

## Chapter 9 Focus Questions

### Section 1

1. Why in methane would using existing orbitals for carbon result in 2 different types of C-H bonds?
2. Why is this a problem?
3. Why would the  $p$  orbitals result in  $90^\circ$  bond angles? Why is this a problem?
4. What is hybridization?
5. Why is the hybridized idea a better explanation than the original “native” orbitals? In other words – why does  $sp^3$  hybridization make sense in terms of orbital shape, geometry, and energy?
6. Look at Figure 9.5. If the hybridized orbitals represent higher energy than the “native”  $2s$  orbital, why would they occur?
7. What determines whether an atom will use native or hybridized orbitals?
8. Double bonds affect shape how?
9. Why does  $sp^3$  hybridization not work for ethylene?
10. How many orbitals are hybridized to achieve the required geometry of ethylene? How many are not hybridized?
11. What is a sigma ( $\sigma$ ) bond and how does it form?
12. What is a pi ( $\pi$ ) bond and what is its geometry in relation to the  $\sigma$  bond? What part of the ethylene Lewis structure does it represent?
13.  $\sigma$  bonds form from orbitals that \_\_\_\_\_ each other.  $\pi$  bonds form from \_\_\_\_\_ orbitals.
14. A double bond is formed from \_\_\_\_\_  $\sigma$  and \_\_\_\_\_  $\pi$  bonds. A triple bond is formed from \_\_\_\_\_  $\sigma$  and \_\_\_\_\_  $\pi$  bonds. A single bond is formed from \_\_\_\_\_  $\sigma$  and \_\_\_\_\_  $\pi$  bonds.
15. What is the general principle of the  $sp^2$  orbital?
16. For  $\text{CO}_2$ , how is the  $180^\circ$  bond angle satisfied with hybridization?
17. In  $\text{CO}_2$ , the O's undergo \_\_\_\_\_ hybridization and the single C undergoes \_\_\_\_\_ hybridization.
18. How many hybridized orbitals does C have? How many unhybridized orbitals?
19. How are the 2 double bonds achieved in by the single C in  $\text{CO}_2$ ?
20. What is the geometric orientation of the two  $\pi$  bonds that carbon has in  $\text{CO}_2$ ? How is this achieved by the unhybridized orbitals?
21.  $\text{N}_2$  has \_\_\_\_\_  $\sigma$  and \_\_\_\_\_  $\pi$  bonds based on its Lewis structure. It undergoes \_\_\_\_\_ hybridization. Each N atom has \_\_\_\_\_ hybridized orbitals and \_\_\_\_\_ unhybridized orbitals.
22. How is nitrogen able to achieve its triple bond with another nitrogen in  $\text{N}_2$ ?
23. Why are 5 orbitals needed in order to achieve trigonal bipyramidal orientation of the  $\text{PCl}_5$  molecule? What hybridization is this called?
24. In  $\text{PCl}_5$ , the P undergoes \_\_\_\_\_ hybridization, while each Cl undergoes \_\_\_\_\_ hybridization. In the total molecule, there are \_\_\_\_\_  $\sigma$  and \_\_\_\_\_  $\pi$  bonds.
25. For  $\text{SF}_6$ , hybridization must explain the \_\_\_\_\_ shape of the molecule. What is this hybridization called? How many orbitals (and which ones) are hybridized? How many are unhybridized?

26. What is the general plan for determining the localized electron model of hybridization?
27. What is the general correlation between steric number, VSEPR shape, bond angle, and hybridization for each type of structure that we have studied?
28. Read through sample exercises 9.1 through 9.5. Then do problems #21, 23, and 25 on page 442.

#### Sections 9.2-9.4

I suggest reading them to enhance your knowledge, but I will not be assigning focus questions for these sections. In understanding these sections (and all sections really) – focus on the figures. Use the text to understand what the figures are attempting to illustrate for you.