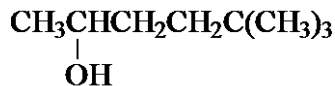
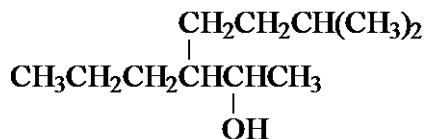


ACS Review Alcohols and Alkyl Halides

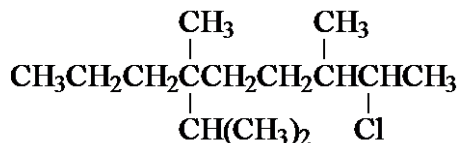
1. What is the IUPAC name of the compound below?



- A. 5,5-dimethyl-2-hexanol
B. 2,2-dimethyl-5-hexanol
C. 5,5-dimethyl-2-pentanol
D. 2,2-dimethyl-5-pentanol
2. What is the IUPAC name of the compound below?



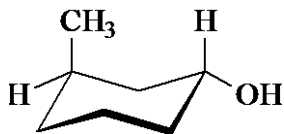
- A. 3-isobutyl-2-hexanol
B. 2-methyl-5-(1-hydroxyethyl)octane
C. 2-methyl-5-propyl-6-heptanol
D. 6-methyl-3-propyl-2-heptanol
3. What is the IUPAC name of the compound below?



- A. 8-chloro-4-isopropyl-4,7-dimethylnonane
B. 2-chloro-6-isopropyl-3,6-dimethylnonane
C. 2-chloro-3,6,7-trimethyl-6-propyloctane
D. 6-*sec*-butyl-2-chloro-3,6-dimethyloctane
4. Rank the following three compounds in order of increasing boiling point.



- A. $\text{I} < \text{II} < \text{III}$
B. $\text{I} < \text{III} < \text{II}$
C. $\text{II} < \text{III} < \text{I}$
D. $\text{II} < \text{I} < \text{III}$
5. What is the IUPAC name of the following compound?



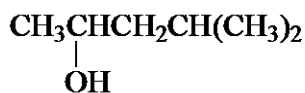
- A. *cis*-3-methylcyclohexanol
B. *trans*-3-methylcyclohexanol

- C. *cis*-5-methylcyclohexanol
- D. *trans*-5-methylcyclohexanol

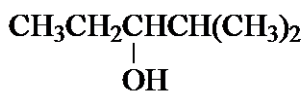
6. Which of the following is isobutyl alcohol?

- A. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
- B. $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$
- C. $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$
- D. $(\text{CH}_3)_3\text{COH}$

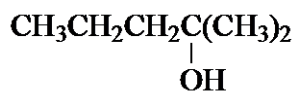
7. Identify the tertiary alcohol(s).



I



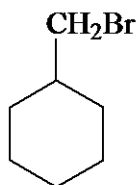
II



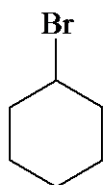
III

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

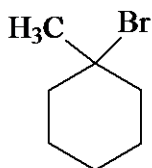
8. Identify the tertiary halide(s).



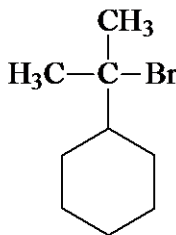
I



II



III



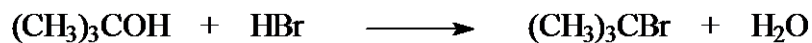
IV

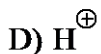
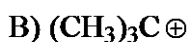
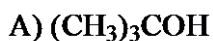
- A. I and II
- B. II and III
- C. III and IV
- D. only IV

9. What is the hybridization of the oxygen atom in alcohols?

- A. sp
- B. sp
- C. sp^2
- D. sp^3

10. What is the nucleophile in the following substitution reaction?



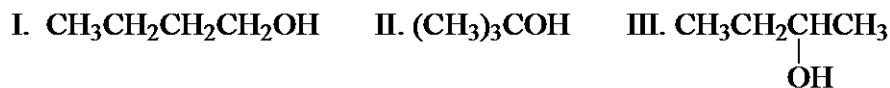


- A. A
B. B
C. C
D. D

11. The C-O-H bond angle in alcohols is closest to:

- A. 90°
B. 109.5°
C. 120°
D. 180°

12. Rank the following alcohols in order of increasing reaction rate with HBr.



- A. II < III < I
B. III < II < I
C. I < III < II
D. I < II < III

13. Chlorination of pentane gives a mixture of isomers having the molecular formula $\text{C}_5\text{H}_{11}\text{Cl}$. The percentage of 1-chloropentane is 22%. Assuming the secondary hydrogens in pentane are equally reactive to monochlorination, what is the percentage of 3-chloropentane in the mixture?

