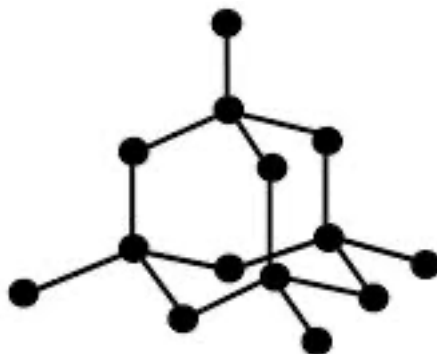


Worksheet 3.4

Graphite and Diamond

1. What are some physical properties of diamond?
2. What are some physical properties of graphite?

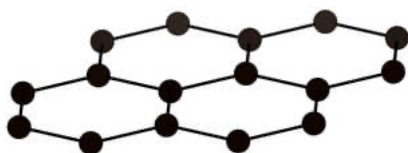
Here is the bonding structure of diamond. The shaded spheres represent carbons, while the lines denote areas of electron density (i.e. a covalent bond, where electrons are most likely to be found). Use this representation to answer the following questions:



3. What is the maximum number of carbons that another carbon is attached to?
4. If there are this many areas of electron density for each carbon, what would be the electron geometry for a given carbon atom in diamond?
5. What would be the bond angle for a given carbon in diamond?
6. Based on your answer for Question 3, how many bonding orbitals (molecular orbitals) are needed for a given carbon in diamond?

7. Valence bond theory says that atomic orbitals mix to make new hybrid orbitals. The number of hybrid orbitals formed is equal to the number of atomic orbitals mixed. How many atomic orbitals need to mix to explain the bonding in diamond?
8. The hybrid orbitals are named after the atomic orbitals that were used to form them. For example, a hybrid orbital formed by mixing one s and one p orbital is called an sp orbital. What would you call the hybrid orbitals used in diamond?

Here is the bonding structure of one sheet of graphite. The shaded spheres represent carbons, while the lines denote an area of electron density (i.e. where electrons are likely to be found). Use this representation to answer the following questions:



9. What is the maximum number of carbons that another carbon is attached to?
10. If there are this many areas of electron density for each carbon, what would be the electron geometry for a carbon atom in graphite?
11. What would be the bond angle for a given carbon in graphite?
12. Based on your answer for Question 9, how many bonding orbitals (molecular orbitals) are needed for a given carbon in graphite?
13. How many atomic orbitals need to mix to explain bonding in graphite? (Hint: refer back to question 7).
14. What would you call the hybrid orbitals used in graphite? (Hint: refer back to question 8).