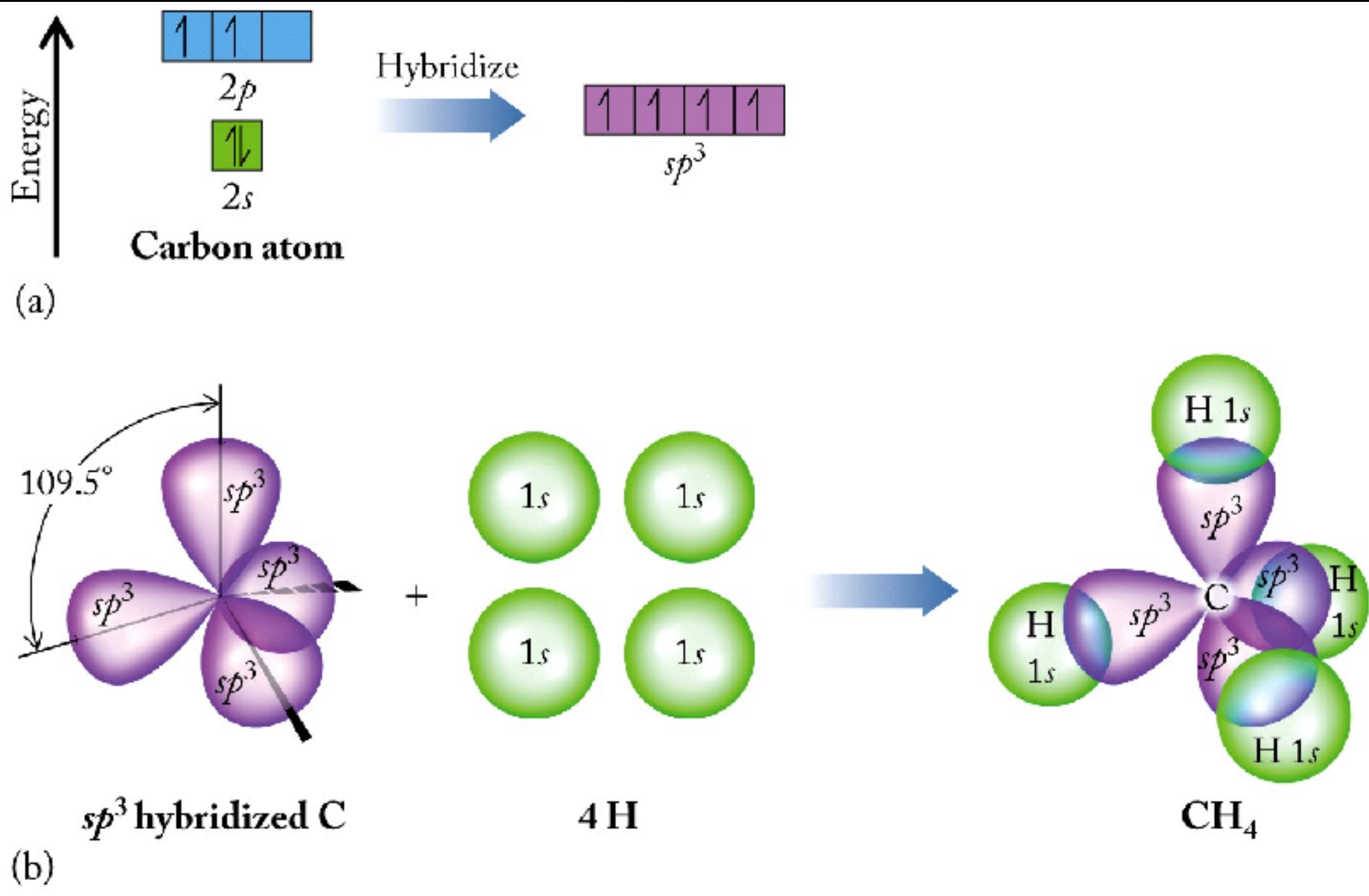


Previously in Molecularity...



