Chem 111

Lecture 26

Announcement

- Recitation session, Wednesday 11/17 at HASA 126 (5-6pm)
- The Exam, data

Homework

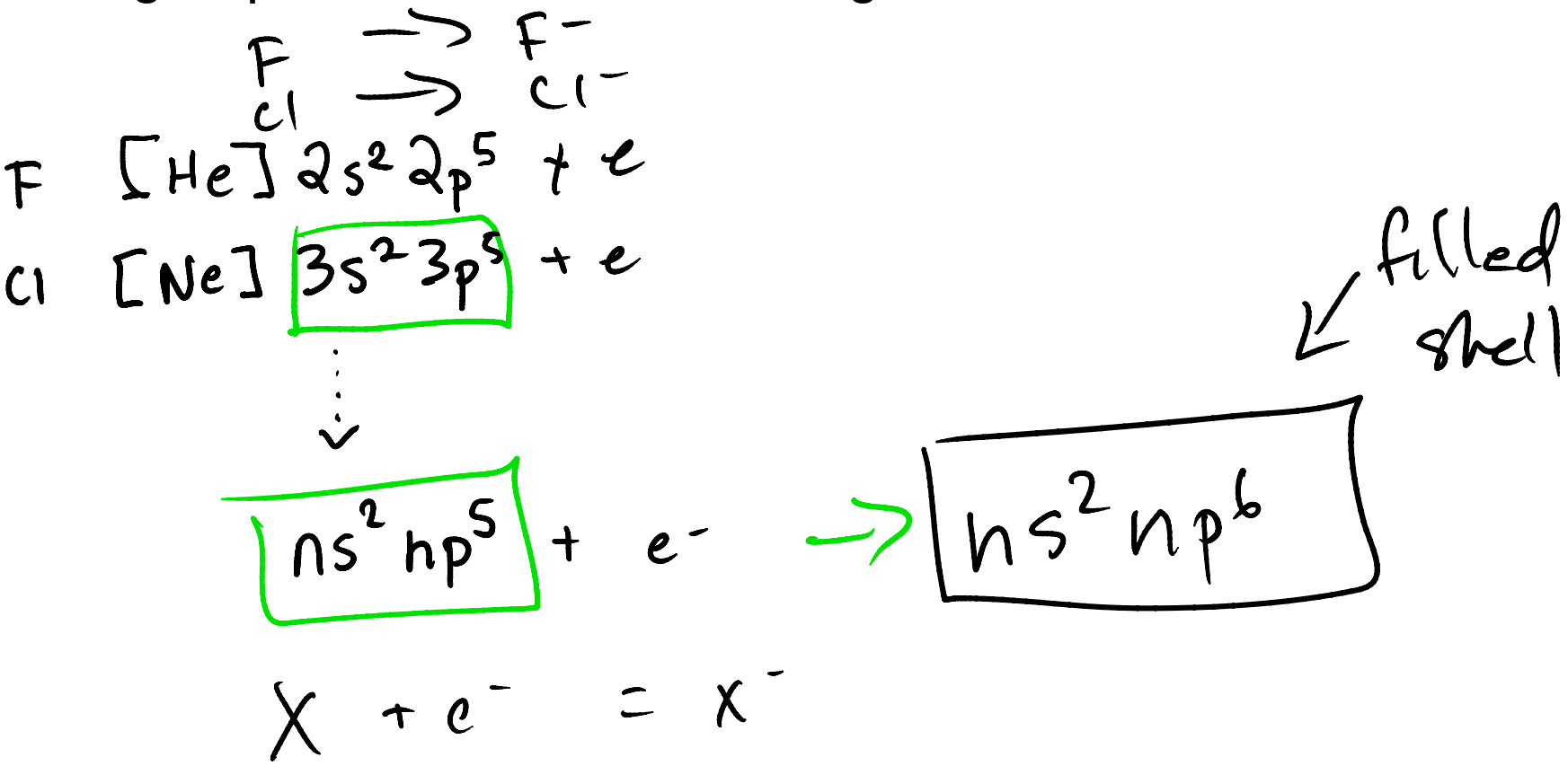
- Finish Reading Chapter 7
- Owl Homework

