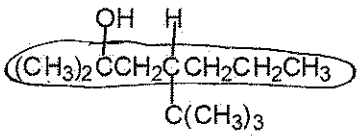
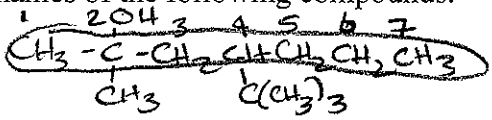
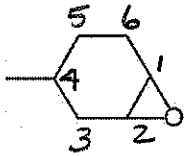
Ch 335 Code KEY
Midterm #1
January 26, 2009

1. 6 (pts) Give the IUPAC names of the following compounds.



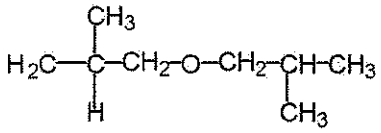


4-t-butyl-2-methyl-2-heptanol



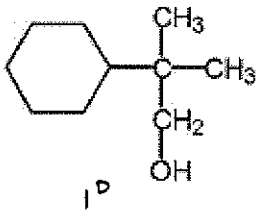
1,2-epoxy-4-methylcyclohexane

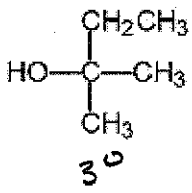
2. 3(pts) Circle the response that correctly names the following compound.

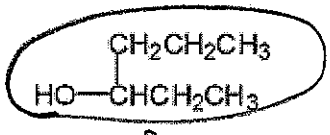


isobutylisopropylether diisopropylether (diisobutylether) none is correct

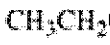
3. 3 (pts) Which of the following compounds is a secondary alcohol? Circle it.

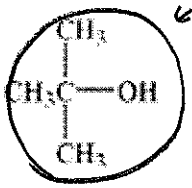

1°

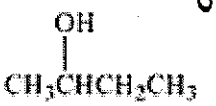

3°


2°

4. 3 (pts) Which of the following compounds has the lowest boiling point?. Circle it.







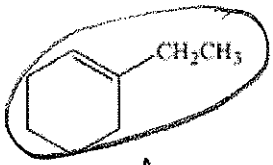
← most branching → spherical
lesser London forces

5. 3(pts) Rank each of the following compounds in order of increasing water solubility (place the letter ID for the compound in the appropriate blank; least soluble compound first)

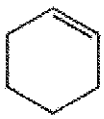
$CH_3(CH_2)_5OH$	$HO(CH_2)_6OH$	$CH_3(CH_2)_4CH_3$
A	**B**	**C**

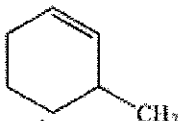
C < A < B

6. 3 (pts) Which of the following alkenes is most stable? Circle it.

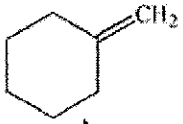


tri sub

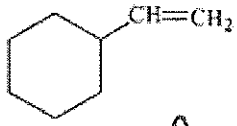

di sub



disub

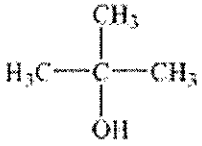


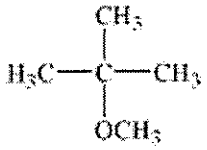
disub

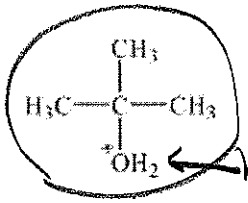


monosub

7. 3 (pts) Circle the compound that is most reactive in an S_N1 reaction.

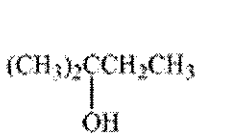




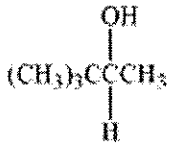


← best leaving group

8. 3 (pts) Which of the following alcohols undergoes acid catalyzed dehydration most slowly? Circle your choice.



