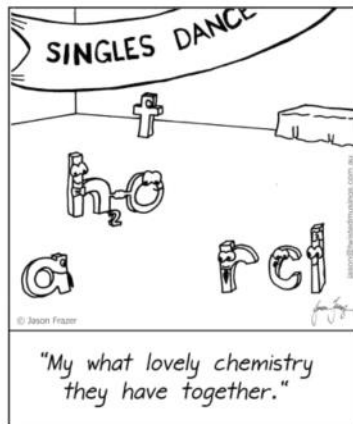


# Science 9

## Unit 2: Chemistry



### BOOK 7: Naming & Writing Chemical Formulas

name: \_\_\_\_\_ block: \_\_\_\_\_



METALS		NON-METALS																																														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																															
1 H Hydrogen 1.0	2 He Helium 4.0											3 B Boron 10.8	4 C Carbon 12.0	5 N Nitrogen 14.0	6 O Oxygen 16.0	7 F Fluorine 19.0	8 Ne Neon 20.2																															
Alkali Metals		Transition Metals										Halogens						Noble Gases																														
3 Li Lithium 6.9	4 Be Beryllium 9.0	5 Na Sodium 23.0	6 Mg Magnesium 24.3	7 K Potassium 39.1	8 Ca Calcium 40.1	9 Sc Scandium 45.0	10 Ti Titanium 47.9	11 V Vanadium 50.9	12 Cr Chromium 52.0	13 Mn Manganese 54.9	14 Fe Iron 55.8	15 Co Cobalt 58.9	16 Ni Nickel 58.7	17 Cu Copper 63.5	18 Zn Zinc 65.4	19 Ga Gallium 69.7	20 Ge Germanium 72.6	21 As Arsenic 74.9	22 Se Selenium 79.0	23 Br Bromine 79.9	24 Kr Krypton 83.8																											
19 Rb Rubidium 85.5	20 Sr Strontium 87.6	21 Y Yttrium 88.9	22 Zr Zirconium 91.2	23 Nb Niobium 92.9	24 Mo Molybdenum 95.9	25 Tc Technetium (98)	26 Ru Ruthenium 101.1	27 Rh Rhodium 102.9	28 Pd Palladium 106.4	29 Ag Silver 107.9	30 Cd Cadmium 112.4	31 In Indium 114.8	32 Sn Tin 118.7	33 Sb Antimony 121.8	34 Te Tellurium 127.6	35 I Iodine 126.9	36 Xe Xenon 131.3	37 Cs Cesium 132.9	38 Ba Barium 137.3	39 La Lanthanum 138.9	40 Ce Cerium 140.1	41 Pr Praseodymium 140.9	42 Nd Neodymium 145.0	43 Pm Promethium (145)	44 Sm Samarium 150.4	45 Eu Europium 152.0	46 Gd Gadolinium 157.3	47 Tb Terbium 158.9	48 Dy Dysprosium 162.5	49 Ho Holmium 164.9	50 Er Erbium 167.3	51 Tm Thulium 168.9	52 Yb Ytterbium 173.0	53 Lu Lutetium 175.0														
55 Cs Cesium 132.9	56 Ba Barium 137.3	57 La Lanthanum 138.9	58 Ce Cerium 140.1	59 Pr Praseodymium 140.9	60 Nd Neodymium 145.0	61 Pm Promethium (145)	62 Sm Samarium 150.4	63 Eu Europium 152.0	64 Gd Gadolinium 157.3	65 Tb Terbium 158.9	66 Dy Dysprosium 162.5	67 Ho Holmium 164.9	68 Er Erbium 167.3	69 Tm Thulium 168.9	70 Yb Ytterbium 173.0	71 Lu Lutetium 175.0	72 Hf Hafnium 178.5	73 Ta Tantalum 180.9	74 W Tungsten 183.8	75 Re Rhenium 186.2	76 Os Osmium 192.2	77 Ir Iridium 192.2	78 Pt Platinum 195.1	79 Au Gold 197.0	80 Hg Mercury 200.6	81 Tl Thallium 204.4	82 Pb Lead 207.2	83 Bi Bismuth 209.0	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)	87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	90 Th Thorium (232)	91 Pa Protactinium (231)	92 U Uranium (238)	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

Based on mass of C-12 at 12.00.  
 Any value in parentheses is the mass of the most stable or known isotopes for elements which do not occur naturally.

