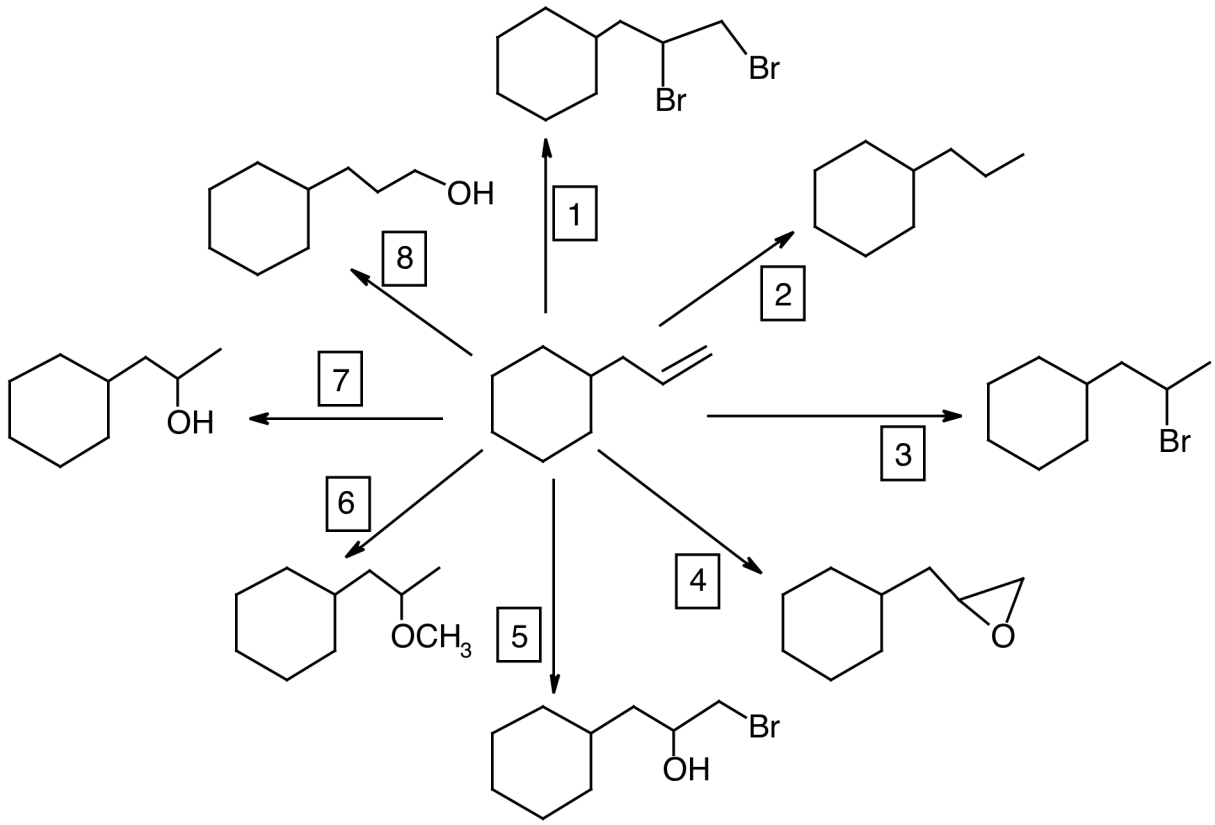
"Grade or Education" = 1

CHEM 2261/01
Summer 12
Exam 2
Chapters 4-6

1. 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 8 can be carried out using BH_3/THF followed by $H_2O_2/OH^-/H_2O$.

__ B. Conversion number 3 can be carried out using Br_2 and H_2O.

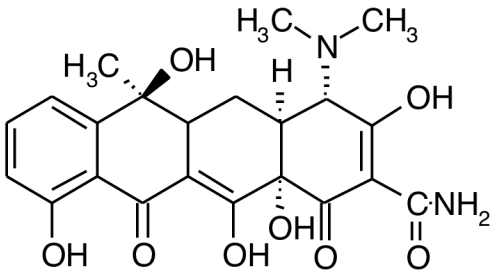
__ C. Conversion number 6 can be carried out using acid (H^+) and CH_3OH.