Recap

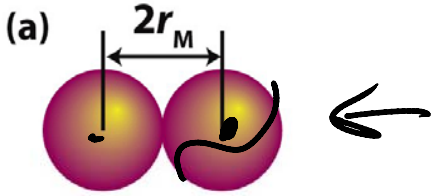
- Magnetism
- Valence Electrons vs Core Electrons
- D-block
- Periodic Table

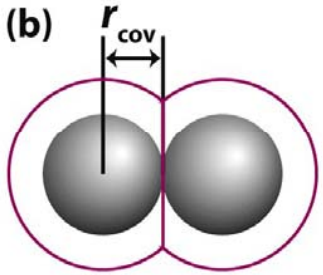
Let's Practice

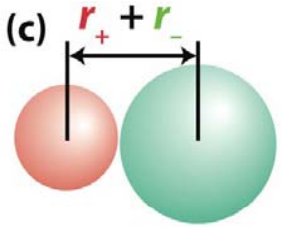
What is the characteristic outer shell electron configuration of the group 7A elements, the halogens?

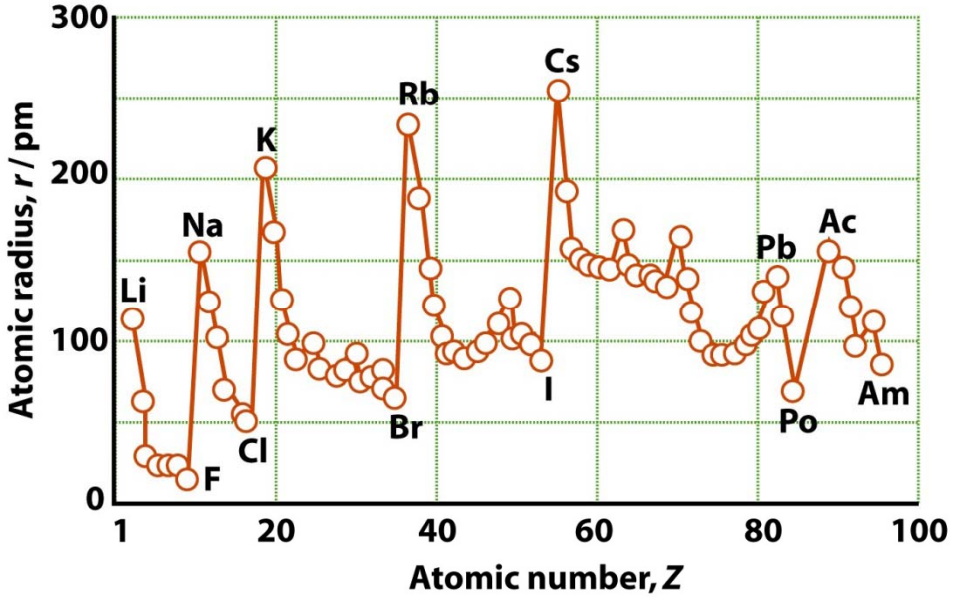


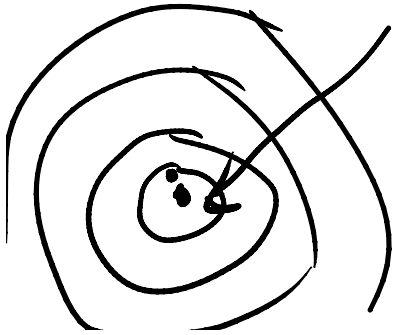
Atomic Radii











Ionization energy

- Ease in which an electron can be removed
- $A(g) \rightarrow A^+(g) + e^-(g)$

$Na(g) \rightarrow Na^+(g) + e^-(g)$

- $I = E(A^+) - E(A)$
- First Ionization Energy, I_1
- Second Ionization, I_2

$Na^+(g) \rightarrow Na^{2+}(g) + e^-(g)$

$I_1 < I_2 < I_3$

$20p \leftrightarrow 20e^-$

$20p \leftrightarrow 19e^-$

Electron Configuration of Ions

highest n e⁻

- Sodium

Na: $[1s^2 2s^2 2p^6 3s^1]$ → Na^+: $[1s^2 2s^2 2p^6]$ + e^-

- Germanium

highest l e⁻

Ge: $[Ar]3d^{10}4s^2 4p^2$ → Ge^{2+}:$[Ar]3d^{10}4s^2$ + $2e^-$

$[Ar]\,4s^2 3d^{10} 4p^2$

filling ≠ taking

- Iron

Fe: $[Ar]3d^6 4s^2$ → Fe^{2+}:$[Ar]3d^6$ + $2e^-$

Fe: $[Ar]3d^6 4s^2$ → Fe^{3+}:$[Ar]3d^5$ + $3e^-$

Ionization energy

noble gas config.

