

Unit 9 Note Packet: Bonding & Nomenclature Chemistry

Name _____

Types of Bonds

Objective: To determine the difference between metallic, ionic, and covalent molecules.

Review Model: Elements v. Compounds/Molecules

Fe is the elemental form of iron
Fe⁺³ is the ionic form of iron
C is the elemental form of carbon
Cl₂ is the elemental form of chlorine
Cl⁻ is the ionic form of ion
FeCl₃ is the compound from iron and chlorine

1. What does the subscript 2 indicate in Cl₂? 3. Classify C, Fe & Cl as metals or nonmetals.

2. What is implied when there is no subscript?

4. Evaluate the statement, "The formulas for elements never contain a subscript." Is this statement true?

5. From the two examples provided, would you expect the formula S₈ to represent a compound or an element? Using examples from the Model, explain how you classified S₈.

Classify each formula below as an element or a compound:

- | | |
|----------------------------|---------------------------|
| a. Co _____ | f. SiO ₂ _____ |
| b. CaCl ₂ _____ | g. PF ₅ _____ |
| c. NaOH _____ | h. P ₄ _____ |
| d. Br ₂ _____ | i. OF ₂ _____ |
| e. NaBr _____ | |

Types of Bonds Model: Metallic v. Ionic v. Covalent

| Metallic | Ionic | Covalent |
|----------|--------------------------------|------------------|
| Na | NaCl | Cl ₂ |
| CuNi | Cu ₃ N ₂ | H ₂ O |
| Cu | MgBr ₂ | NH ₃ |
| Au | ZnO | CO ₂ |

The periodic table is separated into two main groups: Metals & Non-Metals

- Based on the types of Bond Model above, **Metallic bonds** consist of (Only Metals or Metals & Non-metals or Only Non-metals)
- Classify the elements for following ionic compounds:

| Ionic | Element 1 | Metal or Nonmetal | Element 2 | Metal or Nonmetal |
|--------------------------------|-----------|-------------------|-----------|-------------------|
| <i>NaCl</i> | <i>Na</i> | <i>Metal</i> | <i>Cl</i> | <i>NM</i> |
| Cu ₃ N ₂ | | | | |
| MgBr ₂ | | | | |
| ZnO | | | | |

- Based on your information from the data above, **Ionic bonds** consist of elements that are (Only Metals or Metals & Non-metals or Only Non-metals)
- Classify the elements for following covalent compounds:

| Covalent | Element 1 | Metal or Nonmetal | Element 2 | Metal or Nonmetal |
|-----------------------|-----------|-------------------|-----------|-------------------|
| <i>Cl₂</i> | <i>Cl</i> | <i>NM</i> | - | - |
| H ₂ O | | | | |
| NH ₃ | | | | |
| CO ₂ | | | | |

- Based on your information from the data above, **Covalent bonds** consist of elements that are (Only Metals or Metals & Non-metals or Only Non-metals)

SUMMARY: Check all that apply for each type of bond

| | Metal | Non-Metal |
|---------------|-------|-----------|
| Metallic Bond | | |
| Ionic Bond | | |
| Covalent Bond | | |

Practice: Classify each of the following compounds as either ionic or covalent.

- | | | | |
|----------------------|-------|----------------------|-------|
| a. NaBr | _____ | f. BaS | _____ |
| b. SF ₆ | _____ | g. CsF ₂ | _____ |
| c. CoBr ₂ | _____ | h. CrCl ₃ | _____ |
| d. OF ₂ | _____ | i. CO ₂ | _____ |
| e. NO ₂ | _____ | j. CO | _____ |

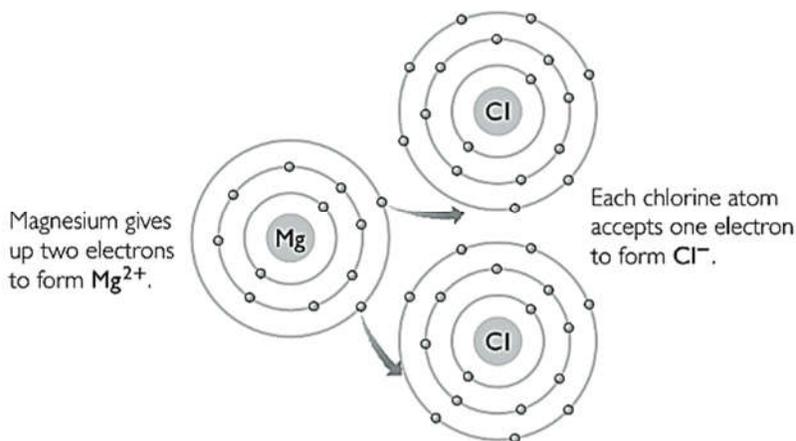
- **Compound**=a substance that has _____ different types of _____ bonded together
- **Bond**=a region that forms when _____
The attraction between 2 or more atoms allows for the formation of a compound.
 - Only _____ electrons participate in bonding
- **Octet Rule**
 - Atoms bond in order to get _____ valence electrons around them (Exception: Hydrogen)

Types of Bonds:

Ionic Bonds:

- Made up of a _____ and a _____
- Electrons are _____ from the _____ to the _____
- Even though the compound is made up of 2 or more charged ions, the compound overall has _____
 - This means that the total charge of the _____ + total charge of _____ = 0

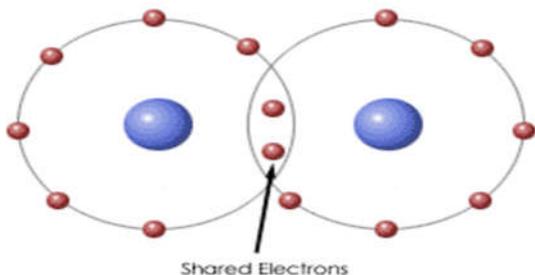
Magnesium Chloride



$Mg^{2+} + Cl^- + Cl^-$ produces $MgCl_2$ with zero charge.

