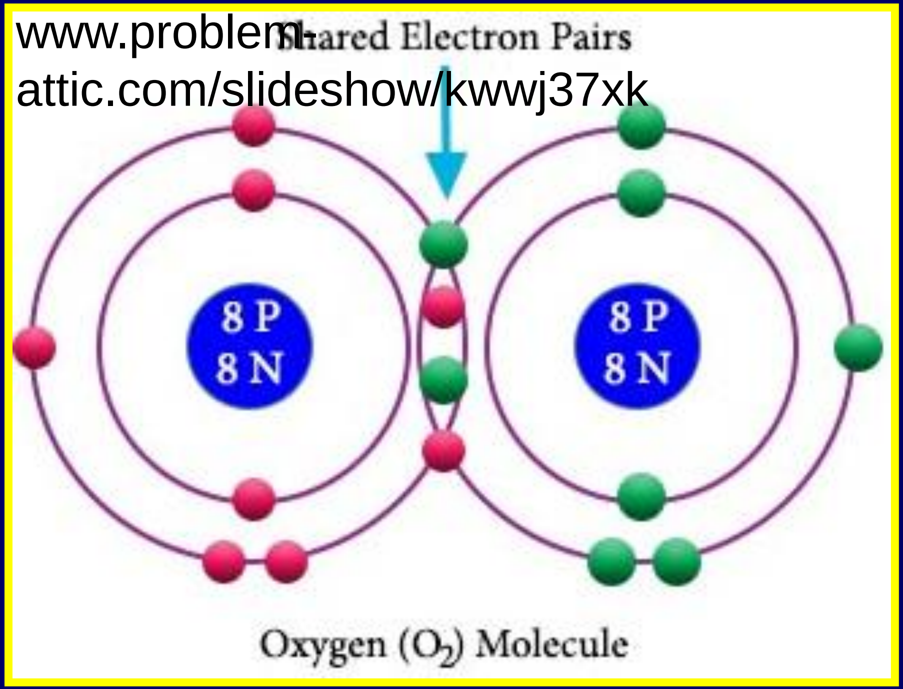
Covalent Compounds



www.problem-attic.com/slideshow/kwwj37xk

Essential Standard 2.2

Understand chemical bonding and chemical interactions.

Learning Objective 2.2.3

Predict chemical formulas and names for simple compounds based on knowledge of bond formation and naming conventions.

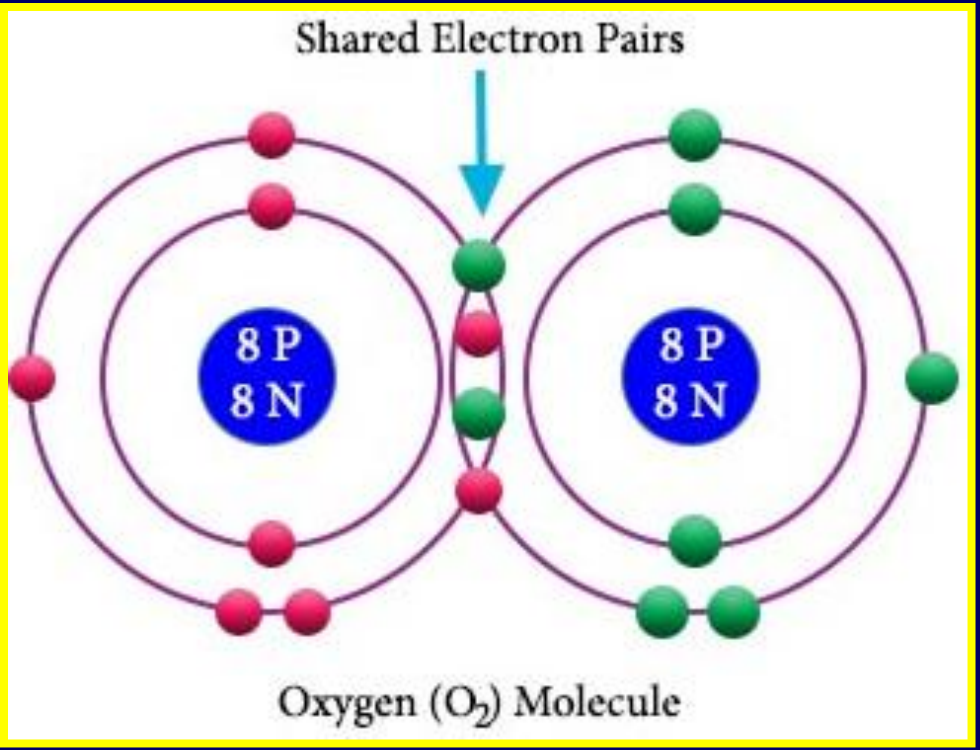
I Can Statements

At the end of this lesson, you should be able to say, with confidence:

- I can determine how many covalent bonds any non-metal can form.
- I can explain how carbon allows for the large variety observed in living organisms.
- I can write molecular formulas for covalent molecules based on their names and visa versa.

