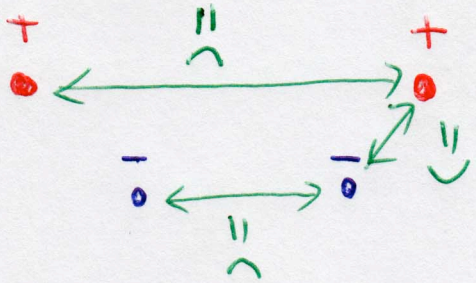
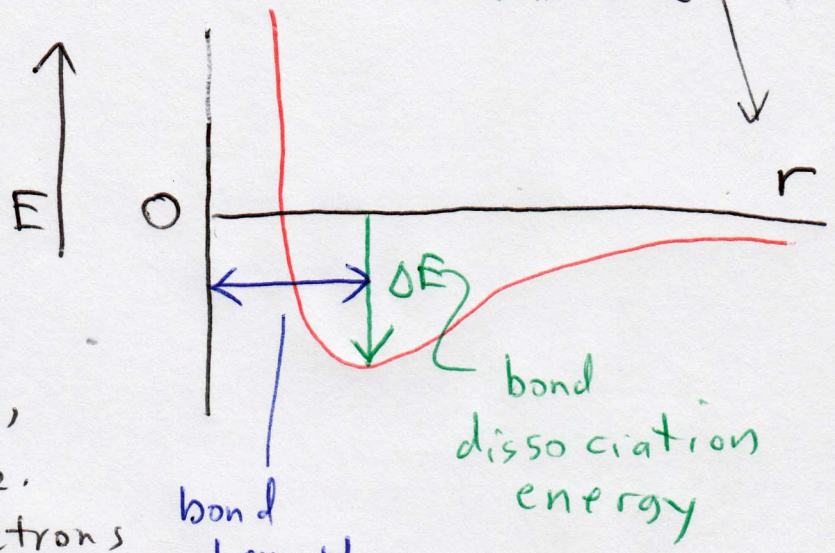
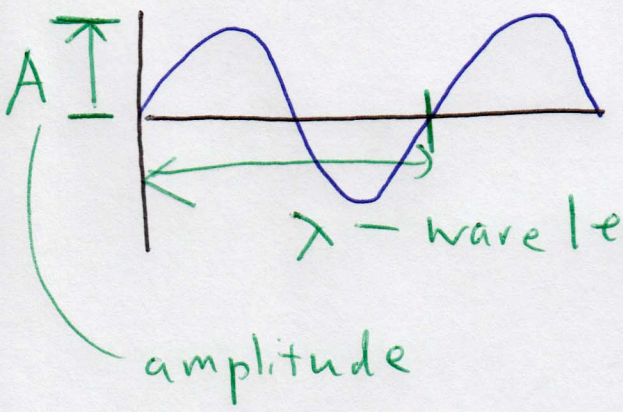
9/30/11

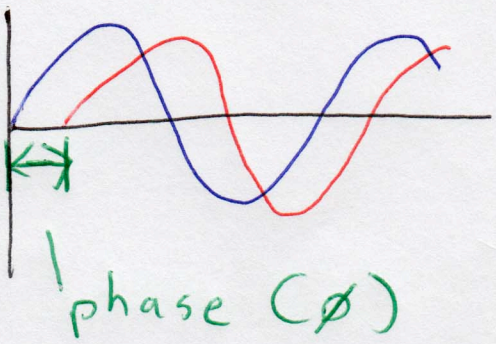
classical bonding model
quantum bonding model
sigma + pi bonds

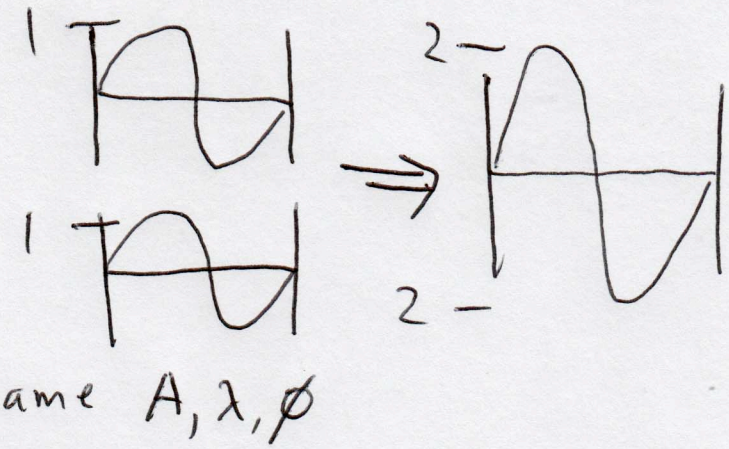




This classical model can be used to describe H_2, but fails to describe He_2. This is because the electrons are treated as particles, ignoring their wave behavior.