Covalent Bonds

- Formed between a _____
- Involves the _____ of valence electrons



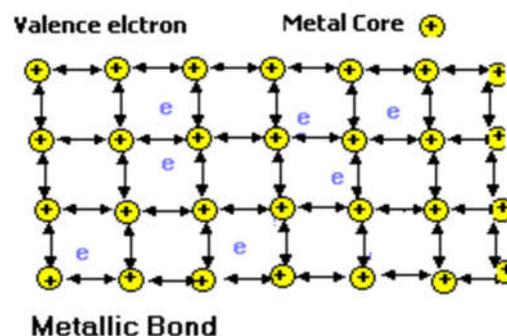
Metallic Bonding: What kind of bonds holds atoms of metals (i.e. copper, silver, gold) together?

- Metals tend to _____ their valence electrons to obtain a noble gas electron configuration
- In a metallic solid, each atom will _____ their _____ to neighboring atoms
- There is a **constant movement of electrons** (aka “_____”) throughout the entire metallic solid since none of the atoms “wants” the electrons
 - Think of it as a big game of “Hot Potato”
 - The constant movement of valence electrons is what makes solid metals



Cu Cu

Cu Cu



Summary Chart

Fill in the following table regarding the differences between the types of compounds you’ve learned about so far this unit.

| | Ionic Compounds | Covalent (Molecular) Compounds | Metals |
|---|--|---|---|
| Made up of... (metal, nonmetal) | | | |
| Electrons are.... (transferred, shared, constantly moving) | | | |
| Physical Properties: (high vs low BP/MP...does or does not conduct) | _____ melting point & boiling point <ul style="list-style-type: none"> • Solids _____ conduct electricity • When dissolved in water: _____ conduct electricity | <ul style="list-style-type: none"> • _____ melting point & boiling point • Solids _____ conduct electricity • When dissolved in water: _____ conduct electricity | <ul style="list-style-type: none"> • _____ melting point & boiling point • Solids _____ conduct electricity |

Types of Bonds WS:

1. Give three characteristics of ionic compounds.
2. Compare table sugar, sucrose ($C_{12}H_{22}O_{11}$) and table salt, sodium chloride (NaCl) when answering the following:
 - a. Which has a higher melting point? Why?
 - b. Which is a better conductor of electricity when dissolved in water? Why?
3. What is the difference between a covalent bond, an ionic bond, and a metallic bond?
4. Would a metallic bond or covalent bond have a higher boiling point? Why?
5. What is a sea of electrons and how does it affect metallic bond properties?
6. If you held a glass rod and a copper wire in a flame, which would eventually feel warm in your hand? Why??

7. Decide if the description represents IONIC bonding or COVALENT bonding

_____ It is a non conductor of electricity, whether it exists as a solid, melted, or dissolved in water.

_____ It is a nonelectrolyte in the solid form, but it can become a good conductor when melted or dissolved in water.

_____ The building blocks of this type of compound are called ions.

_____ The building blocks of this type of compound are called molecules.

_____ The electrons are transferred from one element to another to form this type of bond.

_____ The electrons are shared in between elements in this type of bond.

9. Rank from ionic, covalent and metallic from strongest to weakest strength between molecules

10. Which has the highest boiling point, ionic, metallic or covalent? Why?

Covalent Compounds Naming WS

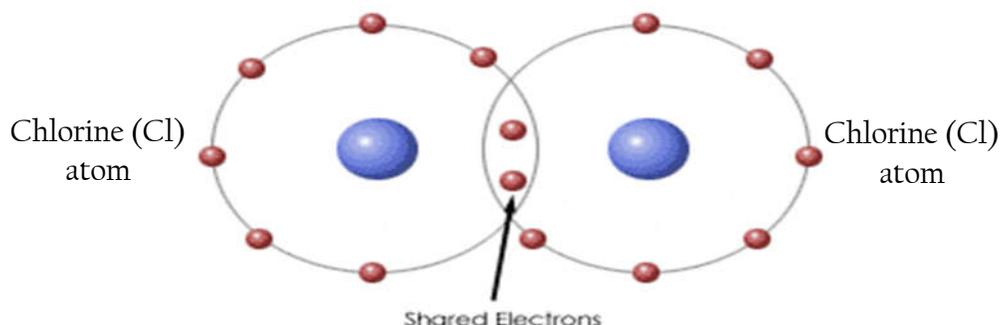
Objective: By the end of this activity, you should be able to name covalent & acid molecules based on the molecular formula; and write the molecular formula based on the name.

REVIEW MODEL: Covalent Molecules

Classify the elements for following covalent molecules:

| Covalent | Element 1 | Metal or Nonmetal | Element 2 | Metal or Nonmetal |
|----------|-----------|-------------------|-----------|-------------------|
| Cl_2 | Cl | NM | - | - |
| H_2O | | | | |
| NH_3 | | | | |
| CO_2 | | | | |

Based on your information from the data above, Covalent bonds consist of elements that are (Only Metals or Metals & Non-metals or Only Non-metals)



The two elements represented in the image above are both _____.

The two elements are _____ the electrons between each other.

BIG IDEA : In COVALENT BONDING, the _____ and the other _____ *SHARE* their electrons.

