

Unit 5

Chemical Compounds

Compounds

- Most elements are not found separately but combined in a compound with something else
- The reason for this is the octet rule

We want 8...eight is great!

Compounds

- There are two different kinds of chemical bonds:
 - Ionic Bonds
 - Covalent Bonds
- Both types have compounds that end up with a full valence.

Compounds – Ionic vs. Covalent

- Ionic Bonds are formed when atoms transfer their electrons from one to the other.
- Covalent Bonds are formed when atoms share their electrons from one to the other.

Compounds – Ionic vs. Covalent

Below is a list of different compounds. How can we tell if they are ionic or covalent?

NaCl	Ionic
SCl ₂	Covalent
Al ₂ O ₃	Ionic
N ₂	Covalent

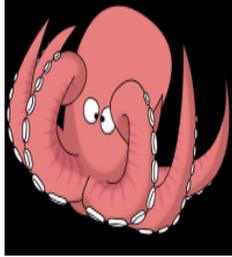
All of the Ionic Bonds have what types of atoms?
All of the Covalent Bonds have what types of atoms?

Compounds – Ionic vs. Covalent

- Ionic Bonds are between metals and nonmetals
 - Metals transfer their electrons to the nonmetals.
- Covalent Bonds are between nonmetals.
 - Electrons are shared between the valences.

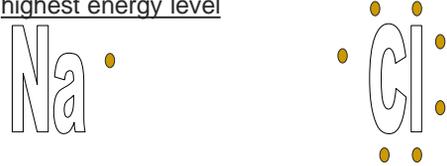
[Compounds – Octet Rule]

- All of the atoms end up like Noble Gases. They have full valence shells.
- These elements have 8 electrons in highest energy level



[Ionic Bonding]

- Atoms will either give up or take electrons to get to have eight in their highest energy level



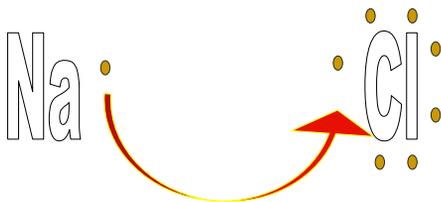
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[Give up/take away electrons]



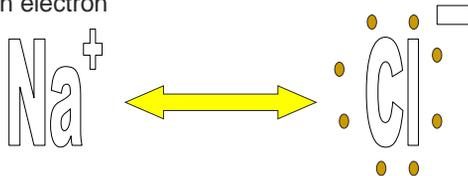
[Charges]

- Sodium now has a +1 charge since it has lost an electron
- Chlorine now has a -1 charge since it gained an electron



[Charges]

- Sodium now has a +1 charge since it has lost an electron
- Chlorine a minus charge since it gained an electron



[Ionic Bond]

- Opposites attract, so a bond is formed between the two of them.



[Determining metal and non-metal charge]

- Where are the metals on the periodic table?
 - Metals always have what charge?
- Where are the nonmetals?
 - Nonmetals always have what charge?

We'll see the charges of the different families on the following slide.

[Using the periodic Table to find an ion's charge]

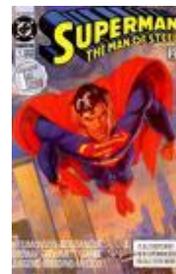
Periodic Table of Elements with charge indicators. The table is color-coded by groups: IA (+1), IIA (+2), IIIA (+3), IVA (+4), VA (+5), VIA (+6), VIIA (+7), and VIIIA (-1). A red box highlights the text "We're going to forget all about the middle of the table for now."

[Counting Atoms]

- Compounds are written with funny numbers above below and to the side of the atomic symbols.
- These are called superscripts, subscripts and coefficients.

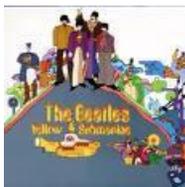
[Counting Atoms - Superscripts]

- Superscripts are written above the text.
- They are the superheroes of the chemical world.
- They are used to tell the charge on a particular ion.
- Examples are:
 - Na⁺
 - N⁻³



Counting Atoms - Subscripts

- Subscripts are written below the text.
- They are the submarines of the chemical world.
- They are used to tell amount of a particular atom.
- Examples are:
 - Al_2O_3
 - UF_6



Compounds - Coefficients

- Coefficients are written IN FRONT OF THE TEXT.
- They add a little math to the world of chemistry.
- They are used to tell the amount of a particular compound.
- Examples are:
 - 2Cl_2
 - 5NH_3