(p)



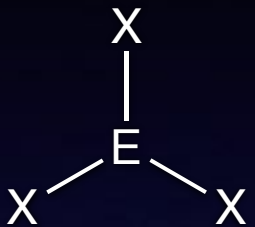
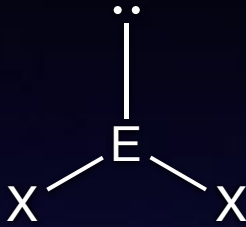
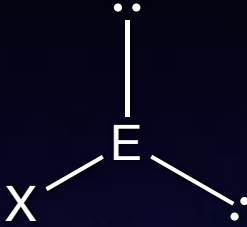

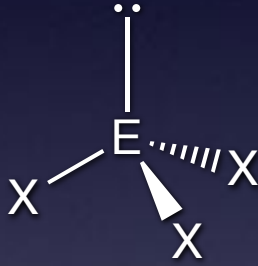
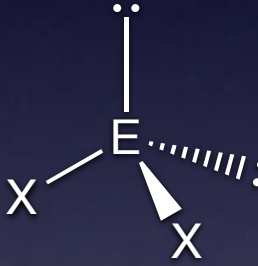
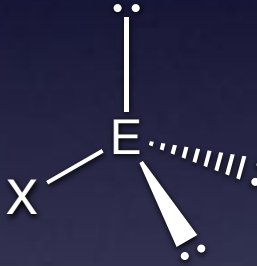

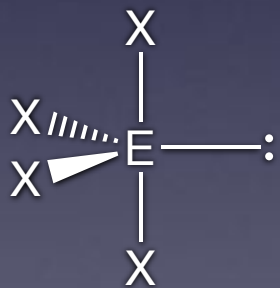
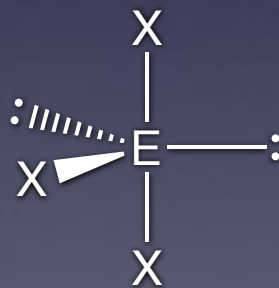
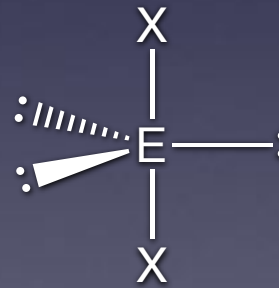
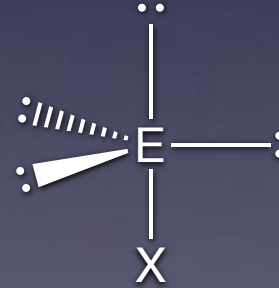
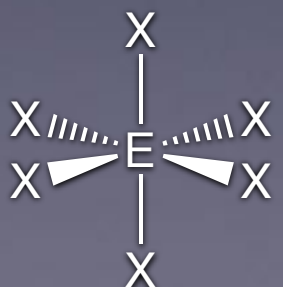


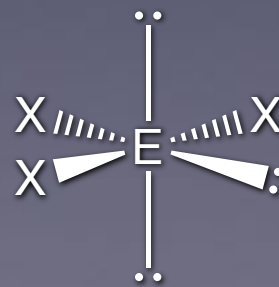

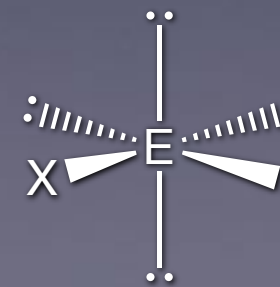
This is where the **tetrahedral** VSEPR structure comes from

A silver fork is stuck vertically into a paved path that recedes into a forest. The path is made of light-colored stones or bricks, and the forest is lush with green trees. The scene is captured in a cinematic style with soft lighting.

Where are we going today?

