

CONCEPT
MAP

GENERAL ORGANIC CHEMISTRY
(ISOMERISM AND ELECTRON
DISPLACEMENT EFFECTS)

The concept of isomerism illustrates the fundamental importance of molecular structure and shape in organic chemistry while the electron displacement through covalent bonds determines the polarity of molecules which helps to understand their physical and chemical properties.

ISOMERISM

The phenomenon of existence of two or more compounds having the same molecular formula but different chemical and physical properties is called isomerism.

Tautomerism

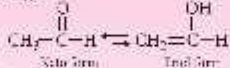
Compounds exist in dynamic equilibrium with each other.

- Arises due to migration of a hydrogen atom from one polyvalent atom to the other within the same molecule.

- In *dyad system*, H-atom oscillates between two polyvalent atoms linked together e.g.,

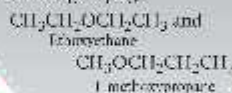


In *trial system*, H atom migrates from first polyvalent atom to third polyvalent atom within the same molecule e.g.,



Metamerism

Compounds differ in the nature of alkyl groups attached on either side of the same functional group e.g.,



Ring Chain Isomerism

Compounds differ in the mode of linkage of C atoms e.g., C_4H_8 , $\text{CH}_2=\text{CH}_2$ and

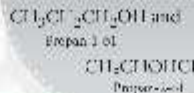


Structural Isomerism

Arises when compounds have same molecular formula but different structures.

Chain or Nuclear Isomerism

Compounds differ in the nature of the carbon chain e.g.,



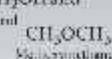
Position Isomerism

Compounds differ in the position of multiple bond or functional groups e.g.,



Functional Isomerism

Compounds differ in the nature of the functional group e.g., $\text{C}_4\text{H}_8\text{O}$ and



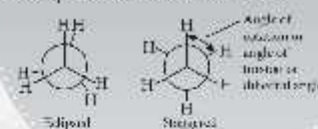
Optical Isomerism

Isomers differ only in behaviour towards the plane polarised light.

- Isomer which rotates the plane polarised light to the right is called *dextrorotatory*.
- Isomer which rotates the plane polarised light to the left is known as *levorotatory*.

Conformational Isomerism

Isomers differ in relative arrangements of the atoms in space which result through rotation about a single bond e.g., staggered and eclipsed conformations of ethane.



Stereoisomerism

Arises when compounds have similar molecular formula and structural formula but differ in spatial arrangement of atoms or groups.

Inductive Effect

Displacement of σ -electrons along a saturated carbon chain whenever an atom of different electronegativity is present at the end of the chain is called inductive effect.

- The atom or group which has tendency to withdraw electrons towards itself is said to have *-I effect*.
- The atom or group which has tendency to repel electrons away from it is said to have *+I effect*.

Electromeric Effect

Complete transfer of electrons of a multiple bond to one of the bonded atoms in presence of an attacking reagent is called electromeric effect.

- If the electrons are transferred towards the attacking reagent, the effect is called *+E effect*.
- If the electrons are transferred away from the attacking reagent, the effect is called *-E effect*.

Geometrical Isomerism

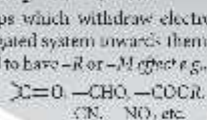
Isomers differ in the arrangement of atoms or groups in space due to hindered rotation around the double bond e.g.,



Resonance or Mesomeric Effect

The flow of electrons from one part of the conjugated system to the other as a result of interaction between two π bonds or a π bond and lone pair of electrons.

- Groups which donate electrons to the double bond or to a conjugated system are said to have *+R* or *+M effect* e.g., OH , OR , SH , SR , NH_2 , NHR , NR_2 , Cl , Br , I , etc.
- Groups which withdraw electrons from a conjugated system towards themselves are said to have *-R* or *-M effect* e.g.,



ELECTRON
DISPLACEMENT
EFFECTS

Hyperconjugation Effect

Delocalisation of σ electrons through overlapping of p -orbitals of a double bond with σ -orbital of the adjacent single bond is called hyperconjugation.

- The effect decreases with decrease in number of α -hydrogens i.e., $-\text{CH}_2 > -\text{CH} > -\text{C}(\text{CH}_3)_2 > -\text{C}(\text{CH}_3)_3$