$ns^1 \rightarrow ns^0 + e^-$

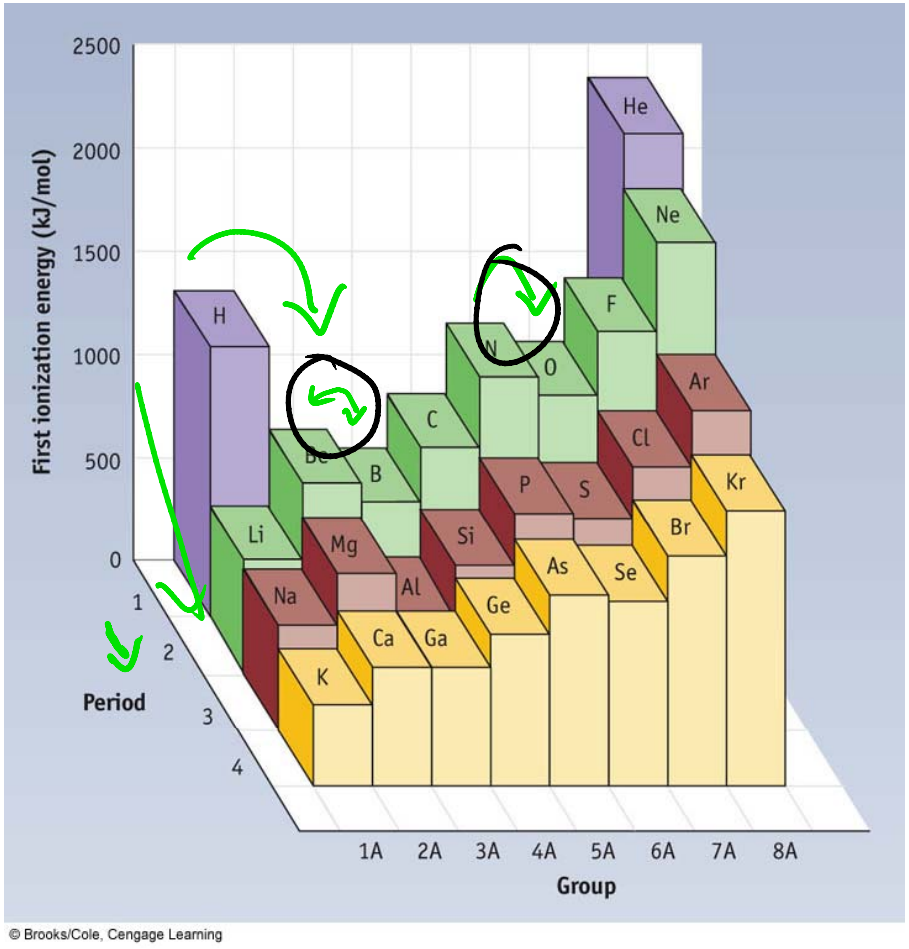
B or 3A

$ns^2np^1 \rightarrow ns^2 + e^-$

ns^2np^4

1L 1↓ 1 1

1L 1 1 1



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full subshells

half filled subshells

Electron affinity

- Ease in which an electron can be added
- $A(g) + e^-(g) \rightarrow A^-(g)$

$Cl(g) + e^-(g) \rightarrow Cl^-(g)$

- $E_a = E(A^-) - E(A)$
- The more negative E_a the easier it is to put an electron on to the atom.

