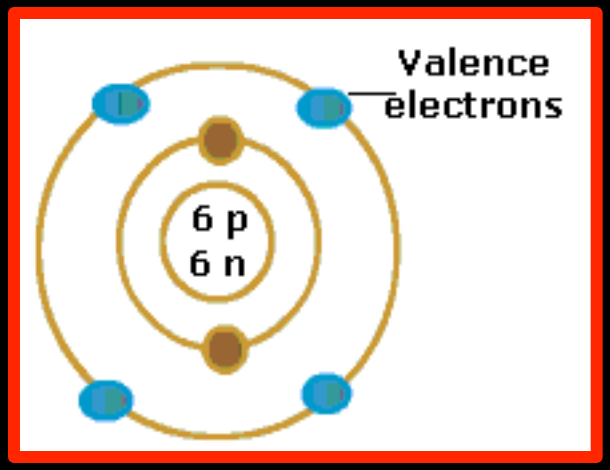
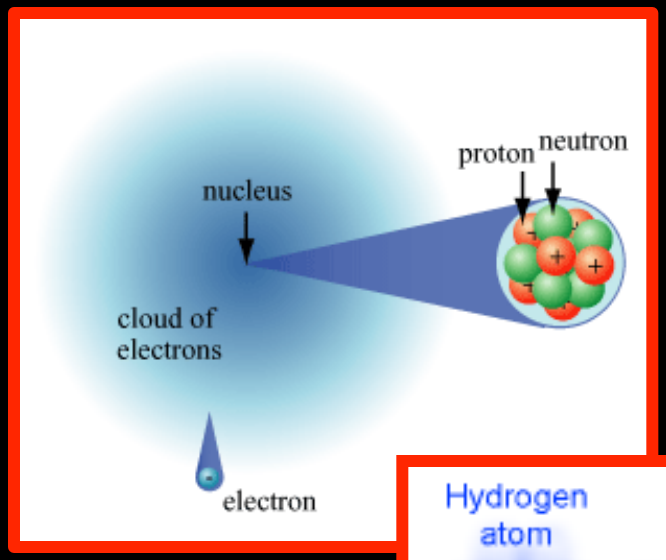
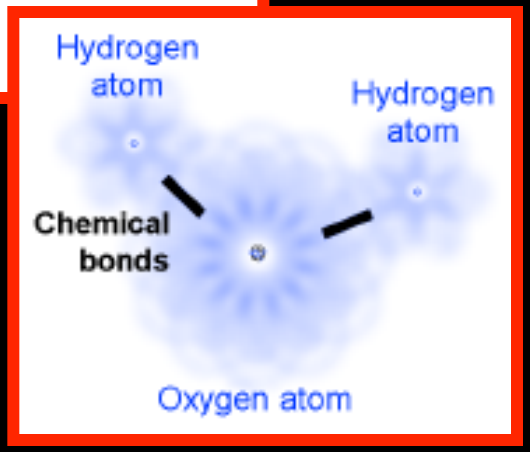
Valence Electrons

1. The electrons responsible for the chemical properties of atoms, and are those in the outer energy level, the valence level.
2. Electrons that make bonds are called valence electrons.
3. Not all electrons in an atom participate in making chemical bonds.
4. Valence electrons – The electrons in the outer energy level.
5. Core electrons – are those in the lower energy levels.
6. Bonding - involves the valence electrons that are electrons in the HIGHEST ENERGY LEVEL, called the Valence Level.





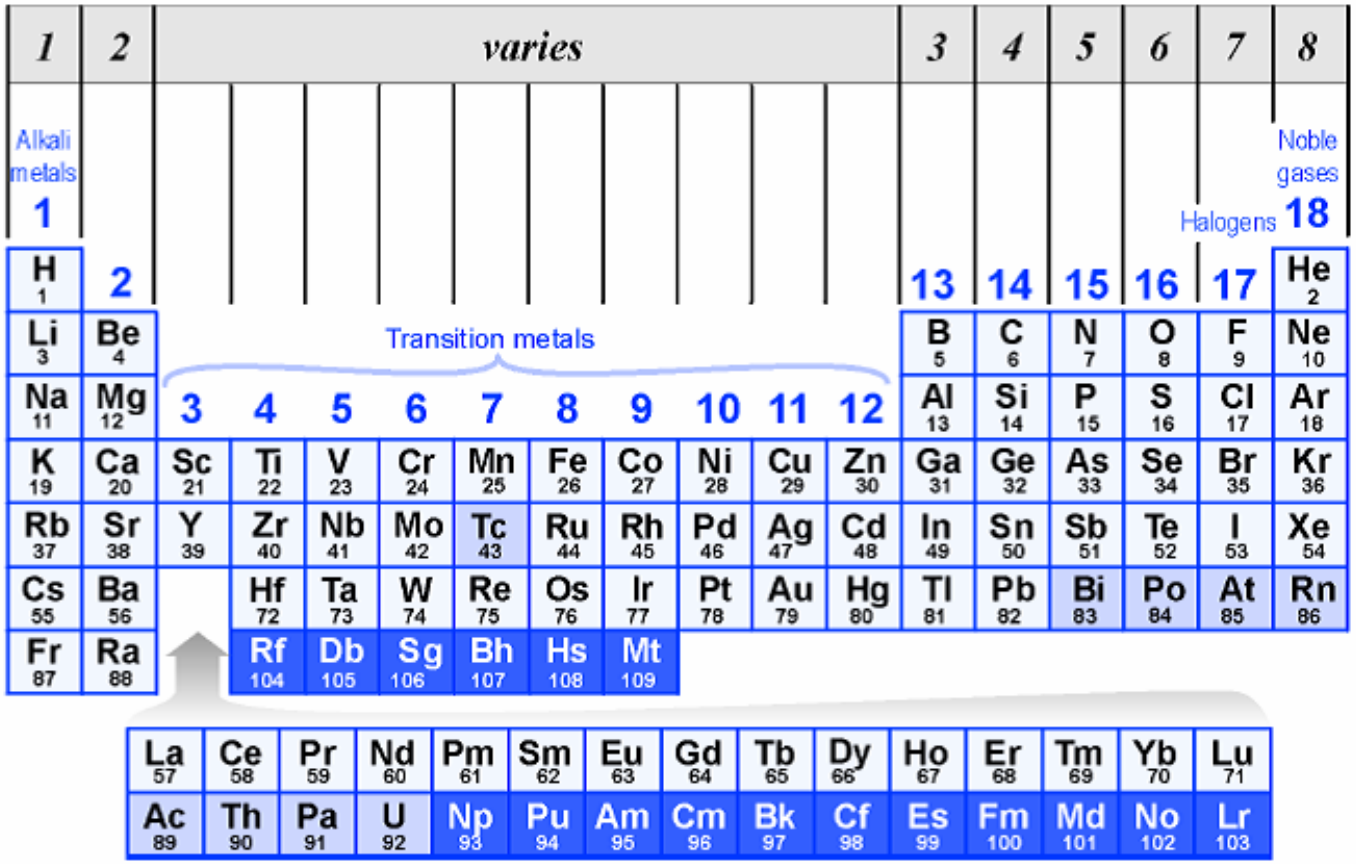


Periodic Table
and
Valence Electrons

Valence Electrons

IA	IIA	IIIA	IVA	VA	VIA	VIIA	VIIIA
Li·	·Be·	·B·	·C·	:N·	:O:	:F:	:Ne:

In general, the number of valence electrons of a representative element is equal to the group number



The Periodic Table arranges elements from left to right by the number of valence electrons.

