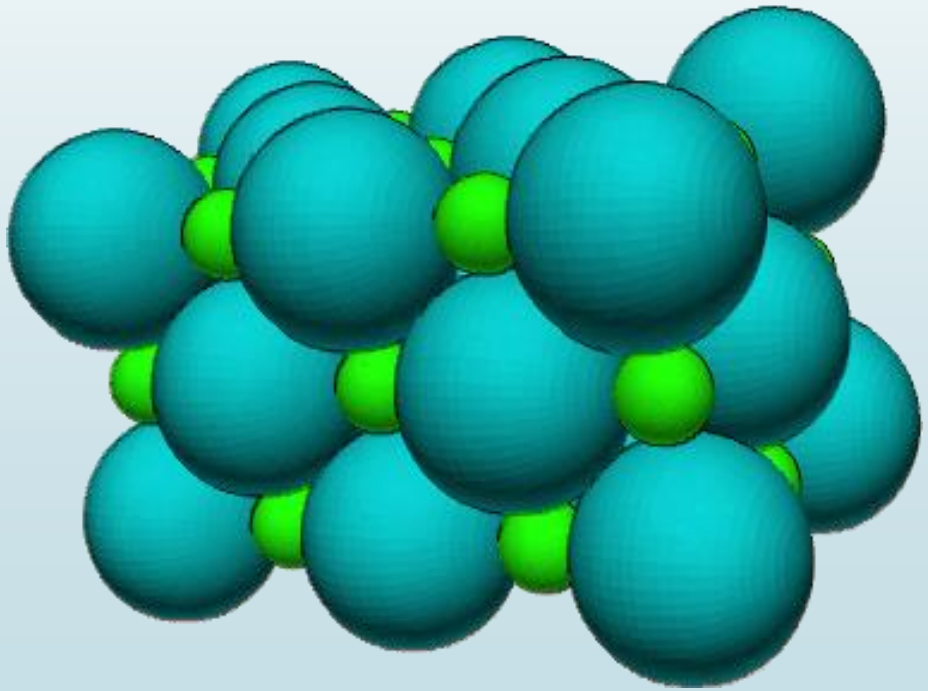
Classifying Chemical Compounds

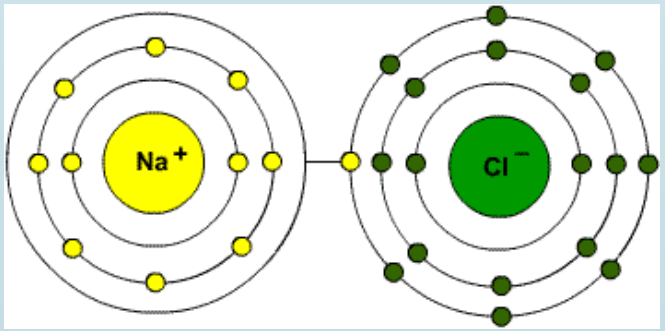


Types of Compounds

- Elements combine in many different ways to form compounds
- Based on physical properties, compounds can be classified into:

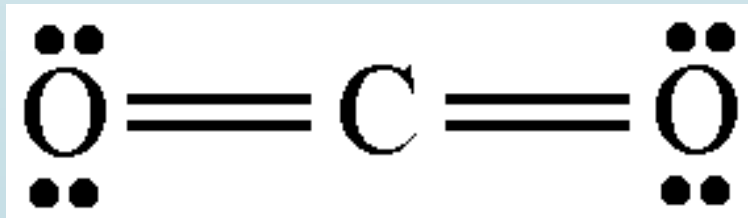
IONIC COMPOUNDS

Ex. NaCl



COVALENT COMPOUNDS

Ex. CO_2



Comparing Ionic & Covalent Compounds

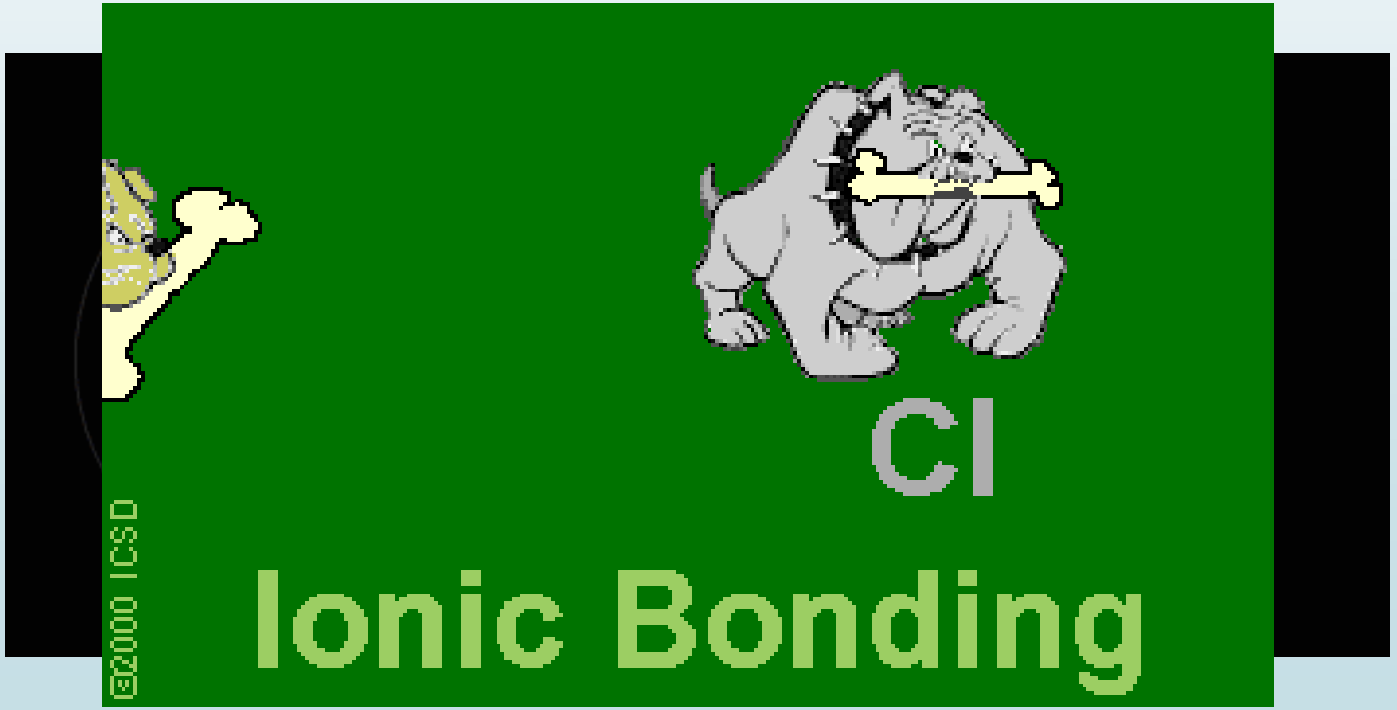
Property	**Ionic Compound**	**Covalent Compound**
State at room temperature	Crystalline solid	Liquid, gas, solid
Melting point	High	Low
Electrical conductivity as a liquid	Yes	No
Solubility in water	Most have high solubility	Most have low solubility
Conducts electricity when dissolved in water	Yes	Not usually

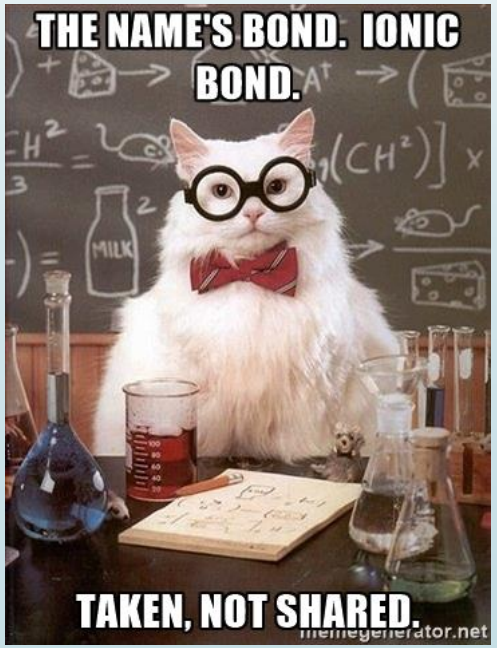
- Different properties of ionic and covalent compounds result from the types of ***chemical bonds*** found in these compounds
- Chemical bonds are ***forces*** that attract atoms to each other in compounds and involves the interaction between the ***valence electrons*** of atoms
- A molecule is ***more stable*** than the isolated atoms from which it is formed
- This stability results in the formation of a chemical bond by losing, gaining, or sharing ***valence electrons***

