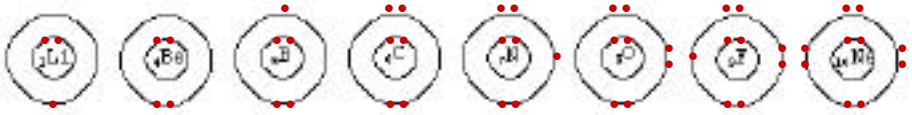
# Achieving Noble Gas Electron Configuration & Bonding

- In this powerpoint, electron shell filling will be reviewed.
- Recognize the appearance of Bohr's Model after an atom lose or gains electrons, or how it bonds to hydrogen.
- Atoms lose electrons (OIL, oxidation) or gain electrons (RIG, reduction) to achieve noble gas electron configuration

A. Valence electrons - Valence (outermost) electrons are in the principle energy shell furthest from the nucleus (the highest energy shell).

a. Draw Bohr electron dot structures for the elements of period (row) 2.



b. Draw Lewis electron dot structures for the elements of period (row) 2.


Group 1 Group 2 Group 3 Group 4 Group 5 Group 6 Group 7 Group 8

the group number equals the number of valence electrons for representative elements

# Formation of Ions from Elements

Cation, $X^+$ , Formation Oxidation (OIL) oxidation is loss of electrons

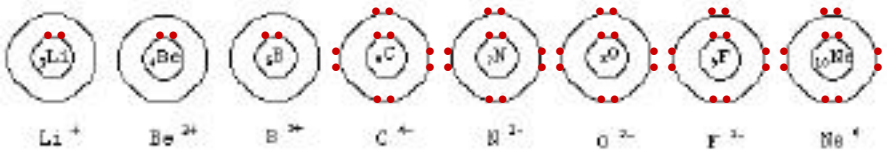
Anion, $X^-$ , Formation Reduction (RIG) reduction is gain of electrons

This is a html hyperlink to a web QuickTime movie tutorial.
If QuickTime movie player is not installed on your computer
the link will not work.

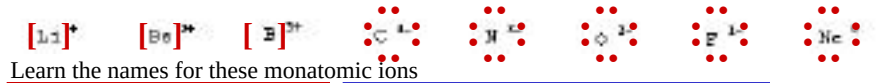
http://www.sdmesa.sdccd.net/~dgergens/chem100/lewis_dot/_atomic_e_dot.html

B. General Chemical Reactivity - The reactivity of an element is related to the tendency to lose or gain electrons; that is to be oxidized (OIL) or reduced (RIG). The chemistry of metals and nonmetals are important to chemists. Metals tend to lose electrons to form positively charged cations, while nonmetals tend to gain electrons to from negatively charged anions.

a. Draw Bohr electron dot structures for the ions of period (row) 2.




b. Draw Lewis electron dot structures for the ions of period (row) 2.




Learn the names for these monatomic ions

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| lithium ion | beryllium ion | boron ion | carbide ion | nitride ion | oxide ion | fluoride ion | neon gas |

These ions are isoelectronic with helium

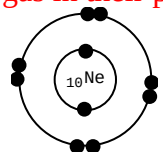
These ions are isoelectronic with neon

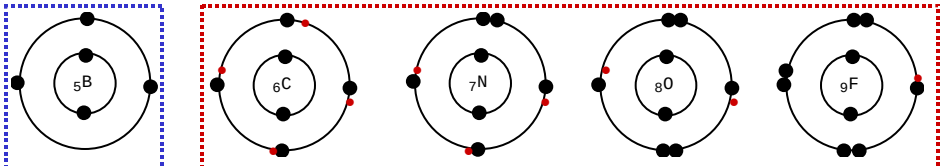
# Achieving Noble Gas Electron Configuration

- Atoms lose electrons (OIL, oxidation) or gain electrons (RIG, reduction) to achieve noble gas electron configuration
- Recognize the appearance of Bohr's Model after an atom loses or gains electrons to form ions, or how it shares electron when it covalently bonds to hydrogen.

