

## CHM2210

### Exam Two Study Sheet

The following topics are considered 'fair game' for the first exam. You will want to review your quizzes, homework, recommended problems, and class notes.

#### Exam One

- Lewis structures
  - Formal charges
- Valence and core electrons
- Covalent bonding
  - Polar covalent bonds
- Molecular orbitals and hybridization
  - Sigma and Pi bonds
- Acid dissociation constants ( $K_a$ )
  - Trends
    - Inductive
    - Delocalized electrons
  - Equilibrium effects
    - Favored species at equilibrium
- Henderson Hasselbach Equation (will be given)
- Nomenclature
  - Alkanes
  - Alkyl Halides
  - Cycloalkanes
  - Amines
  - Alcohols
  - Ethers
- Boiling Point
  - Trends
- Newman Projections for single bond rotation
- Cyclohexane conformers

#### Exam Two

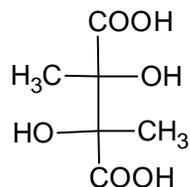
- Cis-Trans Isomers (E,Z) for double bonds
- Chiral Compounds
  - Identifying chiral centers
  - Labeling chiral centers as R or S
  - Fischer projections
  - Enantiomers vs. Diastereomers
    - Physical Properties
- Meso compounds
- Optical activity

- Alkene nomenclature
- Electrophiles and Nucleophiles
- Thermodynamics of alkene reactions (description, not calculation)
- Kinetics of alkene reactions (description, not calculation)
- Hydrogenation reaction
- Halide addition to an alkene
- Carbocation stability and Markovnikov addition
- Water addition to an alkene (and mechanism)
- Alcohol addition to an alkene (and mechanism)
- Carbocation rearrangement (and mechanism)
- Hydroboration (Anti-Markovnikov)
- Halohydrin formation (and mechanism)
- Ozonolysis (no mechanism)
- Epoxide formation (no mechanism)
- Hydrogenation (no mechanism)
- Stereochemistry of alkene addition reactions

**Sample Questions:** The following questions are examples of test questions.

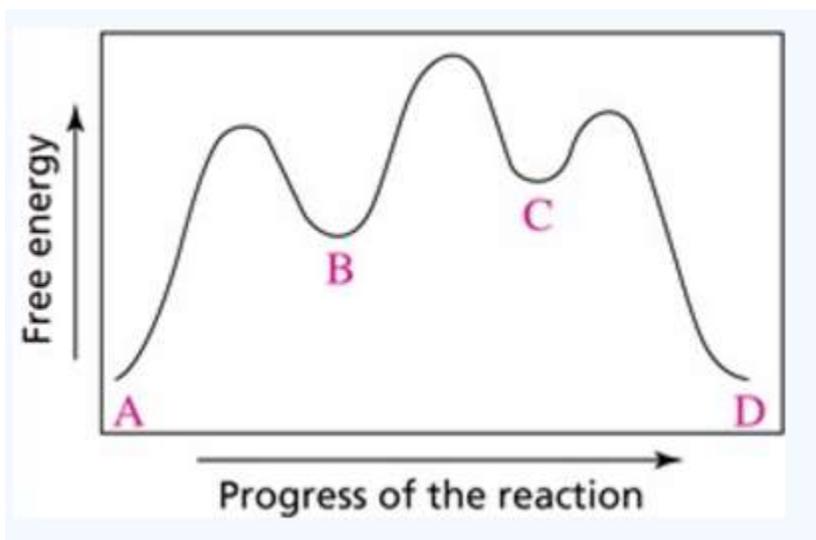
1. Give the major (and minor if any) products formed when 2-methyl-2-butene reacts with
  - a. HCl
  - b.  $\text{BH}_3/\text{THF}$  followed by  $\text{HO}^-$ ,  $\text{H}_2\text{O}_2$ ,  $\text{H}_2\text{O}$
  - c.  $\text{Br}_2$  in Methylene chloride
  - d.  $\text{Br}_2$  in Water
  - e.  $\text{H}_2$  over Pd/C
  - f.  $\text{H}_2\text{O} + \text{H}_2\text{SO}_4$
  - g. Methanol +  $\text{H}_2\text{SO}_4$
2. Give the mechanisms for the major products in (a), (c), (d), and (g).
3. What would you expect to see in a polarimeter when you have the following mixtures? Describe what the effect of these mixtures would be on plane polarized light.
  - a. A 50/50 mix of R-(+)-2,3-dimethyl-3-pentanol and S-(-)-2,3-dimethyl-3-pentanol
  - b. A 80/20 mix of R-(+)-2,3-dimethyl-3-pentanol and S-(-)-2,3-dimethyl-3-pentanol
  - c. A 100% solution of R-(+)-2,3-dimethyl-3-pentanol.
4. What are the major and minor expected products for 3-methyl-1-pentene in the reaction with hydrochloric acid. Draw the reaction coordinate including any necessary transition state(s) and intermediate(s).

5. Consider the molecule below:



- Label the stereocenters in the molecule above as R or S.
- Draw a diastereomer of this molecule, and label the stereocenters as R or S.
- Does the diastereomer have an enantiomer? Why or why not?

6. Consider the reaction coordinate below:



- How many intermediates are formed in this reaction?
- How many transition states are formed in this reaction?
- Which is more stable, B or C?
- Which step is rate determining, A-B or B-C?

7. Propose a mechanism for the following reaction:

