

**CHEM 108A Reading Comprehension Questions & Topics:** This document is designed to help guide your reading by providing the *bare minimum* material you should know when you walk into lecture. Begin your reading assignment by finding the responses to the questions or statements that follow. *The responses are not turned in for credit.* Complete the reading by quickly skimming the text, becoming familiar with bold terms, and making some sense of the figures, schemes, tables etc. Time permitting, you may decide to look up an individual topic on the [Khan Academy Website for OChem](#).

### Lecture 1, Chapter 1

1. Be able to identify or draw the following for B, C, N, O, and F...
  - a. Number of valence electrons
  - b. Electron configuration
  - c. The number of bonds when the element is neutral (zero formal charge).
2. What is a sigma bond and a pi bond? How do they relate to single, double, and triple bonds?
3. Draw the skeletal structure of 2-Methylbutane.

### Lecture 2, Chapter 2.1-2.6

1. What is electronegativity and what is the most electronegative element?
2. What is a dipole? Draw the individual dipole arrows for each bond in water, methanol, and ammonia to explain the overall (net) dipole in each molecule.
3. Draw the Lewis structure of a phosphate ion, nitrate ion, and carbonate ion then calculate the formal charge on each atom.
4. What are the basic rules for resonance forms?

### Lecture 3, Chapter 2.7-2.12

1. What's the difference between the Bronsted-Lowry definition and the Lewis definition of acids and bases?
2. How does pKa relate to acidity...higher pKa means a weaker or stronger acid?
3. What is the conjugate base of acetic acid ( $\text{CH}_3\text{CO}_2\text{H}$ )? Draw its Lewis structure.
4. What are the three intermolecular forces mentioned in section 2.12? Rank them in relative strength.

### Lecture 4, Chapter 3

\* *Make a model and bring to lecture: 2 C's (black) with single bond between them, give each C 3 more single bonds to 3 different colors (same 3 on either side).*

1. Begin memorizing all the functional groups in Table 3.1 (Name & Structure only). Flash cards are helpful.
2. Fill out the table in the Alkane Nomenclature handout (given in lecture) and begin *memorizing* the names.
3. What are the basic steps in naming an alkane?
4. What is a Newman projection? Draw the eclipsed and staggered conformation of ethane.

### Lecture 5, Chapter 4

\* *Cyclohexane: Link 6 C's (black) with single bonds in a ring. The remaining two bonds on each C should be white (pointing up if you hold the ring flat) and green (pointing down). If you don't have green and white, choose any 2 other colors.*

1. The rules for naming alkanes and cycloalkanes are pretty much the same, with one key difference. What's that difference?
2. Define the terms: *stereochemistry*, *stereoisomers*, *cis-trans isomers*, *angle strain*, *torsional strain*, and *steric strain*.
3. Draw the two chair conformations of cyclohexane showing all axial and equatorial H's (the book has a nice tutorial).

**Lecture 6, Chapter 5.1-5.5**

\* *Tetrahedral Carbons: Make two separate models – One C atom with 4 different colors. The other will be its mirror image – another C with 4 different colors single bonded.*

1. What does it mean for a molecule to be “chiral”?
2. What is the basic requirement for an atom to be referred to as a chirality center?
3. What is plane-polarized light?
4. What are the Cahn-Ingold-Prelog rules for ranking substituent priority?

**Lecture 7, Chapter 5.6-5.12**

\* *Bring the same model (just one of them) from Lecture 6.*

1. What is the difference between enantiomers and diastereomers?
2. What are the main criteria for a compound to be a meso compound?

**Lecture 8, Chapter 6**

1. Describe in your own words how to distinguish between an addition, elimination, substitution, and elimination reaction.
2. What is the difference between a radical and polar reaction mechanism?
3. Define the terms “nucleophile” and “electrophile” and give three functional group examples of each, specifying the *atom* that accepts or donates electrons.
4. What are the rules for using curved arrows in polar reaction mechanisms?
5. Describe the relationship between the value of the equilibrium constant ( $K_{eq}$ ) of a reaction, the reaction free energy ( $\Delta G^\circ$ ), and whether the reaction absorbs or releases energy.