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

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

Rationale:
Chapter 4 Problem 47

2. Tetracycline is called a broad-spectrum antibiotic because it is very active against a wide variety of bacteria. The structure of tetracycline is shown below. How many asymetric centers does tetracycline have?



tetracycline

__ A. 4

__ B. 7

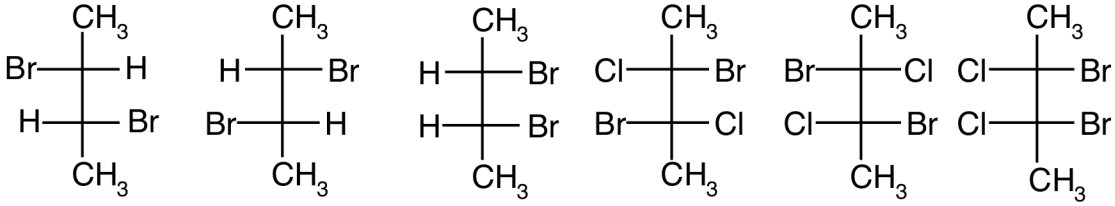
__ C. 6

__ D. 3

__ E. 5

Rationale:
Chapter 5 Problem 6

3. Examine the Fischer projections below. Which of the multiple choices gives the number(s) associated with the Fischer projection(s) of the **CORRECT** stereoisomer(s) obtained from the reaction of 2-butyne with the reagents specified?



1 **2** **3** **4** **5** **6**

__ A. Reaction with, 1. $Na/NH_3(liq)$, followed by 2. Br_2/CH_2Cl_2 gives the products with structures **4** and **5** only.

__ B. Reaction with, 1. H_2/Lindlar catalyst, followed by 2. Br_2/CH_2Cl_2 gives the products with structures **1** and **2** only.

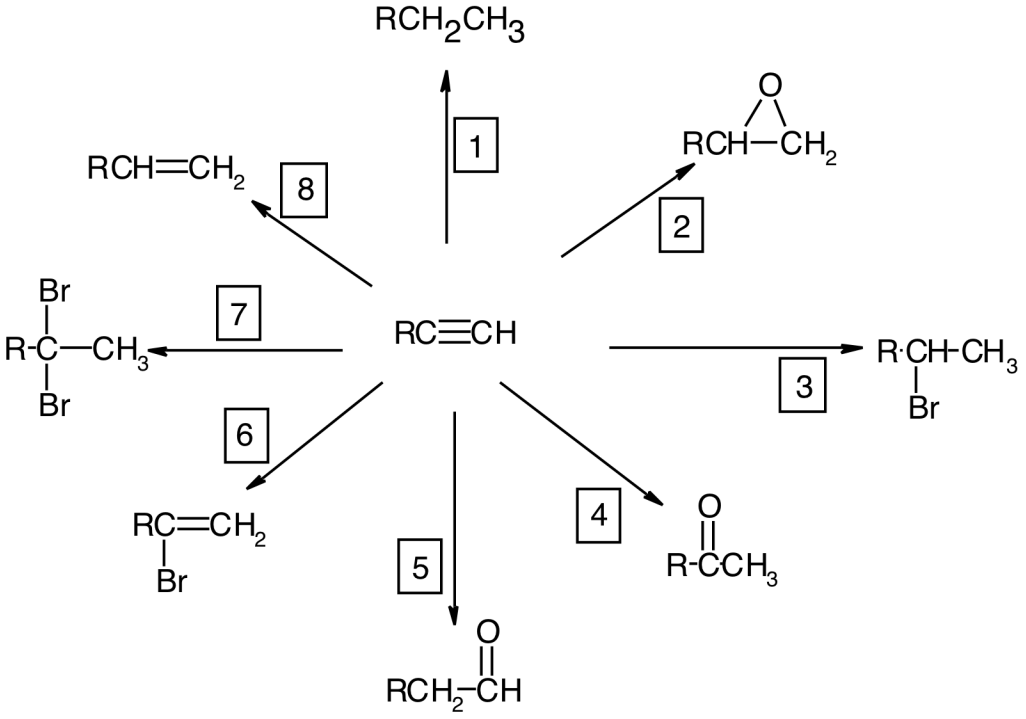
__ C. Reaction with, 1. Cl_2/CH_2Cl_2, followed by 2. Br_2/CH_2Cl_2 gives the products with structures **4** and **5** only.