Naming Model 1: Covalent Molecules

Fill in the table to indicate the number of atoms of each type in the molecular formula (M.F.).

| M.F. | Name of Element 1 | # of atoms for element 1 | Name of element 2 | # of atoms for element 2 | Name of Molecular Compound |
|-------------------------------|-------------------|--------------------------|----------------------|--------------------------|----------------------------|
| ClF | Chlorine | 1 | Monofluoride | 1 | Chlorine monofluoride |
| CO | Carbon | | Monoxide | | Carbon monoxide |
| ClF ₅ | Chlorine | | Pentafluoride | | Chlorine pentafluoride |
| CO ₂ | Carbon | | Dioxide | | Carbon dioxide |
| Cl ₂ O | Dichlorine | | Monoxide | | Dichlorine monoxide |
| PCl ₅ | Phosphorous | | Pentachloride | | Phosphorous pentachloride |
| N ₂ O ₅ | Dinitrogen | | Pentoxide | | Dinitrogen pentoxide |
| CH ₄ | Carbon | | Tetrahydride | | Carbon tetrahydride |
| NH ₃ | Nitrogen | | Trihydride | | Nitrogen trihydride |

- The name of the *first* element in the molecular formula is always the name of the element found on the periodic table.
- The *ending* of the *second* element in the molecular formula always ends in _____.
- Prefixes are put in front of the element name to indicate the _____ of atoms of that element.
- Using the model above, fill the table to the right with the prefix that corresponds to the number of atoms.
- Look at the first 3 M.F.s in the model above, each of the examples have 1 atom for the first element, does the element name start with mono-?

| # of atoms | Prefix |
|------------|---------------|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | hexa- |
| 7 | hepta- |
| 8 | octa- |
| 9 | nona- |
| 10 | deca- |

General Rule: If the first element has only ONE atom, the name _____ require a prefix.

Naming Covalent Compounds Practice

Section I: Write the correct name for each of the following.

1. BrO_3 _____
2. BN _____
3. N_2O_3 _____
4. NI_3 _____
5. SF_6 _____
6. XeF_4 _____
7. PCl_3 _____
8. CO _____
9. P_2O_5 _____
10. ICl_2 _____
11. SO_2 _____
12. CS_2 _____
13. OF_2 _____
14. ClO_2 _____
15. SiO_2 _____
16. BF_3 _____

Section II: Write the correct chemical formula for each of the following.

- | | |
|----------------------------------|---------------------------------|
| 1. Chlorine monoxide _____ | 9. Sulfur dioxide _____ |
| 2. Boron monophosphide _____ | 10. Bromine pentafluoride _____ |
| 3. Dinitrogen monoxide _____ | 11. Disulfur dichloride _____ |
| 4. Nitrogen trifluoride _____ | 12. Boron trifluoride _____ |
| 5. Sulfur tetrachloride _____ | 13. Silicon tetrachloride _____ |
| 6. Xenon trioxide _____ | 14. Krypton difluoride _____ |
| 7. Carbon dioxide _____ | 15. Silicon dioxide _____ |
| 8. Phosphorous trichloride _____ | 16. Boron trichloride _____ |

Read the comic strip “The Bare Essentials of Polarity,” and use it to answer these questions.

1. How does the comic strip define a polar molecule? What causes polarity?
2. What is electronegativity?
3. How does electronegativity change depending based on an element’s location on the periodic table?
4. What is the artist trying to represent by two polar bears arm wrestling or two penguins arm wrestling?
5. What three types of bonds are represented on the third page of the comic strip? Describe the characteristics for the 3 different bonds.

The BARE ESSENTIALS of POLARITY

You don't have to go to the ends of the earth to find polar molecules. They're all over the place. A polar molecule is just a molecule with a difference in electrical charge between two ends.



Polarity in molecules is caused by differences in electronegativity between atoms. Electronegativity describes the ability of an atom to attract bonding electrons toward itself.



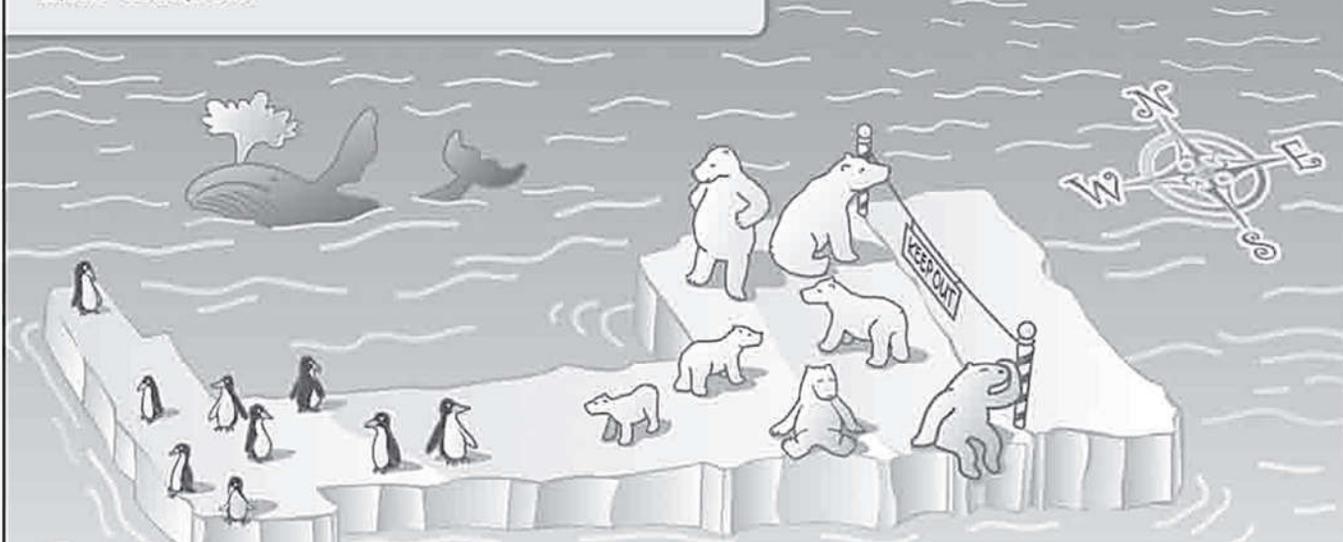
Bonded pair of electrons

HEY!