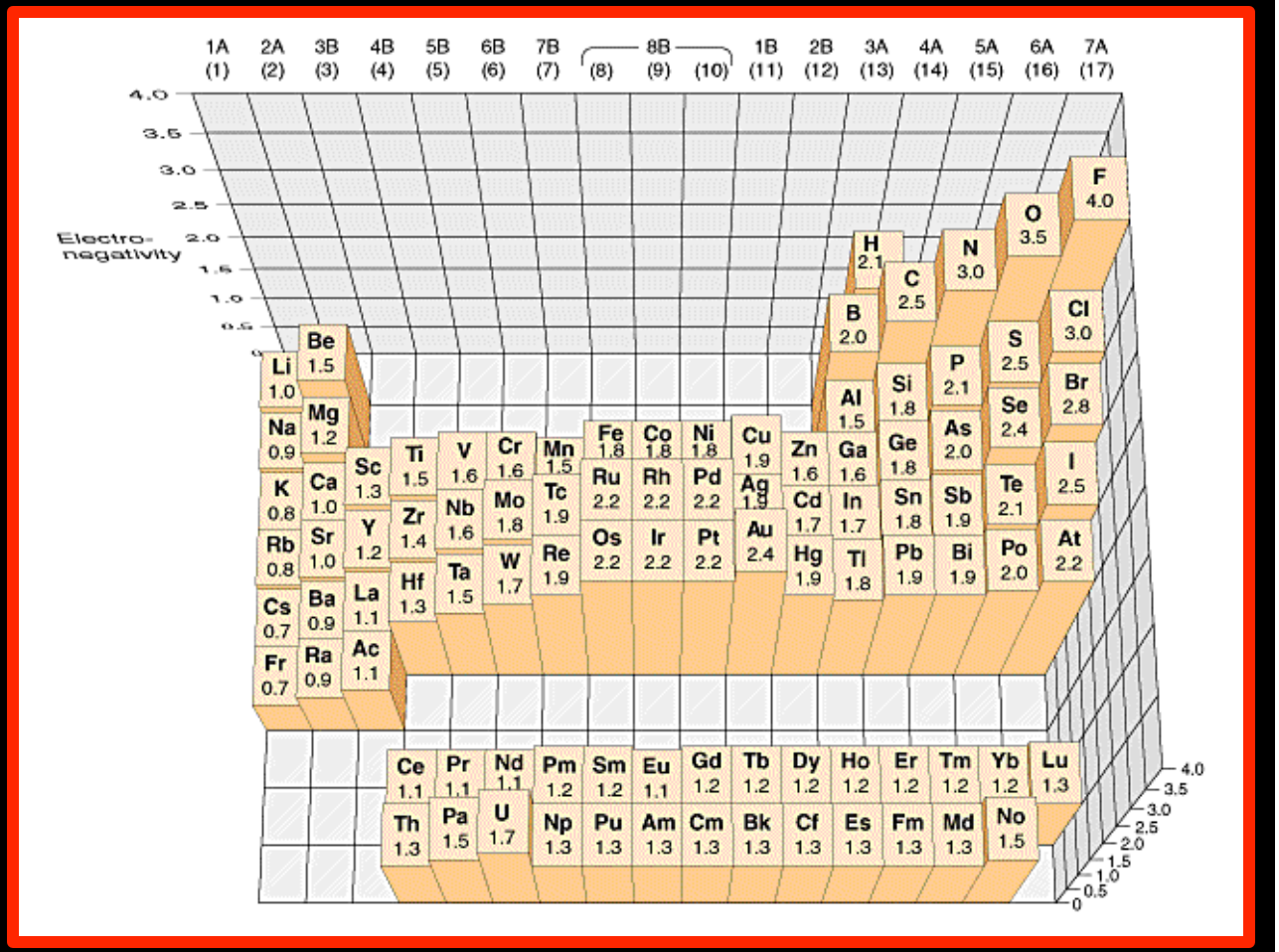
Electronegativity

A. Electronegativity is the tendency of an atom to attract valence electrons.

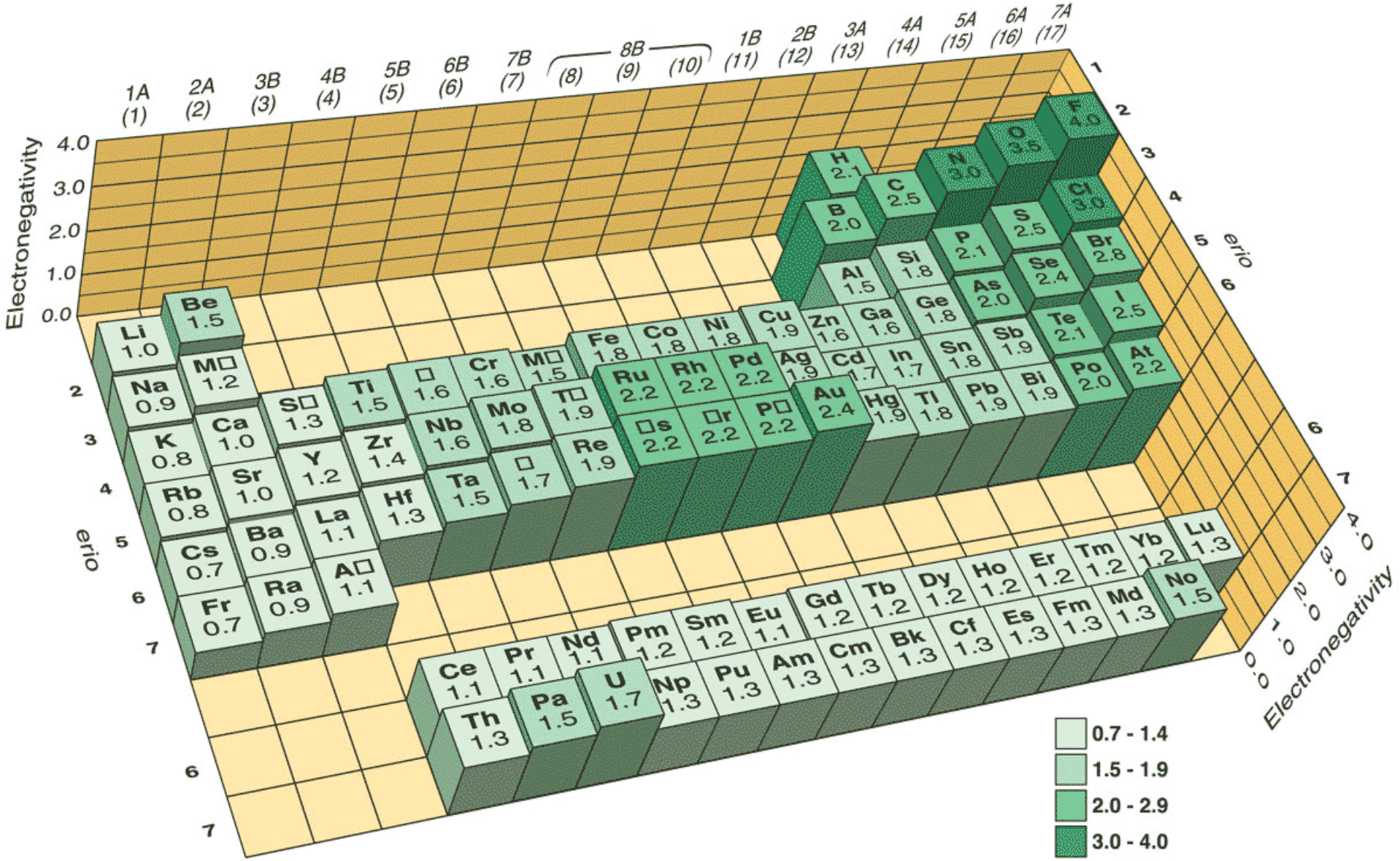
B. If the electronegativity of an atom is high, then it attracts and holds on to electrons.

C. If the electronegativity of an atom is low, then it tends to give electrons away.

- Fluorine, F -Holds onto its valence electrons the most.
- Cesium, Cs -Has the smallest hold for its valance electrons.



