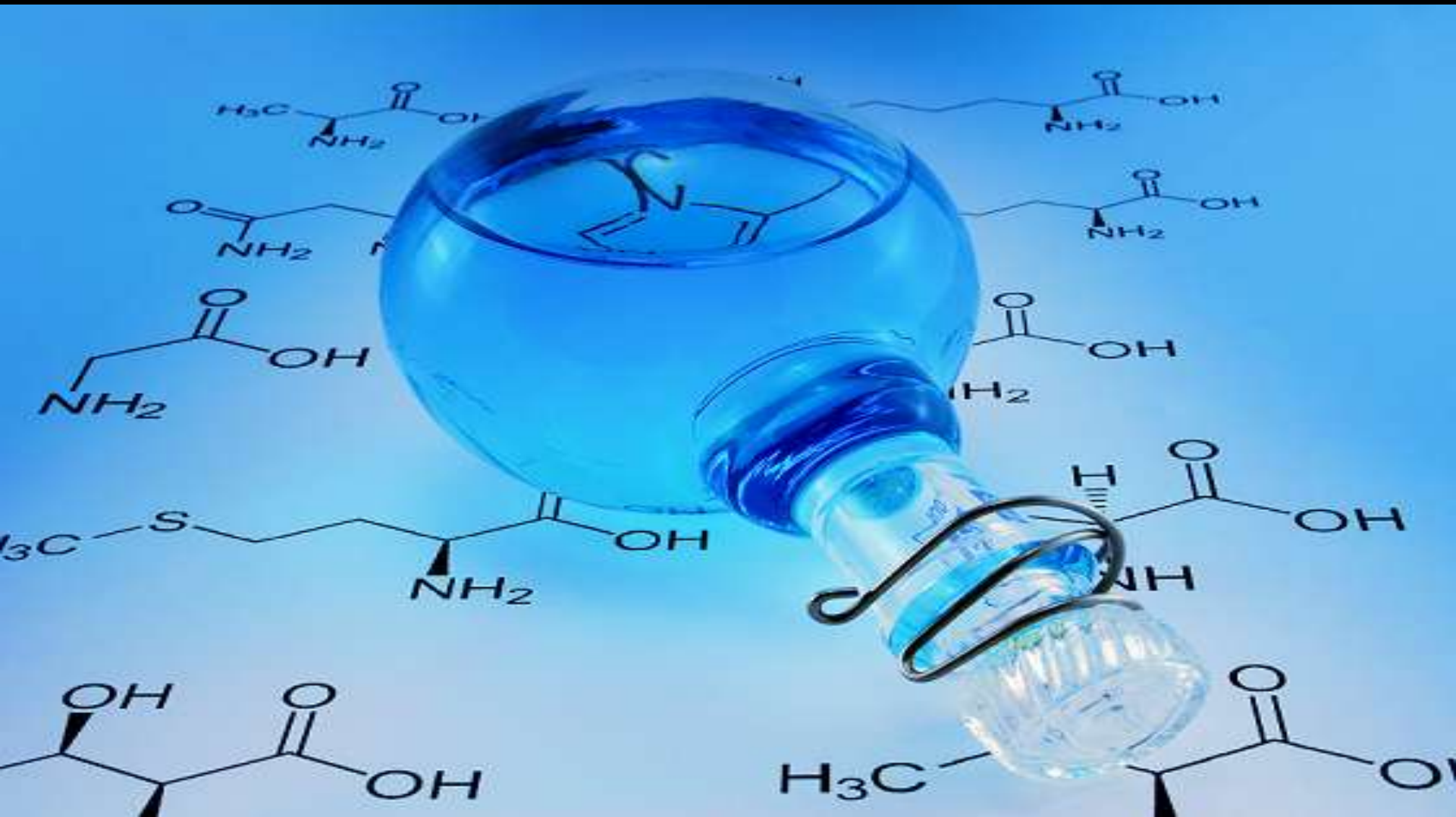
ORGANIC CHEMISTRY



INTRODUCTION

- **Organic** chemistry is the chemistry of carbon, an element that forms strong chemical bonds to other carbon atoms as well as to many other elements like hydrogen, oxygen, nitrogen, and the halogens. Because of its versatility in forming covalent bonds, more than a million carbon compounds are known. Many are composed of only carbon and hydrogen, collectively called **hydrocarbons**.