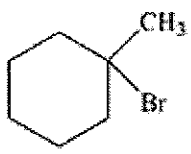
3° alcohol

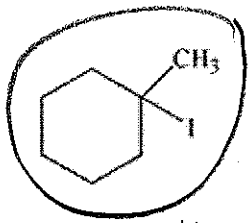


2° alcohol

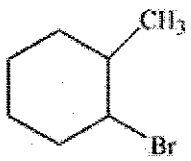
1° alcohol

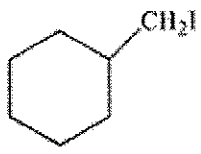
9. 3 (pts) Which of the following compounds would react fastest in an E2 elimination reaction? Circle it.

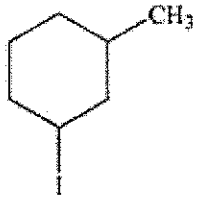




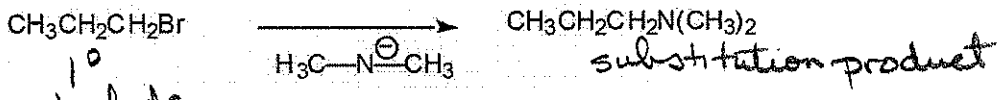
3° halide
I⁻ best leaving group







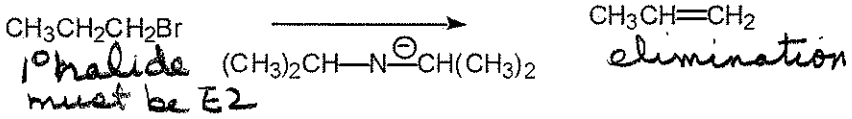
10. 3 (pts) The most likely mechanism for the following reaction is _____? (E1, E2, S_N1, S_N2)



substitution product

1° halide must use S_N2

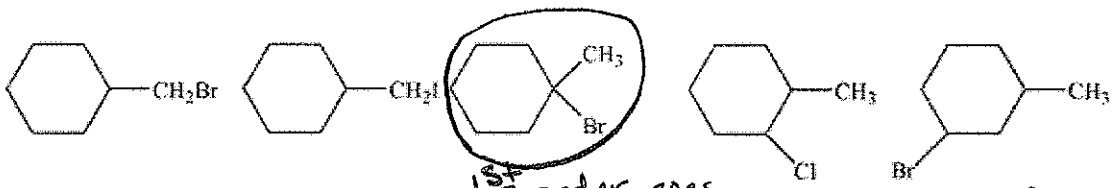
11. 3 (pts) The most likely mechanism for the following reaction it _____? (E1, E2, S_N1, S_N2)



1° halide must be E2

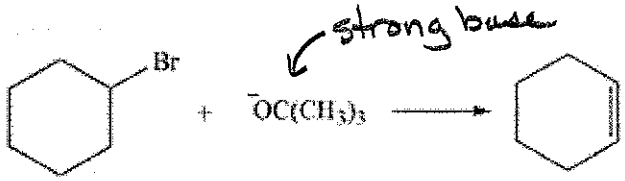
elimination

12. 3 (pts) Which of the following compounds would react fastest in a reaction following first order kinetics? Circle it.



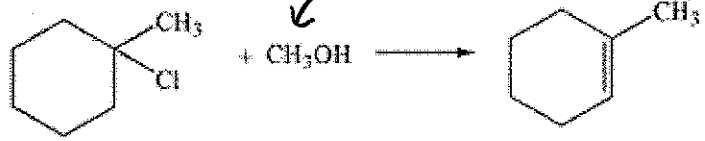
1st order goes through carbocation; gives 3° carbocation

13. 4(pts) Label the following reactions as E1 or E2. Place your answer in the blank provided.



