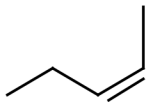
"Grade or Education" = 1

CHEM 2261/01
Summer 10
Exam 2
Chapters 4-6

1. Using **ethyne** as the starting material, pick the choice which **CORRECTLY** describes how the compound with the structure shown below can be prepared.



__ A. First steps: 1. $NaNH_2$, 2. CH_3Br; Next step: Na/NH_3; Final steps: 1. $NaNH_2$, 2. CH_3CH_2Br

__ B. First steps: 1. $NaNH_2$, 2. CH_3Br; Next step: H_2/Lindlar catalyst; Final steps: 1. $NaNH_2$, 2. CH_3CH_2Br

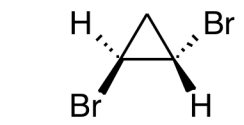
__ C. First steps: 1. $NaNH_2$, 2. CH_3Br; Next steps: 1. $NaNH_2$, 2. CH_3CH_2Br; Final step: H_2 and Pd/C

__ D. First steps: 1. $NaNH_2$, 2. CH_3Br; Next steps: 1. $NaNH_2$, 2. CH_3CH_2Br; Final step: Na/NH_3

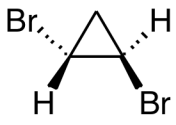
__ E. First steps: 1. $NaNH_2$, 2. CH_3Br; Next steps: 1. $NaNH_2$, 2. CH_3CH_2Br; Final step: H_2/Lindlar catalyst

Rationale:
Chapter 6 Problem 43e

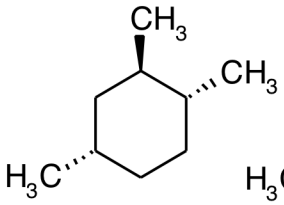
2. Figure out whether each of the following pairs of compounds are identical or are enantiomers, diastereomers, or constitutional isomers. Pick the choice which gives the **CORRECT** relationship between one of these pairs.



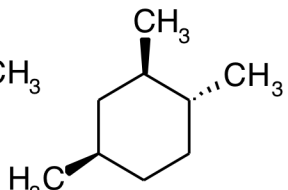
b1



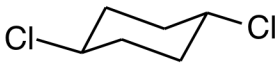
b2



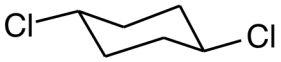
d1



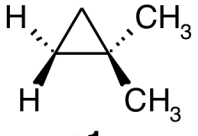
d2



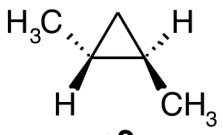
f1



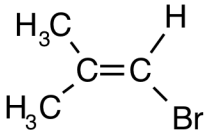
f2



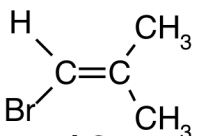
c1



c2



h1



h2

__ A. **b1** and **b2** are identical.

__ B. **f1** and **f2** are identical.

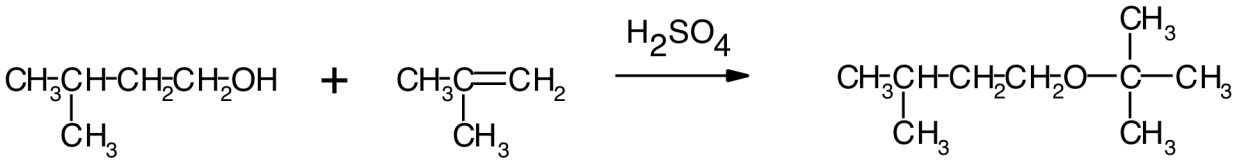
__ C. **d1** and **d2** are enantiomers.

__ D. **c1** and **c2** are diastereomers.

__ E. **h1** and **h2** are enantiomers.

Rationale:
similar to Chapter 5 Problem 67 (b,c,d,f,h)

3. Draw out the mechanism for the reaction shown below using curved arrows to depict electron movement. Use the letter "R" to represent the isopentyl group of the alcohol in order to save time. Use your drawing to choose the statetement from the multiple choices which is **WRONG** about this mechanism.



__ A. In the second step of this mechanism a lone pair of electrons located on the oxygen atom of the alcohol molecule attacks a tertiary carbocation. This is represented by a curved arrow with its tail at the lone pair of electrons and its point directed toward the positive charge.

__ B. In the first step of this mechanism a hydrogen cation attacks a double bond. This is represented by a curved arrow originating at the hydrogen and pointing toward the double bond.