BASICS CONTENT OF ORGANIC CHEMISTRY

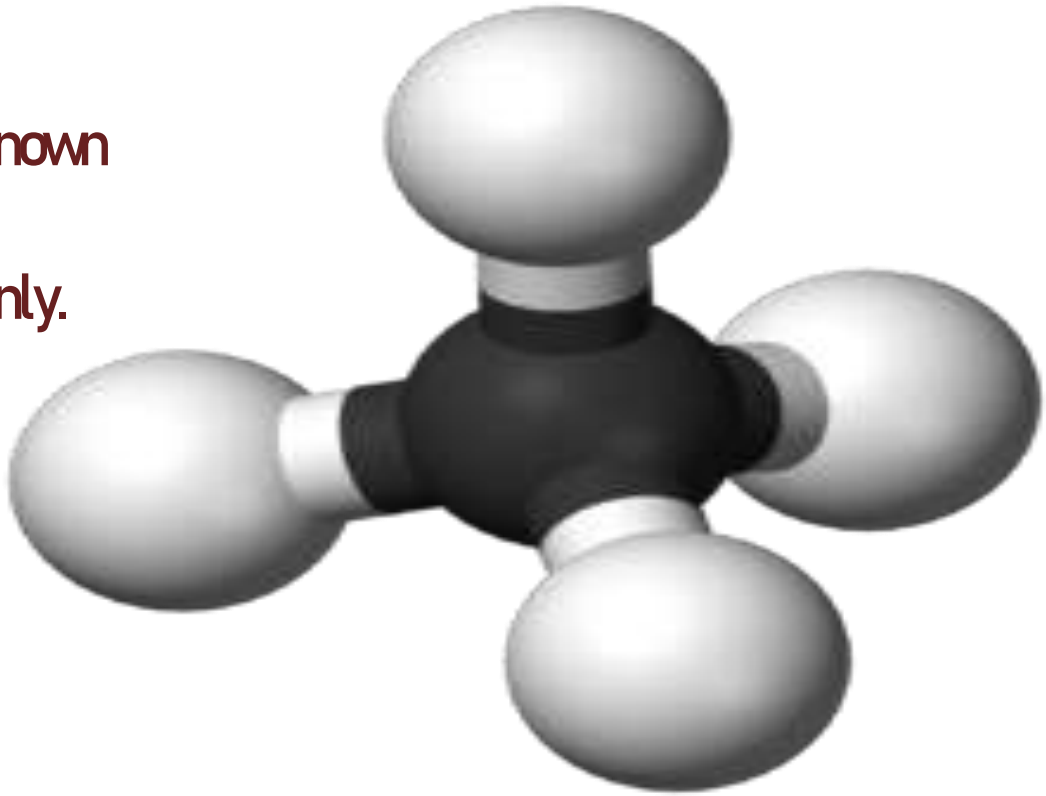
- HYDROCARBONS
- INDUCTIVE EFFECT
- HYPERCONJUCATION
- ELECTROMERIC EFFECT
- RESONANCE
- FORMAL CHARGE
- HYBRIDISATION
- HYDROGEN BONDING
- BOND LENGTH

HYDROCARBONS

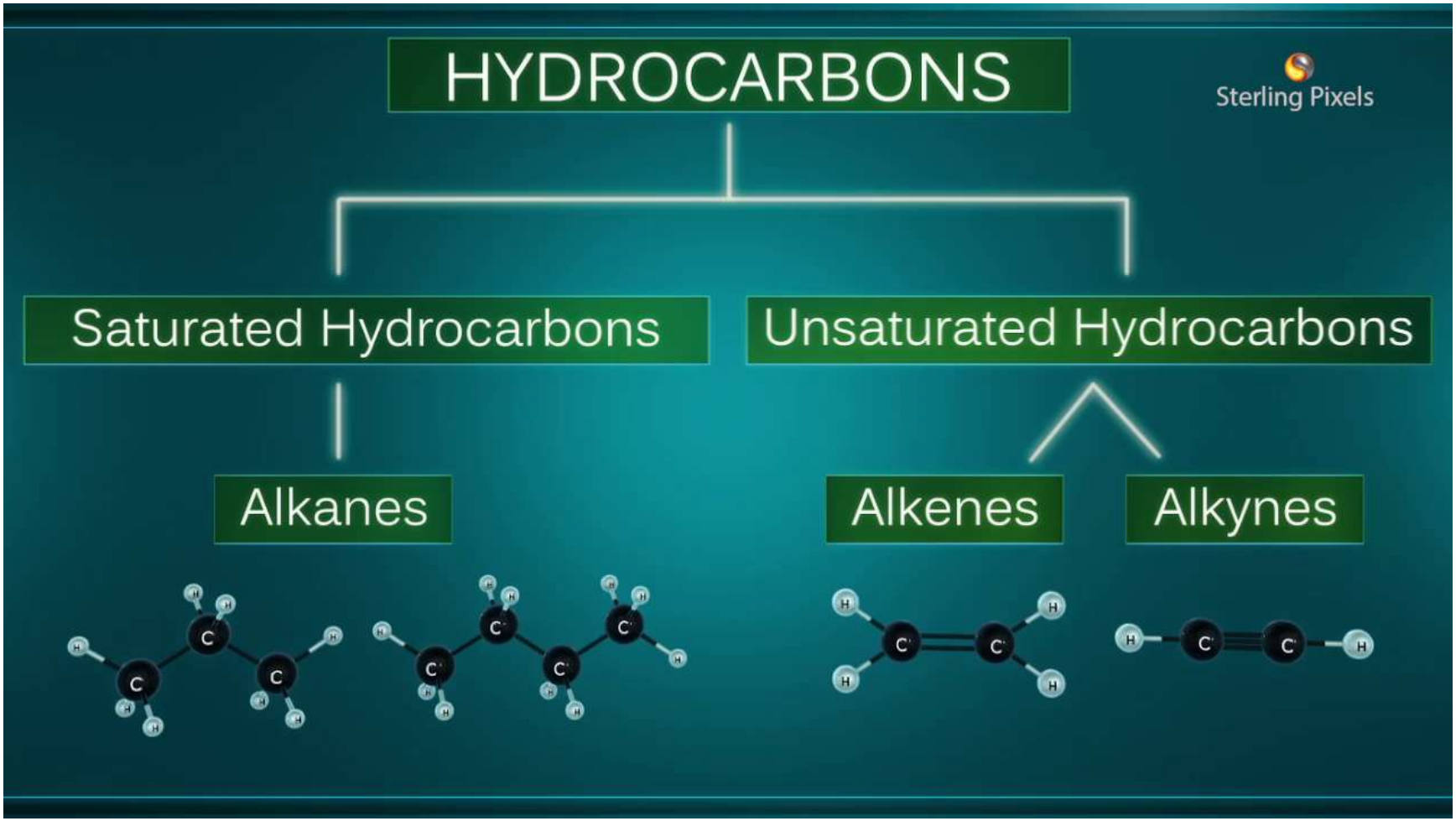
- In organic chemistry, a **hydrocarbon** is an organic compound consisting of hydrogen and carbon.
- Hydrocarbons are examples of group 14 hydrides. Hydrocarbons, from which, one hydrogen atom has been removed are functional groups called **hydrocarbyls**.
- Because carbon has 4 electrons in its outermost shell (and because each covalent bond requires a donation of 1 electron, per atom, to the bond) carbon has exactly four bonds to make, and is only stable if all 4 of these bonds are used.
- Aromatic hydrocarbons (arenes), alkanes, cycloalkanes and alkyne-based compounds are different types of hydrocarbons

