(5) **Today**

Sections 1.5-1.10
Valence Bond Theory

Next Class (6)

Sections 1.5-1.10
Valence Bond Theory

Sections 1.12
Drawing Chemical Structures

(7) **Second Class from Today**

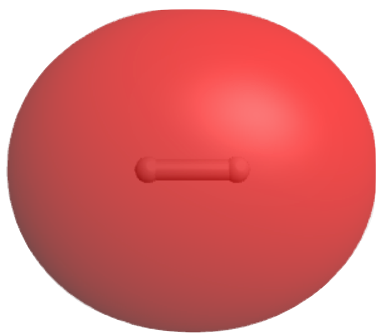
Sections 1.12
Drawing Chemical Structures

Chap 2.1 - 2.4

Third Class from Today (8)

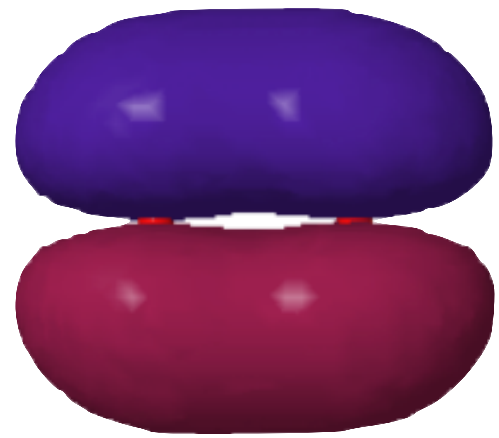
Chap 2.1 - 2.4

Office hours rescheduled to Tuesday



σ

sigma look along the bond it looks a bit like an s orbital ... it looks like a circle

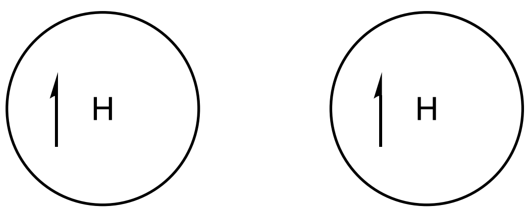


π pi

look like p orbitals when viewed along the bond this orbital has room for 1 more e^-

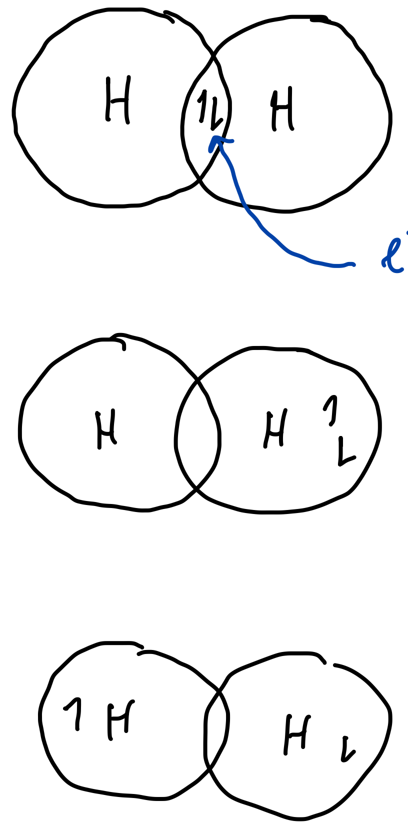
$1s^1$ $1s^1$

so does this one



H—H

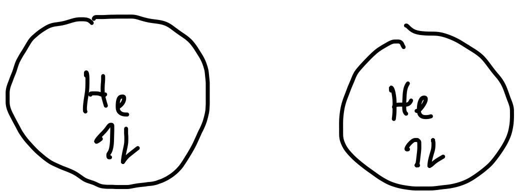
atomic orbitals overlap + e^-'s can be shared from one atom to the other



