Today

Finish Skeletal Structures

Section 1.6: An Introduction to MO Theory

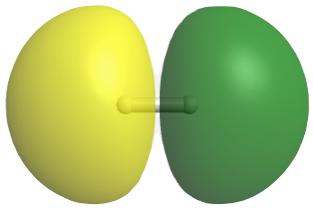
Sections 1.7-1.15: An Introduction to Valence Bond Theory

Next Class

Sections 1.7-1.15
An Introduction to Valence Bond Theory

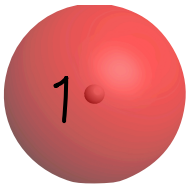
this orbital is modeled by subtracting one 1s orbital from the other

formed from destructive interference of 2 1s orbitals



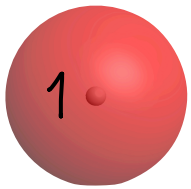
σ^* orbitals of the H_2 molecule

H atom

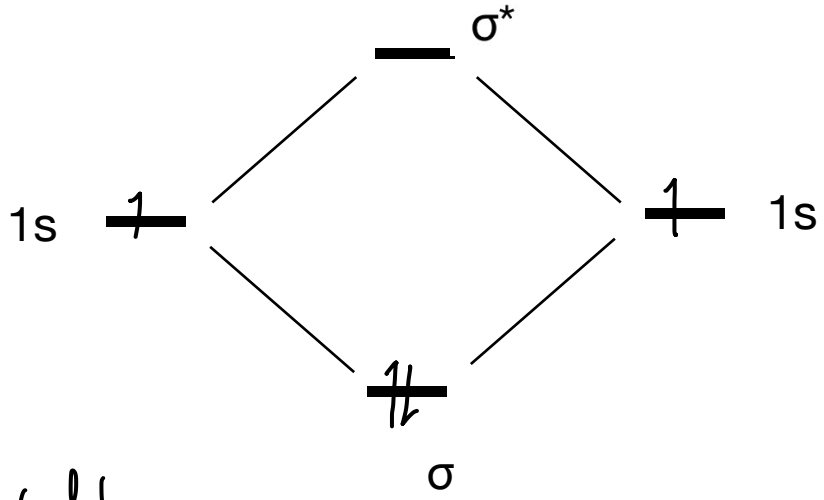


1s

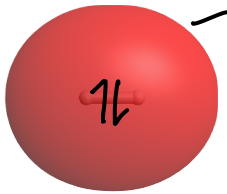
H atom



1s



formed from constructive interference of 2 1s orbitals



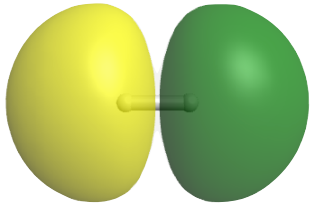
σ

this orbital is modeled by adding the 2 1s orbitals together

graphical representation of the molecular orbitals

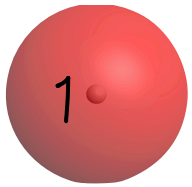
energy level diagram of the molecular orbitals

formed from destructive interference of 2 1s orbitals

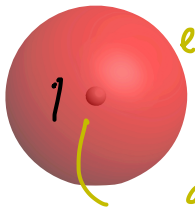


σ*

this is a graphical representation of an antibonding orbital. It is called a σ* (said "sigma star") orbital

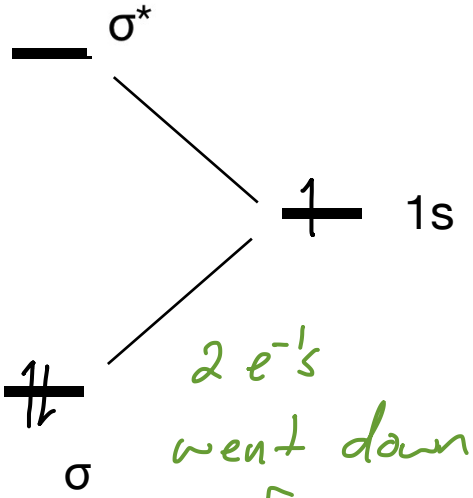


1s



1s

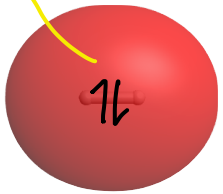
e⁻ in an H atom only gets to experience a single positive charge



