CHEM 347 – Organic Chemistry II (for Majors)

Instructor: Paul J. Bracher

Quiz #1

Due in Monsanto Hall 103 by:

Friday, January 17th, 2014, 8:00 p.m.

Student Name (Printed)	N/A
Student Signature	N/A

Instructions & Scoring

- This quiz must be turned in by the due date listed above.
- You are allowed access to any materials you wish and may discuss the questions with other students.
- Place your answers on the official answer sheet handed out in class. If you print your own, please print it back-to-back on a single sheet of paper.
- Your quiz may be photocopied.

Problem	Points Earned	Points Available
I		50
II		10
III		20
IV		20
TOTAL		100

Original Problems, Required Information in Answers, and Supplementary Explanation

Problem I. (50 points total; 5 points for a correct answer, 1 point for an answer intentionally left blank, and 0 points for an incorrect answer.) For each question, select the best answer of the choices given. Write the answer, legibly, in the space provided on the answer sheet.

(1) D

Arrange the following four molecules in ascending strength of acidity—i.e., list the weakest Brønsted–Lowry acid (with the highest pK_a) first, and the strongest acid (with the lowest pK_a) last.

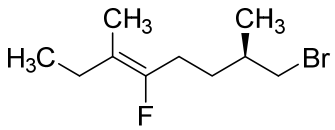
A **B** **C** **D**

(a) **A** < **B** = **D** < **C**
(b) **A** < **B** < **D** < **C**
(c) **A** < **D** < **B** < **C**
(d) **A** < **C** < **B** = **D**
(e) **C** < **B** = **D** < **A**

The best approach to this problem is to look at each molecule and estimate a pK_a value for the most acidic proton. Compound **A** is an alkane that will have protons with pK_a values >50. The hydroxyl groups on **B** and **D** have pK_as around 16. The pK_a of methyl acetate (**C**) is around 24. The alcohols **B** and **D** are enantiomers, so their acidities will be equal.

(2) B

The correct systematic IUPAC name for compound **E** is (3*E*,7*R*)-8-bromo-4-fluoro-3,7-dimethyl-3-octene?

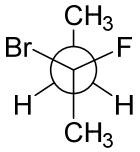


E

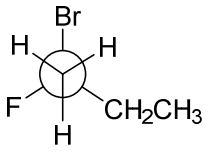
(a) True
(b) False
(c) All of the above
(d) None of the above
(e) Both (a) and (d)

(3) B The compounds represented by Newman projections **F** and **G** are:

(a) identical compounds
(b) enantiomers
(c) diastereomers
(d) constitutional isomers
(e) not isomers

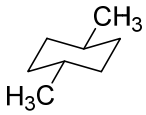


F

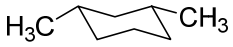


G

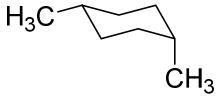
(4) D What structure represents the most stable conformation of *trans*-1,3-dimethylcyclohexane?



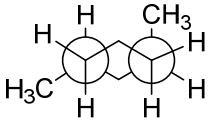
(a)



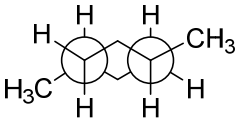
(b)



(c)



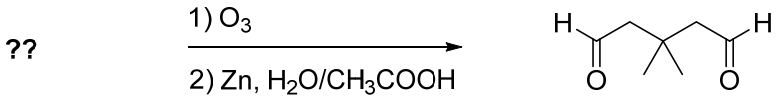
(d)



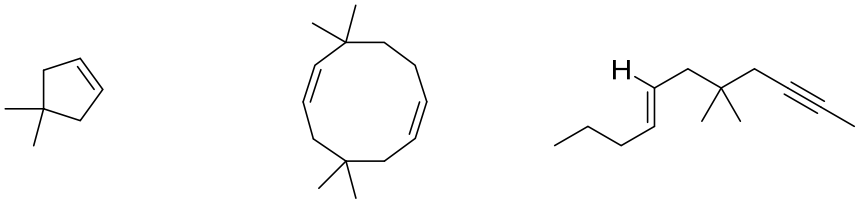
(e)

(5) D

Which of the following molecules would form (at least some amount of) compound **H** as a product after treatment with ozone (O_3) followed by a reductive workup?