### NAMES, FORMULAE AND CHARGES OF SOME POLYATOMIC IONS

Positive Ions	Negative Ions
NH <sub>4</sub> <sup>+</sup> Ammonium	CH <sub>3</sub> COO <sup>-</sup> Acetate
	CO <sub>3</sub> <sup>2-</sup> Carbonate
	ClO <sub>3</sub> <sup>-</sup> Chlorate
	ClO <sub>2</sub> <sup>-</sup> Chlorite
	CrO <sub>4</sub> <sup>2-</sup> Chromate
	CN <sup>-</sup> Cyanide
	Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup> Dichromate
	HCO <sub>3</sub> <sup>-</sup> Hydrogen carbonate, bicarbonate
	HSO <sub>4</sub> <sup>-</sup> Hydrogen sulfate, bisulfate
	HS <sup>-</sup> Hydrogen sulfide, bisulfide
	HSO <sub>3</sub> <sup>-</sup> Hydrogen sulfite, bisulfite
	OH <sup>-</sup> Hydroxide
	ClO <sup>-</sup> Hypochlorite
	NO <sub>3</sub> <sup>-</sup> Nitrate
	NO <sub>2</sub> <sup>-</sup> Nitrite
	ClO <sub>4</sub> <sup>-</sup> Perchlorate
	MnO <sub>4</sub> <sup>-</sup> Permanganate
	PO <sub>4</sub> <sup>3-</sup> Phosphate
	PO <sub>3</sub> <sup>3-</sup> Phosphite
	SO <sub>4</sub> <sup>2-</sup> Sulfate
	SO <sub>3</sub> <sup>2-</sup> Sulfite

### NAMES AND FORMULAE OF COMMON ACIDS

Hydrochloric acid	HCl
Sulfuric acid	H <sub>2</sub> SO <sub>4</sub>
Nitric acid	HNO <sub>3</sub>
Acetic acid	HCH <sub>3</sub> COO

#### PREFIXES

1	mono
2	di
3	tri
4	tetra
5	penta
6	hexa
7	hepta
8	octa
9	nona
10	deca

\* for covalent compounds ONLY!

<sup>2+ or more atoms</sup>  
**PART A: NAMES AND FORMULAS OF COVALENT COMPOUNDS**

A binary covalent compound contains 2 or more elements joined together by one or more covalent bonds.

Unlike ionic compounds, they combine chemically by sharing electrons in a covalent bond.

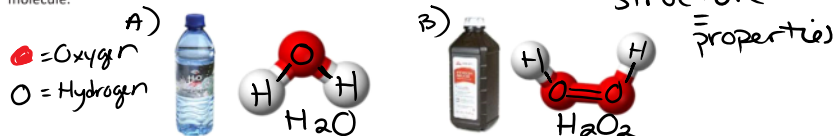
In a covalent compound, the exact precise number of atoms of each element in the molecule is shown by the chemical formula + the name

For example,  $H_2O_2$  is a covalent compound that may be familiar to you as a disinfectant. (hydrogen peroxide)  
 Its name is dihydrogen dioxide

Each molecule of hydrogen peroxide has 2 hydrogen atoms and 2 oxygen atoms, for a total of four atoms in each molecule. DO NOT SIMPLIFY covalent compounds.

Notice that the formula is not reduced to HO, as would be the case for an ionic compound where the formula is simplified into the lowest ratio.

In a covalent compound, the formula+name show the actual number of atoms of each element in the molecule.



In chemistry, we must have a set of naming rules to distinguish compounds and make sure the same language is spoken. Different compounds have different formulas, names, and chemical properties

So in formula of covalent compounds, the subscripts are **VERY IMPORTANT!**

Consider that hydrogen peroxide again, and compare it to water. What are the chemical formula of each:



They differ in 1 oxygen, yet their chemical characteristics are vastly different.

Water is vital to our survival and hydrogen peroxide is poisonous if consumed.

**Naming Covalent Compounds**

Prefixes "are words that go in front", indicate the number of atoms of each element that appear in the formula:

Prefix	mono	di	tri	tetra	penta	hexa	hepta	octa	nona	deca
Subscript (number)	1	2	3	4	5	6	7	8	9	10

**Table 4.13** Prefixes Used in Naming Binary Covalent Compounds

Prefix	Number
mono-	1
di-	2
tri-	3
tetra-	4
penta-	5
hexa-	6
hepta-	7
octa-	8
nona-	9
deca-	10

In covalent compounds, two non-metals atoms may share electrons and combine in several ratios.

