

Chapter 13

STUDY GUIDE

13.1 BONDS IN SPACE

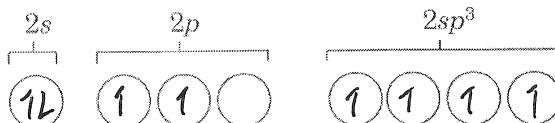
Complete the sentence or answer the question.

- Pairs of electrons that bond two atoms in a molecule are called shared pairs
- Why do electron pairs in the outer levels of atoms in a molecule spread apart as far as possible?
Repulsion Forces push them apart
- Because each of the bond angles of methane equals 109.5° , its molecular shape is a perfect tetrahedron.
- Complete the following diagrams to show the electron content of the outer orbitals of (a) an unbonded carbon atom, and (b) a hybridized carbon atom.

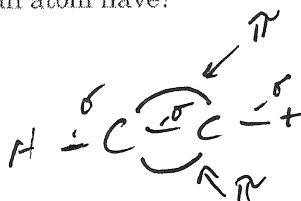
Unbonded carbon atom Hybridized carbon atom

Outer orbitals

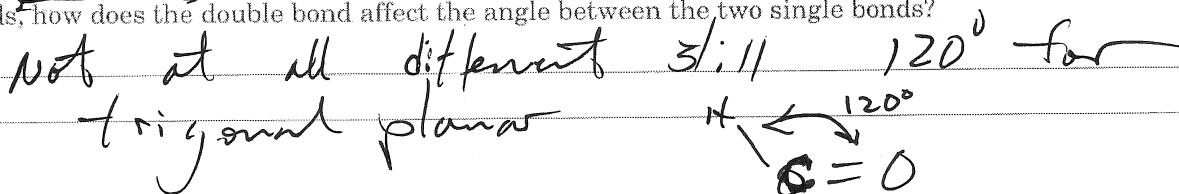
Outer orbitals



- How do hybridized orbitals in an atom compare with one another?
All alike except orientation
- When an sp³ orbital of one carbon atom overlaps that of another carbon atom, how many electrons do the two atoms share?
2
- How many hybrid orbitals of the following types can an atom have?
 - sp³ 4
 - sp² 3
 - sp 2



- In a molecule of ethylene, C₂H₄, how many sigma bonds and how many pi bonds are present?
2π, 3σ
- In a trigonal planar structure such as the CH₂O molecule, with one double bond and two single bonds, how does the double bond affect the angle between the two single bonds?



Write T for true or F for false. If a statement is false, replace the underlined word or phrase with one that will make the statement true, and write your correction on the blank provided.

T

False, π

False, σ

T

F, farther from

10. A shared pair of electrons is formed when an orbital of one atom overlaps an orbital of another atom.
11. Sigma bonds are always formed by the sideways or parallel overlap of unhybridized *p* orbitals.
12. In single, double, and triple bonds between carbon atoms, one of the bonds is always a π bond.
13. When two carbon atoms are joined by more than one bond, the additional bonds are always π bonds.
14. π bonds break more easily than do sigma bonds, because the electrons forming π bonds are closer to the nuclei.