e^-'s can now experience more ⊕ charge so they will be lower in E

Full

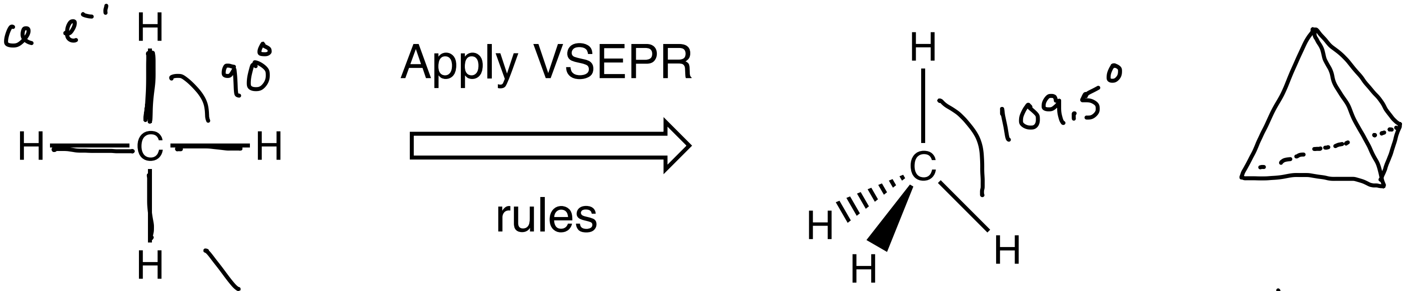
$1s^2$ $1s^2$



no room, so overlapping He orbitals wouldn't be able to share e^-'s. The e^-'s in the filled orbitals would just repell each other

Single bonds, lone-pair electrons, and hybrid orbitals Sections 1.5 - 1.10

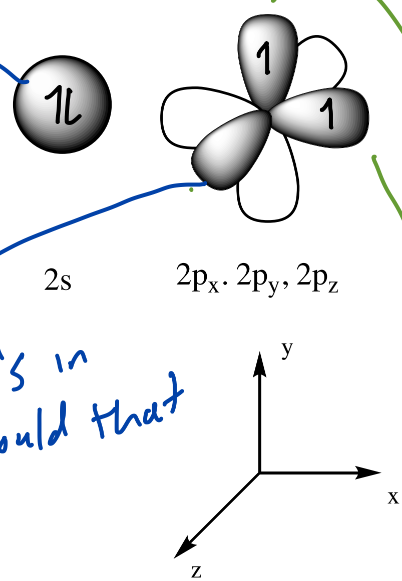
1 C atom 4 valence e^-
4 H atoms 4 valence e^-'s
———
$8e^-$ / 2
4 pair



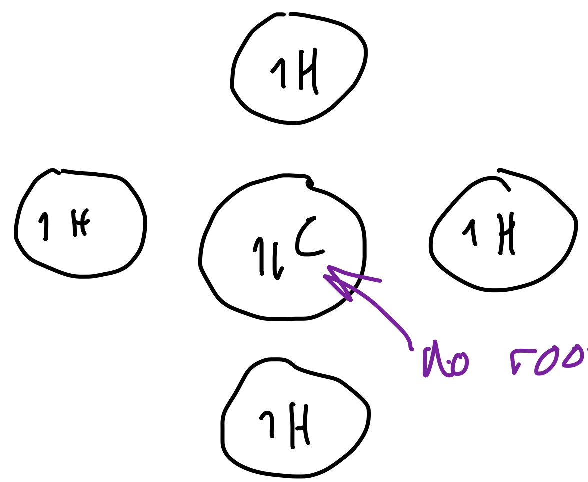
1 2s 3 2p — room for 8 e^-'s

tetrahedral molecule

* no room for more e^-'s in 2s



* room for 2 e^-'s in $2p_z$ but how would that work...?