The Periodic Table and Electronegativity

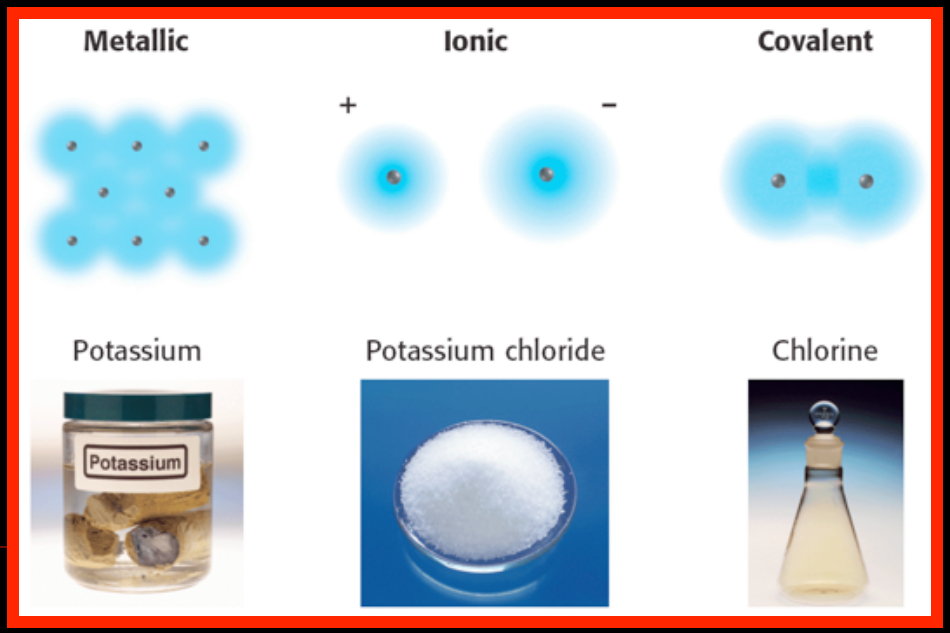


Chemical Bonds and Properties of Substances with Different Types of Bonds

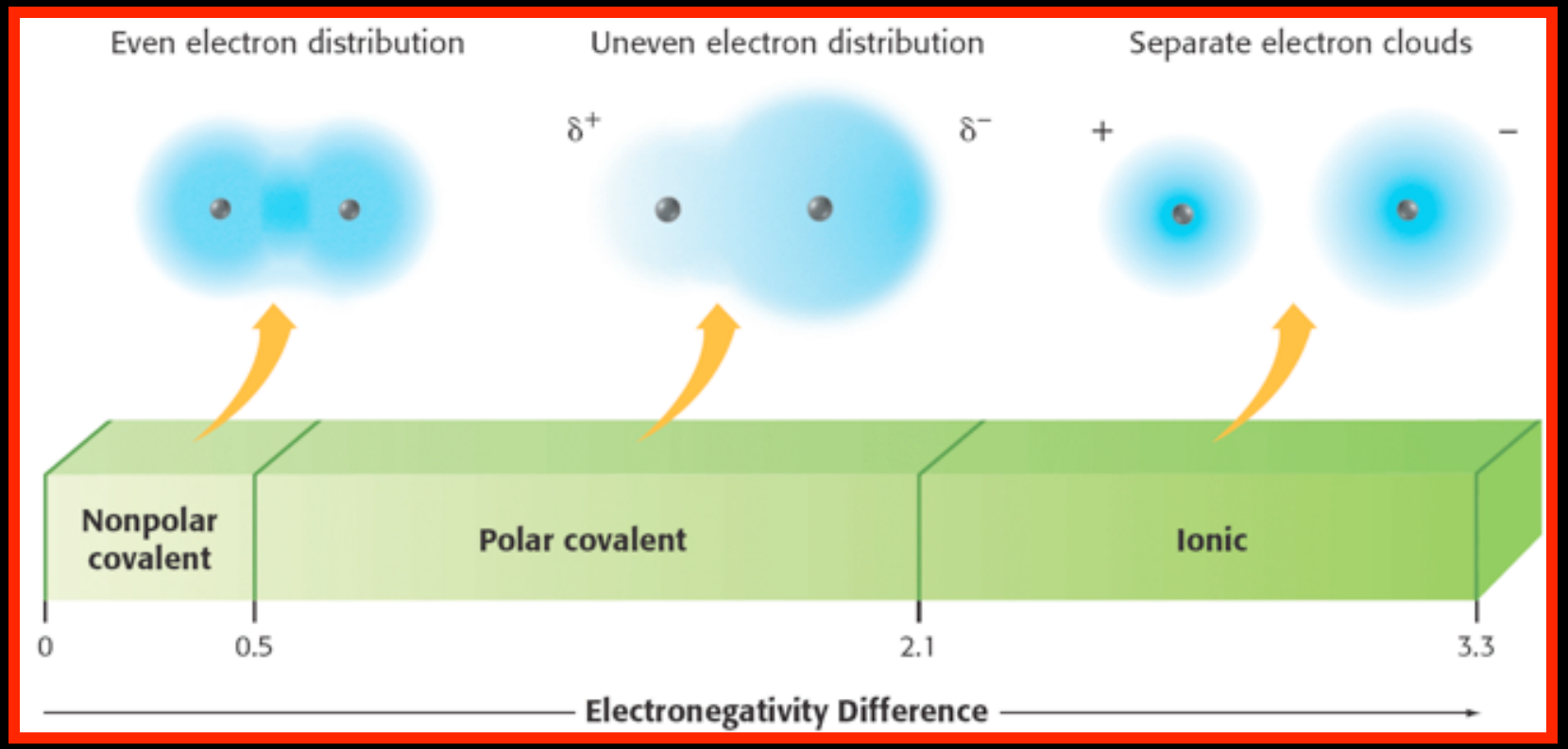
Chemical Bond - Bonds form compounds because all atoms want to obtain an electron configuration like that of noble gases having an **octet**

Three General Types of Chemical Bonds

1. **Covalent Bonds**
2. **Ionic Bonds**
3. **Metallic Bonds**



Electronegativity Is Used To Determine the Type of Bond



Types of Chemical Bonds

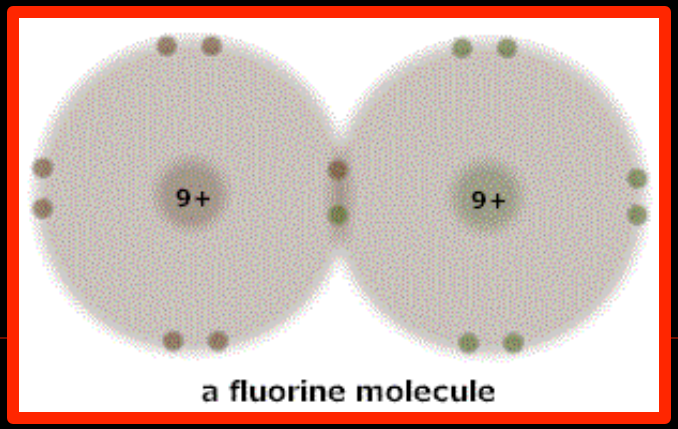
Ionic Bonds occurs between **metals** and **nonmetals**.