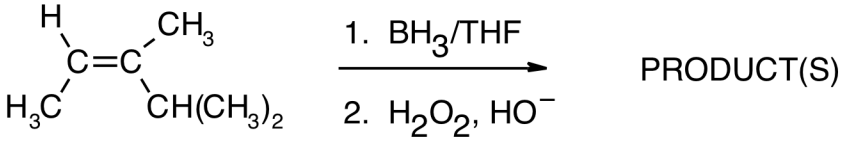
__ C. In the third step of this mechanism a protonated oxygen atom loses a hydrogen cation. This is represented by drawing a curved arrow which originates at the bond between the oxygen atom and the hydrogen atom being lost. This curved arrow points toward the middle of the positively-charged oxygen atom.

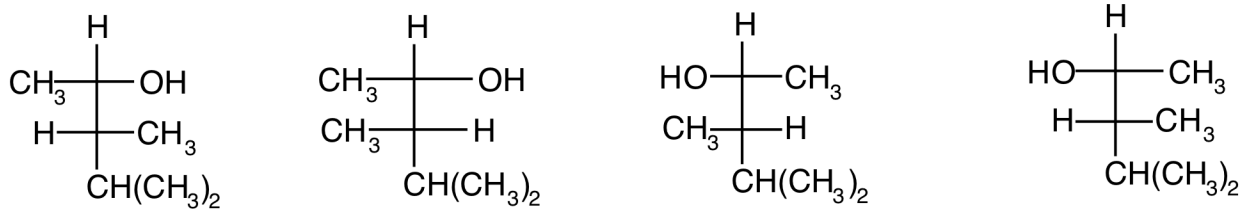
__ D. The second intermediate in this mechanism is an ion containing a positively-charged oxygen atom.

__ E. There are two intermediates and three steps in this mechanism.

Rationale:
Chapter 4 Problem 14

4. Find the structure(s) of the product(s) of the reaction shown below. Pick the choice which references **ALL** of the **CORRECT** reaction products.





__ A. This reaction produces products **1** , **2** , **3** , and **4** .

__ B. This reaction produces only product **3** .

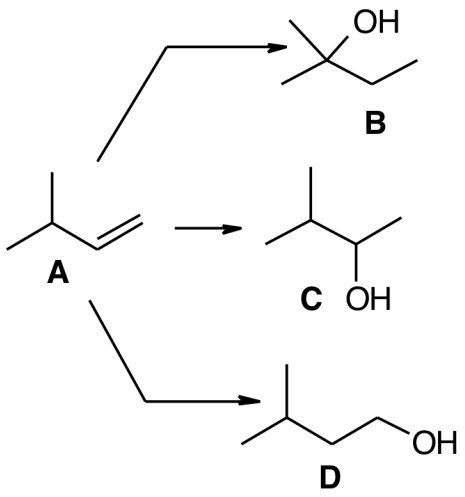
__ C. This reaction produces only product **4** .

__ D. This reaction produces products **2** and **4** .

__ E. This reaction produces products **1** and **3** .

Rationale:
Chapter 5 Problem 93

5. Figure out what reagents are required to convert the alkene labelled **A** shown below into the alcohols labelled **B** , **C** , and **D** . Choose the **CORRECT** statement from the multiple choices.



__ A. Alkene **A** will react with H_2O and H_2SO_4 to form alcohol **B** .

__ B. Alkene **A** will react with: 1. $Hg(OAc)_2$, H_2O/THF; followed by 2. $NaBH_4$ to form alcohol **D** .

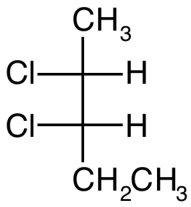
__ C. Alkene **A** will react with: 1. BH_3/THF; followed by 2. H_2O_2, HO^-, H_2O to form alcohol **C** .

__ D. Alkene **A** will react with H_2O and H_2SO_4 to form alcohol **D** .

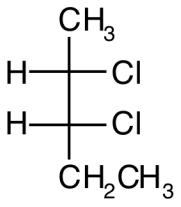
__ E. Alkene **A** will react with H_2O and H_2SO_4 to form alcohol **C** .

Rationale:
Chapter 4 Problem 43

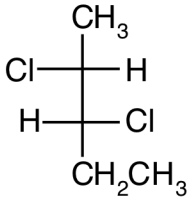
6. Which of the numbered structures shown below is (2R,3R)-2,3-dichloropentane?



