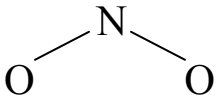
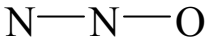
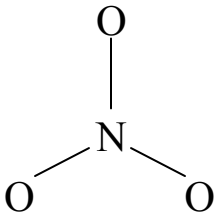
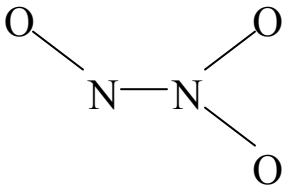
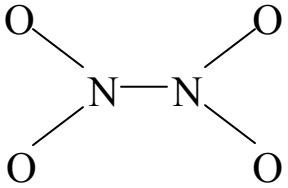
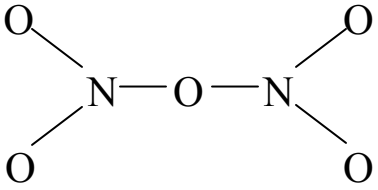
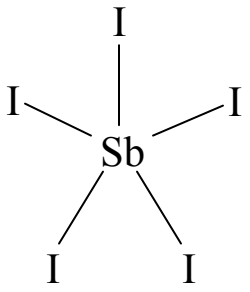
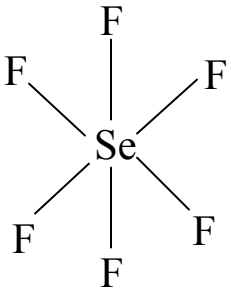
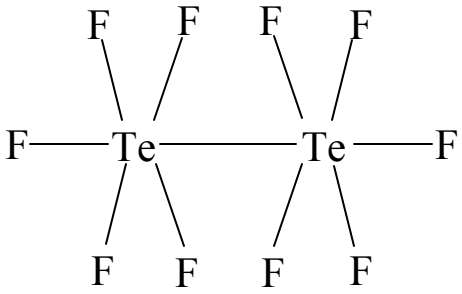
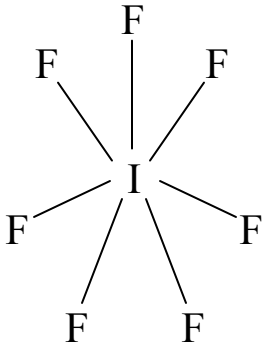
How do I name binary molecular compounds?

The Model

There are several compounds that are all ***oxides of nitrogen***. They are:

Representation	Formula	Unambiguous Name
	NO	**nitrogen monoxide**
	**NO_2**	**nitrogen dioxide**
	**N_2O**	**dinitrogen monoxide**
	**NO_3**	**nitrogen trioxide**
	**N_2O_3**	**dinitrogen trioxide**
	**N_2O_4**	**dinitrogen tetroxide** (or dinitrogen tetraoxide)
	**N_2O_5**	**dinitrogen pentoxide** (or dinitrogen pentaoxide)

The atoms around a central atom repel each other, so there is an upper limit to how many bonds a central atom may have. As the central atom becomes larger, it allows more atoms to surround it without these atoms repelling each other. A number of examples of molecules having several covalent bonds are:

Representation	Formula	Unambiguous Name
	**SbI_5**	**antimony pentaiodide**
	**SeF_6**	**selenium hexafluoride**
	**Te_2F_{10}**	**ditellurium decafluoride**
	**IF_7**	**iodine heptafluoride**

Naming Binary Molecular Compounds

Table 1. Common Greek prefixes that are used to indicate the number of atoms of each element—***this table should be memorized***!

Indicate number of atoms of each element with **Greek prefix** before element name:

# of atoms	Greek Prefix	# of atoms	Greek Prefix
1	mono (usually omitted)	6	hexa
2	di	7	hepta
3	tri	8	octa
4	tetra	9	nona
5	penta	10	deca