Chlorine is more electronegative than hydrogen. So the bonded pair of electrons in HCl spends more time near chlorine.

Electronegativity values tend to increase as you move "northeast" on the periodic table, and decrease as you move "southwest."



The noble gases are often not assigned electronegativity values. They rarely bond to other atoms.

When two atoms with different electronegativity values bond, the bonding electrons spend more time around the more electronegative atom, creating a PARTIAL NEGATIVE CHARGE on that atom. The other atom then has a PARTIAL POSITIVE CHARGE, and the bond is polar.



When atoms with equal electronegativity values bond, they form nonpolar bonds. The electron-attracting strength of each atom is the same.

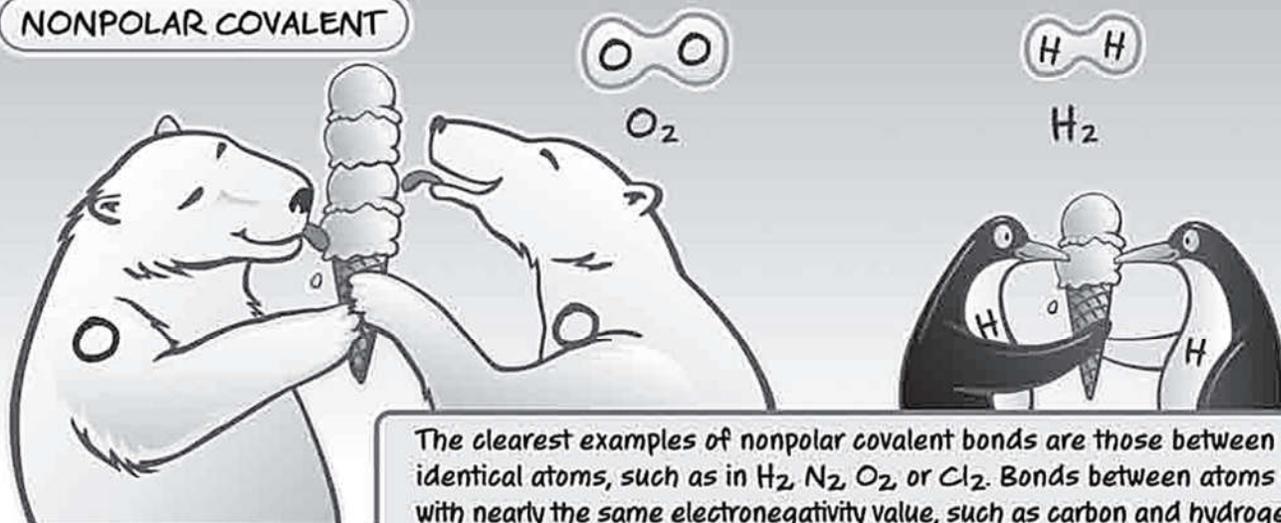


However, if the electronegativities of two bonded atoms are different, then their bond will be polarized—maybe a little...

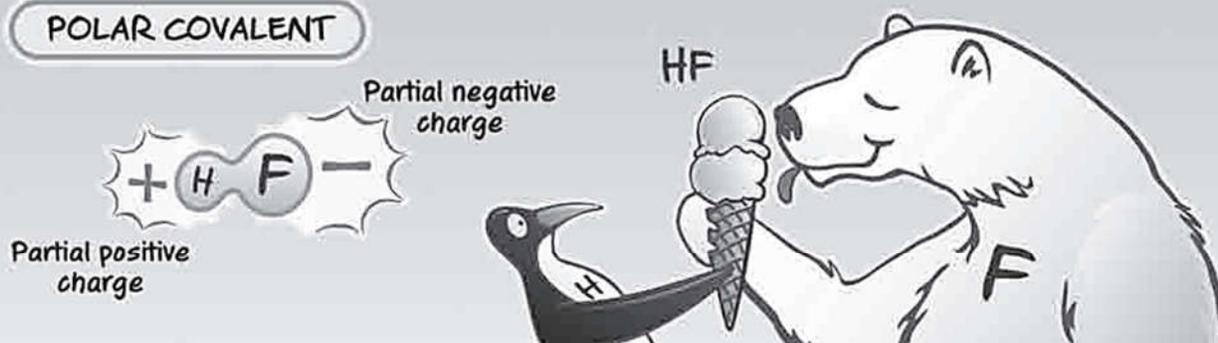


Because the elements have such varying electronegativities and can bond in many different combinations, there is really a continuum of polarity in bonding. We can break the continuum down into three categories.

NONPOLAR COVALENT



POLAR COVALENT



IONIC



*****We can classify a bond as ionic or covalent in one of two ways:**

- 1) Look at the type of elements bonded together
 - a. METAL and a NONMETAL= _____
 - b. NONMETAL and a NONMETAL= _____
- 2) Look at the **electronegativity difference** between the 2 bonded elements
 - a. **0 - 0.3** _____
 - b. **0.4 - 1.7** _____
 - c. **> 1.7** _____

Practice:

1. Identify the elements in each compound as a metal or nonmetal.

| Compound | Electronegativity difference between bonded elements | Ionic, Nonpolar Covalent, or Polar Covalent? |
|-------------------------------|--|--|
| H ₂ O | 3.5 - 2.1 = 1.4 | Polar Covalent |
| Na ₂ O | | |
| N ₂ O ₆ | | |
| CH ₄ | | |
| KCl | | |
| HCl | | |
| CBr ₄ | | |
| H ₂ | | |
| CO ₂ | | |
| Na ₂ S | | |
| O ₂ | | |

| Element | Electroneg |
|---------|------------|
| F | 4.0 |
| O | 3.5 |
| Cl | 3.0 |
| N | 3.0 |
| Br | 2.8 |
| C | 2.5 |
| S | 2.5 |
| H | 2.1 |
| Na | 0.9 |
| K | 0.8 |

2. What types of molecules will always have a nonpolar bond between them?
 - a. Diatomic element ****How do you know?**
 - b. Ionic compound
 - c. Covalent compound
 - d. Metallic element
3. What is the difference between a polar and a nonpolar covalent bond? Explain your answer in terms of both electronegativity difference and how the electrons are shared.