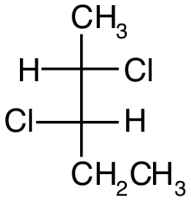
1



2



3



4

__ A. **3**

__ B. **2**

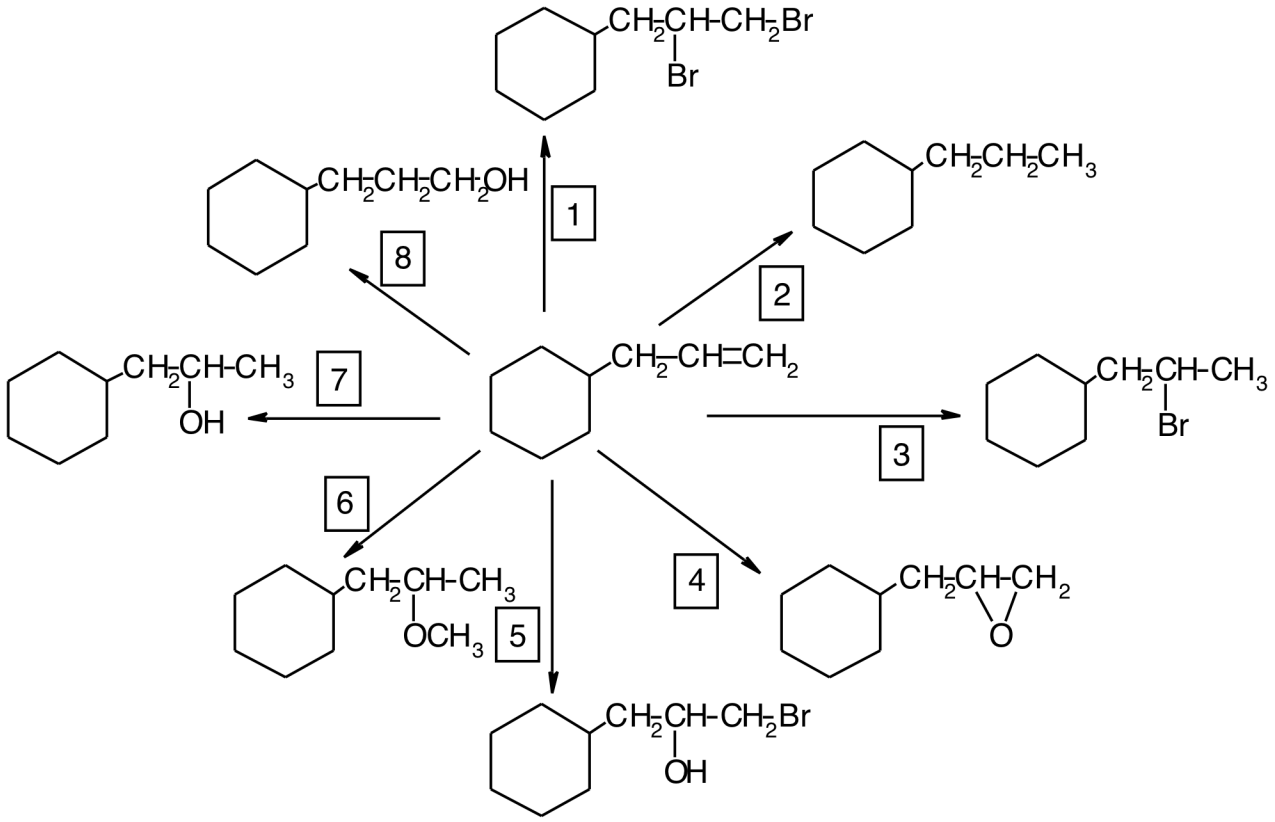
__ C. **4**

__ D. None of these structures is correct.

__ E. **1**

Rationale:
Chapter 5 Problem 88b

7. The compound whose structure is shown in the center of the figure following can be converted into all of the other outer compounds whose structures are shown. Conversion number 1 transforms the center compound into the topmost compound in the figure (see boxed number 1). Conversion number 2 transforms the center compound into the outer compound one position clockwise from the topmost compound, etc. (ie. the conversion numbers are arranged in a clockwise pattern). Use this information to find the multiple choice answer which is **WRONG**.



__ A. Conversion number 5 can be carried out using Br_2 and H_2O.

__ B. Conversion number 8 can be carried out using BH_3 followed by H_2O_2 and base (OH^-).

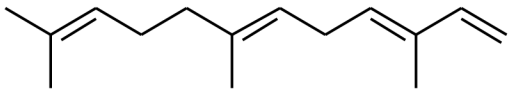
__ C. Conversion number 3 can be carried out using HBr and peroxide.

