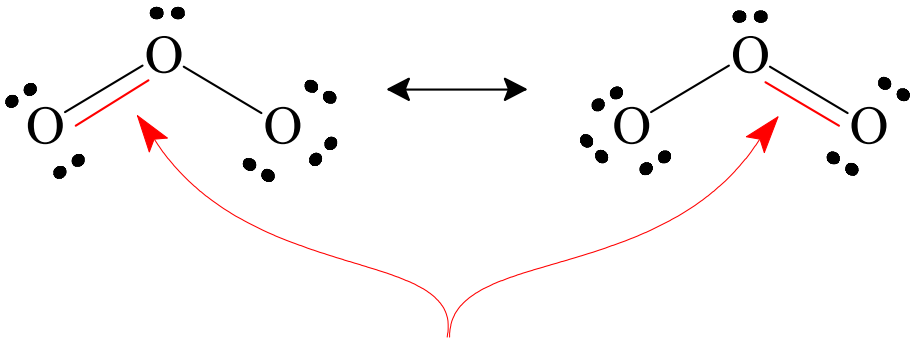
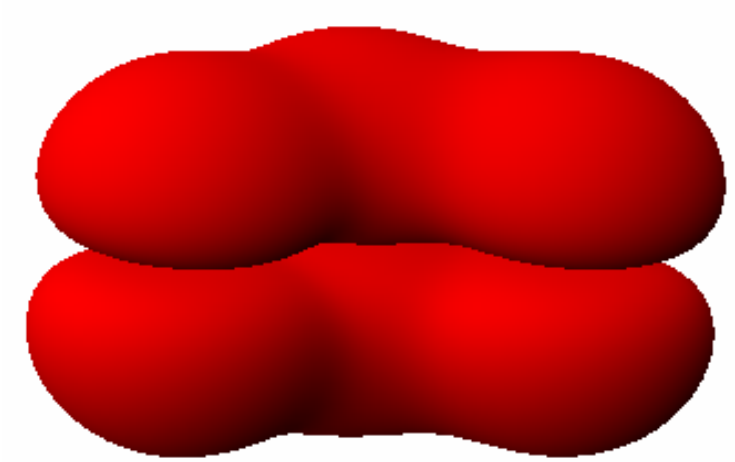
Delocalized Pi Bonding

- Whenever a molecule or ion is a resonance hybrid of two or more canonical forms showing double or triple bonds, the electron pairs moved about from form to form are actually delocalized over the affected bonds in a π system.

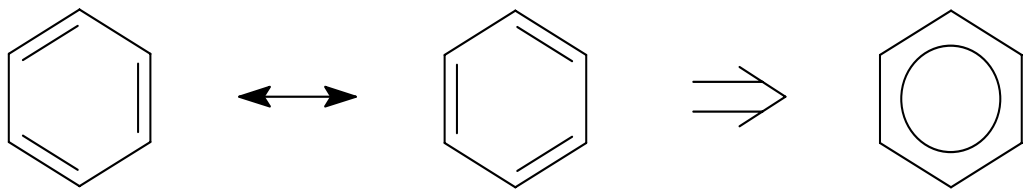


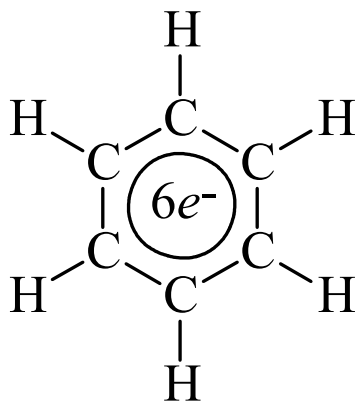
electron pair delocalized in π system



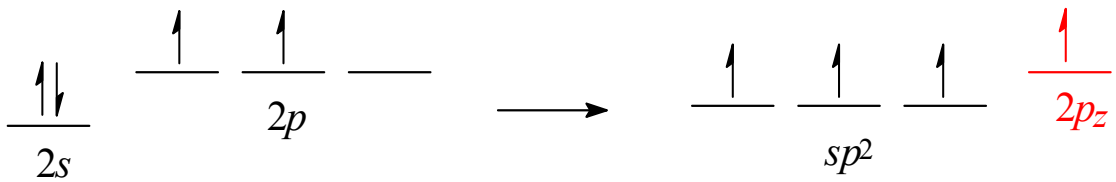
Benzene, C_6H_6

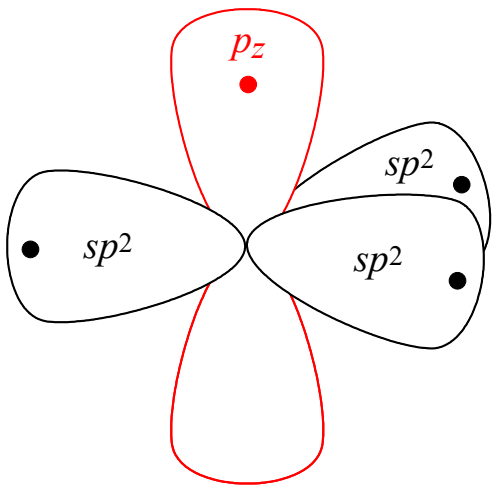
- The two Kekulé resonance forms suggest that the six electrons used to form the three double bonds in the canonical forms are π-delocalized.



