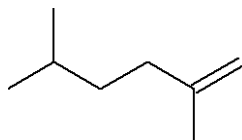
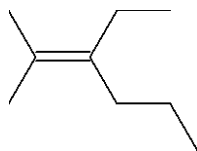


ACS Review Structure and Preparation of Alkenes - Elimination Reactions

- Carbon-carbon double bonds do not freely rotate like carbon-carbon single bonds. Why?
 - The double bond is much stronger and thus more difficult to rotate.
 - Overlap of the two 2p orbitals of the π bond would be lost.
 - The shorter bond length of the double bond makes it more difficult for the attached groups to pass each other.
 - Overlap of the sp^2 orbitals of the carbon-carbon σ bond would be lost.
- What is the IUPAC name of the following compound?



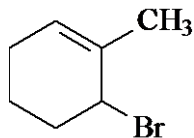
- 2,5-dimethyl-1-hexene
 - 1,4-dimethyl-1-hexene
 - 2,5-dimethyl-2-hexene
 - 2,5-dimethyl-5-hexene
- What is the IUPAC name of the following compound?



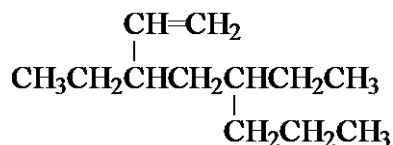
- 2-methyl-3-propyl-2-pentene
 - 3-ethyl-2-methyl-2-hexene
 - 4-ethyl-methyl-4-hexene
 - 4-methyl-3-propyl-3-pentene
- What is the IUPAC name of the following compound?



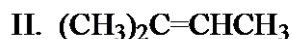
- 3-ethyl-8-methyl-3-nonene
 - 7-ethyl-2-methyl-6-nonene
 - 1,1-diethyl-6-methyl-3-heptene
 - 3-ethyl-7-isopropyl-3-octene
- How many isomeric alkenes of formula C_4H_8 , including stereoisomers, are possible?
 - two
 - three
 - four
 - five
 - How many isomeric alkenes of formula C_5H_{10} , including stereoisomers, are possible?
 - three
 - four
 - five
 - six
 - What is the IUPAC name of the following compound?



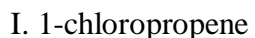
- A. 3-bromo-2-methylcyclohexene
 B. 1-bromo-2-methyl-2-cyclohexene
 C. 6-bromo-1-methylcyclohexene
 D. 2-bromo-1-methylcyclohexene
8. What is the IUPAC name of the following compound?



- A. 3-ethyl-propyl-1-heptene
 B. ethyl-3-vinyloctane
 C. 4,6-diethyl-1-octene
 D. 3,5-diethyl-1-octene
9. Which of the following alkenes exhibit E-Z isomerism?

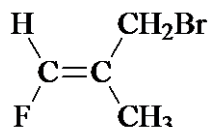


- A. I and II
 B. I and III
 C. II and IV
 D. I, II, and III
10. Which of the following alkenes exhibit E-Z isomerism?



- A. only I
 B. I and II
 C. II and III
 D. I and III

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



- 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

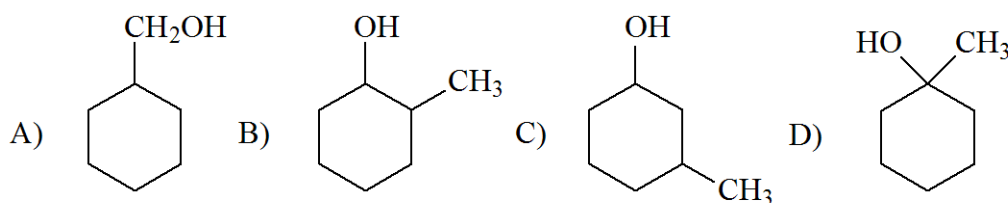
12. Which of the following C_6H_{12} isomers has the highest heat of combustion?