Ch1010-A17-A03 Lecture 19

- § 6.3 Hybridization: the molecules (Valence bond theory)

SN	0 LP	1 LP	2 LP	3 LP	4 LP	5 LP
2	 Linear					
3	 Trigonal planar	 120° Bent				
4	 Tetrahedral	 Trig. pyramidal	 109.5° Bent			
5	 Trig. bipyrimidal	 See-saw	 T-shaped	 Linear		
6	 Octahedral	 Sq. pyramidal	 Sq. planar	 T-shaped	 Linear	

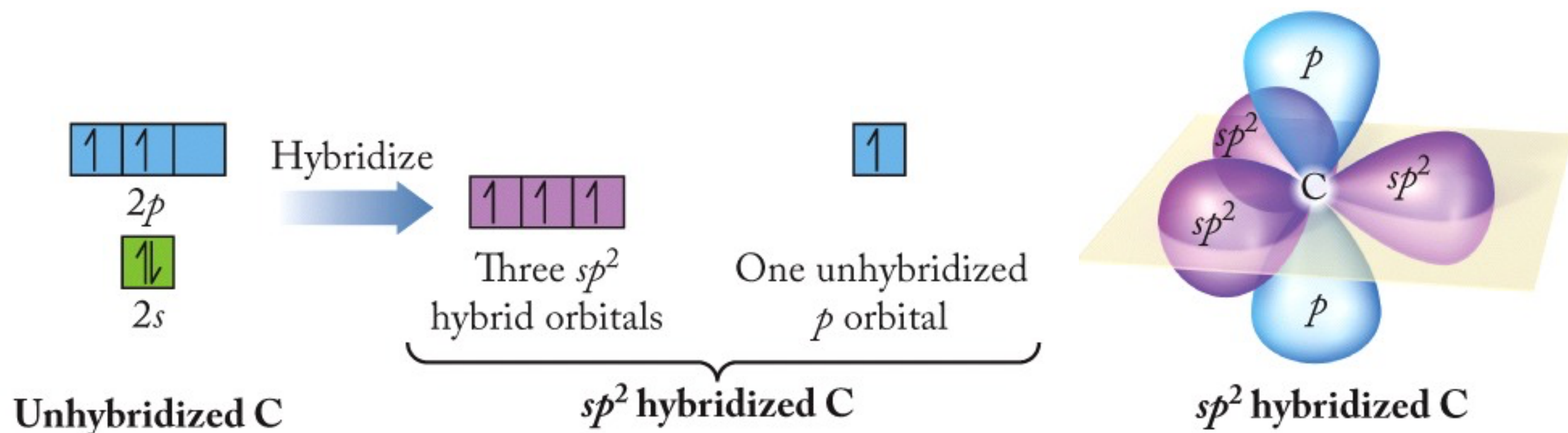
SN	0 LP	1 LP	2 LP	3 LP	4 LP	5 LP
2	$\text{X} - \text{E} - \text{X}$ <p>Linear</p>	$\text{X} - \text{E} - \text{:}$			sp hybridization	
3	$\begin{array}{c} \text{X} \\ \\ \text{X} - \text{E} - \text{X} \end{array}$ <p>Trigonal planar</p>	$\begin{array}{c} \text{:} \\ \\ \text{X} - \text{E} - \text{X} \end{array}$ <p>120° Bent</p>	$\begin{array}{c} \text{:} \\ \\ \text{X} - \text{E} - \text{:} \end{array}$		sp ² hybridization	
4	$\begin{array}{c} \text{X} \\ \\ \text{X} - \text{E} - \text{X} \\ \\ \text{X} \end{array}$ <p>Tetrahedral</p>	$\begin{array}{c} \text{:} \\ \\ \text{X} - \text{E} - \text{X} \\ \\ \text{X} \end{array}$ <p>Trig. pyramidal</p>	$\begin{array}{c} \text{:} \\ \\ \text{X} - \text{E} - \text{:} \\ \\ \text{X} \end{array}$ <p>109.5° Bent</p>	$\begin{array}{c} \text{:} \\ \\ \text{X} - \text{E} - \text{:} \\ \\ \text{:} \end{array}$	sp ³ hybridization	
