

4.8: Molecular Compounds: Formulas and Names

Key Concept Video Naming Molecular Compounds

In contrast to an ionic compound, the formula for a molecular compound *cannot* always be determined from its constituent elements because the same combination of elements may form several different molecular compounds, each with a different formula. We just saw in [Section 4.7](#) that hydrogen and oxygen can form both H_2O and H_2O_2 and each of these formulas is explained by its Lewis structure. Carbon and oxygen can form both CO and CO_2 , and nitrogen and oxygen can form NO , NO_2 , N_2O , N_2O_3 , N_2O_4 , and N_2O_5 . In [Chapter 5](#) we will discuss how to draw Lewis structures for compounds such as these. For now, we focus on naming a molecular compound based on its formula and writing its formula based on its name.

Like ionic compounds, many molecular compounds have common names. For example, H_2O and NH_3 have the common names *water* and *ammonia*. However, the sheer number of existing molecular compounds—numbering in the millions—necessitates a systematic approach to naming them.

The first step in naming a molecular compound is identifying it as one. Remember, *molecular compounds are composed of two or more nonmetals*. In this section, we learn how to name binary (two-element) molecular compounds. Their names have the form:

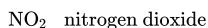


When we write the name of a molecular compound, just as when we write its formula, the first element is the more metal-like one (toward the left and bottom of the periodic table). Generally, we write the name of the element with the smallest group number first. If the two elements lie in the same group, we write the element with the greatest row number first. The prefixes given to each element indicate the number of atoms present:

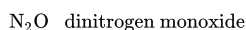
mono = 1	tri = 3	penta = 5	hepta = 7	nona = 9
di = 2	tetra = 4	hexa = 6	octa = 8	deca = 10

These prefixes are the same ones we use when naming hydrates.

If there is only one atom of the *first element* in the formula, we normally omit the prefix *mono-*. For example, we name NO_2 according to the first element, *nitrogen*, with no prefix because *mono-* is omitted for the first element, followed by the prefix *di-*, to indicate two oxygen atoms, and the base name of the second element, *ox*, with the ending *-ide*. Its full name is *nitrogen dioxide*.



We name the compound N_2O (sometimes called laughing gas) similarly except that we use the prefix *di-* before nitrogen to indicate two nitrogen atoms and the prefix *mono-* before oxide to indicate one oxygen atom. Its full name is *dinitrogen monoxide*.



When a prefix ends with “o” and the base name begins with “o,” the first “o” is often dropped. So mono-oxide becomes *monoxide*.

Example 4.8 Naming Molecular Compounds

Name each compound.

- a. NI_3
- b. PCl_5
- c. P_4S_{10}

SOLUTION

- a. The name of the compound is the name of the first element, *nitrogen*, followed by the base name of the second element, *iod*, prefixed by *tri-* to indicate three and given the suffix *-ide*.

NI_3 nitrogen triiodide

- b. The name of the compound is the name of the first element, *phosphorus*, followed by the base name of the second element, *chlor*, prefixed by *penta-* to indicate five and given the suffix *-ide*.

PCl_5 phosphorus pentachloride

- c. The name of the compound is the name of the first element, *phosphorus*, prefixed by *tetra-* to indicate four, followed by the base name of the second element, *sulf*, prefixed by *deca-* to indicate ten and given the suffix *-ide*.

P_4S_{10} tetraphosphorus decasulfide

FOR PRACTICE 4.8 Name the compound N_2O_5 .

FOR MORE PRACTICE 4.8 Write the formula for phosphorus tribromide.

Conceptual Connection 4.7 Nomenclature

Interactive

Not for Distribution

