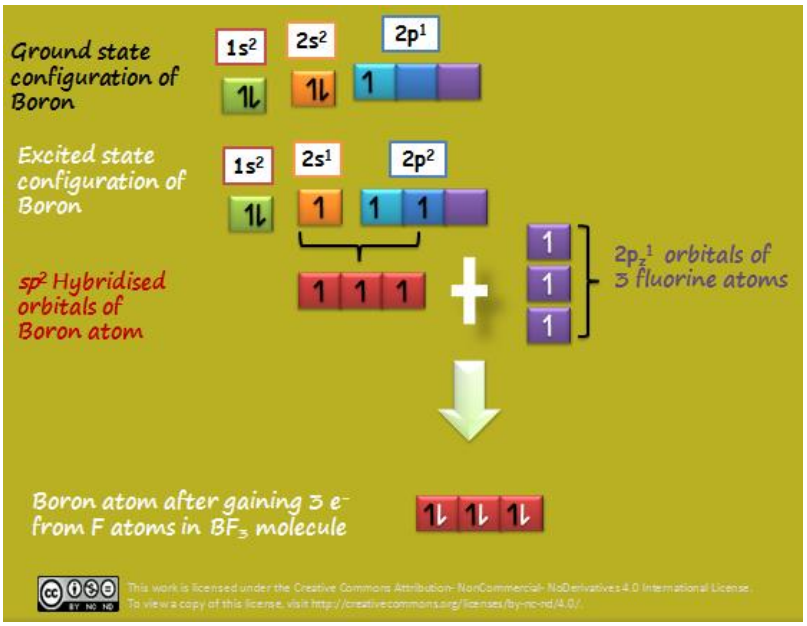
SP2 AND SP HYBRIDIZATION

Today we will discuss the formation of Boron trifluoride BF_3 molecule. Let's write the ground state configuration of central atom B and F.

$^{5}B - 1s^2, 2s^2, 2p^1$

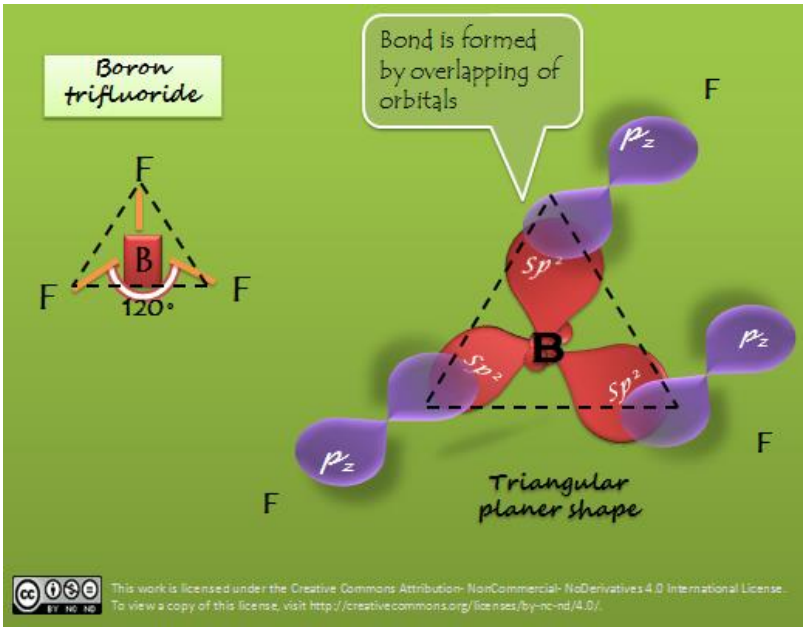
$^{9}F - 1s^2, 2s^2, 2p^5$



B needs 3 unpaired electrons or you can say it needs 3 hybridised orbitals to make bonds with 3 atoms of F. That's why B supplies some energy to *2s* to lifts it to the level of *2p*. In this way one of the paired electron of *2s*jumps to the vacant orbital of *2p*. Now this excited state has the following configuration:

$^{5}B - 1s^2, 2s^1, 2p^2$

Now B chooses one *2s* orbital and two of the *2p* orbital and hybridises them to get three hybridised sp^2 orbitals. These three hybridised sp^2 orbitals get arranged in a triangular shape (fan shaped). Now F atoms come closer to B so that their $2p_z$ orbitals get overlapped with these hybridised sp^2 orbitals and make bonds. Thus BF_3molecule is formed by bonding between three sp^2 orbitals of B and *p* of 3 F atoms.