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

13. 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

14. Which alcohol below would undergo acid-catalyzed dehydration most readily?



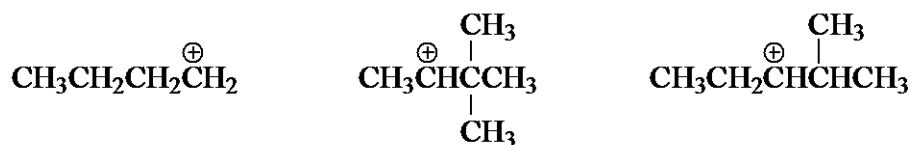
- A. A
 B. B
 C. C
 D. D

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



- 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 β -hydrogen from the carbocation to form an alkene.
 D. The simultaneous loss of a β -hydrogen and water from the oxonium ion.

16. Which of the following carbocations is(are) likely to undergo a rearrangement?



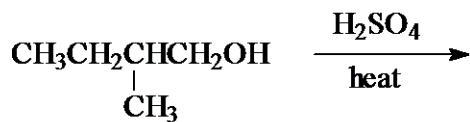
I

II

III

- A. only I
 B. I and III
 C. II and III
 D. I, II, and III

17. Predict the major product of the following reaction:



- A) $\text{CH}_3\text{CH}_2\overset{\text{CH}_3}{\text{C}}=\text{CH}_2$
- B) $\text{CH}_3\text{CH}=\text{CCHCH}_2\text{CH}_3$
- C) $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2$
- D) $(\text{CH}_3)_2\text{CHCH}=\text{CH}_2$

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

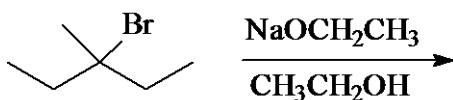
18. Which of the following expressions is the experimentally observed rate law for an E2 reaction of an alkyl halide?

- A. rate = $k[\text{RX}]$
B. rate = $k[\text{RX}][\text{base}]$
C. rate = $k[\text{RX}]^2$
D. rate = $k[\text{base}]$

19. Which of the following most readily undergoes an E2 reaction with sodium ethoxide ($\text{NaOCH}_2\text{CH}_3$)?

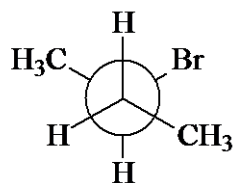
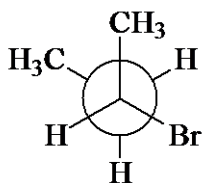
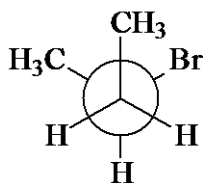
- A. $(\text{CH}_3)_3\text{CF}$
B. $(\text{CH}_3)_3\text{CCl}$
C. $(\text{CH}_3)_3\text{CBr}$
D. $(\text{CH}_3)_3\text{CI}$

20. How many isomeric alkenes are possible, including stereoisomers, in the following reaction?



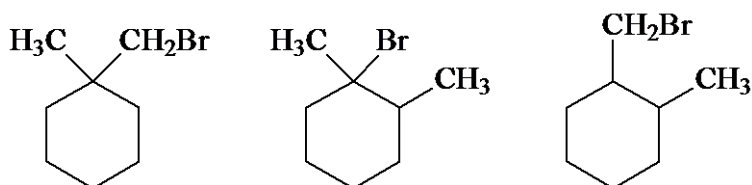
- A. two
B. three
C. four
D. five

21. In the dehydrohalogenation of 2-bromobutane, which conformation below leads directly to the formation of *cis*-2-butene?



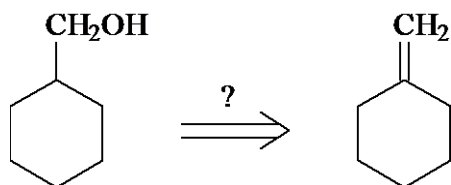
- A. only I
- B. only II
- C. only III
- D. I and II

22. Which of the following cannot undergo an E2 reaction?



- I II III
- A. only I
 - B. only II
 - C. only III
 - D. I and III

23. Which of the following would you predict to be the best method for doing the following conversion with the highest yield?



