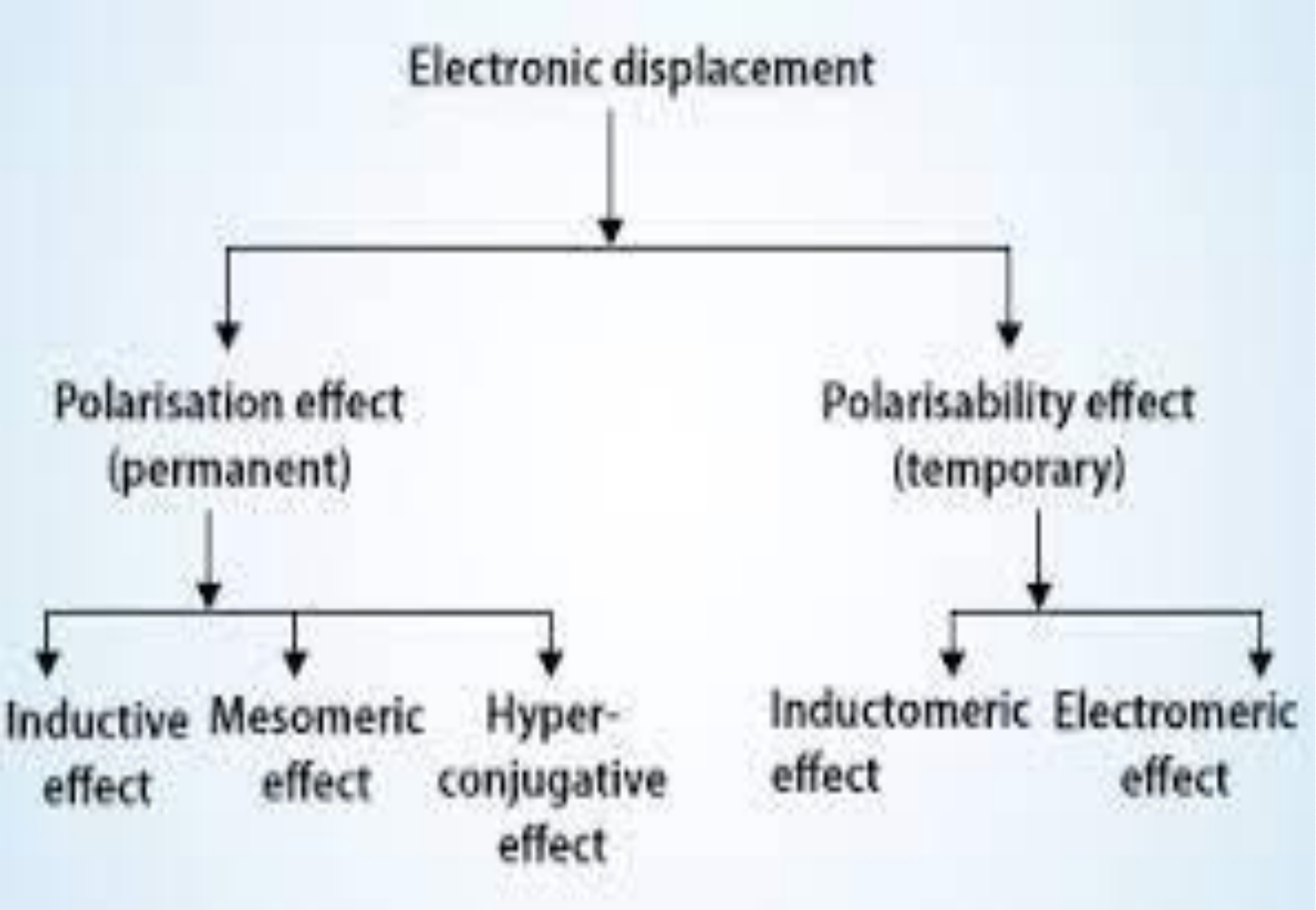
General Organic Chemistry

By – Dr. Rashmi Gaur
Department of Chemistry


Electronic displacement
Polarisation effect (permanent)
Polarisability effect (temporary)
Inductive effect
Mesomeric effect
Hyper-conjugative effect
Inductomeric effect
Electromeric effect

Inductive Effect

The inductive effect in a molecule is a local change in the electron density due to electron-withdrawing or electron-donating groups elsewhere in the molecule, resulting in a permanent dipole in a bond. It is present in a σ bond.