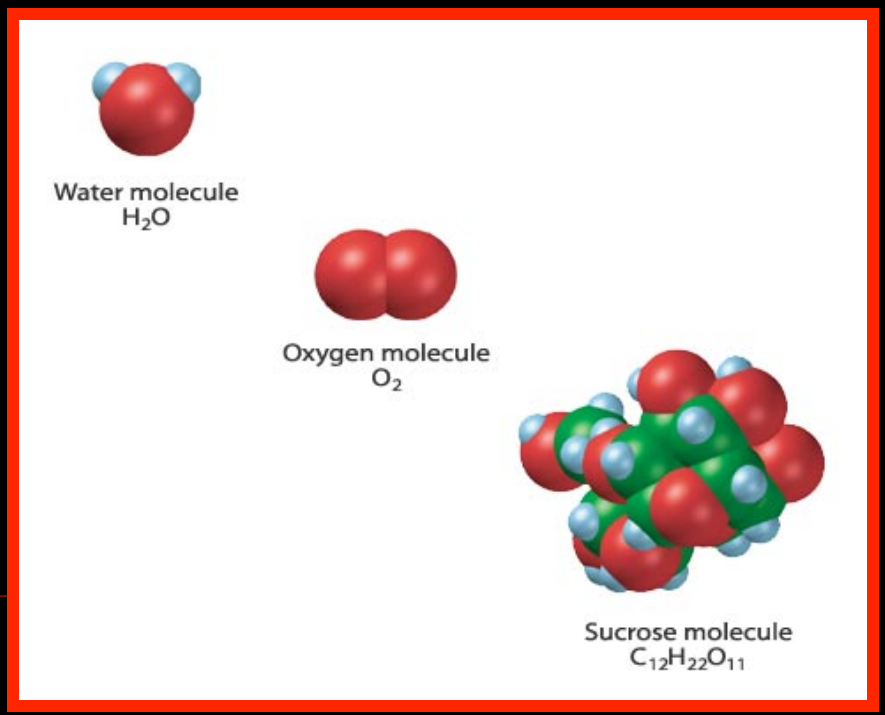
In **ionic compounds** there is an attractive force between **positive ions** and **negative ions**.

Generally, Covalent Bonds occurs between **nonmetals**.

Examples of Covalent Compounds

Note that only nonmetals make them up.





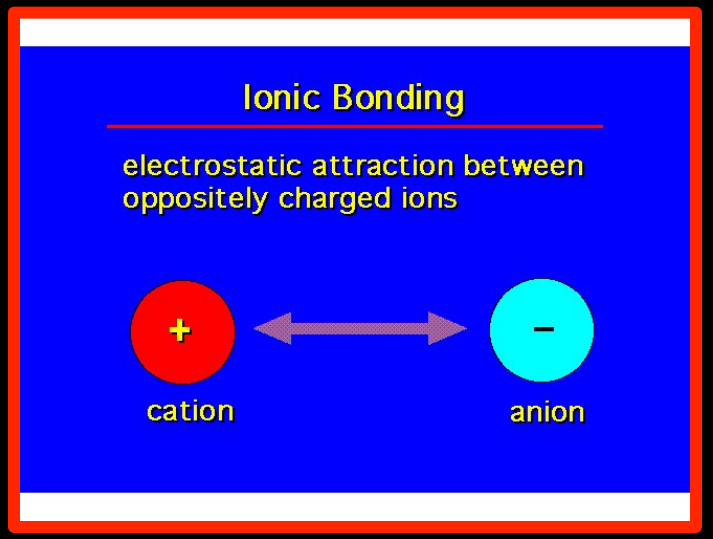
Bonding

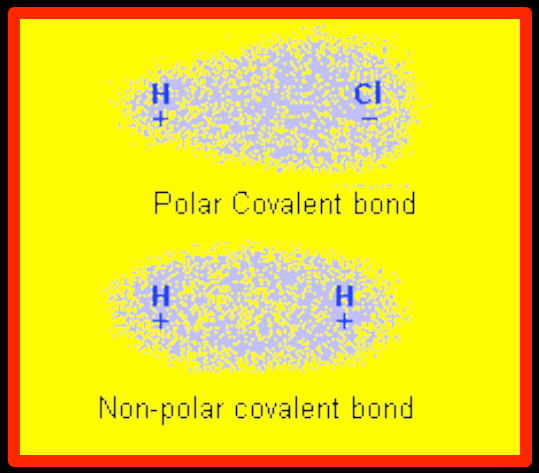
IONIC or COVALENT

Ionic Bonds

Loss and gain of valence electrons between atoms makes cations and anions.

Opposites Attract

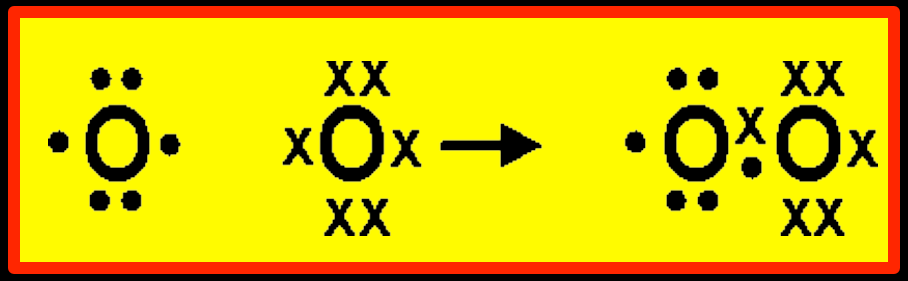




Covalent Bonds

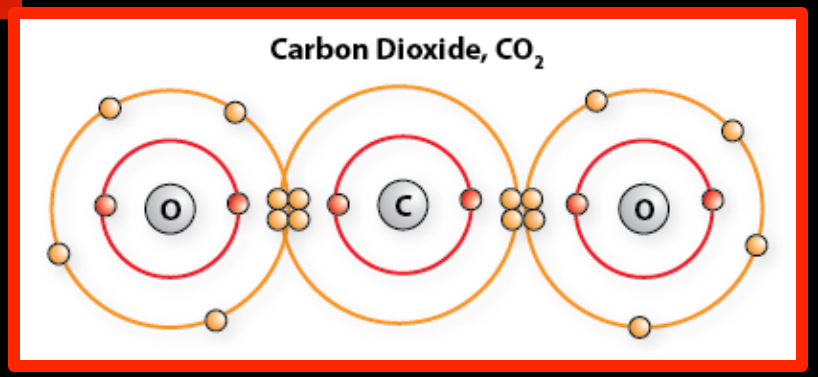
Valance electrons are shared to fill the outer energy level.

Covalent Bonds



Covalent Bonds - One or more pairs of **electrons are shared** by two atoms.

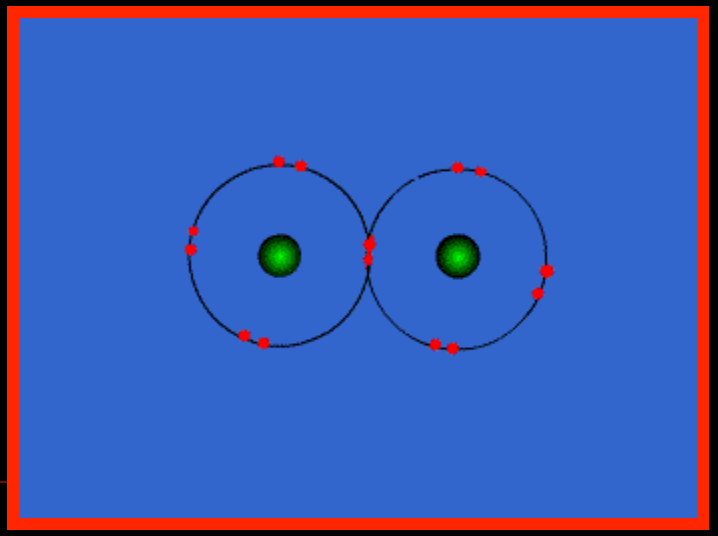
Follow the atoms to the left to see this.



