CHEM 2410 – Principles of Organic Chemistry I – Summer 2016

Instructor: Paul Bracher

Hour Examination #2

Monday, June 6th, 2016

9:00–10:30 a.m. in Macelwane Hall 342

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 may use one letter-sized sheet of hand-written notes (on "official" paper) and your plastic model kit. No electronic resources are permitted and you may not communicate with others.
- Your exam answer sheet may be photocopied.

Problem	Points Earned	Points Available
I		60
II		10
III		12
IV		18
TOTAL		100

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

Special Instructions

Please Make Sure to Do the Following Before Starting Your Exam

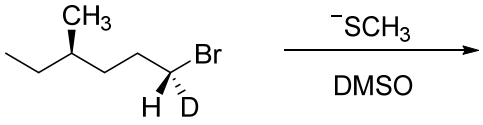
1. Both print your name and sign the front of the answer sheet in the appropriate boxes.
2. Also print your name at the top of the back of the answer sheet.
3. Enter your SLU Banner ID on the front of the answer sheet and bubble the corresponding numbers.
4. Do not check the "Hold for Pick-Up" box on the back of the answer sheet unless you want your graded sheet withheld from the distribution pile and handed back to you privately.

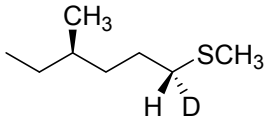
Please Make Sure to Do the Following After Completing Your Exam

1. Ensure that all of your selected circles are darkened completely.
2. Turn in your note sheet with your name and this exam number (#2) in the appropriate space.

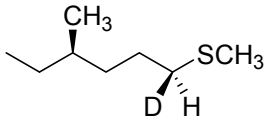
Problem I. Multiple choice (60 points total; +5 points for a correct answer, +2 points for answering with the letter "E", and 0 points for an incorrect answer). For each question, select the best answer of the choices given. Write the answer, legibly, in the space provided on the answer sheet.

(1) _____ What is the major product of the following reaction?

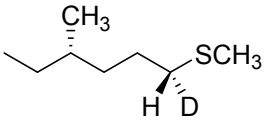




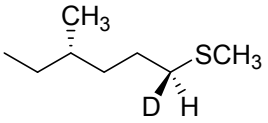
(A)



(B)



(C)

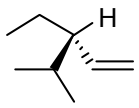


(D)

(2) _____ Which of the following is <u>not</u> true of a catalyst for a reaction?

(A) a catalyst lowers the overall activation barrier for the reaction
(B) a catalyst increases the rate of the reaction
(C) a catalyst shifts the equilibrium for the reaction towards the products
(D) none of the above (i.e., all of the above statements are true)

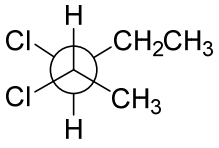
(3) _____ Which of the following stereochemical designations appears in the name of compound **A**?



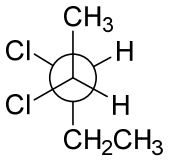
A

(A) *R*
(B) *S*
(C) *cis*
(D) *trans*

(4) _____ What term best describes the relationship of the molecules represented below as Newman projections **B** and **C**?



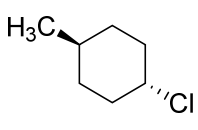
B



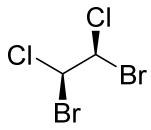
C

(A) enantiomers
(B) diastereomers
(C) identical compounds
(D) structural/constitutional isomers

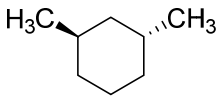
(5) _____ How many of the following three compounds (**D**, **E**, and **F**) are chiral?



D



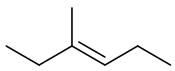
E



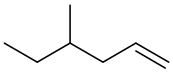
F

(A) none
(B) one
(C) two
(D) three

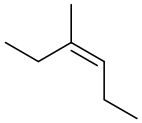
(6) _____ Rank the following three alkenes in descending order of stability (i.e., most stable to least stable).



G



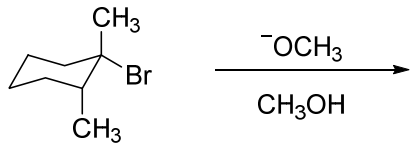
H



J

(A) **J** > **G** > **H**
(B) **H** > **G** > **J**
(C) **H** > **J** > **G**
(D) **G** > **J** > **H**

(7) _____ What is the major product of the following reaction?

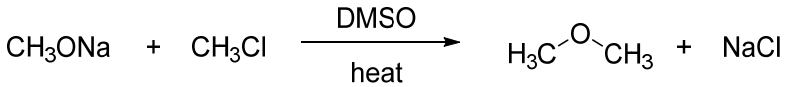


(A) (B) (C) (D)

(8) _____ Compound **K** has a specific rotation of [α] = –10° $(g/mL)^{-1}$ dm^{-1}. If a mixture of **K** and its enantiomer, **L**, gives an observed rotation of +2° $(g/mL)^{-1}$ over a 10 cm path-length, what is the ratio of **K**:**L** in the solution?