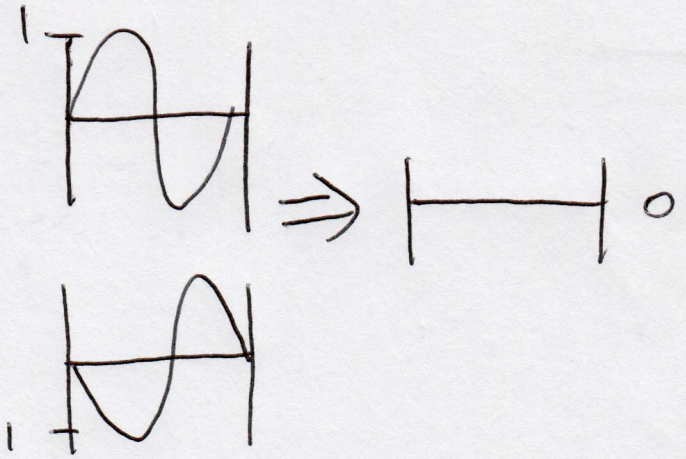






same A, λ, ø

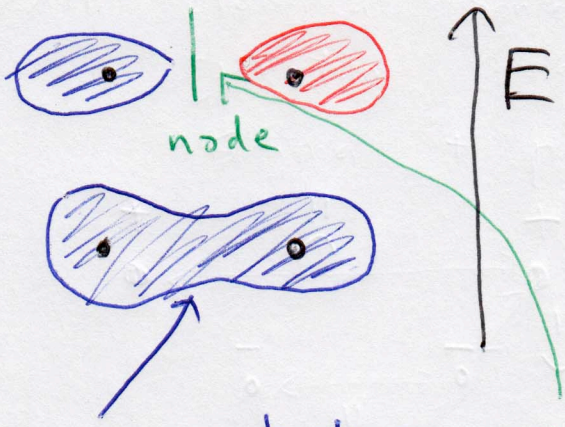
constructive interference



same A, λ
opposite ø

deconstructive interference

H_2



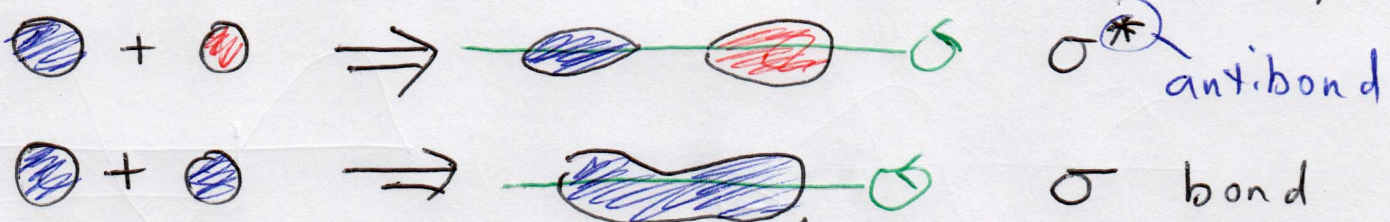
This orbital is an antibond because its energy is higher than the energy of the two atoms if they had not interacted

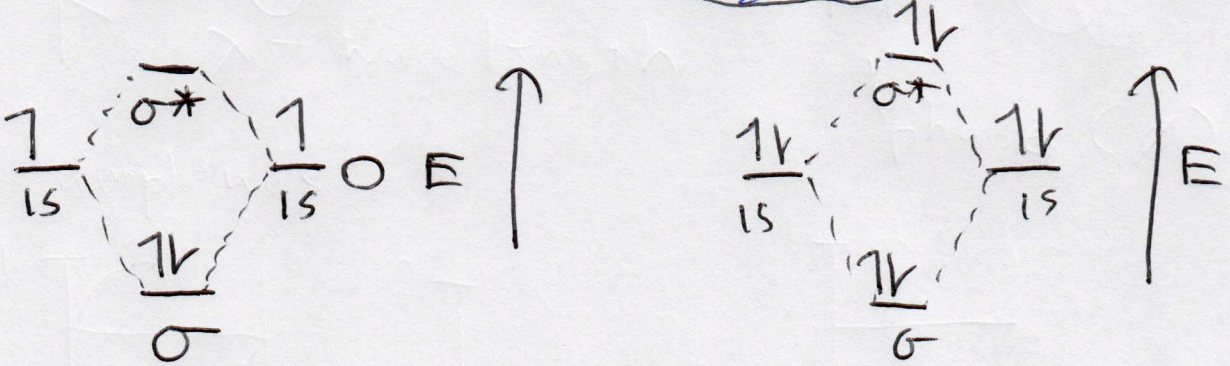
This orbital is a bond because the energy is lower than the isolated atoms.

e^- density between nuclei

no e^- density between nuclei

LCAO - linear combination of atomic orbitals - atomic orbitals are added + subtracted in such a way as to estimate molecular orbitals (MO) such as bonds + antibonds,

