

# Exam 3 Preview - Part 2 Synthesis Prep, 30 points

- Due Nov 14, 2024 at 11:59pm
- Points 30
- Questions 25
- Available Oct 20, 2024 at 12am - Nov 14, 2024 at 11:59pm
- Time Limit None
- Allowed Attempts 3

## Instructions

The Exam 3 Preview assignments are mandatory for all students. Part 2 is due on 11/4 at 11:59 PM.

This assignment presents practice synthesis problems and emphasizes content related to Alcohols, Ethers, Epoxides, and Elimination. It contains 25 questions, and is worth 30 points. There is no time limit for the activity, and you have 2 submission attempts. You may save your work and return to the problem set at a later time. Canvas should indicate to you which answers were incorrect after each submission. The highest of the two scores will be recorded in the gradebook. Note that credit is only given for fully correct answers for multiple-choice and choose-all-that-apply type questions.

It is strongly recommended that you treat your first attempt like a practice test to evaluate where you stand with the material. After you have completed your first attempt, you are welcome to work with other students or discuss the problems at help sessions.

Do not wait until the last minute to being working through this assignment. Some of the problems can be quite challenging. Leave time before the deadline to attend a help session to clarify any questions that are giving you trouble so you can maximize the points earned.

This quiz was locked Nov 14, 2024 at 11:59pm.

## Attempt History

	Attempt	Time	Score
KEPT	<a href="#">Attempt 2</a>	10 minutes	30 out of 30
LATEST	<a href="#">Attempt 2</a>	10 minutes	30 out of 30
	<a href="#">Attempt 1</a>	3,071 minutes	27.5 out of 30

! Correct answers are hidden.

Score for this attempt: 30 out of 30

Submitted Nov 1, 2024 at 3:40pm

This attempt took 10 minutes.



### Question 1

1 / 1 pts

Which of the following are ways that we can **stabilize** carbocations? Choose all that apply.

- ☒ Hyperconjugation
- ☒ Resonance/conjugation
- ☐ Inductive effect
- ☐ Zaitzev's rule
- ☐ Hofmann's rule



### Question 2

1 / 1 pts

Which of the following is the **most effective** way to stabilize carbocations?

- ☐ Zaitzev's rule
- ☐ Hyperconjugation
- ☒ Resonance/conjugation
- ☐ Inductive effect
- ☐ Hofmann's rule



### Question 3

1 / 1 pts

Which of the following are **good leaving groups**? Choose all that apply.

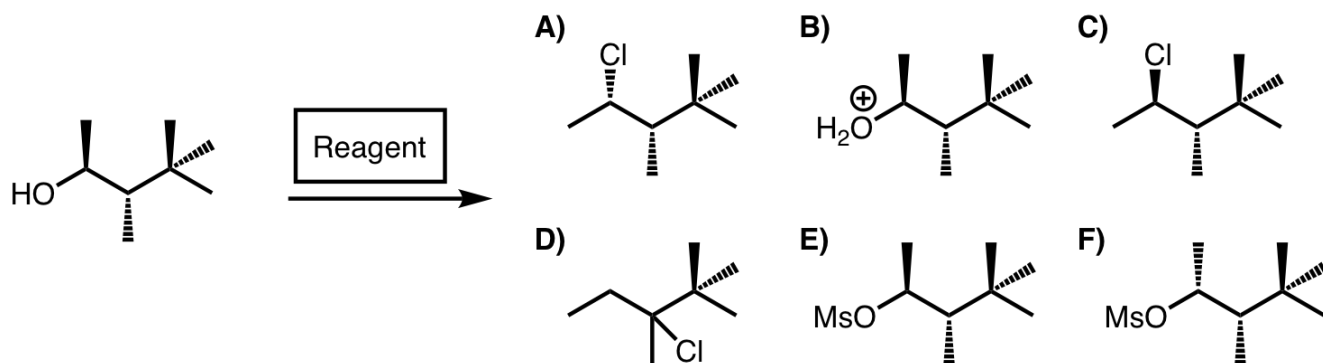
- ☐ -F
- ☒ -Cl
- ☒ -Br
- ☒ -OMs
- ☒ -OTs
- ☒ -OTf
- ☐ -OH
- ☒ H<sub>2</sub>O



### Question 4

2 / 2 pts

Match each reagent to the product that it forms. Multiple reagents may form the same product.



