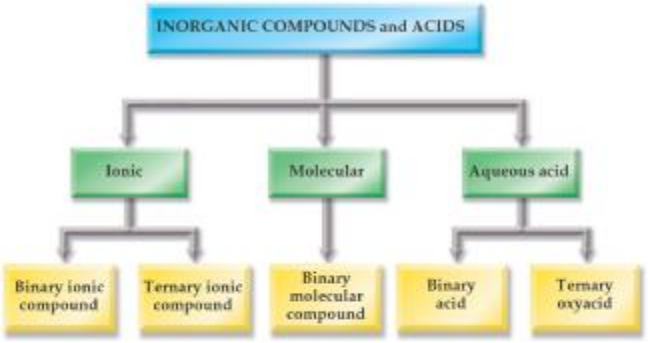
Chem 1075 Chapter 7 Language of Chemistry Lecture Outline

Slide 2-3 Classification of Compounds

- Most _____ compounds do not contain the element _____.
- The exceptions are _____, and carbonates which contain the ion _____.
- There are 5 common classes of inorganic compounds (see flow chart):



Slide 4 Ionic Compounds

- ***Ionic compounds*** contain _____**.**
- ***Binary ionic*** compounds contain _____elements: one _____and one _____.
  - KCl and $AlCl_3$ are binary ionic compounds.

- ***Ternary ionic*** compounds contain _____elements, at least one _____and one _____.
  - KNO_3 and $Al(NO_3)_3$ are ternary ionic compounds

Slide 5 Molecular Compounds

- ***Molecular compounds*** contain _____**.**
- ***Binary molecular*** compounds contain _____elements and **both** are _____.
  - Some examples of binary molecular compounds are:

Slide 6 Aqueous Acids

- An ***aqueous solution*** is produced when a compound _____ and is indicated by the symbol _____.

- An ***aqueous acid*** is any substance that produces _____ when dissolved in water.

- A ***binary acid*** is an _____ solution of a compound containing _____ and one other _____. HCl (aq) is a binary acid.

- A ***ternary oxyacid*** is an _____solution of a compound containing _____, _____, and one other _____. HNO_3 is a ternary oxyacid.

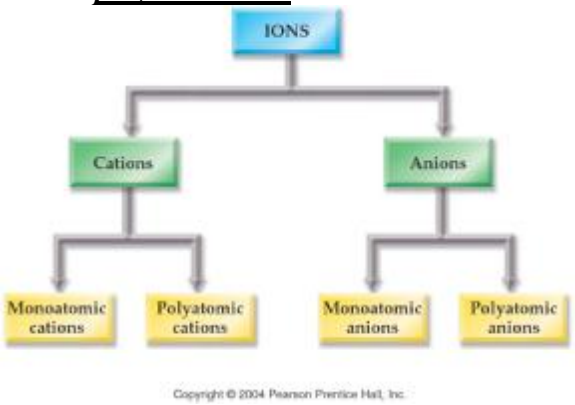
Slide 7 Practice

- Determine whether each of the following would be ionic, molecular or aqueous acid. Then tell if it is binary or ternary.
    1. Na_2S
    2. H_2CO_3
    3. $BaCl_2$
    4. HBr
    5. PCl_3
    6. $AlPO_4$
    7. CO

Slide 8-9 Classification of Ions

- Recall, an ***ion*** is an _____ or _____ with a _____.

- A _____ charged ion is called a ***cation***.
- A _____ charged ion is called an ***anion***.
- A _____ bound together which has an _____ is a ***polyatomic ion***.



Slide 10 Monatomic Cations

- _____atoms can_____ valence electrons and become _____ cations.
- Cations are named using the _____ followed by the word "ion".
    Na^+ is named _____
    Al^{3+} is named _____
- This rule applies for metals that usually _____. This includes the main group metals (except _____) along with Ag^+, Zn^{2+}, and Cd^{2+}.

Slide 11 Metals That Form Multiple Ions

- If a metal can form more than one cation, it is named using the _____, followed by the charge in _____ in parentheses followed by the word "ion".
    Fe^{2+} is the _____
    Fe^{3+} is the _____
- This is called the _____ of naming cations.

Slide 12 Metals That Form Multiple Ions

- An alternative method of naming involves using the _____ followed by
  - _____ for lesser charge OR _____ for greater charge

  Fe^{2+} is the _____
  Fe^{3+} is the _____
- This is called the _____ of naming cations.
- Note: If there is no Latin name, use _____ (i.e. cobalt)

Slide 13 Common Monatomic Cations (See Textbook)

Slide 14 Monatomic Anions

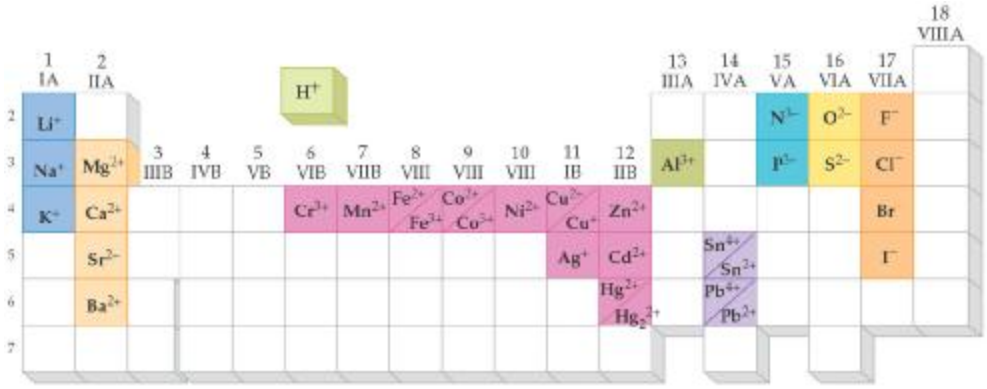
- _____ can _____ valence electrons and become _____ anions.
- Monoatomic anions are named by _____ of the element name and adding the suffix _____.

  Br^- is the bromide ion
  O^{2-} is the oxide ion
  N^{3-} is the nitride ion

Slide 15 Predicting Cation Formulas

Group IA/1
Group IIA/2
Group IIIA/13
Group IVA/14
Transition Metals

Slide 16 Common Cation Charges



Slide 17 Predicting Anion charges

Group VIIA/17
Group VIA/16
Group VA/15

Slide 18 Polyatomic Anions

- Polyatomic anions generally contain one or more elements combined with _____. These anions are called _____.
- Most polyatomic anions have names that end in the suffix _____or _____.

PO_4^{3-} is the _____ ion PO_3^{3-} is the _____ ion
SO_4^{2-} is the _____ ion SO_3^{2-} is the _____ ion
NO_3^- is the _____ ion NO_2^- is the _____ ion

Slide 19 Polyatomic Anions

- What is the **same** comparing -*ate* and -*ite* ions?

- What is **different**?

- The oxyanions that end in _____ have _____ oxygen than the oxyanions than end in _____.

Slide 20 More Polyatomic Anions

The formula for the chlorate ion is ClO_3^{1-}. What is the formula for the chlorite ion?

There are two polyatomic ions that end in _____:

Slide 21 Some Common Polyatomic ions (SEE INSIDE BACK COVER OF TEXT)

Slide 22 Writing Ionic formulas

- An ionic compound is composed of _____ and _____ ions.
- A ***formula unit*** is the _____ of an ionic compound (simplest way to write the formula or simplest ratio of cation to anion).
- A formula unit is _____, so the _____ charge must equal the _____ charge in the formula unit.
- When writing chemical formulas, the _____ (_____) always goes first and the _____ (_____) always goes second.

Slide 23 Formulas for Ionic Compounds

- If the ions in the ionic compound have the same charge, the formula unit contains one of each ion.

Na^+ and Cl^- combine to form _____.
Mg^{2+} and S^{2-} combine to form _____.
Al^{3+} and P^{3-} combine to form _____.

Slide 24 Formulas of Ionic Compounds

- If the charges are not equal, we must _____ the positive and negative charges.

  Ca^{2+} and Cl^- combine to give what formula?

  Ca^{2+} needs two Cl^- to balance charge:

  The Formula would be_____.

Slide 25 Formulas for Ionic compounds

Al^{3+} and O^{2-} combine to give what formula?

The formula would be_____. Don't show _____in final formula.

