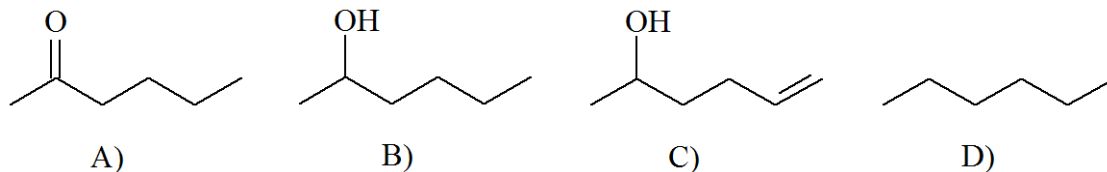
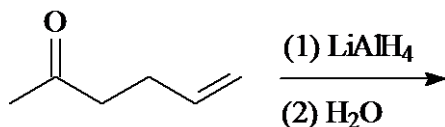


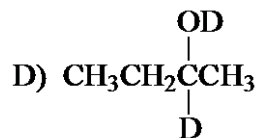
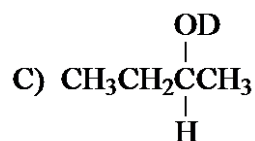
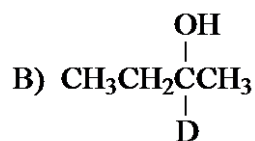
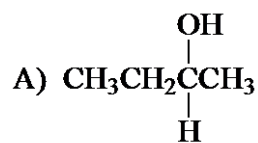
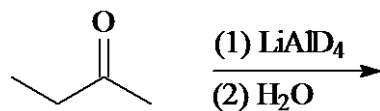
ACS Review Alcohols Diols and Thiols

- Which of the following cannot be made by the reduction of a ketone or aldehyde with NaBH_4 in methanol?
 - 1-butanol
 - 2-butanol
 - 2-methyl-1-propanol
 - 2-methyl-2-propanol
- An alcohol has the same oxidation state as a(n):
 - ketone
 - alkene
 - organolithium compound
 - alkyl halide
- In general, the reduction of a ketone to an alcohol can be accomplished by all of the following except one. Which one will not reduce a ketone?
 - H_2/Pt
 - HIO_4
 - LiAlH_4
 - NaBH_4

- What is the product of the following reaction?

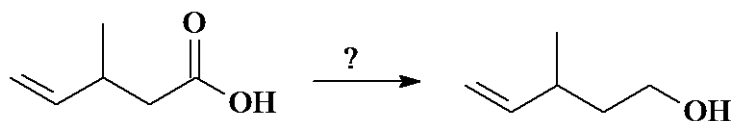


- A
 - B
 - C
 - D
- Which one of the following is not readily oxidized by $\text{K}_2\text{Cr}_2\text{O}_7$ in $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$?
 - n-butyl alcohol
 - sec-butyl alcohol
 - isobutyl alcohol
 - tert-butyl alcohol
 - In general, which one of the functional groups below does not react with LiAlH_4 ?
 - esters
 - ketones
 - ethers
 - carboxylic acids
 - Give the product of the following reaction.



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

8. Which of the following reagents would be used to carry out the transformation shown below?

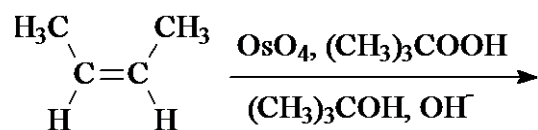


- A. NaBH_4
B. LiAlH_4
C. H_2/Pt
D. $\text{PCC}/\text{CH}_2\text{Cl}_2$

9. The reaction of a Grignard reagent with ethylene oxide followed by dilute acid gives:

- A. a primary alcohol
B. a secondary alcohol
C. a tertiary alcohol
D. methanol

10. What is the product of the following reaction?



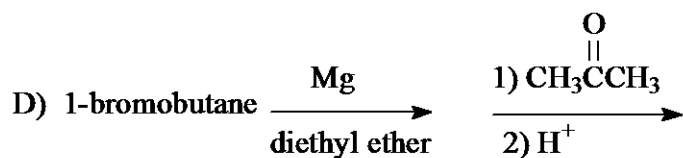
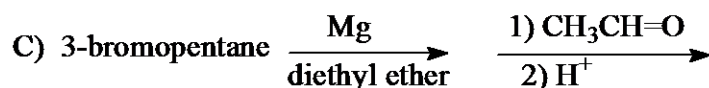
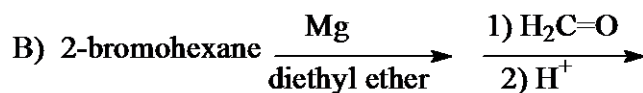
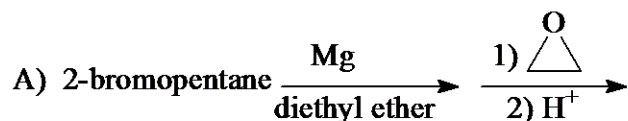
- A. $\text{CH}_3\text{CH}=\text{O}$

