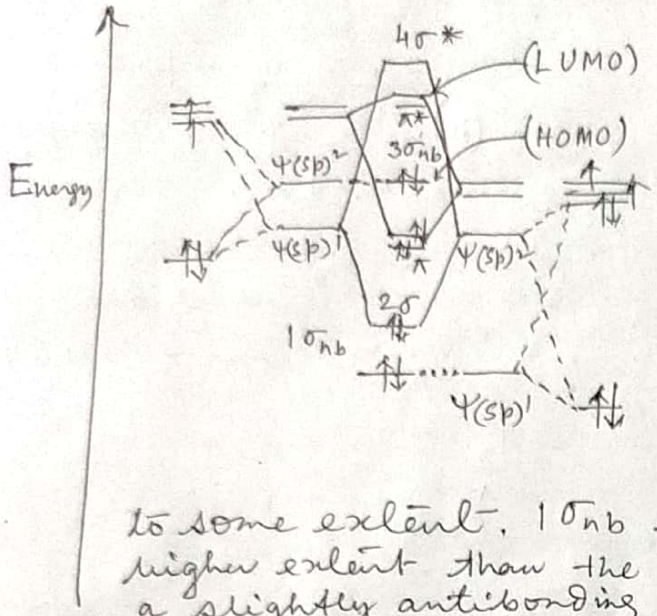
● Compare the bond lengths of CO (1·128 Å) and $CO^+$ (1·115 Å) with the help of MO diagram.




In $CO^+$ the +ve charge is localized mostly on the less electronegative C-atom. Thus the 2s and $2p_x$ orbitals of carbon become of lower energy (bond axis is x-axis) in $CO^+$ which favours effective combination between C and O-orbitals. This leads to a modification of $1\sigma_{nb} \rightarrow 1\sigma_b$ and $3\sigma_{nb} \rightarrow 3\sigma_a$ to some extent. $1\sigma_{nb}$ becomes $1\sigma_b$ with a slight higher extent than the HOMO (i.e. $3\sigma_{nb}$) becoming a slightly antibonding character. This raises the bond order above 3.0. Hence bond length of $CO^+$ is less than that of CO.

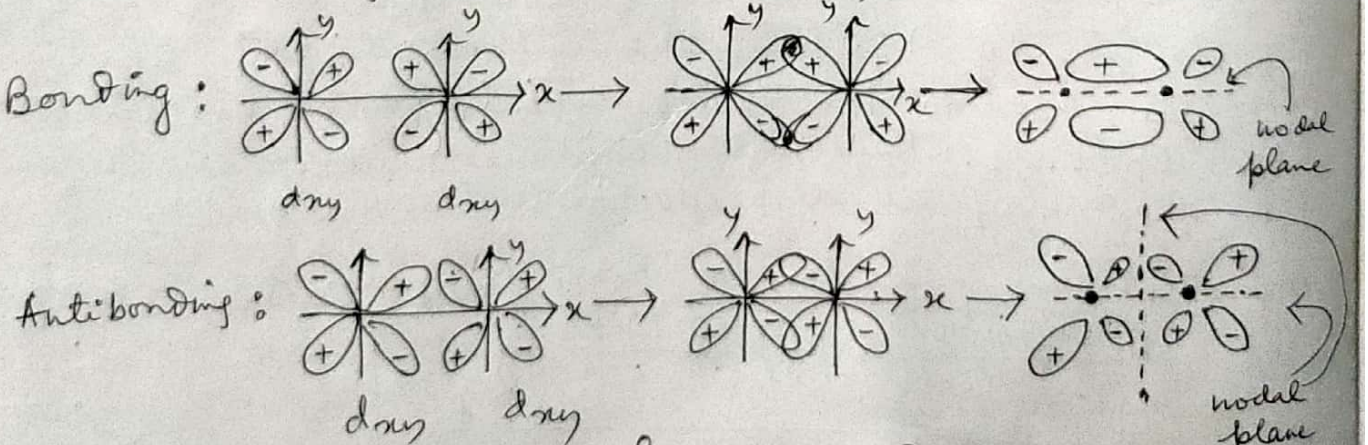
● Assuming x-axis as the bonding axis, predict how many π-MOs would be formed by d-orbitals of two combining atoms. Give the overlap diagram in each case.

Assuming x-axis as the bonding axis total four π-MOs would be formed by d-orbitals of two combining atoms as

(i) For $d_{xy}$ & $d_{xy}$ combination → 2 π MOs (bonding and antibonding)

(ii) For $d_{xz}$ & $d_{xz}$ combination → 2 π MOs (bonding and antibonding)

overlap diagram for $d_{xy}$ & $d_{xy}$ combination:




Same overlap diagram for $d_{xz}$ and $d_{xz}$ would also be observed.