2 e⁻'s went down in E, so the e⁻'s are lower in E when

formed from constructive interference of 2 1s orbitals

e⁻'s can exist close to two positive charges



σ

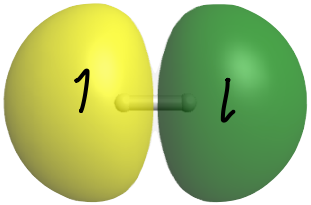
this is a graphical representation of a bonding orbital. It is called a σ (said "sigma") bonding orbital

MO's for He_2

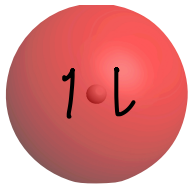
1 He atom

attempt at He_2 molecule

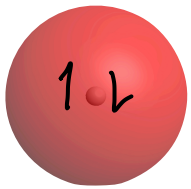
1 He atom



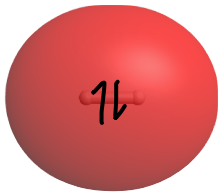
σ*



1s



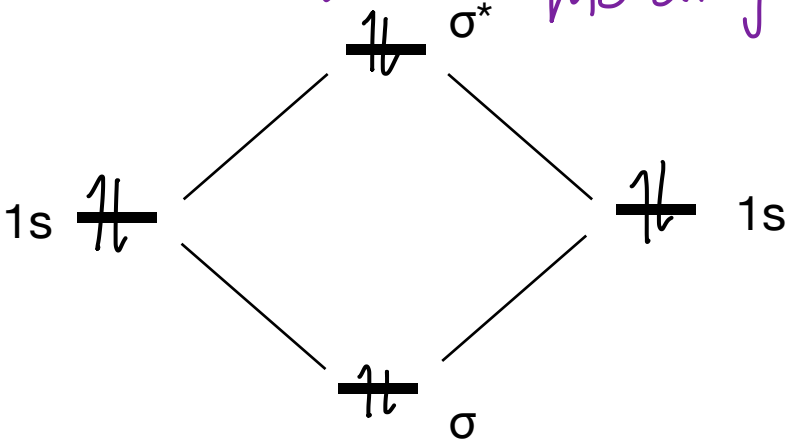
1s



σ

this is a graphical representation

this is the energy level diagram or "MO diagram"