Electron affinity

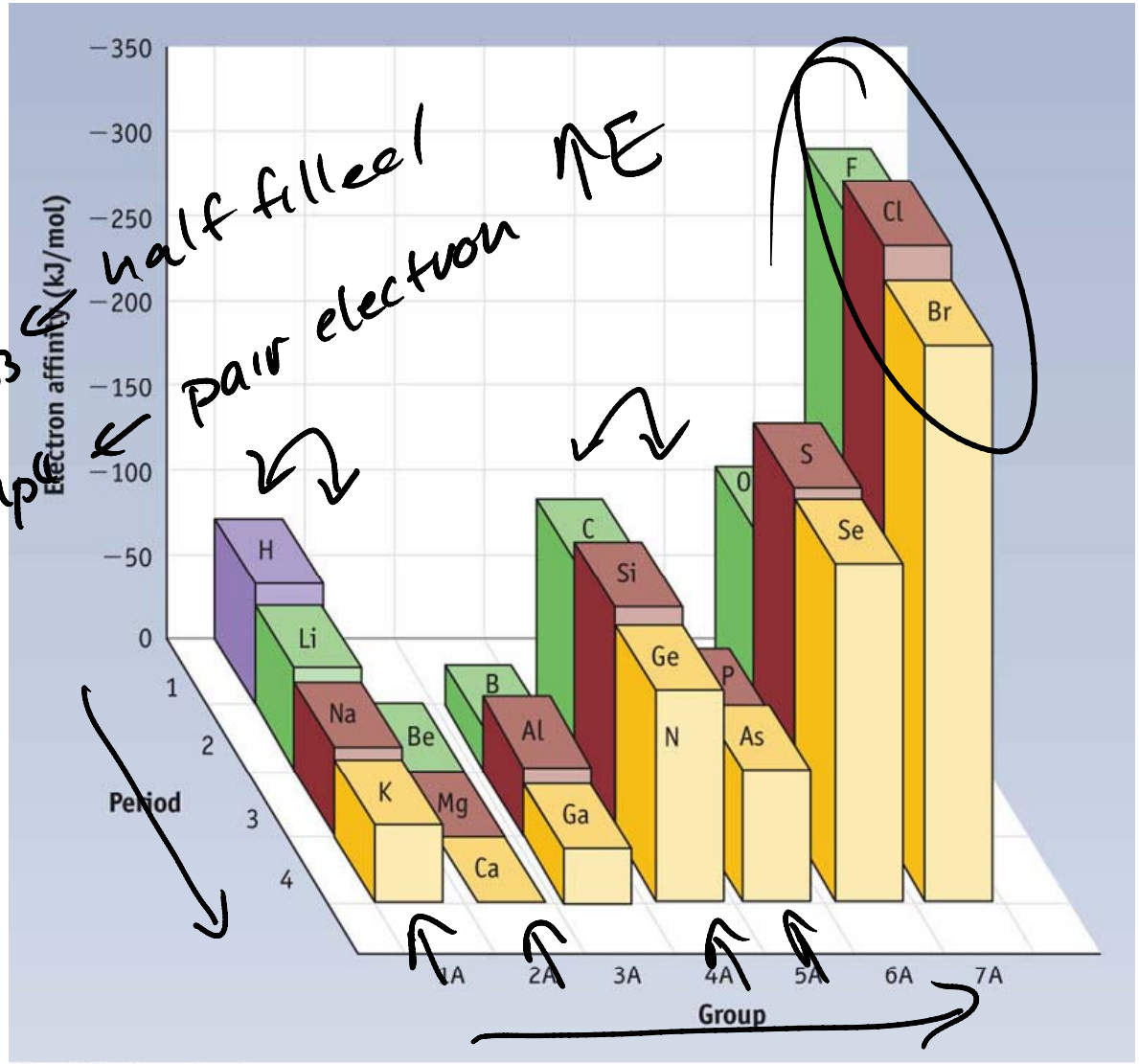
$ns^1 + e^- \rightarrow ns^2$

$ns^2 + e^- \rightarrow ns^2np^1$

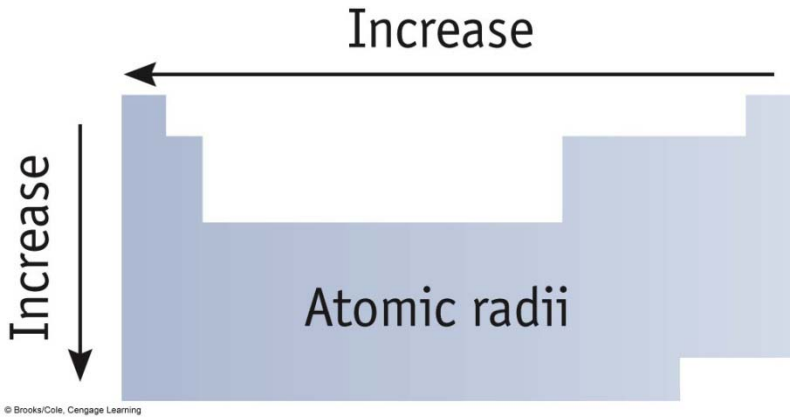
$\rightarrow$

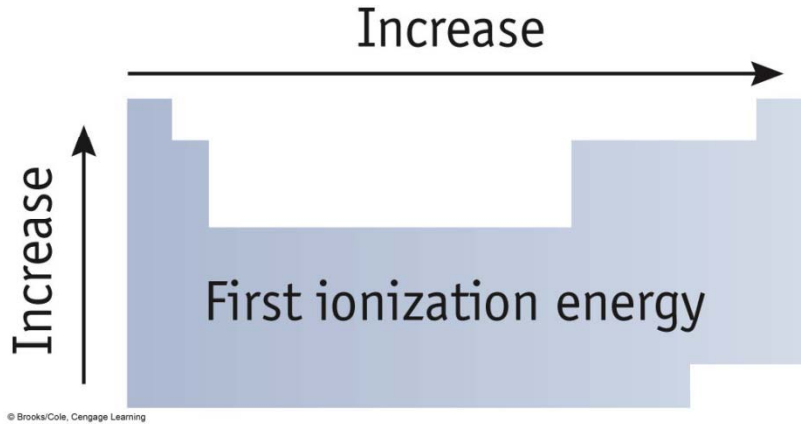
$ns^2np^2 + e^- \rightarrow ns^2np^3$

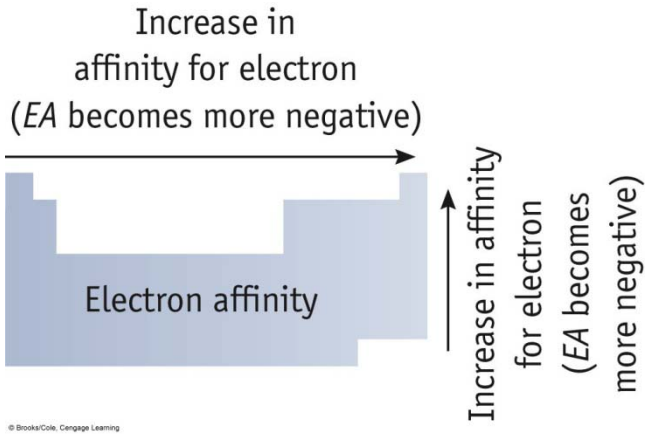
$ns^2np^3 + e^- \rightarrow ns^2np^4$



Summary of Trends