__ D. Conversion number 2 can be carried out using H_2/Pt.

__ E. Conversion number 6 can be carried out using acid (H^+) and CH_3OH.

Rationale:
similar to Chapter 4 Problem 47

8. α-Farnesene is a dodecatetraene found in the waxy coating of apple skins. Its structure is shown below. What is it's systematic name?



__ A. (3E,6E)-3,7,11-trimethyl-1,3,6,10-dodecatetraene

__ B. (6Z,9Z)-2,6,10-trimethyl-2,6,9,11-dodecatetraene

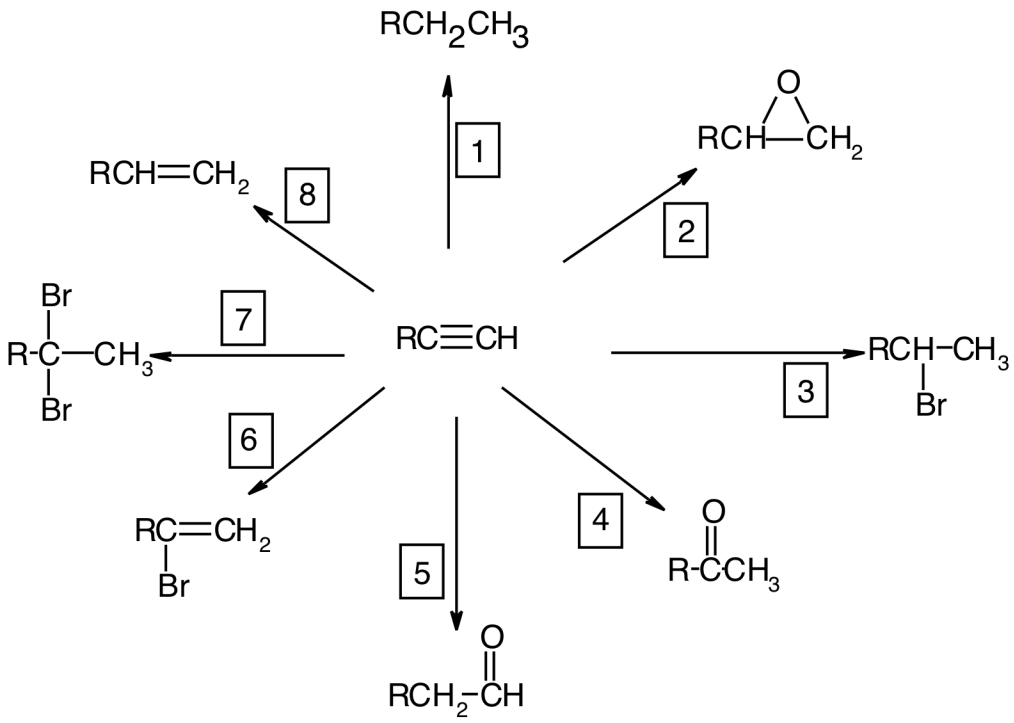
__ C. (6E,9E)-2,6,10-trimethyl-2,6,9,11-dodecatetraene

__ D. (3Z,6Z)-3,7,11-trimethyl-1,3,6,10-dodecatetraene

__ E. (3E,6E,10E)-3,7,11-trimethyl-1,3,6,10-dodecatetraene

Rationale:
Chapter 6 Problem 50

9. The compound whose structure is shown in the center of the figure below can be converted into all of the other outer compounds whose structures are shown. Conversion number 1 transforms the center compound into the topmost compound in the figure (see boxed number 1). Conversion number 2 transforms the center compound into the outer compound one position clockwise from the topmost compound, etc. (ie. the conversion numbers are arranged in a clockwise pattern). Use this information To find the multiple choice answer which is **WRONG**.



__ A. Conversion number 6 can be carried out using 1 equiv. of HBr.

__ B. Conversion number 4 can be carried out using $H_2O/H_2SO_4 + HgSO_4$.

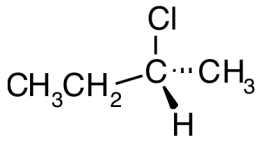
__ C. Conversion number 7 can be carried out using excess HBr.

__ D. Conversion number 5 can be carried out using disiamylborane followed by HO^-/H_2O_2.

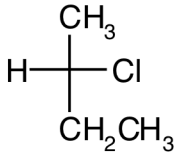
__ E. Conversion number 8 can be carried out using excess H_2/Pd/C.