- https://www.youtube.com/watch?v=_M9khs87xQ8

Two Main Types of Bonds

1. **Ionic Bonding**
   - Chemical bonding resulting from attraction between oppositely charged ions formed when metallic atoms ***transfer valence electrons*** to non-metallic



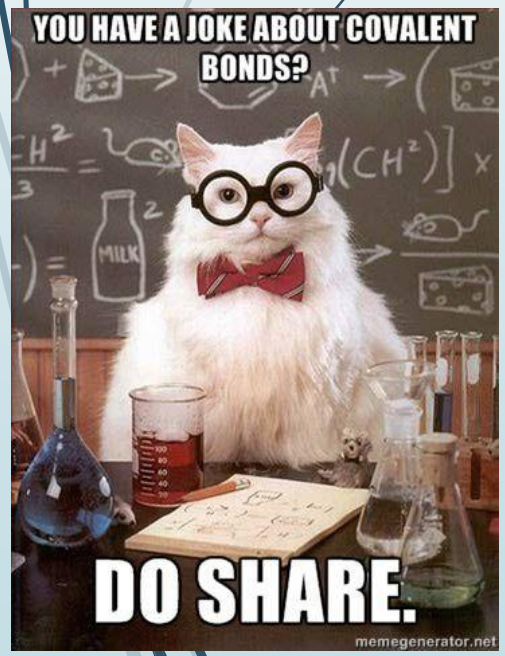


2. Covalent Bonding

- Chemical bonding resulting from the ***sharing of valence electrons*** between atoms

