Introduction to Organic Chemistry

Dr. Zainab Almarhoon

Chem. 108

Leaning objectives:

By the end of this lecture the student will know:

- What is Organic Chemistry?
- How are organic compounds are made from indiviual elements?
- Types of bond in organic compounds and their significance
- Different methods of representing chemical bonding

What is organic chemistry?

- Organic chemistry is the study of carbon contaning compounds and the study of the chemistry of life.
- organic chemistry would be to consider it the study of molecules containing the carbon-hydrogen (C-H) bond and their reactions.

Importance of organic compounds

- DNA: the giant molecules that contain all the genetic information.
- proteins: blood, muscle, and skin.
- Enzymes: catalyze the reactions that occur in our bodies.
- **Petroleum: furnish the energy that sustains life.**
- **Polymers: Cloths, cars, plastic.**
- **Medicine**

Chemical Bonds

- The attractive force which holds together the constituent particles (atoms, ions or molecules) in chemical species is known as chemical bond.
- Each bond is made up of two electrons
- The electrons that participate in chemical bonds are the valence electrons, which are the electrons found in an atom's outermost shell.
- An ionic bond is formed when one atom accepts or donates one or more of its valence electrons to another atom. A covalent bond is formed when atoms share valence electrons.
- The atoms do not always share the electrons equally.

Chemical Bonding

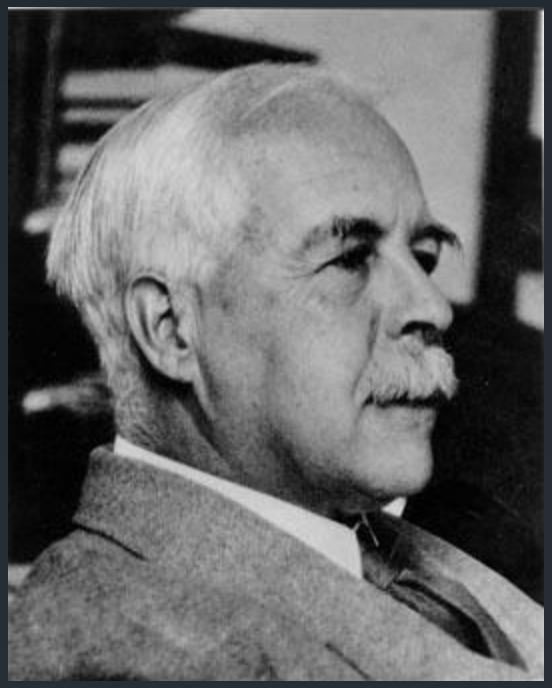
1. Covalent Bonds

2. Ionic Bonds

General Properties of Covalent compounds

results when two or more atoms of the similar electronegativities react, by sharing valence electrons. Covalent bonds form between two non-metal atoms.

- **Covalent compounds generally have much lower melting and boiling points than ionic compounds.**
- **Covalent compounds don't conduct electricity in water.**
- **Covalent compounds tend to be soft and relatively flexible.**
- **When dissolved in water, covalent compounds don't conduct electricity.**
- **Many covalent compounds don't dissolve well in water.**



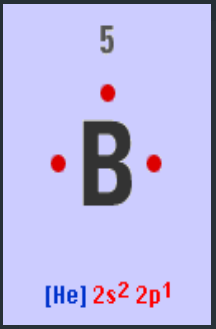
Chemical bonding in Molecules by Lewis (electron dot) structures

1. The symbol of the element is written first. This represents the nucleus of the element with all the inner electrons that do not take part in the bond formation.
2. The valence electrons (electrons in the OUTERMOST energy level) are then written as dots or small cross marks around the symbol. They are spread in a pair on four sides of the symbol.
3. In case of ions the charge is shown with the symbol

Examples:

B^5 its electronic configuration is $1s^2$ $2s^2$ p^1;

so the outer energy level is 2, with 3 valence electrons These can be represented by Lewis structure.