+I Effect

- When a chemical species with the tendency to release or donate electrons, such as an alkyl group, is introduced to a carbon chain, the charge is relayed through the chain.
- This effect is called the electron-releasing inductive effect or the +I effect.
- Examples -CH_3, C_2H_5

-I Effect

- When an electronegative atom, such as a halogen, is introduced to a chain of atoms (generally carbon atoms), the resulting unequal sharing of electrons generates a positive charge which is transmitted through the chain.
- This effect is called the electron-withdrawing inductive effect or the -I effect.

Inductive Effect

- Groups
- -I (electron withdrawing) releasing)

$NR_3^+ > SR_2^+ > NH_3^+ > NO_2$
$> SO_2R > CN > SO_2Ar > CO_2H$
$> F > Cl > Br > I > OAr > CO_2R$
$> OR > COR > SH > SR > OH$
$> SH > C{\equiv}CR > Ar$

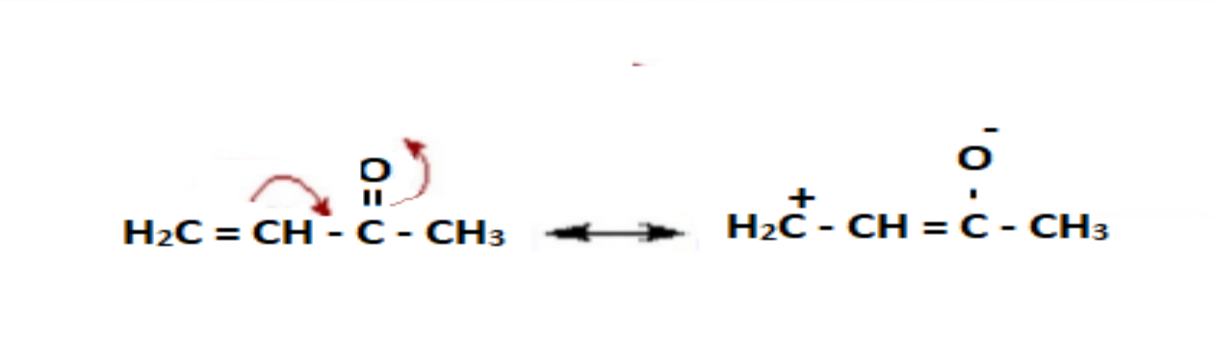
+I (electron

$O^- > CO_2^- > CR_3$
$> CHR_2 > CH_2R$
$> CH_3 > D$

Source: March's Advanced Organic Chemistry

Mesomeric Effect

- The polarity developed between atoms of a conjugated system by the electron transfer or pi–bond electron transfer is known as the Mesomeric effect. In simple terms, we can describe mesomeric effect occurs when π electrons move away from or towards a substituent group in a conjugated orbital system.



❖ The mesomeric effect can be subdivided into two types:

1. +M effect
2. -M effect

Mesomeric Effect

+M effect
(Positive mesomeric effect)

- When the electrons or the pi electrons are transferred from a particular group towards a conjugate system, thus increasing the electron density of the conjugated system then such a phenomenon is known as (+M) effect or positive mesomeric effect.
- For the +M effect, the group should have either a lone pair of electrons or should have a negative charge.

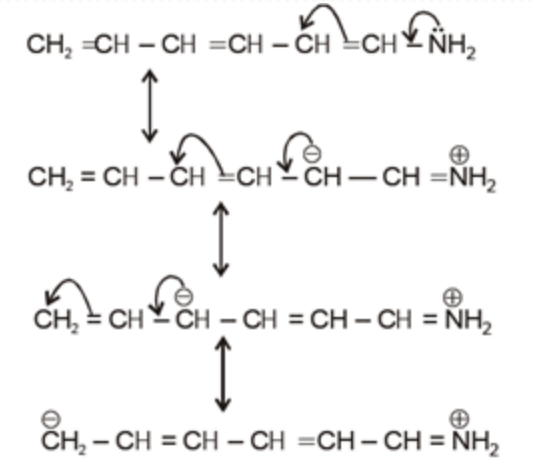
-M Effect
(Negative mesomeric effect)

- When the pi-bond electrons are transferred from the conjugate system to a particular group thus the electron density of the conjugate system is decreased, then this phenomenon is known as negative mesomeric (–M) effect.
- For –M effect, the group should have either a positive charge or should have a vacant orbital.

