Course 343 Lecturer Gellman

Day Friday Date 9/4/15

Notes Taken By Kirandeep Deol Total # of Pages 3

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course website: https://www.chem.wisc.edu/chem343-gellman/index

Rec. Problems: (Chapter 1) ⇒ 1, 3-9, 11-13, 16-18, 20, 22-26, 30-32, 40, 41, 44, 45 of 6th Ed.

Recall key themes in organic molecules

- bonding + molecular geometry via consideration of

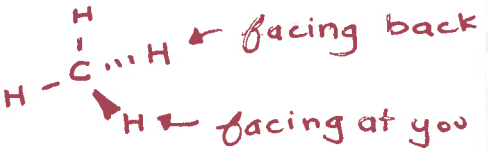
⇝ "phototypical molecules"

#1 = methane = $CH_4$

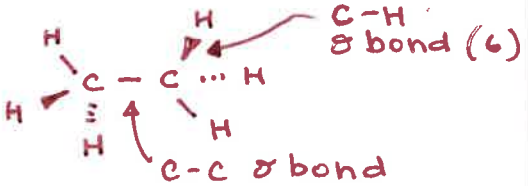
3D structure → "tetrahedral"

$H-\hat{C}-H = 109.5°$

↳ for an $sp^3$ hybridized carbon

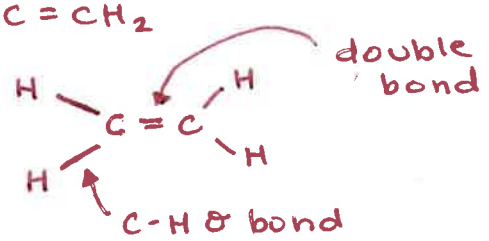



#2 = ethane = $C_2H_6 = CH_3CH_3$



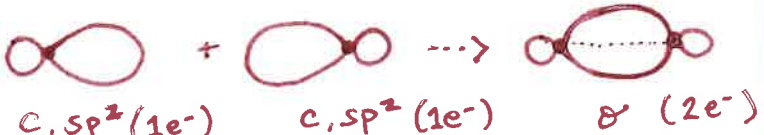

#3 = ethene, or ethylene = $C_2H_4$, $H_2C=CH_2$

carbon is $sp^2$ hybridized ⇐ has 1 σ bond & 1 π bond ⇒




Spatial characteristics of σ- and π bonds

C-C, σ




atomic orbitals

C=C, π


AOs

"It's very easy to mistake familiarity with mastery." – Prof. Gellman 9/3/15

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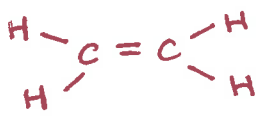
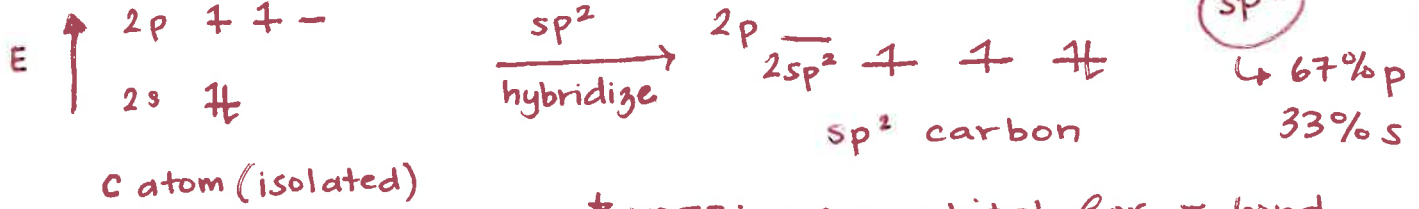
- Because π MO e⁻ are necessarily displaced from the inter-nuclear axis, the π e⁻'s are NOT as "tightly held" as σ e⁻'s.
  ∴ π bonds are often sites of reactivity



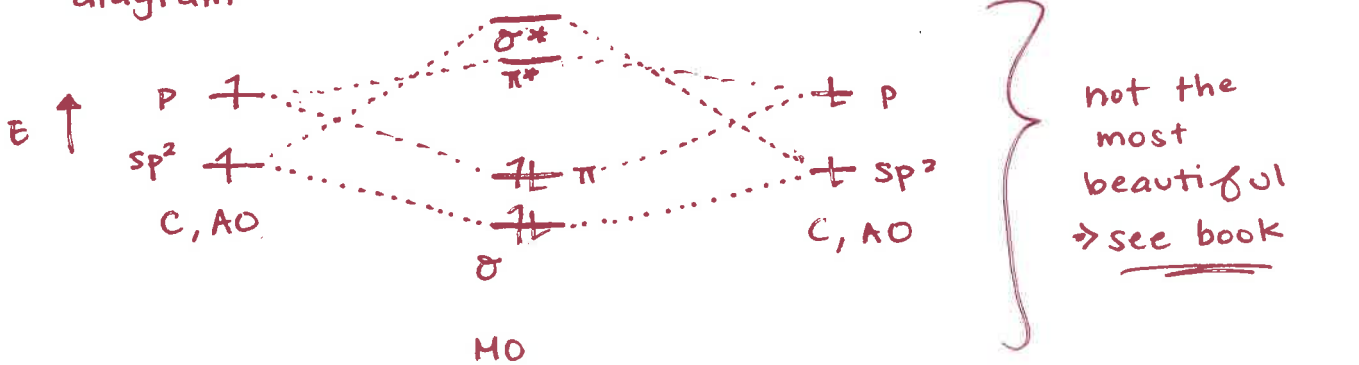
Each C bonds to 3 partners
∴ $sp^2$ hybridized

- Thus,



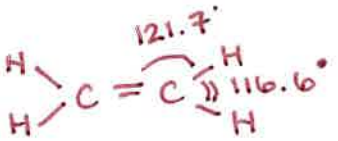

* NOTE: one p orbital for π bond

- C=C orbital energy diagram




- Geometry

$sp^2$ C · bond angles ~ 120°C




* ie. ethylene

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#H • acetylene (ethyne) = $C_2H_2$, $H-C\equiv C-H$

↑ triple bond ($\sigma + 2\pi$)

• sp-hybridized C bond angle ~ 180°

Bond lengths

| | |
|---|---|
| $H_3C-CH_3$ | 1.54 Å |
| $H_2C=CH_2$ | 1.33 Å |
| $HC\equiv CH$ | 1.20 Å |

($Å = 10^{-10}$ m)