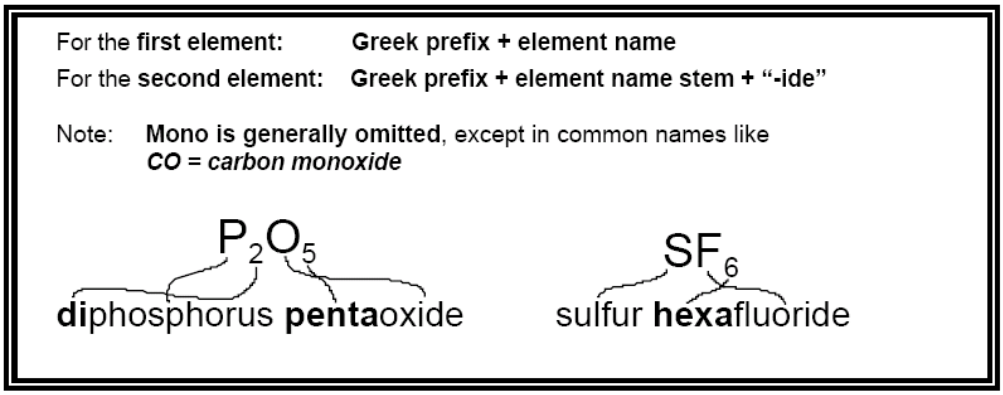


Figure 1. Examples of how to use the Greek Prefixes to name a binary molecular compound

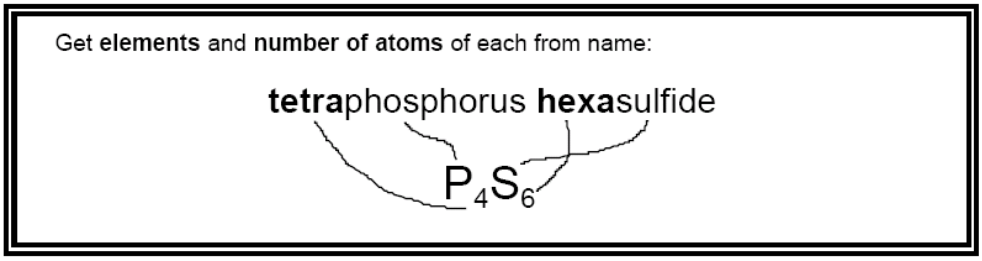


Figure 2. How to determine the formula of a binary molecular compound from its name

Key Questions

1. From the Model, what is meant by "***binary molecular compound***" *Hint*: How many elements are in each of the presented molecules?

2a. Classify the elements in the compounds presented in the Model as metals (***M***), nonmetals (***N***), or semimetals (metalloids) (***S***). The elements below are presented in order of increasing atomic number. *Circle your answers below*.

Nitrogen: ***M*** or ***N*** or ***S*** ?	Selenium: ***M*** or ***N*** or ***S*** ?
Oxygen: ***M*** or ***N*** or ***S*** ?	Antimony: ***M*** or ***N*** or ***S*** ?
Fluorine: ***M*** or ***N*** or ***S*** ?	Tellurium: ***M*** or ***N*** or ***S*** ?
Sulfur: ***M*** or ***N*** or ***S*** ?	Iodine: ***M*** or ***N*** or ***S*** ?

b. When elements belonging to the classifications you listed in (a) combine, what type of compound are they likely to form: molecular or ionic? (You may circle your answer.)

c. How can you tell from the formula of a compound if it is a binary molecular compound? Hint: What kind of elements are in a binary molecular compound.

3a. How do the prefixes "mono-", "di-", "tri-", *etc*. in the names in the Model help the reader?

b. Pertaining specifically to the family of nitrogen oxides, explain why it is so important to use the prefixes when naming a compound?

4. From the Model, what is the apparent rule for using the prefix "mono-"? When is it not used?

5. With what suffix does the name of a binary compound always end?

6. For each of the binary compounds presented in the Model, find the relative positions of the two elements on the Periodic Table. Based on the positions of any two nonmetals/semi-metals on the Periodic Table, state a general rule that is used to determine which element's name is written first in the compound's name. For example, NO is "nitrogen monoxide". Its formula is not "ON" nor is it called "oxygen mononitride". Why?

Exercises

Provide the correct unambiguous name for each of the following binary molecular compounds.

7. Br_3O_8 _____

8. I_4O_9 _____

9. ICl _____

10. AsF_5 _____

11. CO_2 _____

Write the correct formulas for each of the following binary molecular compounds:

12. dichlorine monoxide _____

13. sulfur trioxide _____

14. tetraphosphorous heptasulfide _____

15. disilicon hexaiodide _____

16. selenium tetrabromide _____

17. bromine pentafluoride _____

18. Like the nitrogen oxides, there is a "family" of sulfur fluorides: S_2F_2, SF_4, SF_6, and S_2F_{10}. Attempt to sketch a representation of each one (use those in the Model as a guide) and next to each representation provide the unambiguous name for the four sulfur fluorides.

a. S_2F_2 _____

b. SF_4 _____

c. SF_6 _____

d. S_2F_{10} _____