Sharing Electrons

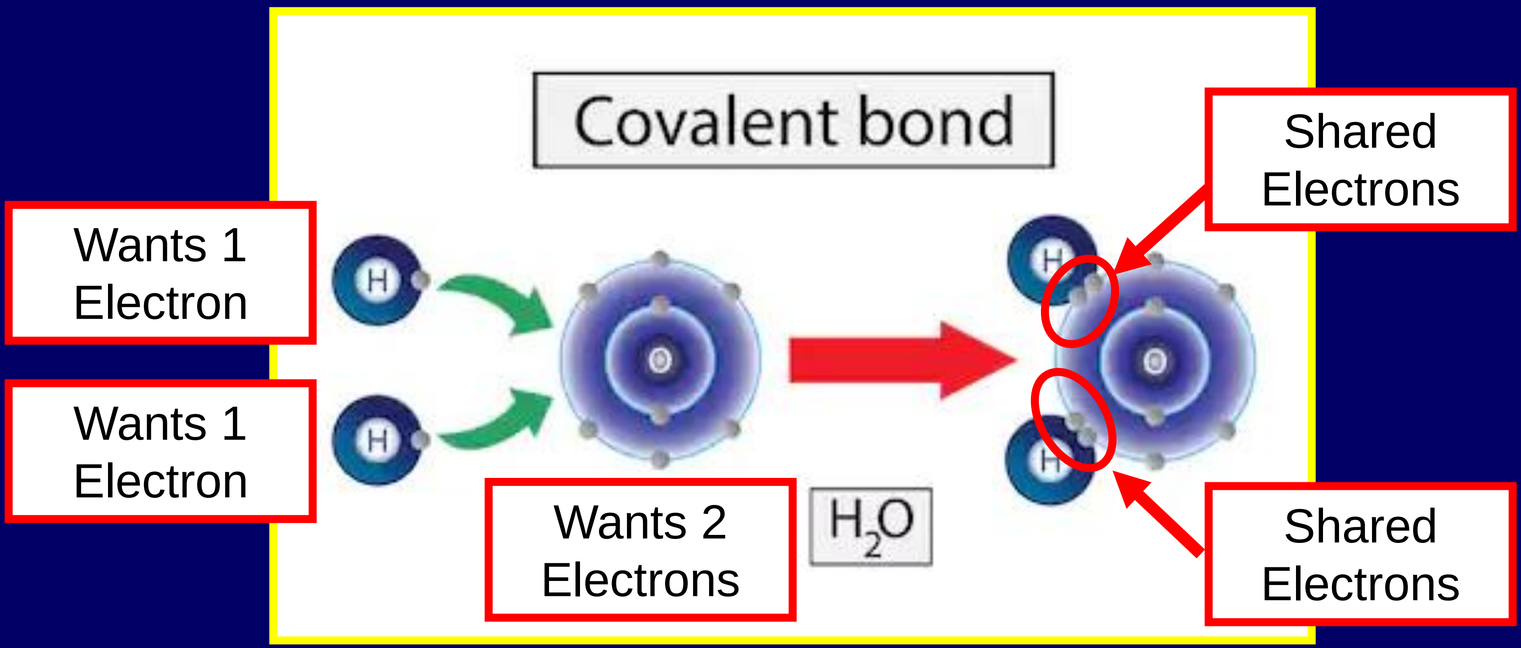
Non-metals are able to share valence electrons.



Since they don't gain or lose electrons, they do not develop a charge and remain neutral.

Covalent Bonds

When atoms join together by sharing valence electrons they form covalent bonds.

