Naming Molecular (Covalent) Compounds

Unit: Nomenclature & Formulas

MA Curriculum Frameworks (2016): HS-PS2-6

Mastery Objective(s): (Students will be able to…)

- Write names for molecular (covalent) inorganic compounds.
- Write chemical formulas for molecular (covalent) inorganic compounds.

Success Criteria:

- Compound names contain the name of each element with the appropriate prefix (except that a compound cannot start with "mono-").
- Chemical formulas have elements listed in the correct order (increasing electronegativity).
- Chemical formulas have the correct subscript for each element.

Tier 2 Vocabulary: molecule, compound

Language Objectives:

- Explain how prefixes are used with molecular compounds.

Notes:

molecular compound (also known as a covalent compound): a compound made of atoms joined by covalent bonds (shared electrons).

molecule: a set of atoms joined by covalent bonds.

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Unlike ionic compounds, covalent compounds have names that give the chemical formula of the molecule. The numbers in the formula are Greek numbers made into prefixes.

No.	Prefix	No.	Prefix	No.	Prefix	No.	Prefix
1	mono- or hen-	10	deca-	100	hecta-	1000	kilia-
2	di- or do-	20	(i)cosa-	200	dicta-	2000	dilia-
3	tri-	30	triaconta-	300	tricta-	3000	trilia-
4	tetra-	40	tetraconta-	400	tetracta-	4000	tetralia-
5	penta-	50	pentaconta-	500	pentacta-	5000	pentalia-
6	hexa-	60	hexaconta-	600	hexacta-	6000	hexalia-
7	hepta-	70	heptaconta-	700	heptacta-	7000	heptalia-
8	octa-	80	octaconta-	800	octacta-	8000	octalia-
9	nona-	90	nonaconta-	900	nonacta-	9000	nonalia-

Rules:

1. The first atom in the formula has a number prefix only if the molecule contains more than one of that atom.
2. The last atom in the formula always has a number prefix, whether or not there are more than one of that atom.
3. For huge numbers of atoms, the number prefixes combine in *reverse* order of place value. (Yes, it's weird.)

   For example, the compound $C_{51}S_{22}$ (if it existed) would be called henpentacontacarbon docosasulfide.

In practice, prefixes larger than 10 (deca-) are rarely used.

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Examples:

- CO_2 has 1 carbon atom ("carbon") and 2 oxygen atoms ("di-oxide"), so its name is carbon dioxide.
- P_2O_5 has 2 phosphorus atoms ("di-phosphorus") and 5 oxygen atoms ("pent-oxide"), so its name is diphosphorus pentoxide.
- N_2O has 2 nitrogen atoms ("di-nitrogen") and one oxygen atom ("mono-oxide," which we elide to "monoxide"), so its name is dinitrogen monoxide.
- H_2O has 2 hydrogen atoms and one oxygen atom, but it is always "water," not "dihydrogen monoxide*". The same goes for NH_3, which is always called "ammonia."

* Someone has created a humorous website, http://www.dhmo.org, which attempts to make people aware of the "dangers" of dihydrogen monoxide, or "DHMO."

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Homework Problems

Give the name for each of the following covalent compounds, using the prefix system.

1. NF_3
2. NO
3. NO_2
4. B_2O_3
5. N_2O
6. N_2O_4
7. PCl_3
8. PCl_5
9. SF_6
10. CO_2

Give the chemical formula for each of the following compounds.

11. phosphorus triïodide
12. sulfur dichloride
13. xenon trioxide
14. dinitrogen tetrafluoride
15. sulfur tetrafluoride
16. boron trichloride
17. phosphorus pentafluoride
18. diphosphorus trioxide
19. dichlorine heptoxide
20. carbon tetrachloride

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