

The Landscape of Electronic Displacement

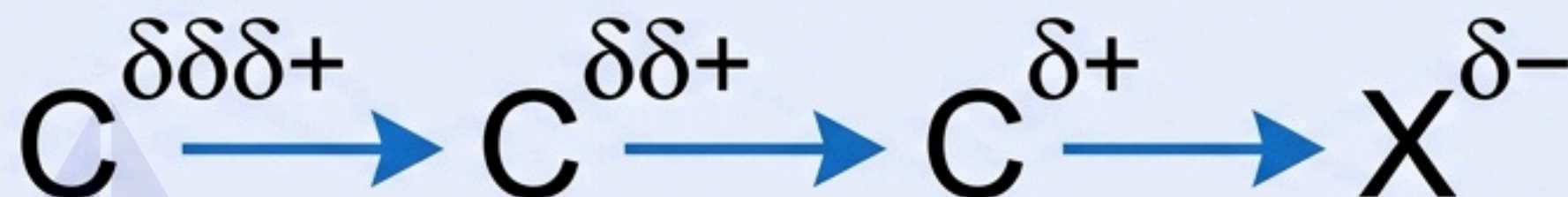
How electron density shifts within covalent bonds to drive organic reaction mechanisms.

In organic molecules, electron displacement occurs either in the ground state (built-in) or under the influence of an attacking reagent. This dictates all chemical reactivity.



The Inductive Effect (I-Effect)

The permanent polarization of a σ -bond due to electronegativity differences.



Electron density shifts along σ -bonds towards the more electronegative atom (X). The effect is distance-dependent and decays rapidly, becoming negligible after three carbon atoms.

Electron Withdrawing (-I)

Atom or group draws σ -electrons away from the carbon chain.

High-Yield Trend (Decreasing order):



Electron Donating (+I)

Atom or group pushes σ -electrons into the carbon chain.

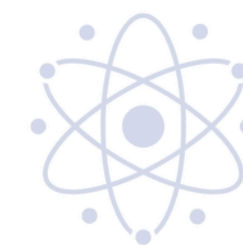
High-Yield Trend (Decreasing order):





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$$E=mc^2$$



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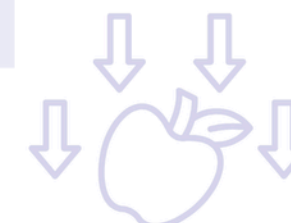
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The Resonance Effect (R-Effect)

The permanent delocalization of π -electrons or lone pairs across a conjugated system.

Polarity produced by the **interaction** of **two π -bonds** or between a π -bond and a **lone pair of electrons** present on an adjacent atom.

Positive Resonance (+R)

Transfer of electrons is away from the atom or substituent group attached to the conjugated system.

Creates centers of high electron density at specific positions (e.g., ortho/para positions in benzene).

Key Functional Groups

**-OH, -OR, -SH, -NH₂, -NHR, -NR₂,
-NHCOR, -Halogens**

Negative Resonance (-R)

Transfer of electrons is towards the atom or substituent group attached to the conjugated system.

Decreases overall electron density in the conjugated system (deactivates the ring).

Key Functional Groups

-COOH, -CHO, >C=O, -CN, -NO₂

The Electromeric Effect (E-Effect)

A temporary, complete transfer of shared π -electrons triggered by an attacking reagent.

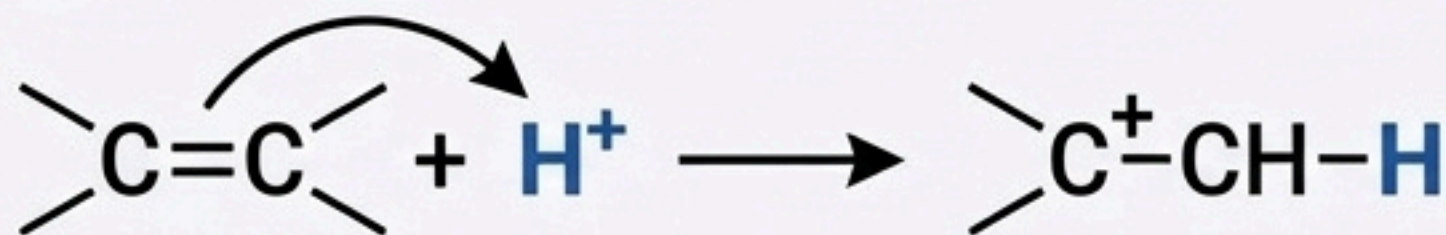
The Trigger Condition

Operates ONLY in organic compounds having multiple bonds (double or triple). The effect instantly vanishes when the attacking reagent is removed from the reaction domain.

Positive Electromeric (+E)

Mechanism: π -electrons of the multiple bond are transferred to the atom to which the reagent gets attached.

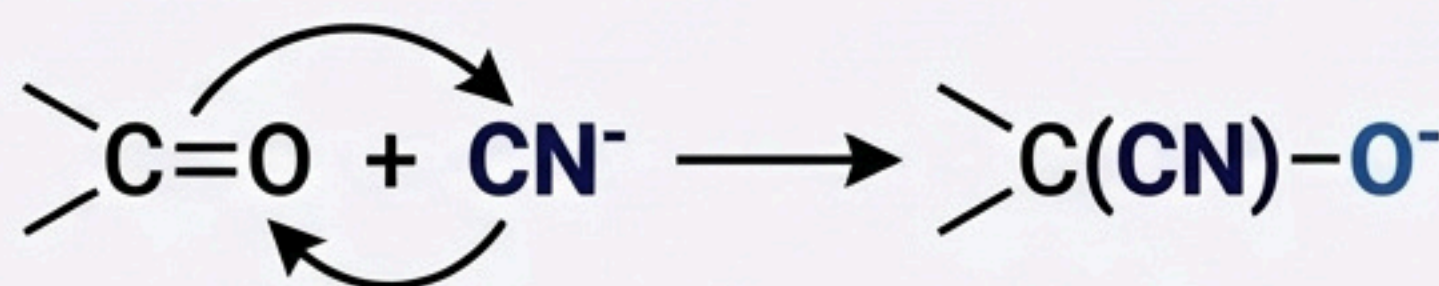
Trigger: Typically initiated by an Electrophile (e.g., H^+).



Negative Electromeric (-E)

Mechanism: π -electrons of the multiple bond are transferred to the atom to which the reagent does not get attached.

Trigger: Typically initiated by a Nucleophile (e.g., CN^-).



JEE Revision Frame: Electronic Effects

High-yield comparative matrix for rapid visual recall and exam synthesis.

Effect	Nature & Cause	Electron Type	Key Characteristics
Inductive (I)	Permanent; Electronegativity diff.	σ (sigma) electrons	Distance-dependent; Decays rapidly; Alkyls (+I), Halogens/Nitro (-I)
Resonance (R)	Permanent; Conjugation	π (pi) electrons & Lone pairs	Distance-independent; Creates specific electron-rich/poor centers; Delocalization
Electromeric (E)	Temporary; Attacking reagent	π (pi) electrons	Requires multiple bonds; Vanishes when reagent is removed; Complete transfer



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