Counting Atoms - Parentheses

- Parentheses are written (in the middle of the text).
- They call time out in the chemical world.
- They are used to count a group of atoms separately.
- Examples are:
 - $\text{Na}(\text{CO}_3)$
 - $(\text{NH}_4)_2\text{S}$



Compounds – Counting Atoms



How many Mg's are there? **1**

How many Cl's are there? **2**

Compounds – Counting Atoms



How many Mg's are there? **3**

How many Cl's are there? **6**

Compounds – Counting Atoms



How many Mg's are there? **3**

How many N's are there? **2**

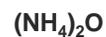
Compounds – Counting Atoms



How many Mg's are there? **12**

How many N's are there? **8**

Compounds – Counting Atoms



How many N's are there? **2**

How many H's are there? **8**

How many O's are there? **1**

Compounds – Counting Atoms



How many N's are there? **6**

How many H's are there? **24**

How many O's are there? **3**

Chemical Nomenclature

How to write and say
chemical formulas

Naming Ionic Compounds

- Ionic Compounds are between a metal and a non-metal
 - Why?
- When naming ionic compounds:
 - Write/say the name of the metal
 - (THE METAL IS ALWAYS FIRST!)
 - Write the name of the non-metal
 - Drop the ending and add -ide to it.
 - Usually before the second vowel from the end.

Naming Ionic Compounds

- NaCl =>
 - Sodium
 - Chlorine
 - -ide
 - Sodium Chloride



Practice Problem

- Name the following ionic compounds
 1. ZnO Zinc oxide
 2. LiBr Lithium bromide
 3. Mg₃N₂ Magnesium nitride
 4. BaS Barium sulfide
 5. K₃P Potassium phosphide

Combining metals and nonmetals

- When combining a metal and a non-metal:
 - the overall charge of the compound must be zero.
 - The metal must be written first



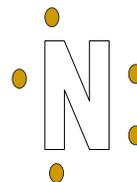
You must balance out the overall charge!

Combining metals and nonmetals

- Take for instance calcium nitride.
 - What is the symbol for Calcium?
 - Ca
 - What is the charge of the calcium ion?
 - +2
 - What is the symbol for Nitrogen?
 - N
 - What is the charge of the nitride ion?
 - -3

Combining metals and nonmetals

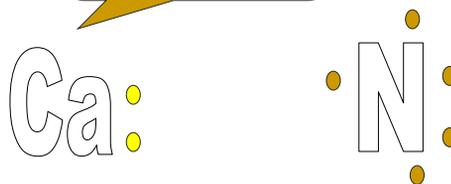
- Ca⁺² means each calcium ion has 2 more electrons than it wants
- N⁻³ means each nitride ion needs 3 more electrons.