**Lecture 9, Chapter 7.1-7.6**

\* *Two models: One cis-alkene and one trans-alkene.*

1. What does it mean for a compound to be unsaturated?
2. How does the numbering system for alkenes differ from that for alkanes?
3. Give a simple example of a cis-alkene, trans-alkene, E-alkene, and Z-alkene.
4. Compare the rules for prioritizing chiral centers to those for E/Z designation.

**Lecture 10, Chapter 7.7-7.11**

1. Explain how a reaction can be regioselective.
2. What is Markovnikov's Rule and how does it relate to carbocation stability?
3. What is the difference between a hydride and a proton?

**Chapter 8.1-8.3**

4. How does anti/syn stereochemistry compare to trans/cis?
5. How many different ways can halogens be introduced into a molecule with an alkene? How are the reaction mechanisms different and how are they similar?

**Lecture 11, Chapter 8.4-8.8**

1. Know these functional group names: Alkyl Halide, Alkyl Dihalide, Halohydrin, Alcohol, Alkane, Alkene, Epoxide, 1,2-Diol, Ketone, Aldehyde, Carboxylic Acid.
2. How many different ways can water be added across an alkene? What is the main difference in the outcome of these different methods?
3. How can you tell if the organic reactant is oxidized or reduced?
4. Review all the new ways to introduce oxygen into an alkene, in addition to the addition of water from question 1.

**Lecture 12, Chapter 8.12-8.13**

1. How many of the alkene reactions occur with relative stereochemistry, assuming the products have chiral centers? Which reactions will always form a racemic mixture?
2. Review the system for naming alkynes. This will not be covered in lecture.

**Chapter 9**

3. Most of the reactions of alkynes in this chapter are identical to those of alkenes. Take the time to draw an example of each alkyne reaction (up to and including section 9.6) and then draw an example of an alkene reacting with those same reagents (or the parallel set of reagents based on what you learned in chapter 8).
4. What is a terminal alkyne and how can it be used to make C-C bonds?

**Lecture 13, Chapter 10**

1. Show a simple example of each reaction used to synthesize organobromides from (a) alkanes, (b) alkenes, and (c) alcohols.
2. What are organometallic reagents? Give a few examples. Are they nucleophiles or electrophiles?

**Lecture 14, Chapter 11.1-11.6**

1. Are alkyl halides nucleophiles or electrophiles?
2. How many steps are there in the mechanism of an SN1 reaction? Of an SN2 reaction?
3. Is an SN1 reaction favored with more or less highly substituted alkyl halides? What about an SN2 reaction?
4. List a few examples of good leaving groups and good nucleophiles. Are hydroxide and fluoride good leaving groups? Are they good nucleophiles?

**Lecture 15, Chapter 11.7-11.12**

1. Show the stereochemistry of the E2 reaction using Newman projections for acyclic alkyl halides and chairs for cyclohexyl halides.
2. What do the SN1 and E1 reactions have in common?
3. Give examples of strong bases and weak bases.
4. As best as you can, list examples of compounds that can act as...
  - a. Nucleophile and base
  - b. Nucleophile but not a base
  - c. A base but not a nucleophile
  - d. Nucleophile and solvent
5. What is an  $\alpha,\beta$ -unsaturated ketone?

**Lecture 16, Chapter 14**

1. What is the difference between a conjugated and an unconjugated diene?
2. Why does the addition of HBr or Br<sub>2</sub> to conjugated dienes become more complicated than with an unconjugated diene?
3. What is meant by a 1,2-addition vs. a 1,4-addition of HBr to a conjugated diene?
4. What is the basic functional group requirements for two molecules to undergo a Diels-Alder reaction?
5. What is the main structural characteristic of the product of a Diels-Alder reaction?

**Lecture 17, Chapter 15.1-15.6**

1. Memorize the common names of the aromatic compounds in Table 15.1.
2. How is ortho-, meta-, para- used in the naming of aromatic compounds? When should numbering be used instead?
3. What are the criteria for a compound to be aromatic?