- A. H_2SO_4 , heat
- B. $\text{NaOCH}_2\text{CH}_3$
- C. (1) PBr_3 (2) NaOH
- D. (1) PBr_3 (2) $\text{KOC}(\text{CH}_3)_3$

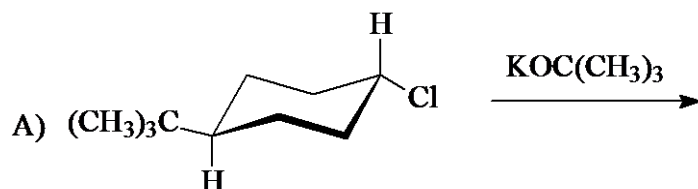
24. When a strong base is used in the elimination reaction of an alkyl halide the mechanism, in general, is:

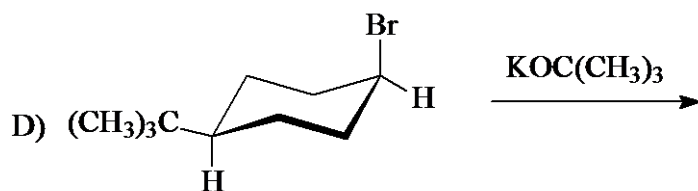
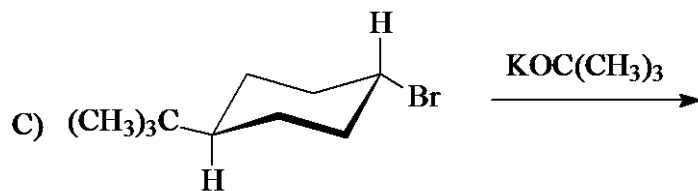
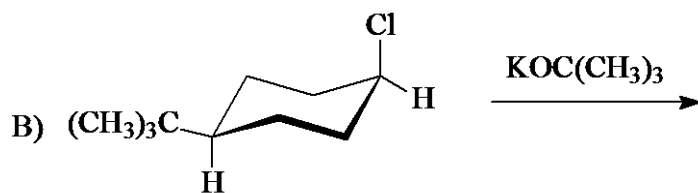
- A. E1
- B. E2
- C. E1 for tertiary halides, E2 for primary and secondary halides
- D. E2 for tertiary halides, E1 for primary and secondary halides

25. 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.

26. Which of the following would have the fastest rate of reaction to form 4-*tert*-butylcyclohexene?



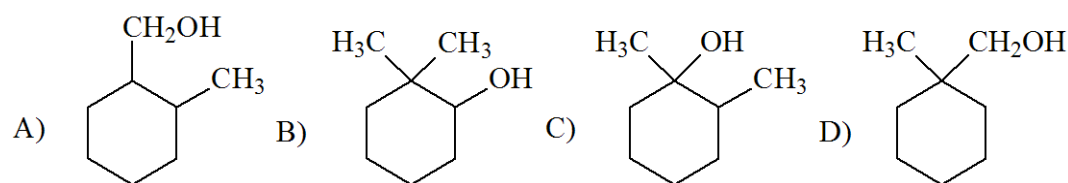


- A. A
B. B
C. C
D. D

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

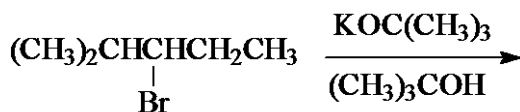
- A. The loss of OH^- to form a carbocation.
B. The protonation of the hydroxyl group.
C. The loss of the proton from the hydroxyl group to give an alkoxide ion.
D. The removal of a β -hydrogen from the alcohol.