strong base

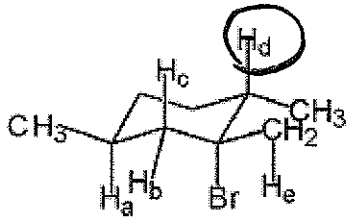
E2



weak base

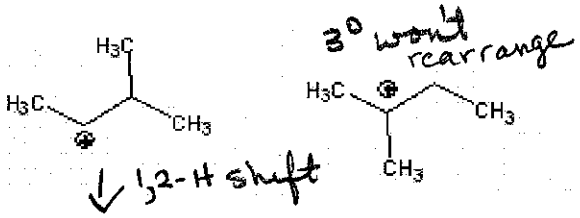
E1

14. 3 (pts) Which of the labeled protons in the following compound is most readily abstracted under conditions of E2 elimination? Circle it.



anti-periplanar and can give more stable alkene product

15. 6 (pts) Examine the following carbocations. If a carbocation is likely to rearrange, circle it and draw what its rearranged structure will be below it. Assume only 1,2-shifts will occur.

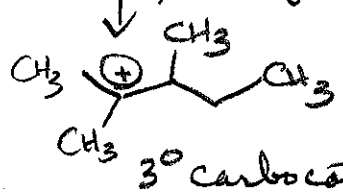


3° won't rearrange

1,2-H shift

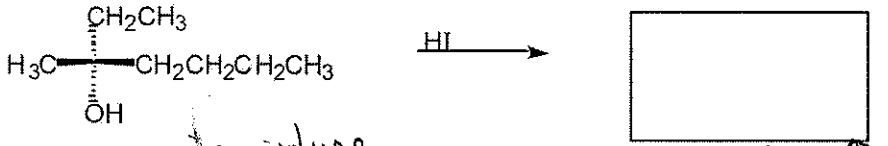
1,2-alkyl shift

3° carbocation

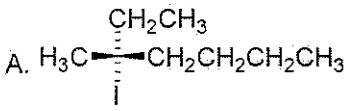


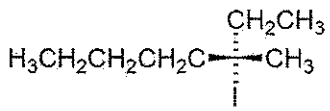
3° carbocation

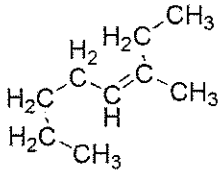
16. 3 (pts) What is the product or products of the following reaction? Circle the correct response.



racemic mixture because carbocation is planar (achiral)

A. 

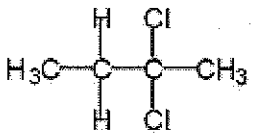
B. 

C. 

(D) A and B

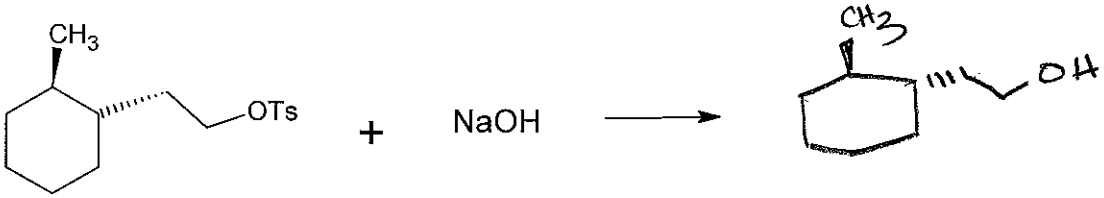
E. none of the above

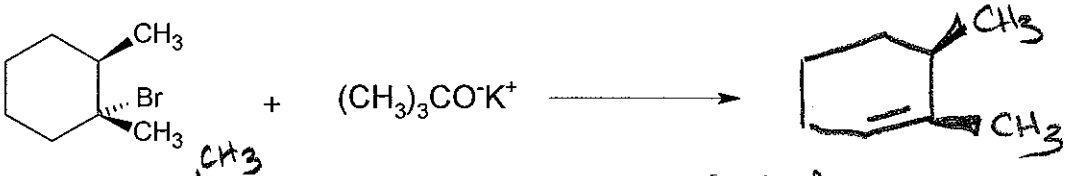
17. 10 (pts) Give the **major organic product only** from each of the following reactions.