BALL AND STICK MODEL OF METHANE

Methane is part of a homologous series known as the alkanes, which contain single bonds only.



TYPES OF HYDROCARBON



INDUCTIVE EFFECT

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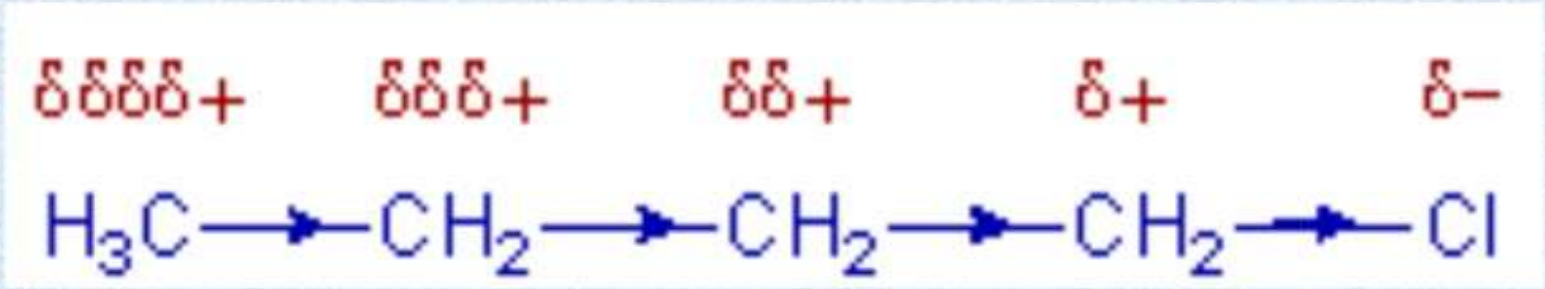
The polarization of a σ bond due to electron withdrawing or electron donating effect of adjacent groups or atoms is called inductive effect.



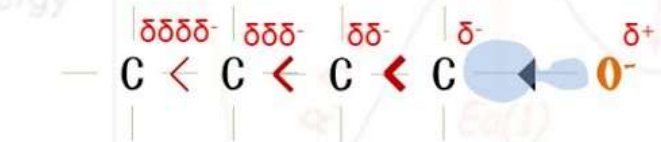
TYPES

Inductive Effect

Electronic Effect
Reaction Mechanism

-I Effect (minus I effect)

Pulling Electrons



+I Effect (plus I effect)

