CHEM 346 – Organic Chemistry I (for Majors)

Instructor: Paul J. Bracher

Practice Hour Examination #2

Monday, October 14th, 2013
1:10 p.m.

Student Name (Printed)	
Student Signature	

Please also write your name on the back of the exam

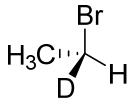
Scoring

Question	Points Earned	Points Available
1		15
2		25
3		25
4		20
5		15
TOTAL		100

Original Problems, Required Information in Answers, and Supplementary Explanation

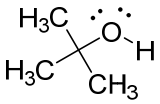
Problem 1. (15 points total, 3 points each) Determine whether the following five statements are true or false. Write out the full word "true" or "false" beside each statement; do not just write "T" or "F". If any part of the statement is false, the entire statement is false.

(i) _____ If the *S* stereoisomer of compound **A** reacts with chloride ion (Cl^-) in an S_N2 reaction, the designation of the stereogenic carbon in the product will be *R*.



A

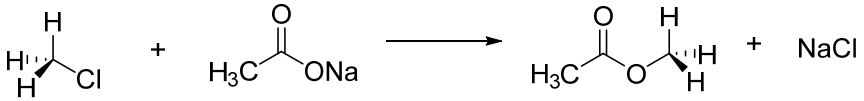
(ii) _____ Compound **B**, *tert*-butanol, is a polar, protic molecule that can be used as a solvent for E1 reactions.



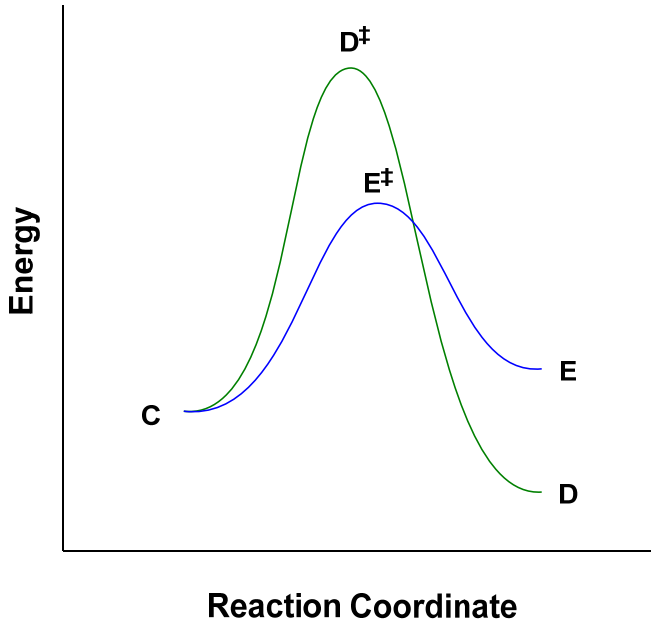
m.p. = 25 °C
b.p. = 82 °C

B

(iii) _____ Chloromethane and sodium acetate react to produce methyl acetate by an S_N1 mechanism.



For questions 1-(iv), 1-(v), and 2-(i), refer to the following figure that plots energy diagrams for the hypothetical competing reactions **C** → **D** and **C** → **E**.



(iv) _____ Product **E** is generated faster than product **D** from starting material **C**.

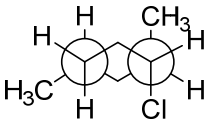
(v) _____ Compound **E** could be produced from **D** via an intermediate, **C**, in an endothermic process

Problem 2. (25 points total, 5 points each) For each question, select the best answer of the choices given. Write the answer, legibly, in the space provided.

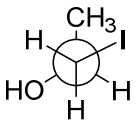
(i) _____ If the system above is allowed to reach equilibrium, what will be the relative concentrations of compounds **C**, **D**, and **E**.

(a) [**C**] < [**E**] < [**D**]
(b) [**D**] < [**E**] < [**C**]
(c) [**C**] < [**D**] < [**E**]
(d) [**D**] < [**C**] < [**E**]
(e) [**E**] < [**C**] < [**D**]

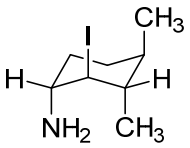
(ii) _____ Which of the following three-dimensional structures depicts an alkyl halide in a conformation suitable for E2 elimination?



