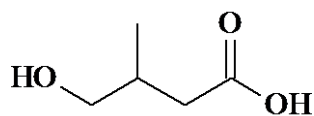
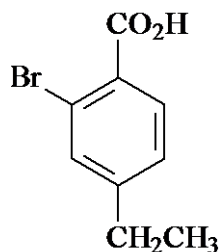


ACS Review Carboxylic Acids

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



- A. 4-hydroxy-3-methylbutanoic acid
B. 3-hydroxy-2-methylbutanoic acid
C. 1-hydroxy-2-methylbutanoic acid
D. 3-(hydroxymethyl)butanoic acid
2. What is the systematic IUPAC name of the compound below?



- A. 6-bromo-4-ethylbenzenecarboxylic acid
B. 2-bromo-4-ethylbenzenecarboxylic acid
C. *ortho*-bromo-*para*-ethylbenzoic acid
D. 1-bromo-3-ethylbenzoic acid
3. Rank the following compounds in decreasing order of acidity.

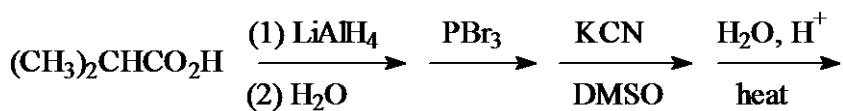


- A. II > I > III
B. II > III > I
C. III > II > I
D. III > I > II
4. A mixture of 1-hexanol and hexanoic acid in diethyl ether is shaken with an aqueous sodium bicarbonate solution. Which line below correctly describes the major organic species in the two resulting immiscible solutions?

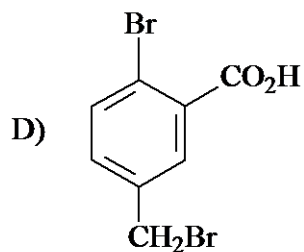
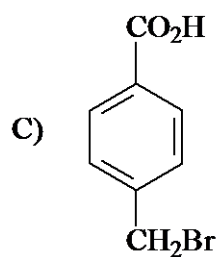
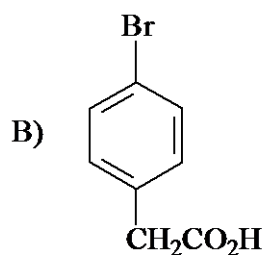
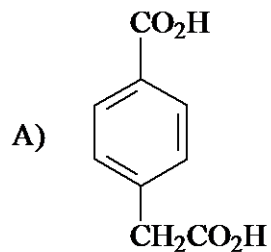
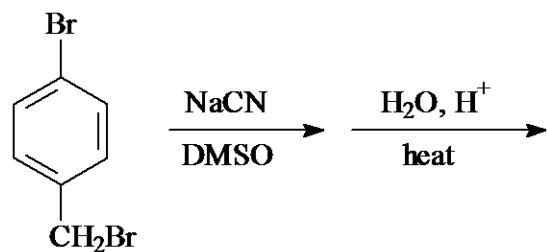
<u>ether solution</u>	<u>sodium bicarbonate solution</u>
A) hexanoic acid	1-hexanol
B) 1-hexanol	hexanoic acid
C) sodium hexanoate	1-hexanol
D) 1-hexanol	sodium hexanoate

- A. A
B. B
C. C
D. D
5. The cleansing action of soaps is due to the formation of:

