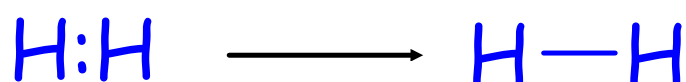


*Recap:* List the 7 elements that exist as diatomic molecules and draw their dot diagrams.

An electron dot structure such as  $\text{H}:\text{H}$  represents the shared pair of electrons of the covalent bond by two dots.

The 'dots' are often replaced by a 'dash'



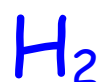
**A structural formula** represents the covalent bonds by dashes and shows the arrangement of covalently bonded atoms.

So....

Structural Formula



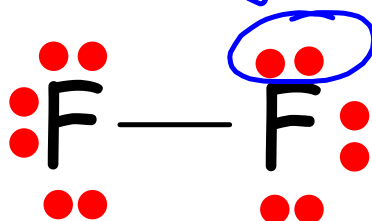
Molecular Formula



The halogens also form single covalent bonds in their diatomic molecules.

Draw 2 dot diagrams for fluorine. What would they look like as a diatomic molecule?

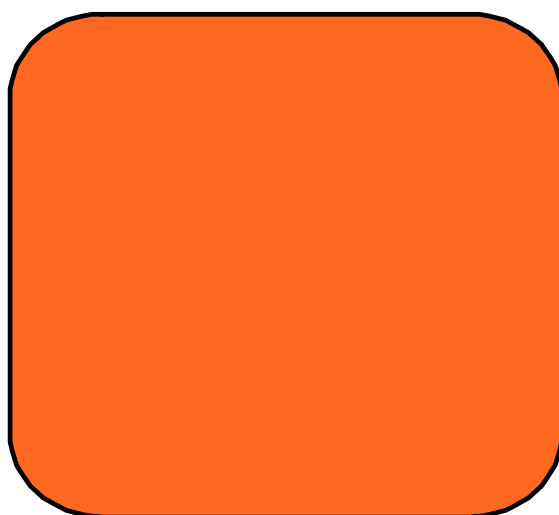
Also notice that there are valence electrons that do not get shared between atoms. These are called **unshared pairs** or **lone pairs**.



You can draw electron dot structures for molecules of compounds the same way.

Example: water

Draw dot diagrams for each of the atoms in a water molecule. How do you think they combine to form a molecule of water?

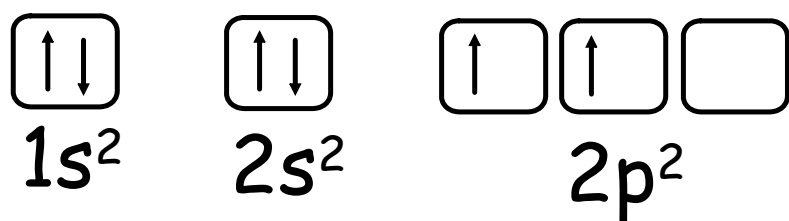


Try to draw the electron dot structure for ammonia ( $\text{NH}_3$ )

Try to draw an electron dot structure for methane ( $\text{CH}_4$ )

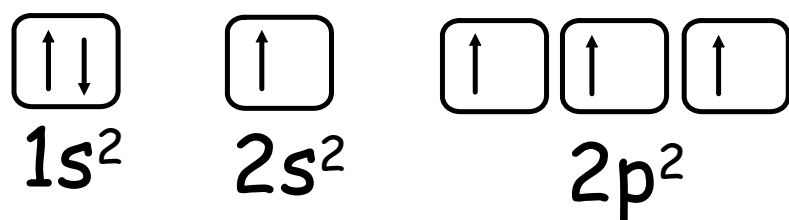


If we were to look at the electron configuration of carbon



How many bonds would you expect it to form with hydrogen?

One of carbon's 2s electrons is promoted to the vacant 2p orbital. This takes a small amount of energy.



The stability of the resulting methane ( $\text{CH}_4$ ) is much more energetically favored than the formation of  $\text{CH}_2$

i) Try questions #7 and 8 on page 220

ii) Draw the dot diagrams for:

HCl, SrCl<sub>2</sub>, GaCl<sub>3</sub>, CCl<sub>4</sub>, SbCl<sub>3</sub>,  
SeCl<sub>2</sub>, and H<sub>2</sub>O

## Double and Triple Covalent Bonds

Sometimes atoms bond sharing more than one pair of electrons.

Atoms form double bonds if they can attain a noble gas structure by sharing 2 pairs or 3 pairs of electrons.

2 shared pairs --> double bond

3 shared pairs --> triple bond

The molecular compound for nitrogen ( $N_2$ ) contains a triple bond. *Draw 2 dot diagrams for nitrogen.*



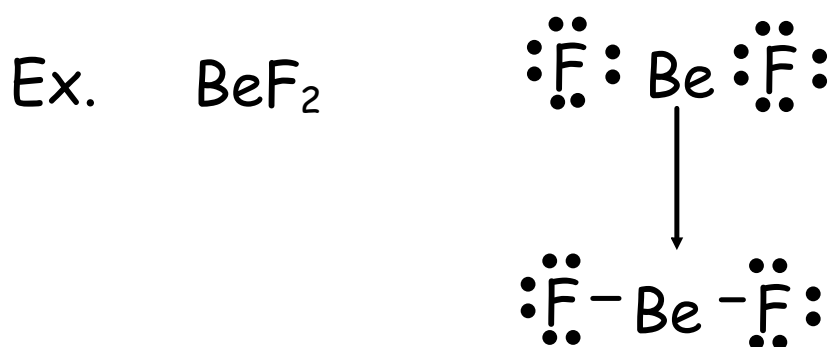
Note: the diatomic molecule for oxygen does not follow the octet rule.

Other single, double, and triple bonds can form between unlike atoms as well.

Draw dot diagrams for the atoms in carbon dioxide ( $\text{CO}_2$ ).  
What kind of bonds do you think they form?

Like everything else, there are exceptions to the octet rule when forming bonds.

Weak molecular bonds can be made using some metals (ie - beryllium, boron, and aluminum). In these cases, these central atoms do not fill their octets.





## The Nature of Covalent Bonding

 <https://www.youtube.com/watch?v=a8LF7JEb0IA>