Chapters 1-3 Test Review (Basic Concepts)

Chapter 1

1. Name the important characteristics of carbon.
2. Define the term “isotope”.
3. Name the four types of orbitals, the shape of the orbitals, and the number of electrons each orbital can hold.
4. What is the relationship between orbitals and shells?
5. What is the Afbaue Principle?
6. What is the Pauli Exclusion Principle?
7. What is Hund’s Rule?
8. Know how to write out the full ground-state electron configuration for a given element (not the abbreviated version). For example, write the ground-state electron configuration for the following element:
   1. Phosphorous
9. What is the difference between a covalent and ionic bond?
10. Be able to draw Lewis Dot, Line-Bond, Condensed and Skeletal structures when given a molecular formula (and be able to convert between the forms).
11. What bond types do sigma and pi bonds correlate to?
12. What kind of orbital overlap is associated with sigma bonds?
13. What kind of orbital overlap is associated with pi bonds?
14. Out of single, double and triple bonds, which bonds are the weakest/ strongest, which bonds are the longest/shortest?
15. How do you determine the hybridization of an atom?
16. Fill in the following table:

|  |  |  |
| --- | --- | --- |
| Hybridization | Bond Angle | Molecular Geometry |
| sp |  |  |
| sp2 |  |  |
| sp3 |  |  |

Chapter 2

1. What is electronegativity?
2. What is the most electronegative element?
3. Know how to determine the polarity of a bond when given a table of electronegativity values.
4. What numerical differences in electronegativity correspond to covalent nonpolar, covalent polar and ionic bonds?
5. What is a dipole moment?
6. How are dipole moments represented in a molecule?
7. How do you calculate the formal charge of an atom?
8. What does a molecule represented by multiple resonance structures actually look like?
9. When drawing resonance structures:
   1. How do you represent electron flow?
   2. To draw resonance forms, what must be present?
   3. What is the same, and what is different, between the multiple resonance forms of a given molecule?
10. What are the Bronsted definitions for acids and bases?
11. What is the definition of an organic acid and an organic base?
12. What are the Lewis definitions for acids and bases?
13. In an acid-base reaction:
    1. Strong acids produce ­­­­­­­­­­­­­ \_\_\_\_\_\_\_\_\_\_\_\_\_ conjugate bases.
    2. Weak acids produce \_\_\_\_\_\_\_\_\_\_\_\_\_ conjugate acids.
14. A strong acid has:
    1. A \_\_\_\_\_\_\_\_\_\_ Ka
    2. A \_\_\_\_\_\_\_\_\_\_ pka
15. A weak acid has:
    1. A \_\_\_\_\_\_\_\_\_\_ Ka
    2. A \_\_\_\_\_\_\_\_\_\_ pka
16. What is the concentration of water at 25°C?
17. What makes an acid “strong”?
18. What makes a base “strong”?
19. Name common examples of Lewis Acids:
20. Name common examples of Lewis Bases:
21. In reference to a molecule, what does the term “amphoteric” mean?
22. Define the following non-covalent interactions:
    1. Dipole-Dipole Forces
    2. Dispersion Forces
    3. Hydrogen Bonds

Chapter 3

1. What is the formula for a saturated alkane?
2. What does it mean for an alkane to be saturated?
3. Fill in the names for the following saturated alkanes:

|  |  |  |  |
| --- | --- | --- | --- |
| CH4 |  | C7H16 |  |
| C2H6 |  | C8H18 |  |
| C3H8 |  | C9H20 |  |
| C4H10 |  | C10H22 |  |
| C5H12 |  | C11H24 |  |
| C6H14 |  | C12H26 |  |

1. What is a constitutional isomer?
2. Fill in the following table:

|  |  |
| --- | --- |
| Isopropyl |  |
| Isobutyl |  |
| Sec-butyl |  |
| Tert-butyl |  |

1. How do you determine the degree of substitution for a carbon/ attached hydrogens and substituents?
2. List the steps for naming alkanes.
3. What happens to the boiling point and melting point of alkanes when:
   1. The chain length increases
   2. The number of side groups/ side chain length increases