- A. water insoluble micelles with lipophilic interiors
 B. water soluble micelles with lipophilic interiors
 C. water insoluble micelles with hydrophilic interiors
 D. water soluble micelles with hydrophilic interiors
6. Which one of the following has the best soap cleansing properties?
 A. $\text{CH}_3(\text{CH}_2)_{16}\text{CO}_2\text{H}$
 B. $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$
 C. $\text{CH}_3(\text{CH}_2)_{16}\text{CO}_2\text{Na}$
 D. $\text{CH}_3\text{CH}_2\text{CO}_2\text{Na}$
7. Which of the following is the strongest acid?
 A. $\text{FCH}_2\text{CO}_2\text{H}$
 B. $\text{ClCH}_2\text{CO}_2\text{H}$
 C. $\text{BrCH}_2\text{CO}_2\text{H}$
 D. $\text{ICH}_2\text{CO}_2\text{H}$
8. Which of the following has the largest acid equilibrium constant, K_a ?
 A. $\text{CH}_3\text{CO}_2\text{H}$
 B. $\text{CH}_2\text{ClCO}_2\text{H}$
 C. $\text{CHCl}_2\text{CO}_2\text{H}$
 D. $\text{CCl}_3\text{CO}_2\text{H}$
9. Rank the following three carboxylic acids in order of increasing acidity.
 I. 4-chlorobutanoic acid II. 3-chlorobutanoic acid III. 2-chlorobutanoic acid
- A. $\text{I} < \text{II} < \text{III}$
 B. $\text{I} < \text{III} < \text{II}$
 C. $\text{III} < \text{I} < \text{II}$
 D. $\text{III} < \text{II} < \text{I}$
10. Which of the following has the largest acid equilibrium constant, K_a ?
 A. benzoic acid
 B. *ortho*-nitrobenzoic acid
 C. *para*-methylbenzoic acid (*para*-toluic acid)
 D. *para*-methoxybenzoic acid
11. What is the product of the following sequence of reactions?

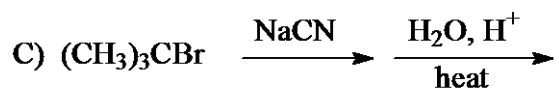
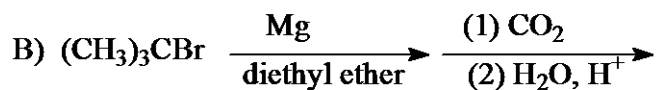
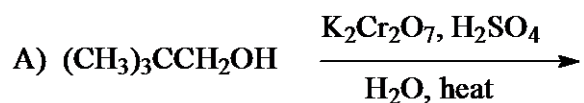


- A. $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{NH}_2$
 B. $(\text{CH}_3)_2\text{C}=\text{CHCO}_2\text{H}$
 C. $(\text{CH}_3)_2\text{CHCHBrCO}_2\text{H}$
 D. $(\text{CH}_3)_2\text{CHCH}_2\text{CO}_2\text{H}$
12. What is the product of the reaction shown below?



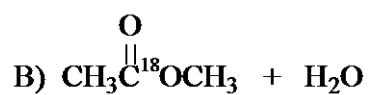
- A. A
 B. B
 C. C
 D. D

13. Which of the following is not a good method to make 2,2-dimethylpropanoic acid?



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

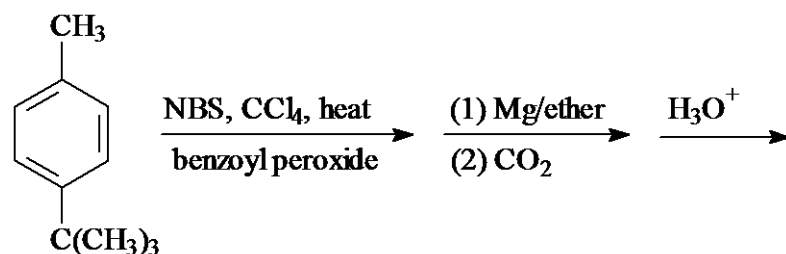
14. Reaction of acetic acid, $\text{CH}_3\text{CO}_2\text{H}$, with isotopically labeled $\text{CH}_3^{18}\text{OH}$ and catalytic sulfuric acid gives:

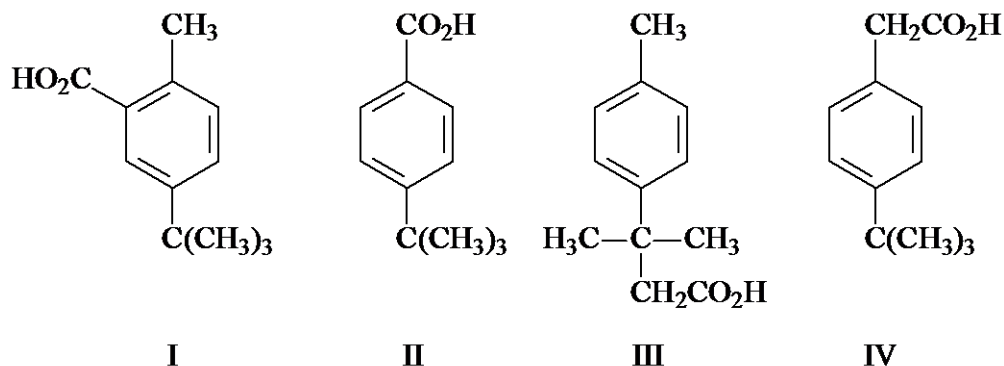


D) equal amounts of A and B

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

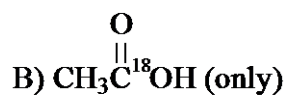
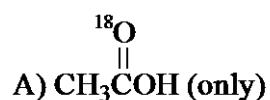
15. Which of the following is the product of the reaction sequence below?





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

16. Acetic acid is mixed with isotopically labeled water, H_2^{18}O , and a small amount of hydrochloric acid. Which of the following results of ^{18}O labeling would be expected?

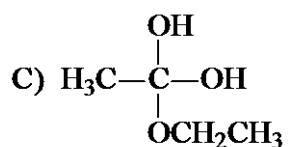
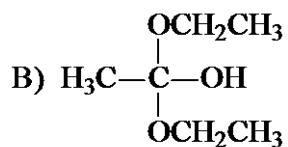
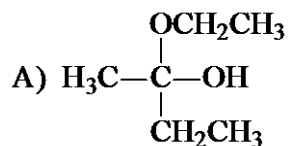


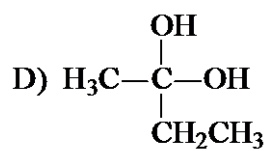
C) a mixture of A and B

D) no ^{18}O incorporated in acetic acid

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

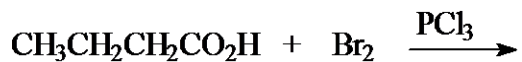
17. Which of the following is the tetrahedral intermediate in the acid-catalyzed Fischer esterification reaction of acetic acid, $\text{CH}_3\text{CO}_2\text{H}$, and ethanol, $\text{CH}_3\text{CH}_2\text{OH}$?





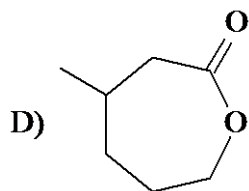
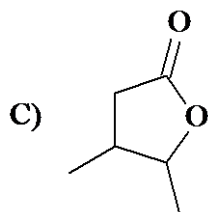
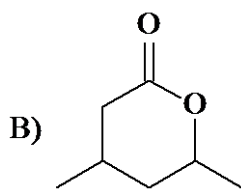
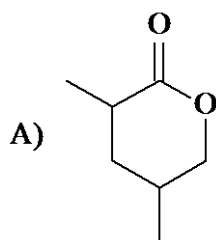
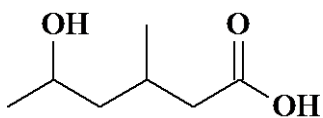
- A. A
B. B
C. C
D. D

18. What is the product of the reaction below?



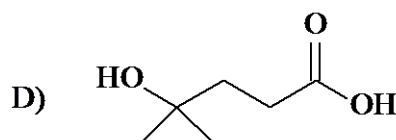
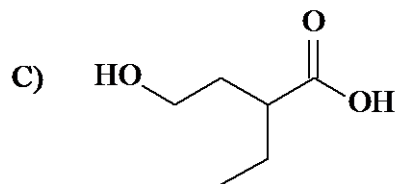
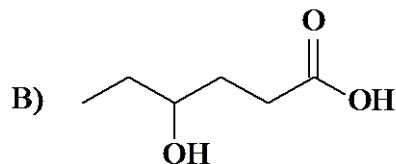
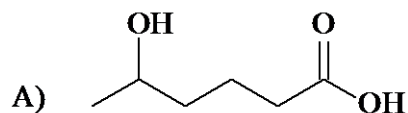
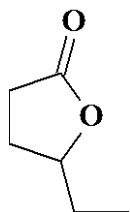
- A. 2,3-dibromobutanoic acid
B. 3-chlorobutanoic acid
C. 2-bromobutanoic acid
D. 2-chlorobutanoic acid

