CHEM 346 – Organic Chemistry I – Fall 2014

Instructor: Paul Bracher

Quiz #3

Due: Monday, October 13th, 2014

6:00 p.m. (in Monsanto Hall 103)

Student Name (Printed)	
Student Signature	

Instructions & Scoring

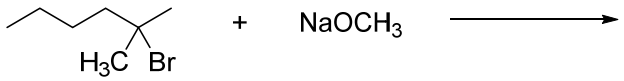
- Please write your answers on the official answer sheet. No answers marked in this booklet will be graded. You must submit a hard copy of your answer sheet. Answer sheets submitted electronically will not be graded.
- You may use any resources you wish and collaborate with others.
- Any questions should be posted to the Blackboard discussion board so all students have equal access to the information.
- Your quiz answer sheet may be photocopied.

Problem	Points Earned	Points Available
I		35
II		26
III		27
IV		12
TOTAL		100

This quiz focuses on Chapters 5 through 8 in Janice Smith's *Organic Chemistry*, 4th ed.

Problem I. Multiple choice (35 points total; +5 points for a correct answer, +2 points 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.

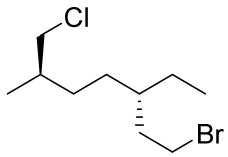
(1) _____ Which of the following types of reactions is least likely to occur when compound **A** is treated with sodium methoxide ($Na^{+-}OCH_3$)?



A

(a) S_N1
(b) S_N2
(c) E1
(d) E2

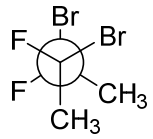
(2) _____ What is the best name for compound **B**?



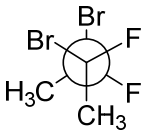
B

(a) (2*S*,5*S*)-5-bromoethyl-2-chloromethylheptane
(b) (2*R*,5*S*)-7-bromo-1-chloro-5-ethyl-2-methylheptane
(c) (2*R*,5*R*)-7-bromo-1-chloro-5-ethyl-2-methylheptane
(d) (3*S*,6*R*)-1-bromo-7-chloro-3-ethyl-6-methylheptane
(e) (3*R*,6*R*)-1-bromo-7-chloro-3-ethyl-6-methylheptane

(3) _____ What term best describes the relationship of the molecules drawn below as Newman projections **C** and **D**?



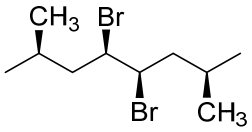
C



D

(a) enantiomers
(b) diastereomers
(c) identical compounds
(d) structural/constitutional isomers
(e) none of the above

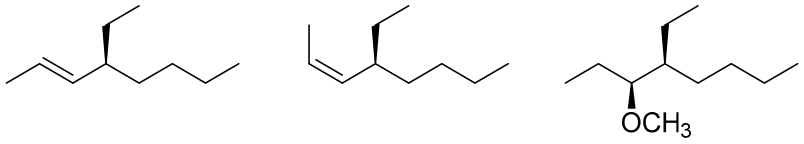
(4) _____ How many stereoisomers exist of compound **E** (including **E** itself)?



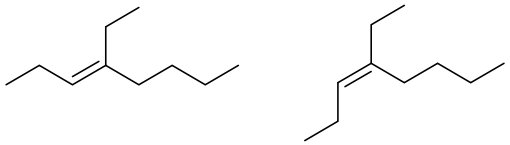
E

(a) 3
(b) 4
(c) 14
(d) 15
(e) 16

(5) _____ What is the major product when (3*R*,4*S*)-4-ethyl-3-iodooctane is treated with sodium methoxide ($NaOCH_3$) in methanol (CH_3OH)?

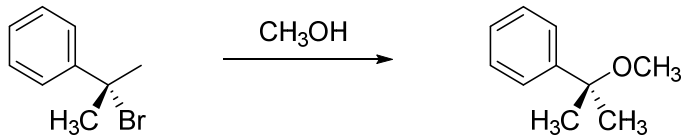


(a) (b) (c)



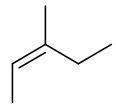
(d) (e)

(6) _____ How many steps (i.e., transition states) appear in the mechanism for the following transformation?

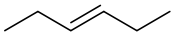


(a) 0
(b) 1
(c) 2
(d) 3
(e) 4

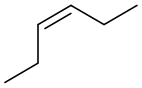
(7) _____ Which of the following isomers of C_6H_{12} would release the most heat when subjected to complete combustion in an oxygen atmosphere to produce 6 equivalents of CO_2 and 6 equivalents of H_2O?