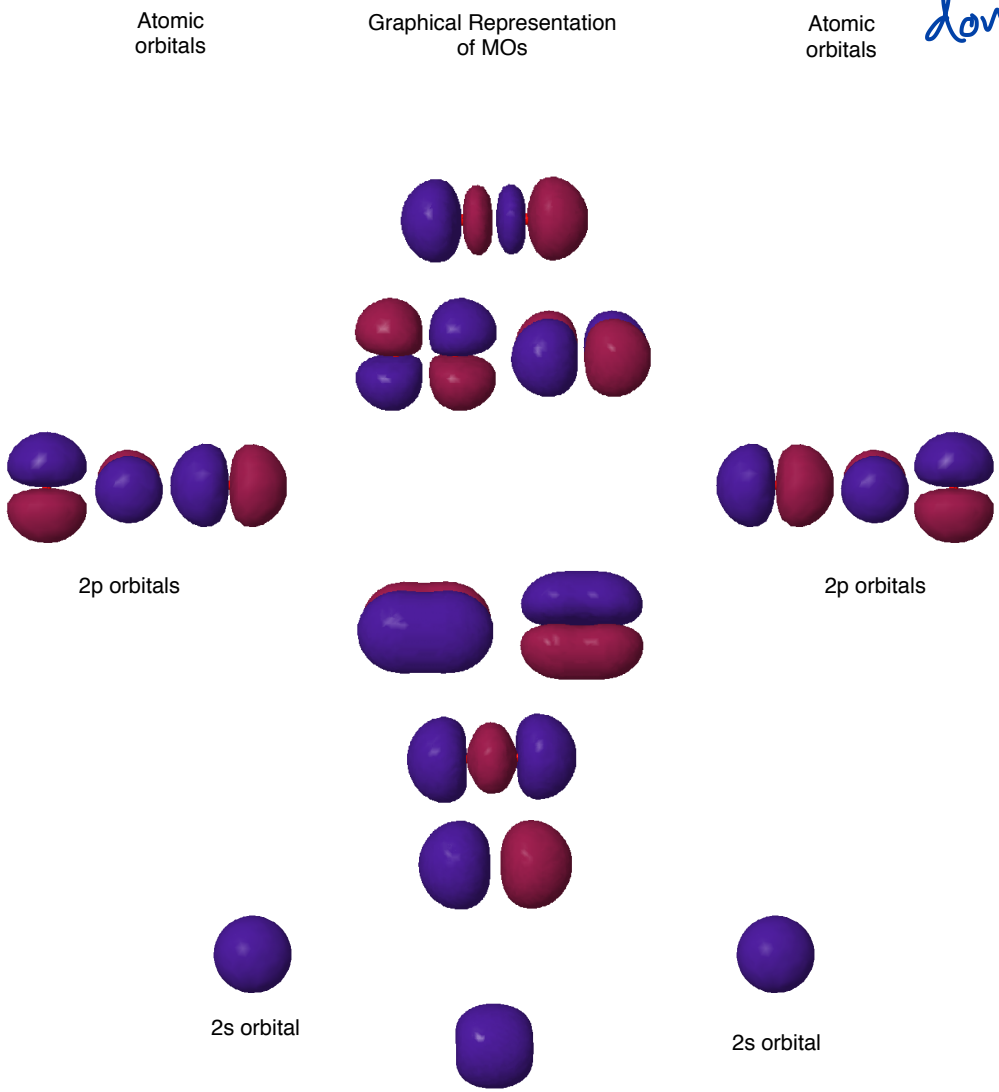


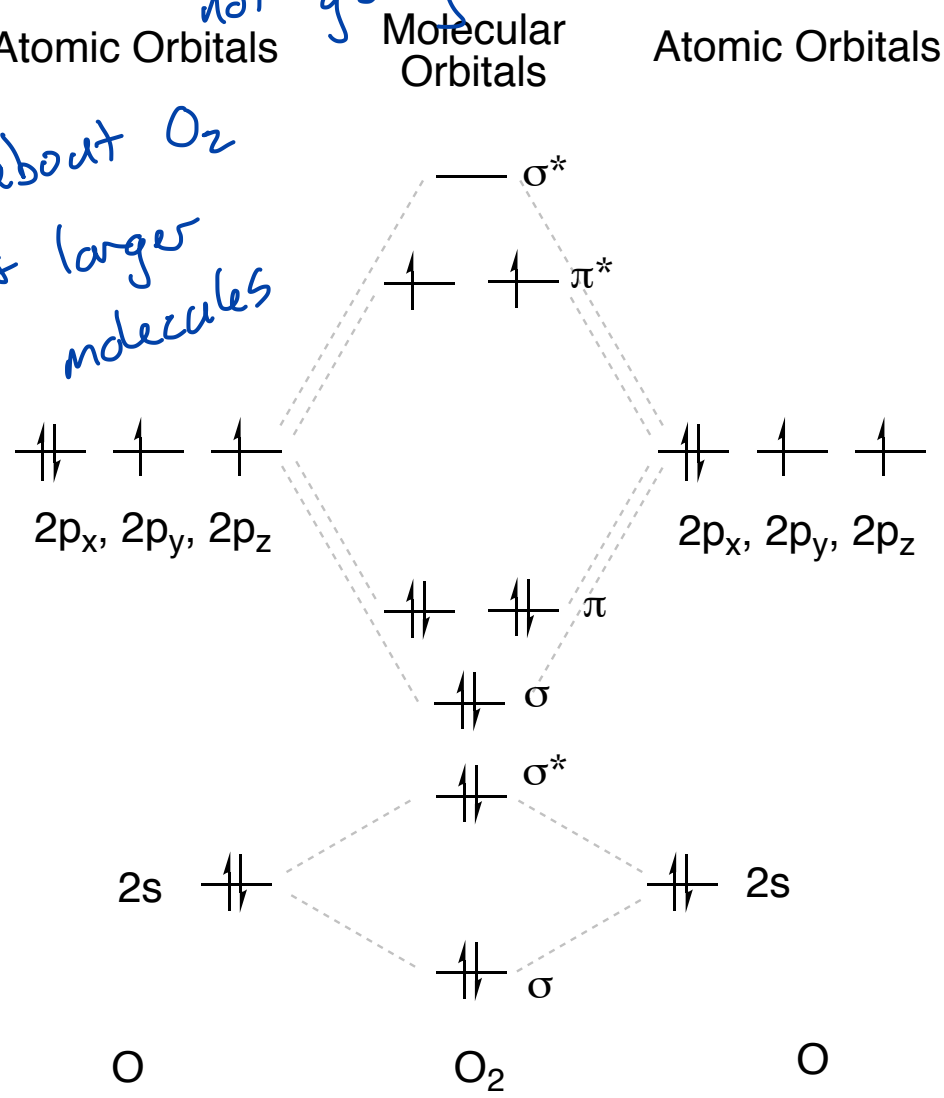
In He_2 there is no net stabilization because 2 e^-'s are destabilized even though 2 e^- were stabilized