Types of Covalent Molecules Practice

1. What is the difference between an ionic and a covalent bond?

2. What are the two types of covalent bonds?

3. Determine the type of bond for each of the following. (Use the electronegativity chart below).
SHOW ALL WORK!!

a. O₂

b. NO₂

c. NaCl

d. SH₂

e. NBr₃

| Element | Electroneg |
|---------|------------|
| F | 4.0 |
| O | 3.5 |
| Cl | 3.0 |
| N | 3.0 |
| Br | 2.8 |
| C | 2.5 |
| S | 2.5 |
| H | 2.1 |
| Na | 0.9 |
| K | 0.8 |

4. For each pair, indicate which element is more electronegative.

a. N-F

b. H-Br

c. F-O

d. C-O

5. Based on your knowledge of electronegativity and covalent bonding, will nitrogen or oxygen have a larger radius in the **compound** NO₂? Why?

Ionic Bonding Puzzle Activity

Introduction

When metals and non-metals chemically react, the atoms will tend to form **ions** or charged atoms. Ions form because **electrons** are either gained or lost. Metals will generally form **cations** or positive ions, since they tend to **donate electrons**. Non-metals will form **anions** or negative ions, since they tend to **accept electrons**.

Activity

In this activity you will work with a partner and create models of ionic compounds and observe the chemical formula of the molecules you have created.

Ionic Bonding Puzzle Activity Notes

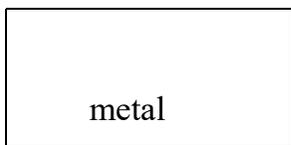
Fill in the blanks below with these words: lose, cations, gain, anions

Metals _____ electrons and become positive ions or _____.

Non-metals _____ electrons and become negative ions or _____.

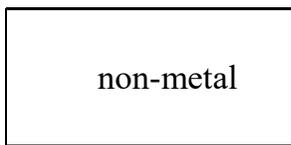
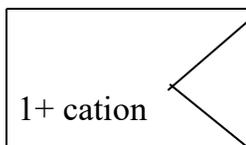
The Model

neutral atom

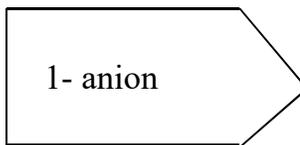


lose 1 e⁻
→

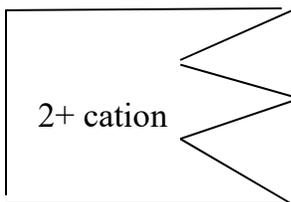
ions



gain 1 e⁻
→



Similarly, a 2+ cation would look like this:



Draw a 2- anion:

Model 2: Ions

| | |
|---|--|
| Mono-atomic ions | Polyatomic ions |
| Na ⁺ ; Cl ⁻ ; Mg ⁺² ; K ⁺ ; O ⁻² ; N ⁻³ | OH ⁻ ; NO ₃ ⁻ ; CO ₃ ⁻² ; SO ₄ ⁻² ; PO ₄ ⁻³ |
| What is a MONO-atomic ion? | What is a POLYatomic ion? |

Ions – Metal Cations

- Some of the metal cations have a roman numeral (i.e. I, II, III, etc.) next to their name.
- In the table below, list 5 elements under each category. After the metals have been sorted, identify the family/families, each category consists of.

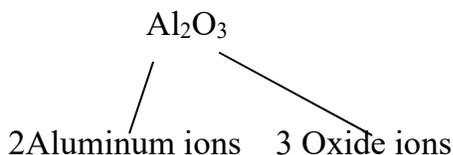
| Metals WITHOUT Roman Numerals | Metals WITH Roman Numerals |
|--------------------------------------|-----------------------------------|
| | |
| Family/Families: | Family/Families: |

- Based on the table above, what elements should have roman numerals next to their name?
- In the table below, find elements with the roman numeral next to their name and write the charge associated with that metal.

| Element | Roman numeral | Charge |
|----------------------------|----------------------|---------------|
| <i>Example: Copper (I)</i> | <i>I</i> | <i>+1</i> |
| | II | |
| | II | |
| | III | |
| | III | |

- Based on your data above, what do the roman numerals indicate?

Bonding and Predicting Chemical Formulas



The charge of each Al ion is ____; there are ____ Al ions in the compound above; the total charge is ____

The charge of each O ion is ____; there are ____ O ions in the compound above; the total charge is ____

Fill in the blanks below with these words:

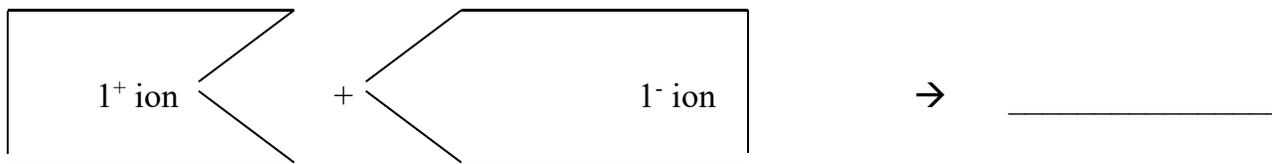
subscripts, compound, ions, charge, number, ratio, formula, balance, zero, neutral

The _____ show the _____ of each atom in the _____.

