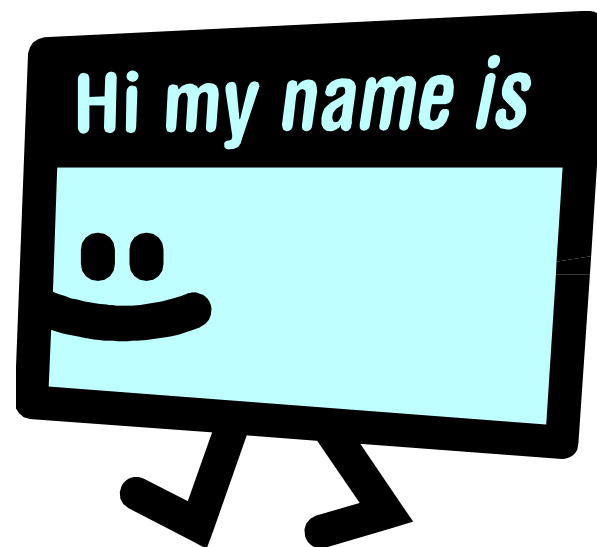
What are the two general types of compounds?

How do you recognize each?

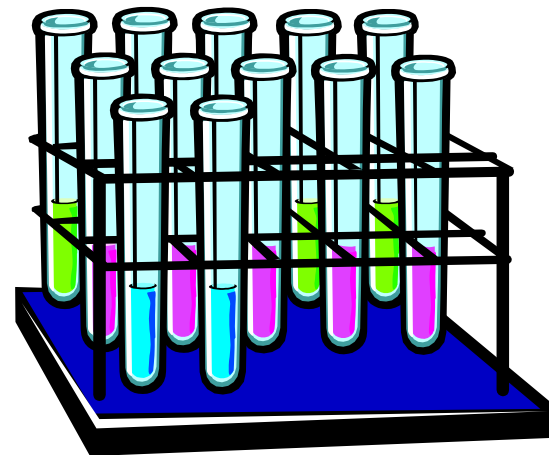


# Warm-up

Name  $\text{NO}_2$  and  $\text{N}_2\text{F}_4$



# Warm-up



Give the symbol and the name of the ion that each element forms:

**Mg   Al   P   Br**

How do you know  $\text{NH}_4\text{NO}_3$  is ionic even though it has only nonmetal atoms?



# Warm-up



1. Fill in the table:

*Molecular*

*Ionic*

---

**Types of atoms**

---

**Name of formula**

---

**Name of bond**

---

2. Name  $\text{N}_2\text{O}$  and  $\text{Al}_2(\text{SO}_4)_3$ .

# Name or give formula:

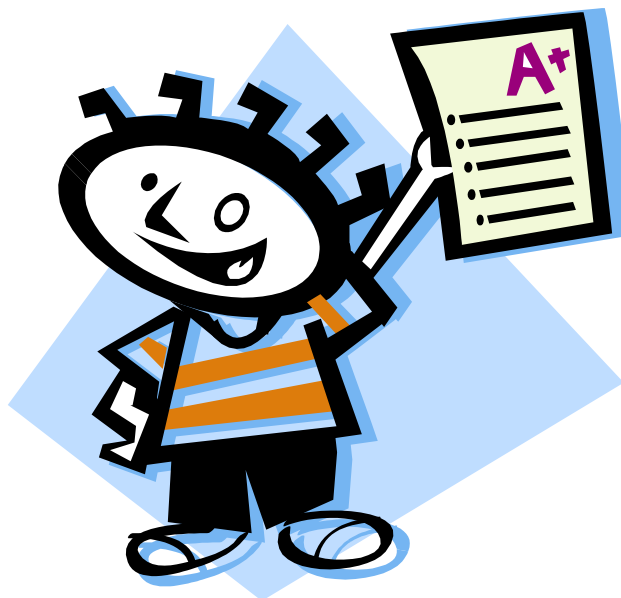
gold(I) sulfate



barium phosphide



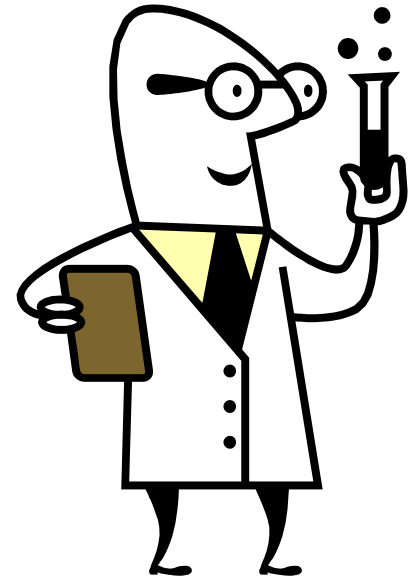
calcium hydrogen carbonate



# Warm-up

**Write the formula unit for sodium sulfate.**

**Why can't this formula be reduced?**



# Name or give formula:



magnesium nitride



calcium sulfate



aluminum hydrogen sulfate



barium phosphate



# Warm-up

Name or write formula:



• Hydroiodic acid



# Warm-up

Name or write formula:

- lead(IV) carbonate
- barium nitride
- CO
- SnS<sub>2</sub>
- sulfurous acid