ve-'s for C
$2s^2 2p^2$

no room at the inn

* these p orbitals have room for 1 e^- each

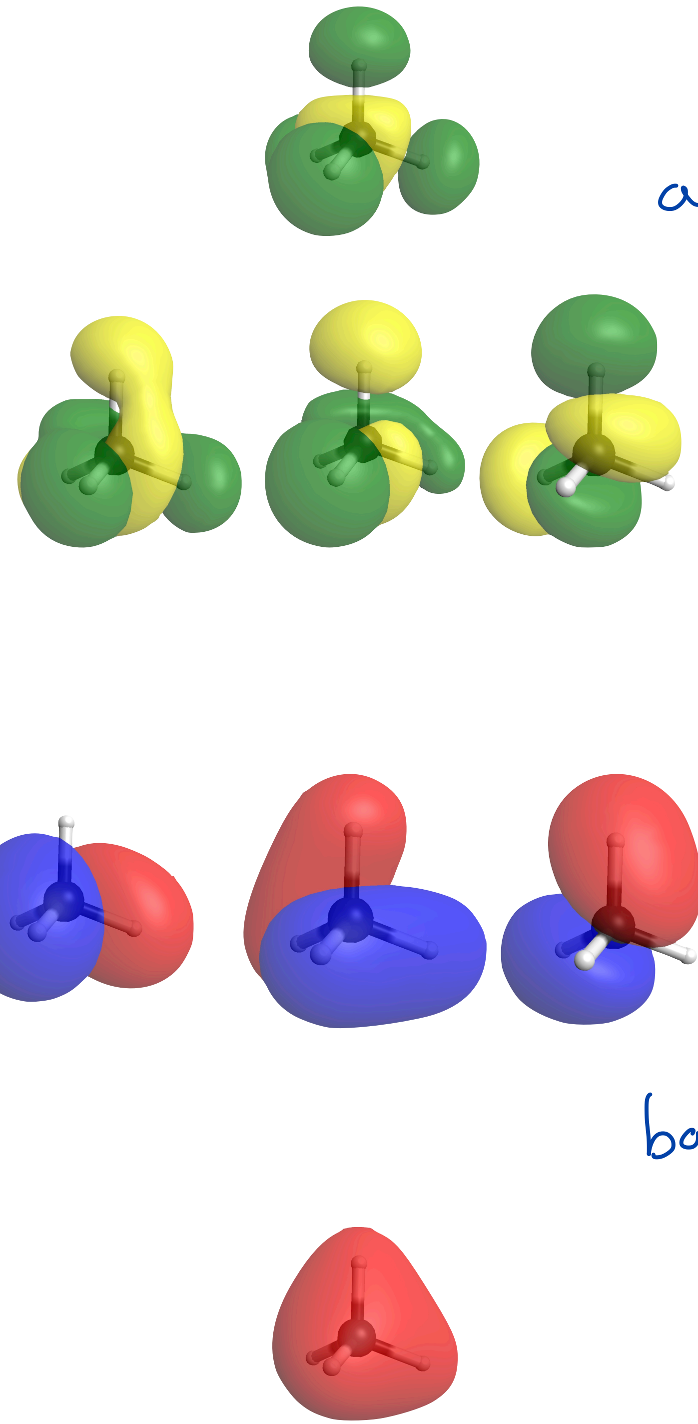
* carbon's atomic orbitals are not arranged in a way that allows them to form 4 tetrahedrally arranged 2-e^- bonds

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

Just a Reminder that what I just said about orbitals being the "wrong" shape isn't a problem in MO theory