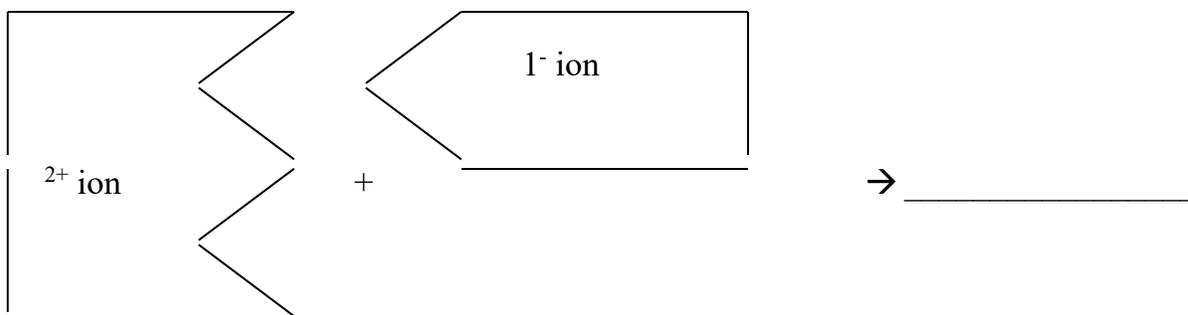
For an ionic bond, the charges of the _____ need to add up to _____. The chemical _____ shows how many of each ion is needed to _____ the _____ and make the compound neutral. The _____ of the ions should be in lowest terms.

To have a _____ MOLECULE, the positive and negative charges must balance each other out.

What ratio will the +1 and -1 ions combine to balance the charge?



What ratio will the 2+ and 1- ions combine to balance the charge?



Activity: Obtain a bag of ions from the instructor and create the bonds listed. Complete the table below and make the compounds from the following list. You will need to use the wildcard ions if you do not have enough of a certain ion. The first one is completed for you as an example.

| Elements | Ion name | Ion symbol | Anion/Cation | How many? | Chemical Formula |
|------------------------------------|-----------------|-----------------|--------------|-----------|------------------|
| EXAMPLE Potassium & Chlorine | Potassium | K ⁺ | Cation | 1 | KCl |
| | <u>Chloride</u> | Cl ⁻ | Anion | 1 | |
| Lithium and oxygen | | | | | |
| | | | | | |
| Sodium and fluorine | | | | | |
| | | | | | |
| Titanium (IV) and oxygen | | | | | |
| | | | | | |
| Iron (II) and oxygen | | | | | |
| | | | | | |
| Iron (III) and oxygen | | | | | |
| | | | | | |
| Yttrium (III) and chlorine | | | | | |
| | | | | | |
| | | | | | |
| Copper (I) and phosphorous | | | | | |
| | | | | | |
| Magnesium and nitrogen | | | | | |
| | | | | | |
| Copper (II) and phosphorous | | | | | |
| | | | | | |
| Aluminum and bromine | | | | | |
| | | | | | |
| Silver and iodine | | | | | |
| | | | | | |

Ionic Compounds—Univalent Metal Ions

1. If the following pairs of elements were mixed and heated, they would combine into solid ionic compounds. Write the name and formula of each compound formed.

| | Name | Formula |
|---------------------------|---------------|--------------------|
| a) silver and iodine | silver iodide | $\text{AgI}_{(s)}$ |
| b) magnesium and oxygen | _____ | _____ |
| c) magnesium and bromine | _____ | _____ |
| d) calcium and nitrogen | _____ | _____ |
| e) zinc and selenium | _____ | _____ |
| f) sodium and sulfur | _____ | _____ |
| g) barium and phosphorus | _____ | _____ |
| h) aluminium and fluorine | _____ | _____ |
| i) potassium and chlorine | _____ | _____ |
| j) silver and oxygen | _____ | _____ |

SUMMARY: Ionic Compounds

1. Charges Of Ions

Trends for Ionic Charge

| | | | | | | | | | | | |
|----------------------|-----------------------|--|--|--|--|--|----------------------|-----------------------|----------------------|----------------------|---------------------|
| 1 H Hydrogen | | | | | | | | | 2 He Helium | | |
| 3 Li Lithium | 4 Be Beryllium | | | | | | | 7 N Nitrogen | 8 O Oxygen | 9 F Fluorine | 10 Ne Neon |
| 11 Na Sodium | 12 Mg Magnesium | | | | | | 13 Al Aluminum | 15 P Phosphorus | 16 S Sulfur | 17 Cl Chlorine | 18 Ar Argon |
| 19 K Potassium | 20 Ca Calcium | | | | | | 30 Zn Zinc | 31 Ga Gallium | 34 Se Selenium | 35 Br Bromine | 36 Kr Krypton |
| 37 Rb Rubidium | 38 Sr Strontium | | | | | | 47 Ag Silver | 48 Cd Cadmium | | 53 I Iodine | 54 Xe Xenon |
| 55 Cs Cesium | 56 Ba Barium | | | | | | | | | | 86 Rn Radon |
| 87 Fr Francium | 88 Ra Radium | | | | | | | | | | |

2. Ionic Compounds: in general, made up of _____

3. Charges of ions MUST _____

4. Simple Binary Compounds:

(_____) + (_____)

5. Transition Metal Cations (and Sn and Pb)

Must include _____ of the cation using (_____)

Exceptions: Zn is always +2, Ag is always +1

6. **Polyatomic Ions:** Made up of 2 or more different types of atoms. Use parentheses to indicate more than 1 of the polyatomic ion. **Must memorize!**

| | | | |
|-----------|--|-----------|--|
| Ammonium | | Hydroxide | |
| Carbonate | | Nitrate | |
| Phosphate | | Sulfate | |

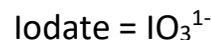
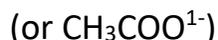
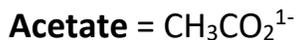
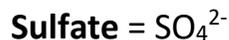
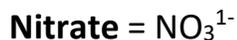
Polyatomic Ions

Polyatomic ions contain _____ different atoms (polyatomic means “many atoms”).