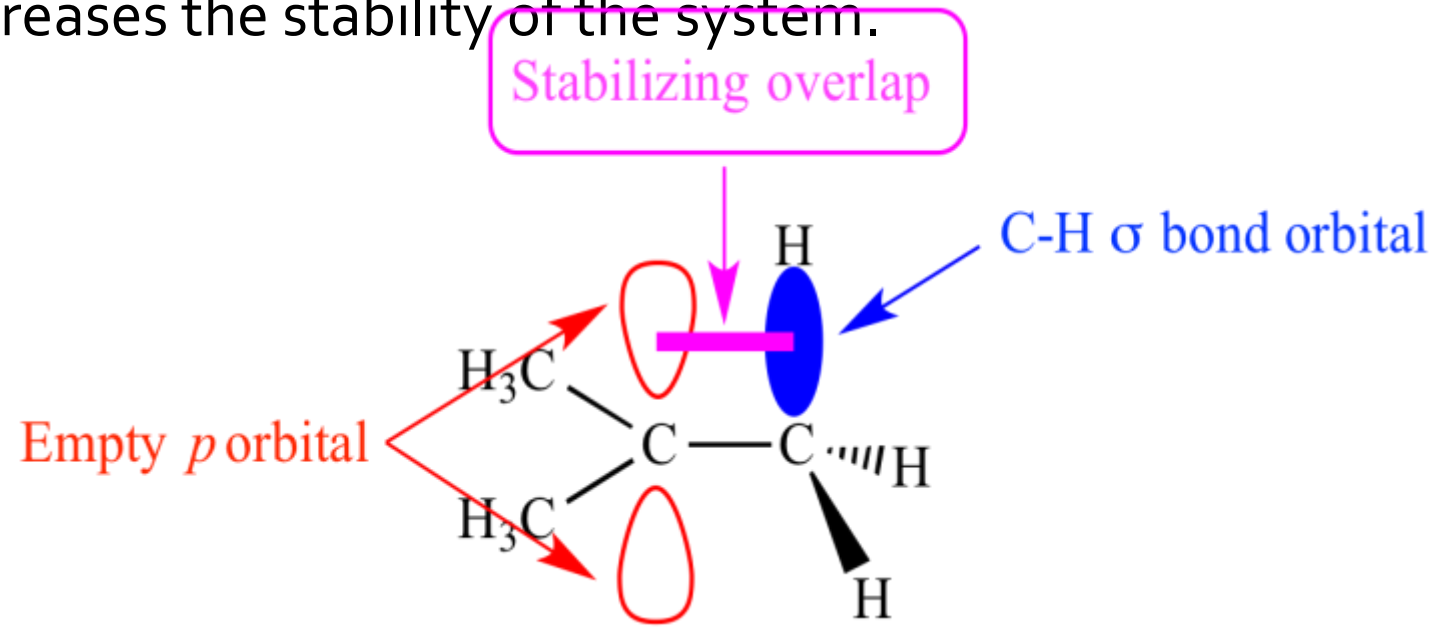
Pushing Electrons

- Polarization transmission along **Sigma Bond**
- **Polarization gets weaker** as it reaches atoms farther away
- Inductive force is weaker compared to Mesomeric as it is transferred through Sigma bond in a linear manner

H 2.1																	
Li 1.0	Be 1.5											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	
Na 0.9	Mg 1.2											Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	

HYPERCONJUGATION

- **Hyperconjugation** is the stabilising interaction that results from the interaction of the electrons in a σ-bond (usually C-H or C-C) with an adjacent empty or partially filled p-orbital or a π-orbital to give an extended molecular orbital that increases the stability of the system.

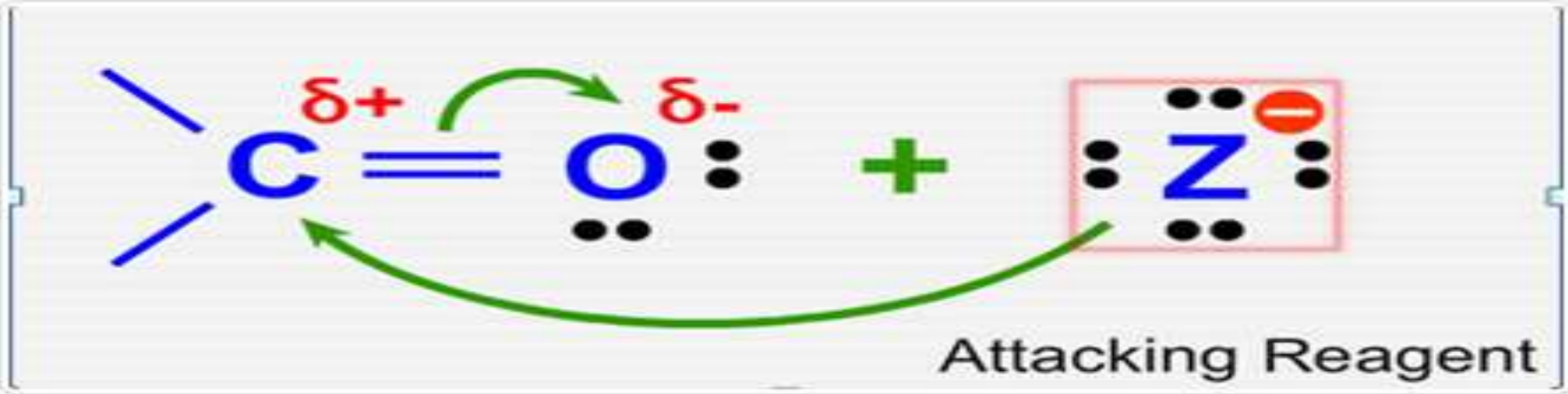


STABILITY

- Hyperconjugation generally depends on number of alpha hydrogens.
- More number of alpha hydrogens more will be the stability.

