LeAP: SN1 Mechanism

- Due Oct 3, 2024 at 11:59pm
- Points 5
- Questions 9
- Available Sep 1, 2024 at 12am - Oct 7, 2024 at 11:59pm
- Time Limit None
- Allowed Attempts 2

Instructions

Lecture Application Practices (LeAPs) serve as initial opportunities for students to apply the information they've gathered from the pre-lecture videos and in-person lectures/lecture videos.

Students are strongly encouraged to complete LeAPs on the same day that the corresponding topic is completed in class. However, to provide consistent due dates, sets of LeAPs will be due on Thursdays at 11:59 PM - Chicago time. See the Weekly Schedules or Course Calendar for specific due dates for each activity.

Each LeAP is worth 5 points. Credit will be awarded based on accuracy. There is no time limit. Students will receive two attempts for each assignment and the highest score will be recorded in the gradebook. LeAPs may consist of multiple-choice, calculation, ranking, choose all that apply, and fill in the blank type questions.

This quiz was locked Oct 7, 2024 at 11:59pm.

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	1,714 minutes	5 out of 5

ⓘ Correct answers are hidden.

Score for this attempt: 5 out of 5
Submitted Oct 2, 2024 at 1:28pm
This attempt took 1,714 minutes.

Question 1
0.5 / 0.5 pts

Which statement about the rate-determining step of an SN1 reaction is TRUE?

- (●) The rate-determining step is endothermic and the transition state is late.
- ( ) The rate-determining step is endothermic and the transition state is early.
- ( ) The rate-determining step is exothermic and the transition state is late.

- The rate-determining step is exothermic and the transition state is early.

Question 2
0.5 / 0.5 pts

While discussing the SN1 mechanism, we learned that H_2O is an extremely weak nucleophile. So weak that it CANNOT perform an S_N2 mechanism.

Analyze the properties of the oxygen atom in H_2O, since the oxygen is the atom that attacks in an SN1 mechanism. Which nucleophiles listed below share similarities to H_2O and would be expected to be very weak nucleophiles as well? **Choose all that apply.**

- [x] $HOCH_3$
- [x] $HOCH_2CH_2CH_3$
- [ ] NaOH
- [ ] $LiOCH_2CH_2CH_3$
- [x] CH_3CO_2H (a carboxylic acid)
- [ ] CH_3CO_2Na (a carboxylate)

Question 3
0.5 / 0.5 pts

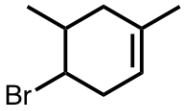
You are working on designing an efficient S_N1 reaction. You can choose to use either iodomethane or 2-iodopropane as your electrophile. Which electrophile will be more reactive (result in a faster rate) and why?

- Iodomethane will be more reactive because it is more substituted and the carbocation will be more stabilized by hyperconjugation.
- Iodomethane will be more reactive because it is less substituted and the carbocation will be less stabilized by hyperconjugation.
- (selected) 2-Iodopropane will be more reactive because it is more substituted and the carbocation will be more stabilized by hyperconjugation.
- 2-Iodopropane will be more reactive because it is less substituted and the carbocation will be less stabilized by hyperconjugation.

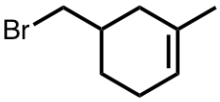
Hyperconjugation occurs when the empty p orbital of the carbocation aligns with an adjacent sigma bond; the sigma bond can then share some of its electron density with the empty p orbital (electron delocalization), which stabilizes the carbocation and accelerates the rate of the reaction.

Question 4
1 / 1 pts

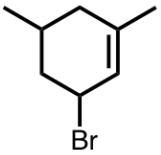
Rank the electrophiles shown below from most reactive (1) to least reactive (3) for an S_N1 reaction.



Isomer A



Isomer B



Isomer C

1

Isomer C

2

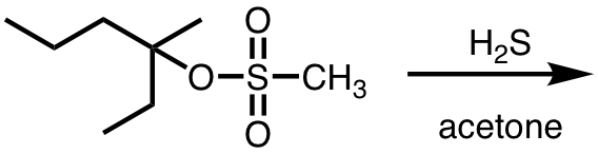
Isomer A

3

Isomer B

Question 5
0.5 / 0.5 pts

Use the S_N1 reaction shown below to answer questions 5-9.



Which option gives the correct order for bonds broken and bonds formed during the arrow-pushing mechanism for this reaction?

Step 1: C-O bond breaks

Step 2: S-C bond forms

Step 3: S-H bond breaks at the same time as an O-H bond forms

Step 1: S-H bond breaks at the same time as an O-H bond forms

Step 2: C-O bond breaks at the same time as an S-C bond forms

Step 1: S-C bond breaks

Step 2: C-O bond forms

Step 1: S-H bond breaks at the same time as a C-O bond breaks

Step 2: S-C bond forms

Step 3: O-H bond forms

Question 6

0.5 / 0.5 pts

What is the HOMO and LUMO for the reaction?

HOMO: S sp3 orbital

LUMO: C p orbital

HOMO: S-H σ orbital

LUMO: C-S σ* orbital

HOMO: S-H σ orbital

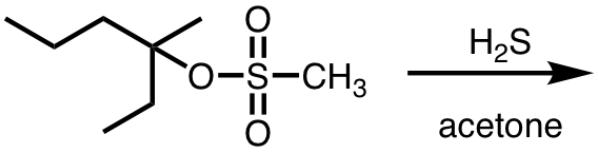
LUMO: C-O σ* orbital

HOMO: S sp3 orbital

LUMO: S-O π orbital

Question 7

0.5 / 0.5 pts



How will the rate of the reaction change if the concentration of H_2S is doubled?

- (•) The reaction rate will not change.
- ( ) The reaction rate will increase and be 2 times faster.
- ( ) The reaction rate will increase and be 4 times faster.
- ( ) The reaction rate will decrease and be half as fast.

Question 8
0.5 / 0.5 pts

How will the reaction rate change if the solvent is changed from acetone to $HOCH_3$?

- (•) The rate will increase.
- ( ) The rate will decrease.
- ( ) The rate will not change.
- ( ) The change in rate cannot be determined.

Question 9
0.5 / 0.5 pts

How will the reaction rate of the SN1 reaction change if the electrophile is changed from the tertiary electrophile to a secondary electrophile by removing the methyl group from the alpha carbon?

- ( ) The rate will increase.
- (•) The rate will decrease.
- ( ) The rate will not change.
- ( ) The change in rate cannot be determined.

Quiz Score: 5 out of 5