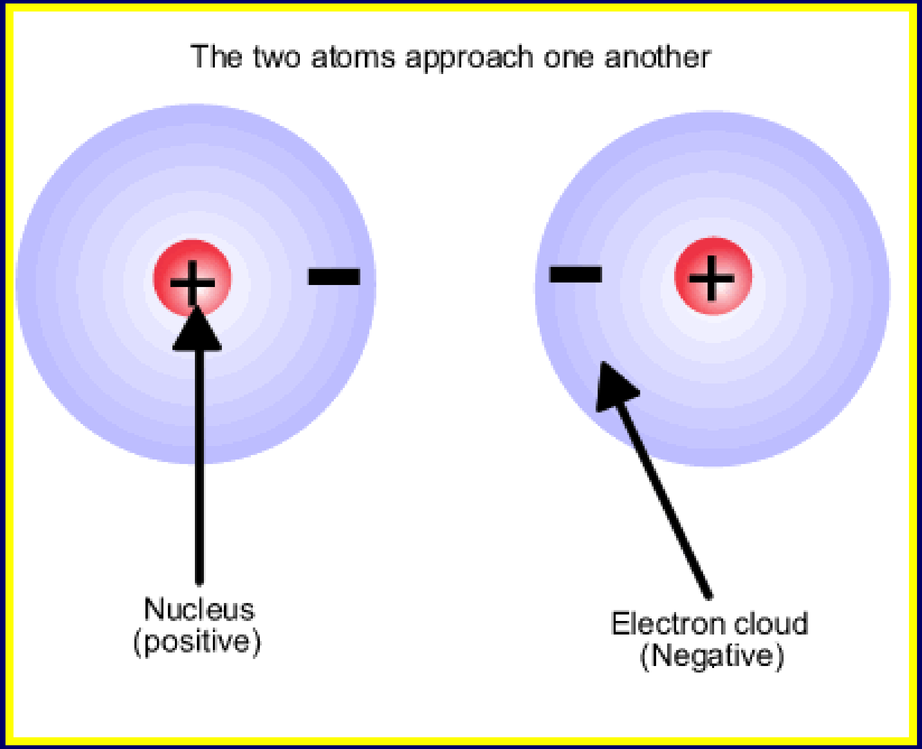


Co-workers share the work

Co-valent compounds share valence electrons

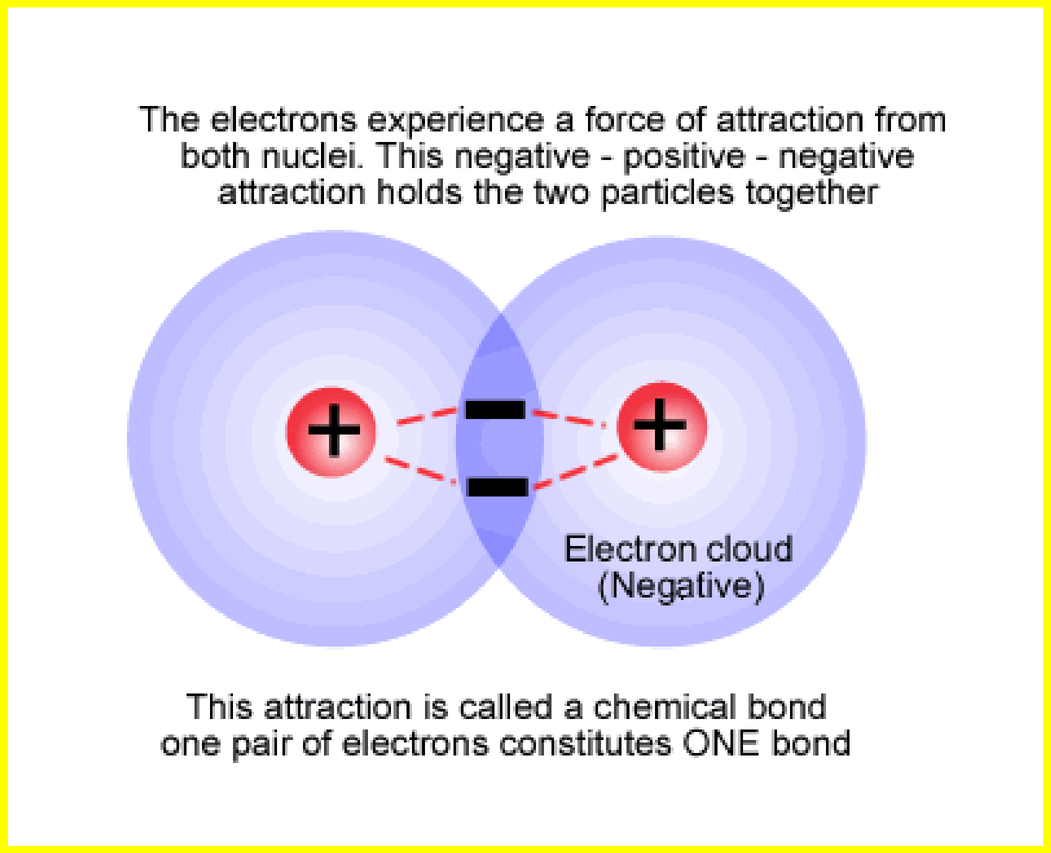
Covalent Bonds

When atoms share electrons, the electrons of each atom are attracted to the nuclei of the other atom.



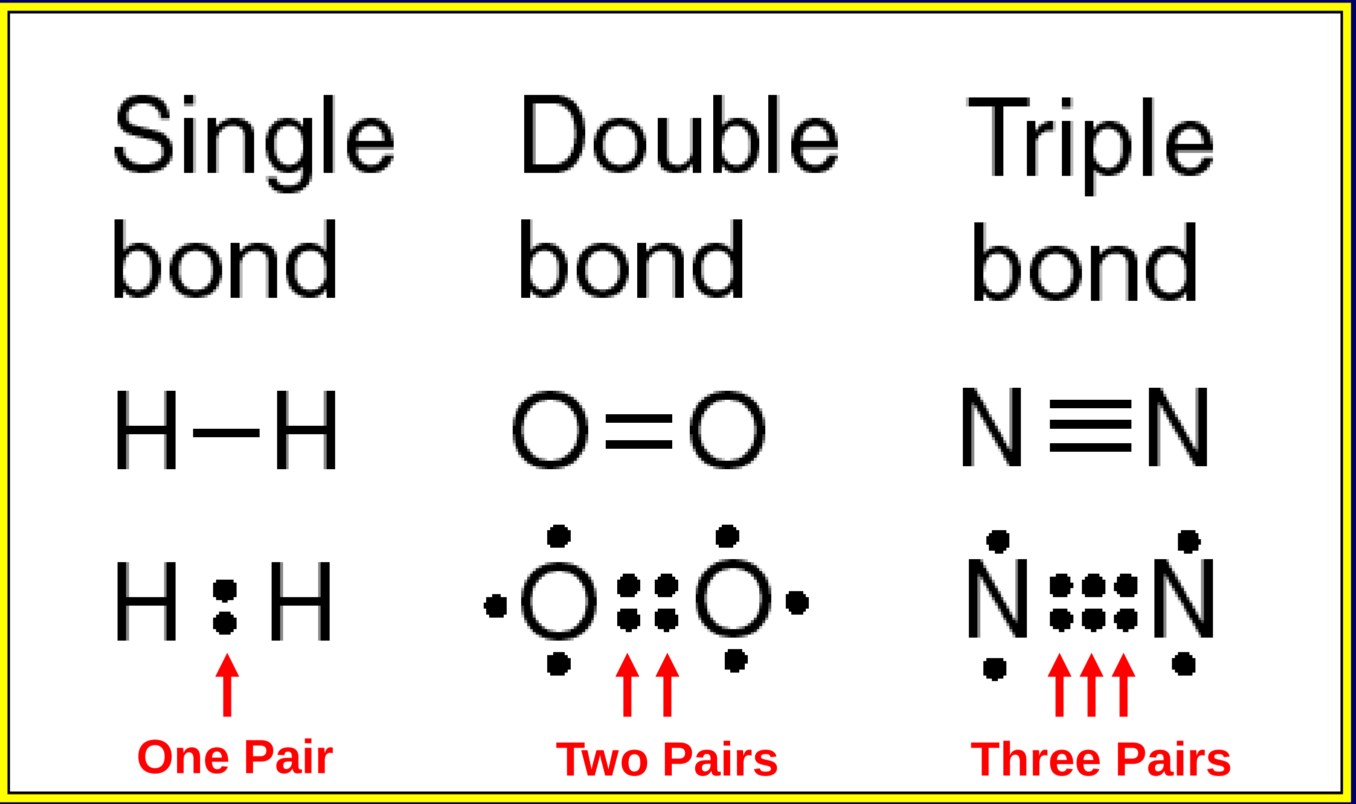
Covalent Bonds

The shared electrons will actually orbit about the nuclei of both atoms.