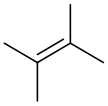
(a)



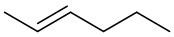
(b)



(c)



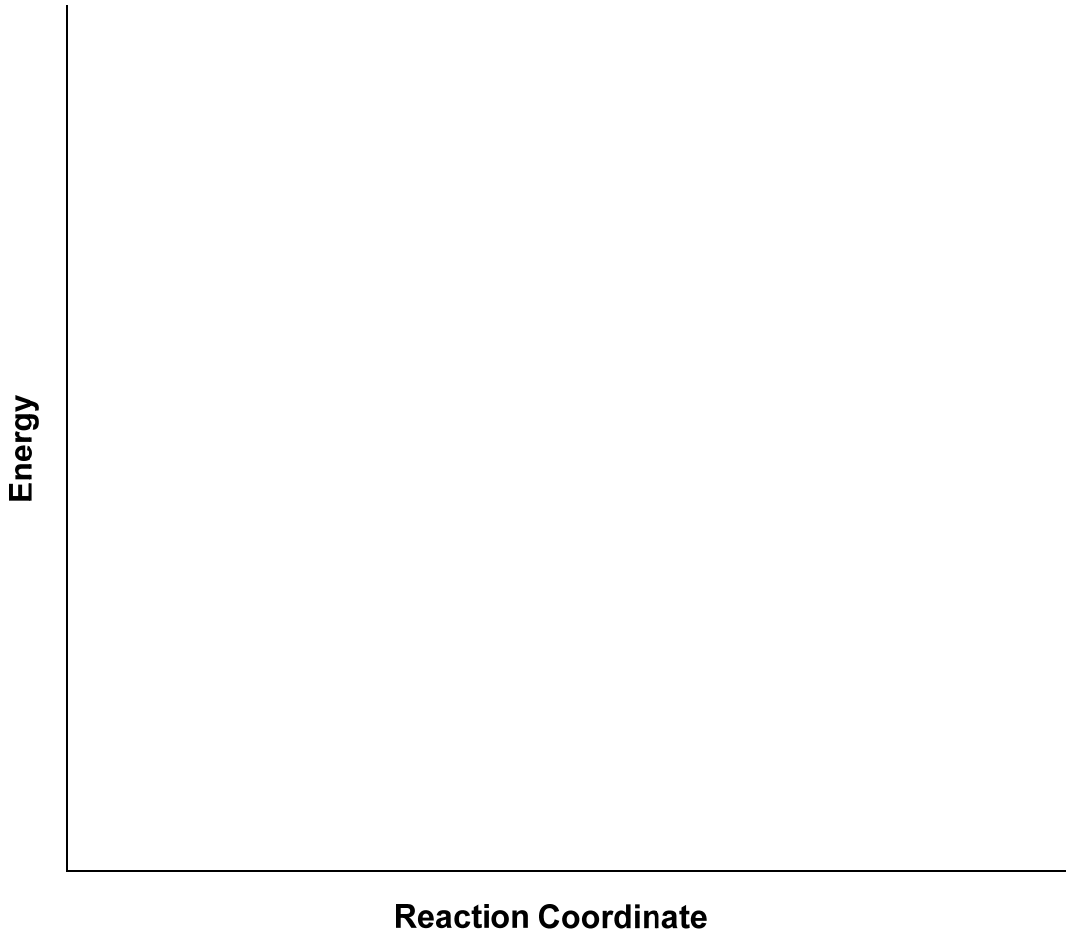
(d)



(e)

Problem II. Reaction Diagram (26 points).

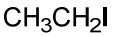
(1) (18 points) Draw two superimposed reaction diagrams on the (same) set of axes found on your answer sheet. First, plot the one-step conversion of molecule **F** to molecule **G** in an exothermic process. On the same figure, plot a reaction diagram for the conversion of **F** to **G** when catalyzed by **X**. The catalyzed process proceeds via two intermediates: first, **X–F** and then, **X–G**. The formation of **X–G** from **X–F** is the rate-determining step of the catalyzed reaction. Label **F**, **G**, **X–F**, **X–G**, and Δ*G* on your plot.



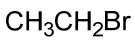
(2) (8 points) A sample reaction mixture at equilibrium contains 2.8 mmol of **G** and 0.40 mmol of **F**. What is the value of Δ*G*° for the reaction in kJ/mol? Show your work for this calculation.

Problem III. Explanations (27 points). For each question posed below, write the letter of your answer in the box on the answer sheet and provide a brief explanation (of no more than four sentences) for your choice. You should draw out any relevant structures or diagrams in your explanation.

(1) (9 points) Of compounds **H** and **J**, which reacts faster with potassium thiomethoxide ($K^{+-}SCH_3$) in DMSO?

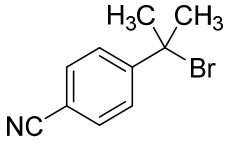


H

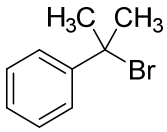


J

(2) (9 points) Of compounds **K** and **L**, which reacts faster with methanol?



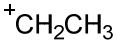
K



L

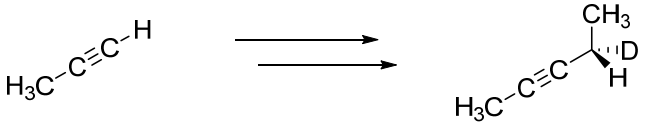
(3) (9 points) Of carbocations **M** and **N**, which is more stable? (Note: I want to see some sort of drawing or diagram in your explanation.)

M



N

Problem IV. Synthesis (12 points). Provide a synthetic route—i.e, a sequence of reactions—to produce compound **Q** using propyne (**P**) as the starting material and any other reagents you wish that contain two carbons or fewer.



P **Q**