ELECTROMERIC EFFECT

- **Electromeric effect** refers to a molecular polarizability **effect** occurring by an intramolecular electron displacement characterized by the substitution of one electron pair for another within the same atomic octet of electrons in the presence of an attacking reagent.

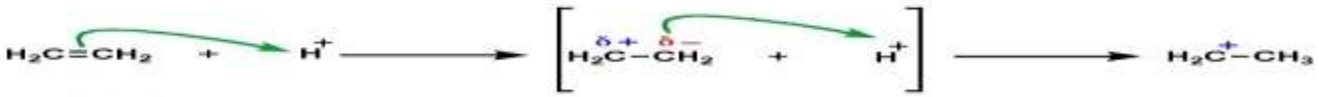


TYPES

+E EFFECT

If the attacking species is an electrophile, the π electrons are transferred towards the positively charged atom. This is the +E effect.

An example is the protonation of ethene. When the H^+ comes near the double bond, the bond is polarized towards the proton.



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−E EFFECT

If the attacking reagent is a nucleophile, the electrons are transferred away from the attacking reagent and into the π system. This is the −E Effect.

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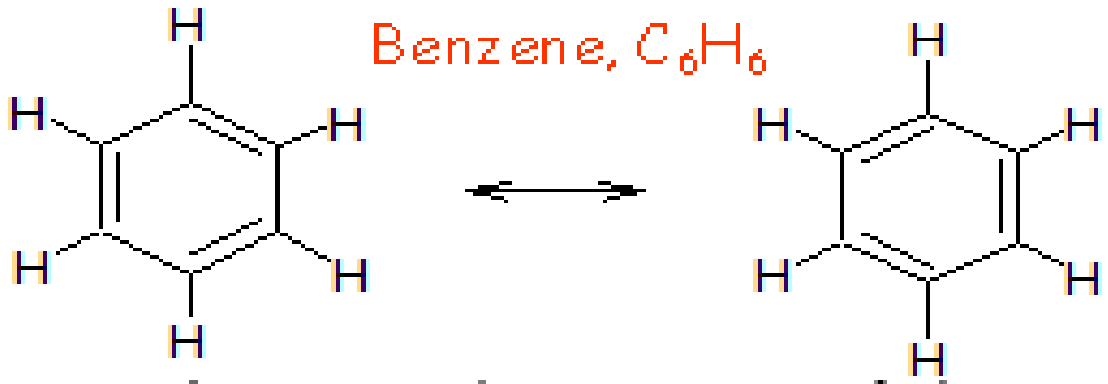
The term "electromeric effect" is somewhat outdated. We are more likely now to use words like "Use curved arrow notation to show the movement of electrons during the reaction".

RESONANCE

Resonance

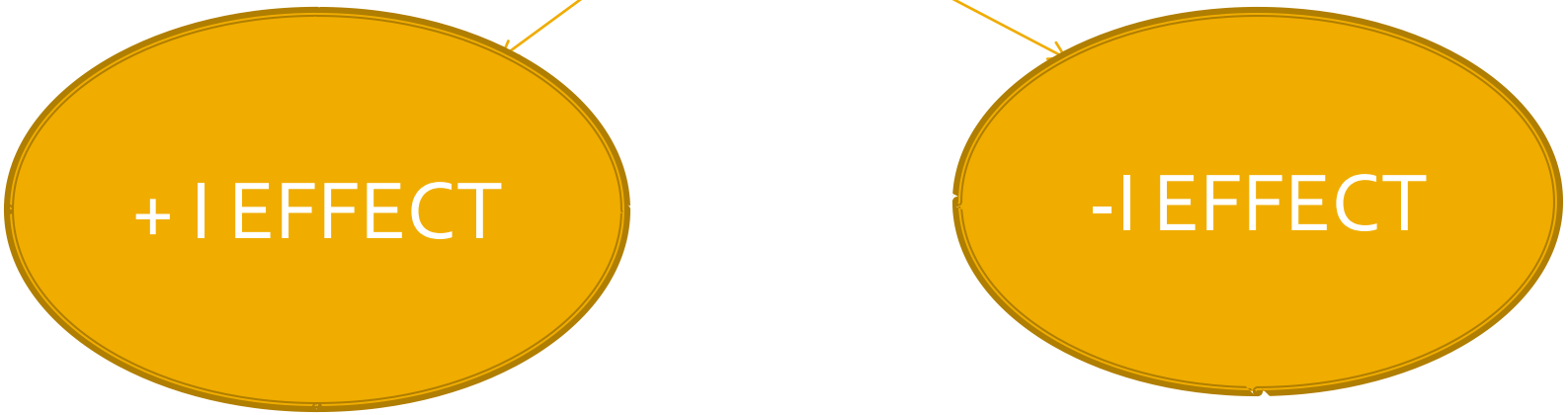
- Resonance is invoked when more than one valid Lewis structure can be written for a particular molecule.



- The actual structure is an average of the resonance structures.
- The bond lengths in the ring are identical, and between those of single and double bonds.