Trends in Ions Sizes

If an atom loses electrons, the resulting cation will be smaller in size than the parent atom.

If an atom gains electrons, the resulting anion will be larger in size than the parent atom.

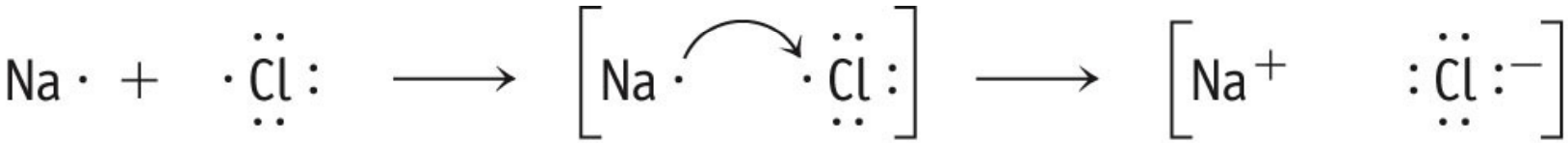
Let's Practice

Which will be closer to the nucleus, the n= 3 electron shell in Ar or the n=3 shell in Kr?

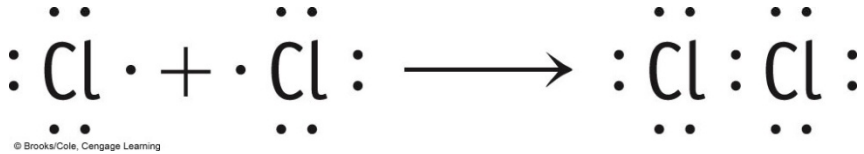
Arrange the following atoms in order of increasing first ionization energy: Ne, Na, P, Ar, K.

Bonding

Ionic Bonds – refers to electrostatic forces that exist between ions of opposite charge.

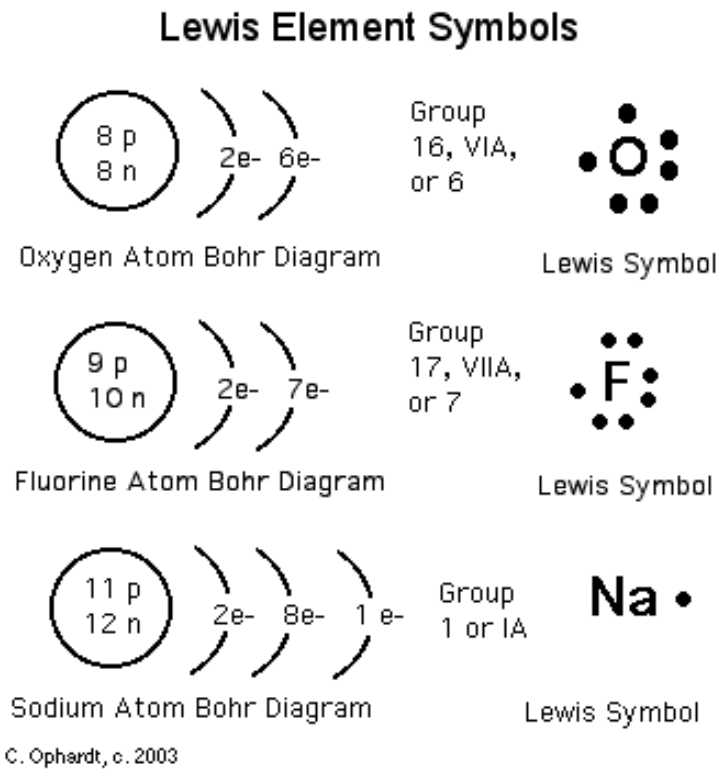


Covalent Bonds – results from the sharing of electrons between two or more atoms.