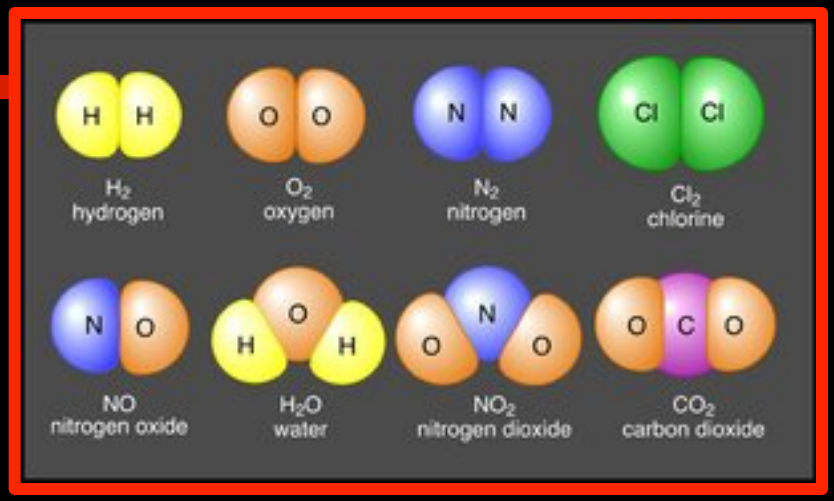
Type of Covalent Bonds

I. Nonpolar covalent bond -a covalent bond in which the bonding electrons are shared equally by the bonded atoms.

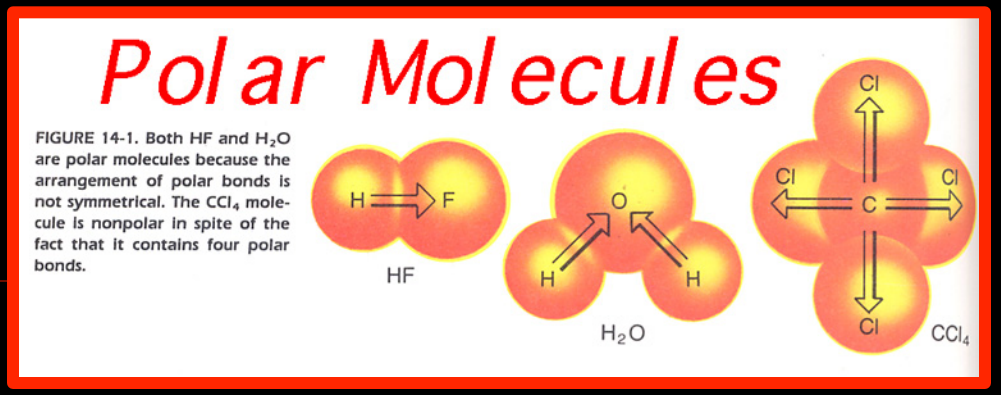
II. Polar covalent bond –a covalent bond in which the bonded atoms do NOT share electrons equally. Polar Bonds have UNEQUAL SHARING.



Covalent Bonds

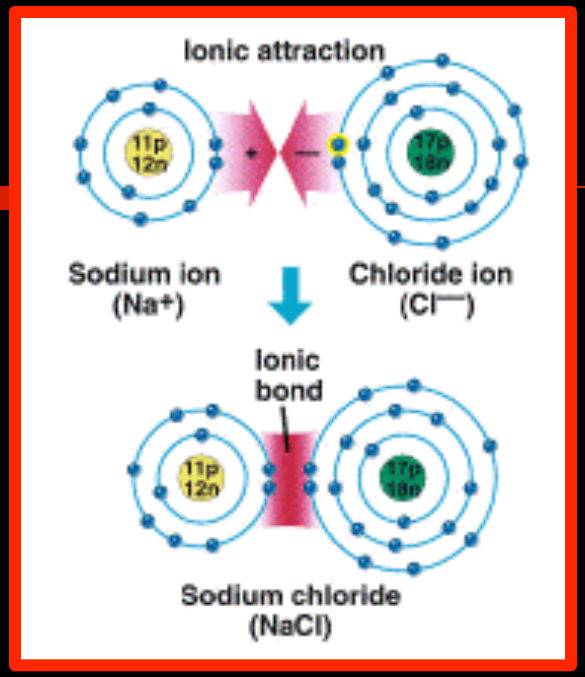


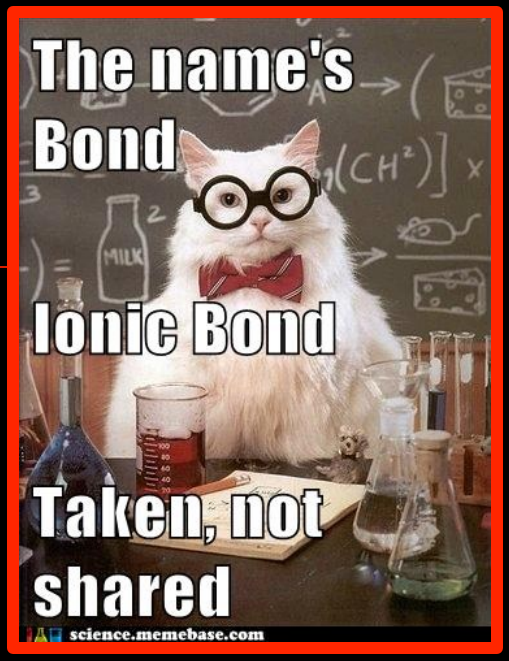
- **A covalent bond is typically formed by two non-metals.**
- Non-metals have similar electronegativities.
- Consequently, neither atom is "strong" enough to steal electrons from the other.
- Therefore, the atoms must share the electrons.

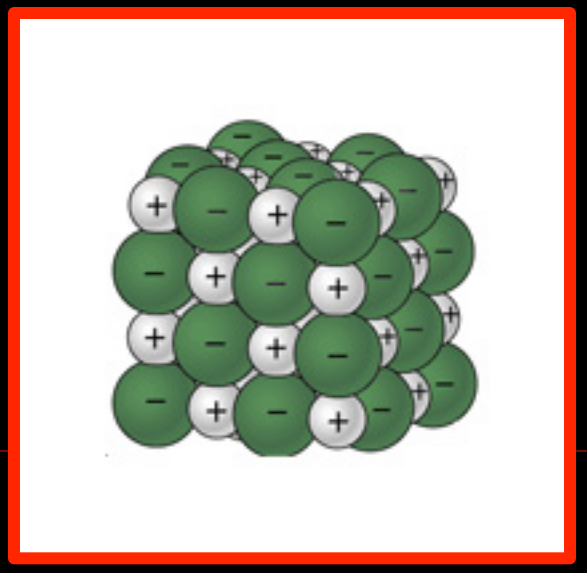


Ionic Bonds

- An ionic bond is typically formed between a metal and a non-metal.
- Metals have low electronegativities, while non-metals have high electronegativities.
- Consequently, the non-metal is "stronger" than the metal, and can take electrons very easily from the metal.
- This results in the metal becoming a cation, and the non-metal becoming an anion.