Draw the following into your notes opposite page 64

**nonmetals** gain electrons to achieve noble gas e- configuration of the noble gas in their period (row)




semimetal

C $^{4-}$ carbide ion

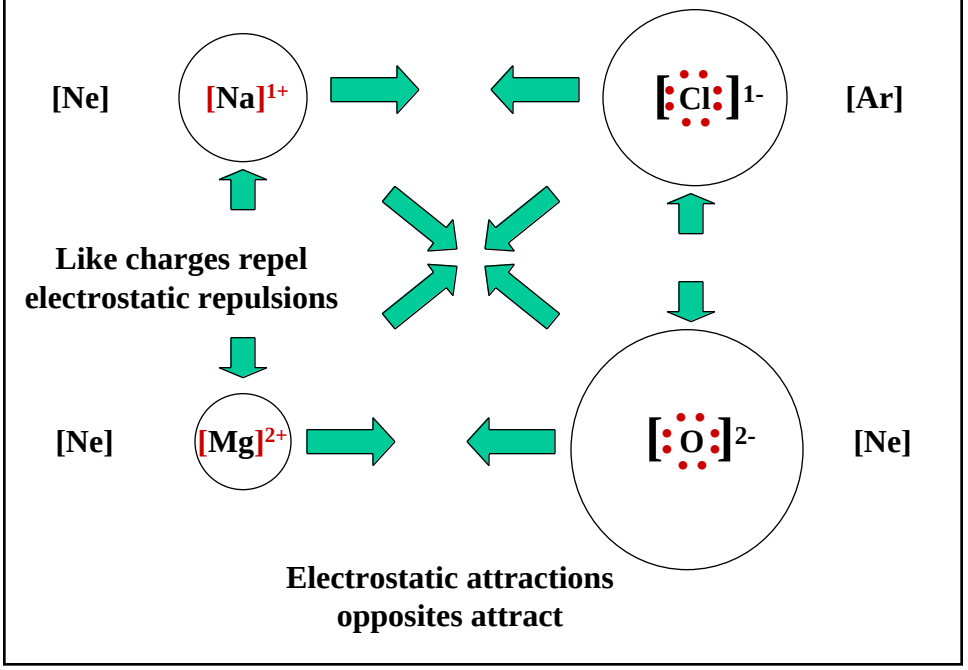
N $^{3-}$ nitride ion

O $^{2-}$ oxide ion

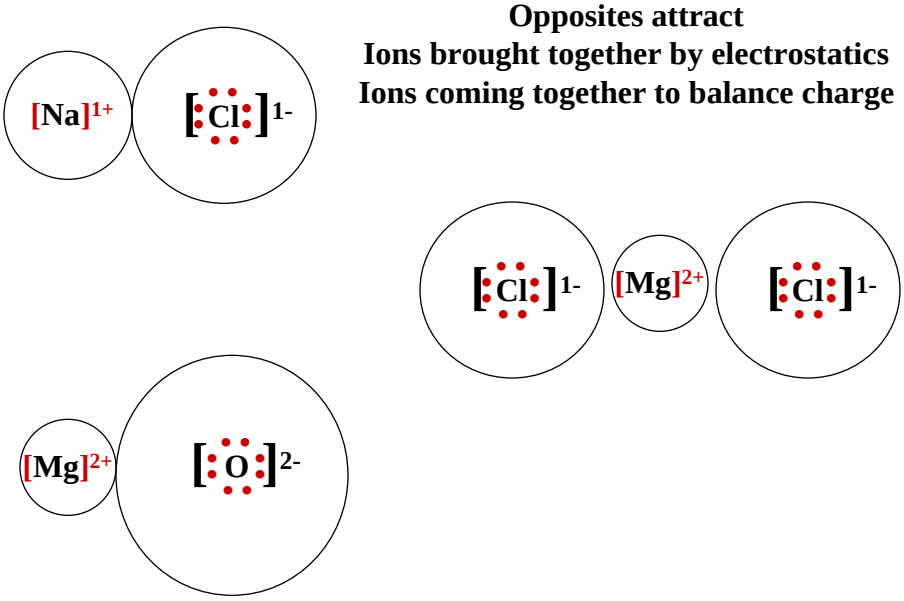
F $^{-}$ fluoride ion

nonmetals ions

**Ions isoelectronic ("same electronic configuration") with noble gases**



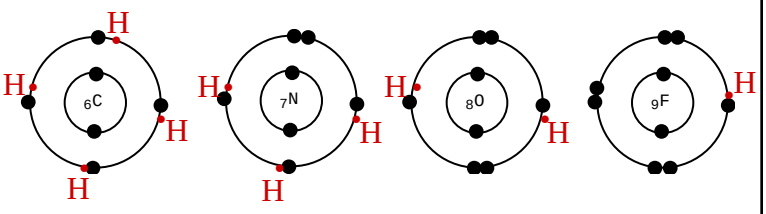

**Ionic Bonding**
**Opposites attract**
**Ions brought together by electrostatics**
**Ions coming together to balance charge**



**nonmetals** bond to hydrogen to achieve noble gas e- configuration of the noble gas in their period (row)


Addition of hydrogen

Achieving an OCTET valence



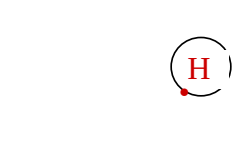

$CH_4$ methane gas

$NH_3$ ammonia gas

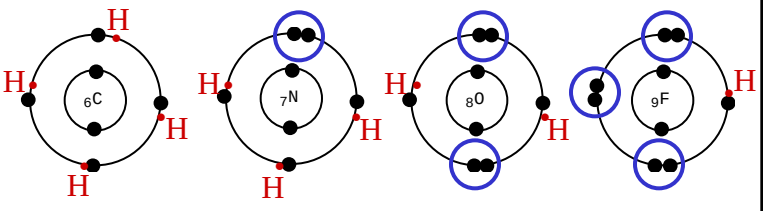
$H_2O$ water

HF hydrogen fluoride

molecules of nonmetals hydrides




Achieving an OCTET valence (eight electrons in the outer most atom shell)




$CH_4$ methane gas

$NH_3$ ammonia gas

$H_2O$ water

HF hydrogen fluoride

molecules of nonmetals hydrides

Circle nonbonding pairs of electrons

[Na]$^{1+}$ [:Cl:]$^{1-}$

## Ionic substances

Supplemental packet page 64