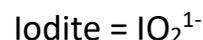
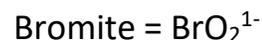
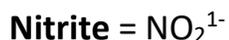
Here are some common examples: **YOU NEED TO MEMORIZE THE BOLDED ONES!**

a. **Ammonium:** NH_4^{1+} (the only positive polyatomic ion you need to know)

b. **“ATE” ions:** contain an atom bonded to several oxygen atoms:



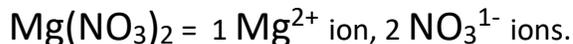
c. **“ITE” ions:** remove one oxygen from the “ATE” ion and keep the same charge:



d. Other common complex ions:



e. For polyatomic ions, use parentheses and then a subscript to indicate how many of that ion you need



Ionic Compounds Practice

| Chemical Formula | Compound Name | Trans. Metal, Sn, or Pb? | Polyatomic Ion? | Cation | Anion |
|----------------------------|--------------------------|--------------------------|-----------------|--------|-------|
| | Lithium Sulfide | | | | |
| | Calcium Bromide | | | | |
| | lead (II) nitride | | | | |
| | titanium (II) acetate | | | | |
| | chromium (III) hydroxide | | | | |
| TiBr_3 | | | | | |
| Cu_3P | | | | | |
| AlPO_4 | | | | | |
| $\text{Fe}(\text{NO}_3)_3$ | | | | | |
| $\text{Pb}(\text{SO}_4)_2$ | | | | | |

Ionic Bonds & Naming w/ Polyatomic Ions WS

1. Match the ion with the correct name (1 point each blank)



Hydroxide _____ Carbonate _____ Ammonium _____

Phosphate _____ Nitrate _____ Sulfate _____

2. There are 3 transition metals that do not require roman numerals, list them in the table below.

| <i>Transition Metal Name</i> | <i>Ion Symbol</i> |
|------------------------------|-------------------|
| | |
| | |
| | |

3. Each of the following compounds is a binary ionic compound. Fill in the table with the required information. The first two rows have been done for you as an example.

| Compound Name | Symbol and Charge of the Cation | Symbol and Charge of the Anion | Chemical Formula of the Compound |
|--------------------------|--|---------------------------------------|---|
| <i>Copper (II) oxide</i> | Cu^{+2} | O^{-2} | CuO |
| <i>Sodium sulfate</i> | Na^+ | $(\text{SO}_4)^{-2}$ | Na_2SO_4 |
| Calcium hydroxide | | | |
| Potassium nitrate | | | |
| Sodium Phosphate | | | |
| Iron (II) hydroxide | | | |
| Ammonium Chloride | | | |
| Copper (II) Sulfate | | | |
| | Cu^{+1} | $(\text{NO}_3)^{-1}$ | CuNO_3 |
| | | | $\text{Co}(\text{CO}_3)_2$ |
| | | | $\text{Mn}_3(\text{PO}_4)_2$ |
| | | | ZnSO_4 |

Naming Acids (type of covalent compound)

| Contains H and... | Acid Name |
|---|--------------------|
| 1 other nonmetal (NM) | Hydro(NM-)___ Acid |
| Polyatomic Ion (PAI) that ends in - _____ | (PAI-)___ Acid |
| Polyatomic Ion (PAI) that ends in - _____ | (PAI-)___ Acid |

1. HCl _____

6. HNO₂ _____

2. H₂CO₃ _____

7. H₃PO₄ _____

3. HF _____

8. HBr _____

4. HC₂H₃O₂ _____

9. H₂SO₄ _____

5. HNO₃ _____

10. H₂SO₃ _____

Naming Acids Practice

Section I: Write the correct name for each of the following.

1. HBr _____

7. H₂Se _____

2. HC₂H₃O₂ _____

8. H₃PO₄ _____

3. HNO₃ _____

9. HClO₃ _____

4. HI _____

10. H₂SO₄ _____

5. H₂S _____

11. HClO₂ _____

6. HNO₂ _____

Section II: Write the correct chemical formula for each of the following acids

1. Sulfurous acid _____

5. Chloric acid _____

2. Chlorous acid _____

6. Hydrobromic acid _____

3. Hydrofluoric acid _____

7. phosphorous acid _____

4. Hydrosulfuric acid _____

CHECKPOINT: Naming ALL compounds

| Type of Compound | Characteristics of Compound/Name |
|--|----------------------------------|
| Metal + Nonmetal; Roman Numeral for Trans. Metals | |
| 2 or more Nonmetals; prefix is present | |
| <i>hydrogen</i> is present along with other nonmetals | |

Indicate whether the following compounds are ionic, covalent, or acidic. Name accordingly:

| Name/Formula | Ionic/covalent/acid | Formula/Name |
|-----------------------------|---------------------|--------------|
| a. N_4O_6 | | |
| b. $AlCl_3$ | | |
| c. HCl | | |
| d. $CrNO_3$ | | |
| e. nickel (II) carbonate | | |
| f. boron trioxide | | |
| g. Na_3PO_4 | | |
| h. H_2SO_4 | | |