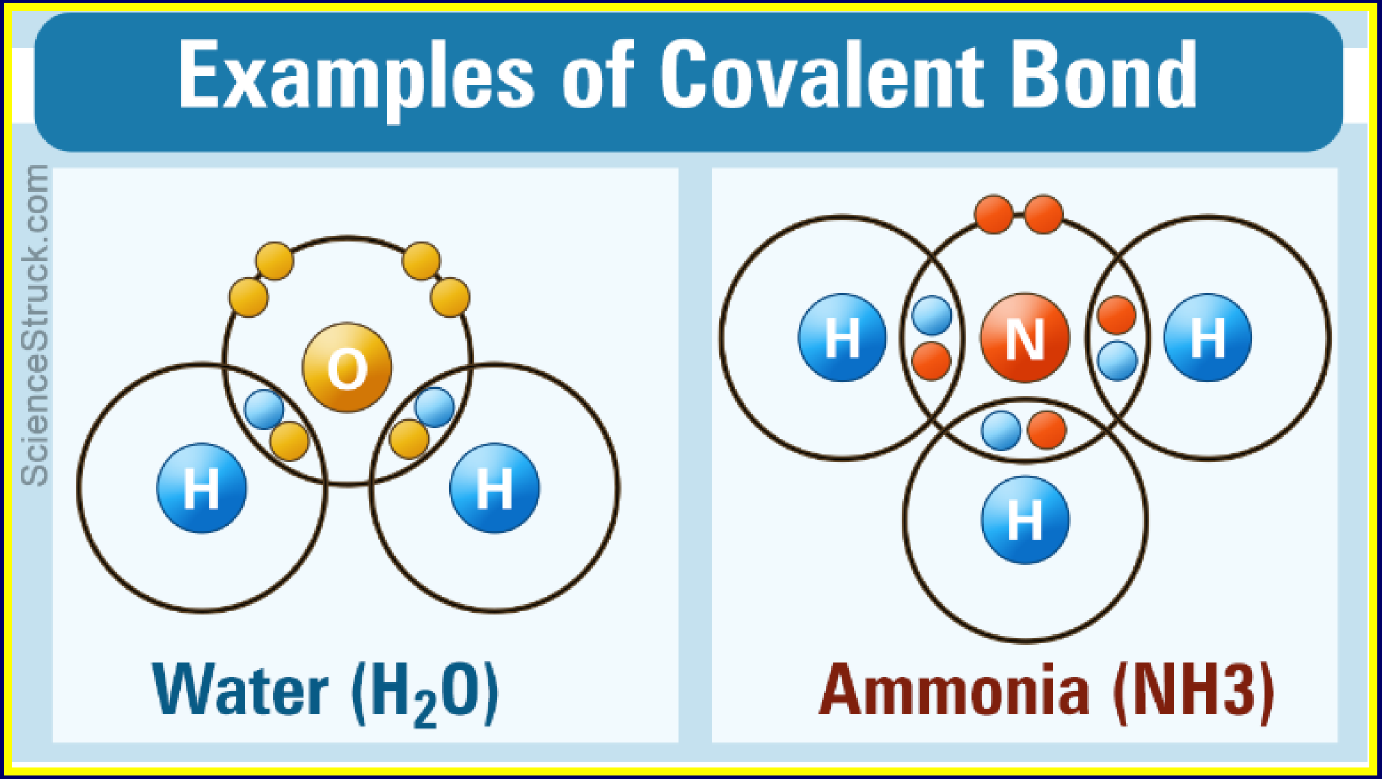
Covalent Bonds

Each pair of shared electrons equals one covalent bond and is represented by one line.



Covalent Bonds

Only non-metals can form covalent bonds.

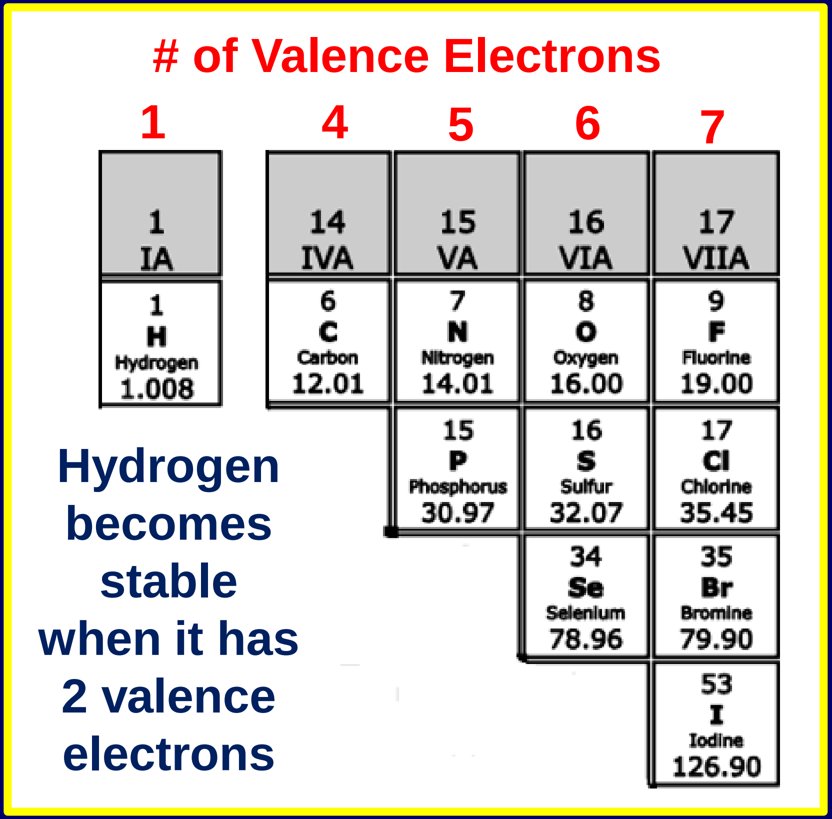


Hydrogen, Oxygen, and Nitrogen are all nonmetals.

Octet Rule

Just like in Ionic Compounds, atoms form chemical bonds to fill their outer energy level so they can become stable.

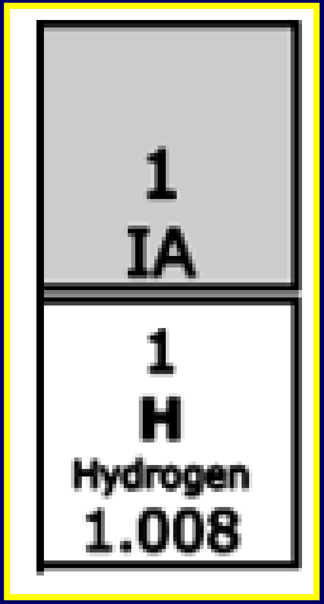
All atoms, except hydrogen, become stable when they meet the octet rule by having 8 valence electrons.



Number of Covalent Bonds

The <u>number</u> of <u>valence</u> <u>electrons</u> a non-metals <u>needs</u> in order to fill its outer energy level will equal the <u>number</u> of <u>covalent</u> <u>bonds</u> formed by a non-metal.

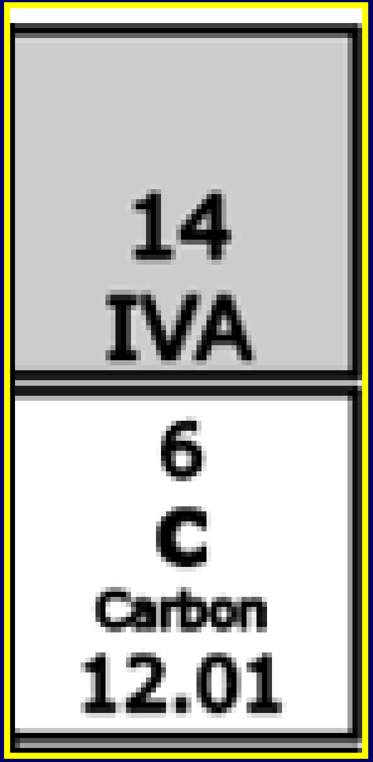
Hydrogen <u>needs</u> only <u>1</u> more valence electron, so it can only <u>form</u> <u>1</u> covalent bond.