H

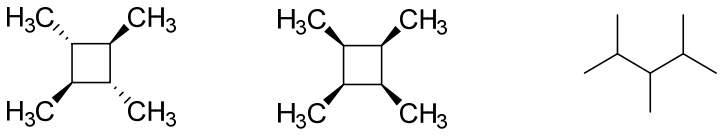


J **K** **L**

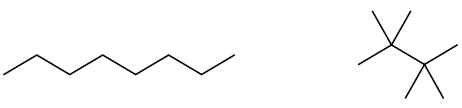
(a) Only compound **J**
(b) Only compound **K**
(c) Only compound **L**
(d) Only compounds **J** and **K**
(e) Compounds **J**, **K**, and **L**

(6) E

Which of the following compounds is the isomer of C_8H_{18} with the highest melting point?

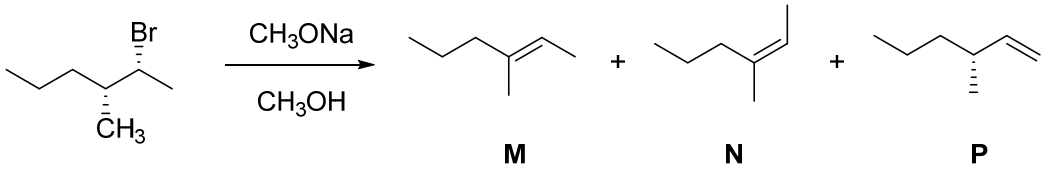


(a) (b) (c)



(d) (e)

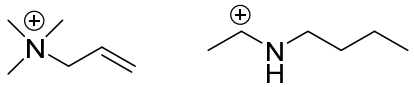
(7) A Which of the following statements best describes the expected results of the following elimination reaction?



M **N** **P**

(a) The major product will be **M**
(b) The major product will be **N**
(c) The major product will be **P**
(d) The reaction will produce a roughly-equal mixture of **M** and **N**
(e) All three products (**M**, **N**, and **P**) are expected in roughly-equal yield

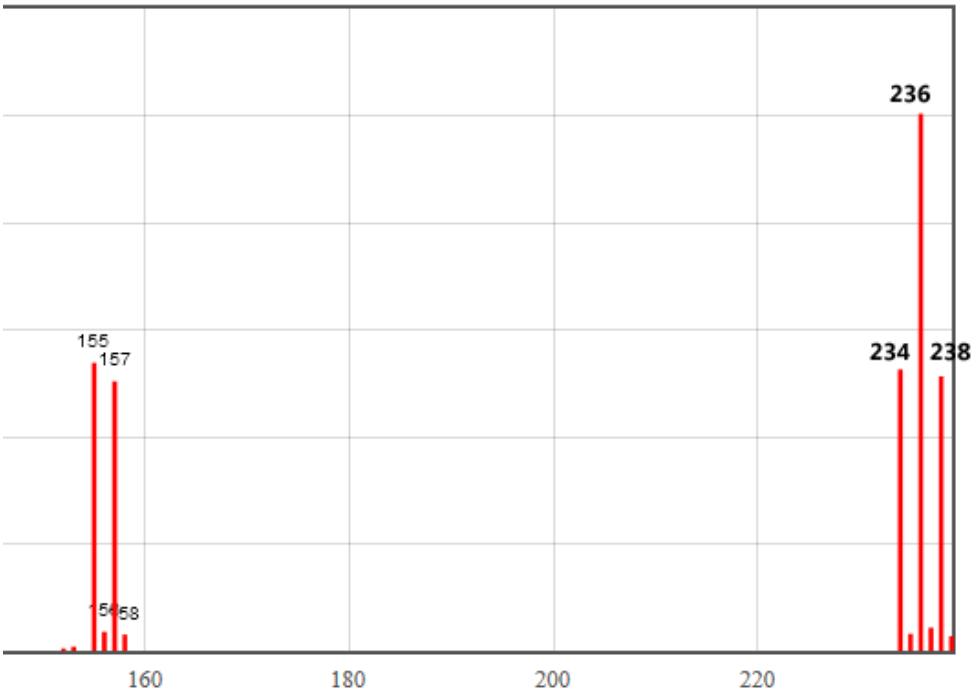
(8) E Choose the most correct and complete statement about the following Lewis structures.



Q **R**

(a) Cations **Q** and **R** are constitutional isomers
(b) Cations **Q** and **R** are both stabilized by resonance effects
(c) Cations **Q** and **R** both have atoms with unhybridized *p* orbitals
(d) Statements (b) and (c) are both true
(e) Statements (a) and (c) are both true
(f) Statements (a), (b), and (c) are all true

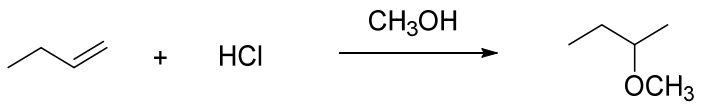
(9) C The mass spectrum below belongs to a pure compound composed solely of carbon, hydrogen, and bromine. How many bromine atoms are present in each molecule? The peak at m/z = 234 represents the molecular ion.