WS-Naming *ALL* compounds

Complete the table below by either writing the name or the formula and they type of compound/molecule

| Formula | Ionic/Covalent/Acid | Name |
|----------------|---------------------|------------------------|
| | | Sodium Fluoride |
| K_3N | | |
| | | Sulfur hexafluoride |
| | | Calcium nitrite |
| P_4O_{10} | | |
| CSe_2 | | |
| | | Manganese (IV) oxide |
| | | Iron (III) Chloride |
| | | Strontium nitrate |
| PdF_2 | | |
| H_3PO_4 | | |
| SO_3 | | |
| | | Dinitrogen trioxide |
| | | Hydrobromic acid |
| | | Phosporous trichloride |
| $CdBr_2$ | | |
| $SiCl_4$ | | |
| | | Aluminum Phosphate |
| | | Titanium (II) Chloride |
| $Al_2(SO_4)_3$ | | |
| | | Zinc Phosphate |
| | | Nitric Acid |
| XeF_4 | | |
| | | Silver nitrate |
| | | Oxygen difluoride |
| | | Potassium sulfate |
| HCl | | |
| | | Sulfurous acid |

Naming Compounds w/ % Composition and Moles Review

Determine the molecular formula of each compound based on its name. Then, find the molar mass and percent composition of the specified element.

| Chemical Name | Molar Mass | Percent composition of specified element |
|---|--|---|
| <i>EX: Tricarbon octahydride</i> <i>C₃H₈</i> | $(3 \times 12.01) + (8 \times 1.01) =$ <i>44.11 g/mol</i> | <i>Hydrogen:</i> $\frac{(8 \times 1.01)}{44.11} \times 100\% = 18.3\%$ |
| Sodium carbonate | | Carbon: |
| Selenium hexafluoride | | Selenium: |
| Copper (II) Chloride | | Copper: |
| Silver oxide | | Oxygen: |
| Barium nitrate | | Nitrogen |
| Hydrochloric Acid HCl | | Hydrogen: |

Empirical vs. Molecular Formula Review

| Chemical Compound | Molecular Formula | Empirical Formula |
|-------------------|-------------------------------------|-------------------|
| Hydrogen Peroxide | H_2O_2 | |
| Glucose | $\text{C}_6\text{H}_{12}\text{O}_6$ | |
| Water | H_2O | |
| Acetic Acid | $\text{C}_2\text{H}_4\text{O}_2$ | |

Empirical and Molecular formulas can be the same!!

Determining Molecular Formulas

Steps to finding molecular formulas:

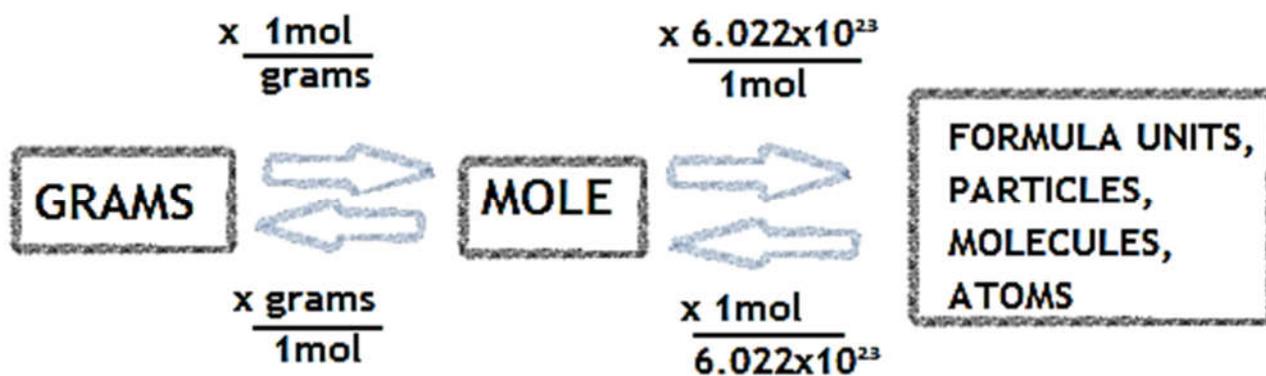
1. Determine the empirical formula
2. Divide the molar mass of the compound by the molar mass of the empirical formula
3. Round the value to the nearest whole number
4. Multiply the subscripts in the empirical formula (**REMEMBER: no subscript=1**) to get the molecular formula

PRACTICE:

1. A compound has an empirical formula of CH_2 and a molecular mass of 42.0g/mol. Determine its molecular formula and NAME of the molecular formula.

2. A combustion analysis gives the following empirical formula of $\text{C}_2\text{H}_4\text{O}$. Determine the molecular formula knowing that the molecular mass = 132.16g/mol.

Molar Conversions Review



Practice

- 1) How many moles are in 25 grams of calcium chloride?
- 2) How many grams are in 4.5 moles of lithium oxide?
- 3) How many molecules are in 25 grams of nitrogen trihydride?

Molar Conversions & MF/EF Review

1. Complete the molar conversions below (Note: avogadro's number is $1\text{ mole} = 6.022 \times 10^{23}$ particles)

| Problem | Chemical Formula & molar mass of formula | Conversion | Final answer |
|--|---|---|-----------------|
| <i>EX: Find the number of moles in 508 g of ethanol</i> | $C_2H_5OH = (2 \times 12.01) + (6 \times 1.01) + 16.00 = 46.08 \text{ g/mol}$ | $\frac{508 \text{ g}}{46.08 \text{ g}} \times \frac{1 \text{ mole}}{1}$ | <i>11.02 mo</i> |
| How many grams are in 5.66 mol of calcium carbonate? | | | |
| What is the mass of 3.20×10^{31} molecules of carbon dioxide? | | | |
| How many molecules of iron (III) oxide are contained in 92.2 grams? | | | |

2. Determine the Molecular Formulas for the following:

| EF | Molar Mass of MF | Calculations | MF |
|----------|------------------|--------------|----|
| P_2O_5 | 283.88 g/mol | | |
| HO | 34.02 g/mol | | |
| CH_2 | 84.18 g/mol | | |

