Acs Review Ethers Epoxides and Sulfides

1. The name of the following ether is:

(CH₃)₂CH-O-CH₂CH₂CH₂CH₃

- A. butyl isopropyl ether.
- B. isobutyl propyl ether.
- C. *sec*-butyl isopropyl ether.
- D. butyl propyl ether.
- 2. The IUPAC name of the following epoxide is:

- A. *cis*-2-ethyl-3-methyloxirane.
- B. *trans*-2-ethyl-3-methyloxirane.
- C. *trans*-1ethyl-2-methyloxycyclopropane.
- D. *trans*-1-ethyl-2-methylethane epoxide.
- 3. The C-O-C bond angle in dimethyl ether is closest to:
 - A. 90°
 - B. 109°
 - C. 120°
 - D. 180°
- 4. Consider the three compounds below:

I. CH₃CH₂OCH₂CH₃

II. CH₃CH₂CH₂CH₂CH₃

III. CH₃CH₂CH₂CH₂OH

The two most similar in boiling point are _____ and the two most similar in solubility in water are

- A. I and III, II and III
- B. I and II, I and III
- C. II and III, I and II
- D. I and III, I and III
- 5. Match the boiling points with the following three isomers of $C_4H_{10}O_2$.

	CH ₃ OCH ₂ CH ₂ OCH ₃	CH ₃ CH ₂ OCH ₂ CH ₂ OH	HOCH ₂ CH ₂ CH ₂ CH ₂ OH
A)	85°C	230°C	135°C
B)	230°C	85°C	135°C
C)	85°C	135°C	230°C
D)	135°C	230°C	85°C

- A. A
- B. B
- C. C
- D. D
- 6. The role of 18-crown-6 in the reaction shown below is to:

$$CH_3CH_2CH_2CH_2Br + KF \frac{18-crown-6}{C_6H_6, \text{ heat}} CH_3CH_2CH_2CH_2F + KBr$$

- A. complex F by ion-dipole attraction and make it more nucleophilic
- B. remove Br by ion-dipole attraction and shift the equilibrium to the products
- C. complex K⁺ by ion-dipole attraction increasing the solubility of KF and the nucleophilicity of F⁻
- D. stabilize the carbocation in the substitution reaction
- 7. Of the following, which yields isopropyl methyl ether as the major product with little or no by-products?

C) (CH₃)₂CHOH + CH₃OH
$$\frac{\text{H}_2\text{SO}_4}{}$$

- D) all three give isopropy methyl ether as the major product
 - A. A
 - B. B
 - C. C
 - D. D
- 8. What is the product of the following reaction?

- A. A
- B. B
- C. C
- D. D
- 9. Which of the following is <u>not</u> a good method to make *tert*-butyl methyl ether?

C)
$$H_2C=C(CH_3)_2 + CH_3OH \xrightarrow{H^+}$$

- A. A
- B. B
- C. C
- D. D
- 10. What is the major product of the following reaction?

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

11. Which of the following is <u>not</u> an intermediate in the reaction below?

2 CH₃OH
$$\xrightarrow{\text{H}_2\text{SO}_4, \text{ heat}}$$
 CH₃OCH₃ + H₂O

- A. A
- B. B
- C. C
- D. they are all intermediates

12. Which one of the following reactions makes the cyclic ether shown below?



B)
$$HO$$
 OH H_2SO_4

D) Br
$$H_2O, H_2SO_4$$

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

13. What are the products of the reaction below?

D)
$$CH_2I$$
 + CH_3I

- A. A
- B. B
- C. C
- D. D
- 14. How many constitutionally isomeric ethers are there with a formula of $C_4H_{10}O$?
 - A. only one
 - B. two
 - C. three
 - D. four
- 15. What is the product of the following reaction?

$$\begin{array}{c|c} H & CH_2CH_3 & \begin{matrix} O \\ & || \\ CH_3COOH \end{matrix} \\ \\ H_3C & H \end{array}$$

A)
$$H_{3C}$$
 O H

C)
$$HO$$
 CH_2CH_3 H OH

D)
$$H_{3C}$$
 OH

- A. A
- B. B
- C. C
- D. D
- 16. Which of the following is compound X of the synthesis shown below?