19. Identify the lactone formed by the following hydroxy carboxylic acid.



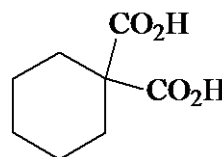
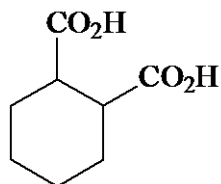
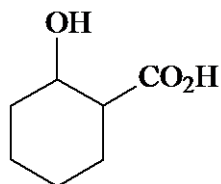
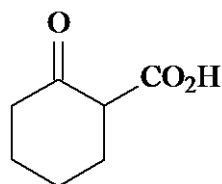
- A. A
- B. B
- C. C
- D. D

20. Which structure below is the hydroxy acid which corresponds to the following lactone?



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

21. Which of the following undergo decarboxylation upon heating?



I

II

III

IV

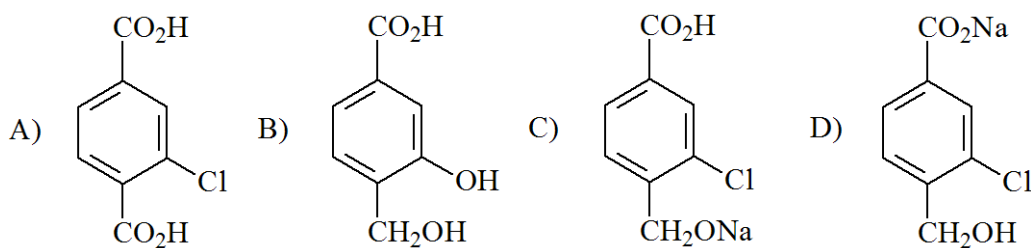
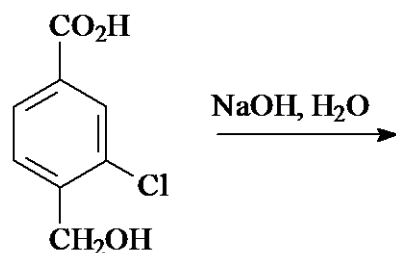
- A. I and IV
- B. I and III

- C. II and III
- D. III and IV

22. What is the product of the thermal decarboxylation of dimethylpropanedioic acid?

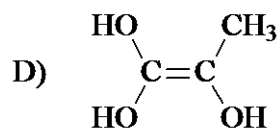
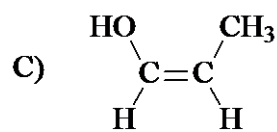
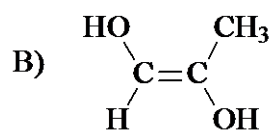
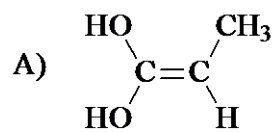
- A. propanoic acid
- B. 2-methylpropanoic acid
- C. 2,2-dimethylpropanoic acid
- D. acetic acid

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



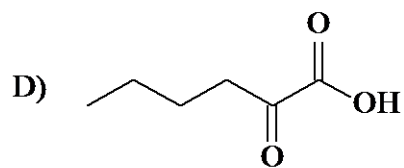
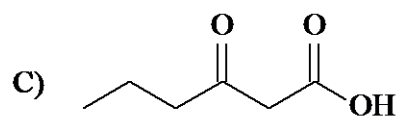
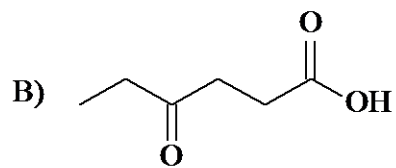
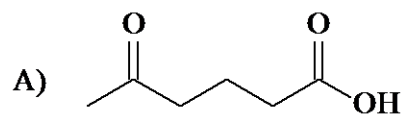
- A. A
- B. B
- C. C
- D. D

24. Which of the following is the enol intermediate in the thermal decarboxylation of methylpropanedioic acid, CH₃CH(CO₂H)₂?