### Reagents

$\text{SOCl}_2$ , pyridine: C

$\text{ClSO}_2\text{CH}_3$ , pyridine: E

$\text{HCl}$ : D

$\text{PCl}_3$ : C

### Answer 1:

- A
- B
- C
- D
- E
- F

### Answer 2:

- A
- B
- C
- D
- E
- F

### Answer 3:

- A
- B
- C
- D
- E
- F

### Answer 4:

- A
- B
- C
- D

E

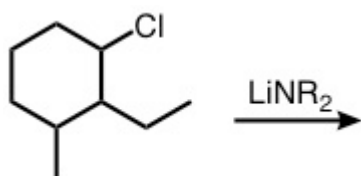
F



### Question 5

1 / 1 pts

Consider the reaction shown below to answer questions 5-8.



What is the dominant mechanism that occurs in this reaction?

☐ E1

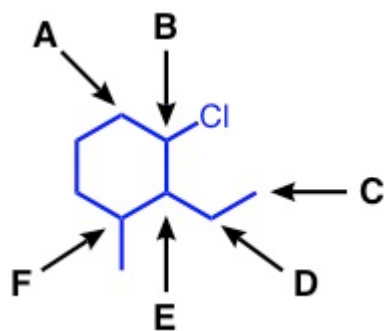
☒ E2



### Question 6

1 / 1 pts

Identify **all possible positions** that could be deprotonated based on the mechanism that you chose in Problem 5.



☒ A

☐ B

☐ C

☐ D

☒ E

☐ F



### Question 7

1 / 1 pts

Let the R group in the reagent over the arrow be isopropyl. (i.e. The reagent is  $\text{LiN}[\text{CH}(\text{CH}_3)_2]_2$ .)

Now, fill in the blanks. This reaction will follow \_\_\_\_\_ rule and will form the \_\_\_\_\_ substituted alkene.

- ☐ Zaitzev's; more
- ☐ Zaitzev's; less
- ☐ Hofmann's; more
- ☒ Hofmann's; less

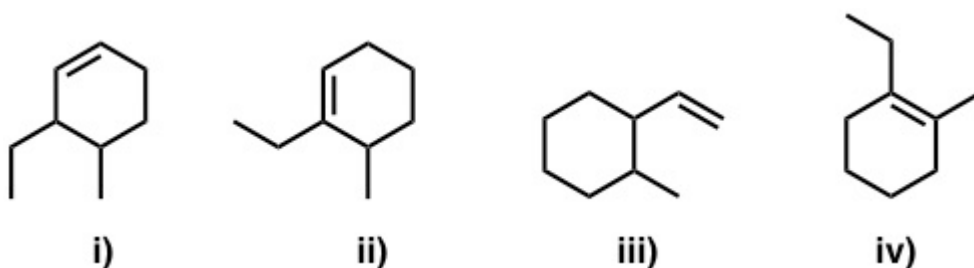


#### Question 8

1 / 1 pts

Let the R group in the reagent over the arrow be isopropyl. (i.e. The reagent is  $\text{LiN}[\text{CH}(\text{CH}_3)_2]_2$ .)

What is the major organic product formed during this reaction?



- ☒ i
- ☐ ii
- ☐ iii
- ☐ iv



#### Question 9

1 / 1 pts

Consider the **dehydration reaction** using the starting material shown below to answer questions 9-12.



Which reagent(s) are required to perform a dehydration reaction?