TYPES

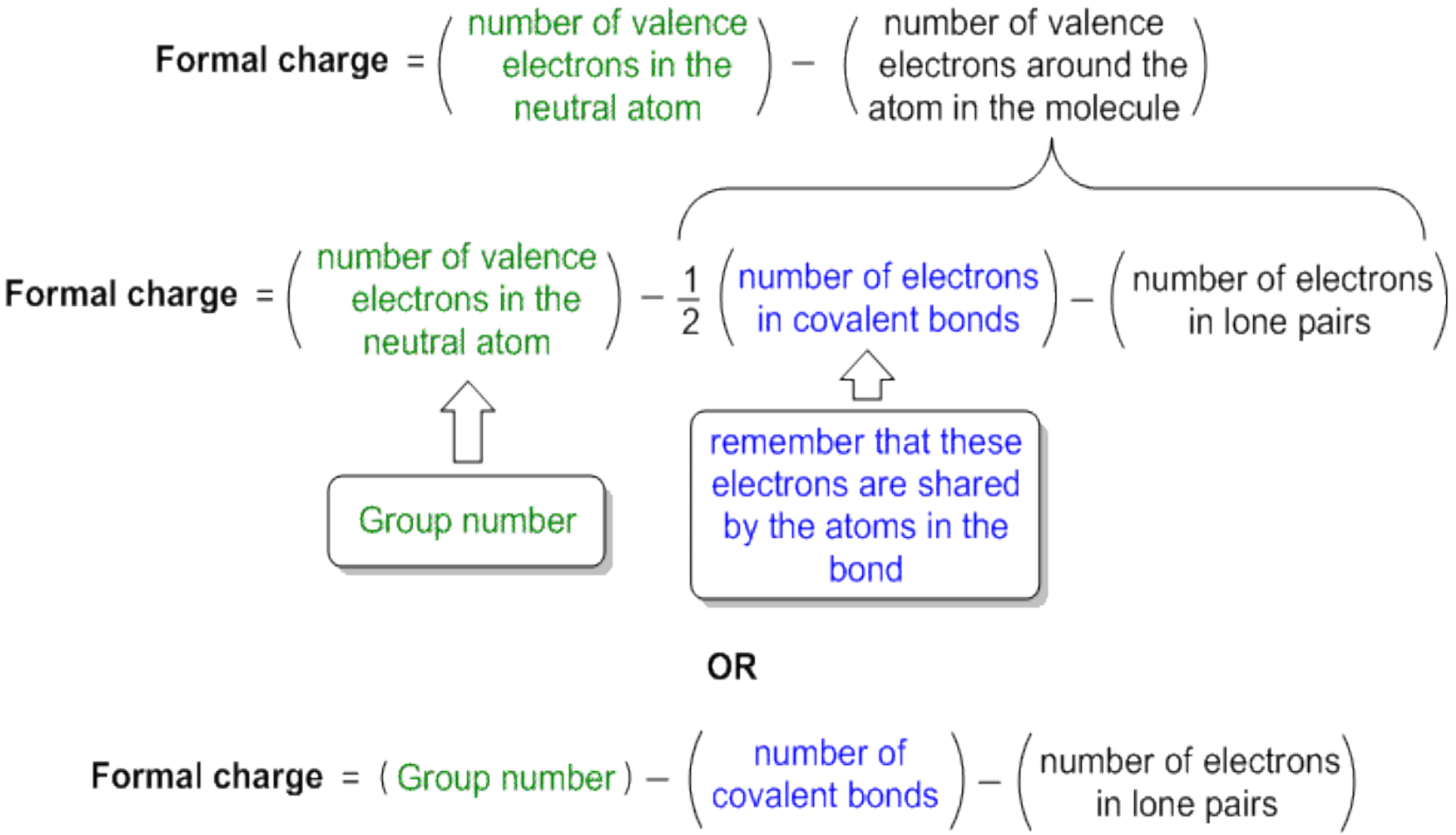
- Resonance effect



In which electron donating groups are present

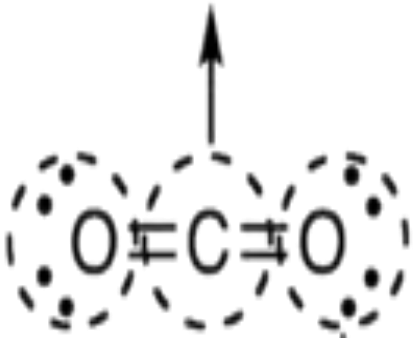
In which electron withdrawing groups are present