__ D. Reaction with, 1. $Na/NH_3(liq)$, followed by 2. Br_2/CH_2Cl_2 gives the product with structure **6** only.

__ E. Reaction with, 1. $Na/NH_3(liq)$, followed by 2. Br_2/CH_2Cl_2 gives the products with structures **1** and **2** only.

Rationale:
Chapter 6 Problem 44

4. Figure out what reagents could be used to carry out the syntheses shown below. Pick the choice which specifies the **CORRECT** reagent(s) for one of these syntheses.



__ A. The reagents used to carry out the synthesis associated with box 5 are BH_3/THF followed by HO^-, H_2O_2, and H_2O.

__ B. The reagents used to carry out the synthesis associated with box 3 are excess H_2 with Pd/C followed by HBr.

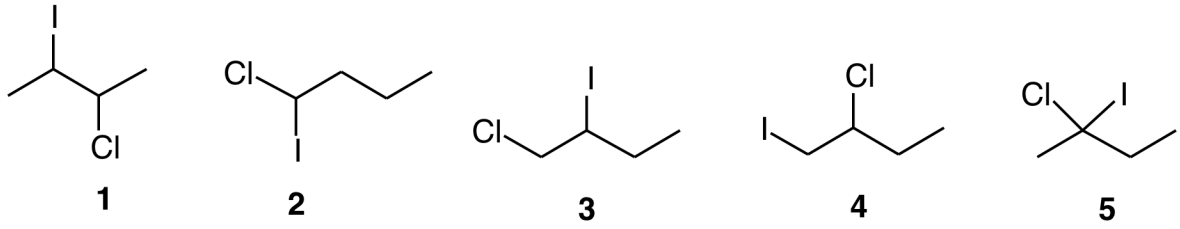
__ C. The reagent used to carry out the synthesis associated with box 7 is Br_2 in CH_2Cl_2.

__ D. The reagent used to carry out the synthesis associated with box 1 is H_2/Lindlar catalyst.

__ E. The reagent used to carry out the synthesis associated with box 8 is excess H_2 with Pd/C.

Rationale:
Chapter 6 Problem 29

5. Find the correct structure of the product of the addition of I-Cl (iodine monochloride) to 1-butene among the numbered structures in the figure below (Hint: chlorine is more electronegative than iodine).