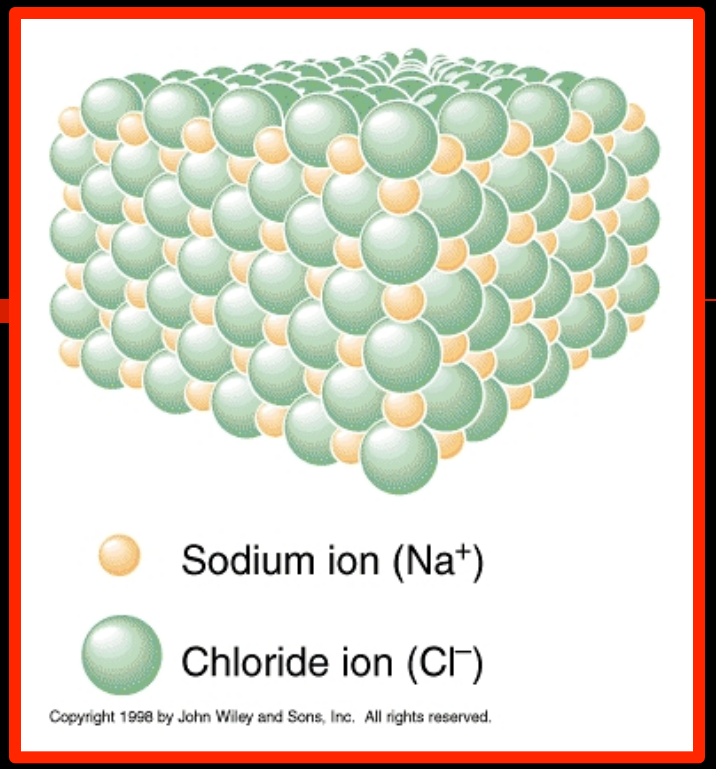


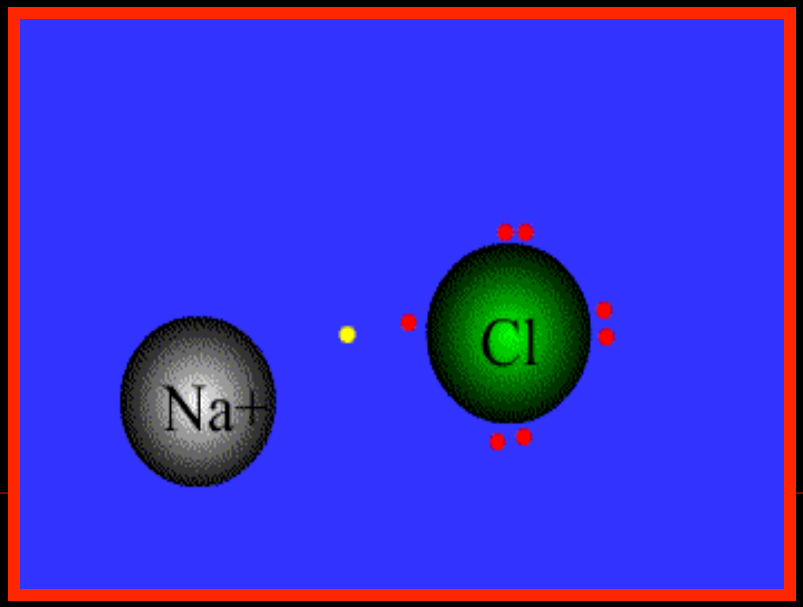




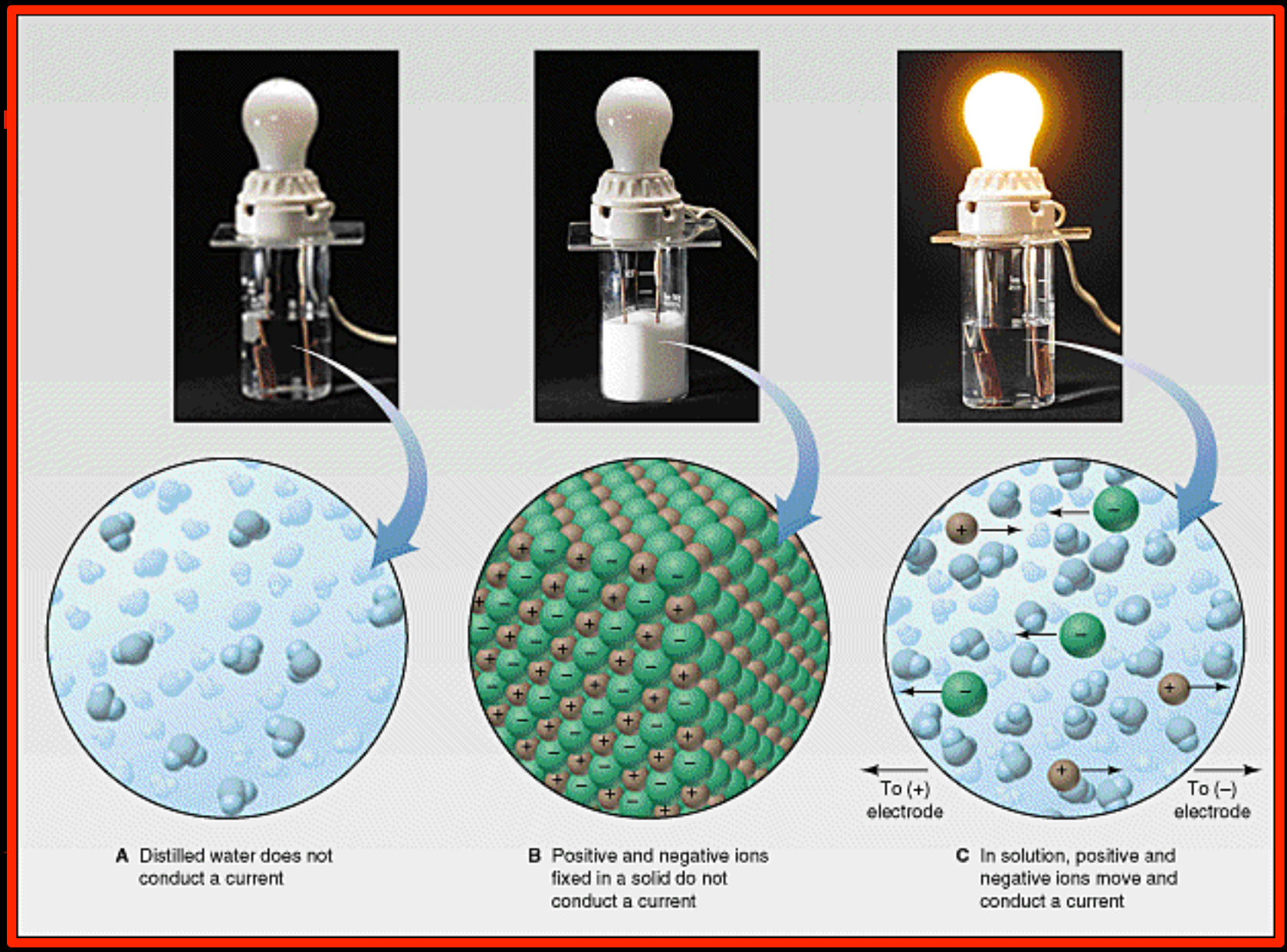
Ionic Bonds

- One or more electrons from an atom are removed and attached to another atom, resulting in a cation and an anion forming which attract each other –opposite charges attract.
- Watch carefully the box to the right and see the positive and negative ion form.



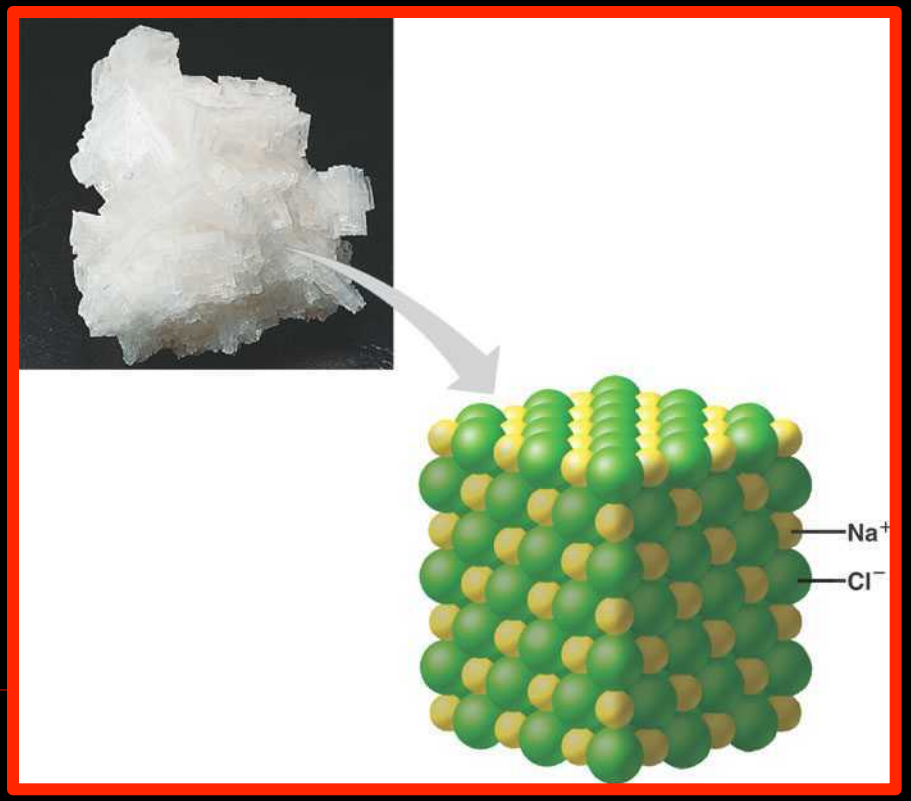


Ionic compounds form IONS in solution making them electrolytes.
Notice **ionic compounds when solid- do not conduct electricity**.