Let's take another example of Beryllium difluoride BeF_2molecule. Here you might raise a question about the nature of BeF_2 molecule. You might have debated that it is an ionic compound because Be belongs to the 2^{nd} group and F belongs to the 17^{th} group and they have a large electronegativity difference. I have told you in one of my previous posts that a bond will be purely covalent only if the electronegativity difference between bonded atoms is less than 1.7, but in BeF_2 it is 2.5 which is much greater and still BeF_2 molecule is a pure covalent compound. It is one of the few exceptions but has an explanation. I will discuss it in detail in the coming post.

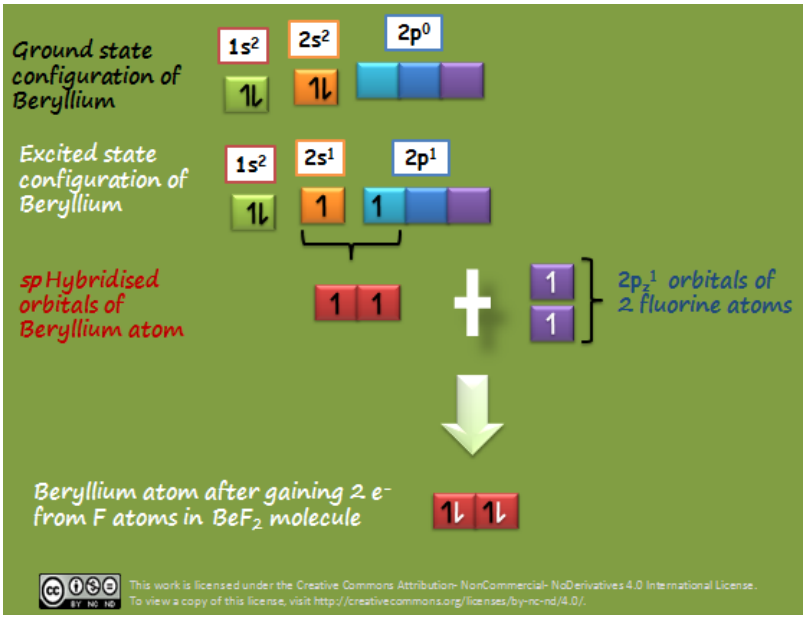
Write the ground state configuration of Be and F:

$^{2}Be - 1s^{2}, 2s^{2}$

$^{9}F - 1s^{2}, 2s^{2}, 2p^{5}$

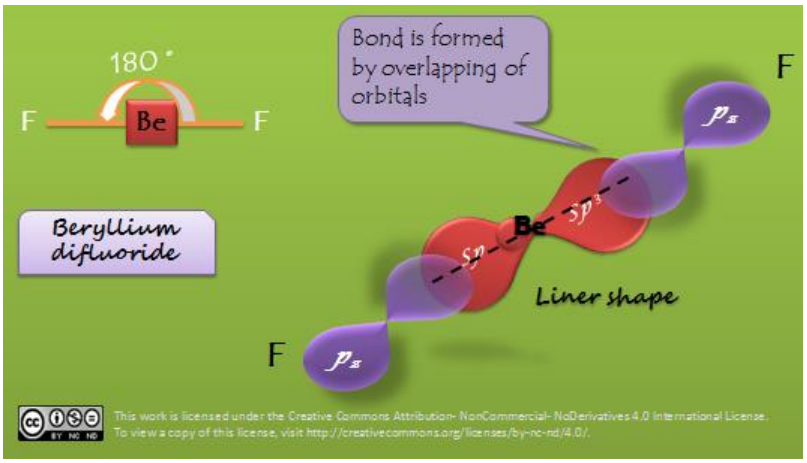
Be has 2 paired electrons but it needs 2 unpaired electrons to combine with unpaired electrons of two atoms of F. Outer orbit of Be has two orbitals *s* and *p* so it promotes its one electron to the *p* orbital. Now it's excited state configuration will be

$^{2}Be - 1s^{2}, 2s^{1}, 2p^{1}$



With the promotion of electron, *2s* orbital also gets promoted to the level of *2p* orbital. Now Be picks one *s* and one *p* orbital and hybridises them to get two *sp* hybridised orbitals. These two *sp* hybridised orbitals get arranged in a linear shape.

Now two F atoms come closer to Be atom and *sp* hybridised orbitals of Be and *p* orbital of F get overlapped with each other and make bonds. Thus BeF_2 molecule is formed by bonding between *sp-p*.



Up to now we have discussed those molecules which have single covalent bonds. In previous post of covalent compounds we have seen two more type of covalent bonds double bond and triple bond. How are these bonds formed? You know these bonds are formed by sharing of 4 and 6 valence electrons respectively. What is the role of orbitals in their formation? We will see the sights of orbitals in the formation of double and triple bond in the next post.

Source : http://chemistrynotmystery.blogspot.in/2014/08/sp2-and-sp-hybridization.html