5	$\begin{array}{c} \text{X} \\ \\ \text{X} \text{ \textbackslash } \text{E} \text{ / } \text{X} \\ \\ \text{X} \end{array}$ <p>Trig. bipyrimidal</p>	$\begin{array}{c} \text{X} \\ \\ \text{X} \text{ \textbackslash } \text{E} \text{ - } \text{:} \\ \\ \text{X} \end{array}$ <p>See-saw</p>	$\begin{array}{c} \text{X} \\ \\ \text{:} \text{ \textbackslash } \text{E} \text{ - } \text{:} \\ \\ \text{X} \end{array}$ <p>T-shaped</p>	$\begin{array}{c} \text{X} \\ \\ \text{:} \text{ \textbackslash } \text{E} \text{ - } \text{:} \\ \\ \text{X} \end{array}$ <p>Linear</p>	sp ³ d hybridization	
6	$\begin{array}{c} \text{X} \\ \\ \text{X} \text{ \textbackslash } \text{E} \text{ / } \text{X} \\ \\ \text{X} \end{array}$ <p>Octahedral</p>	$\begin{array}{c} \text{X} \\ \\ \text{X} \text{ \textbackslash } \text{E} \text{ / } \text{X} \\ \\ \text{:} \end{array}$ <p>Sq. pyramidal</p>	$\begin{array}{c} \text{:} \\ \\ \text{X} \text{ \textbackslash } \text{E} \text{ / } \text{X} \\ \\ \text{:} \end{array}$ <p>Sq. planar</p>	$\begin{array}{c} \text{:} \\ \\ \text{X} \text{ \textbackslash } \text{E} \text{ / } \text{X} \\ \\ \text{:} \end{array}$ <p>T-shaped</p>	sp ³ d ² hybridization	