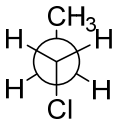
(a)



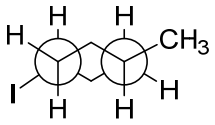
(b)



(c)

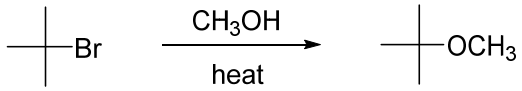


(d)



(e)

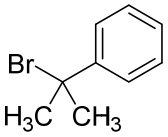
(iii) _____ In the S_N1 reaction between methanol and *t*-butyl bromide, the orbital that is attacked by the nucleophile is:



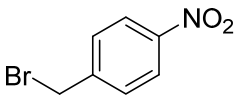
(a) the backside of the σ bonding orbital of the C–Br bond
(b) the σ* antibonding orbital of the C–Br bond
(c) the σ* antibonding orbital of the C–H bond
(d) an unhybridized *p* orbital on carbon
(e) none of the above

(iv) _____ For which of the following compounds would heterolytic cleavage of the carbon–halogen bond be the most facile?

(a)



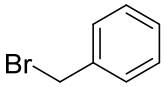
(b)



(c)

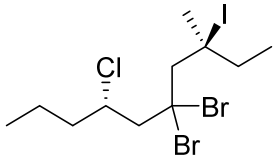
CH_3Br

(d)



(e)

(v) _____ What is the IUPAC name of compound **F**.

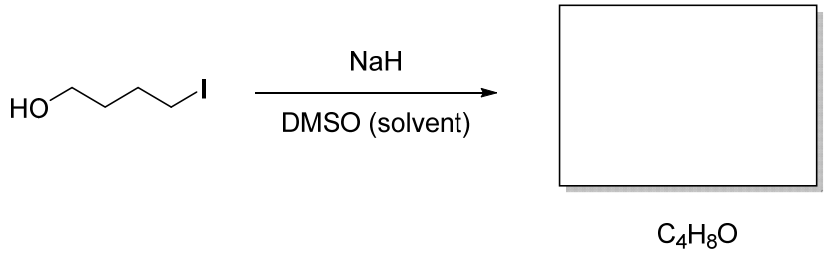


F

(a) (*3S,7S*)-5,5-dibromo-7-chloro-3-iodo-3-methyldecane
(b) (*3S,7R*)-5,5-dibromo-7-chloro-3-iodo-3-methyldecane
(c) (*4S,8R*)-6,6-dibromo-4-chloro-8-iodo-8-methyldecane
(d) (*4S,8S*)-6,6-dibromo-4-chloro-8-iodo-8-methyldecane
(e) (*4S,8R*)-6,6-dibromo-4-chloro-8-iodo-8-methylundcane

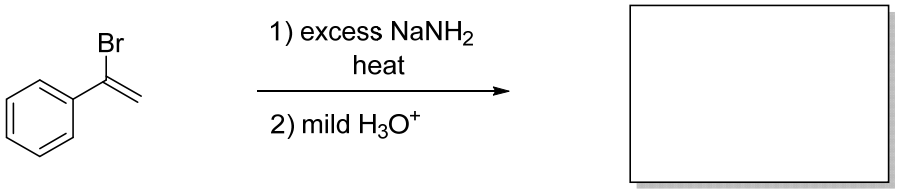
Problem 3. (25 points total, 5 points each) Reactions. The following chemical reactions are missing their starting materials, reagents, or products. Write the missing compounds into the empty boxes below, as appropriate. In some cases, there will be more than one correct answer that will merit full credit.