Ionic compounds are held together by strong electrical forces between oppositely charged ions (e.g., $Na^+$, $Cl^-$). These forces are referred to as **ionic bonds**. Typically, ionic compounds (**ionic salts**) have relative high melting points (mp NaCl = 801 °C).and exist physically as solids at room temperature. It takes a lot of energy to break an ionic bond. Can you give additional examples of ionic compounds?

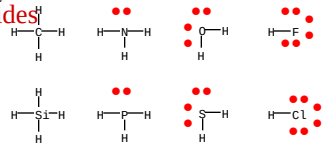
Molecular compounds. Two or more atoms may combine with one another to form an uncharged molecule. The atoms involved are unusually those of nonmetallic elements. Within the molecule, atoms are held to one another by strong forces called **covalent bonds**.

diatomic molecules - there are **seven diatomic molecules** that behave as discrete units. The physical states for these molecules at room temperature are variable.

N≡N gas  O=O gas  H—H gas  F—F gas  Cl—Cl gas  Br—Br liquid  I—I solid

molecules with multiple bonding patterns

molecules of nonmetals hydrides



Summary

What is the favorite charge of these elements as ions? Indicate charge. Is there a relationship between the type of element that likes to have positive charge? a negative charge?

| | Li | Be | B | C | N | O | F |
|---|---|---|---|---|---|---|---|
| ion charge: | 1+ | 2+ | 3+ | 4- | 3- | 2- | 1- |