(a) zero
(b) one
(c) two
(d) three
(e) like, a lot, man

(10) B

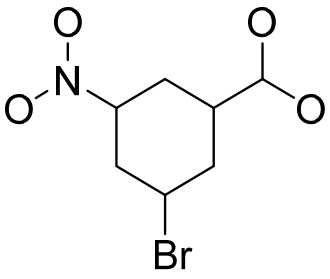
In the mechanism of the following reaction, what orbital does the alkene nucleophile attack?

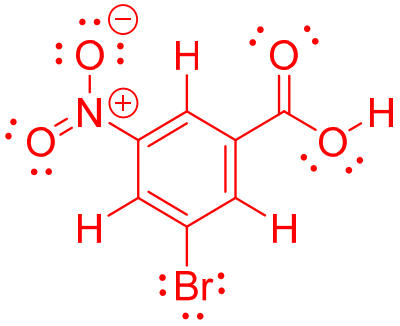


Careful…where are the protons? Big hint: the pK_a of protonated methanol is −2.2 and the pK_a of hydrochloric acid is −8.0.

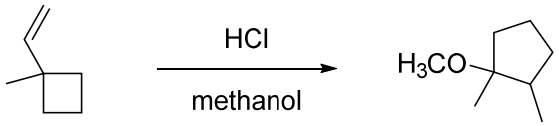
(a) the 1s orbital of a lone proton (H^+)
(b) the σ* antibonding orbital of an H–O bond
(c) the σ* antibonding orbital of an H–Cl bond
(d) an unhybridized p orbital on H^+
(e) a lone pair on the negatively charged oxygen

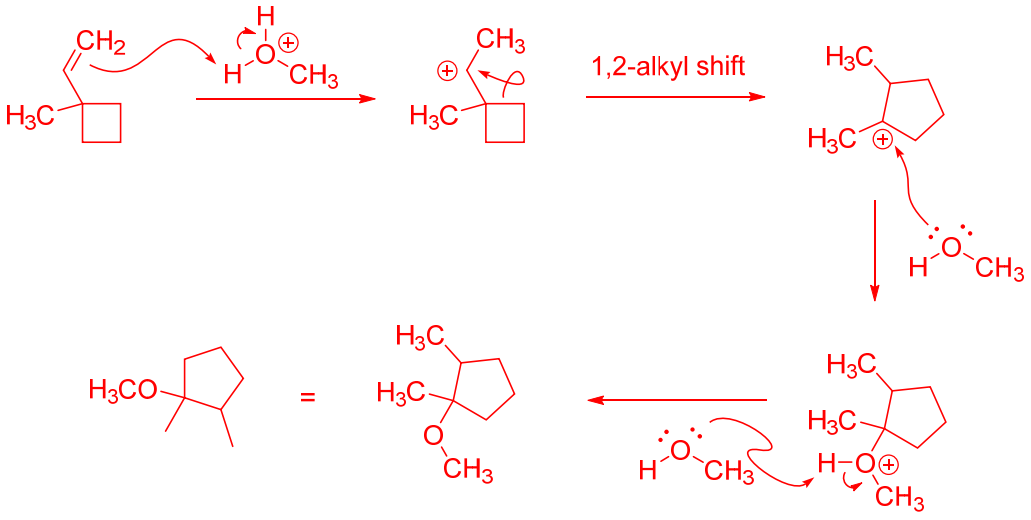
Problem II. (10 points) Complete the Lewis structure for 3-bromo-5-nitrobenzoic acid. Among other features, the compound has an aromatic ring, a nitro group, and a carboxylic acid. The molecule has a molecular formula of $C_7H_4BrNO_4$. Draw a stable structure for this molecule and explicitly include—i.e., draw out—all hydrogens, bonding pairs, lone pairs, and formal charges on your Lewis structure. The molecule has been started below (and on your answer sheet).





Problem III. (20 points) Mechanism. Draw a sensible mechanism for the transformation shown below. Remember to use proper "curved arrow notation" to account for the movement of electrons in the making and breaking of bonds.





Problem IV. (20 points) Déjà vu Synthesis. Design an efficient synthesis of compound **T** using any starting materials you wish that contain two atoms of carbon or fewer. You may use reagents that contain greater than two atoms of carbon, so long as these reagents do not contribute carbon atoms that are present in the final product. Be careful in choosing the order of reactions you use—that is, the reactions used towards the end of the synthesis shouldn't interfere with any of the functionality you've already "installed" in previous steps.