Interpret Molecular Orbitals

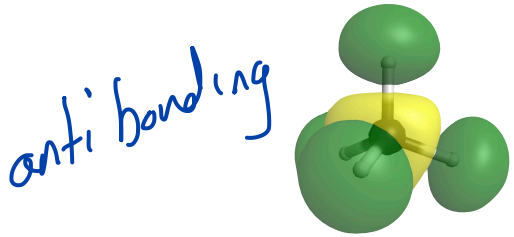
An Introduction to Molecular Orbital Theory: O_2

larger molecules can be done too, but we are not going to worry about O_2 & larger molecules

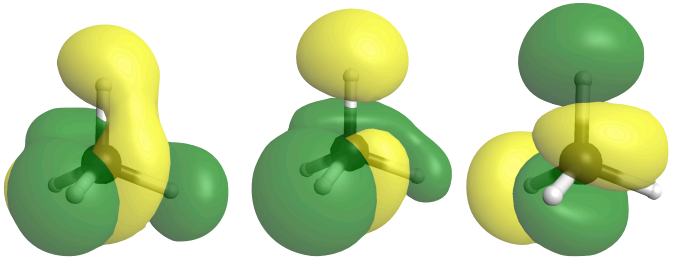




Interpret Molecular Orbital Diagrams

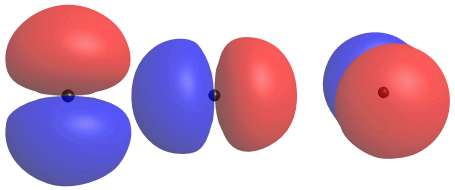


anti bonding

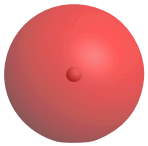


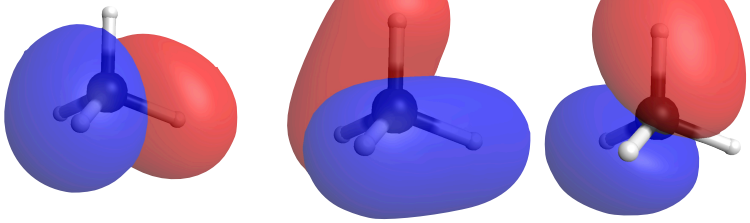
multi atom molecules can be done to... but we are not going to do them

four 1s orbitals
from
four H atoms

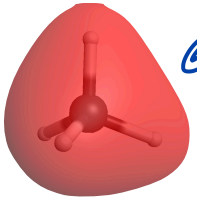


one 2s orbital
and
three 2p orbitals



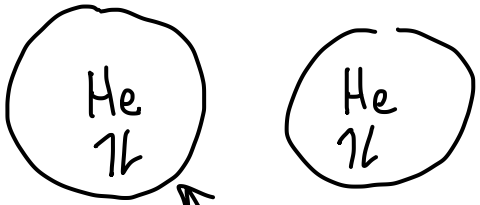


bonding



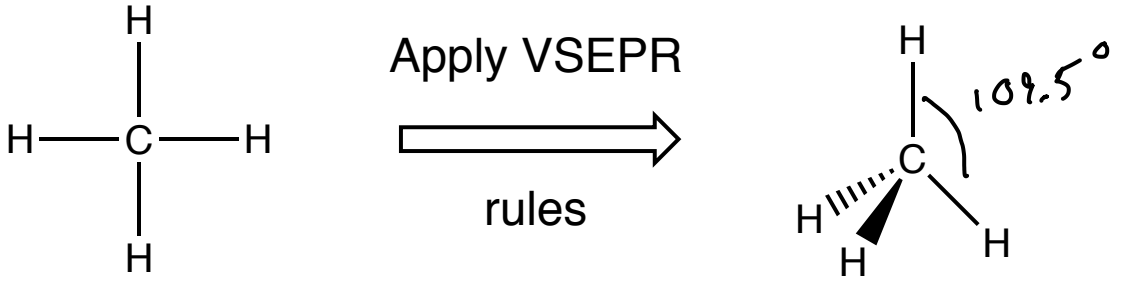
looks big ... 5 nuclei are inside it. MO's can stretch over multiple nuclei, but can still only hold 2 e-'s

H—H

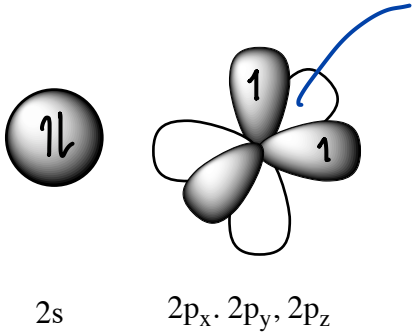


No room for more e⁻.