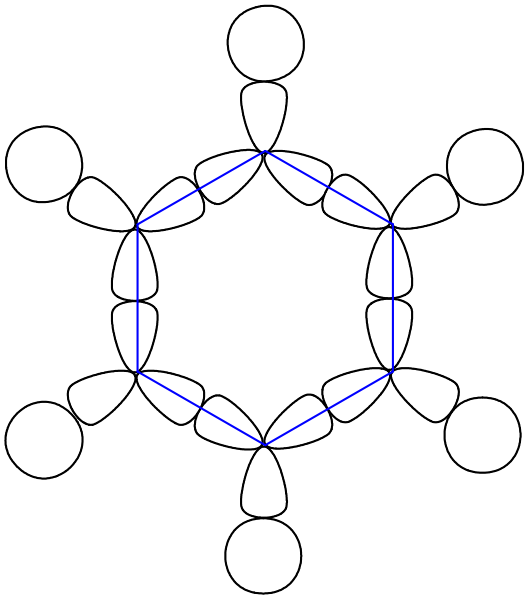


VB Model of Benzene
Hybridization of Carbon





VB Model of Benzene
Sigma Bonding

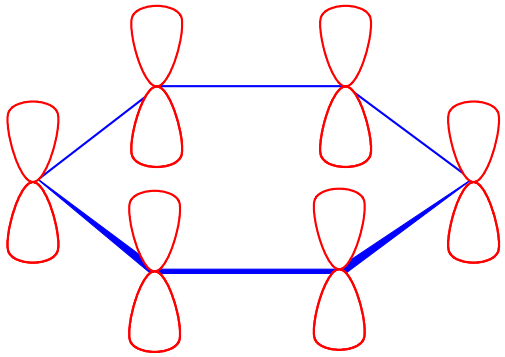


- Carbon atoms are sp^2 hybridized.

- C–C σ bonds are formed by overlap of sp^2 hybrids on adjacent carbon atoms, sharing 6 pairs of electrons (2 electrons from each carbon).

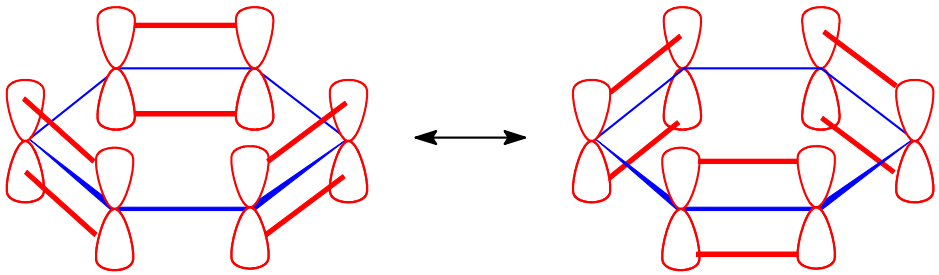
- C–H σ bonds are formed by overlap of remaining sp^2 hybrids on carbon atoms with 1*s* orbitals on hydrogen atoms, sharing 6 pairs of electrons (1 electron from each C and 1 electron from each H).

VB Model of Benzene
Pi Delocalized System

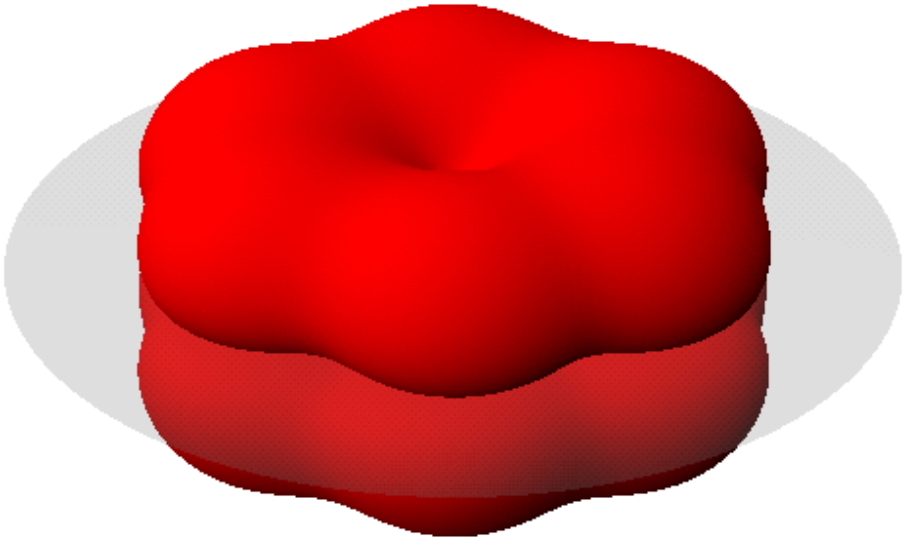


- Each $2p_z$ orbital on each carbon atom contributes one electron to the π system (6 electrons total).

- The two Kekulé canonical forms, showing localized π bonds:



Pi Delocalized System in Benzene



Nitrate Ion Pi Delocalization