How to determine hybridization

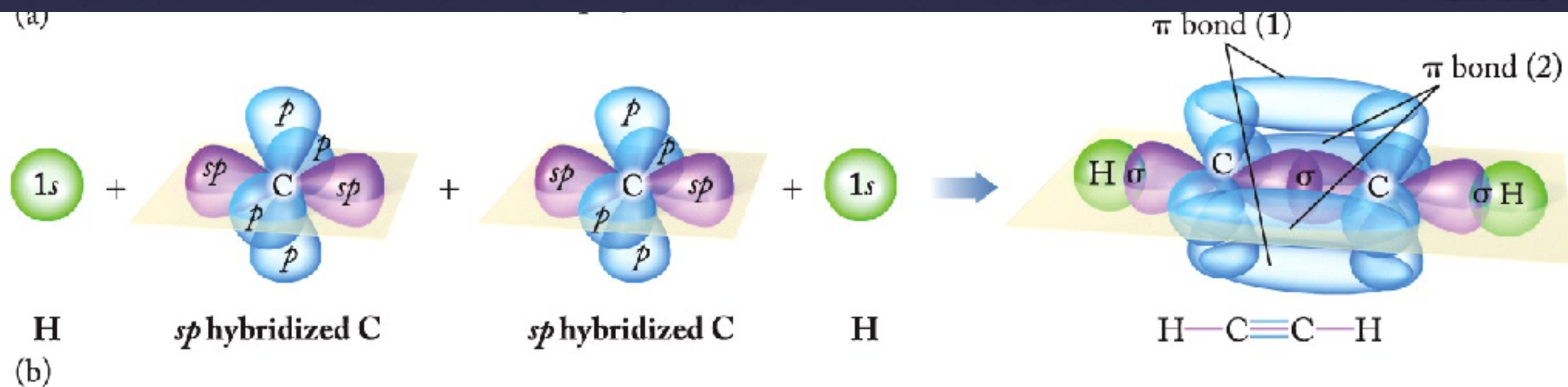
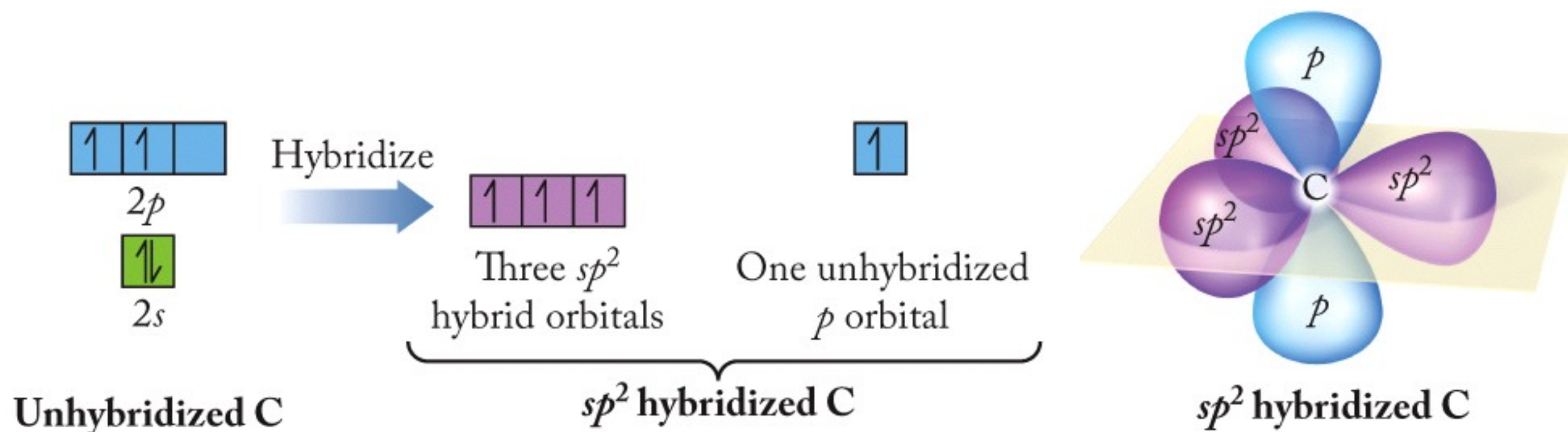
- Start with VSEPR structure, and don't forget about leftover p 's!
 - Atoms with sp hybridization have 2 p orbitals remaining
 - Atoms with sp^2 hybridization have 1 p orbital remaining
 - Atoms with sp^3 hybridization have 0 p orbitals remaining
 - Carbon can demonstrate all three cases, sp , sp^2 , or sp^3 !

Why does one orbital remain unhybridized?