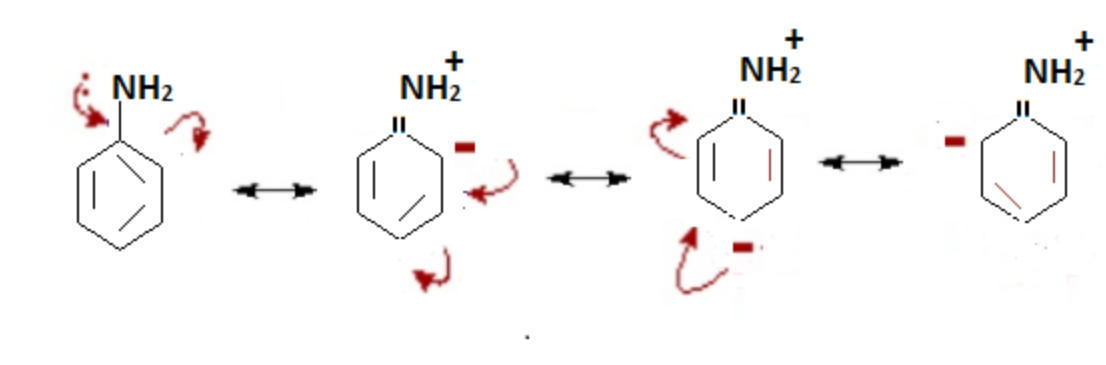
Examples of +M Effect

–NH, –NH_2,–NHR, –NR_2, – O, – OH, –OR, – F, – Cl, –O–COR, – NHCOR, –SH, – SR etc

Example 1-



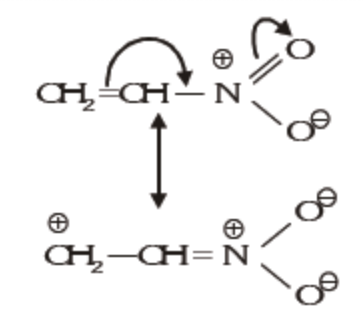
Example 2-



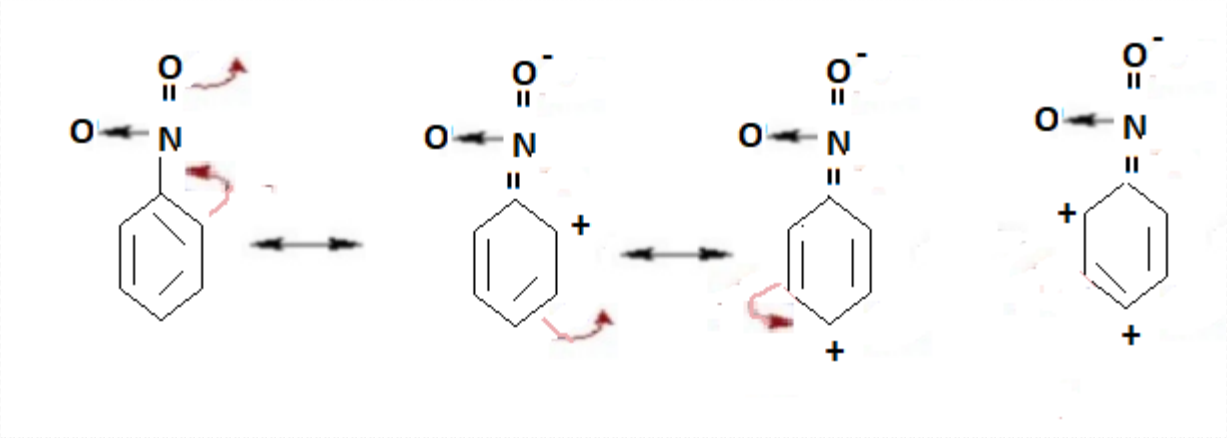
Examples of -M Effect

$-NO_2$, $-CN$, $-COX$, $-SO_3H$, $-CHO$, $-CONH_2$, $-COR$, $-COOH$, $-COOR$ etc

Example 1-



Example 2-



THANK YOU