- Used to show an element and the number of valence electrons.
- Q1:Draw Lewis structure for Cl

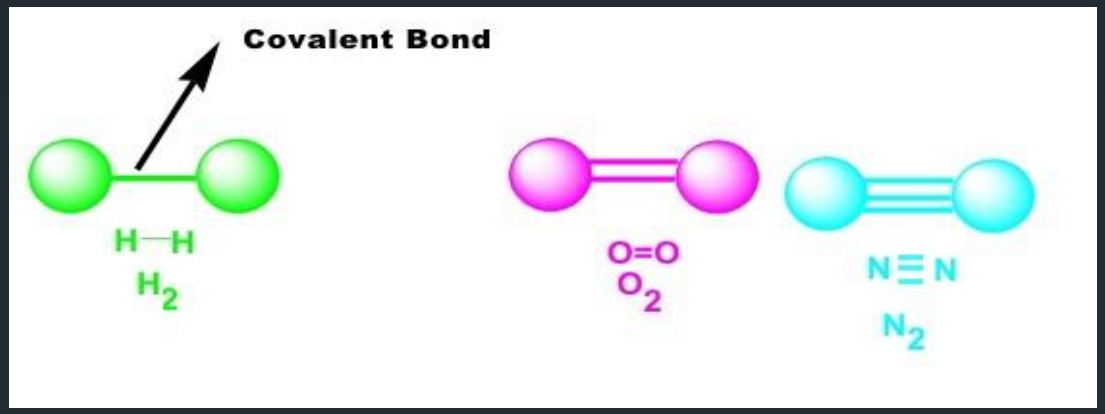
Covalent Bonds:

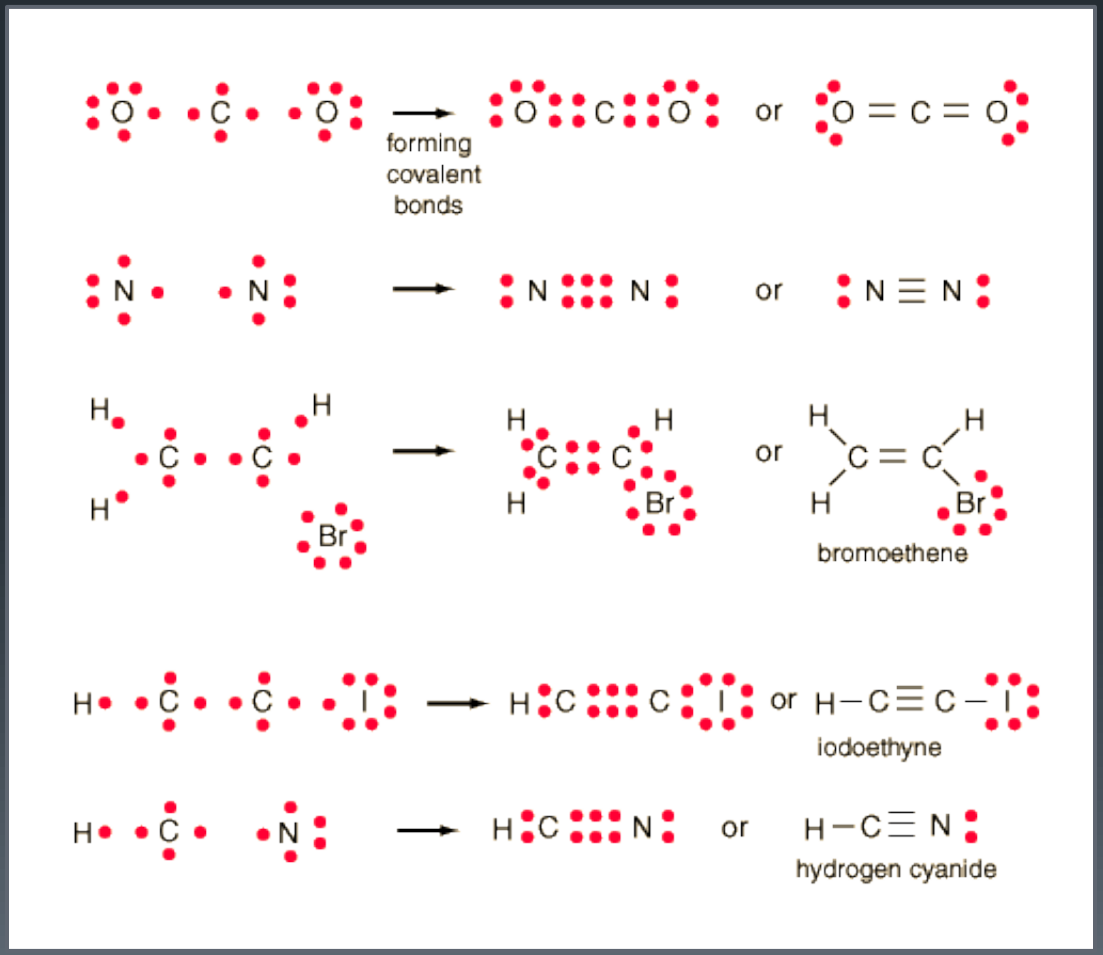
1. single or multiple

A covalent bond in which one electron pair is shared by two at oms, represented in chemical formulas by one line or two vertical dots, as C–H or C:H.

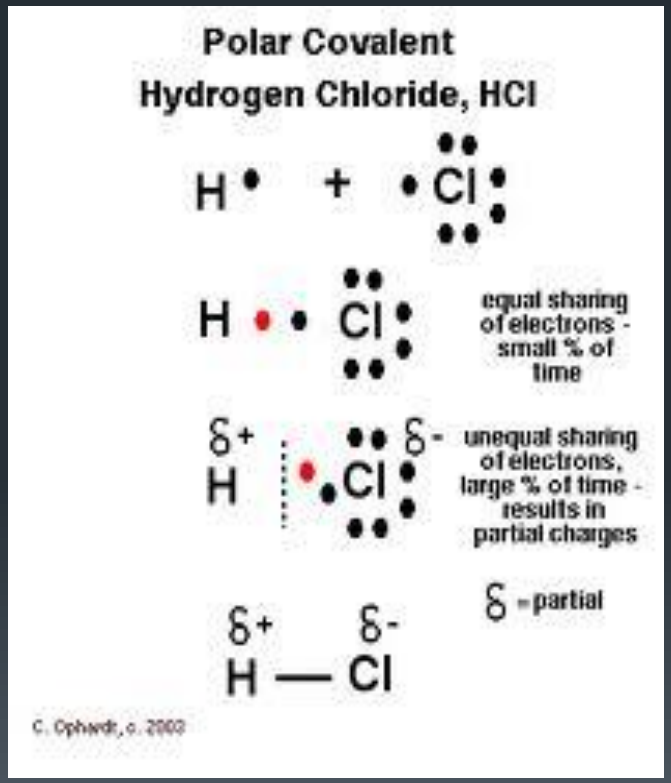
A double covalent bond is where two pairs of electrons are shared between the atoms rather than just one pair, represented in chemical formulas by two lines or four vertical dots, as O=O or O::O .

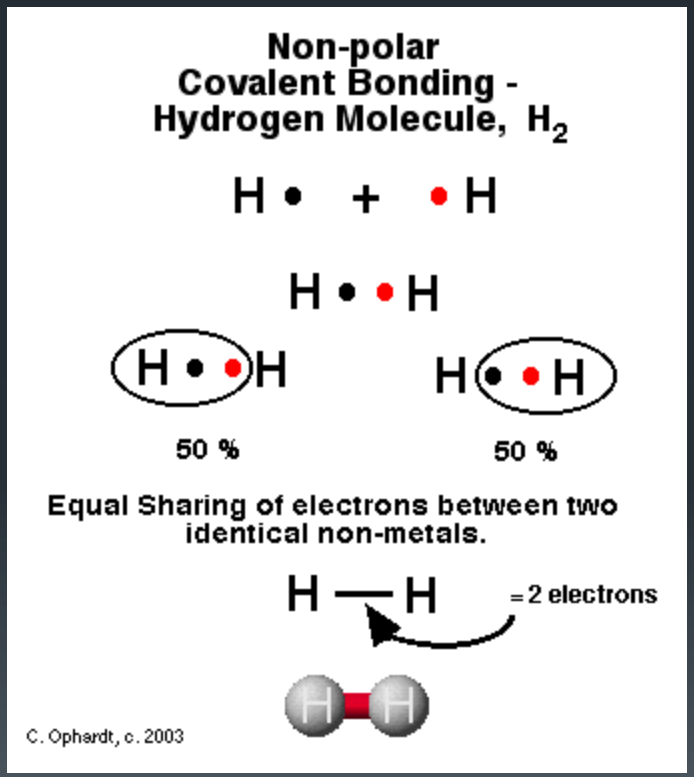
A triple covalent bond is where three pairs of electrons are shared between the atoms rather than just one pair, represented in chemical formulas by three lines or sex vertical dots ≡


