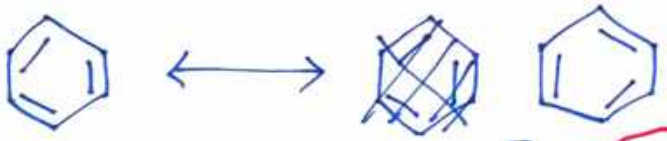
Resonance

⊛ In the case of some molecules, where more than one structure can be written for a compound, but none of them is able to explain all the known properties of the compound completely, the different structures written are known as the resonating or contributing or canonical structures. This phenomenon is known as resonance or mesomerism.



I ⟷ II

C–C → 1.54 A°

C=C → 1.34 A°

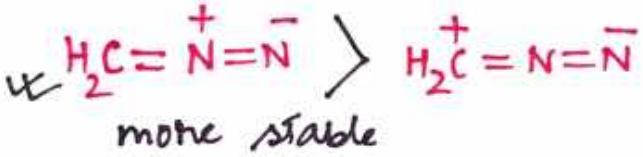
actual length → 1.39 A°

⊛ None of the structures I & II can not explain.

⊛ So, among them, the most stable is known as resonance hybrid.

Conditions for Writing resonating Structures

- Same atomic skeleton.
- Same number of unpaired electrons.
- Same energy.
- Closer bond length & bond angles.
- Negative charge should reside on most electronegative atom & positive charge ⟶ most electropositive atom.
- Unlike charges should reside on neighbouring atoms.



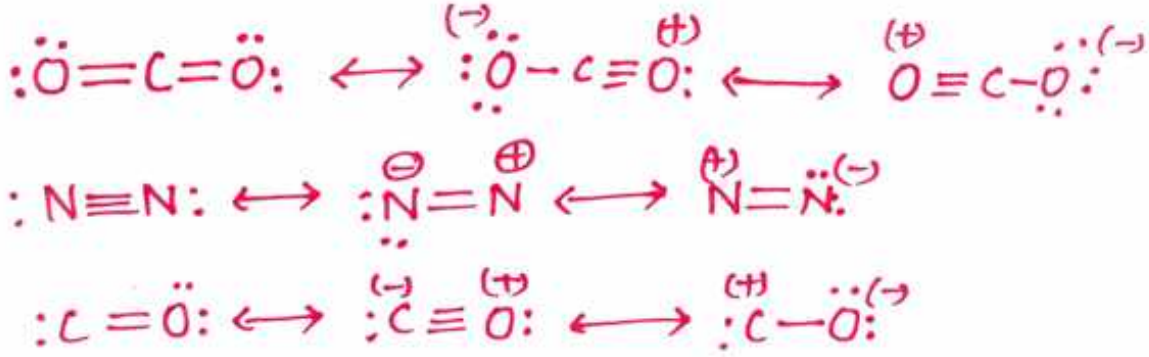
- The structure having maximum number of bonds is most stable.
- More is the distance of separation of charges, lower is the stability of resonating structure.
- The compounds exhibiting resonance must be planar in nature.

Characteristics of Resonance Hybrid

1. Stability :- Greater the number of contributing structures for a molecule, greater will be stability of the resonance hybrid.

2. Resonance Energy :- The resonance energy gives a measure of the stability of the resonance is known as resonance energy. The resonance energy gives a measure of the stability of the resonance hybrid. Greater its value, greater is the stability of the hybrid.

Example :-



Resonance Effect or Mesomeric Effect :-

In case of compounds having conjugated π-systems (having alternate σ & π-bonds), electrons can flow from one part to the other due to resonance. This flow of $e^{\ominus}$s caused by resonance is called resonance effect or mesomeric effect.

Resonance effect and Mesomeric effect

+R or +M effect

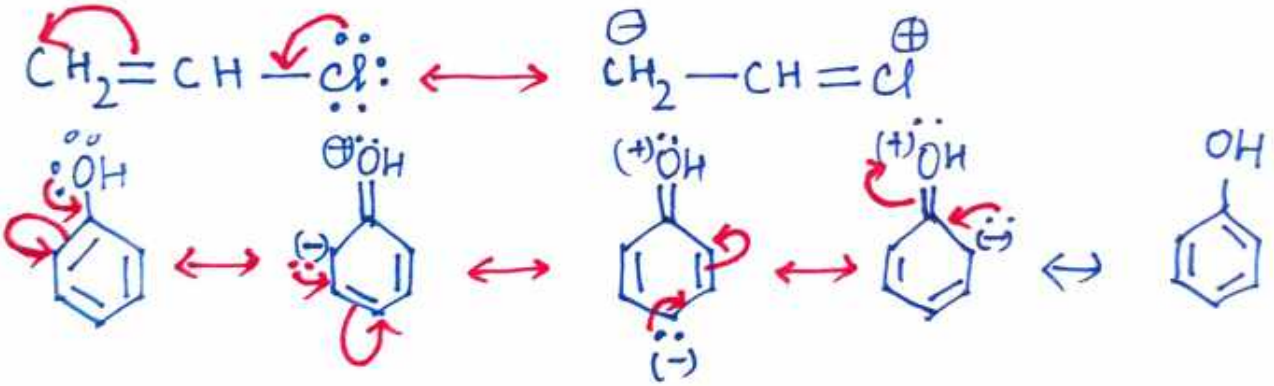
→ Electron donating group donates → conjugated π-system.

e.g. Cl, F, Br, I, NH_2, SH, OR

−R or −M effect

* Electron withdrawing group withdraw $e^{\ominus}$s towards itself through resonance from the conjugated π-system.

* +R or +M effect →



* −M / −R Effect :