

Introduction

Building on the fundamentals of covalent bonding, we will be looking deeper into the structures and behaviors of molecular compounds. We will be exploring how covalent bonding is involved in the structure of these molecules and determines how they interact with the world around them.

What shape would you expect the compound Hydrogen Fluoride to have?

- Pyramidal
- Tetrahedral
- Linear
- Bent

Which of the following substances would you not expect to dissolve in water?

- Alcohol
- Oil
- Sugar
- Salt

COVALENT MOLECULES

The way covalent molecules behave is strongly influenced by their structure. A major theme in chemistry overall is that structure greatly impacts properties. This structure/property relationships is why, for example, some liquids have a higher boiling point than others and why certain vitamins are easier to digest than others.

To start out, we will be taking a deeper dive into Lewis Dot Structure and how we can use skill to model the covalent bonding of simple molecular compounds and determine their shapes. Next, we will look at the concept of bond polarity. Finally, we will look at how shape and polarity these molecules gives them the properties we observe in the real world.



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LEWIS DOT STRUCTURE FOR MOLECULAR COMPOUNDS

Lewis dot structure is a helpful tool for determining the bonding properties of a nonmetal based molecular structure. As a quick reminder, molecular compounds form from non-metals and form covalent bonds. Each of these covalent bonds is made of two electrons, and multiple bonds can be formed between a pair of atoms to make what we call double and triple bonds.

Let us consider how to show the Lewis Dot Structure of the molecule water: H_2O .

The first question we must ask ourselves is:

How many unpaired valence electrons do each of these atoms have?



Hydrogen atoms each have
1 unpaired valence electron.



an oxygen atom has
2 unpaired valence electrons.

Week 2 Structure and Properties of Molecular Compounds

Here are the Lewis dot structures of the three atoms in this structure. Since there are only two electrons possible in a single covalent bond, the unpaired electrons are the ones that will be most able to form bonds.



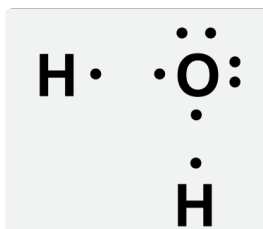
Now let us consider how we would connect these together.

There are a series of quick steps to follow for simple compounds:

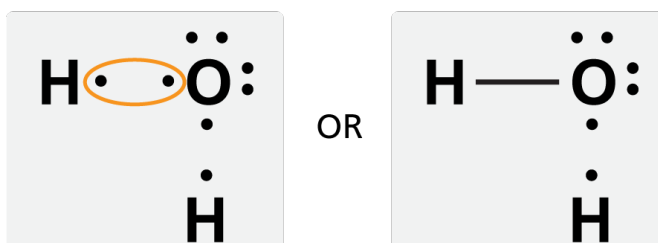
1. Place the atom that can make the most bonds in the middle



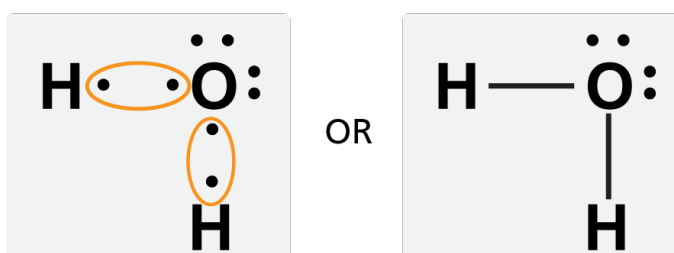
2. Place the other atoms around the center atom, doing the best job possible of lining up unpaired electrons with each other.



3. Pair up the electrons by circling OR draw a line from one to the other to make a bond.



4. Repeat step 3 until all atoms have a full shell (8 for most atoms, 2 for hydrogen).



Complete the sentence by filling in the blanks:

Hydrogen atoms each have **2 unpaired valence electrons** while an oxygen atom has **2 unpaired valence electrons**.