- A. 48%
B. 26%
C. 22%
D. 14%

14. Which one of the following gives a single monochlorination product?

- A. 2,2-dimethylpropane
B. 2,2-dimethylbutane
C. 2,3-dimethylbutane
D. 2-methylpropane

15. Which of the following hydrocarbons has the slowest reaction rate with Br_2 and light?

- A. CH_4
B. $\text{CH}_3\text{CH}_2\text{CH}_3$
C. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
D. $(\text{CH}_3)_3\text{CH}$

16. Which method or methods would work to quantitatively prepare a sodium ethoxide solution?

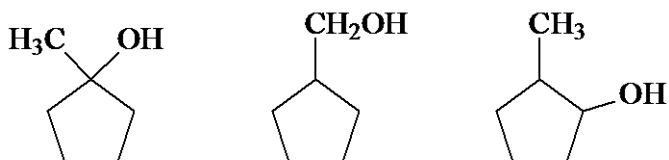
- I. $\text{CH}_3\text{CH}_2\text{OH} + \text{NaOH}$
II. $\text{CH}_3\text{CH}_2\text{OH} + \text{NaH}$
III. $\text{CH}_3\text{CH}_2\text{OH} + \text{Na}$

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

17. What are the products of the following reaction?

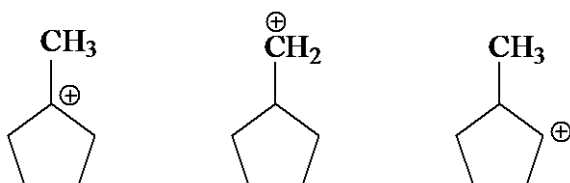


- A. 1-bromobutane and water
 - B. 1-bromobutane and hydrogen
 - C. butane and HOBr
 - D. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OBr}$ + hydrogen
18. Which of the following is not a good method to make bromocyclopentane?
- A. cyclopentanol plus HBr
 - B. cyclopentanol plus NaBr
 - C. cyclopentanol plus PBr_3
 - D. cyclopentane plus Br_2 with light
19. Which of the following is most reactive with HBr?
- A. CH_3OH
 - B. $\text{CH}_3\text{CH}_2\text{OH}$
 - C. $(\text{CH}_3)_2\text{CHOH}$
 - D. $(\text{CH}_3)_3\text{COH}$
20. Arrange the following alcohols in order of their decreasing reactivity with HBr (most reactive first).



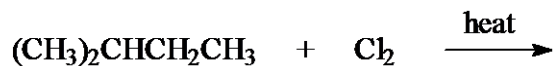
- A. I > II > III
- B. I > III > II
- C. III > I > II
- D. II > III > I

21. Arrange the following carbocations in order of their decreasing stabilities (most stable first).



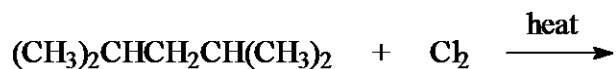
- A. I > II > III
- B. III > II > I
- C. I > III > II
- D. II > III > I

22. How many monochlorination products do you expect in the following reaction?



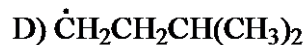
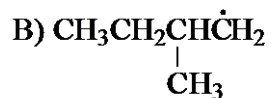
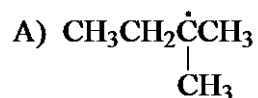
- A. two
- B. three
- C. four
- D. five