- ☐  $\text{H}_2\text{SO}_4$
- ☒  $\text{H}_2\text{SO}_4$ , heat
- ☐  $\text{H}_2\text{O}$

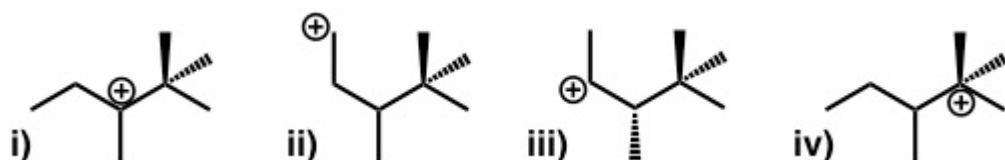
- ☐ HCl
- ☐ NaOH
- ☐ NaH
- ☐ heat, NaOH



### Question 10

1 / 1 pts

Identify all carbocations that appear in the mechanism for this reaction. Choose all that apply.



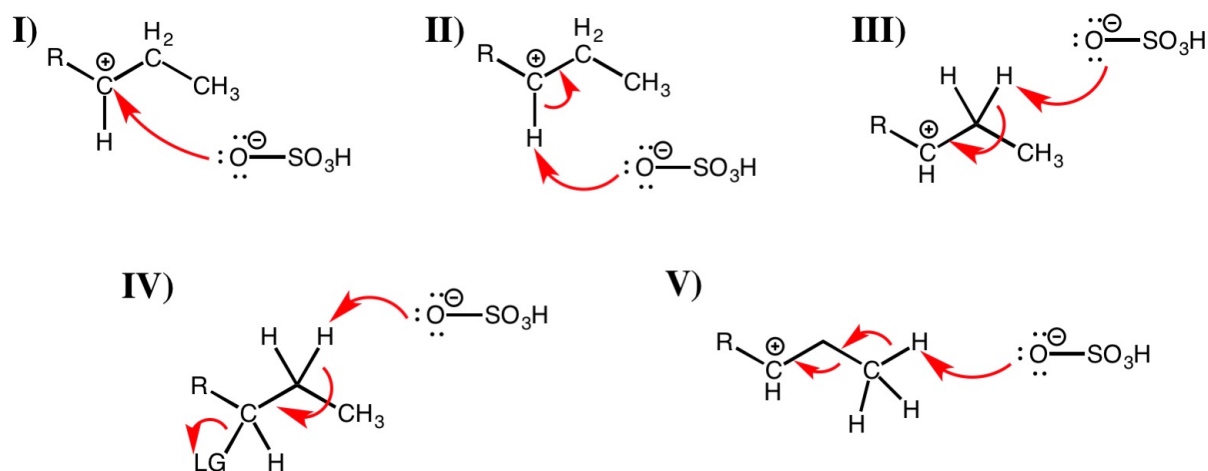
- ☒ i
- ☐ ii
- ☒ iii
- ☐ iv
- ☐ None of the above. The reaction goes by an E2 mechanism and no carbocations are formed.



### Question 11

1 / 1 pts

Consider the mechanism that occurs in this reaction. Which generic arrow-pushing mechanism best describes the deprotonation step that occurs in the mechanism in order to form the final alkene product?



- ☐ I
- ☐ II
- ☒ III
- ☐ IV

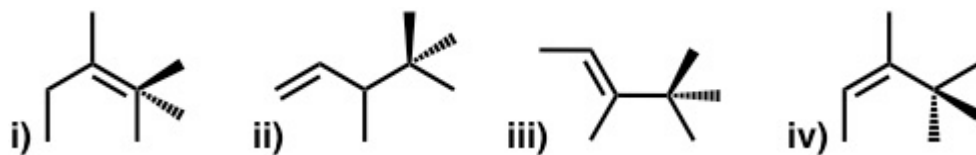
☐ V



### Question 12

1 / 1 pts

Dehydration reactions **ALWAYS** form the most stable alkene as the major product. What is the major organic product formed during this reaction?



☐ i

☐ ii

☒ iii

☐ iv



### Question 13

1 / 1 pts

For problems 13-19, answer the questions about the 2-step reaction sequence (ie. synthesis problem) shown below.