Covalent Bond
H—H
H2
O=O
O2
N≡N
N2

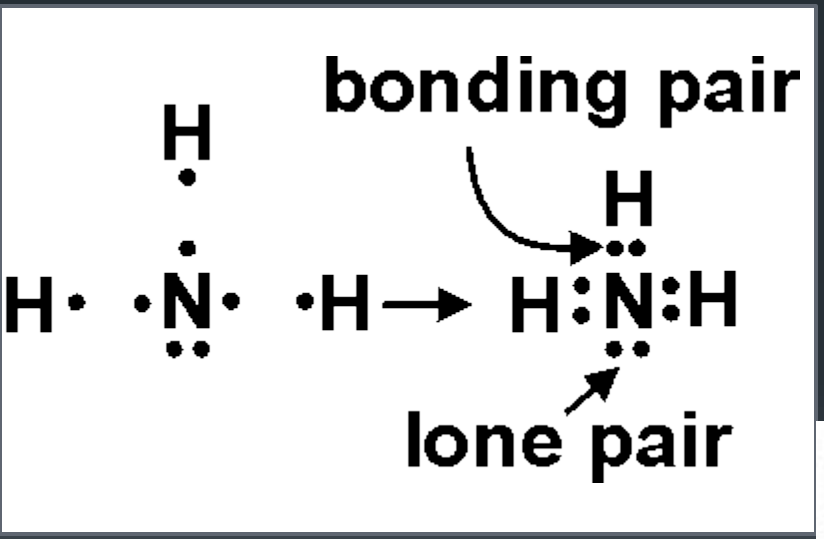

forming covalent bonds
or
or
or
bromoethene
or
iodoethyne
or
hydrogen cyanide

2. polar or non polar

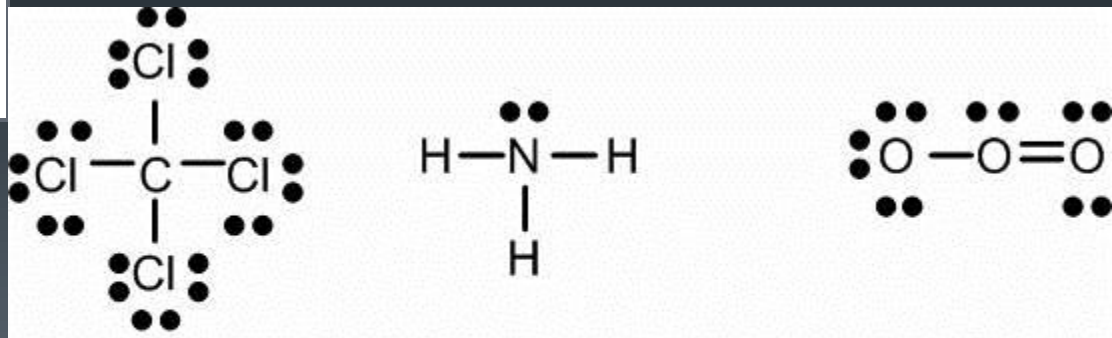




Types of valence electrons



Valence electrons of an atom which are shared with others are called BOND PAIRS and those are unshared are called LONE PAIRS (LP).

