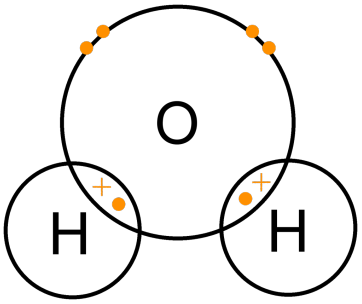
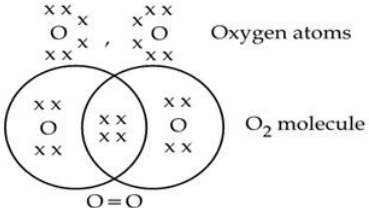
5.3 Covalent Bonding

- Elements are called atoms-no electric charge like an ion
- In covalent bonding, atoms share valence electrons with each other.
- Hydrogen is a nonmetal who needs two valence electrons to be happy. All the other elements want eight valence electrons to be happy.
- Covalent bonding is between nonmetal elements.
- If an atom has a subscript of 1, then you just write the chemical symbol for that element. DO NOT WRITE 1 FOR A SUBSCRIPT EVER!
- Subscripts tell you the ratio of elements in a compound/number of atoms in a molecule
- For example: H_2O The chemical formula for water shows us that there are two hydrogen atoms for every one oxygen atom.



- In the picture above, we see that each hydrogen atom has one valence electron on their own. Each "x" represents the valence electron that the hydrogen atom has. The oxygen atom has six valence electrons. Each "dot" represents the valence electrons for oxygen. Each Hydrogen atom wants two valence electrons to be happy, but they currently have one valence electron each. The oxygen atom has six valence electrons and it wants eight valence electrons to be happy. To make the atoms happy, we must share valence electrons and perform covalent bonding. Notice where the "dot" and "x" valence electrons are together in the same space. A pair of shred valence electrons shows us covalent bonding has taken place. There are two single covalent bonds where valence electrons are shared between the atoms. Oxygen shares one valence electron with each hydrogen atom (two valence electrons in total.) Each hydrogen atom shares their valence electrons with oxygen. Each atom is happy sharing!
- Where electrons are shared between elements is where a bond can be found.
- Double bond-a chemical bond formed when atoms share two pairs of electrons.



- Triple bond-a chemical bond formed when atoms share three pairs of electrons.

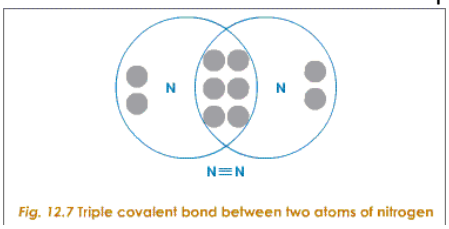
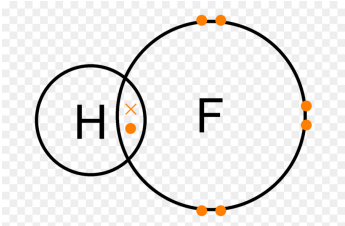
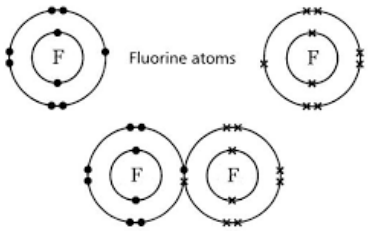


Fig. 12.7 Triple covalent bond between two atoms of nitrogen

- There are two types of covalent bonding: nonpolar and polar.
- Nonpolar bond-a covalent bond in which electrons are shared <u>equally.</u>
- Polar bond-a covalent bond in which electrons are shared <u>unequally.</u>
- When deciding if a covalent bond is nonpolar or polar think about a game of the game tug-of-war with the valence electrons.
- For example, look at the bond between hydrogen and fluorine. The chemical symbol is HF.



- In this valence electron tug-of-war- example, the hydrogen atom is pulling with a weaker pull because it has less valence electrons. The fluorine atom is pulling with a stronger pull because it has more valence electrons. This is an example of unequal sharing, so it is a polar covalent bond.
- Look at two fluorine atoms, which is chemical formula F_2:



A fluorine molecule, F_2

- In this valence electron tug-of-war example, the valence electrons of each atom are pulling with the same amount of pull because they have equal amounts of valence electrons. This is an example of equal sharing, so it is a nonpolar covalent bond.
- Water is an example of polar covalent bonding.
- Molecules that contain two polar bonds are **sometimes** polar.

<u>NOW THAT YOU'VE READ THIS DOCUMENT, PLEASE WATCH THE SCIENCE 5.3 VIDEO</u>