What new functional group is found in the final product?

☐ Alkyne

☒ Alkene

☐ Alcohol

☐ Tert-butyl group

☐ Carbonyl

☐  $\alpha,\beta$ -unsaturated carbonyl



### Question 14

1 / 1 pts

Dehydration **WILL NOT** produce the desired product from the given starting material. (See questions 9-12 for comparison.)

We need a stereospecific reaction to control the orientation of the four groups attached to the alkene in the product; we need to use an **E2 reaction**. In addition to a strong base, what other components does an E2 reaction require? Choose all that apply.

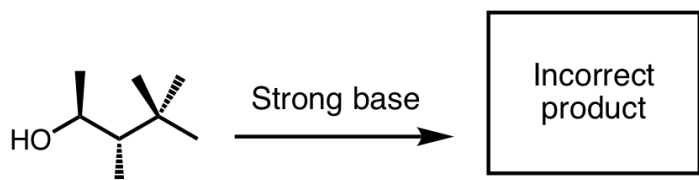
- ☐ A carbocation
- ☒ A good leaving group
- ☒ An antiperiplanar relationship between the leaving group and a H atom.
- ☐ A gauche relationship between the leaving group and a H atom.
- ☐ An eclipsed relationship between the leaving group and a H atom.



#### Question 15

1 / 1 pts

The desired product **WILL NOT** form if a strong base is applied to the starting material right away in Reaction 1. Why does this synthetic route fail to produce the desired alkene product?



- ☐ A carbocation rearrangement occurs.
- ☒ The base will deprotonate the most acidic position, which is the alcohol instead of the carbon.
- ☐ An S<sub>N</sub>2 reaction will occur instead of an E2 reaction.
- ☐ The base will deprotonate the alcohol and form an epoxide product.



#### Question 16

1 / 1 pts

How can the issue encountered in the previous problem be avoided?

(Fill in the blank.) Before a strong base is applied, we must \_\_\_\_.

- ☒ Activate the alcohol.
- ☐ Oxidize the alcohol.
- ☐ Deprotonate the alcohol.
- ☐ Reduce the alcohol.
- ☐ Perform a radical halogenation reaction.

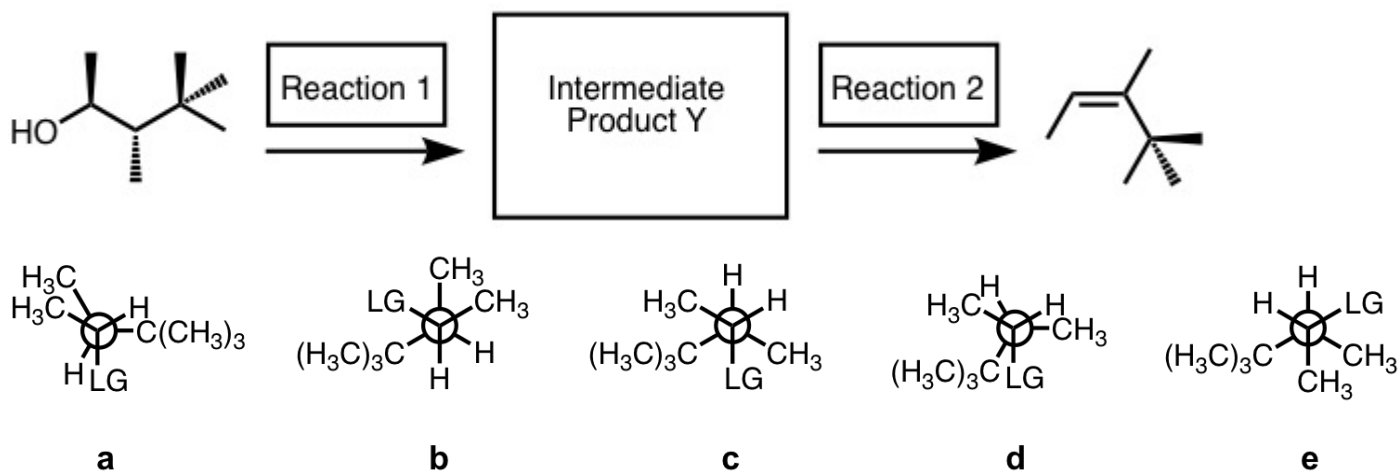


#### Question 17

1 / 1 pts

Based on the fact that this synthesis problem requires an E2 reaction to form the alkene, which **conformation** is needed to produce the desired stereochemistry in the product?