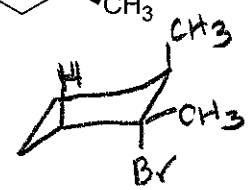


$\xrightarrow{2NaNH_2}$ $CH_3-C\equiv C-CH_3$

$CH_3CH_2OH \xrightarrow{PBr_3} CH_3CH_2Br$

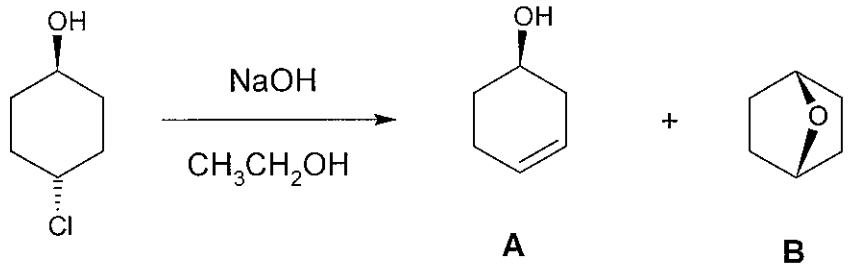






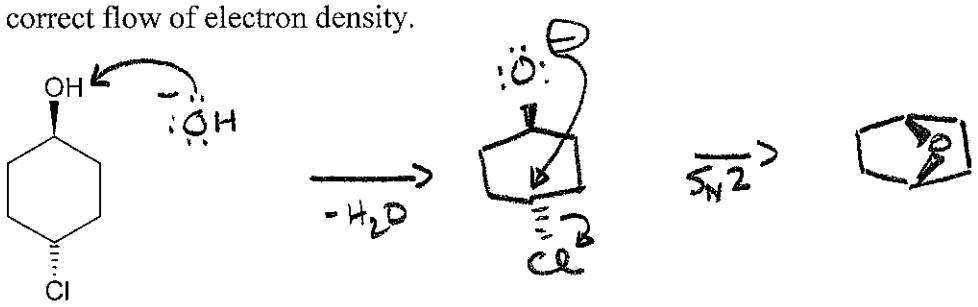
gives less substituted alkene because of anti-periplanar geometric requirement

18. 3 (pts) When *trans*-4-chlorocyclohexanol is treated with sodium hydroxide in ethanol, it gives two products which are labeled A & B in the reaction below.



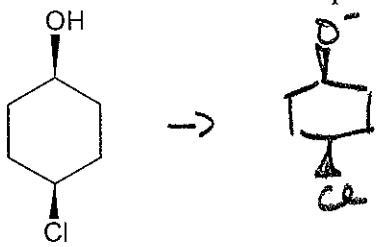
(a) Although you have not seen the exact reaction that forms Compound B, you have seen a very similar reaction in Chapter 9. Starting with the *trans*-chlorocyclohexanol, draw a mechanism that shows how Compound B is formed. Be sure to show any separate steps individually, and draw your arrows so they show correct flow of electron density.

(2 pts)



(b) Explain why the same ether product can't be formed when *cis*-4-chlorocyclohexanol is used in this reaction.

(1 pt)



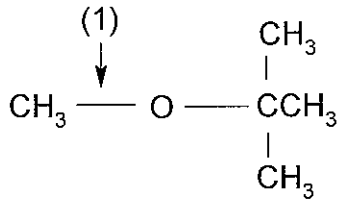
Explanation:

backside attack not available so no substitution occurs.

19. 5 (pts) The following ether can by synthesized by two different combinations of alkyl halide and alkoxide ion. Show one combination that forms ether bond #1 and another combination that forms either bond #2. Draw the alkyl halide and alkoxide to the right of the => symbol.