Slide 26 Criss-Cross Method

- You can quickly verify that the chemical formula is written correctly by _____ _____ the charge on each ion.
- The charge on the aluminum ion becomes the _____ for the oxygen, and the charge on the oxide ion becomes the _____for the aluminum ion.

Slide 27 Practice

- Write the formulas for the ionic compounds containing:

1. lithium and bromine
2. magnesium and nitrogen
3. calcium and oxygen
4. aluminum and iodine
5. potassium and phosphorus
6. barium and sulfur

Slide 28 Formulas with Polyatomic Ions

- Follow the same rules as binary ionic compounds; if the charges are _____, the formula has _____ of each ion.

Mg^{2+} and SO_4^{2-} combine to form _____.
K^+ and ClO_3^- combine to form _____.

- If the charges are _____ equal, the total charge must equal _____. If you have more than one polyatomic ion, it is placed in _____.

Al^{3+} and CO_3^{2-} combine to form _____.

Slide 29 Practice

- Write the formulas for the ionic compounds containing:
    1. barium ion and nitrate ion
    2. rubidium ion and sulfite ion
    3. tin(II) ion and phosphate ion
    4. lead(IV) ion and carbonate ion
    5. calcium ion and bicarbonate ion
    6. iron(III) ion and hydroxide ion

Slide 30 Determining Ionic Charge

- If an ionic compound contains a metal which can have _____ than _____ ionic charge, we must determine the _____ on the ion. The sum total charge of an ionic compound must equal _____.
- What is the charge on the iron ion in Fe_2O_3?

Slide 31 Naming Binary Ionic Compounds

- When naming ionic compounds, we combine the _____ and _____ name (drop the word "ion") with the cation _____ and the anion _____.

- MgO is composed of magnesium ion and oxide ion, therefore the name is _____ _____.
- What is the name of cinnabar, HgS? _____

Slide 32 Determining Formulas for Binary Ionic Compounds

What is the formula of iron (III) fluoride?

1.

2.

3.

4.

Slide 33 Naming Ternary Ionic compounds

- We name ternary ionic compounds like binary ionic compounds: the cation name followed by the anion name.
- K_2CO_3 is named _____.
- $Al(NO_3)_3$ is named _____.

- If we have a metal that can have more than one oxidation state, we have to determine the charge on the metal.
- $Co(ClO_3)_3$ is composed of _____ and is named _____

Slide 34 Predicting Formulas for Ionic compounds

What is the formula for radium carbonate given that calcium carbonate is $CaCO_3$?

The formula for radium carbonate is _____.

Slide 35 Binary Molecular Compounds

Binary molecular compounds are composed of_____

A _____ is the simplest representative particle of a binary _____ compound.

Slide 36 Naming Binary Molecular Compounds

- The first element in the compound is named first and the second element has the suffix *-ide*.
- The number of atoms of each element must be indicated by Greek prefixes.

1	6
2	7
3	8
4	9
5	10

Slide 37 Names of Binary Molecular Compounds

The molecular compound P_4S_3 is used on match tips. What is the name?

What is the name for Br_3O_8?

Slide 38 An Exception

There is one exception to the use of the Greek prefixes when naming binary molecular compounds.

If there is only _____atom of the first element, the _____ is not used. The prefix _____ is always used for the second element.

CO is_____

IF_6 is _____

Slide 39 Binary Acids

- A binary acid is an aqueous solution of a compound containing _____ and a _____.

- The formula of an acid always begins with _____: HF (aq)
- Binary acids are named by using the prefix _____ before the element stem and adding the suffix_____

  HF (aq) is _____
  H_2S (aq) is _____

Slide 40 Ternary Oxyacids

- Ternary oxyacids are aqueous solution of a compound containing _____ and an _____.
- If the acid is derived from an oxyanion ending in _____, the suffix is changed to _____.
  HNO_3 (aq) is _____ (from NO_3^-, nitrate ion)
- If the acid is derived from an oxyanion ending in _____, the suffix is changed to _____.
  HNO_2 (aq) is _____ (from NO_2^-, nitrite ion)

Slide 41-42 Practice

Formula	Cation	Anion	Name
HBr			
	H^+	SO_3^{2-}	
			Chloric acid
HBrO			