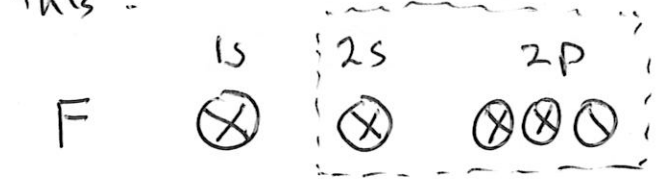
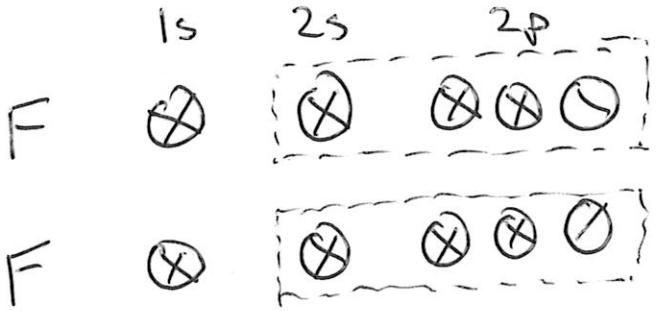
Orbital Diagrams

The orbital diagram for the atom Fluorine looks like this!



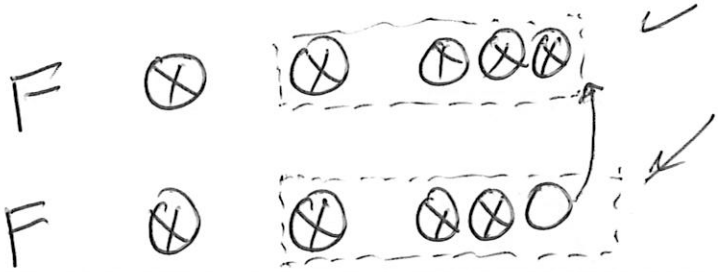
← the valence shell contains 7 electrons. One p orbital is half-filled. Fluorine is <u>reactive</u> because it wants to fill this orbital!

What would the orbital diagram for the molecule F_2 look like?



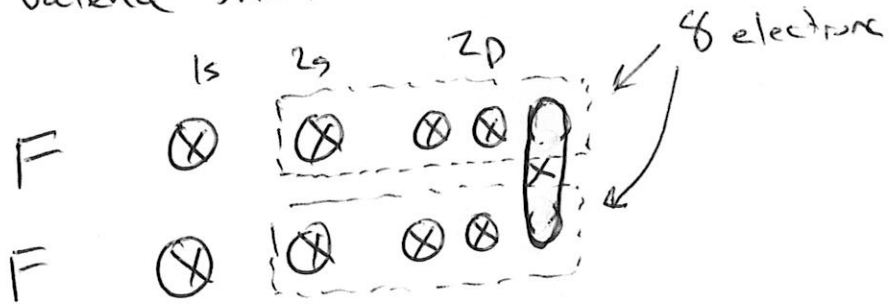
Each atom of F would like to pick up one electron to complete its valence shell

If one F were to steal the other F's single electron we would see



- no bond is formed
- both atoms have the same electronegativity so one electron cannot leave one atom and go to another.

Now if the half-filled p orbitals were to overlap and become one orbital that is shared between the two F's each atom would now count 8 electrons in it's valence shell.



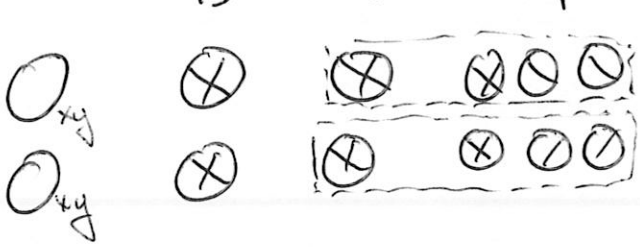
By sharing the electrons in the half-filled orbitals each Fluorine atom counts 8 electrons in its valence shell → STABLE!!

Stick diagram of F_2

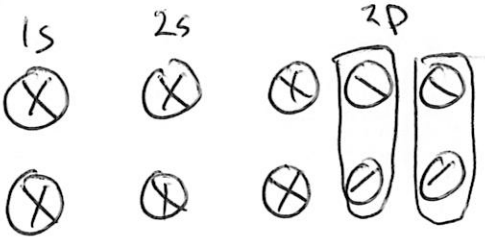
F – F

↑ the stick represents the overlapping orbitals (bond) with 2 electrons equally shared

O_2



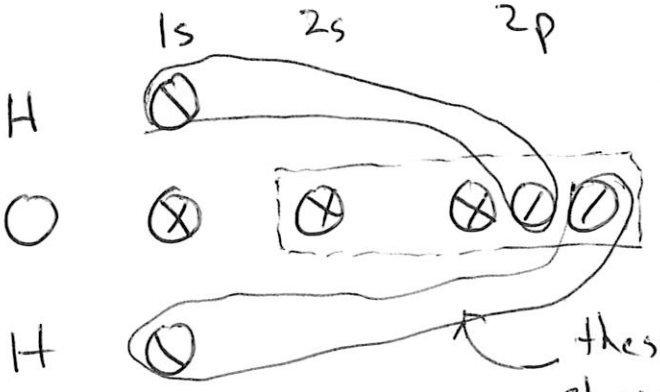
Overlapping half-filled orbitals gives



O=O

↑ a double bond

H_2O



these electrons are not equally shared. Oxygen has a larger electronegativity.

Because there are no 1p orbitals, hydrogen fills it's valence shell with just 2 electrons

Oxygen counts 8 electrons. all three atoms have a full outer shell. Stable!

Draw Orbital diagrams for the following molecules

1. HF

2. N_2

3. NH_3

4. Why do you think OH is so <u>reactive</u>. Which compound is more stable; the OH^- ion or OH? Why?