CH₃CH₂CH=CH₂
$$\xrightarrow{\text{Br}_2/\text{H}_2\text{O}}$$
 compound X $\xrightarrow{\text{NaOH}}$ CH₃CH₂CH-CH₂

B)
$$CH_3CH_2CH$$
— CH_2
 Br

OBr
$$\stackrel{|}{\text{D}}$$
 CH $_3$ CH $_2$ CH $\stackrel{|}{\text{CH}}$ CH $_2$ OH

A

- A.
- B. B
- C. C
- D. D
- 17. The reaction shown below can be described as an:

$$\begin{array}{ccc} OH & O \\ \downarrow & \downarrow & \\ H_3C-CH-CH_2Br & \longrightarrow & H_3C-CH-CH_2 \end{array}$$

- A. acid-base reaction followed by an intramolecular Williamson ether synthesis.
- B. acid-base reaction followed by an intramolecular S_N1 reaction.
- C. E2 reaction followed by an addition reaction to a double bond.
- D. S_N2 reaction followed by an intramolecular Williamson ether synthesis.
- 18. What is the product of the following sequence of reactions?

$$\begin{array}{c|c} H_3C & H \\ & & \\ H & CH_3 \end{array} \xrightarrow{Br_2/H_2O} \begin{array}{c} NaOH \\ \hline H_2O \end{array}$$

C)
$$H_3C$$
 CH_3

D)
$$H_3C$$
 O B_r CH_3

- A. A
- B. B
- C. C
- D. D
- 19. What is the product of the following reaction?

$$\begin{array}{c}
O \\
& \stackrel{\text{NaOH, H}_2O}{\longrightarrow}
\end{array}$$

- A. (S)-1,2-propanediol
- B. (R)-1,2-propanediol
- C. racemic mixture of 1,2-propanediol
- D. 1,3-propanediol
- 20. What is the final product of the following sequence of reactions?

$$(CH_3)_2CHOH$$
 $\xrightarrow{PBr_3}$ \xrightarrow{Mg} $\xrightarrow{1) \triangle}$ \xrightarrow{PCC} $\xrightarrow{CH_2Cl_2}$

- A) (CH₃)₂CHOCH₂CH₂OH
- O || B) (CH₃)₂CHCCH₃
- C) (CH₃)₂CHCH₂CHO
- D) (CH₃)₂CHCH₂CO₂H
 - A. A
 - B. B
 - C. C
 - D. D
- 21. Which of the following reacts the fastest with NaOH, H₂O?
 - A. ethylene oxide (oxirane)
 - B. *cis*-2,3-dimethyloxirane
 - C. *trans*-2,3-dimethyloxirane
 - D. 2,2,3,3-tetramethyloxirane
- 22. What is the product of the reactions below?