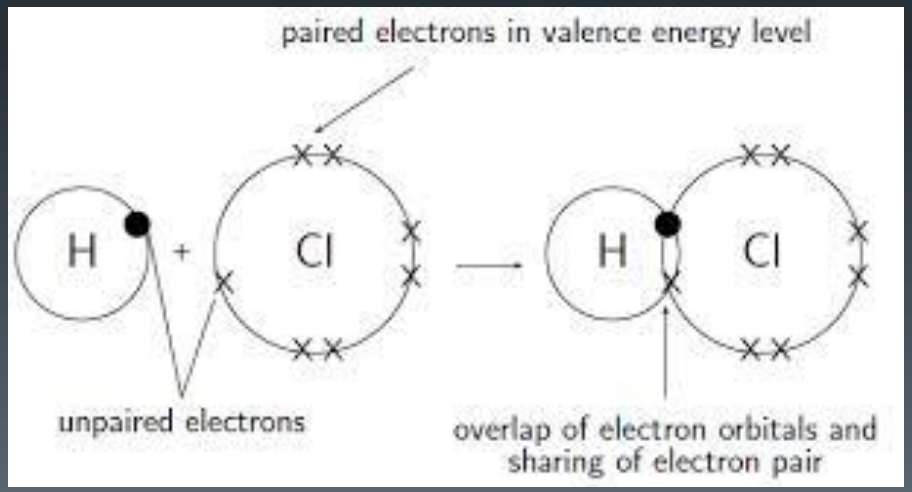


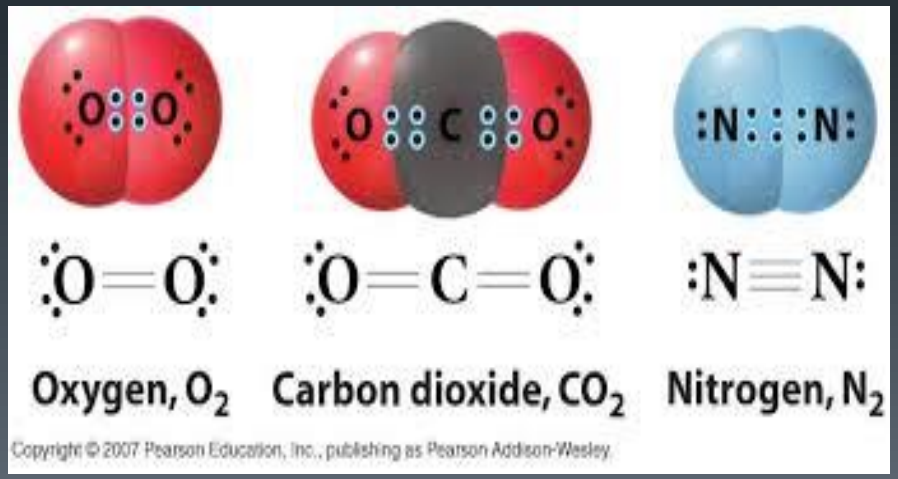
Correct Lewis structures for carbon tetrachloride, ammonia, and ozone.

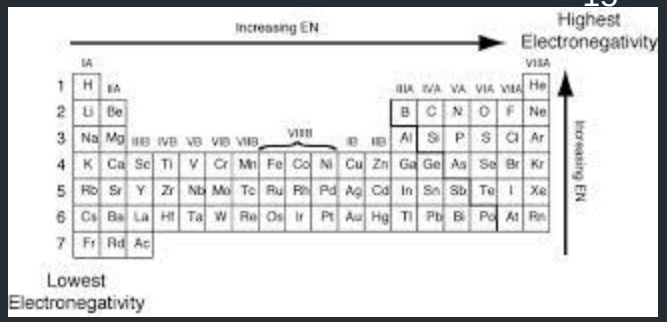
Bond Formation

A bond can result from an overlap of atomic orbitals on neighboring atoms.

Note : that each atom has a single, unpaired electron.