28. Which of the following does not give 1,2-dimethylcyclohexene as one of the acid-catalyzed dehydration products?



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

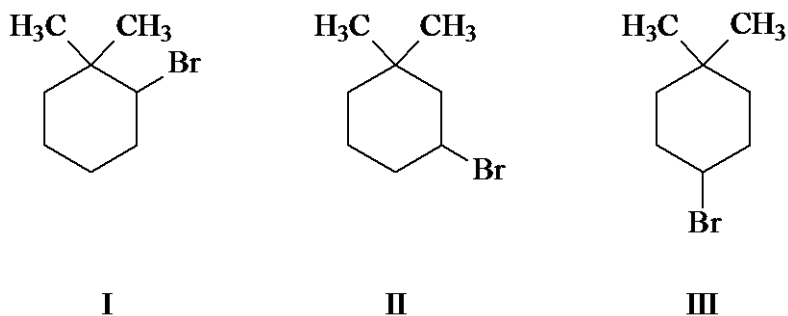
29. Including E-Z isomers, how many E2 products are possible in the following reaction?



- A. one
B. two

- C. three
D. four

30. Which of the following compounds gives a single E2 product on reaction with sodium ethoxide, $\text{NaOCH}_2\text{CH}_3$?

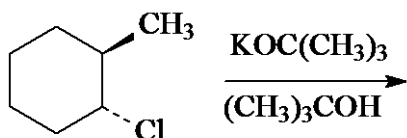


- A. I and II
B. I and III
C. II and III
D. I, II, and III

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

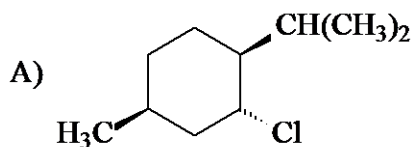
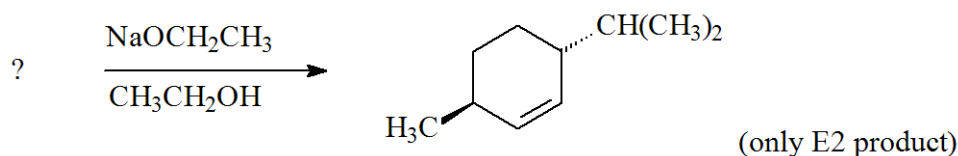
- A. 2-bromo-3-methylbutane
B. 1-bromo-3-methylbutane
C. 2-bromo-2-methylbutane
D. 1-bromo-2-methylbutane

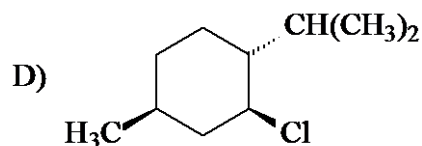
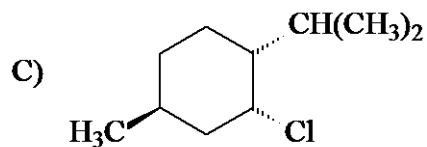
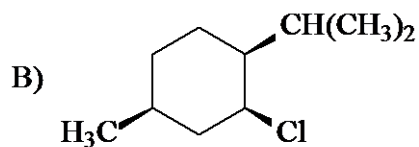
32. If the following E2 reaction proceeds through an anti-periplanar transition state, what product or products are expected?



- A. only 1-methylcyclohexene
B. only 3-methylcyclohexene
C. only 4-methylcyclohexene
D. equal amounts of 1-methylcyclohexene and 3-methylcyclohexene

33. Which of the following stereoisomers gives the exclusive E2 product shown?



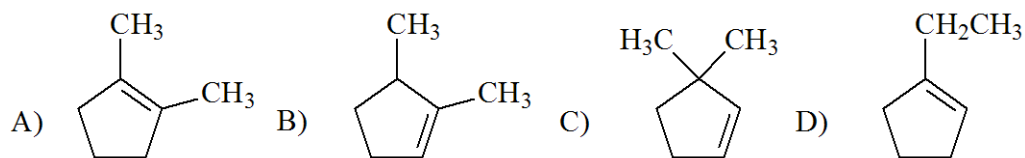
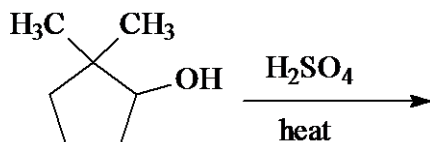


