

TRINITY COLLEGE FOR WOMEN NAMAKKAL



Department of Chemistry

Inductive effects

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AP/CHEMISTRY

General chemistry

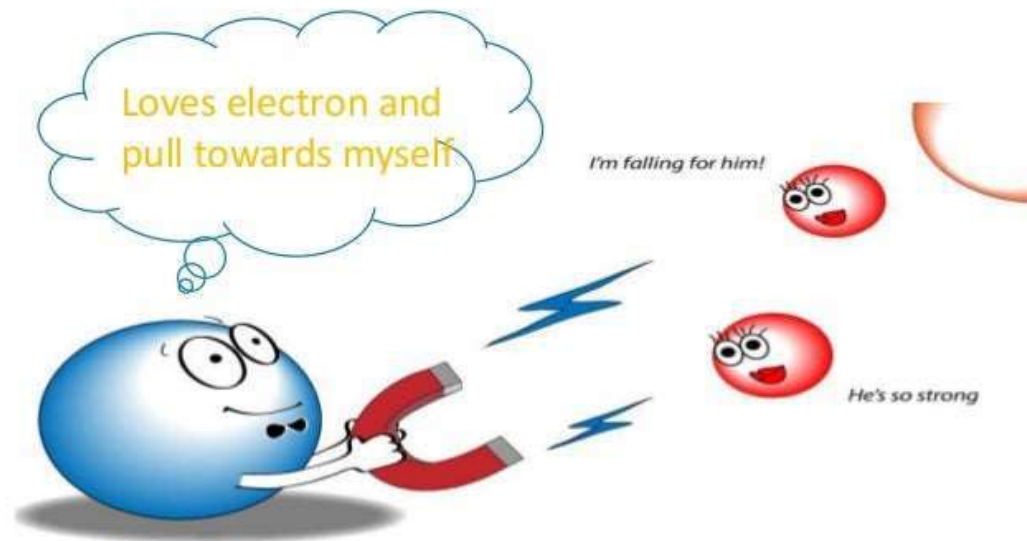
Inductive effects

- **-I effect**
- **+I Effect**
- **Example**
- **Application**
- **Summary**

Electronegativity plays a important role in inductive effect

EN atoms

N,
O,
X(halogens)



ADAM'S ABILITY TO ATTRACT A BONDING PAIR OF ELECTRONS

ELECTRONEGATIVITY

SURFGUPPY.COM

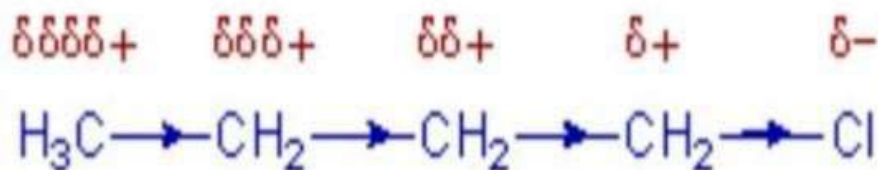
What is **INDUCTIVE EFFECT**?

➤ *The process of electron shift* along a chain of atoms *due to the presence of* electron withdrawing group (*-I group*) or electron donating group (*+I group*) is called inductive effect.

(OR)

➤ The *polarization of sigma bond* due to electron withdrawing or electron donating effect of adjacent groups is called inductive effect.

- *The direction of displacement* is shown by placing an *Arrow head midway* along the line presenting the sigma bond.