Therefore, the name of the molecular compound must reveal its formula to distinguish it from the other compounds of the same two elements.

The name of a molecular compound uses a Prefix code to provide its formula. (# for subscript)

The prefixes used are shown LEFT.

The names of all binary compounds have an "ide" suffix (ending)

$N_2O_4$  is therefore di nitrogen tetra oxide.

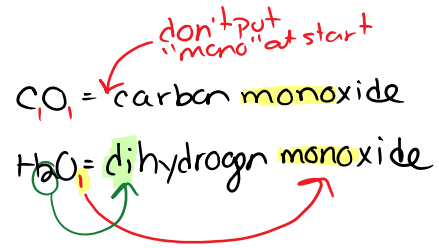
Note that the number of atoms comes before the name of the element but after the symbol of the element. dinitrogen =  $N_2$

The prefix mono- is assumed for the first element named if no prefix is stated.

For example, carbon di oxide is  $CO_2$ , NOT mono carbon dioxide



*Handwritten notes:* "right side of P.T.", "don't put 'mono' at start", "don't start with mono", "assumed for", "CO2", "P4S10", "P=phosphorus", "S=sulfur", "4=tetra", "10=deca", "numbers first", "always end in 'ide'"



**1. FROM CHEMICAL FORMULA --> COMPOUND NAME**

**Sample Problem — Determining the NAME of a Molecular Compound from Its Formula**  
 What is the name of  $P_4S_{10}$ ?

**What to Think about**  
 1. Write the names of each element and the number of atoms of each.  
 2. Rewrite this information using the prefix code.

**How to Do It**  
 $P_4S_{10}$  → P = phosphorus, 4 = tetra, S = sulfur, 10 = deca → Tetraphosphorus decasulfide

**PRACTICE**

Name the following covalent compounds:

- $N_2O$  dinitrogen monoxide
- $CO_2$  carbon dioxide
- $PI_3$  phosphorus triiodide
- $PCl_5$  phosphorus pentachloride
- $SO_2$  sulfur dioxide
- $N_2O_4$  dinitrogen tetroxide
- $P_4S_{10}$  tetraphosphorus decasulfide
- $S_2F_{10}$  disulfur decafluoride
- $NI_3$  nitrogen triiodide
- $NO$  nitrogen monoxide

## 2. FROM COMPOUND NAME --> CHEMICAL FORMULA symbols + subscripts

1. Confirm that you are dealing with a covalent compound.

↳ 2 non-metal names

2. Translate the prefixes and element names into symbols and subscripts.

### Sample Problem — Determining the FORMULA of a Molecular Compound from Its Name

What is the formula of xenon tetrafluoride?

✓ non-metals

fluorine  
F

? Xenon tetrafluoride

#### What to Think about

- Write the symbols of each element and the number of atoms of each.
- Rewrite this information as a formula.

#### How to Do It

no prefix = 1

Xe F<sub>4</sub>

### PRACTICE

Write the chemical formula for the following covalent compounds:

- 1 nitrogen tribromide NBr<sub>3</sub>
- sulfur hexafluoride \_\_\_\_\_
- 2 dinitrogen tetrasulfide N<sub>2</sub>S<sub>4</sub>
- oxygen difluoride \_\_\_\_\_
- carbon tetraiodide \_\_\_\_\_

- nitrogen tribromide NBr<sub>3</sub>
- sulfur hexafluoride SF<sub>6</sub>
- dinitrogen tetrasulfide N<sub>2</sub>S<sub>4</sub>
- oxygen difluoride OF<sub>2</sub>
- carbon tetraiodide CI<sub>4</sub>
- sulfur trioxide SO<sub>3</sub>
- phosphorus pentabromide PBr<sub>5</sub>
- diiodine hexachloride I<sub>2</sub>Cl<sub>6</sub>
- dichlorine monoxide Cl<sub>2</sub>O
- xenon hexafluoride XeF<sub>6</sub>