23. How many monochlorination products do you expect in the following reaction?



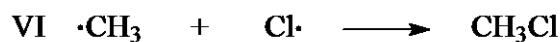
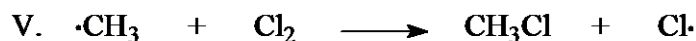
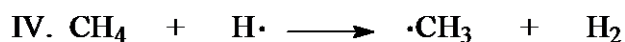
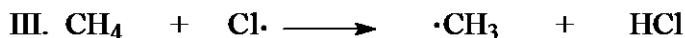
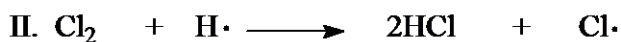
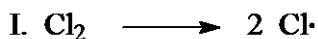
- A. two
- B. three
- C. four
- D. five

24. Which of the following is the most stable radical?



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

25. Which of the following are the chain propagating steps in the free radical chlorination of methane?



- A. I and III
 B. II and VI
 C. III and IV
 D. III and V

26. What is the product of the following reaction?



- A. $\text{ClCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 B. $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{SH}$
 C. $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$
 D. $\text{ClCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{SOCl}$

27. Calculate ΔH° of reaction for the free radical bromination of cyclopentane to give bromocyclopentane.

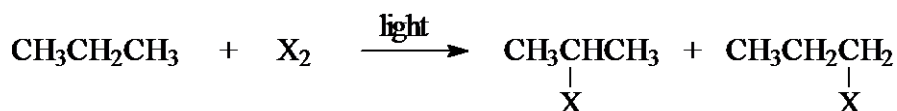
<u>Bond</u>	<u>Bond Dissociation Energy (kJ/mol)</u>
$\text{C}_5\text{H}_9\text{-H}$	395
$\text{C}_5\text{H}_9\text{-Br}$	284
Br_2	192
HBr	366

- A. -121 kJ/mol
 B. -63 kJ/mol
 C. +121 kJ/mol
 D. +63 kJ/mol

28. Which constitutional isomer of C_6H_{14} gives only two monochlorination products?

- A. 2-methylpentane
 B. 3-methylpentane
 C. 2,2-dimethylbutane
 D. 2,3-dimethylbutane

29. Consider the following reaction (X = Cl or Br).



Which statement(s) is(are) correct?

- I. Statistically the 1-halopropane should be the major isomer.

- II. The 2-halopropane to 1-halopropane ratio is largest when X=Br.
 III. The 2-halopropane to 1-halopropane ratio is the largest when X=Cl.

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

30. The central carbon of the *tert*-butyl carbocation, $(\text{CH}_3)_3\text{C}^+$, is:

- A. sp^2 hybridized with a +1 formal charge
 B. sp^2 hybridized with a 0 formal charge
 C. sp^3 hybridized with a +1 formal charge
 D. sp^3 hybridized with a 0 formal charge

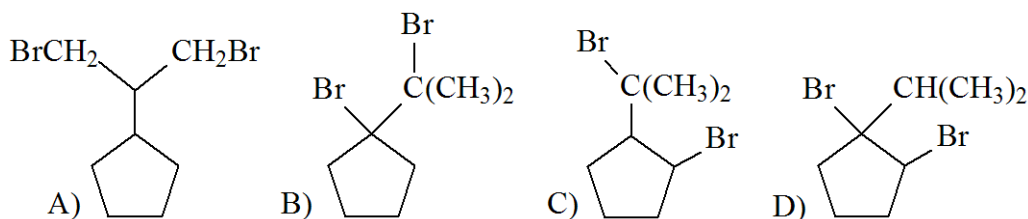
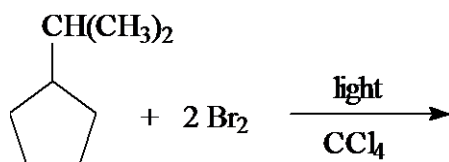
31. What are the C-C-C bond angles in the *tert*-butyl carbocation, $(\text{CH}_3)_3\text{C}^+$?

- A. 60°
 B. 90°
 C. 109.5°
 D. 120°

32. Studies indicate that the methyl radical is trigonal planar. Based on this, which of the following best describes the methyl radical?

- A. The carbon is sp^2 hybridized and the unpaired electron occupies an sp^2 orbital.
 B. The carbon is sp^2 hybridized and the unpaired electron occupies a 2p orbital.
 C. The carbon is sp^3 hybridized and the unpaired electron occupies an sp^3 orbital.
 D. The carbon is sp^3 hybridized and the unpaired electron occupies a 2p orbital.