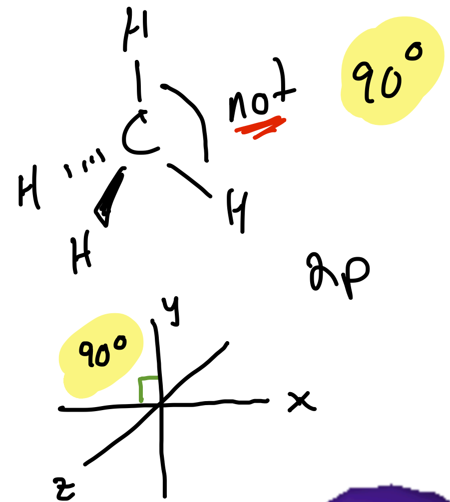
antibonding orbitals

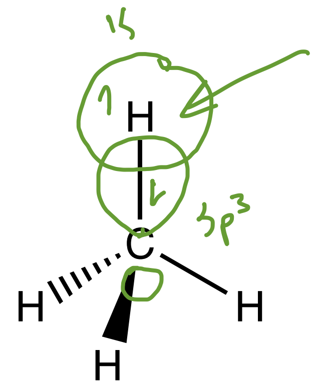


one 2s orbital
and
three 2p orbitals
from
one C atom

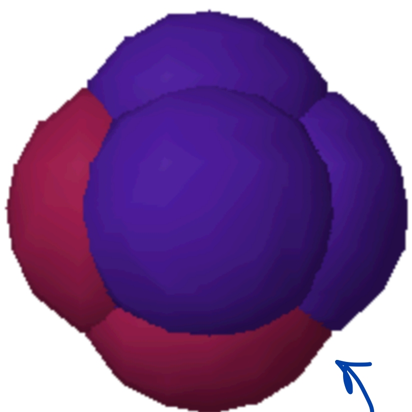
four 1s orbitals
from
four H atoms

bonding orbitals

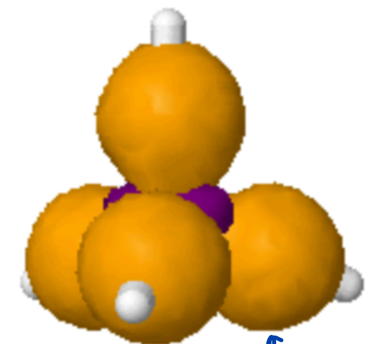


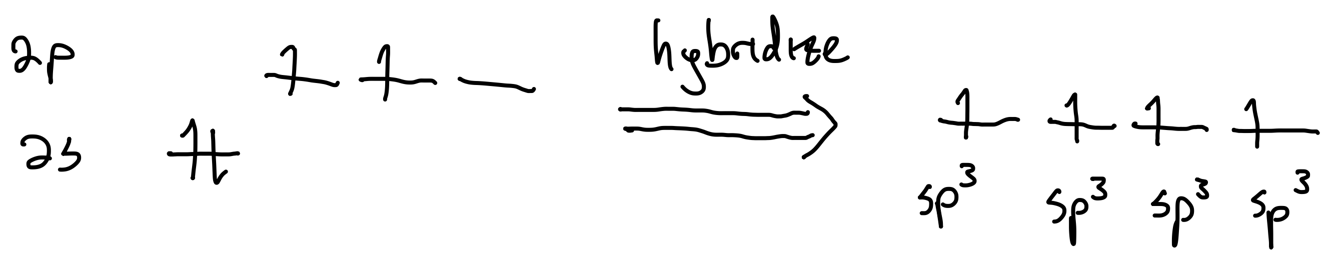


a 1s orbital on H overlaps with a (singly occupied) sp^3 orbital on the C atom and e⁻'s are shared between the 2 atoms



change our 2s + 2px, 2py, 2pz into new orbitals





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

1 draw Lewis structure

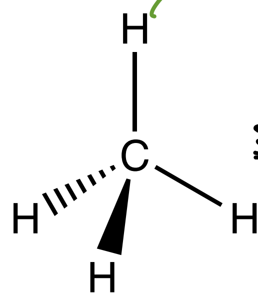
2 draw VSEPR interpretation
determine the # of directions you need the orbitals to point

3 # of HO's needed = # of directions the orbitals need to point

4. # of HO's needed = # of AO's to hybridize

5. starting with s valence orbital add in p orbitals until you reach the # of HO's needed

6. name... $sp^{(\text{number of p orbitals used})}$



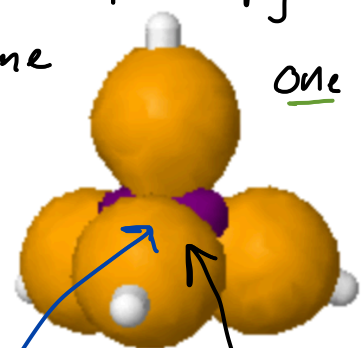
2. 4 sets of e^{-1}'s need to point in 4 directions

3. 4 HO's are needed

4. mix 4 AO's to get 4 HO's

5. $2s + 2p_x + 2p_y + 2p_z$

6. name



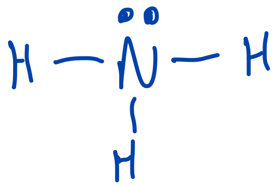
one part s
three parts p
sp^3

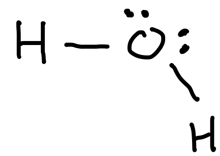
there are 4 sp^3 hybrid orbitals on this C atom

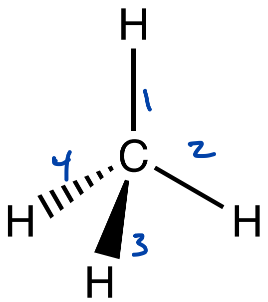
an sp^3 hybridized C atom

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





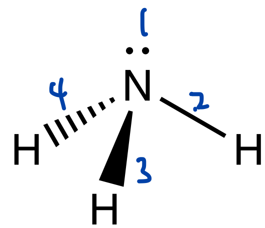


4 directions

$2s \times 2p_x \times 2p_y \times 2p_z$

⇓

$sp^3 \quad sp^3 \quad sp^3 \quad sp^3$



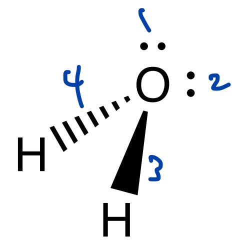
4 directions

4 HO's need

$2s \times 2p_x \times 2p_y \times 2p_z$

⇓

$sp^3 \quad sp^3 \quad sp^3 \quad sp^3$



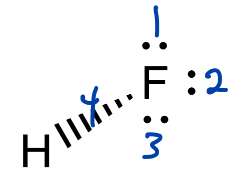
4 directions

4 HO's need

$2s \times 2p_x \times 2p_y \times 2p_z$

⇓

$sp^3 \quad sp^3 \quad sp^3 \quad sp^3$



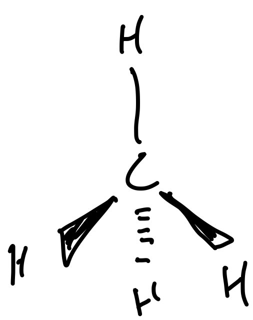
4 directions

4 HO's need

$2s \times 2p_x \times 2p_y \times 2p_z$

⇓

$sp^3 \quad sp^3 \quad sp^3 \quad sp^3$



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