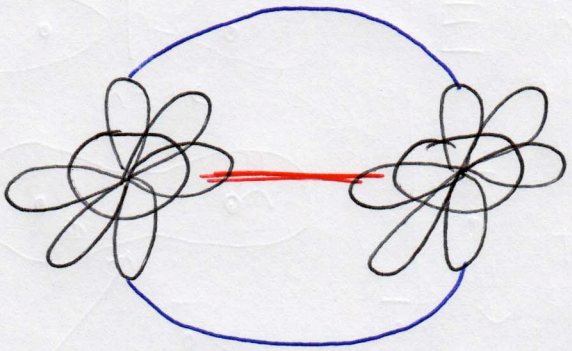




H_2 Bond Order = $\frac{\#\text{ bonding } e^- - \#\text{ antibond } e^-}{2}$

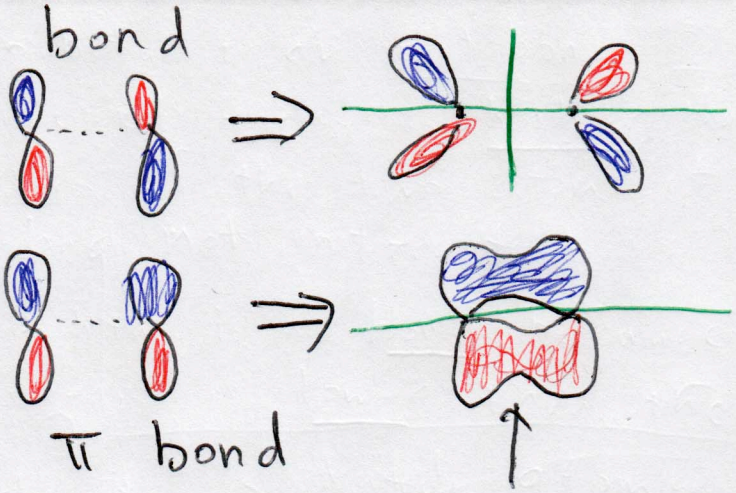
Each antibonding e^- causes a destabilization (increase in energy) that negates the stabilization (decrease in energy) provided by a bonding electron.

π bonds



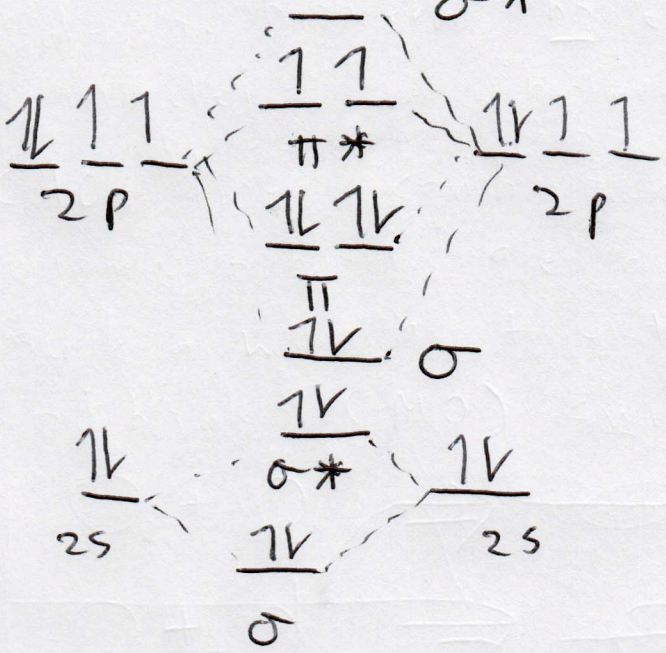
σ*

π* bond



π bond

no node between atoms



$$B.O. = \frac{8-4}{2} = 2$$

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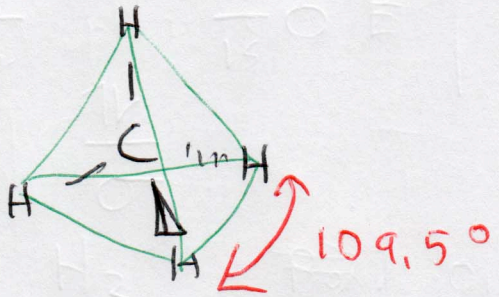
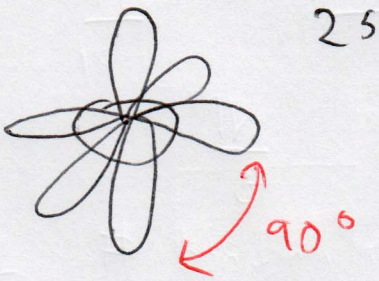
methane CH_4





The atomic orbitals of carbon cannot be used directly to describe the molecule methane since the geometry of the orbitals does not match and the energy of the orbitals is not the same. To describe methane, a set of hybrid orbitals are created by adding + subtracting orbitals on the same atom.