1. Carbon-carbon double bonds do not freely rotate like carbon-carbon single bonds. Why?

   A. The double bond is much stronger and thus more difficult to rotate.
   B. Overlap of the two 2p orbitals of the π bond would be lost.
   C. The shorter bond length of the double bond makes it more difficult for the attached groups to pass each other.
   D. Overlap of the sp² orbitals of the carbon-carbon σ bond would be lost.

2. What is the IUPAC name of the following compound?

   ![Diagram of a compound]

   A. 2-methyl-3-propyl-2-pentene
   B. 3-ethyl-2-methyl-2-hexene
   C. 4-ethyl-methyl-4-hexene
   D. 4-methyl-3-propyl-3-pentene

3. How many isomeric alkenes of formula C₄H₈, including stereoisomers, are possible?

   A. two
   B. three
   C. four
   D. five

4. What is the IUPAC name of the following compound?

   ![Diagram of a compound]

   A. 3-bromo-2-methylcyclohexene
   B. 1-bromo-2-methyl-2-cyclohexene
   C. 6-bromo-1-methylcyclohexene
   D. 2-bromo-1-methylcyclohexene
5. Which of the following alkenes exhibit E-Z isomerism?

   I. CH₃CH₂CH=CHCH₂CH₃
   II. (CH₃)₂C=CHCH₃
   III. CH₃CH₂CH=CHBr
   IV. H₂C=CHCH₂CH(CH₃)₂

   A. I and II  
   B. I and III  
   C. II and IV  
   D. I, II, and III

6. What is the IUPAC name of the following compound?

   \[
   \begin{array}{c}
   \text{H} \\
   \text{C} \\
   \text{F} \\
   \text{CH₃}
   \end{array}
   \quad \quad \quad
   \begin{array}{c}
   \text{CH₂Br} \\
   \text{C} \\
   \text{CH₃}
   \end{array}
   \]

   A. (E)-3-bromo-1-fluoro-2-methylpropene  
   B. (Z)-3-bromo-1-fluoro-2-methylpropene  
   C. (E)-1-bromo-3-fluoro-2-methylpropene  
   D. (Z)-1-bromo-3-fluoro-2-methylpropene

7. Identify the major organic product expected from the acid-catalyzed dehydration of 2-methyl-2-pentanol.

   A. 2-methyl-1-pentene  
   B. 2-methyl-2-pentene  
   C. 3-methyl-1-pentene  
   D. cis-3-methyl-2-pentene

8. What is the slow, rate-determining step, in the acid-catalyzed dehydration of 2-methyl-2-propanol?

   \[
   \text{(CH₃)₃COH} \quad \xrightarrow{\text{H₂SO₄}} \quad \text{(CH₃)₃C=CH₂}
   \]

   A. Protonation of the alcohol to form an oxonium ion.  
   B. Loss of water from the oxonium ion to form a carbocation.  
   C. Loss of a b-hydrogen from the carbocation to form an alkene.  
   D. The simultaneous loss of a b-hydrogen and water from the oxonium ion.
9. Predict the major product of the following reaction:

\[ \text{CH}_3\text{CH}_2\text{CHCH}_2\text{OH} \xrightarrow{\text{H}_2\text{SO}_4, \text{heat}} \]

    \[ \text{CH}_3 \]

A) \( \text{CH}_3\text{CH}_2\text{C}==\text{CH}_2 \)

B) \( \text{CH}_3\text{CH}==\text{CCHCH}_2\text{CH}_3 \)

C) \( \text{CH}_3\text{CH}==\text{C(CH}_3)_2 \)

D) \( (\text{CH}_3)_2\text{CHCH}==\text{CH}_2 \)

A. A  
B. B  
C. C  
D. D

10. Which of the following most readily undergoes an E2 reaction with sodium ethoxide (NaOCH\(_2\)CH\(_3\))?

A. \( (\text{CH}_3)_2\text{CF} \)  
B. \( (\text{CH}_3)_2\text{CCl} \)  
C. \( (\text{CH}_3)_2\text{CBr} \)  
D. \( (\text{CH}_3)_3\text{Cl} \)

11. In the dehydrohalogenation of 2-bromobutane, which conformation below leads directly to the formation of \( \text{cis}-2\)-butene?

\[ \text{I} \quad \text{II} \quad \text{III} \]

A. only I  
B. only II  
C. only III  
D. I and II
12. Which of the following would you predict to be the best method for doing the following conversion with the highest yield?

\[
\text{CH}_2\text{OH} \rightleftharpoons \text{CH}_2
\]

A. \( \text{H}_2\text{SO}_4 \), heat  
B. \( \text{NaOCH}_3\text{CH}_3 \)  
C. (1) \( \text{PBr}_3 \), (2) \( \text{NaOH} \)  
D. (1) \( \text{PBr}_3 \), (2) \( \text{KOC(CH}_3)_3 \)

13. Which of the following sets of conditions most favors the E1 mechanism?

A. When the alkyl halide is tertiary and the base is a weak base.  
B. When the alkyl halide is tertiary and the base is a strong base.  
C. When the alkyl halide is primary or secondary and the base is a weak base.  
D. When the alkyl halide is primary or secondary and the base is a strong base.