The 1s orbitals are both filled. No room for other atom's e⁻. No sharing. No bond



tetrahedral C atom

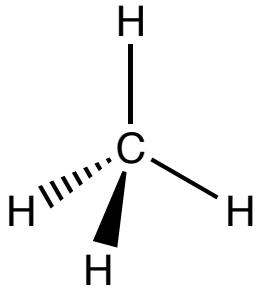


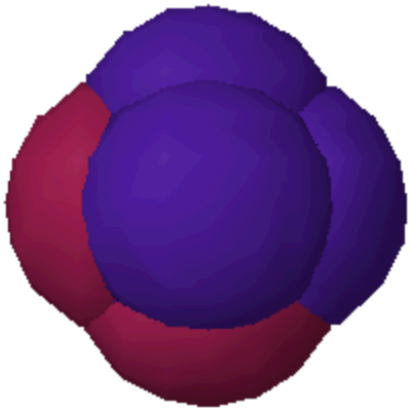
90° ∠ between orbitals not 109.5° ∠ that is seen between C-H bonds

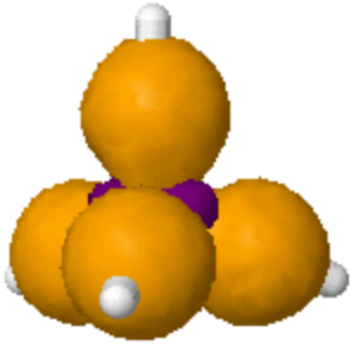
If angles are "wrong" and not all the orbitals have room for more electrons, how do 4 bonds form... hybridization

https://www.westfield.ma.edu/PersonalPages/cmasi/organic/hybrid/hybrid.html

Identify atoms that use sp^3 hybrid orbitals to form bonds and hold lone-pair electrons

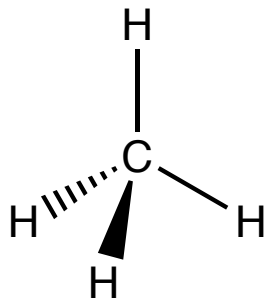


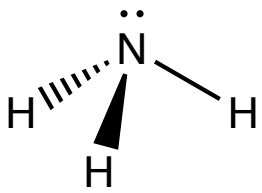


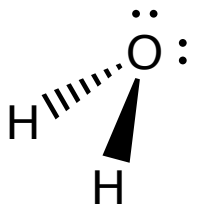


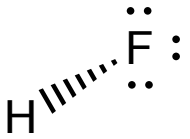
https://www.westfield.ma.edu/PersonalPages/cmasi/organic/hybrid/hybrid.html

Identify atoms that use sp^3 hybrid orbitals to form bonds and hold lone-pair electrons

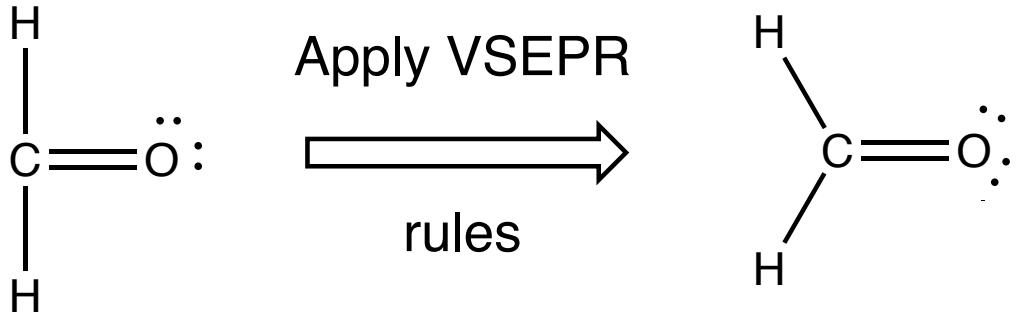








Identify atoms that use sp^3 hybrid orbitals to form bonds and hold lone-pair electrons



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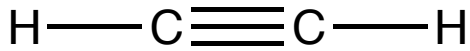
Identify atoms that use sp^2 hybrid orbitals to form bonds and hold lone-pair electrons



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Identify atoms that use sp hybrid orbitals to form bonds and hold lone-pair electrons