INTRODUCTION + ELECTRONEGATIVITY

Three main types: ↳ CHEMICAL BONDING

1. Ionic
2. Metallic
3. Covalent
   i) Polar Covalent
   ii) Non-Polar Covalent

Important Terminology:

1. Electronegativity
2. Polarity
   i) Dipoles
   ii) Partial Charges
   iii) Lone pairs

Electronegativity:

- The electronegativity of an element is the relative ability of each of its' atoms to attract the electrons of a covalent bond towards itself

- It is measured on the Pauling Scale, where 0 is the least electronegative and 4 is the most electronegative

Some quick facts:

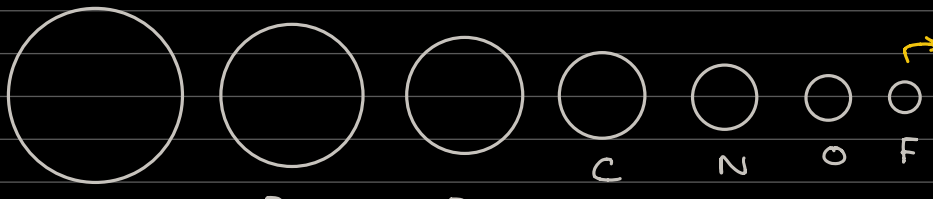
- Fluorine is the most electronegative atom
- Non-metals in general are more electronegative (smaller atomic radius)
- Metals in general are less electronegative (greater atomic radius)

Factors that determine the electronegativity of an element:

1. Atomic Radius
2. Nuclear Charge

- Atomic radius decreases across a period, as new electrons enter the same energy level and hence experience roughly the same shielding effect but a stronger effective nuclear force due to more protons in the nucleus

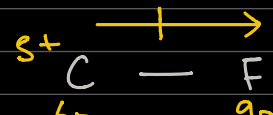
- For example, period 2:



→ F has the most protons, hence the greatest nuclear charge and is also the smallest and therefore, has the greatest charge density, the deciding factor which determines electronegativity

→ Atomic radius decreases across the period

Example: A C-F bond



- Since F has a higher charge density, a greater nuclear charge, and a smaller atomic radius, it pulls the electrons involved in the covalent bond towards itself

↓

Therefore, electrons exist closer to the F nucleus than the C nucleus

- As a result, F develops a partial negative charge (δ^-) and C develops a partial positive charge (δ^+)

Note: ⟶ represents the direction in which the pair of electrons in the covalent bond are attracted / pulled towards

Separation of charge refers to the attraction of electrons towards one end of a molecule, leading to the formation of a dipole

- If a dipole exists in a molecule, then that molecule is polar and accordingly, if there is no dipole, the molecule is non-polar

Pauling Scale values of some common elements:

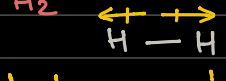
Fluorine	4.0	Lithium	1.0
Oxygen	3.5	Carbon	2.5
Chlorine	3.0	Hydrogen	2.1
Nitrogen	3.0	Caesium	0.7

- Generally speaking, if the difference in electronegativity is greater than 2.0, then the bond can be considered ionic

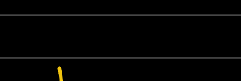
- Similarly, for covalent bonds, the difference in electronegativity is usually less than 1.0

Note: Although individual bonds may be polar, there may still be no overall charge on the molecule, as the shape of the molecule might be such that the dipoles cancel out
↳ However, it is also possible that the shape might be such that dipoles are reinforced

Some common molecules, their dipoles, and their polarity:



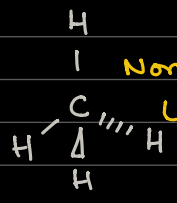
dipoles cancel out, hence non-polar



dipole towards F, hence polar

dipoles cancel out, hence non-polar

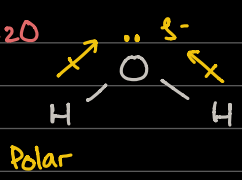
CH_4



Non-polar

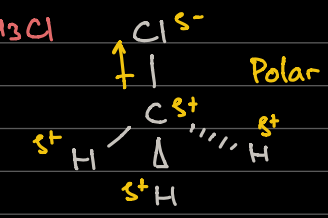
(All C-H bonds are non-polar)

H_2O



Polar

CH_3Cl



Polar

Note: Lone pairs and non-bonding electrons do affect the polarity of a molecule

↳ They not only act as areas of negative charge to add to the δ^- nature of some atoms, but they can also influence the bond angles and the symmetry of a molecule, leading to dipoles not cancelling each other out and the molecule being polar