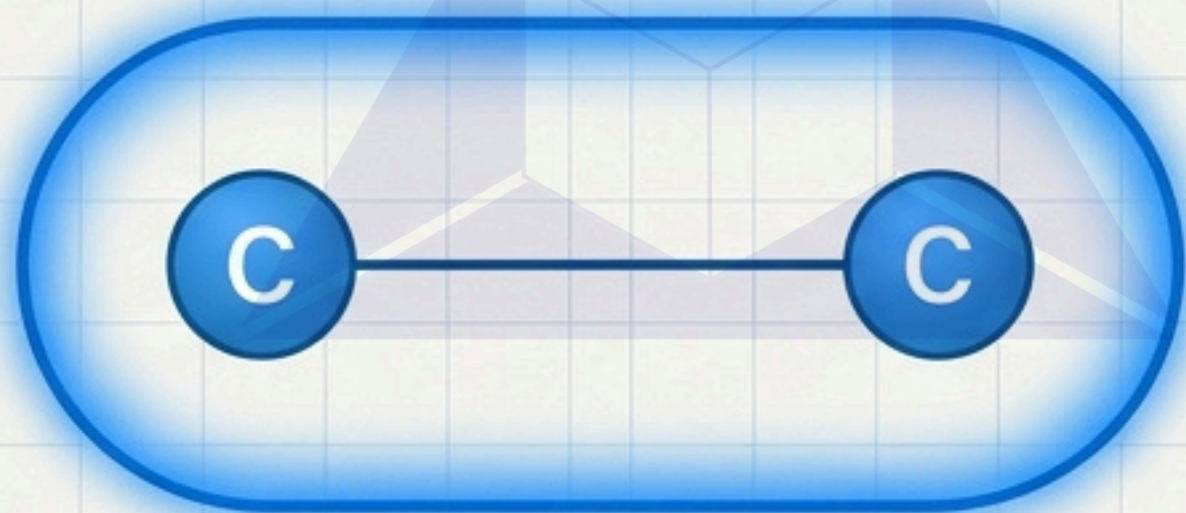


The Inductive Effect: σ -Bond Polarisation

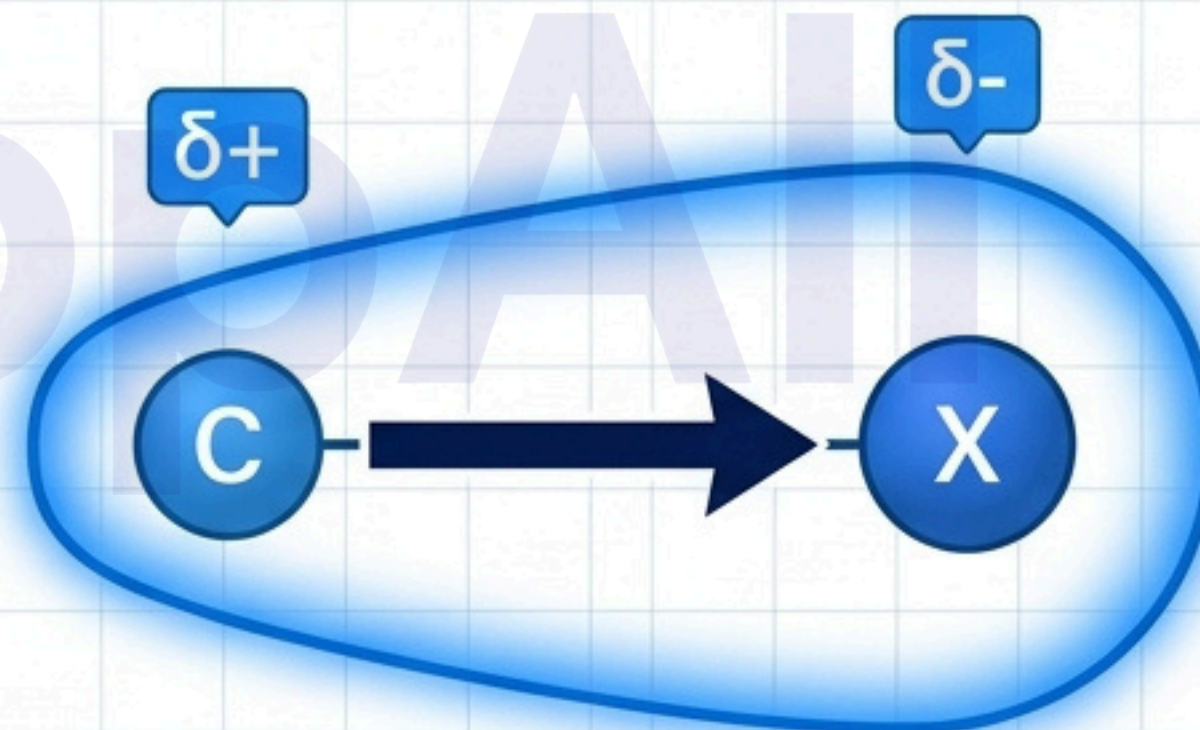
The Inductive Effect is the permanent polarisation of a single covalent (σ) bond due to differences in the electronegativity of the bonded atoms.