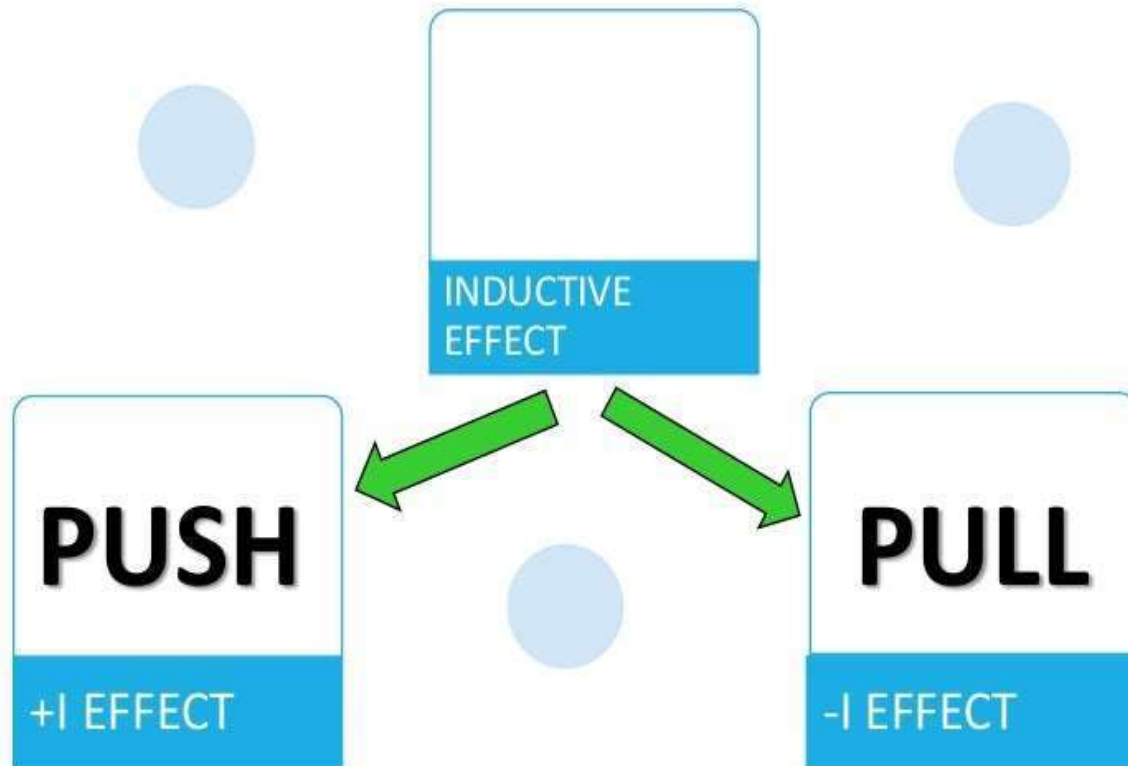


- This *effect decrease* as the *distance from* the *electronegativity* atom *increases*.
- This is a *permanent effect* and is almost *negligible* *beyond two carbon atom from the active group*.

Inductive Effect



Electron Shift towards more electronegative Atom.



-I effect :

electron withdrawing groups

$-R_3N^+ > -NO_2 > -SO_2R > -CN > -COOH > -F$
 $> -Cl > -Br > -I > -OR > -COR > -OH > -C_6H_5$
 $> -CH=CH_2 > -H$

+I effect :

electron donating groups

$(CH_3)_3C- > (CH_3)_2CH- > CH_3CH_2- > -CH_3 > -D$
 $> -H$

Inductive Effects

pKa Values

H-COOH	3.75	CH ₃ CH ₂ CH ₂ -COOH	4.8
CH ₃ -COOH	4.75	$\begin{array}{c} \text{CH}_2\text{CH}_2\text{CH}_2\text{-COOH} \\ \\ \text{Cl} \end{array}$	4.5
CH ₃ CH ₂ -COOH	4.87	$\begin{array}{c} \text{CH}_3\text{-CH-CH}_2\text{-COOH} \\ \\ \text{Cl} \end{array}$	4.0
CH ₃ CH ₂ CH ₂ -COOH	4.81	$\begin{array}{c} \text{CH}_3\text{CH}_2\text{-CH-COOH} \\ \\ \text{Cl} \end{array}$	2.9
$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{-C-COOH} \\ \\ \text{CH}_3 \end{array}$	5.02		

Alkyl groups release electrons. This decreases acidity

When the chlorine atom is moved further away from the carboxyl group, acidity decreases

distance

THANK YOU

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