SEMESTER – I
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FUNDAMENTALS OF ORGANIC CHEMISTRY

Electronic Displacements :

In organic reactions the displacement of electrons may be :–

[a] Temporary and
[b] Permanent

[a] Temporary :– [Time variable]

These are brought about only at the demand of the attacking reagent or come into play prior to reaction and also called polarisability effects. These are two types :–

[1] Inductomeric effect
[2] Electromeric effect

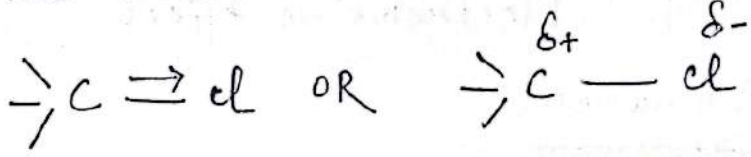
[b] Permanent :–

The displacements are products within the molecule due to presence of specific substituents of linkage in it. Such displacements are called polarisation effects. These are as follows –

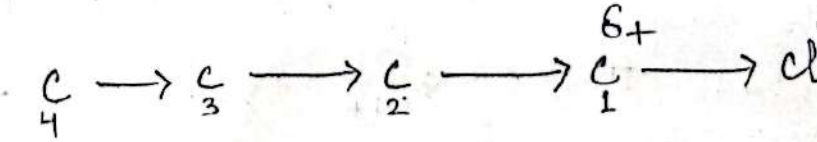
[1] Inductive effect
[2] Mesomeric OR Resonance effect
[3] Hyperconjugation OR Baker – Nathan [1935] OR No bond Resonance effect.

[1] INDUCTIVE EFFECT

This is a permanent effect operating in a polar covalent bonds. In a single covalent bond between two atoms of different electronegativities, the more electronegative atom draws the electron pair of σ-bond towards itself and acquires a larger share in it. Thus in C–Cl bond, the electronegative chlorine pulls the electrons towards itself causing an electric dipole with negative end on chlorine and positive end on carbon. If this carbon-chlorine bond forms the terminal of a carbon chain, the effect of this electron displacement gets relayed to other carbon atom in the chain.



"This displacement of electrons of a σ-bond is known as Inductive displacement or Transmission effect"



[OR "Inductive effect may be defined as the permanent displacements of electrons forming a covalent bond towards the more electronegative element or group."]

The positive charge on carbon one (C_1) attracts the electron pair bonding C_1 and C_2. This will also causes C_2 to acquire a small positive charge, but this charge on C_2 will be smaller than that of C_1. Similarly C_3 will acquire a positive charge that will be still smaller.

This effect can be relayed still further although it would decrease in intensity considerably.

"This process of electron shift along a chain of atom due to the presence in it of a polar covalent bond is called Inductive effect OR Transmission effect OR Inductive displacement."

The effect becomes progressively weaker as the number of bond distance increases.

Sign of Inductive effect :

Such effect may be either electron withdrawing or electron releasing
(−) (+)

a] **−I effect** : $R_2\overset{R}{\underset{|}{N}}^{+} > -NO_2 > -CN > -COOH >$

$-F > -Cl > -Br > -I > -COOR > -OR >$

$-OH > Ar > -SO_2R > -CH=CH_2$, etc.

b] **+I effect** : $-O^- > -COO^- > CR_3 >$

$-CHR_2 > -CH_3 >$ etc.