- B. *meso*-2,3-butanediol
- C. racemic (2R,3R) and (2S,3S)-2,3-butanediol
- D. *cis*-2,3-epoxybutane

11. Consider the conversion of 1-butanol to each of the compounds shown below. In which conversion is an oxidizing agent needed?

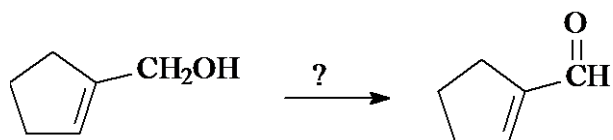
- A. $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- B. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
- C. $(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2)_2\text{O}$
- D. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{O}$

12. Which of the following syntheses gives 3-methyl-1-hexanol?



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

13. Identify the reagent needed to carry out the following conversion.



- A. $\text{K}_2\text{Cr}_2\text{O}_7, \text{H}_2\text{SO}_4/\text{H}_2\text{O}$
- B. $\text{PCC}/\text{CH}_2\text{Cl}_2$
- C. HIO_4
- D. $\text{OsO}_4, (\text{CH}_3)_3\text{COOH}, (\text{CH}_3)_3\text{COH}, \text{OH}^-$

14. Which one of the following diols would cleave into two fragments with HIO_4 ?

- A. 1,3-hexanediol
- B. 2,4-hexanediol
- C. 3,4-hexanediol
- D. 1,6-hexanediol

15. Consider the structure of the AlH_4^- ion. The formal charge of Al is:

- A. -1
- B. 0
- C. +1
- D. +3

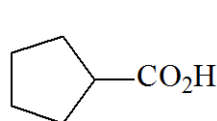
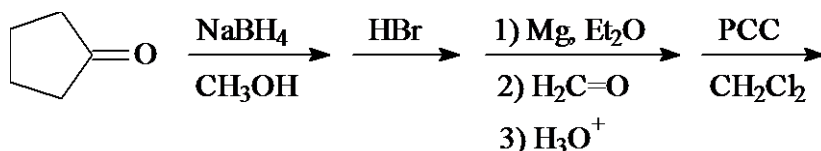
16. As a reducing agent, NaBH_4 donates a _____ to a ketone or aldehyde.

- A. proton
- B. hydrogen atom
- C. hydride ion
- D. hydrogen molecule

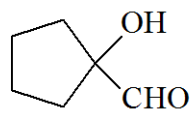
17. Which of the following best describes the role of the coenzyme NAD^+ (nicotinamide adenine dinucleotide) in biological chemistry?

- A. It reduces other species.
- B. It oxidizes other species.
- C. It catalyzes oxidation-reduction reactions.
- D. It inhibits oxidation-reduction reactions.

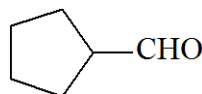
18. What is the product of the synthetic sequence below?



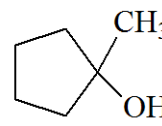
A)



B)



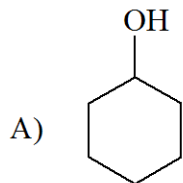
C)



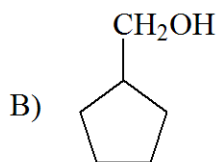
D)

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

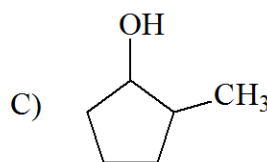
19. Compound A, $\text{C}_6\text{H}_{12}\text{O}$, is readily oxidized with $\text{K}_2\text{Cr}_2\text{O}_7$ in $\text{H}_2\text{SO}_4/\text{H}_2\text{O}$ to give compound B, $\text{C}_6\text{H}_{10}\text{O}$. Compound B has four peaks in its C-13 NMR (broadband decoupled). Which one of the following fits the data for compound A?