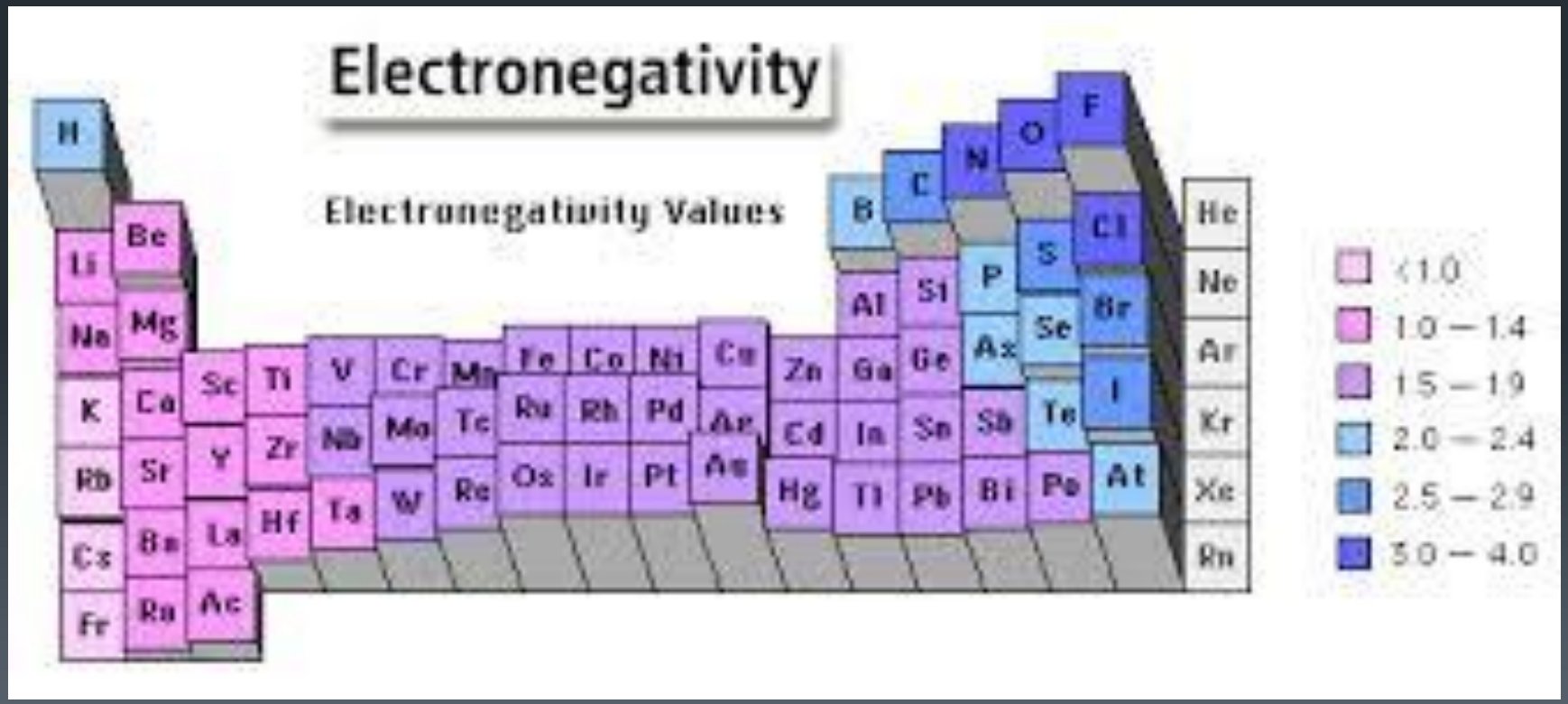




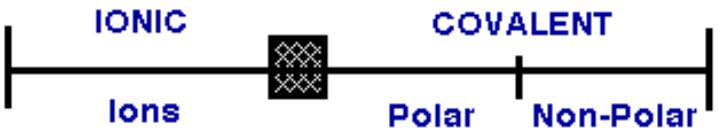


Electronegativity

measures the ability of an atom to attract electrons.



