

**Chem 0310, Winter/Spring, 2009**  
**Professor Dennis P. Curran**  
(curran@pitt.edu)

**Exam 1, Friday, Jan 30, 10-10:55am**  
**Study Summary**

Numbers in parentheses are suggested problems from the text.

**Chapter 1: Structure and Bonding**

Electronic configurations of “organic” elements (H, C, N, O, F)

hybridization and bonding descriptions that result from qualitative applications of MO theory (31)

Lewis structures and atomic charges (21, 23, 24, 29). Can you write Lewis structures of molecules containing functional groups with C, H, O, N, halogens? Can you recognize where charges are needed from the bonding scheme without a “formal charge” calculation?

Ionic, covalent, and polar covalent bonds (22)

Resonance theory. How is it used to describe structures? Can you write resonance contributors and a resonance hybrid for simple molecules? (25-27)

Condensed, line and other structures (32-39)

- can you convert one type of structure to another?
- can you recognize the same structure drawn different ways?
- can you recognize incorrect or impossible structures?

**Chapter 2: Alkanes:**

Acidity and basicity. Can you use pKa's to establish where equilibria lie? What controls acidity/basicity? (23-24)

What is a functional group? Can you recognize one? (27)

Nomenclature of simple alkanes, cycloalkanes and alkyl halides (29-33)

- can you write IUPAC names from structures and structures from names?
- do you know important group names: methyl, ethyl, isopropyl, 2°-butyl, 3°-butyl, isobutyl, neopentyl?
- can you give IUPAC names to branched groups? (34, 39)
- can you identify 1°, 2°, 3°-carbons and hydrogens? (Chapter 3, 13)

Constitutional (structural) isomers of alkanes

- can you construct all isomers of simple alkanes and derivatives? (32)

Shapes of molecules: sp<sup>3</sup> atoms are tetrahedral

Conformational analysis of ethane. What is eclipsed? Staggered? Energy difference between them? Can you construct a “rotation coordinate” profile showing how energy changes?

Conformational analysis of butane. What is anti? Gauche? Energy difference? Could you apply this analysis to a different but related compound? (37, 38)

Can you work comfortably with Newman projections and “sawhorse” drawings? (36)

Can you recognize constitutional isomers, conformational isomers, and non-isomers?

Thermodynamics of reactions (how far). Can you write the expression for an equilibrium constant (K)? Given K, can you estimate  $\Delta G$  (and vice versa)?

Kinetics of reactions (how fast). What are activation barriers and why do reactions have them? What is the relationship between free energy, enthalpy and entropy of activation? What is a transition state and how it is different from a reactant, intermediate or product?

### Chapter 3: Radical Reactions

Structures, names and classes (primary, secondary, tertiary) of radicals (13, 14)

Homolytic bond dissociation energies and radical stabilities. Use of homolytic bond dissociation energies ( $\Delta H^0$ ) to calculate thermodynamics of an overall reaction or individual steps in a chain reaction. A table of bond dissociation energies *will* be provided on the exam, if needed. (17,18,33)

Halogenation of alkanes:

- Reactions of alkanes with halogens: products and reaction conditions (19-26).
- Mechanism of a chain reaction: initiation steps, propagation steps, and termination steps. Use of arrows to track electrons in each step.
- Differences in reactivity between  $F_2$ ,  $Cl_2$ ,  $Br_2$ , and  $I_2$  and reasons (31).
- Activation energies ( $E_{act}$ ) for endo- and exothermic reactions: The Hammond-Leffler postulate.

Consider also trying the practice quizzes on the web site for each chapter:

<http://bcs.whfreeman.com/vollhardtschore5e>