Symmetric Non-Polar Bond

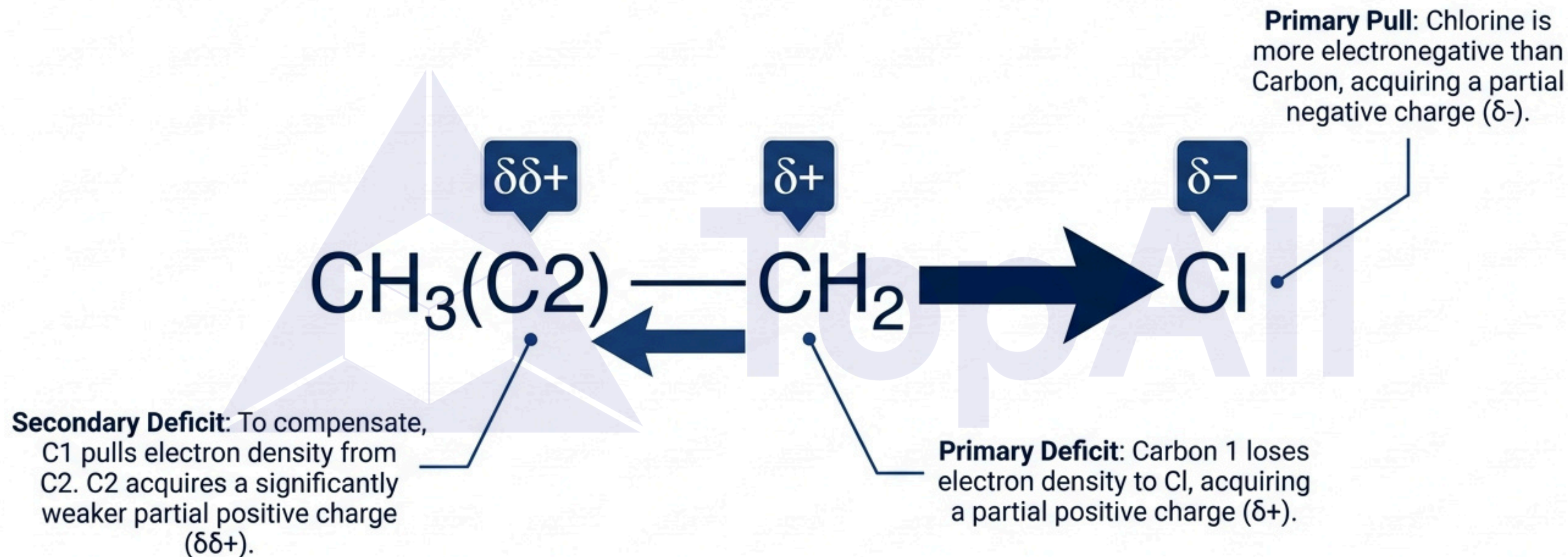


Equal sharing of σ -electrons.
No partial charges.