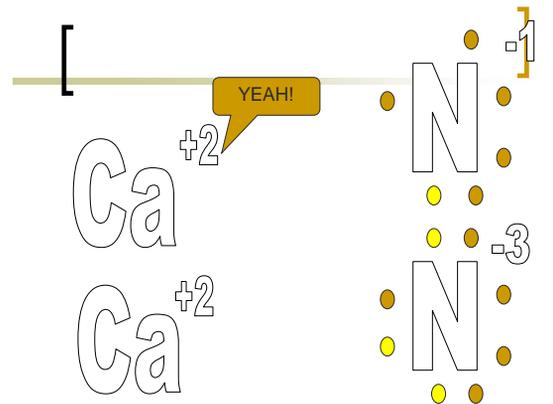
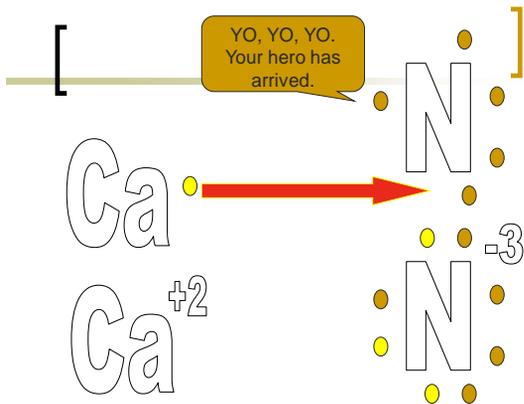
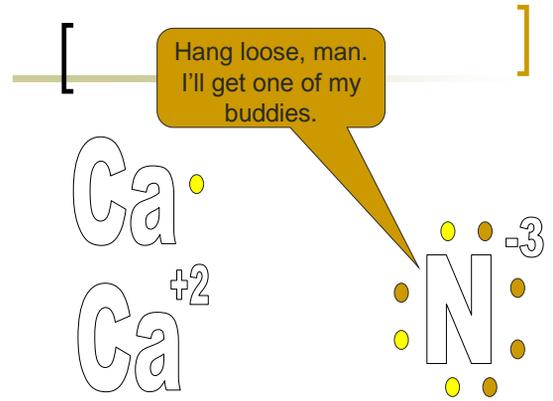
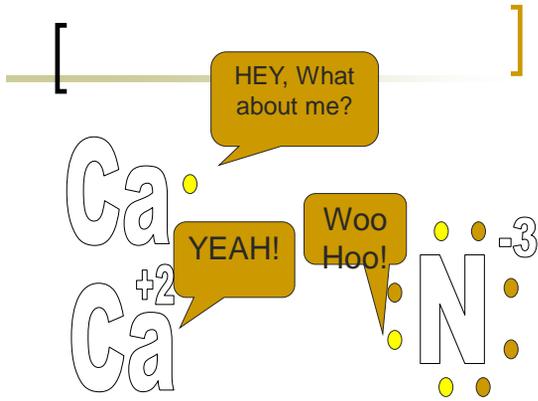
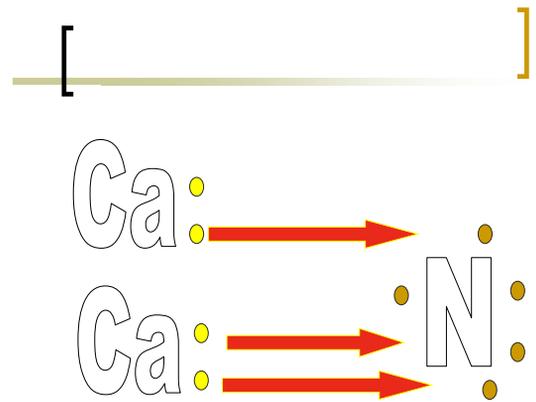
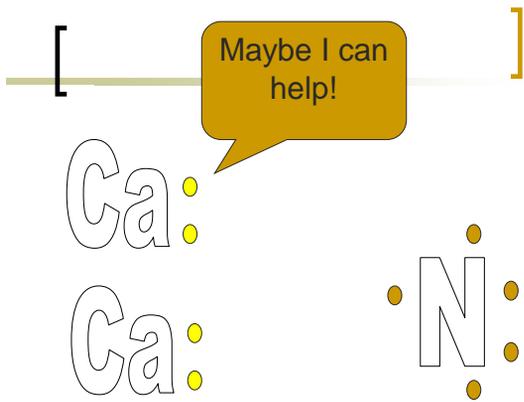


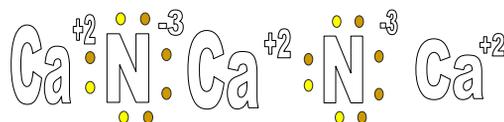
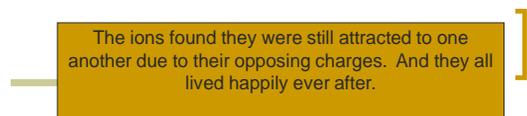
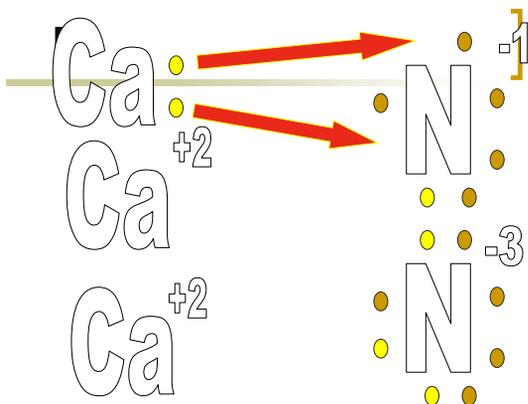
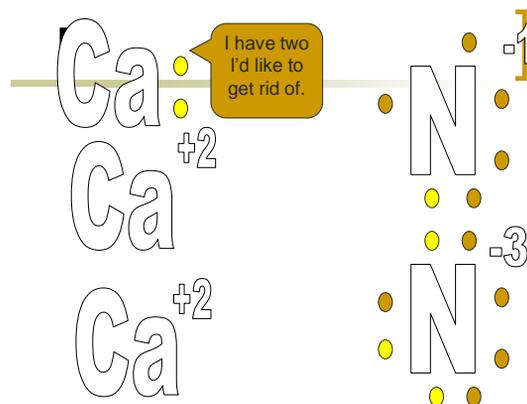
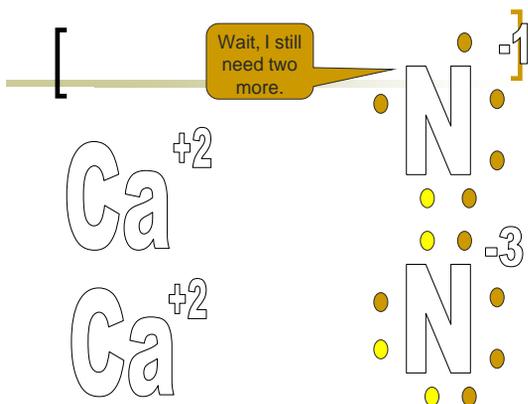
Hey buddy, can you spare 3 electrons?