$$CH_3CH_2CH=CH_2 \xrightarrow{CH_3CO_3H} \xrightarrow{CH_3OH, H_2SO_4(cat.)}$$

- A) CH₃CH₂CHCH₂OCH₃ OH
- B) CH₃CH₂CHCH₂OH OCH₃
- C) CH₃CH₂CHCH₂OH OH

D) CH₃CH₂CHCH₂OH CH₃

- A. A
- B. B
- C. C
- D. D
- 23. What reagents and/or reaction sequence below would convert *trans*-3-hexene to *meso*-3,4-hexanediol?
 - A. OsO₄, (CH₃)₃COOH, (CH₃)₃COH, NaOH
 - B. B₂H₆/diglyme followed by H₂O₂/NaOH
 - C. O_3 followed by Zn/H_2O
 - D. CH₃CO₃H followed by NaOH/H₂O
- 24. What reagents and/or reaction sequence below would convert *cis*-3-hexene to *meso*-3,4-hexanediol?
 - A. OsO₄, (CH₃)₃COOH, (CH₃)₃COH, NaOH
 - B. B₂H₆/diglyme followed by H₂O₂/NaOH
 - C. O_3 followed by Zn/H_2O
 - D. CH₃CO₃H followed by NaOH/H₂O
- 25. Which of the following yields an epoxide on treatment with NaOH?
 - A. *cis*-2-bromocyclohexanol
 - B. *trans*-2-bromocyclohexanol
 - C. *cis*-1,2-cyclohexanediol
 - D. 3-bromocyclohexene
- 26. Which reagent(s) below converts cyclohexene to trans-1,2-cyclohexanediol?
 - A) OsO₄, (CH₃)₃COOH, (CH₃)₃COH, NaOH
 - B) O₃ followed by Zn/H₂O
 - O || C) CH₃COOH followed by NaOH/H₂O
 - D) HIO₄
 - A. A
 - B. B
 - C. C
 - D. D
- 27. Which of the following epoxides is formed when KOH is added to the optically active halohydrin shown below?

- A. *trans*-(2S,3S)-2,3-dimethyloxirane
- B. *trans*-(2R,3R)-2,3-dimethyloxirane
- C. 2,2-dimethyloxirane
- D. *meso-*2,3-dimethyloxirane
- 28. Which of the following is the preferred conformation for epoxide ring formation? (Assume a base is provided.)

- A. A
- B. B
- C. C
- D. D
- 29. Benzene reacts with 2-methyloxirane in the presence of AlCl₃ to give a product with a formula of $C_9H_{12}O$. Identify the product.

- A. A
- B. B
- C. C
- D. D
- 30. Which of the followings reagents would be used to carry out the reaction shown below?

$$\begin{array}{c|cccc}
O & & OH & OCH_3 \\
H_2C & C-CH_3 & ? & & H_2C & C-CH_3 \\
CH_3 & & CH_3
\end{array}$$

- A. CH₃OH, CH₃O⁻Na⁺
- B. CH_3OH , H_2SO_4
- C. CH₃MgBr/ether followed by H₃O⁺
- D. H_2O/H_2SO_4 followed by CH_3OH
- 31. What is the product of the following reaction?

$$\frac{2 \text{ HBr}}{-0}$$

- A. 1,2-dibromobutane
- B. 1,3-dibromopropane
- C. 1,4-dibromobutane
- D. 1,2-dibromopropane
- 32. What is the major product of the following nucleophilic ring-opening reaction?

$$\begin{array}{c|c}
O \\
H_3C \\
H
\end{array}$$

$$\begin{array}{c}
H_3O^+ \\
\end{array}$$

- A. A
- B. B
- C. C
- D. D
- 33. Which synthetic pathway below gives a racemic mixture of the following deuterated compound with little or no isomeric impurities?

A) cyclopentene
$$CH_3COOH$$
 1) LiAlD₄ 2) H₂O

B) cyclopentene
$$\frac{1) BD_3/THF}{2) H_2O_2$$
, NaOH

C) cyclopentene
$$\frac{D_2/Pt}{CCl_4}$$
 $\frac{Br_2, h\nu}{CCl_4}$ $\frac{NaOH}{H_2O}$

D) cyclopentene
$$\frac{DC1}{heat}$$
 $\frac{H_2O, CH_3OH}{heat}$

- A. A
- B. В
- C. C
- 34. Ethylene glycol reacts in acid to form a cyclic compound with the formula of C₄H₈O₂. Which one of the following is this cyclic compound?

- B. В
- C. C
- D. D
- 35. In general, ethers have a much lower boiling point than their isomeric alcohols. Why?
 - A. The carbon-oxygen bond in ethers is nonpolar.
 - Unlike alcohols, ethers cannot act as Lewis bases. В.
 - C. Ethers are less reactive than alcohols.
 - D. Unlike alcohols, ethers cannot hydrogen bond with each other.
- 36. What is the product of the reaction shown below?

$$\begin{array}{ccc}
O & CH_3 & \frac{CH_3O Na^+}{CH_3OH} \\
CH_3 & CH_3OH
\end{array}$$

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

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