- ☐ a
- ☐ b
- ☒ c
- ☐ d
- ☐ e



Question 18

2 / 2 pts

Consider the procedure you proposed in Problem 16, your answer to Problem 17, and the stereocenters in the starting material. Which reagent should be used in **Reaction 1**?



- ☐ LiAlH<sub>4</sub>
- ☐ CITS, pyridine
- ☐ LDA
- ☒ PBr<sub>3</sub>
- ☐ HBr
- ☐ CrO<sub>3</sub>, HCl, pyridine
- ☐ NaOH



Question 19

1 / 1 pts

Consider the structures of Intermediate Product Y and the final product. What would be the best reagent to place in the box for **Reaction 2**?

- ☐ H<sub>2</sub>O
- ☐ HCl
- ☒ NaOH
- ☐ KOC(CH<sub>3</sub>)<sub>3</sub>
- ☐ CrO<sub>3</sub>, H<sub>2</sub>O, H<sub>2</sub>SO<sub>4</sub>
- ☐ Mg
- ☐ NaBH<sub>4</sub>
- ☐ BrCH<sub>3</sub>



Question 20

1 / 1 pts

For problems 20-25, answer the questions about the 2-step reaction sequence (ie. synthesis problem) shown below.



Number the carbons in your starting material. (This numbering scheme is arbitrary and is only intended to help you track where the carbons from your starting material appear in your product.) Identify those same carbons in your final product and number them accordingly. What **new type of bond** has formed off of the starting material?

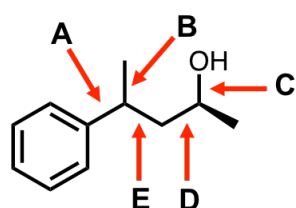
- ☐ C-O
- ☐ C=C
- ☒ C-C
- ☐ C=O
- ☐ C-N
- ☐ C=N



Question 21

2 / 2 pts

Where is the location of the new bond you identified in the previous problem?



- ☐ A
- ☐ B
- ☐ C
- ☐ D
- ☒ E



### Question 22

2 / 2 pts

What kind of nucleophile will you need to form the new bond identified in Problems 20 and 21?

- ☒ Organometallic reagent
- ☐ Pyridine
- ☐ Hydride reagent
- ☐ Alkoxide
- ☐ Cyanide
- ☐ Enolate
- ☐ Tosylate



### Question 23

2 / 2 pts

What kind of electrophile will you need to form the new bond that you identified in Problems 20 and 21?

- ☐ Ester
- ☐ Aldehyde
- ☒ Epoxide
- ☐ Ketone
- ☐ Alkyl halide (ex. XR)
- ☐ Sulfonate ester
- ☐ Carboxylic acid



### Question 24

1 / 1 pts

Should the starting material be transformed into the nucleophile or the electrophile? Stated another way, is **Intermediate Z** the nucleophile or the electrophile?



- ☒ Nucleophile!  
☐ Electrophile!  
☐ Neither!



Question 25

1 / 1 pts

Which reagent(s) should be used to transform the starting material into Intermediate Z during **Reaction 3**?

- ☐ NaOH  
☒ Mg  
☐ MgBr  
☐ LiAlH<sub>4</sub>  
☐ H<sub>2</sub>SO<sub>4</sub>  
☐ CrO<sub>3</sub>, H<sub>2</sub>O, H<sub>2</sub>SO<sub>4</sub>  
☐ H<sub>2</sub>O  
☐ CIMS, pyridine

Quiz Score: 30 out of 30