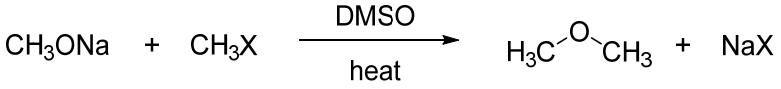
(A) 4:1
(B) 3:2
(C) 2:3
(D) 1:4

(9) _____ For the following reaction, what description most accurately describes the reactive orbital on the nucleophile?



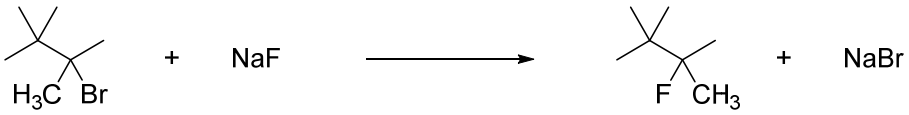
(A) the empty π bonding orbital of the C–Cl bond
(B) an unhybridized p orbital on carbon
(C) a filled sp^3-hybridized orbital on oxygen
(D) the σ* antibonding orbital of the C–Cl bond

(10) _____ Which of the following alkyl halides reacts <u>fastest</u> when DMSO is the solvent?



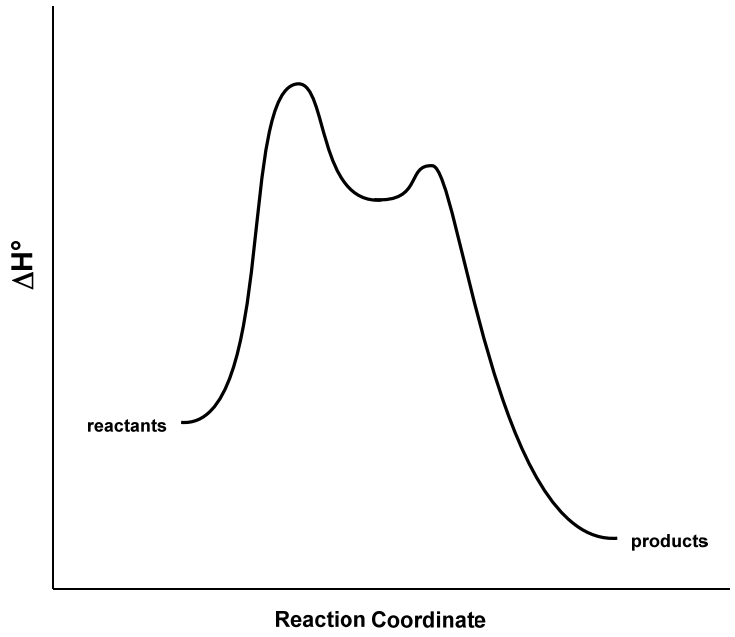
(A) CH_3F
(B) CH_3Cl
(C) CH_3Br
(D) CH_3I

(11) _____ For the reaction drawn below, how will the rate change if the concentration of 2-bromo-2,3,3-trimethylbutane dissolved in the reaction mixture is halved (0.5x) and the concentration of sodium fluoride is doubled (2x)?



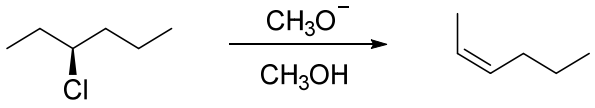
(A) the new rate will be approximately one-fourth of the previous rate
(B) the new rate will be approximately one-half of the previous rate
(C) the new rate will be approximately equal to the previous rate
(D) the new rate will be approximately double the previous rate

(12) _____ What statement is <u>true</u> of the following reaction diagram?



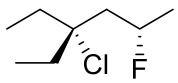
(A) the reaction is endothermic
(B) the diagram is consistent with that expected of an S_N2 reaction
(C) the reaction has two intermediates
(D) none of the above statements is true

Problem II. Transition States (10 points). Provide a 3-D drawing of the <u>transition state</u> of the rate-determining step for the following reaction. Used dashed lines to represent bonds that are being broken or formed. Indicate all formal charges and/or partial formal charges that are in the process of developing.



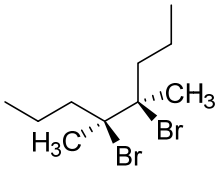
Problem III. Alkyl Halides (12 points). Provide the systematic IUPAC names of the following two compounds.

Part (1) (6 points).



R

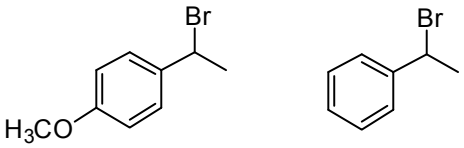
Part (2) (6 points).



S

Problem IV. Explanations (18 points). For each question posed below, write the letter of your answer in the box on the answer sheet and provide a brief explanation for your choice. You should draw out any relevant resonance forms if the concept factors into your explanation.

(1) (9 points) Of compounds **T** and **U**, which reacts <u>faster</u> in hot methanol?



T **U**

(2) (9 points) Of methyl bromide (**X**) and ethyl bromide (**Y**), which reacts faster with potassium cyanide in DMSO? Your response should include a discussion of orbitals.

CH_3Br CH_3CH_2Br

X **Y**