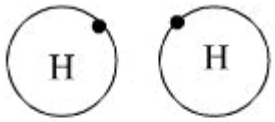
The electron involved in bonding are the valance electrons.

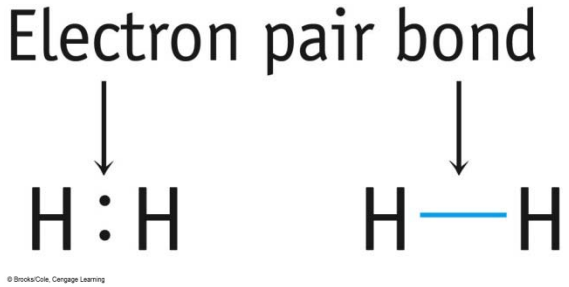
Lewis Structure

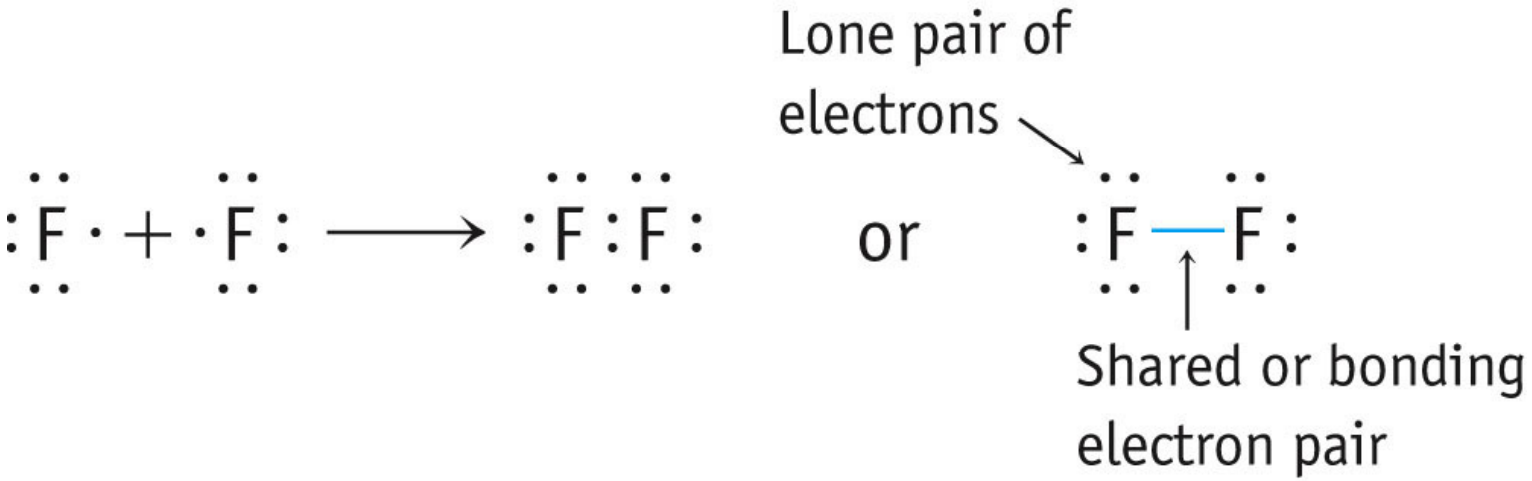


Covalent Bond

Non metals (hydrogen & P-Block)







Octet

Each atom wants to fill its valence electron shell (have a noble gas configuration). Lewis structures will want (mostly) want an octet (8) electrons around an atom.