Sorry dude, I only have two.







[Steps for Writing Ionic Formulas]

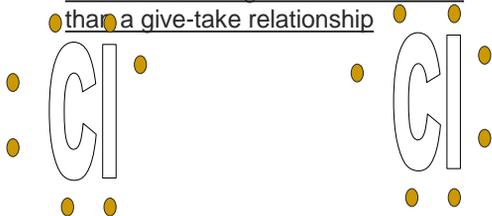
- Write the Symbol for the metal
 - Write the charge as a superscript
- Write the Symbol for the nonmetal
 - Write the charge as a superscript
- Balance the charges
 - OR
- Switchy Switchy

[Practice Problem]

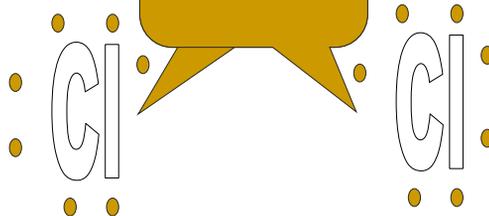
- Give the formulas for the following compounds
1. Beryllium iodide BeI₂
 2. Potassium sulfide K₂S
 3. Magnesium oxide MgO
 4. Strontium fluoride SrF₂

Covalent Bonds

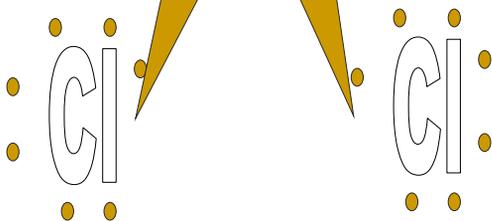
- Compounds formed by two non-metals
- More of a sharing of electrons rather than a give-take relationship



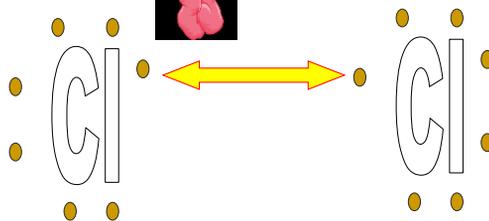
Can you spare an electron?



JINX!



Why don't you share an electron? You know sharing is caring!

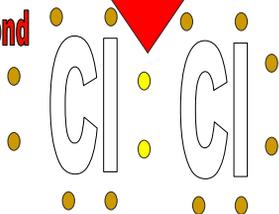


Shared pair of electrons

=

Covalent Bond

Co=together
Valent=valence electrons...
therefore, covalent is sharing electrons!



Naming Covalent Bonds

- We will write the prefixes on periodic table
- If there is only one of the first element, no prefix. Otherwise attach prefix (2-10)
- Second always gets prefix and -ide ending (just like ionic anion) (1-10)

Prefixes

Covalent Compound Prefixes	
1	mono-
2	di-
3	tri-
4	tetra-
5	penta-
6	hexa-
7	hepta-
8	octo-
9	nona-

Practice

- Name these:
 - ICl_5
 - Iodine Pentachloride
 - N_2O
 - Dinitrogen Monoxide

Practice Problems

- Name the following covalent compounds
 1. CO_2 Carbon dioxide
 2. PCl_5 Phosphorous pentachloride
 3. CO Carbon monoxide
 4. P_3F_6 Triphosphorous hexaflouride

Practice Problems

- What are the formulas for the following compounds?
 1. Nitrogen dioxide NO_2
 2. Sulfur hexafluoride SF_6
 3. Dicarbon hexahydride C_2H_6
 4. Nitrogen monoxide NO

THAT'S
ALL
FOLKS!