(i) (5 points)

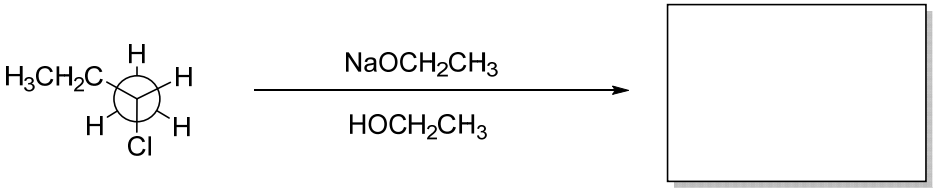


C_4H_8O

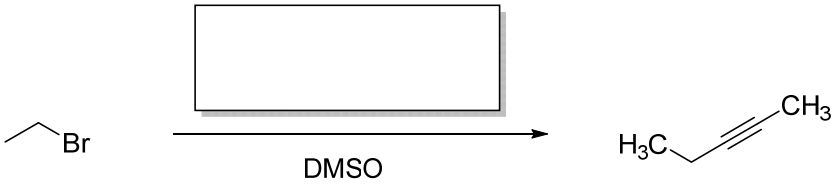
(ii) (5 points)



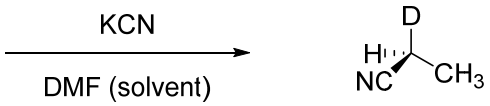
(iii) (5 points)



(iv) (5 points)

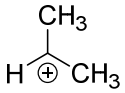


(v) (5 points)



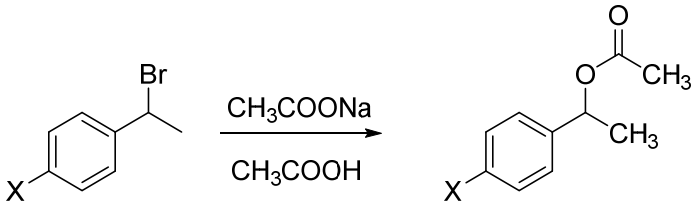
Problem 4. (20 points total) Short answers.

(i) (10 points) Hyperconjugation is responsible for stabilizing carbocations substituted with alkyl groups. Draw a picture that shows one hyperconjugative interaction for carbocation **G**. Label the identity of the filled orbital and the empty orbital that are interacting in your picture.



G

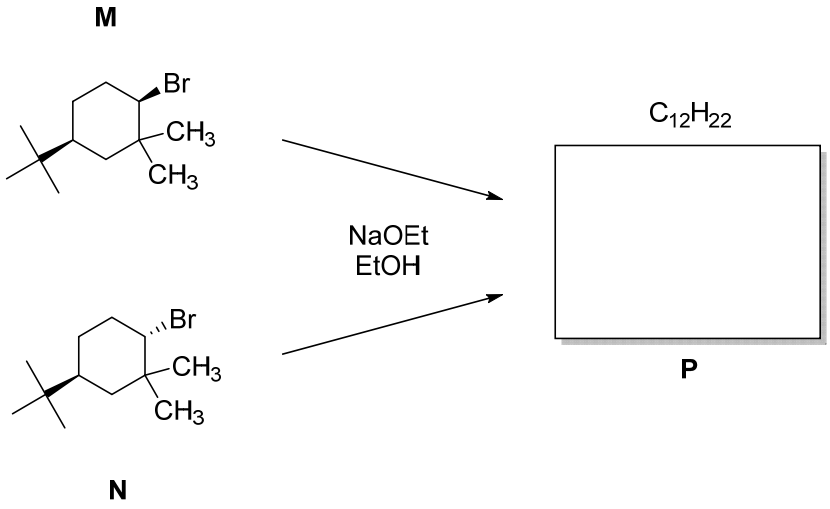
(ii) (10 points) Explain why the substitution reaction drawn below is slowest for compound **J** and fastest for **L**.



compound	X =
J	—NO_2
K	—H
L	—OCH_3

Problem 5. (15 points total)

Consider the following reactions:



(i) (5 points) Draw the structure of the common product, compound **P**, in the box above.

(ii) (10 points) Explain why compound **N** reacts more slowly than compound **M** to produce the same product. You will want to draw things here.