# Nomenclature for Covalent Compounds

## Naming Binary Covalent (Molecular) Compounds

By Dr. Shawn P. Shields

# Overview of Covalent (Molecular) Compounds

- Molecular compounds are held together by covalent bonds, as opposed to ionic bonds.
- Binary covalent (molecular) compounds involve two different nonmetals bonding together.
- Electrons are *shared* between atoms in covalent compounds
- Recall that one atom takes the electron away from another to form cations and anions in ionic compounds. Ionic compounds are held together by electrostatic attractions.

# Overview of Covalent (Molecular) Compounds

- Examples of covalent compounds:
  - $CO_2$ (carbon dioxide)
  - $SO_3$ (sulfur trioxide)
  - $CF_4$ (carbontetrafluoride)
  - $PCl_5$ (phosphorous pentachloride)

- **Beware! Different naming rules apply for covalent compounds versus ionic compounds.**

# Overview: Naming Covalent Compounds

Before you start naming, make *sure* you have a covalent compound (i.e., both elements is the compounds are nonmetals, and the compound is not an acid.)

The name of a covalent compound will have two words.

Each word in the name will tell us two things; what each element is, and how many there are of each in the compound.

# Overview: Naming Covalent Compounds

Let's analyze $CO_2$ to see where this is going…

The first element in the compound is carbon, so the first word in the name is "carbon".

The second element is oxygen, and there are two of them. We indicate how many O using a prefix and change the end of the name to –ide.

Di-ox-ide "dioxide"

So, the name of $CO_2$ is "carbon dioxide".

# Prefixes Used for Naming Covalent Compounds

| Prefix added to each element in the name | Meaning (number of atoms of that element) |
|---|---|
| Mono- | 1 |
| Di- | 2 |
| Tri- | 3 |
| Tetra- | 4 |
| Penta- | 5 |
| Hexa- | 6 |
| Hepta- | 7 |
| Octa- | 8 |
| Nona- | 9 |
| Deca- | 10 |

**Remember…only use these prefixes for covalent compounds, NOT ionic compounds.**

# Rules for Naming Covalent Compounds

Step 1: Analyze the compound to see how many of each element are present.

Step 2: Write the first part of the name by taking the element name and adding the appropriate prefix. NOTE: If there is only one atom of the first element, leave off the "mono-" on the first part of the name.

Step 3: Write the root of the second element name. Add the ending –ide, and then the appropriate prefix (mono-, di-, tri-, etc.)

# A Few Other Details about Naming Covalent Compounds

Usually, the less electronegative element is placed first in the compound (or listed first in the name). We have not learned how to rate electronegativity of elements yet, so this info will be given.

When the name of the element begins with a vowel and prefix ends in "o", we end up with two vowels in a row, which is hard to say. So, one of the two vowels is "dropped" in the name.

$N_2O_5$ : "dinitrogen peta-oxide" becomes "dinitrogen pentoxide"

# Mini Quiz

- Write the names for the following compounds:
  - $NO_2$
  - $S_2Cl_2$
  - $CBr_4$
  - $SiO_2$

# Mini Quiz Solutions

- Write the names for the following compounds:
  - $NO_2$

    Both elements involved in the compound are nonmetals, so we need to use covalent naming rules.

    The first element is nitrogen, and there is only one, so the first word is "nitrogen"
    The second element is oxygen, and there are two, so we need to take the root of the name, add the prefix "di-" and add the ending –ide.

    "nitrogen dioxide"

# Mini Quiz Solutions

- Write the names for the following compounds:

  $S_2Cl_2$ (Both elements involved in the compound are nonmetals, so we need to use covalent naming rules.)

  The first element is sulfur, and there are two of them, so add the prefix and the first word is "disulfur"
  The second element is chlorine, and there are two, so we need to take the root of the name (chlor), add the prefix "di-" and add the ending -ide.

  "disulfur dichloride"

# Mini Quiz Solutions

- Write the names for the following compounds:

  $CBr_4$ (Both elements involved in the compound are nonmetals, so we need to use covalent naming rules.)

  The first element is carbon, and there is only one of them, so the first word is "carbon".
  The second element is bromine, and there are four, so we need to take the root of the name (brom), add the prefix "tetra-" and add the ending –ide.

  "carbon tetrabromide"

# Mini Quiz Solutions

- Write the names for the following compounds:

  $SiO_2$

  (Both elements involved in the compound are nonmetals, so we need to use covalent naming rules.)

  The first element is silicon, and there is only one of them, so the first word is "silicon".
  The second element is oxygen, and there are two, so we need to take the root of the name (ox), add the prefix "di-" and add the ending –ide.

  "silicon dioxide"

# Mini Quiz

- Write the formulas for the following compounds:
  - Hexaboron silicide
  - Chlorine dioxide
  - Antimony triiodide
  - Nitrogen trifluoride

# Mini Quiz Solutions

- Write the formulas for the following compounds:
  - Hexaboron silicide has 6 boron atoms and one silicon atom $B_6Si$
  - Chlorine dioxide
  - Antimony triiodide
  - Nitrogen trifluoride

# Mini Quiz Solutions

- Write the formulas for the following compounds:
  - Hexaboron silicide has 6 boron atoms and one silicon atom $B_6Si$
  - Chlorine dioxide has one chlorine atom and two oxygen atoms $ClO_2$
  - Antimony triiodide
  - Nitrogen trifluoride

# Mini Quiz Solutions

- Write the formulas for the following compounds:
  - Hexaboron silicide has 6 boron atoms and one silicon atom $B_6Si$
  - Chlorine dioxide has one chlorine atom and two oxygen atoms $ClO_2$
  - Antimony triiodide has one antimony atom and three iodine atoms $SbI_3$
  - Nitrogen trifluoride

# Mini Quiz Solutions

- **Write the formulas for the following compounds:**
  - Hexaboron silicide has 6 boron atoms and one silicon atom $B_6Si$
  - Chlorine dioxide has one chlorine atom and two oxygen atoms $ClO_2$
  - Antimony triiodide has one antimony atom and three iodine atoms $SbI_3$
  - **Nitrogen trifluoride has one antimony atom and three iodine atoms $NF_3$**