Number of Covalent Bonds

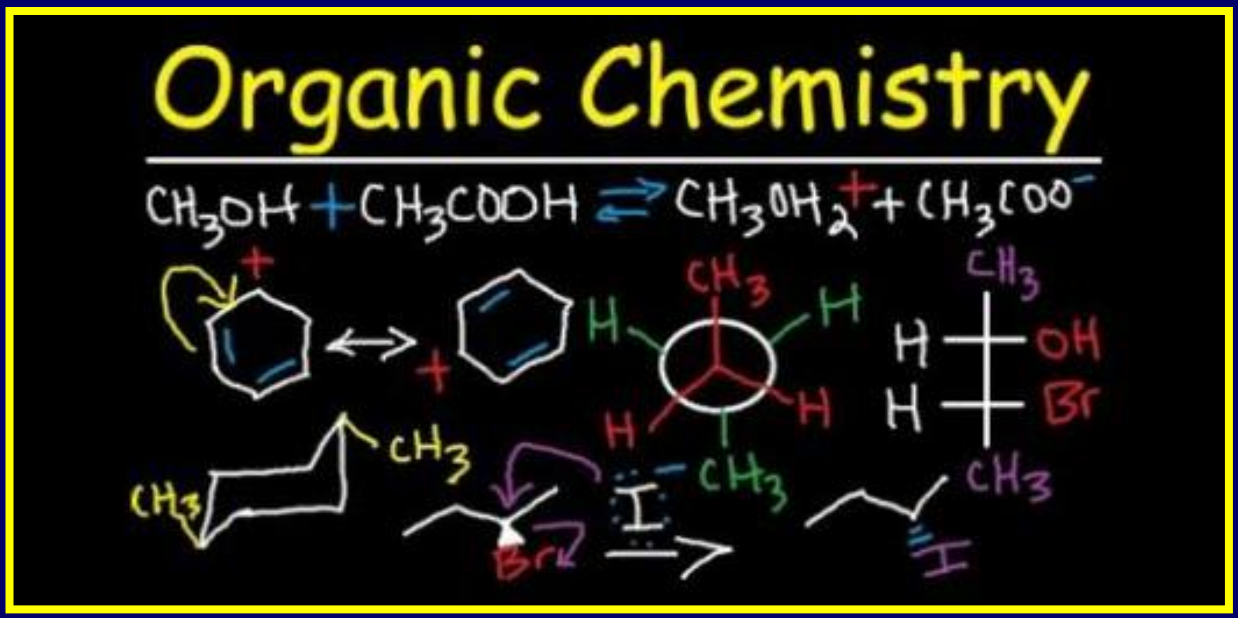
Carbon needs 4 valence electrons to meet the octet rule, so it can form 4 covalent bonds.

The fact carbon can form 4 covalent bonds, makes it very versatile in the amount of structures it can form, which is why it is so crucial to living organisms.



Organic Chemistry

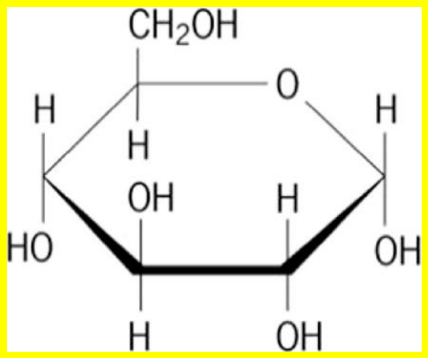
There is an entire branch of chemistry that just studies carbon-based molecules produced by living organisms, called <u>Organic Chemistry</u>.



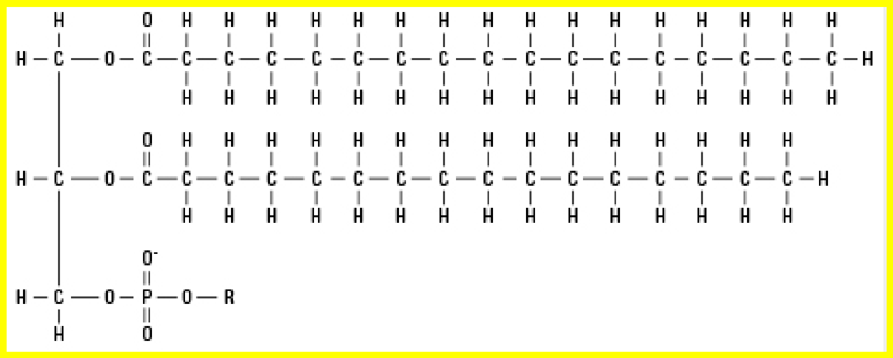
Every student that majors in Biology, Chemistry, Pre-med, Pre-dental, or Pre-veterinary medicine has to take 2 college semesters of Organic Chemistry.

Biomolecules

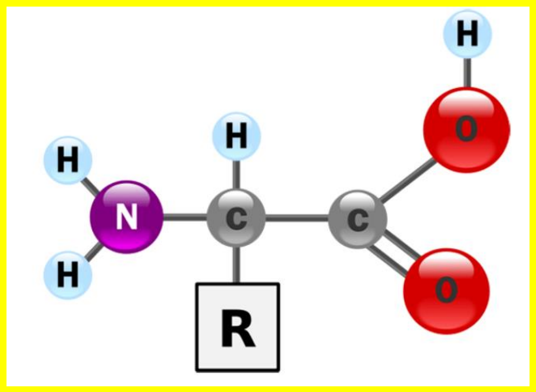
Remember the four biomolecule groups from Biology? All of them contain carbon.