Rationale:
Chapter 6 Problem 29

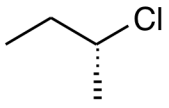
10. Which of the structures below is/are (S)-2-chlorobutane?



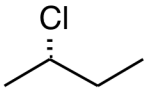
a



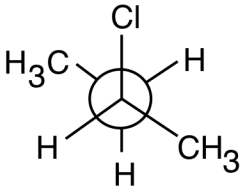
b



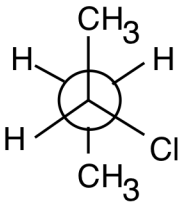
c



d



e



f

__ A. Only **b** is (S)-2-chlorobutane.

__ B. Only **c** is (S)-2-chlorobutane.

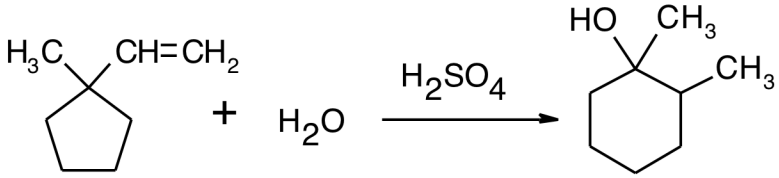
__ C. Structures **b** , **d** and **f** are (S)-2-chlorobutane.

__ D. Structures **a** , **c** , and **d** are (S)-2-chlorobutane.

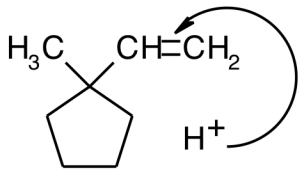
__ E. Structures **b** and **c** are (S)-2-chlorobutane.

Rationale:
Chapter 5 Problem 78

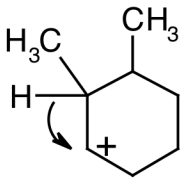
11. Work out the curved arrow mechanism for the reaction below, which involves a carbocation rearrangement.



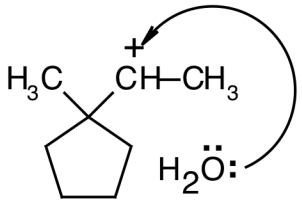
Choose the structure below with curved arrows which **CORRECTLY** depicts the electron movement involved in **ONE** of the steps of your mechanism.



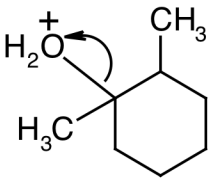
1



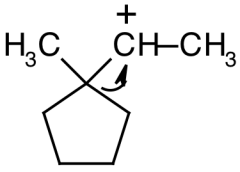
4



2



5



3

__ A. 5

__ B. 2

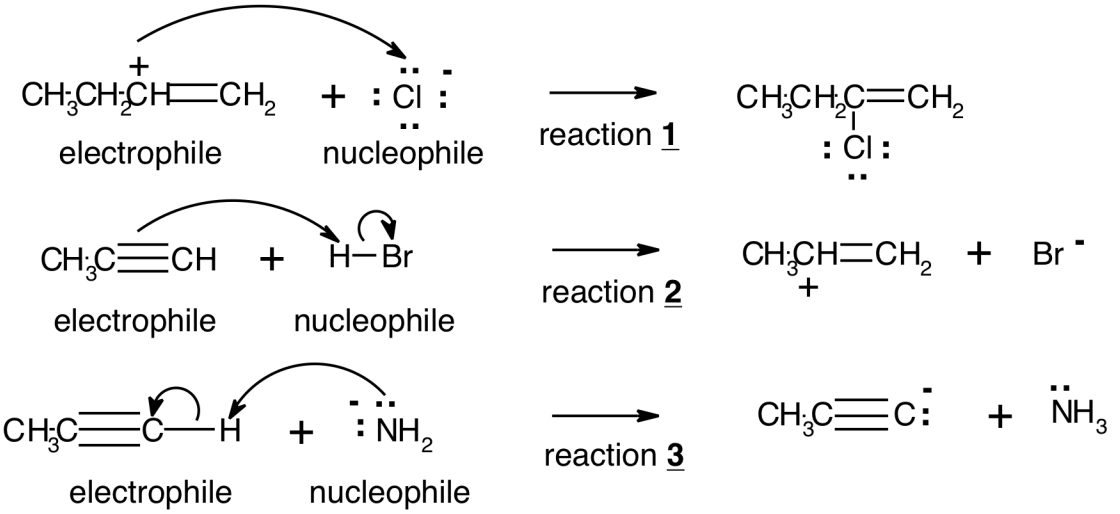
__ C. 1

__ D. 4

__ E. 3

Rationale:
Chapter 4 Problem 64

12. Identify the electrophile and the nucleophile **CORRECTLY** in each of the following reaction steps. Then figure out how to draw curved arrows which **CORRECTLY** illustrate the bond-making and bond-breaking processes involved in these reactions. Pick the choice which **ACCURATELY** describes what is correct and what is wrong about the way in which one of these three reactions is laid out.



