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# Warm-Up | Nomenclature of Covalent Compounds

## Lesson Objectives

By the end of this lesson, you should be able to:

- Use the International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules to write the names of [ ] compounds.
- Write formulas for covalent compounds, and interpret those formulas in terms of composition and structure.
- Use [ ] nomenclature rules to name and write the chemical formulas of acids and bases.

**Science Practice:** Develop vocabulary by using the IUPAC rules for naming covalent compounds.

## Words to Know

*Write the letter of the definition next to the matching word as you work through the lesson. You may use the glossary to help you.*

| | |
|---|---|
| _____ binary acids | A. a compound that ionizes to form hydrogen ions; a chemical substance that increases H+ concentration in an aqueous solution |
| _____ acid | B. acids containing polyatomic ions that contain one or more oxygen atoms |
| _____ oxyacids | C. a compound that ionizes to form hydroxide ions; a chemical substance that decreases H+ concentration in an aqueous solution or that increases OH– concentration in a solution |
| _____ base | D. acids composed of two different types of atoms |

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# Instruction | Nomenclature of Covalent Compounds

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**Lesson Question**

Slide 2

## Nomenclature for Ionic Compounds

Rules for naming ionic compounds:

- Name the _____ first, then the anion.
  - KBr = potassium bromide, not bromine potassium
- Do not indicate the number of each ion in the compound.
  - $MgCl_2$ = magnesium chloride, not magnesium dichloride
- Name the _____ ion by ion name.
  - $SO_4$ = sulfate, not sulfur tetroxide
- Indicate charge with Roman numerals for cations that can have several different _____.
  - $FeSO_4$ = iron(II) sulfate, not iron sulfate

## Nomenclature for Covalent Compounds

Rules for naming covalent compounds:

- The element farther to the left of the _____ table is named _____.
  - $CO_2$ = carbon dioxide, not oxygen carbide
- The second _____ is given an *–ide* ending.
- $CO_2$ = carbon dioxide, not carbon dioxygen

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# Instruction | Nomenclature of Covalent Compounds

Slide 2

Rules for naming covalent compounds:

- Prefixes are used to indicate how many atoms of each element are present in the compound.
  - *Mono* = [ ], usually used for the second element in the compound; for example, carbon monoxide, CO
  - [ ] = two; for example, sulfur dioxide, $SO_2$
  - *Tri* = three; for example, phosphorus trihydride, $PH_3$
  - *Tetra* = four; for example, carbon tetrachloride, $CCl_4$
- Do not use [ ] numerals in covalent compound names.

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## Exceptions: Traditional Names

A number of familiar compounds have common names, sometimes called [ ] names.

| Formula | Common Name | IUPAC Name |
|---|---|---|
| $H_2O$ | | Dihydrogen monoxide |
| $NH_3$ | Ammonia | Nitrogen trihydride |
| NO | Nitric oxide | Nitrogen monoxide |
| $NO_2$ | Nitrous [ ] | Nitrogen dioxide |
| $PH_3$ | Phosphine | Phosphorus trihydride |

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## Exceptions: Compounds Containing H

Another group of substances that illustrate exceptions to IUPAC naming rules contains many compounds with _____ atoms.

- Some common compounds that contain hydrogen have non-IUPAC names that do not indicate the _____ of hydrogen atoms.
- Examples:
  - Hydrogen sulfide ($H_2S$)
  - Hydrogen fluoride (HF)
  - Hydrogen chloride (HCl)
  - Hydrogen sulfate ($H_2SO_4$)

Slide 10

## Writing Chemical Formulas

Rules for writing chemical formulas:

- Identify the elements involved.
  - Nitrogen trifluoride: nitrogen (N), fluorine (F)
- Write the chemical _____ in the correct order.
  - Nitrogen trifluoride: NF
- Use _____ to identify how many of each atom are present.
  - Nitrogen trifluoride: N = 1, F = 3
- Write the chemical formula, using subscripts as necessary.
  - Nitrogen trifluoride: _____

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# Instruction | Nomenclature of Covalent Compounds

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## Writing Chemical Formulas

- Identify the _____ involved.
- Write the chemical symbols in the correct order.
- Use prefixes to identify the number of atoms present.
- Write the chemical formula, using _____ as necessary.

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## Acids and Bases

**Acids**:

- Increase _____ of $H^+$ ions in aqueous (water) solution
- May be _____ or covalent
- Generally contain H atoms bonded to other atoms or to polyatomic ions

Properties:

- Turn blue _____ paper red
- Taste sour

**Bases**:

- Increase concentration of _____ ions in aqueous solution
- May be ionic or covalent
- Ionic bases contain $OH^-$ in formula
- Covalent bases do not contain $OH^-$

Properties:

- Turn red litmus paper _____
- Taste bitter
- Feel slippery or soapy

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# Instruction | Nomenclature of Covalent Compounds

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## Naming Acids

Naming _____ (acids that contain exactly two atoms):

- Start with *hydro-* to indicate _____.
- Add the root of the nonmetal.
- Add *–ic.*

Naming _____ (acids that contain polyatomic ions, which contain one or more oxygen atoms):

- *-ate* _____ make *-ic* acids $HNO_3$ _____ acid
- *-ite* anions make *-ous* acids $HNO_2$ _____ acid

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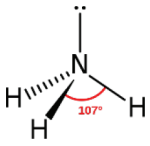
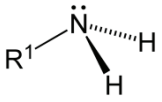
## Naming Bases

Naming bases:

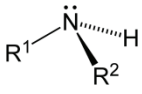
- Covalent bases are usually amines.
  - Derivatives of _____
- A hydrogen ion can attach to a _____ pair of electrons.
- Naming is based on the number of groups attached to N.
- _____ bases follow the samenaming rules as other ionic compounds.



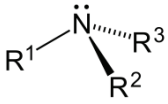
Ammonia



Primary amine



Secondary amine



Tertiary amine

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# Summary | Nomenclature of Covalent Compounds

**Lesson Question**

What is the method for naming covalent compounds?

**Answer**

Slide 2

## Nomenclature for Covalent Compounds

- The [ ] farther to the left of the periodic table is named first.
- The second element is given an *–ide* ending.
- No [ ] numerals are used for covalent compounds.
- Prefixes are used to indicate how many atoms of each element are present in the compound.
- Some compounds (such as water) have common names, not IUPAC names.

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# Summary | Nomenclature of Covalent Compounds

Slide 2

## Acids and Bases

"Acids _____"

- Produce [ ] in solution
- Turn [ ] litmus paper red
- Taste sour

Binary acids: start with *hydro,* change anion *-ide* to *-ic*

Polyatomic acids: change anion *–ate* to *–ic* and add *acid*

"Bases _____"

- Produce $OH^-$ in solution
- Turn red litmus paper blue
- Taste bitter
- Feel slippery or soapy

Covalent amines: [ ], secondary, and tertiary

Ionic bases: cation name + hydroxide

*Use this space to write any questions or thoughts about this lesson.*

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