Resonance

There are large no. of molecules and ions such as CO_2, NO_2, SO_4^{2-} etc. in which basic mode of bond formation can not explain by Single structure.
We explain it by saying that the structure of the substance is hybrid of these resonating structures. This phenomenon is called resonance.
as for example – H_2 mol. (In formation of H_2 mol. we have seen)

$H-H$, $H^+ : H^-$, $H^- : H^+$
I II

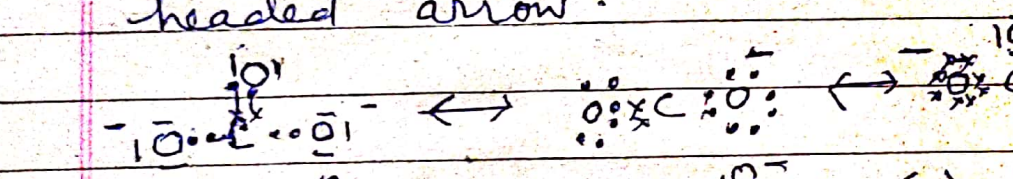
Resonance energy = Actual bond energy – energy for.

Example :– CO_2

If we consider the bonding of CO_2 as follow $O=C=O$, molecule is linear one because SP hybridization. In CO_2 the bond distance is 1.154°. This is intermediate between 1.21 A° in Ketone (C=O) and in CO = 1.134° which is generally supposed to contain a triple bond (C≡O). Hence we conclude that Carbon-oxygen is stronger than a double bond. This increase in strength is due to resonance.

According to Resonance, when ever a single Lewis structure cannot describe a molecule accurately, a number of structures with similar energy position of nuclei bonding and non-bonding pairs of electron (lone pair) taken as the canonical structures of the hybrid which describe the molecule accurately.

Resonace is represented by a double headed arrow.

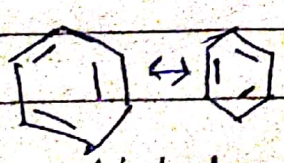


or $\bar{O}-\overset{\overset{O}{\|}}{C}-O^- \leftrightarrow O=\overset{\overset{O^-}{|}}{C}-O^- \leftrightarrow \bar{O}-\overset{\overset{O^-}{|}}{C}=O$

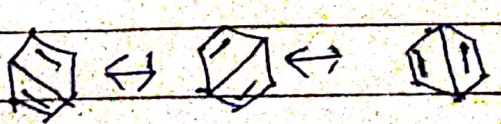
According to the experimental finding, all carbon to oxygen bonds in IO_3^- are equivalent i.e. π electrons are delocalised.

NECESSARY CONDITIONS

(1) The nuclei of the atom in each structure must remain in fixed positions. only the arrangement of electrons may change the bond length, bond angle should be closer to real structure.



Kekule Structure



Dewar Structure