Exam One Study Guide
Organic Chemistry I (CHM 223-001)
Prof. Chad Landrie • Fall 2018

Information

Date: Tuesday, September 18, 2018
Location: 340 Lee SHC
Time: 11:00 a.m. – 12:00 p.m. Lecture to follow.

Policies

1. Each student must present a valid Oakton or state photo ID to obtain an exam. Pictures on the ID must be clearly visible and not excessively worn or degraded.

2. You are required to write your name and your Oakton ID at the top of each side of each page. Failure to follow these instructions will result in the loss points listed on each side of each page in the exam. You will not be allowed to complete this when time is called. This should be done at the beginning of the exam.

3. The only electronic device that may be used on the exam is a handheld standard calculator. Programmable calculators and graphing calculators are **NOT** allowed. These electronic devices also may **NOT** be used during the exam: cell phones, iPhones, any iDevice, PDA's, iPod's, laptops, earphones or any other device that is not a standard, non-programmable calculator.

4. Exam answer must be legible for full credit. It is recommended that you use a pencil so that corrections can be made. Illegible, difficult to read answers will be marked incorrect.

Format and Content

The format of the exam will closely resemble homework, quizzes, clicker questions and skillbuilder exercises. The content will cover lectures 1-8:

Ranking (10 questions):	20 pts
Short Answer and Essay (15 questions):	80 pts
Total:	**100 pts**

Study Guide

Ranking (10 questions; 20 points)
The following are potential ranking questions on the exam.

- Rank in order of increasing acidity (1 = least acidic, 5 = most acidic).
- Rank in order of increasing boiling point (1 = lowest boiling point; 5 = highest boiling point).
- Rank in order of increasing acidity (1 = weakest acid, 5 = strongest acid).acidity/basicity (pKa)
- Rank each conformation in order of increasing potential energy (1 = lowest energy, most stable; 4 = highest energy, least stable).
- Rank in order of increasing number of chirality centers (1 = fewest chirality centers; 4 = most chirality centers).

- Rank in order of increasing heat of combustion (1 = lowest heat of combustion; 5 = highest heat of combustion)
- Rank each conjugate base in order of increasing stability (1 = least stable, highest potential energy; 5 = most stable lowest potential energy)
- Rank in order of increasing angle strain (1 = least angle strain; 5 = most angle strain)
- Rank each monosubstituted cyclohexane conformation in order of increasing potential energy (1 = lowest potential energy, most stable; 5 = highest potential energy, least stable)
- Rank in order of increasing polarizability (1 = least polarizable; 4 = most polarizable)

Short Answer and Essay (15-20 questions; 80 points)
The following are potential short answer questions/topics. This list is not exhaustive, just a guide. Lab concepts are fair game, but will not be the focus. The questions will be similar in format to those found on homework, quizzes and i>Clicker questions.

- Isomerism: Know isomer tree and be able to classify pairs of molecules (e.g., constitutional, conformational, configurational, optical, enantiomers, etc.)
- Determine the Keq for an acid-base reaction; Predict whether a base is strong enough to deprotonate an alkyne
- Draw conjugate acids and bases
- Write IUPAC names for alkanes and cycloalkanes
- Draw Newman, Fisher and sawhorse projections for conformations of alkanes.
- Explain the meaning of hyperconjugation; Draw a molecular orbital diagram to support your explanation that illustrates the greater degree of overlap between the bonding and adjacent antibonding C-H bond in the staggered conformation.
- Draw the MO for a C-H bond and antibond
- Name functional groups; Draw specific examples of functional groups
- Draw resonance structures; determine major contributors; determine formal charge on atoms
- Complete equilibrium expression by drawing Lewis structure for conjugate acid or base
- Describe the Van der Waals intermolecular forces present in alkanes (e.g. London dispersion forces); using these principles and polarizability, explain why the polymer tetrafluoroethylene (Teflon®) is anti-stick.
- Draw chair conformations of mono and disubstituted cyclohexane rings; ring-inversion
- Determine the most stable configuration for disubstituted cyclohexane rings (e.g., cis-1,3-dimethylcyclohexane vs trans-1,3-dimethylcylcohexane)
- Determine the relationship (cis or trans) of groups on cyclohexane chair conformations
- Draw electron configuration diagrams for hybridized and nonhybridized atoms
- Predict bond angles for sp3, sp2 and sp hybridized atoms; predict hybridization of atoms in molecules
- Use hybridization and valence bond theory to explain the relative acidity of alkanes, alkenes and alkynes
- Illustrate a σ-bond and π-bond using the valence bond model.
- Compare the effects on Ka and ΔG when the energy of the conjugate base is altered (electronegativity) or the energy of the conjugate acid is altered (bond-strength)
- Predict the most acidic H-atom in a molecule
- Draw an example of a sigma-bond and pi-bond using valence bond theory.
- compare and contrast the three models of bonding—Lewis, Valence, Molecular Orbital
- Determine whether groups on cyclohexane chair conformations are cis or trans
- Summarize the three types of strain
- Rationalize/predict the solubility of organic species in water and organic solvents (e.g., CH2Cl2)

- Outline the steps required to separate two organic compounds by base extraction (e.g., benzoic acid and toluene) or acid extraction (e.g., triethylamine and toluene).
- Draw electron configuration diagrams for sp3, sp2 and sp hybridized atoms
- Identify gauche, eclipsed and anti relationships in conformations
- Calculate formal charges
- Draw Lewis structures for simple polyatomic compounds/ion of both organic and inorganic types (e.g., H2CO3, NaSO4, CH2O, C2O2H4)
- Write condensed formulas from structural formulas (Lewis structures).
- Write structural formulas in bond-line notation from condensed formulas.
- Interconvert bond-line and Fisher projections
- Determine whether a chirality center is R or S
- Distinguish between chirality center and stereogenic center
- Circle the molecules below that are meso
- Draw the enantiomer of a molecule
- Determine wheather a molecule is chiral or achiral