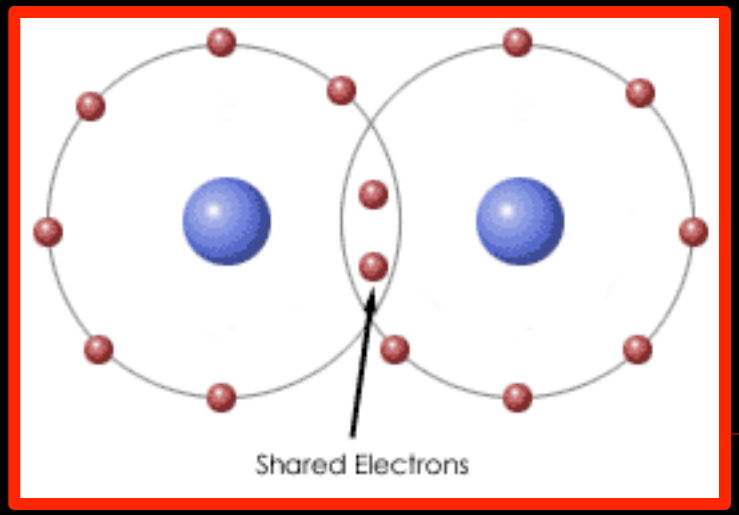
Ionic Compounds form Crystals

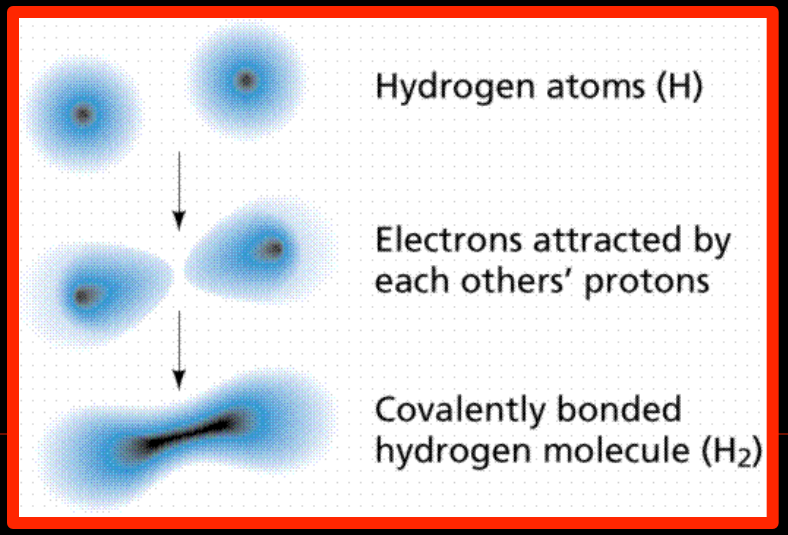
1. Due to the interaction of the charged ions, the sodium and chlorine ions are arranged in an alternating pattern.
2. Forming an ionic crystals. Ionic compounds form crystals solids.



Covalent Compounds

1. A single water molecule can exist by itself or as many water molecules held together by intermolecular forces.
2. Molecules can exist by themselves because electrons are shared, so there are no ionic charges formed.
3. Resulting in- molecular compounds move about freely and tend to exist as liquids or gases at room temperature.





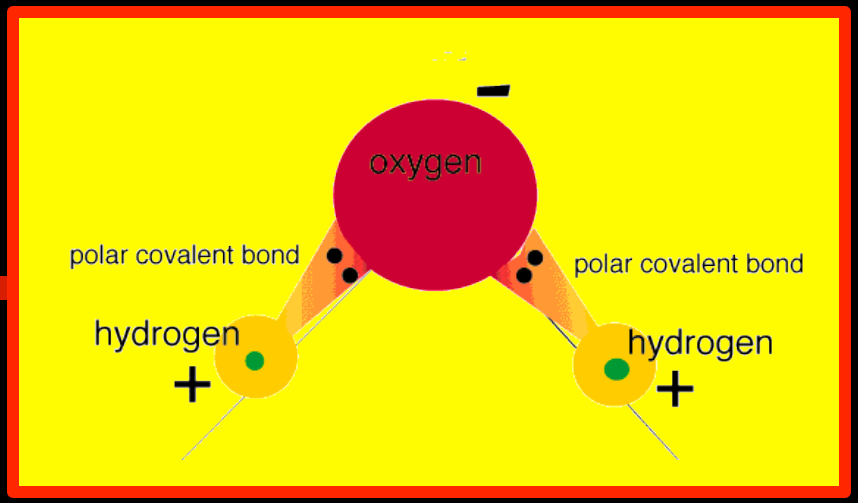
Covalent Compounds

1. Gases, liquids, or solids
2. Low melting and boiling points
3. Form molecules in solution
4. Poor electrical conductors in solution making them non-electrolytes
5. Many are soluble in nonpolar solvents but not in water
6. Examples: butter, oil, sugar

Ionic Compounds

1. Crystalline solids
2. High melting and boiling points
3. Form ions in solution
4. Conduct electricity in solution making them electrolytes
5. Many soluble in water but not in nonpolar solvents
6. Examples: salt

Water as a Polar Molecule

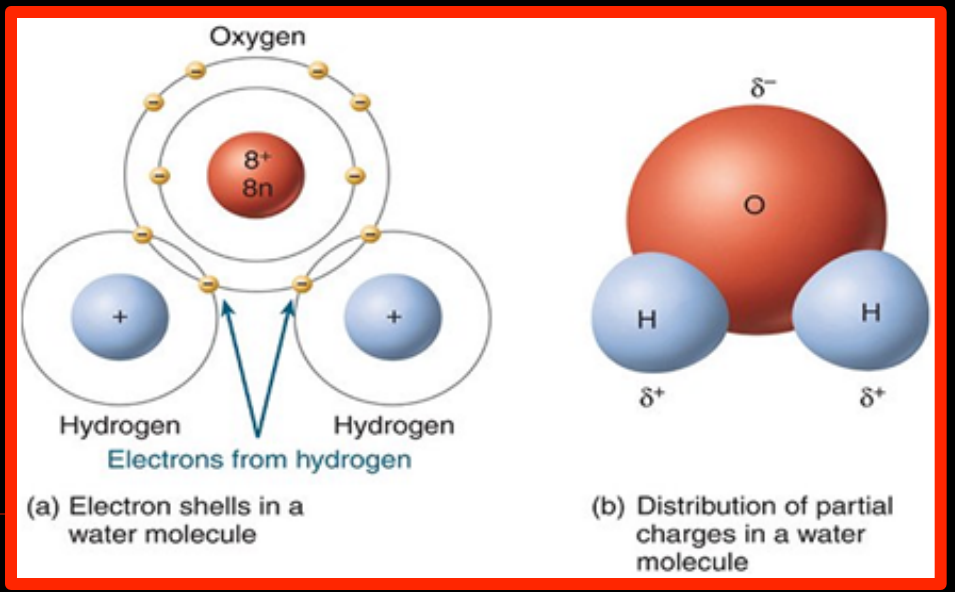


A. Polar covalent bond unequal sharing of electrons

B. A great example of a molecule with polar covalent bonds is water. Water considered polar because the oxygen is where the negative charge is, and the hydrogen is the location of the positive charge.