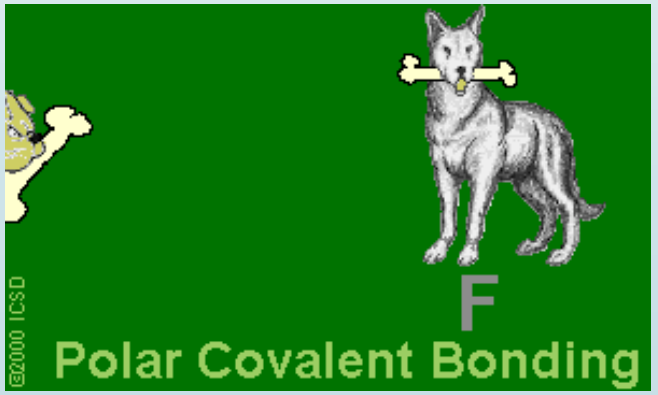
a) Nonpolar Covalent Bonding

- ***"equal"*** sharing of electrons
- Ex. H_2, Cl_2



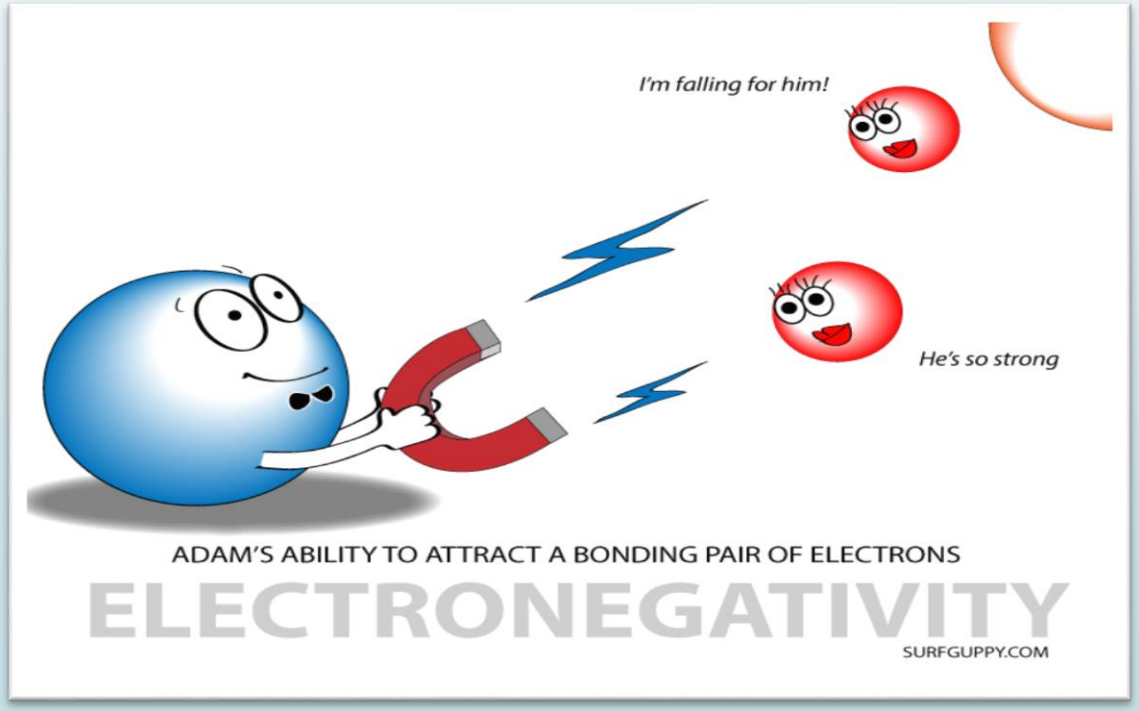
b) Polar Covalent Bonding

- ***"unequal"*** sharing of electrons
- Ex. H_2O, CO_2

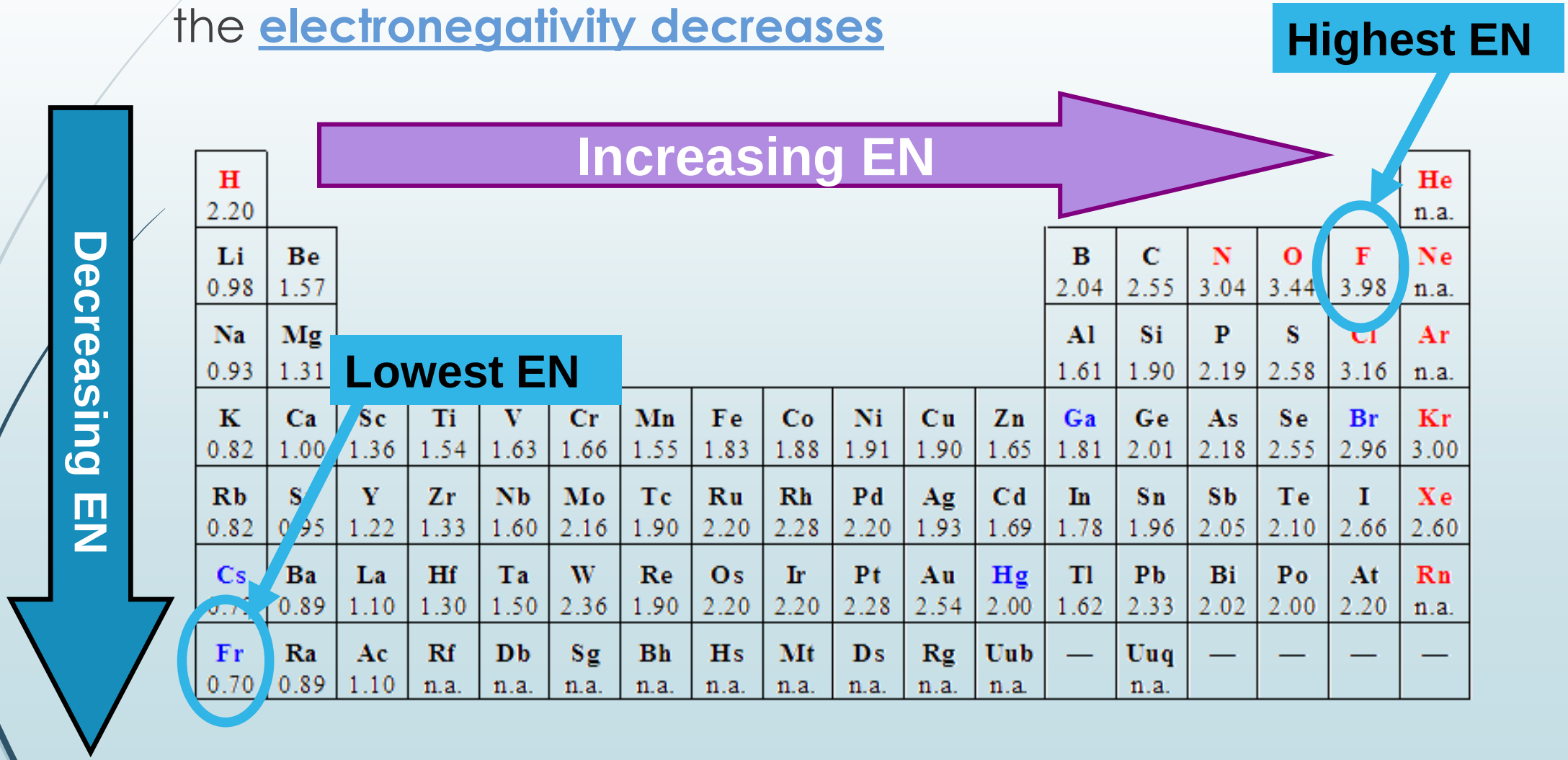


Electronegativity

- When two atoms form a bond, each atom attracts the other atom's electrons in addition to its own
- Electronegativity is a quantitative measurement of the atom's ability to attract electrons in a **chemical bond**



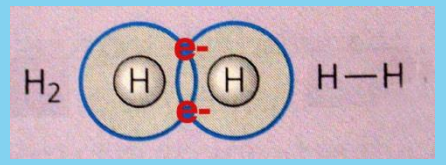
- As one moves **across a period** on the periodic table, the **electronegativity increases**
- As one moves **down a group** on the periodic table, the **electronegativity decreases**



Ex. H_2

$\Delta EN = 2.20 - 2.20$

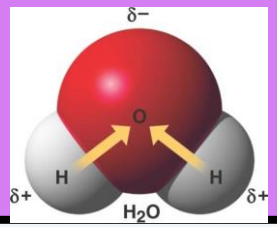
$= 0$



Ex. H_2O