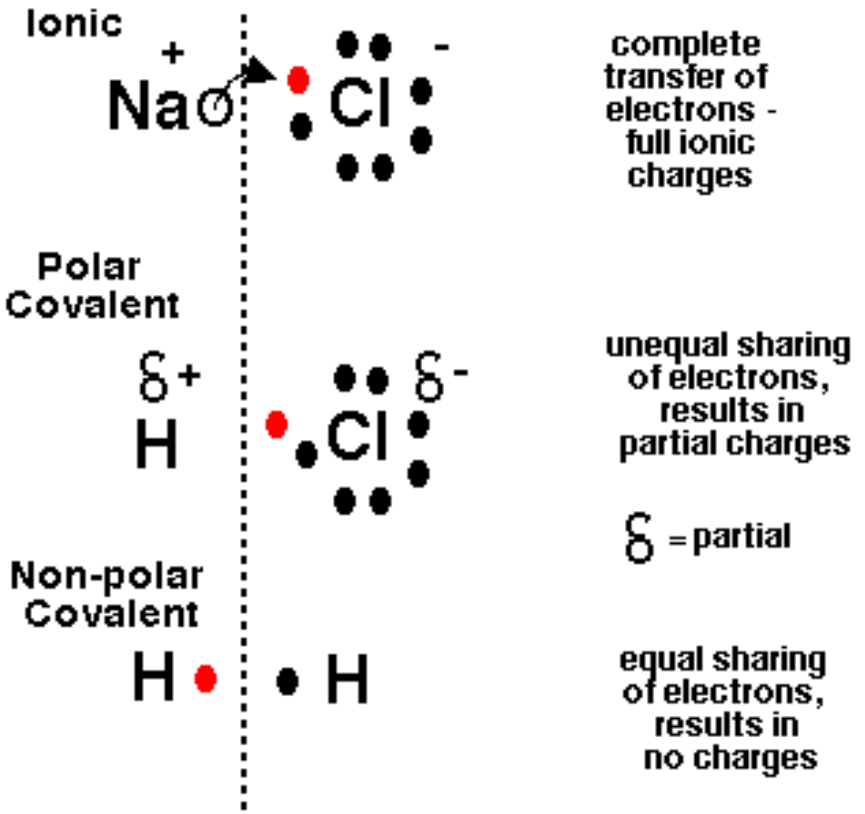
Comparison of Ionic, Polar, and Non-Polar Bonding



Complete tranfer of electrons	Unequal sharing of electrons	Equal sharing of electrons
Full Ionic Charges	Partial Ionic Charges	No Charges
$Na^{+}Cl^{-}$	$H^{\delta+}Cl^{\delta-}$	H - H
metal + non-metal	two different non-metals	two identical non-metals