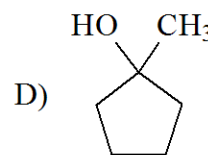
A)



B)



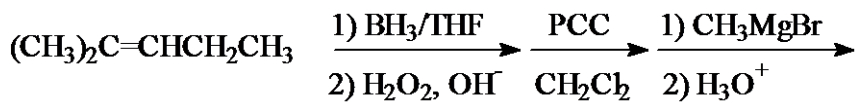
C)



D)

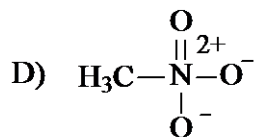
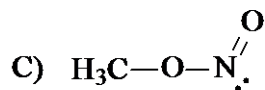
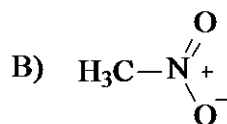
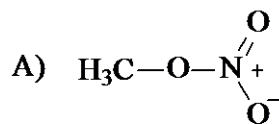
- A. A
- B. B
- C. C
- D. D

20. What is the final product of the following reactions?



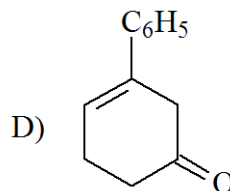
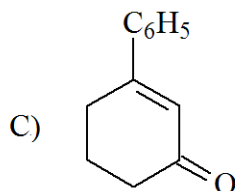
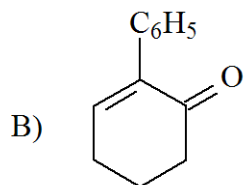
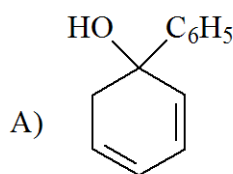
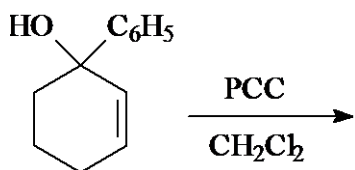
- A. 2,3-dimethyl-3-pentanol
 B. 2,3-dimethyl-2-pentanol
 C. 2,4-dimethyl-3-pentanol
 D. 2,2-dimethyl-3-pentanol

21. Which of the following is the ester formed between methanol and nitric acid, HNO_3 ?



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

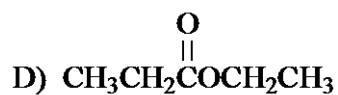
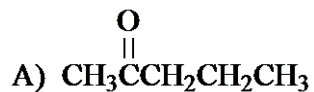
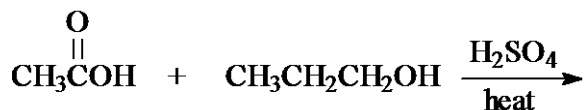
22. The tertiary alcohol below was reacted with PCC in CH_2Cl_2 and gave a product, $\text{C}_{12}\text{H}_{12}\text{O}$. The product had a strong absorption in the IR spectrum at 1700 cm^{-1} . Predict which of the following is the product. (Note: PCC is pyridinium chlorochromate, $[\text{C}_5\text{H}_5\text{NH}^+][\text{ClCrO}_3^-]$.)



- A. A
 B. B
 C. C

D. D

23. What is the product of the reaction below?



A. A

B. B

C. C

D. D

24. Which of the following reagents will convert cyclohexene into *cis*-1,2-cyclohexanediol?

A. OsO_4 , $(\text{CH}_3)_3\text{COOH}$, $(\text{CH}_3)_3\text{COH}$, OH^-

B. HIO_4

C. O_3 followed by $\text{Zn}/\text{H}_2\text{O}$

D. $\text{CH}_3\text{CO}_3\text{H}$ (peroxyacetic acid)

25. In which of the following forms does nicotinamide adenine dinucleotide have an aromatic pyridine ring?

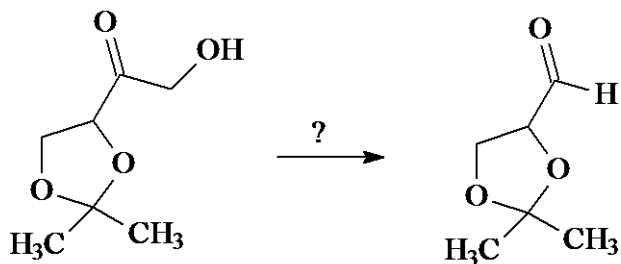
A. NADH

B. NAD^+

C. both NADH and NAD^+

D. neither NADH or NAD^+

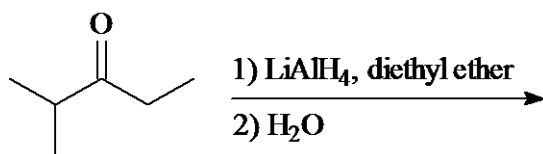
26. Which of the synthetic procedures below would carry out the following transformation?