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

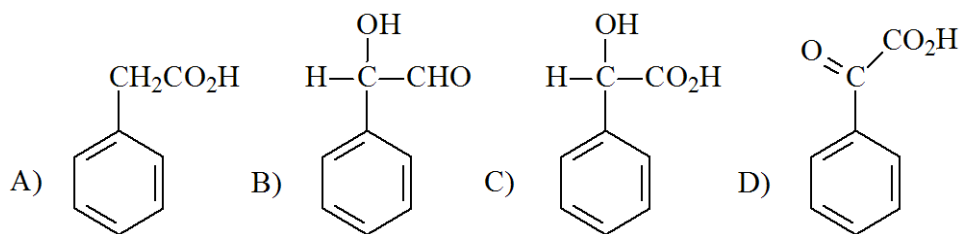
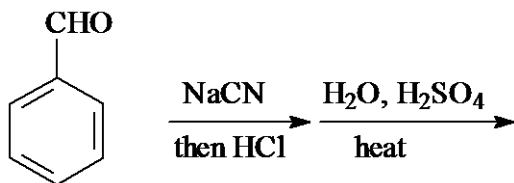
25. Which one of the following compounds undergoes decarboxylation upon heating?



- A. A

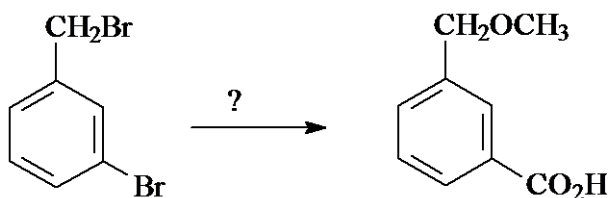
- B. B
C. C
D. D

26. What is the product of the reaction sequence below?



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

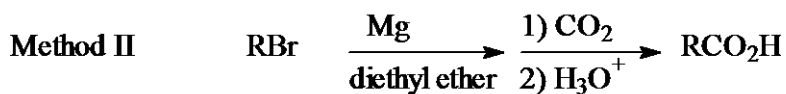
27. Only one of the reaction sequences below can carry out the following transformation. Identify which reaction sequence it is.



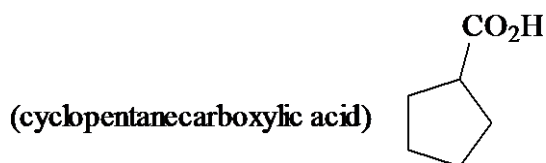
- A) (1) Mg/diethyl ether (2) CO₂ (3) H₂O, H⁺ (4) CH₃O⁻Na⁺
 B) (1) NaOH (2) Mg/diethyl ether (3) CO₂ (4) H₂O, H⁺ (5) CH₃I
 C) (1) CH₃O⁻Na⁺ (2) Mg/diethyl ether (3) CO₂ (4) H₂O, H⁺
 D) (1) CH₃O⁻Na⁺ (2) KCN, DMSO (3) H₂O, H₂SO₄, heat

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

28. Two possible methods to synthesize carboxylic acids are shown below:

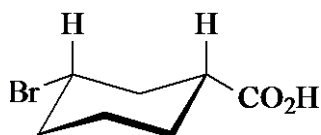


For the synthesis of cyclopentanecarboxylic acid from bromocyclopentane, which of the following statements is true?



- A. Neither method I or II would work.
- B. Only method I would work.
- C. Only method II would work.
- D. Both method I and II would work.

29. What is the name of the compound below?



- A. *trans*-3-bromocyclohexanecarboxylic acid
- B. *cis*-3-bromocyclohexanecarboxylic acid
- C. *trans*-5-bromocyclohexanecarboxylic acid
- D. *cis*-5-bromocyclohexanecarboxylic acid

30. Chloroacetic acid, $\text{ClCH}_2\text{CO}_2\text{H}$, is a stronger acid than acetic acid. Which one of the following best explains this?

- A. $\text{ClCH}_2\text{CO}_2^-$ is more stable than CH_3CO_2^- because of the electron-withdrawing Cl.
- B. $\text{ClCH}_2\text{CO}_2^-$ is more soluble in water than CH_3CO_2^- because of the Cl.
- C. $\text{ClCH}_2\text{CO}_2^-$ is more stable than CH_3CO_2^- because of an additional resonance form.
- D. $\text{ClCH}_2\text{CO}_2^-$ is more stable than CH_3CO_2^- because of hydrogen bonding.

ACS Review Carboxylic Acids KEY

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