1 **2** **3** **4** **5**

__ A. The correct product has structure 5.

__ B. The correct product has structure 3.

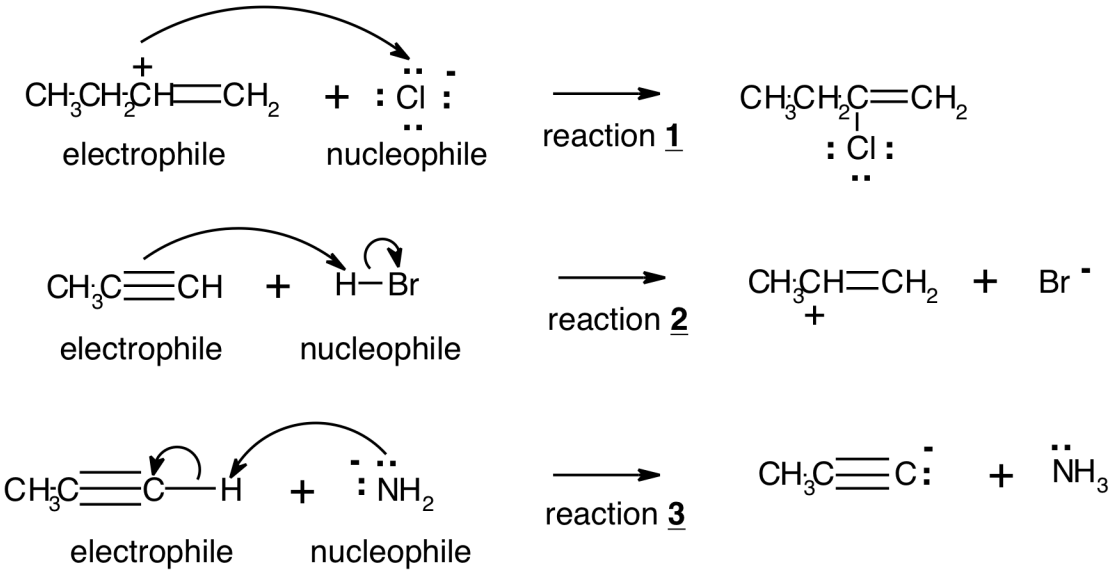
__ C. The correct product has structure 4.

__ D. The correct product has structure 1.

__ E. The correct product has structure 2.

Rationale:
Chapter 4 Problem 21

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

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

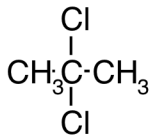
__ C. In reaction **1** the electrophile and nucleophile labels are reversed and the curved arrow is drawn backwards.

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

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

Rationale:
Chapter 6 Problem 27

7. Starting with acetylene, how could the compound whose structure is shown below be synthesized?



__ A. First react the acetylene with $NaNH_2$ followed by CH_3Br. Next react with H_2/Lindlar's catalyst. Finally react with $Cl_2/CHCl_2$.

__ B. First react the acetylene with Na/NH_3. Next react with CH_3Br. Finally react with excess HCl.

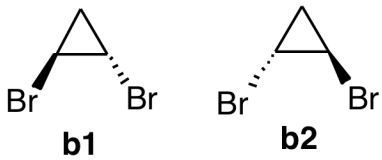
__ C. First react the acetylene with $NaNH_2$ followed by CH_3Br. Next react with excess HCl.

__ D. First react the acetylene with Na/NH_3 followed by CH_3Br. Next react with H_2/Lindlar's catalyst. Finally react with $Cl_2/CHCl_2$.

__ E. First react the acetylene with Na/NH_3. Next react with CH_3Br. Finally react with Cl_2/CH_2Cl_2.

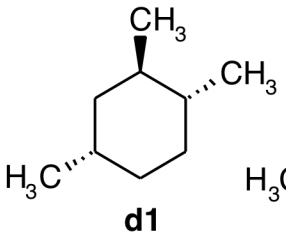
Rationale:
Chapter 6 Problem 24f

8. 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.

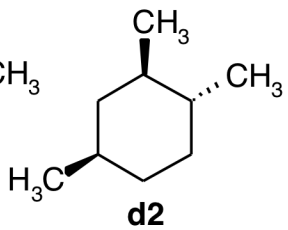


b1

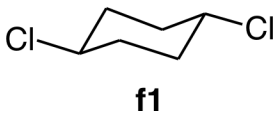
b2



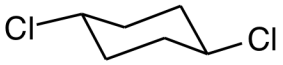
d1



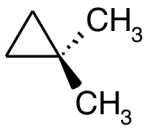
d2



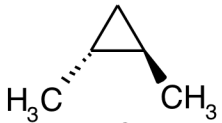
f1



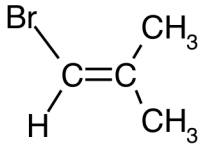
f2



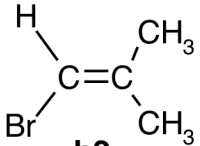
c1



c2



h1



h2

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

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

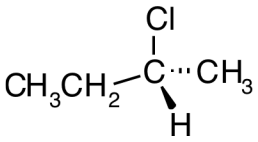
__ C. **h1** and **h2** are enantiomers.