- A) LiAlH_4 followed by $\text{H}_2\text{SO}_4/\text{heat}$
- B) O_3 followed by $(\text{CH}_3)_2\text{S}$
- C) $\text{PCC}/\text{CH}_2\text{Cl}_2$ followed by HIO_4
- D) $\text{NaBH}_4/\text{methanol}$ followed by HIO_4

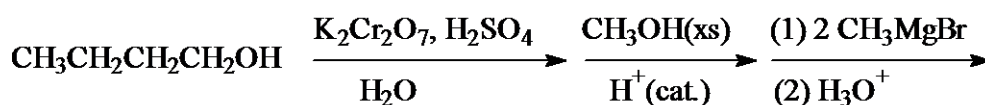
- A. A
B. B
C. C
D. D

27. The alcohol product(s) of the reduction of 2-methyl-3-pentanone with LiAlH_4 is(are):

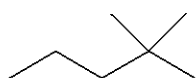


- A. a single enantiomer.
B. a racemic mixture.
C. two diastereomers.
D. two constitutional isomers.

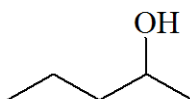
28. What is the product of the following reaction sequence?



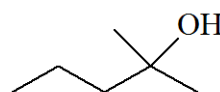
A)



B)



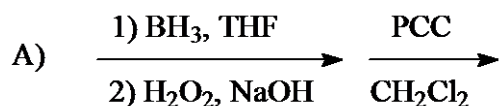
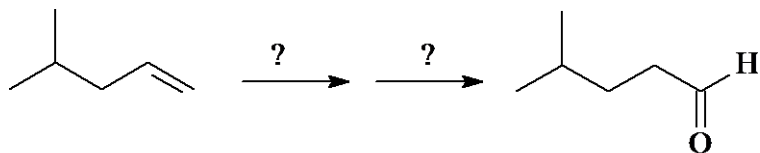
C)

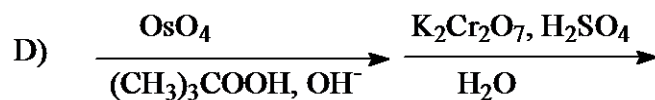
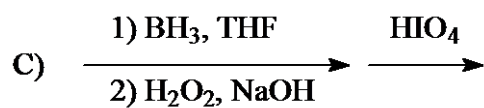
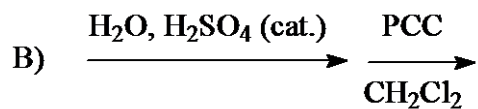


D)

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

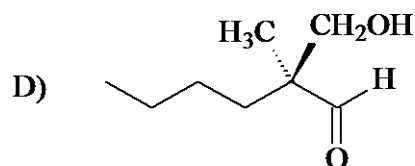
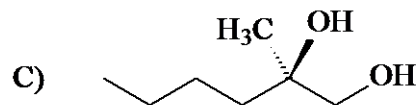
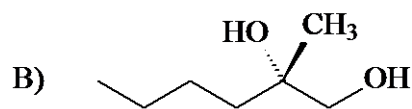
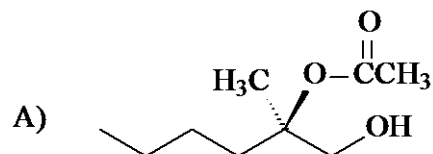
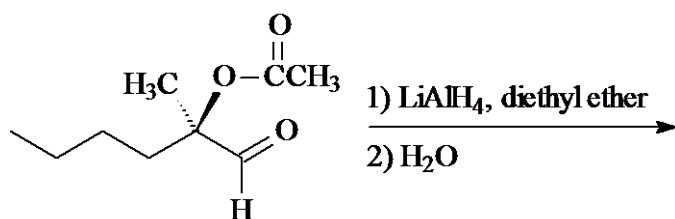
29. Which one of the following reaction steps work best to carry out the transformation shown below?





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

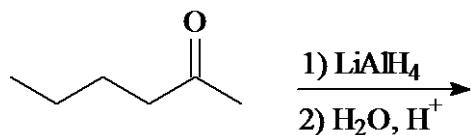
30. Which compound below is the product expected from the following reaction?



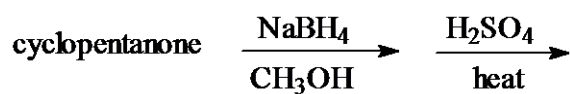
- A. A

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

31. What is the product of the reaction shown below?



- A. hexane
 - B. 1-hexene
 - C. 1-hexanol
 - D. 2-hexanol
32. What is the product of the following reaction sequence?



- A. cyclopentene oxide
- B. cyclopentene
- C. cyclopentane
- D. *cis*-1,2-cyclopentanediol

ACS Review Alcohols Diols and Thiols KEY

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