Asymmetric Polar Bond



Propagation in Chloroethane ($\text{CH}_3\text{--CH}_2\text{--Cl}$)



Polarisation originates at the most electronegative atom and is transmitted through the σ -bond framework.

Taxonomy I: Electron-Withdrawing Groups (-I Effect)

The -I Effect: Atoms or groups more electronegative than hydrogen that pull electron density away from the carbon chain.

Strength Timeline

-NO₂

>

-CN

>

-COOH

>

-COOR

>

-OAr

>

Halogens

F

>

Cl

>

Br

>

I



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$$E=mc^2$$



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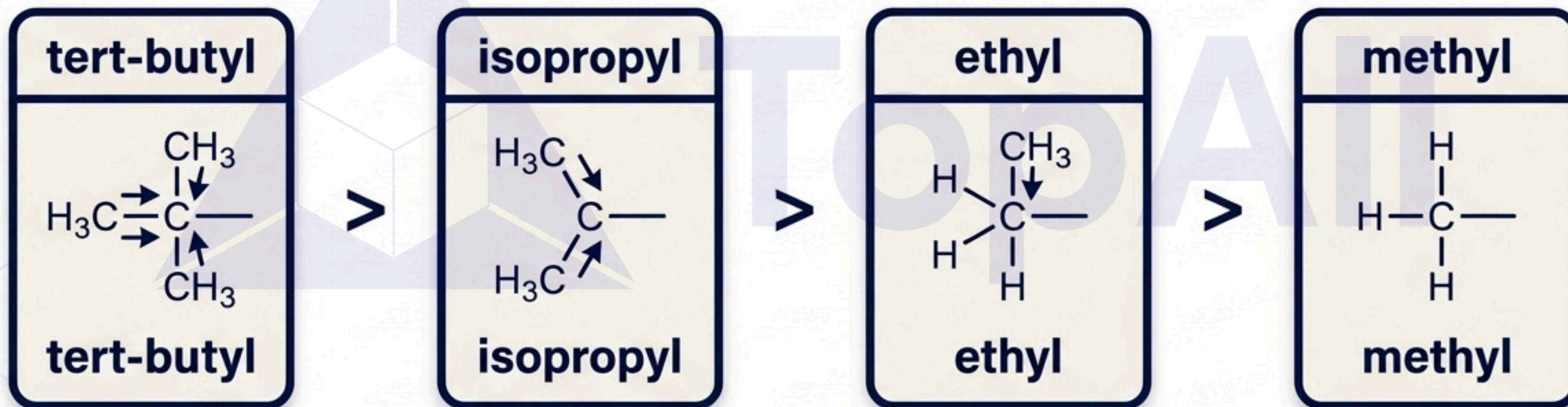
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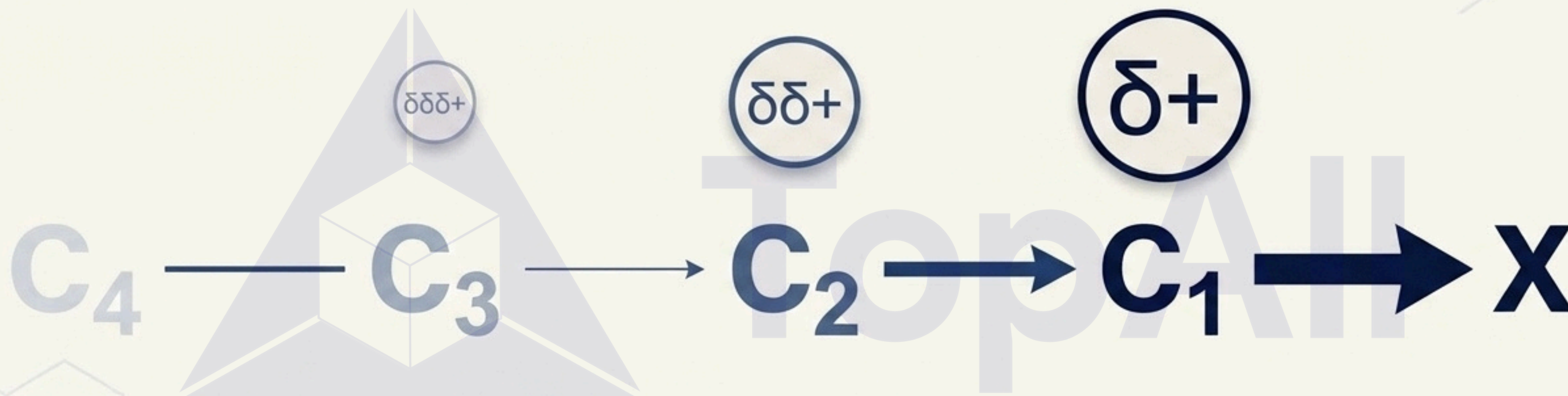
Taxonomy II: Electron-Donating Groups (+I Effect)