$\Delta EN = 3.44 - 2.20$

$= 1.24$

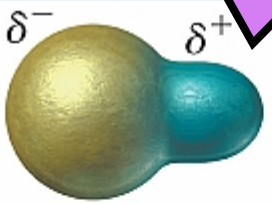


Ex. NaCl

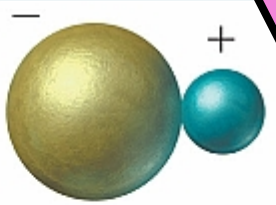
$\Delta EN = 3.16 - 0.93$

$= 2.24$

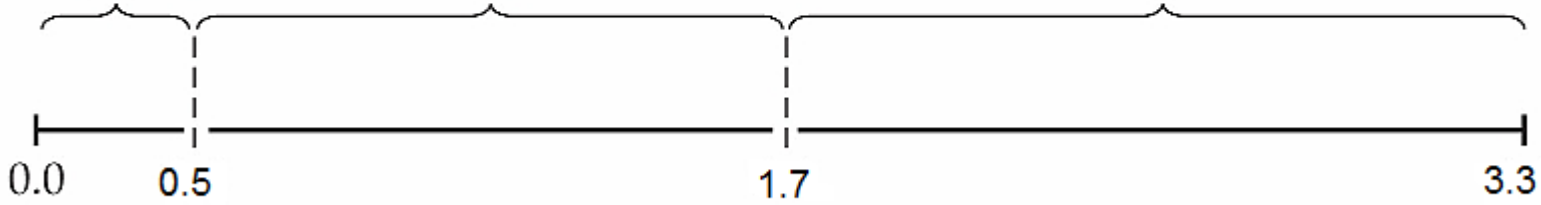
Pure (nonpolar) covalent bond: electrons shared equally



Polar covalent bond: electrons shared unequally



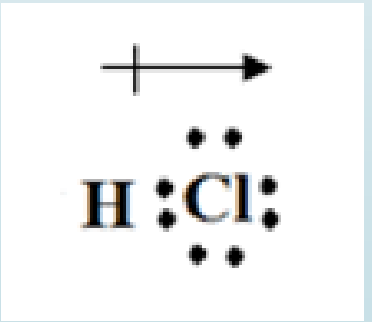
Ionic bond: electron transferred



The Bonding Continuum

Practice: what type of bond??

- O_2
  - Δ EN = 3.44 – 3.44 = 0
  - **covalent**
- KF
  - Δ EN = 3.98 – 0.82 = 3.16
  - **ionic**
- HCl
  - Δ EN = 3.16 – 2.20 = 0.96
  - **Polar covalent**



Practice: Rank the following bonds in order of increasing polar character

- OH bond → $\Delta EN = 3.44 - 2.20 = 1.24$
- NBr bond → $\Delta EN = 3.04 - 2.96 = 0.08$
- CaCl bond → $\Delta EN = 3.16 - 1 = 2.16$

A: NBr, OH, CaCl

covalent

Polar covalent

ionic