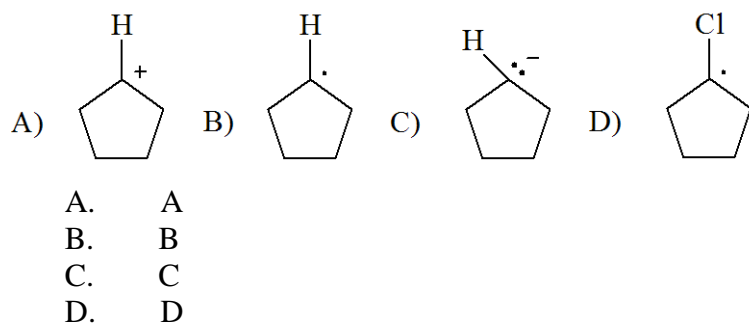
33. Dibromination of isopropylcyclopentane gives a product which can be isolated in good yields. Which of the following would you predict to be this product?



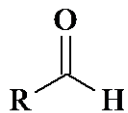
- A. A
 B. B
 C. C
 D. D

34. Which of the following is the key intermediate in the chlorination reaction below?



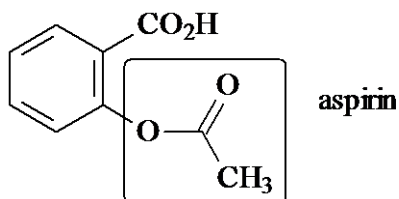


35. The structure below is a generalized abbreviation for which class of compounds?



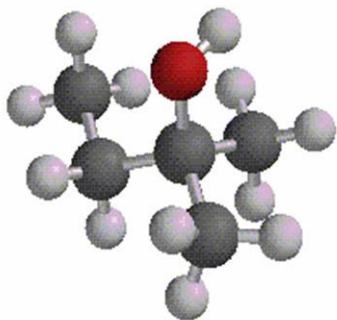
- A. ketones
B. aldehydes
C. carboxylic acids
D. esters

36. Identify the functional group in the boxed area:



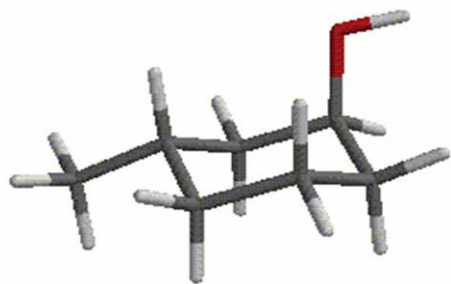
- A. ester
B. ketone
C. carboxylic acid
D. ether

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



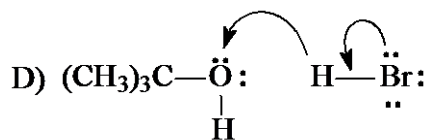
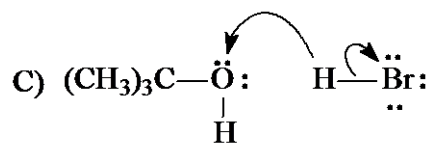
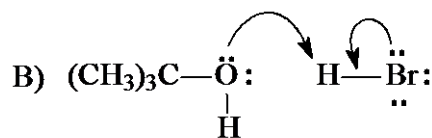
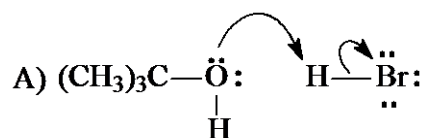
- A. 3-methyl-2-butanol
B. 3-methyl-3-butanol
C. 2-methyl-2-butanol
D. 2,2-dimethyl-1-butanol

38. What is the name of the following compound?



- A. *cis*-3-methylcyclohexanol
- B. *trans*-3-methylcyclohexanol
- C. *cis*-2-methylcyclopentanol
- D. *trans*-3-methylcyclopentanol

39. Which of the following mechanistically depicts the protonation of *tert*-butyl alcohol by hydrogen bromide?



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

40. How many $\text{C}_3\text{H}_6\text{Cl}_2$ constitutional isomers do you expect in the dichlorination of propane?

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

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