

Paper II- Organic Chemistry

Chapter-I **Structure and Bonding**

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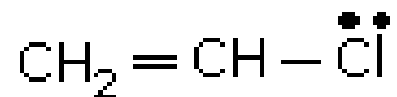
Mesomeric or Resonance Effect

In a normal bond, the electrons are localized between the constituent atoms. However, if double and single bonds are present alternately in a molecule, it is called **conjugation**

e.g. in 1,3-butadiene, the double bonds are conjugated

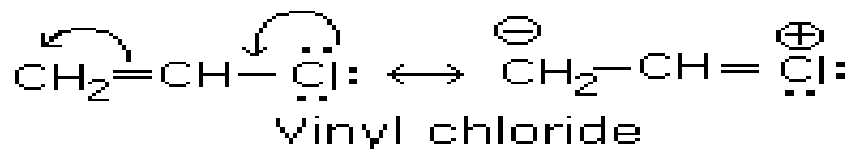


Similarly, if the double, single and a lone pair are present, alternatively, it is also called conjugation e.g. vinyl chloride.



The presence of conjugation alters the properties of the compound and there is a difference in the actual and expected properties.

Note that the electrons are not necessarily present where one would expect them, but are rather delocalised over the entire molecule which gives it extra stability expressed in terms of delocalisation energy or resonance energy. Also, normally, we find chlorine withdrawing electrons towards itself by -I effect but here we find that the same chlorine has got a positive charge and is involved in a double bond. Does this mean that chlorine has lost its -I effect? No, this is not true as -I effect is a permanent effect. In fact, in addition to the -I effect, it now also has an electron donating mesomeric or resonance effect (called +M or +R effect).

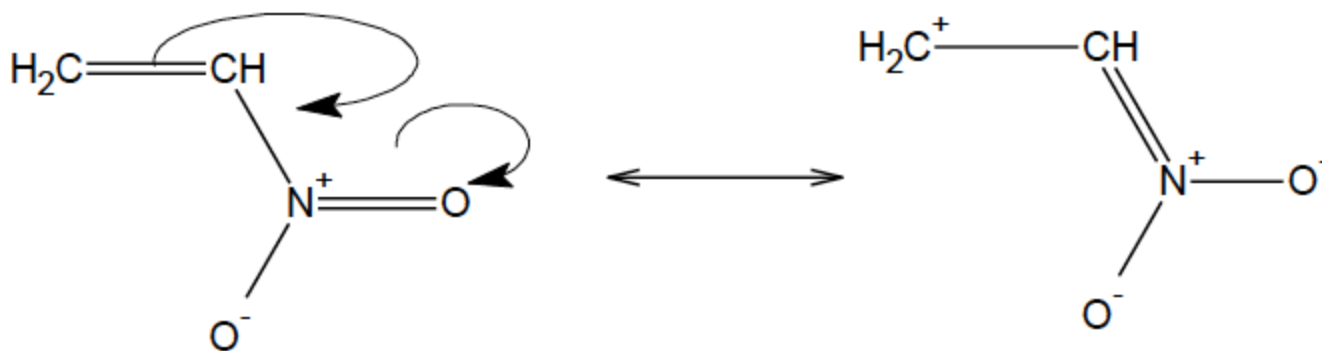


Since the two effects are operating in opposite directions, one of them will overwhelm the other. Remember there was no such possibility if halogen's lone pair was not conjugated. For example in the following case, the Cl is not conjugated to the double bond and hence in the following molecule, Cl is exerting its only $-I$ effect.



The atoms/groups like Cl in which lone pair(or electrons of negative charge) is in conjugation with double or triple bond are electron donating and gain a formal positive charge in the resonating structure in the process and are known to exert $+M/+R$ Effect

Consider the case of $-\text{NO}_2$ joined to a conjugated system, where the nitro withdraws the conjugated electrons and gives rise to polarization as shown below



The atoms/groups like $-\text{NO}_2$ which are in conjugation with double or triple bond and are electron withdrawing and gain a formal negative charge in the resonating structure in the process and are known to exert -M/-R Effect.