FORMAL CHARGE



EXAMPLE

4 – 4 = 0 = formal charge on C



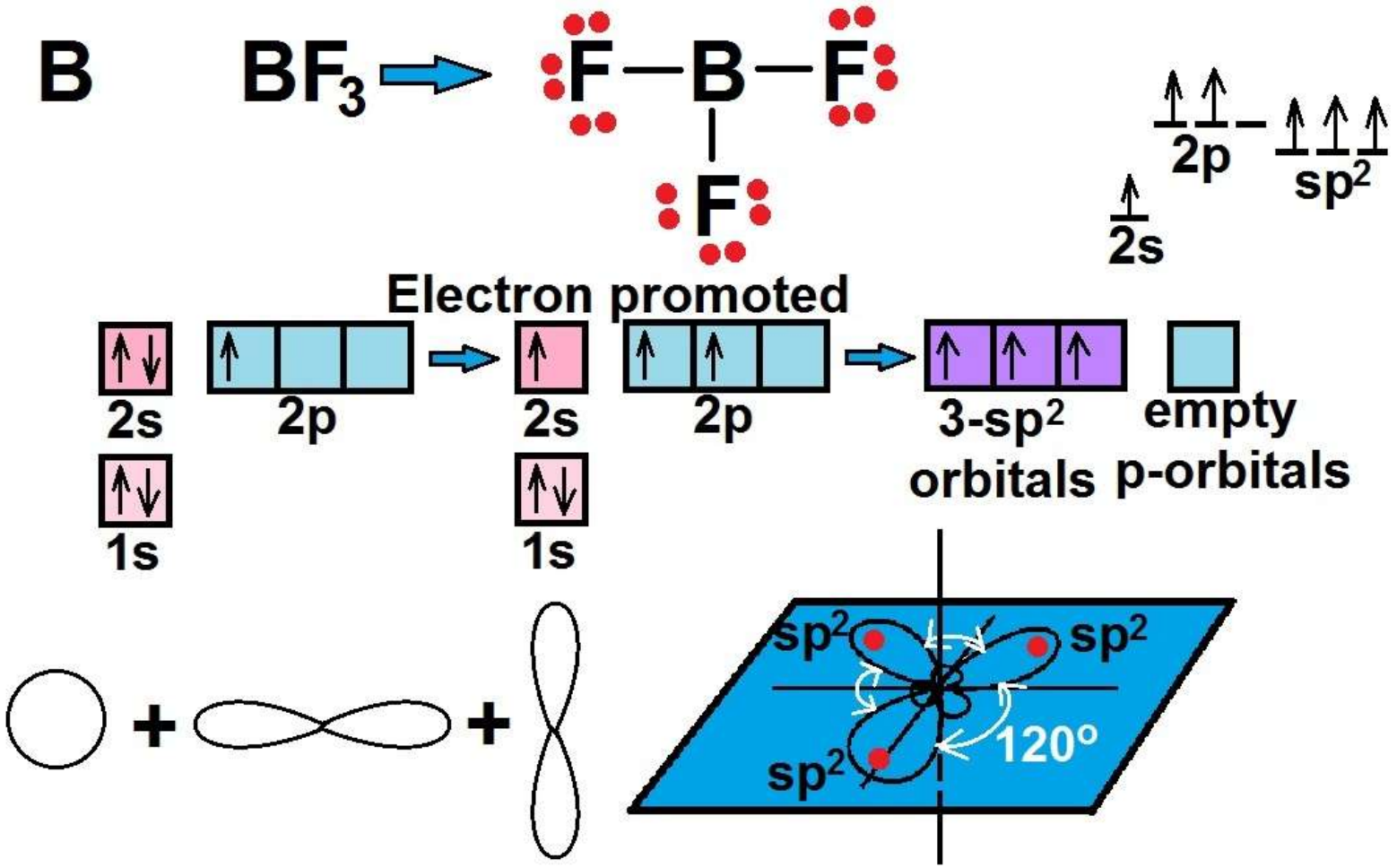
6 – 6 = 0 = formal charge on O

6 – 6 = 0 = formal charge on O

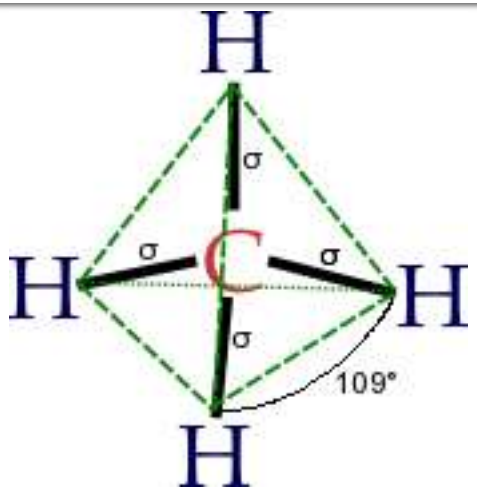
HYBRIDIZATION

- In chemistry, **orbital hybridisation** is the concept of mixing atomic orbitals into new *hybrid orbitals* (with different energies, shapes, etc., than the component atomic orbitals) suitable for the pairing of electrons to form chemical bonds in valence bond theory. Hybrid orbitals are very useful in the explanation of molecular geometry and atomic bonding properties and are symmetrically disposed in space.