C. Ophardt, c. 2003

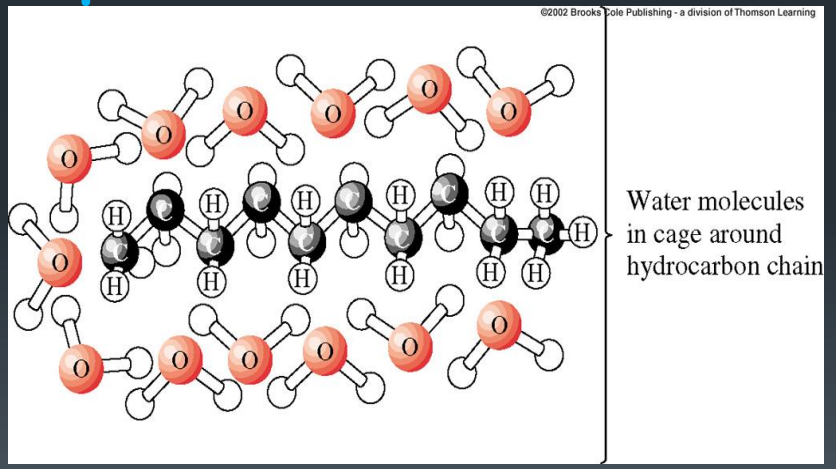
Comparison of Bonding



C. Ophardt, c. 2003

Bond Polarity and physical properties

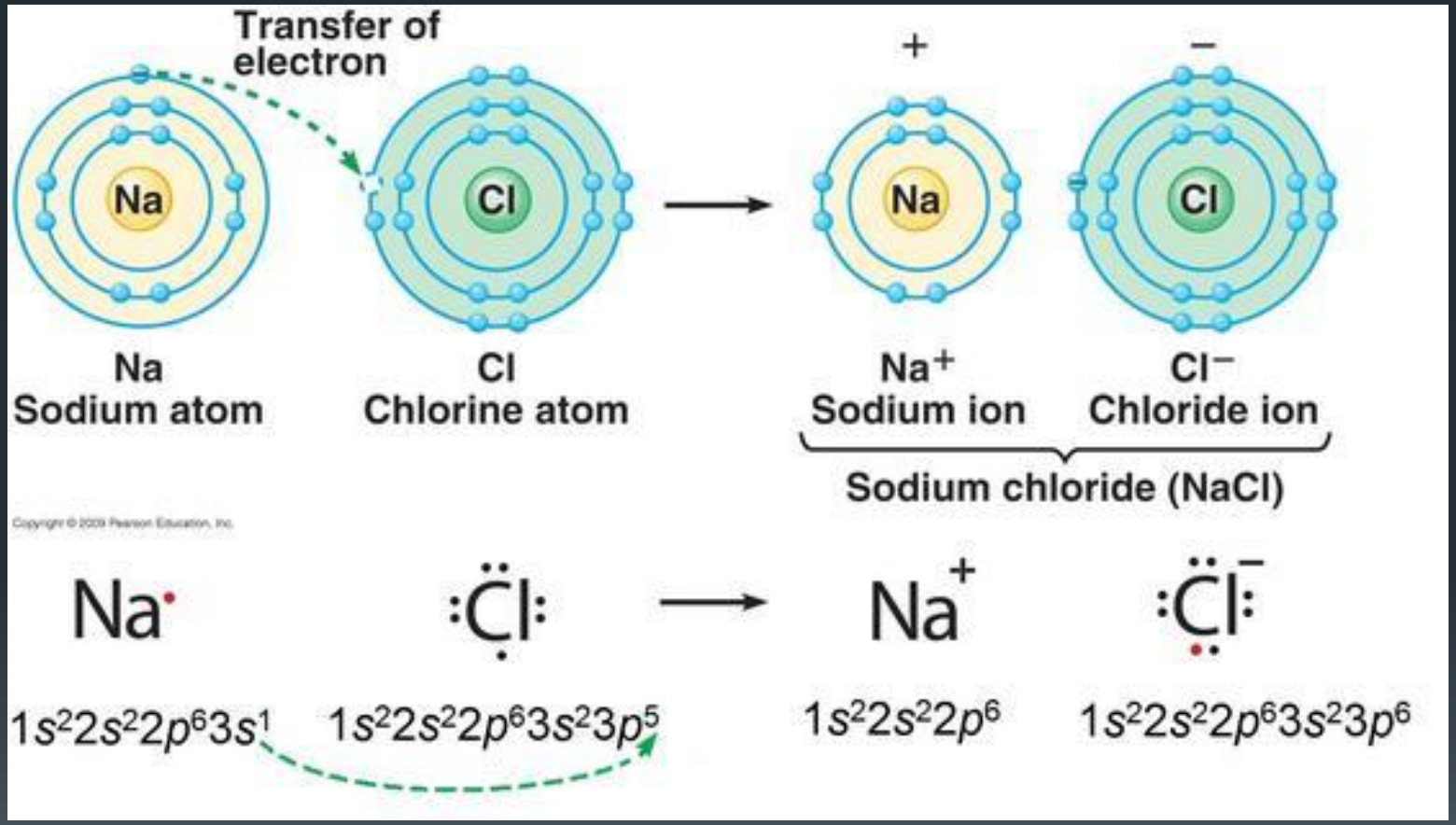
- This is why oil and water will not mix! Oil is nonpolar, and water is polar.



- "Like Dissolves Like"
- Polar dissolves Polar
- Nonpolar dissolves Nonpolar

General Properties of Ionic Compounds

- Ionic compounds are formed when one atom gains a valence electron from a different atom, forming a negative ion (anion) and a positive ion (cation) respectively. These oppositely charged ions are attracted to each other, forming an ionic bond. Therefore ionic bonds are usually between metals and nonmetals ; opposite ends of the periodic table.
- They do not exist as separate molecules . Rather, they form ionic solids, three dimension networks in which each cation is surrounded by anions and each anion is surrounded by cations.
- They have high melting and boiling points and this ionic compounds are generally soluble in water and other polar solvents
- Ionic compounds are good conductors of electricity in the solutions or in their molten states.



Sodium lets Chlorine use its valance electron

Thank You for your kind attention !

Questions?

Comments