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

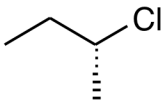
__ E. **b1** and **b2** are identical.

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

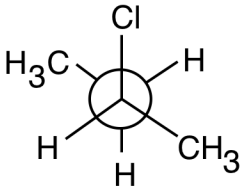
9. Which of the structures below is/are (S)-2-chlorobutane?



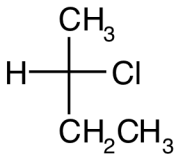
a



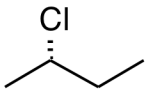
c



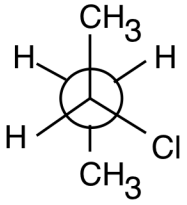
e



b



d



f

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

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

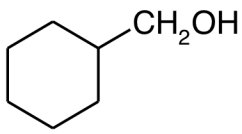
__ C. Only **c** is (S)-2-chlorobutane.

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

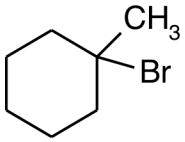
__ E. Only **b** is (S)-2-chlorobutane.

Rationale:
Chapter 5 Problem 78

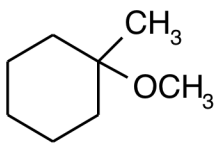
10. Which of the choices **CORRECTLY** describes how a product having structure **1**, **2**, or **3** could be synthesized from an alkene having structure **4** or **5**?



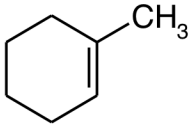
1



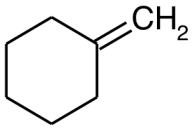
2



3



4



5

__ A. **5** could be reacted with H_2O/H_2SO_4 to yield **1**.

__ B. **4** could be reacted with Br_2/CH_3OH to yield **2**.

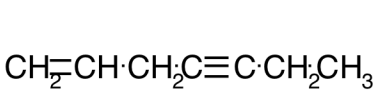
__ C. **4** could be reacted with Br_2/CH_3OH to yield **3**.

__ D. **5** could be reacted with BH_3/THF followed by $OH^-/H_2O_2/H_2O$ to yield **1**.

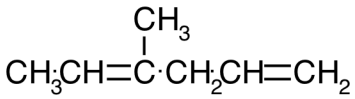
__ E. **4** could be reacted with Br_2/H_2O to yield **2**.

Rationale:
Chapter 4 Problem 37(c-e)

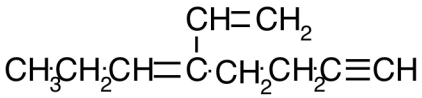
11. Pick the choice which gives a **CORRECT** systematic name for one of the compounds whose structures are shown below.



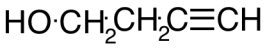
a



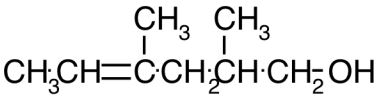
b



c



d



f

__ A. Compound **b** is 3-methyl-2,5-hexadiene.

__ B. Compound **d** is 3-butyn-1-ol.

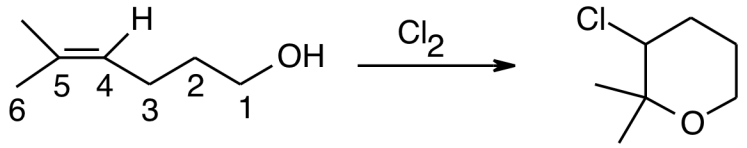
__ C. Compound **f** is 3,5-dimethyl-2-hexen-6-ol.