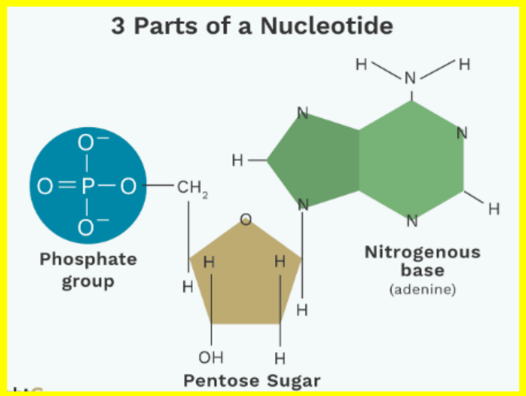
Carbohydrates



Lipids



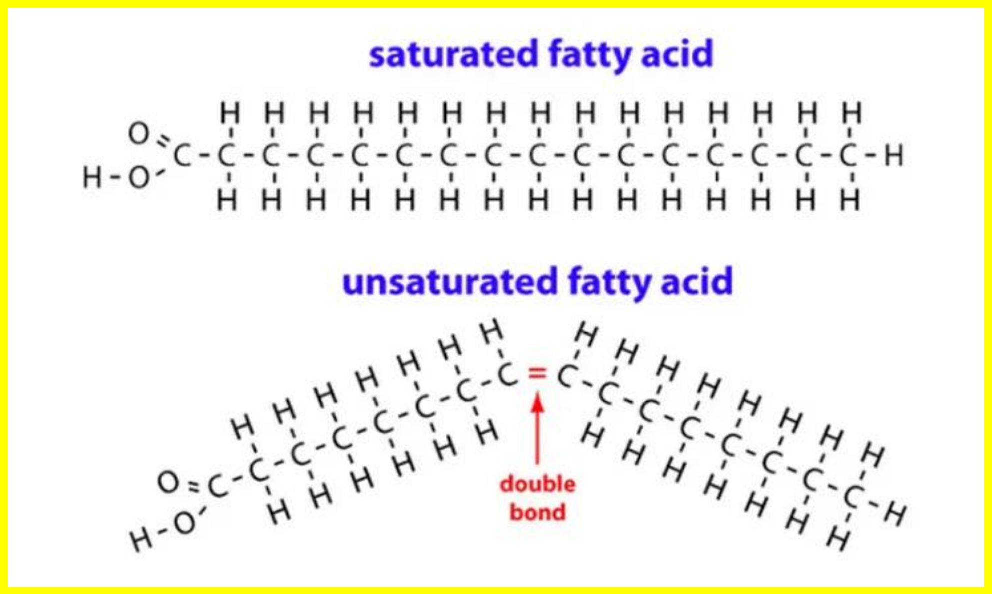
Proteins



Nucleic Acids

Hydrocarbon Chains

Carbon's ability to form form four covalent bonds, allows it to form long hydrocarbon chains in a variety of ways. (H, O, and C)

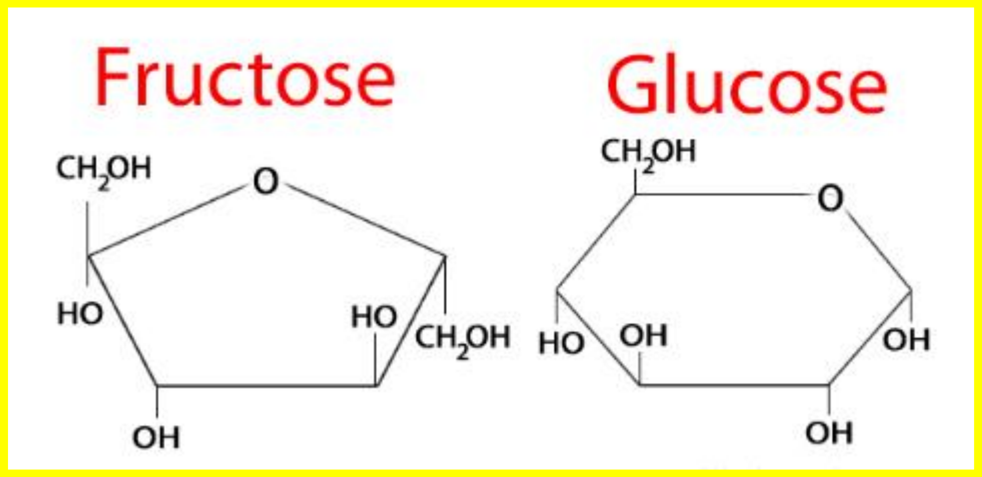


The saturated fats (animal fat) tends to be solids at room temperature.

Whereas, the double bond in the unsaturated fats (olive oil), keep them liquid at room temperature.

Versatility of Carbon

Glucose, $C_6H_{12}O_6$, has the exact same chemical formula as fructose, $C_6H_{12}O_6$.

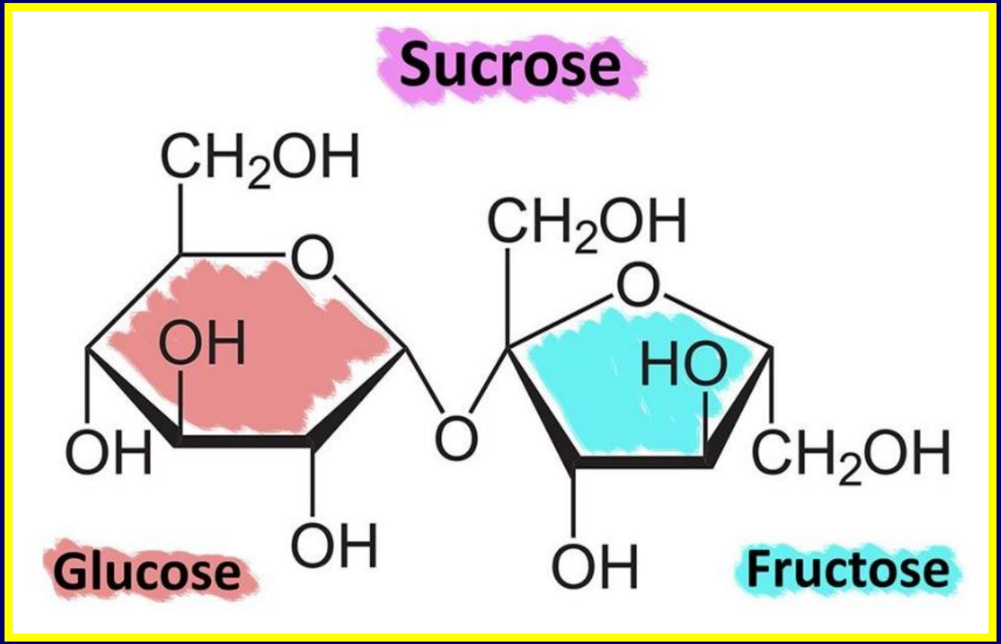


The difference between the two is due to how the atoms are arranged.

Carbon based molecules often form ring structures. When drawn, the C is implied at the junction of each line in the ring.