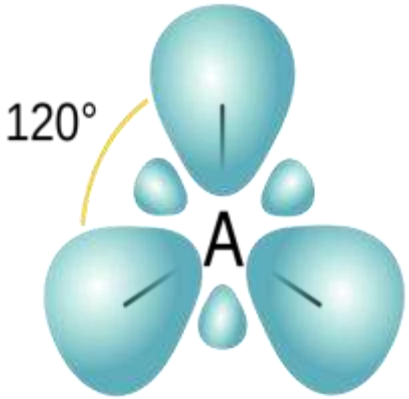
HYBRIDIZATION



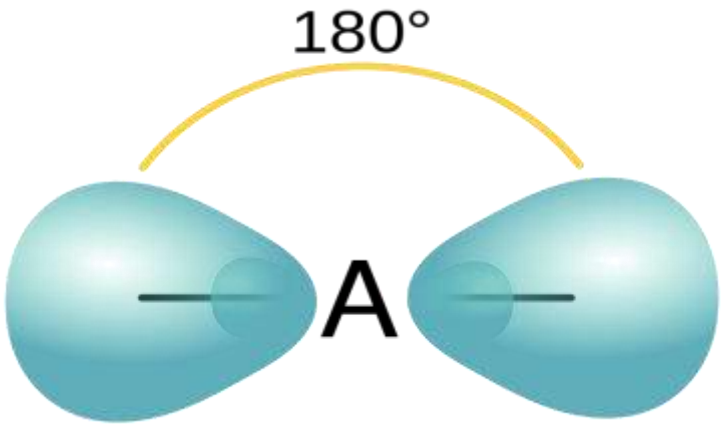
TYPES



Sp3



Sp2

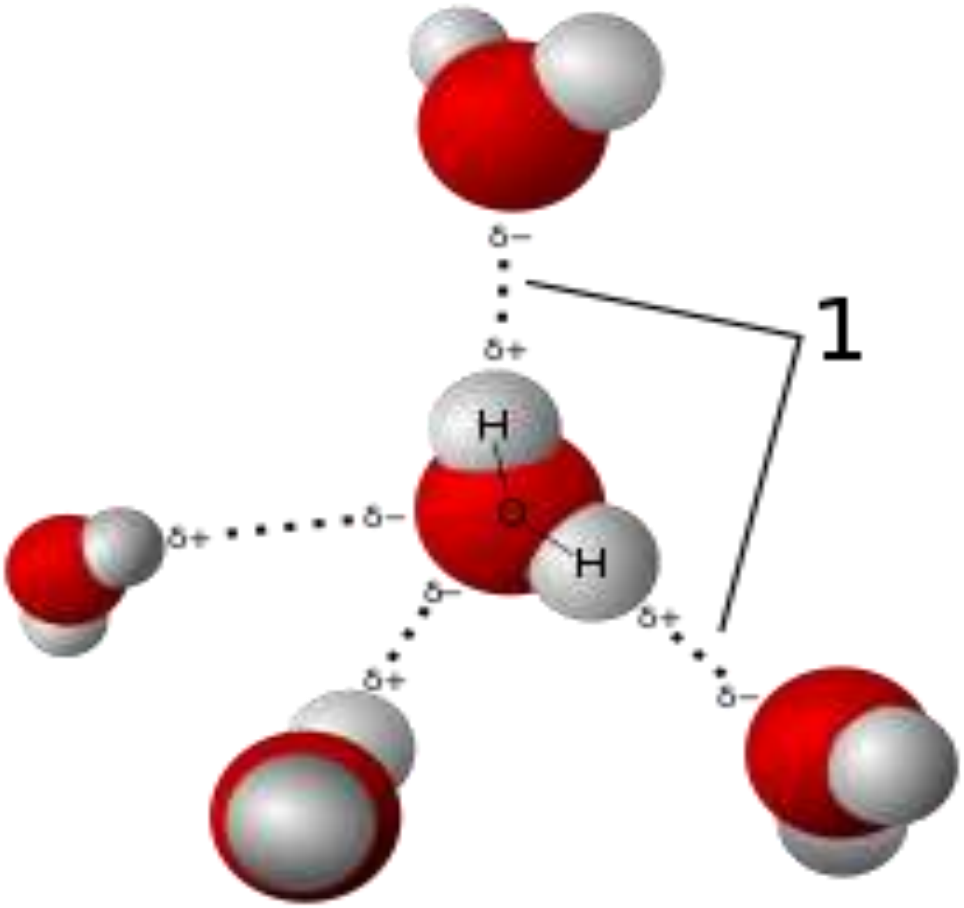


Sp

HYDROGEN BONDING

- A **hydrogen bond** (often informally abbreviated H-**bond**) is a primarily electrostatic force of attraction between a **hydrogen**(H) atom which is covalently bound to a more electronegative atom or group, particularly the second-row elements nitrogen (N), oxygen (O), or fluorine (F)—the **hydrogen bond** donor (Dn)—and another …

REPRESENTATION



TYPES

1. INTERMOLECULAR
2. INTRAMOLECULAR

BOND LENGTH

- The **length** of the **bond** is determined by the number of bonded electrons (the **bond** order). The higher the **bond** order, the stronger the pull between the two atoms and the shorter the **bond length**. Generally, the **length** of the **bond** between two atoms is approximately the sum of the covalent radii of the two atoms.

BOND LENGTH