__ D. Compound **a** is 3-heptyn-6-ene.

__ E. Compound **c** is 3-(3-butynyl)-1,3-hexadiene.

Rationale:
Chapter 6 Problem 6(a,b,c,d,f)

12. Draw out the mechanism for the reaction shown below. Choose the statement which **CORRECTLY** describes one of the steps in the mechanism. Use the numbers under the carbon atoms in the reactant for reference in choosing your answer.



__ A. In the first step of this mechanism Cl_2 adds across the double bond between carbon 4 and carbon 5 resulting in one Cl atom bonded to carbon 4 and a second Cl atom bonded to carbon 5.

__ B. In the second step of this mechanism a lone pair of electrons on the oxygen atom attacks carbon 5 breaking the pi bond between carbon 4 and carbon 5. The electrons in the pi bond are pushed onto carbon 4 where they become a lone pair.

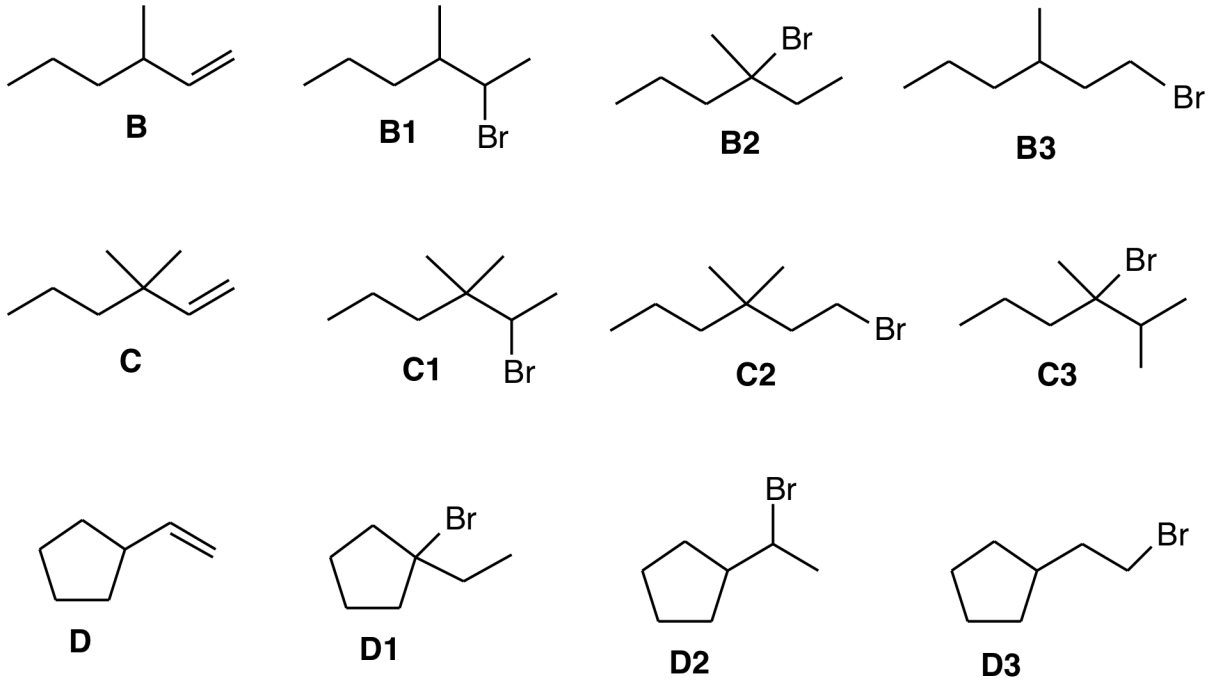
__ C. In the second step of this mechanism a lone pair on the oxygen atom attacks carbon number 5 breaking a bond between a chlorine atom and carbon 5. This is represented by a curved arrow starting at a lone pair on oxygen and pointing to carbon 5, and a second curved arrow starting at the bond between carbon 5 and Cl and pointing to the Cl atom. This step breaks up a 3-membered ring with Cl bonded to both carbon 4 and carbon 5, and results in Cl being bonded only to carbon 4.