C. Water acts like a little magnet polar.

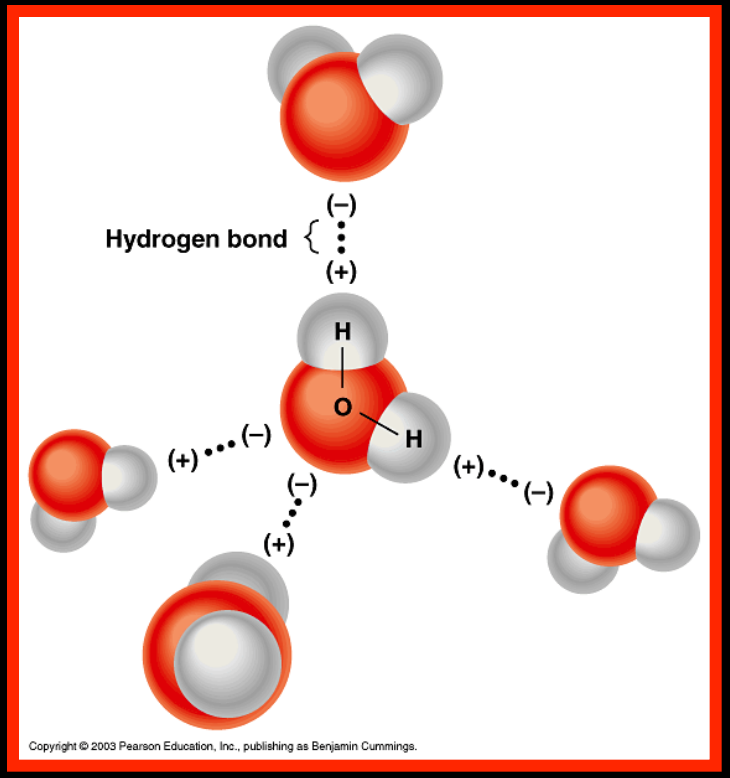
D. The polar molecule creates "hydrogen bonds" between water molecules. This is a weak attraction between molecules, not a real true chemical bond.



Special Characteristics of Water

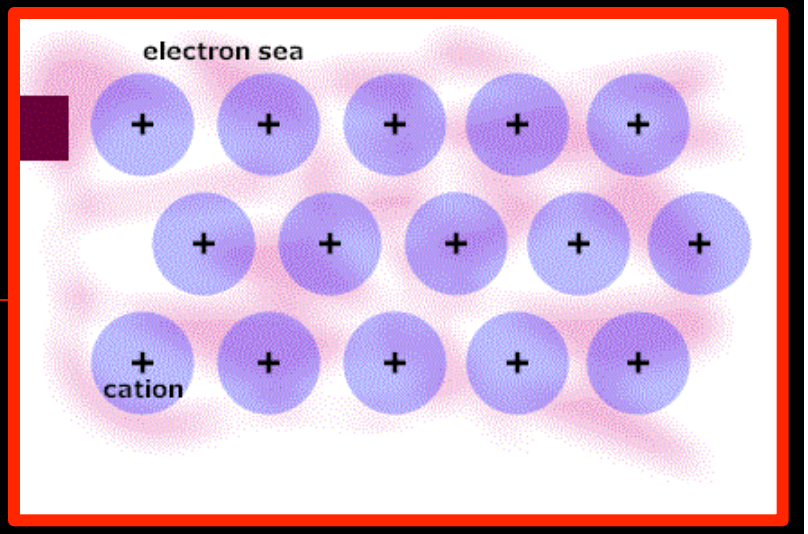
Due to Its Polar Bond and "Hydrogen Bonding" Between Water Molecules

1. Liquid at room temperature
2. Universal solvent- dissolves polar and ionic compounds
3. Water molecules are cohesive (stick together)
4. Temperature of water changes slowly- water has a high heat capacity
5. High heat of vaporization- hard to boil, keeps water at a liquid in most places, most of the time here on the Earth- including in your body.



6. Frozen water is less dense so ice floats, so it melts first and fastest in the spring, in the lakes, rivers and oceans, AND ice floats, so lakes, rivers and streams never become solid bloxks of ice- that would be bad for aquatic life.

Metallic Bonds



Metals hold on to their valence electrons very loose. Valence electrons are not assigned to any particular atom.

Think of metals as positive metal ions floating in a "sea of electrons".

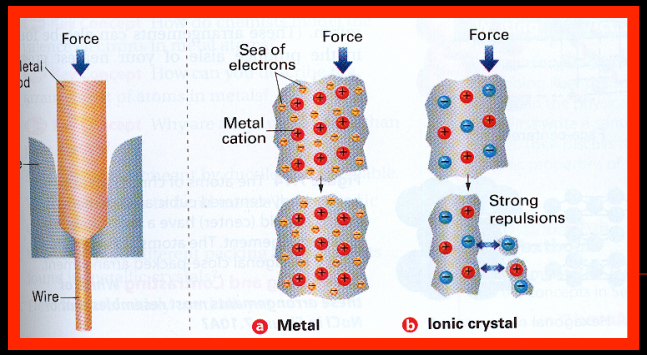
Explains why-

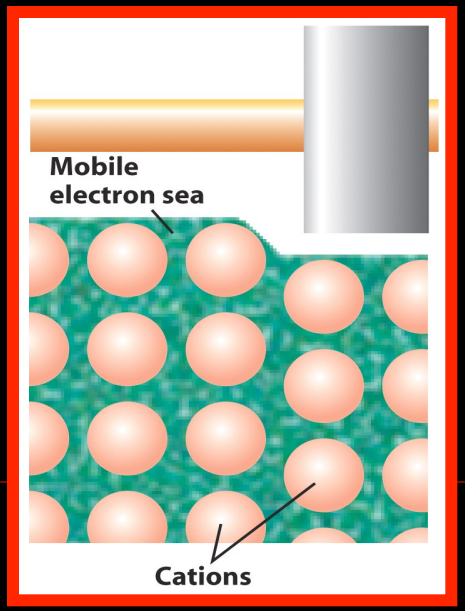
A. Metals conduct electricity.

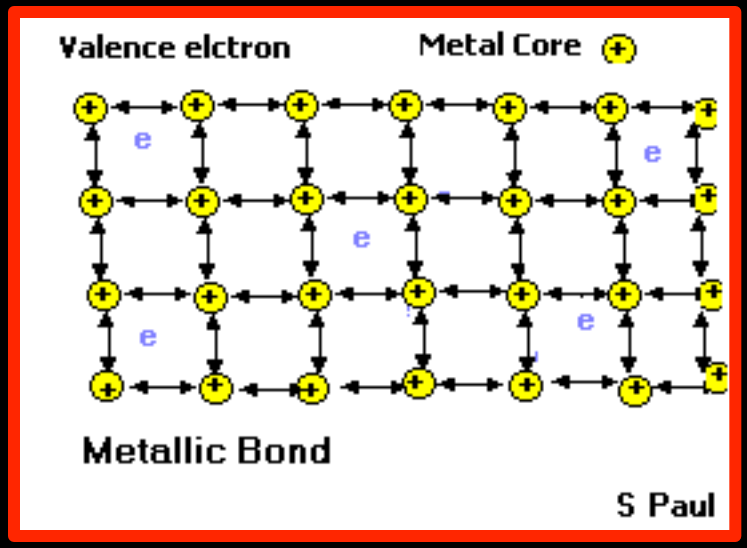
B. Hammered into shape- malleability.

C. Drawn into wires- ductile.

Ductility (below)







Malleability (left)