### PRACTICE

#### Determining the Names and Formulas of Molecular Compounds

1. Write the formula of each of the following molecular compounds:

(a) nitrogen monoxide NO

(b) nitrogen dioxide NO<sub>2</sub>

(c) dinitrogen tetroxide N<sub>2</sub>O<sub>4</sub>

(d) dinitrogen trioxide N<sub>2</sub>O<sub>3</sub>

2. Name each of the following molecular compounds:

(a) PCl<sub>5</sub> Phosphorus pentachloride

(b) SO<sub>2</sub> sulfur dioxide

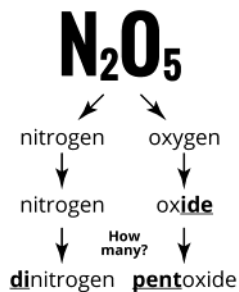
(c) CO carbon monoxide

(d) P<sub>2</sub>O<sub>5</sub> diphosphorus pentoxide

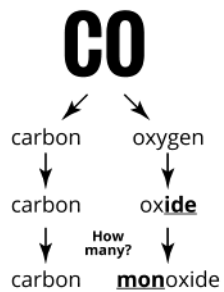
# Writing Compound Names

## Covalent Bonds

(a bond between two nonmetals)

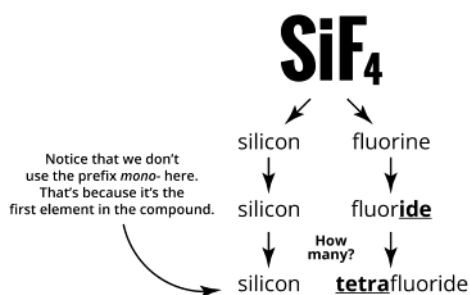


**dinitrogen pentoxide**



**carbon monoxide**

prefix	number
<i>mono-</i>	1
<i>di-</i>	2
<i>tri-</i>	3
<i>tetra-</i>	4
<i>penta-</i>	5
<i>hexa-</i>	6
<i>septa-</i>	7
<i>octa-</i>	8
<i>nona-</i>	9
<i>deca-</i>	10



**silicon tetrafluoride**

If the element starts with a vowel, you may need to drop the *o-* or *a-* at the end of your prefix.

*penta-* → **pentoxide**  
*di-* → **dioxide**  
*tetra-* → **tetroxide**  
*hexa-* → **hexoxide**

# Homework

## Assignment #1: Covalent Compounds Practice Problems

Complete this assignment in the space provided below.

HW April 10<sup>th</sup>

### Practice Problems

1. Write the names of the following compounds.

- |   |  |
|---|--|
| (a) $N_2O$ <u>dinitrogen monoxide</u>       | (f) $N_2O_4$ <u>dinitrogen tetroxide</u>           |
| (b) $CO_2$ <u>carbon dioxide</u>            | (g) $P_4S_{10}$ <u>tetraphosphorus decasulfide</u> |
| (c) $PI_3$ <u>phosphorus triiodide</u>      | (h) $S_2F_{10}$ <u>disulphur decafluoride</u>      |
| (d) $PCl_5$ <u>phosphorus pentachloride</u> | (i) $NI_3$ <u>nitrogen triiodide</u>               |
| (e) $SO_2$ <u>sulfur dioxide</u>            | (j) $NO$ <u>nitrogen monoxide</u>                  |

2. Write the formulas of the following compounds.

- |  |   |
|--|---|
| (a) nitrogen tribromide <u><math>NBr_3</math></u>      | (f) sulfur trioxide <u><math>SO_3</math></u>          |
| (b) sulfur hexafluoride <u><math>SF_6</math></u>       | (g) phosphorus pentabromide <u><math>PBr_5</math></u> |
| (c) dinitrogen tetrasulfide <u><math>N_2S_4</math></u> | (h) diiodine hexachloride <u><math>I_2Cl_6</math></u> |
| (d) oxygen difluoride <u><math>OF_2</math></u>         | (i) dichlorine monoxide <u><math>Cl_2O</math></u>     |
| (e) carbon tetraiodide <u><math>CI_4</math></u>        | (j) xenon hexafluoride <u><math>XeF_6</math></u>      |

3. Identify each of the following compounds as either ionic or covalent.

- |  |  |
|--|--|
| (a) $(NH_4)_2S$ <u>ionic</u>                   | (e) $N_2O_3$ <u>covalent (dinitrogen trioxide)</u> |
| (b) $OCl_2$ <u>covalent (oxygendichloride)</u> | (f) $SCl_2$ <u>covalent (sulphur dichloride)</u>   |
| (c) $SrCl_2$ <u>ionic</u>                      | (g) $NBr_3$ <u>covalent (nitrogen tribromide)</u>  |
| (d) $NaNO_3$ <u>ionic</u>                      | (h) $FeF_2$ <u>ionic</u>                           |

metals!