__ D. In the first step of this mechanism Cl_2 attacks carbons 4 and 5. This is represented by a curved arrow originating at a lone pair on a Cl atom in the Cl_2 molecule and pointing to carbon 5, with a second curved arrow originating at the double bond between carbon4 and carbon 5, which points to the other Cl atom in the Cl_2 molecule.

__ E. In the third step of this mechanism the pi bond between carbon 4 and carbon 5 attacks carbon 1 and breaks the bond between carbon 1 and oxygen, releasing a molecule of water. This is represented by a curved arrow originating at the double bond between carbon 4 and carbon 5 and pointing to carbon 1, with a second curved arrow origination at the bond between carbon 1 and oxygen and pointing at oxygen.

Rationale:
Chapter 4 Problem 23

13. The figure below shows the structures of three alkenes, labelled **B**, **C**, and **D**. Which choice gives the **CORRECT** major product of the reaction of one of these alkenes with HBr? Reaction product structures are labelled **B1** - **D3** for reference.



__ A. Alkene **C** gives product **C3** on reaction with HBr.

__ B. Alkene **D** gives product **D2** on reaction with HBr.

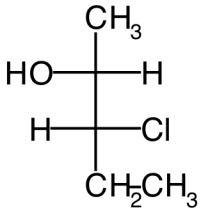
__ C. Alkene **B** gives product **B1** on reaction with HBr.

__ D. Alkene **C** gives product **C2** on reaction with HBr.

__ E. Alkene **B** gives product **B3** on reaction with HBr.

Rationale:
Chapter 4 Problem 60

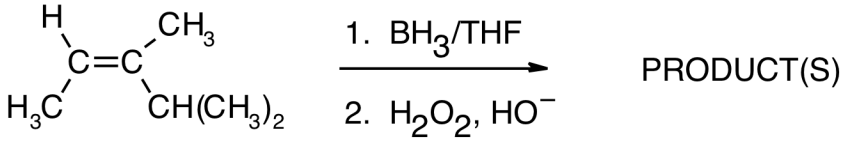
14. Choose a **CORRECT** name for the compound whose structure is shown below.

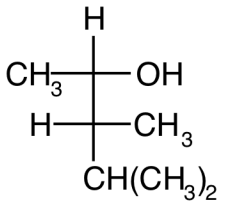


__ A. (2R,3S)-3-chloro-2-pentanol
__ B. (2R,3R)-3-chloro-2-pentanol
__ C. (2S,3S)-3-chloro-2-pentanol
__ D. (2S,3R)-3-chloro-2-pentanol
__ E. (3S,4S)-3-chloro-4-pentanol

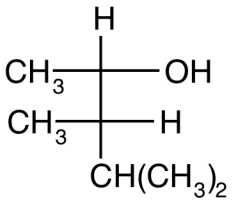
Rationale:
Chapter 5 Problem 65c

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

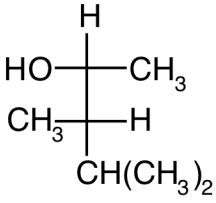




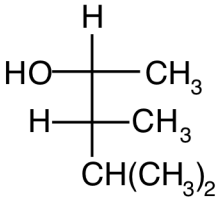
1



2



3



4

__ A. This reaction produces only product **4**.
__ B. This reaction produces products **2** and **4**.
__ C. This reaction produces products **1** and **3**.
__ D. This reaction produces products **1**, **2**, **3**, and **4**.
__ E. This reaction produces only product **3**.

Rationale:
Chapter 5 Problem 93

Answer Key

"Grade or Education" = 1

CHEM 2261/01
Summer 12
Exam 2
Chapters 4-6

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