- A. A
B. B
C. C
D. D

34. Zaitsev's rule can be used to predict the major product for which of the following reactions?

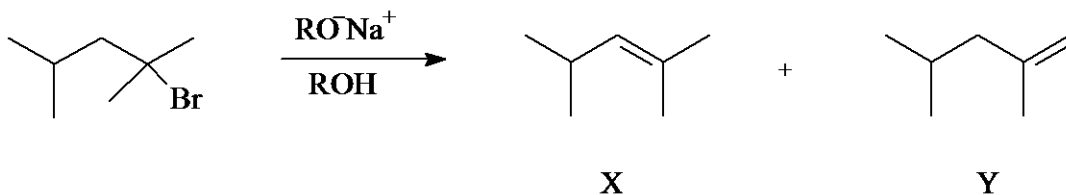
- A. 2-methylpentane + Br₂(with light)
B. 2-bromo-2-methylpentane + NaOCH₂CH₃ (in ethanol)
C. 2-methyl-2-pentanol + PBr₃
D. 2-methyl-2-pentanol + HCl

35. The acid-catalyzed dehydration of the alcohol shown below gives a major product which results from a carbocation rearrangement. Identify this major product.



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

36. Consider the following reaction.



R = -CH₃ or -C(CH₃)₃

Which statement(s) below is(are) correct?

- I. X is the major product based on Zaitsev's rule.
- II. The X:Y ratio is greater when R = -CH₃ than when R = -C(CH₃)₃.
- III. The X:Y ratio is greater when R = -C(CH₃)₃ than when R = -CH₃.

- A. I and II
- B. I and III
- C. only II
- D. only III

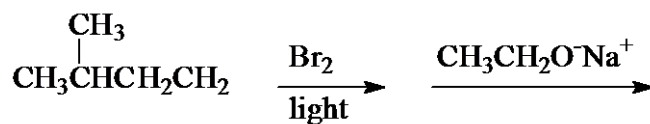
37. How many different E2 products are expected in the reaction of 3-bromo-1,1-dimethylcyclohexane with NaOCH₂CH₃?

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

38. Which one of the following compounds cannot undergo an E2 reaction?

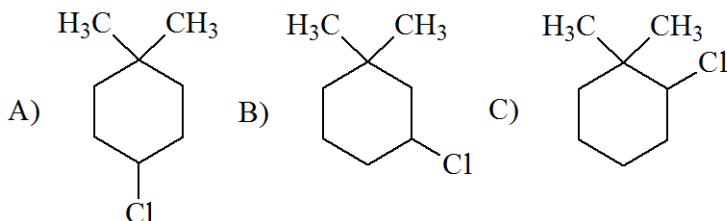
- A. 1-bromo-2,2-dimethylbutane
- B. 1-bromo-2,3-dimethylbutane
- C. 1-bromo-3,3-dimethylbutane
- D. 2-bromo-2,3-dimethylbutane

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



- A. 2-methyl-1-butene
- B. 2-methyl-2-butene
- C. 3-methyl-1-butene
- D. 2-methylbutane

40. Which of the following compounds gives 4,4-dimethylcyclohexene as the exclusive E2 product.



- A. A
- B. B
- C. C
- D. both A and B

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1. B
2. A
3. B
4. A
5. C
6. D
7. C
8. D
9. B
10. A
11. A
12. A
13. B
14. D
15. B
16. D
17. C
18. B
19. D
20. B
21. A
22. A
23. D
24. B
25. A
26. D
27. B
28. D
29. C
30. B
31. D
32. B
33. D
34. B
35. A
36. A
37. B
38. A
39. B
40. A