(a)

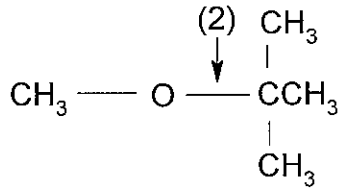
(2pts)



=> CH_3Br + $^{\ominus}O-C(CH_3)_3$

(b)

(2pts)



=> CH_3O^- + $Br-C(CH_3)_3$

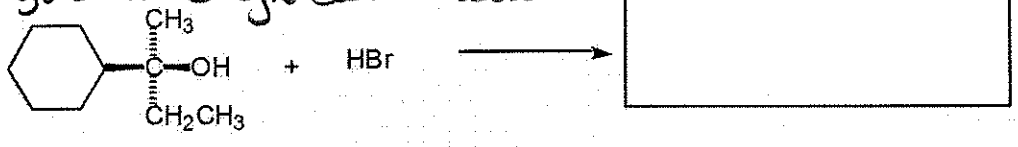
(c) Which combinations give the higher yield of ether product. Method (a) or (b)? ____
Justify your choice:

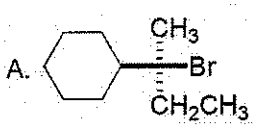
(1pt) (a) is the best choice. Route (b) would give an elimination product rather than substitution

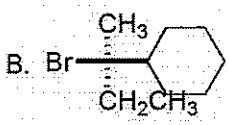
3 20. (pts) Predict the products. (Stereochemistry is important here). Circle your choice.

goes through carbocation

(3pts)

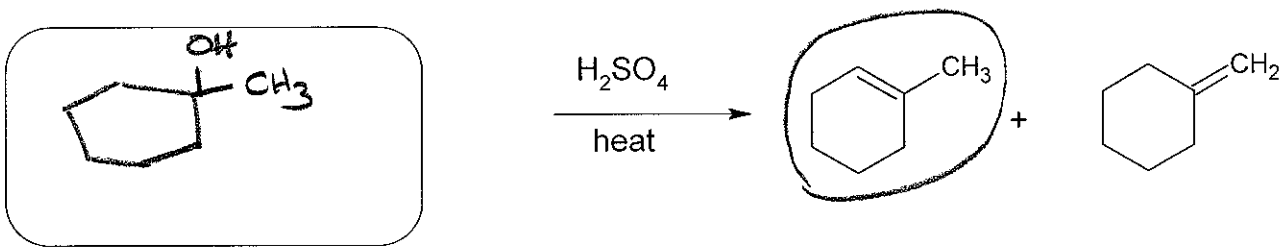






C. A and B

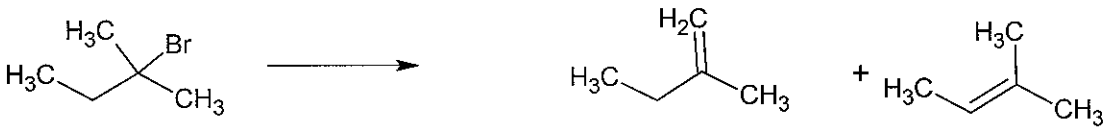
21. 4 (pts) Draw the structure of the starting material for the following reaction in the box provided.

2pts 

1pt (a) Are the products formed in equal amounts? (Circle your answer) Yes (No)

1pt (b) If they are formed in different amounts, circle the major product.

22. 3 (pts) Consider the results of using two different bases in the following E2 reaction.



$CH_3CH_2O^-$	21%	79%
$(CH_3)_3CO^-$	73%	27%

(a) Succinctly (that means briefly and efficiently) explain the t-butoxide result (your answer must fit in the space provided below.)

The bulky t-butoxide can more easily abstract a hydrogen from the less-substituted carbon

23 4 (pts) Answer the following questions as true or false by circling the appropriate response.