Versatility of Carbon

Glucose, found in bread, does not taste sweet at all, but fructose, found in fruit, tastes very sweet.



Both glucose and fructose can combine together to form sucrose, which is table sugar.

Number of Covalent Bonds

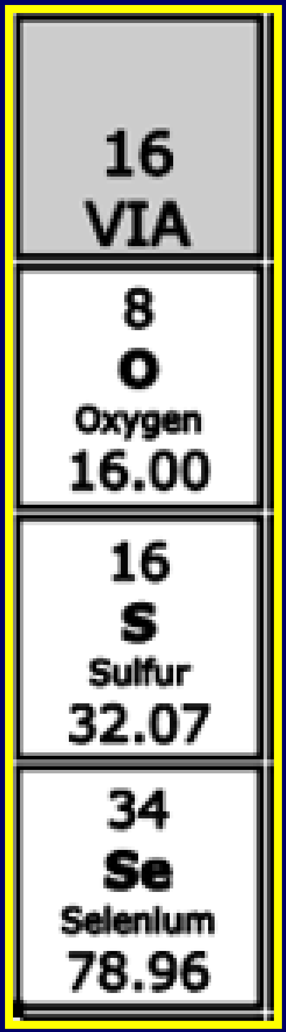
<u>Nitrogen</u> and <u>phosphorus</u> have 5 valence electrons and so can form <u>3</u> covalent bonds.

$8 - 5 = 3$

Number of Covalent Bonds

Oxygen, sulfur and selenium have 6 valence electrons and will form 2 covalent bonds.

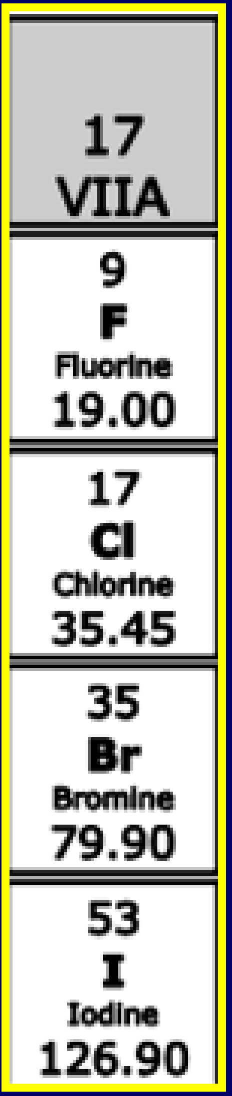
$$8 - 6 = 2$$



Number of Covalent Bonds

All of the halogens have 7 valence electrons so they can only form 1 covalent bond.

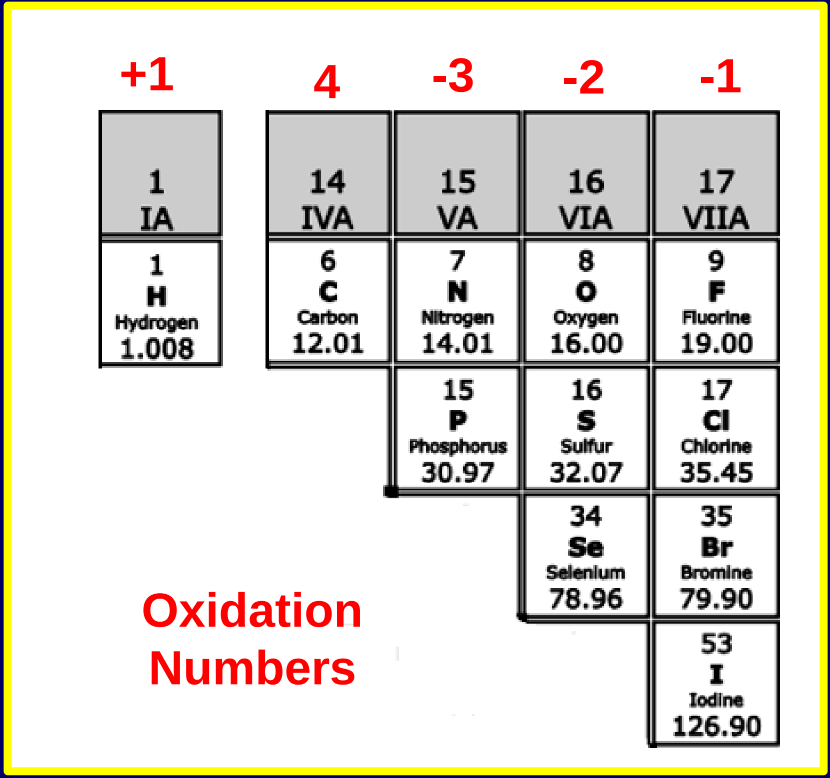
8 – 7 = 1



Number of Covalent Bonds

A quick way to determine the number of covalent bonds a non-metal can form is by using its oxidation number.

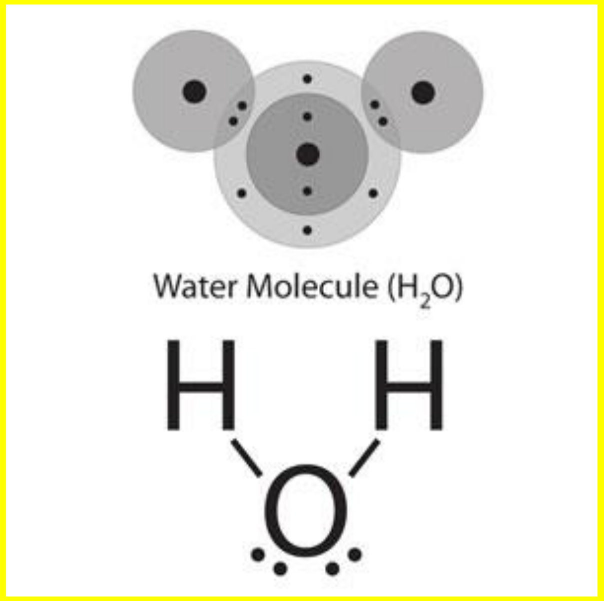
Just ignore the charge.



Molecules

Because electrons are shared and not transferred, there are no charges involved and the compounds formed are called molecules.