__ A. In reaction **1** the electrophile and nucleophile labels are reversed and the curved arrow is drawn backwards.

__ B. Both the curved arrows and the electrophile and nucleophile labels are correctly laid out in reaction **2** .

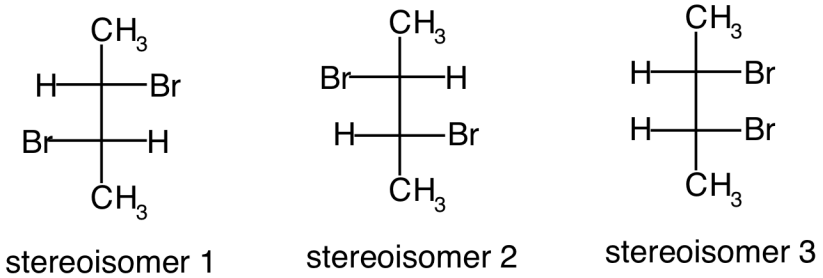
__ C. In reaction **3** the electrophile and nucleophile are labelled correctly but the curved arrows are drawn incorrectly.

__ D. The curved arrow is correctly drawn in reaction **1** but the electrophile and nucleophile labels are reversed.

__ E. Both the curved arrows and the electrophile and nucleophile labels are correctly laid out in reaction **3** .

Rationale:
Chapter 6 Problem 27

13. Pick the stereoisomer(s) from below obtained from the reaction of 2-butyne with $Na/NH_3(liq)$ followed by Br_2/CH_2Cl_2.



__ A. Stereoisomers 2 and 3 are obtained.

__ B. Only stereoisomer 1 is obtained.

__ C. Only stereoisomer 3 is obtained.

__ D. Stereoisomers 1, 2, and 3 are obtained.

__ E. Stereoisomers 1 and 2 are obtained.

Rationale:
Chapter 6 Problem 44b

14. Draw or analyze all of the stereoisomers for each of the compounds named in the multiple choices. Which choice gives the **CORRECT** number of stereoisomers that exist for the compound named?

__ A. 1,4-dichlorocyclohexane has three stereoisomers.

__ B. 2,4-dichloropentane has three stereoisomers.

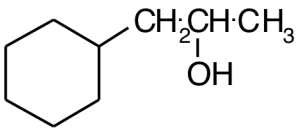
__ C. 2,4-dichloroheptane has three stereoisomers.

__ D. 3,4-dichlorohexane has four stereoisomers.

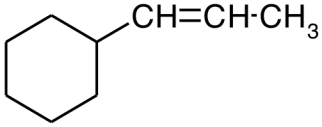
__ E. 3-chloro-3-methylpentane has two stereoisomers.

Rationale:
Chapter 5 Problem 34(e,g,h,i,l)

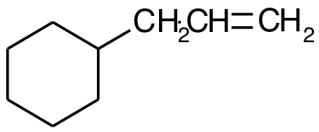
15. Which of the following methods would be the **BEST** way to prepare the compound having structure **1** shown below?



1



2



3

__ A. Start with the compound having structure 2 and treat it with $Hg(OAc)_2$ and water followed by $NaBH_4$.

__ B. Start with the compound having structure 2 and treat it with BH_3/THF followed by H_2O_2/OH^-.

__ C. Start with the compound having structure 3 and treat it with acid (H^+) and water.

__ D. Start with the compound having structure 2 and treat it with acid (H^+) and water.

__ E. Start with the compound having structure 3 and treat it with BH_3/THF followed by H_2O_2/OH^-.

Rationale:
Chapter 4 Problm 50e

Answer Key

"Grade or Education" = 1

CHEM 2261/01
Summer 10
Exam 2
Chapters 4-6

1. E
2. B
3. B
4. E
5. A
6. A
7. C
8. A
9. E
10. C
11. E
12. E
13. C
14. B
15. C