(a) OH^- is not as good a leaving group as H_2O — (True) False

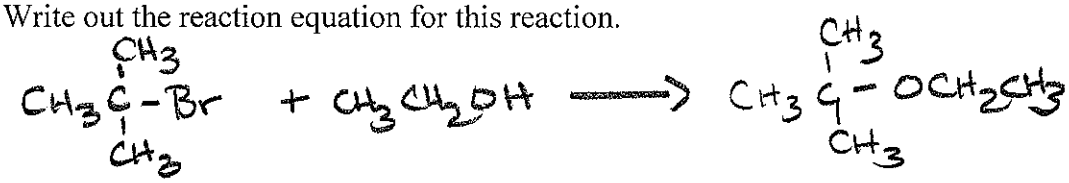
(b) t-Butoxide is a strong, nucleophilic base (non-nucleophilic) — True (False)

(c) A tertiary carbocation is more stable (possesses more (less) energy) than a secondary carbocation — True (False)

(d) An S_N2 reaction yields inverted configuration when the reaction occurs at a stereogenic center — (True) False

24. 13 When t-butyl bromide is placed in boiling ethanol, ethyl t-butyl ether can be isolated from the reaction mixture. Be as specific as possible with your answers to the following questions.

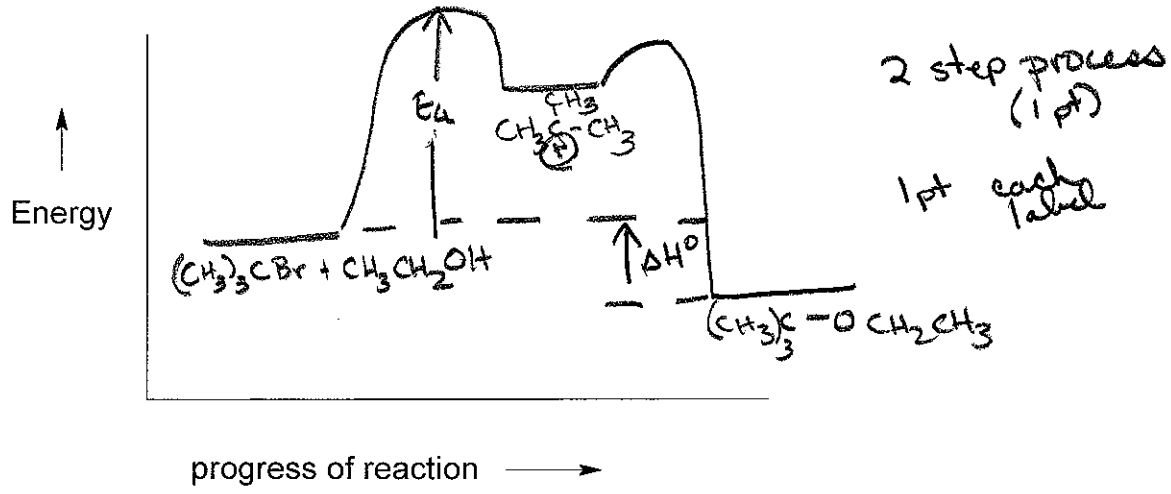
(a) Write out the reaction equation for this reaction.



(b) Write the rate equation for this reaction.

Rate = $k[t\text{-BuBr}]$

(c) Draw a potential energy diagram for this reaction using the axes below. Label the starting material, product and any intermediates (showing the structure) if they exist. Label the E_a and ΔH°. Assume the reaction is exothermic.



(d) What happens to the rate in each of the following instances?

[1] The Br is changed to Cl?

rate is slower

[2] The concentration of ethanol is decreased by a factor of two.

no effect

[3] The concentrations of both t-butyl bromide and ethanol are doubled.

rate doubles

[4] A stoichiometric amount of t-butoxide is added to the mixture.

reaction will change to elimination because of strong, bulky, non-nucleophilic base