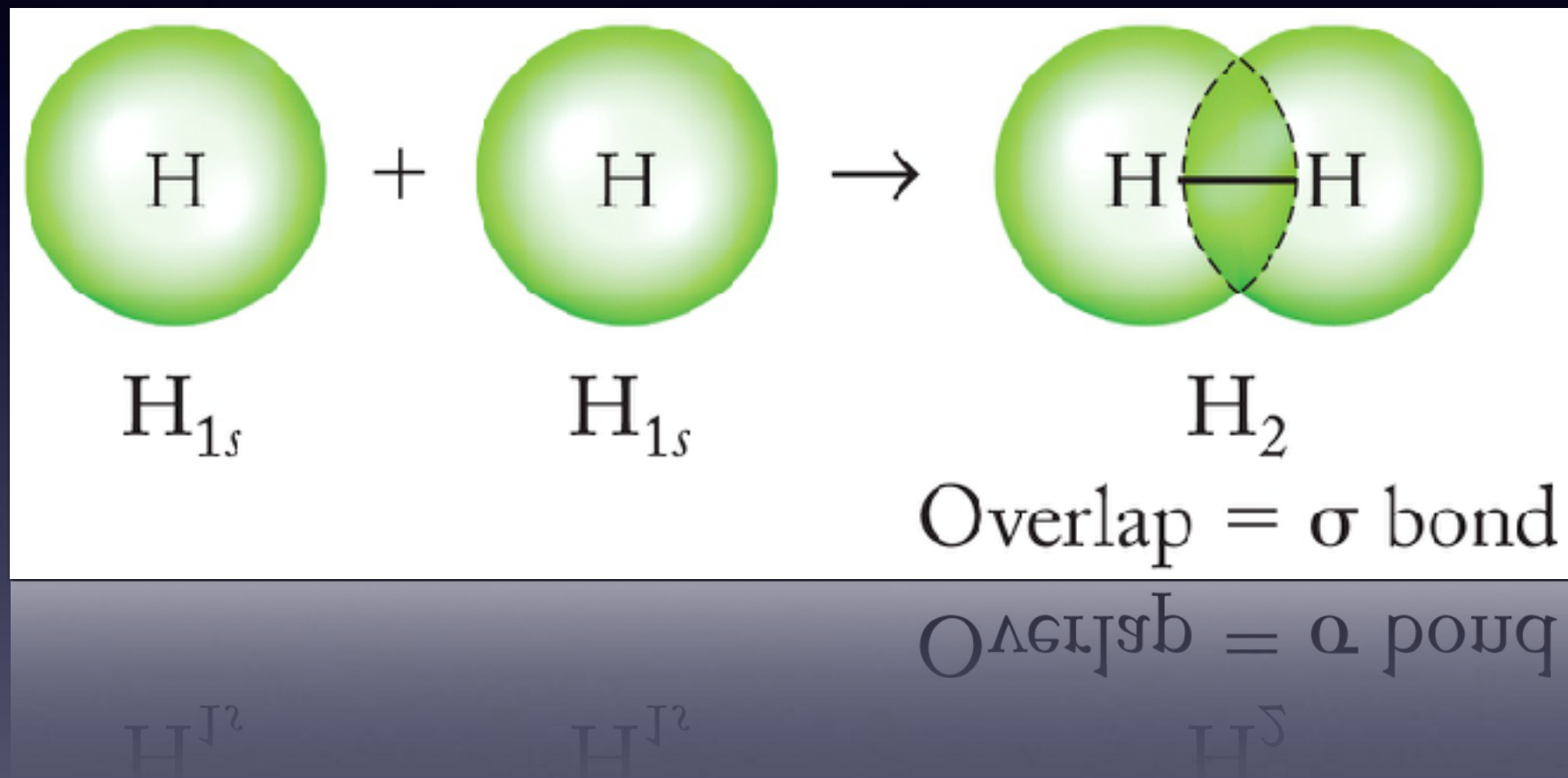
GKF 5.26



- Objective is to maximize bonding and minimize steric repulsion!