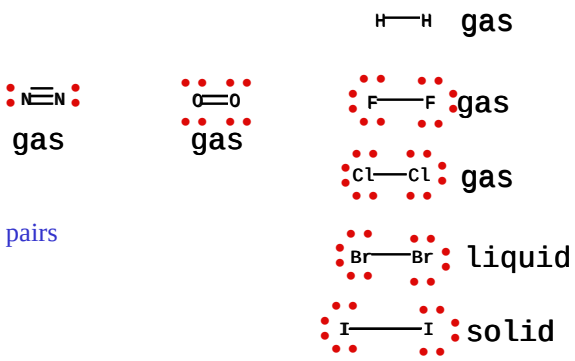
How many atoms will each element bond to in order to be stable? Indicate the number of bonds that each element will make.

| | Li | Be | B | C | N | O | F |
|---|---|---|---|---|---|---|---|
| number of bonds: | 1 | 2 | 3 | 4 | 3 | 2 | 1 |

Is there a relationship between ion charge and the number of bonds an element will make? If so, describe the relationship.

Supplemental packet page 64

To these molecules,
Add missing
nonbonding electron pairs



# Favorite covalent bonding modes for nonmetals C, N,O, halogen, H

| | C | N | O | F | H |
|---|---|---|---|---|---|
| •Know the preferred total number of covalent bonds to these elements | 4 | 3 | 2 | 1 | 1 |
| •**N O ,** nitrogen and oxygen may vary their total number of covalent bonds | | (2) | (1) | | |
| | | (4) | (3) | | |

Supplemental packet page 68

**VSEPR =** valence shell electron pair repulsion

Determine the angles between bonds, name the geometry about the central atom and give the its hybridization.

Ideal bonding for carbon = four bonds to carbon = four bonding modes

**Ideal Geometries**

| | | | | |
|---|---|---|---|---|
| bond angles | 109.5° 109.5° 109.5° | 120° 120° 120° | 180° | 180° |
| geometric name | tetrahedral | trigonal planar | linear | linear |

What are the ideal bonding angles for carbon's four bonding modes?

**Non-Ideal Geometries**

| | | | |
|---|---|---|---|
| bond angles | 107.5° | θ<120° | |
| geometric name | pyramidal or trigonal pyramid | bent | |

Bond angles for these non-ideal geometries are slightly smaller than an ideal angles because a nonbonded electron pair

1) occupies a lot of space and
2) is held close to nucleus of the central atom

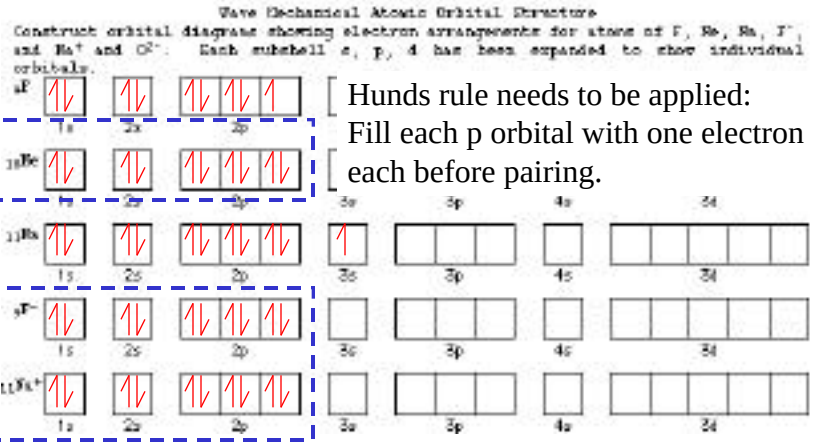
| | | |
|---|---|---|
| bond angles | 104.5° | |
| geometric name | bent | |

# Structure and Bonding

Go to the powerpoint
Rules for Drawing Lewis Dot Structures

Supplemental packet page 53

# Electron Orbital Filling revisited




Hunds rule needs to be applied: Fill each p orbital with one electron each before pairing.

$F^-$ and $Na^+$ are **isoelectronic** (the same electronically) with Ne

All elements lose or gain electrons to achieve noble gas e- configuration