14. What is the first step in the mechanism of the dehydration reaction of a tertiary alcohol with sulfuric acid to form an alkene?

A. The loss of \( \text{OH}^- \) to form a carbocation.  
B. The protonation of the hydroxyl group.  
C. The loss of the proton from the hydroxyl group to give an alkoxide ion.  
D. The removal of a \( \beta \)-hydrogen from the alcohol.

15. Including E-Z isomers, how many E2 products are possible in the following reaction?

\[
\begin{array}{c}
\text{CH}_3\text{CHCH}_2\text{CH}_3 \quad \text{KOC(CH}_3)_3 \\
\text{Br} \quad \text{CH}_3\text{COH}
\end{array}
\]

A. one  
B. two  
C. three  
D. four

16. Which of the following will give 2-methyl-1-butene as the only alkene product on treatment with \( \text{KOC(CH}_3)_3 \) in dimethyl sulfoxide?

A. 2-bromo-3-methylbutane  
B. 1-bromo-3-methylbutane  
C. 2-bromo-2-methylbutane  
D. 1-bromo-2-methylbutane
17. Which of the following stereoisomers gives the exclusive E2 product shown?

\[
\begin{align*}
\text{NaOCH}_2\text{CH}_3 & \quad \text{CH}_3\text{CH}_2\text{OH} \\
\Downarrow & \\
\text{H}_3\text{C} & \quad \text{CH} (\text{CH}_3)_2 \quad \text{(only E2 product)}
\end{align*}
\]

A) \[
\begin{align*}
\text{H}_3\text{C} & \quad \text{CH} (\text{CH}_3)_2 \\
\text{Cl} & \\
\end{align*}
\]

B) \[
\begin{align*}
\text{H}_3\text{C} & \quad \text{CH} (\text{CH}_3)_2 \\
\text{Cl} & \\
\end{align*}
\]

C) \[
\begin{align*}
\text{H}_3\text{C} & \quad \text{CH} (\text{CH}_3)_2 \\
\text{Cl} & \\
\end{align*}
\]

D) \[
\begin{align*}
\text{H}_3\text{C} & \quad \text{CH} (\text{CH}_3)_2 \\
\text{Cl} & \\
\end{align*}
\]

A. A  
B. B  
C. C  
D. D
18. The acid-catalyzed dehydration of the alcohol shown below gives a major product which results from a carbocation rearrangement. Identify this major product.

\[ \text{H}_3\text{C} \quad \text{CH}_3 \quad \text{OH} \xrightarrow{\text{H}_2\text{SO}_4, \text{heat}} \]

![Chemical structures](image)

A) \( \text{CH}_3 \quad \text{CH}_3 \quad \text{CH}_3 \)  
B) \( \text{CH}_3 \quad \text{CH}_3 \quad \text{CH}_3 \)  
C) \( \text{H}_3\text{C} \quad \text{CH}_3 \)  
D) \( \text{CH}_2\text{CH}_3 \)

A. A  
B. B  
C. C  
D. D

19. How many different E2 products are expected in the reaction of 3-bromo-1,1-dimethylcyclohexane with \( \text{NaOCH}_2\text{CH}_3 \)?

A. only 1  
B. 2  
C. 3  
D. 4

20. What is the major product of the reaction sequence shown below?

\[ \text{CH}_3 \quad \text{CH}_3\text{CHCH}_2\text{CH}_2 \xrightarrow{\text{Br}_2, \text{light}} \text{CH}_3\text{CH}_2\text{O}^+ \text{Na}^- \]

A. 2-methyl-1-butene  
B. 2-methyl-2-butene  
C. 3-methyl-1-butene  
D. 2-methylbutane
Chemistry 210 - Chapter 5 - Quiz 1 Key

1. B
2. B
3. C
4. C
5. B
6. A
7. B
8. B
9. C
10. D
11. A
12. D
13. A
14. B
15. C
16. D
17. D
18. A
19. B
20. B
Chemistry 210 - Chapter 5 - Quiz 1 Summary

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