The +I Effect: Alkyl groups that push electron density toward the carbon chain due to higher polarizability (and hyperconjugation).



More branching = Greater cumulative electron donation (+I).

The Boundary Condition: Distance Decay



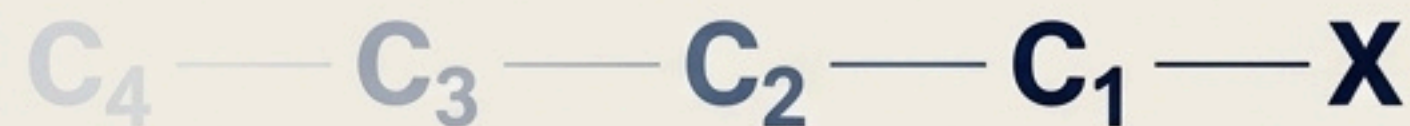
Critical Rule: The inductive effect is a short-range force. It decays rapidly and becomes vanishingly small after three bonds.

Revision Frame: The Inductive Effect

Core Properties

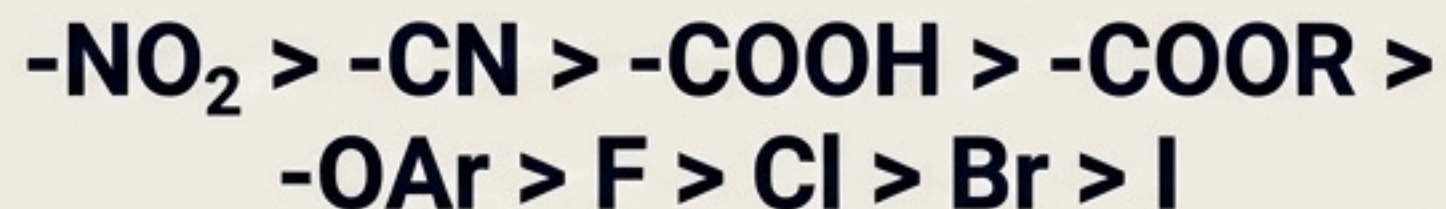
- Permanent dipole effect.
- Operates exclusively via σ -bonds.
- Fractional charges ($\delta+$, $\delta-$) created.
- Does not involve actual electron transfer.

Distance Decay



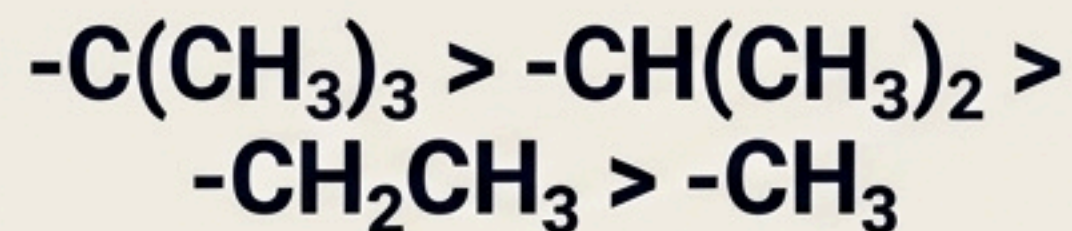
Negligible after 3 bonds.

The -I Series (Pullers)



Electron-withdrawing groups.

The +I Series (Pushers)



Electron-donating alkyl groups
(Tert > Sec > Pri > Methyl).



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