Lewis electron-dot structures: show valence electrons as dots

Mg

Cl

Ionic bonding: attraction between oppositely-charged ions

Molecule: atoms bonded in a group
contain…

an H_2 molecule contains two H atoms **covalently** bonded:

Covalent bond: pair of **shared** valence electrons

H_2

CH_4

- Noble gases have __ valence electrons
- Stable main-group ions have __ valence electrons
- Covalently bonded atoms have access to __ valence electrons

Octet rule: atoms want to have __ valence electrons to be stable

Lewis electron-dot structures of molecules

H C N O F

valence e^-:

covalent bonds:

A proper Lewis structure for a molecule:

- shows <u>all</u> valence electrons
  - covalent bonds = lines
  - unshared electrons = dots
- has full octets or duets
- has the correct number of bonds on each atom

NH_3: total # valence e^- in molecule:

CH_2O: total # valence e^- in molecule:

Lewis structures of polyatomic ions

<u>Polyatomic ion</u>: charged molecule

NH_4^+ (ammonium ion): tot # ve^- =

<u>check:</u>
correct tot. #ve^-?
full octets/duets?

Polyatomic ions do not follow the rules for the normal number of covalent bonds to atoms (this is one reason they are charged!)

NO_3^-

ClO_3^-

Ionic

Na^+ / Cl^-

metal/nonmetal

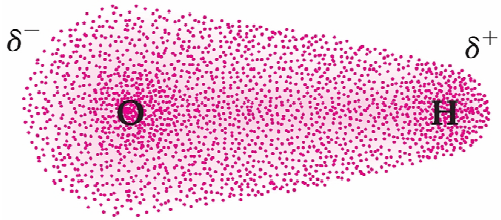
from transfer of valence e^-

Covalent

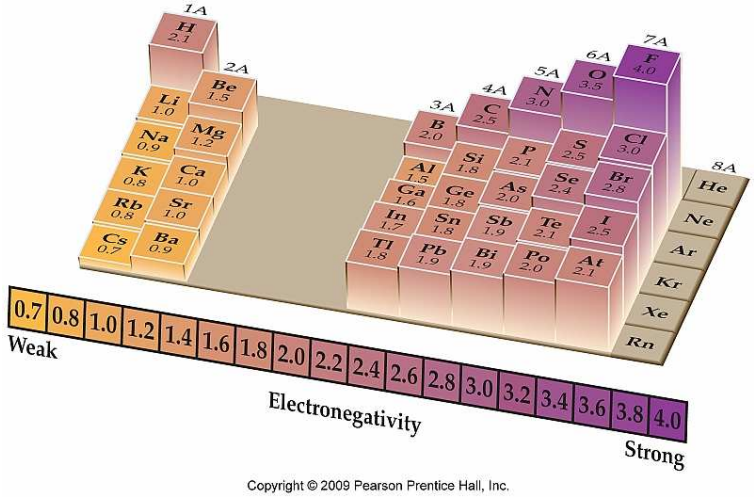
Cl—Cl

Electronegativity: tendency of an atom to claim more shared electron density

Oxygen is more electronegative than hydrogen:



Fluorine is the most electronegative element:



Polar covalent bonds

An HCl molecule:

δ = Greek lowercase delta, means "partial"

dipole arrow: 

NH_3

CH_4

Polarity of molecules

HCl is a **polar** molecule because it can be separated into δ+ and δ- sides:

Net dipole moment: one dipole arrow that represents the polarity of the entire molecule. It points from the δ+ side to the δ- side.

A **nonpolar** molecule:

- cannot be separated into δ+ and δ- halves
- may have polar bonds that completely cancel each other
- has no net dipole moment

Is CH_3Cl polar or nonpolar?

Is CO_2 polar or nonpolar? (draw it with the correct shape)

Linear shape: 2 atoms attached to the central atom, **no** lone pairs on the central atom

Bent shape: 2 atoms attached to the central atom, lone pairs on the central atom

Trigonal planar shape: 3 atoms on central atom, no lone pairs on central atom

Trigonal pyramidal shape: 3 atoms on central atom, lone pairs on central atom

Tetrahedral shape: 4 atoms attached to central atom

Is H_2O polar or nonpolar?

Is CH_2Cl_2 polar or nonpolar?

Is CF_4 polar or nonpolar?

Is NH_3 polar or nonpolar?

Is FCN polar or nonpolar?

Shapes and polarity

	If all bonds have equal polarity:	If bonds have unequal polarities:
Linear		
Bent		
Trigonal planar		
Trigonal pyramidal		
Tetrahedral		