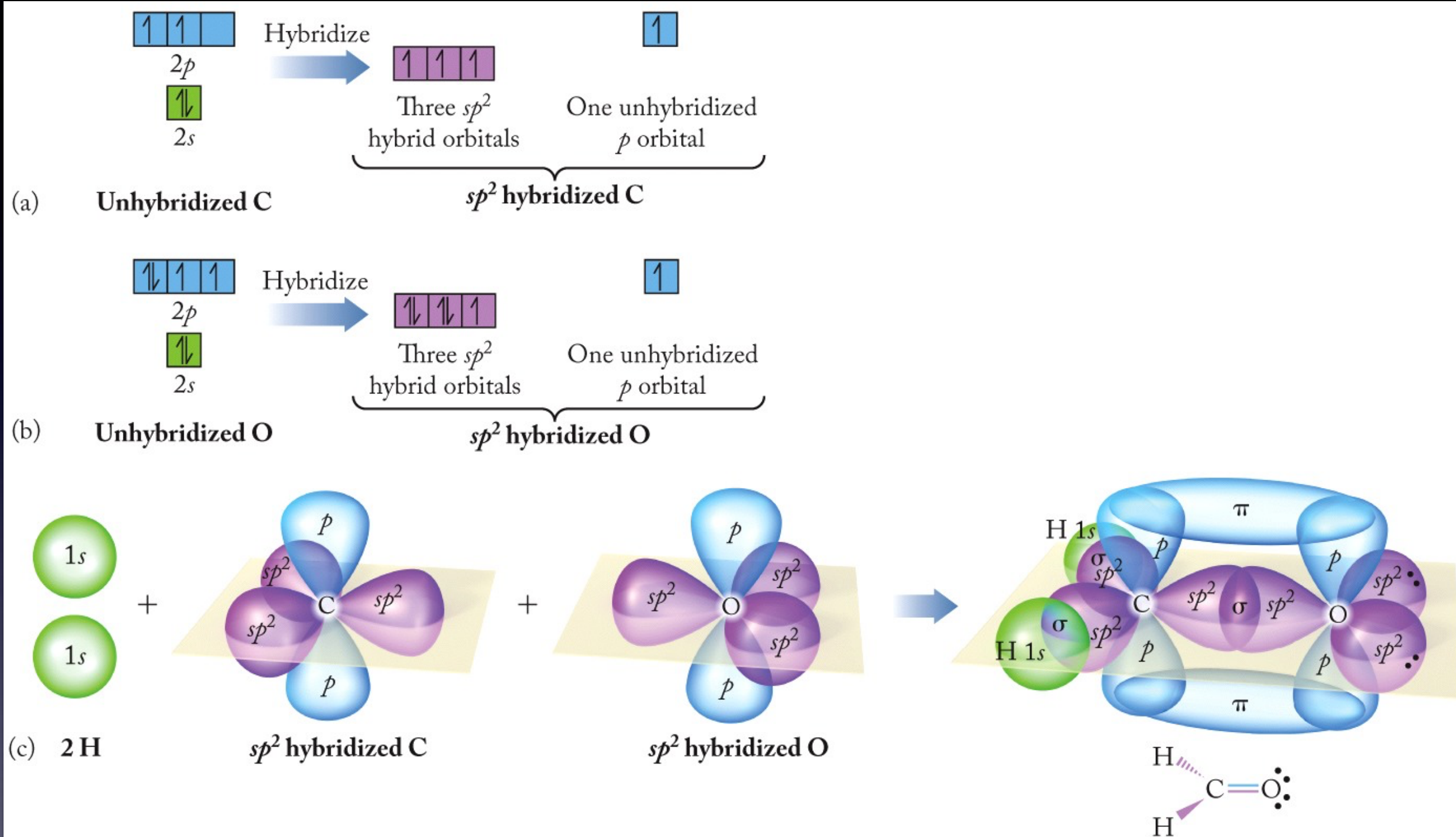


Valence bond theory

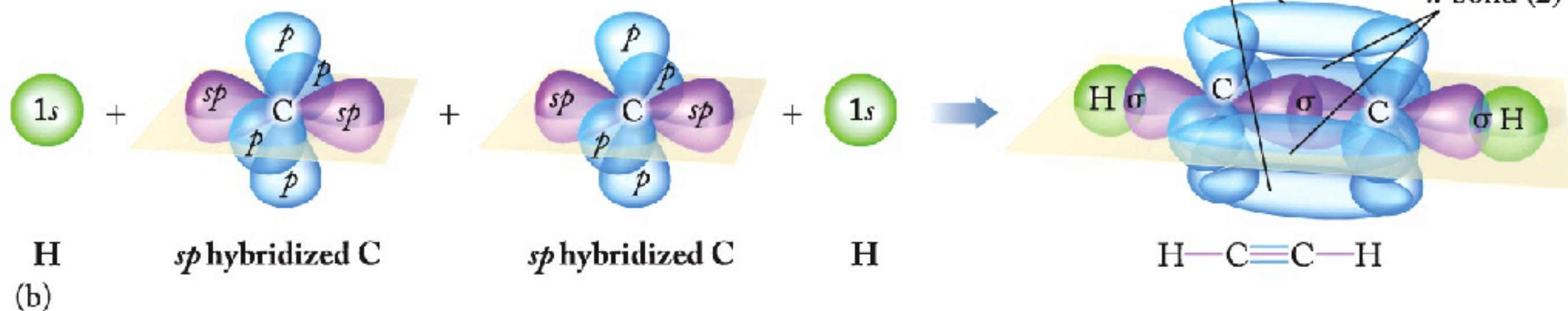
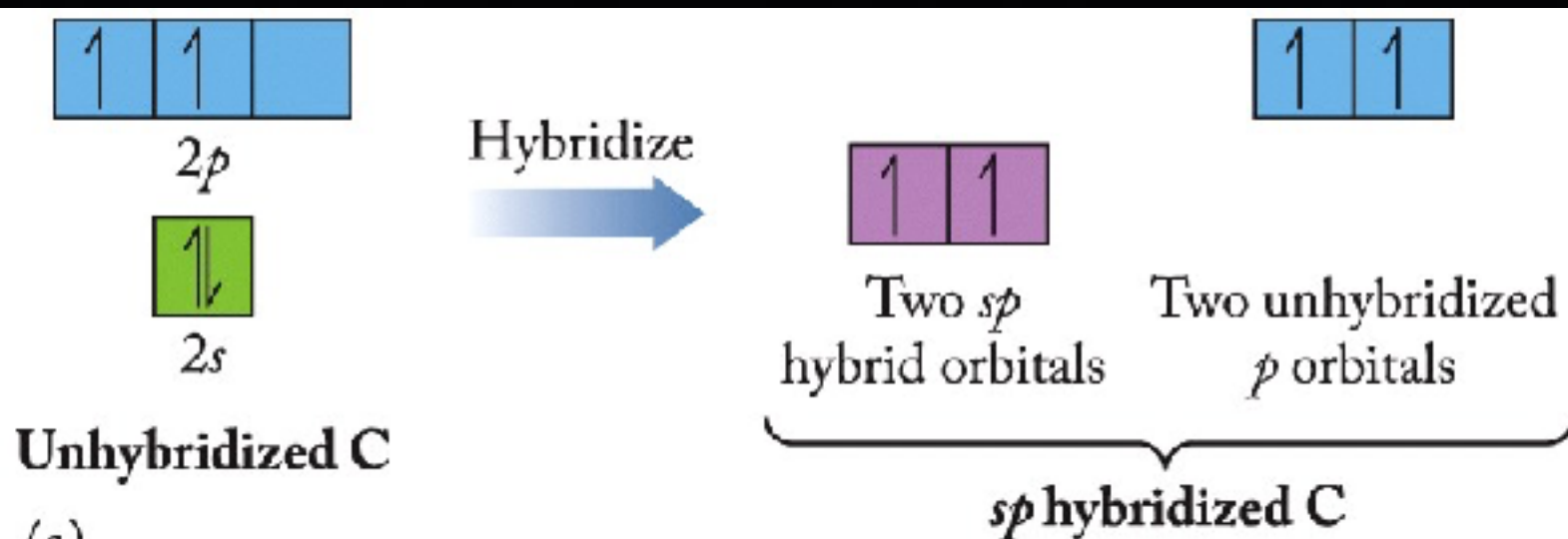


GKF 5.20

Sigma bonds have **zero** nodes between the atoms



Pi bonds have **one** node that is coplanar with the atoms



Pi bonds have **one** node that is coplanar with the atoms

How many different ways can you arrange
four different atoms around carbon?



Where did we go today?

Ch1010-A17-A03 Lecture 19

- § 5.4 Valence bond theory
- Great problems at chapter's end:
5.67, 69, 71, 75–85

Next time...

- § 5.5 Atoms with multiple “centers”
- § 5.6 Chirality & molecular recognition