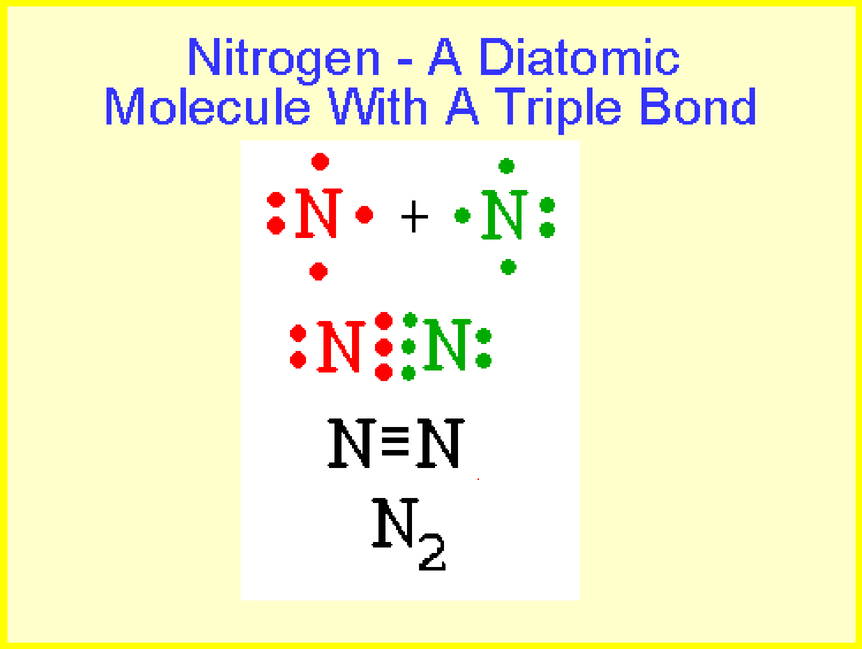
They are still compounds because they are formed when two or more different atoms are chemically combined, but they are a special group of compounds.



Diatomic Molecules

Some of the non-metals can form covalent bonds with similar atoms to themselves.

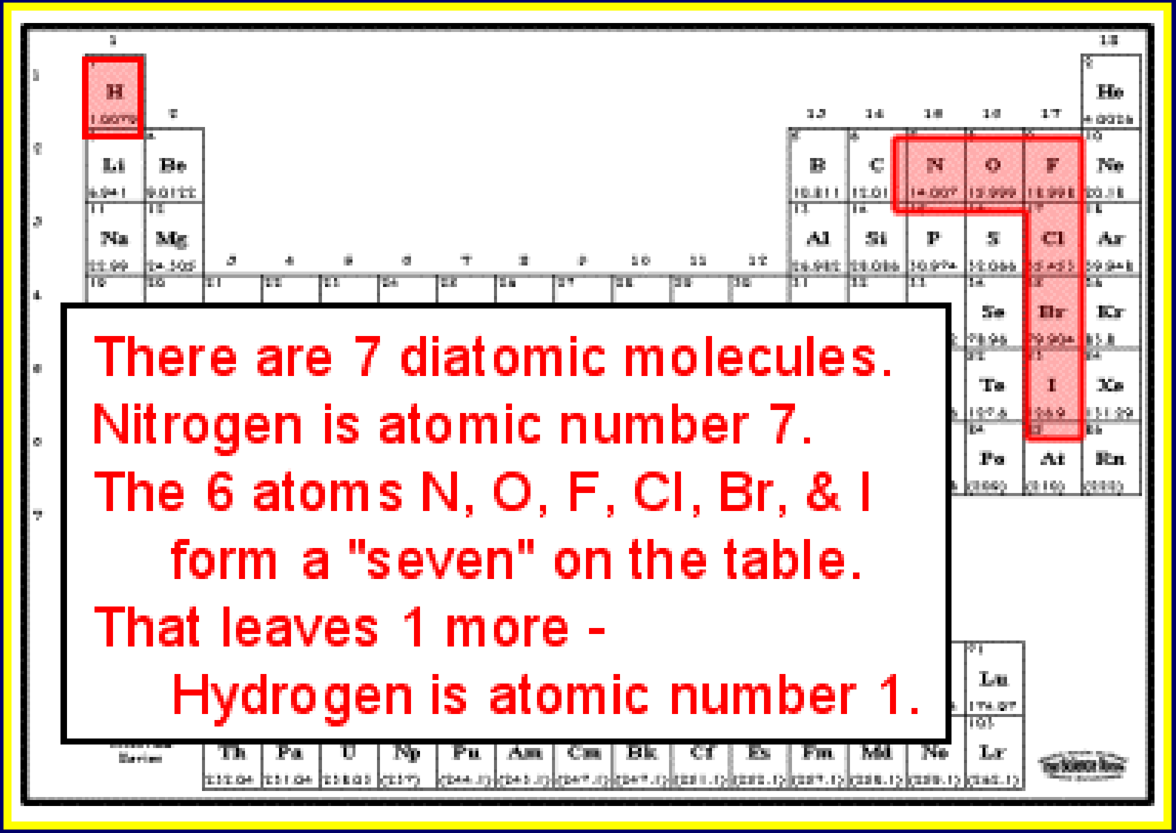
Nitrogen, for example can form 3 covalent bonds with another nitrogen atom.



When an atoms bonds with itself, it's called a diatomic molecule. (di = 2 atomic = atoms)

Diatomic Molecules

There are 7 diatomic molecules: N_2, O_2, F_2, Cl_2, Br_2, I_2 and H_2.



Naming Covalent Molecules

Some pairs of non-metals can form more than one type of molecule.

N_20 NO NO_2 N_2O_5

Nitrogen and oxygen can form 4 different molecules.

If we followed the same naming rules as ionic compounds, they would all be named nitrogen oxide.

Prefixes

When naming covalent molecules, we use Greek prefixes.

1	Mono	6	Hexa
2	Di	7	Hepta
3	Tri	8	Octa
4	Tetra	9	Nona
5	Penta	10	Deca

Naming Covalent Molecules

As a general rule, the mono prefix is never used on the first atom, but is used on the second atom.

CO_2

Carbon Dioxide

CO

Carbon Monoxide

Naming Covalent Molecules

Also, while the first atom's name remains exactly the same, once the prefix is added, the ending of the second atom's name is changed to "ide".

H_2O

Dihydrogen Monoxide

Water

Writing Formulas for Covalent Molecules

Simply use the prefixes to write the subscripts for each atom in the molecular formula and just remember that ones are not written as subscripts.

Dinitrogen Pentoxide

N_2O_5

The End