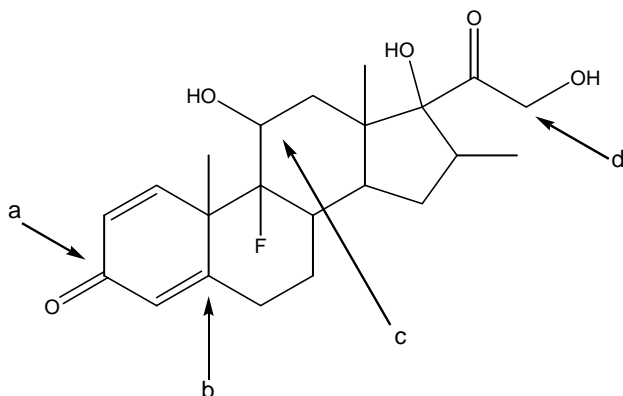


<b>Organic Chemistry</b>
--------------------------

1. According to the VSEPR model, what is the shape of the  $I_3^-$  anion?

- a) linear
- b) bent
- c) trigonal planar
- d) tetrahedral

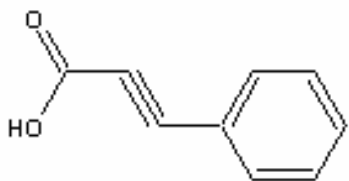
2. Betamethasone is a drug widely prescribed for rheumatoid arthritis. What is the approximate bond angle of atom (a)?



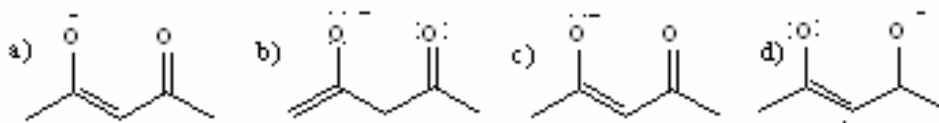
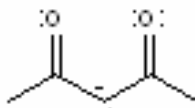
- a)  $120^\circ$
- b)  $120^\circ$
- c)  $109^\circ$
- d)  $109^\circ$

3. How many  $\pi$ -bonds are there in the molecule below?

- a) 3
- b) 4
- c) 5
- d) 6



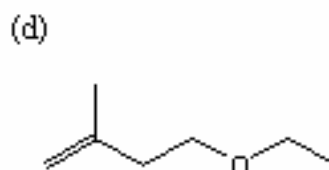
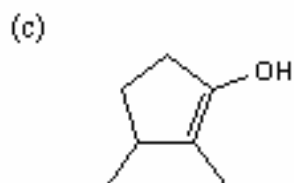
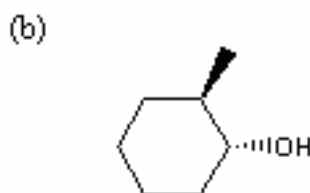
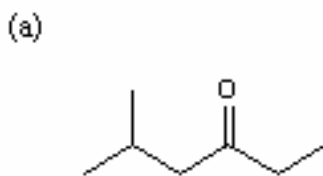
4. Which of the following is a correct and important resonance form of the acetylacetonate anion shown below?



5. How many important resonance forms can be constructed for the phenoxide anion,  $C_6H_5O^-$ ?

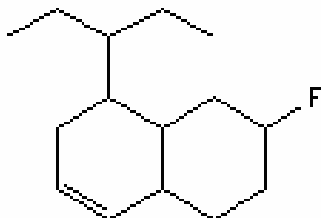
- a) 4
- b) 5
- c) 6
- d) 7

6. Which compound below is NOT a constitutional isomer of 1-methylcyclohexanol?

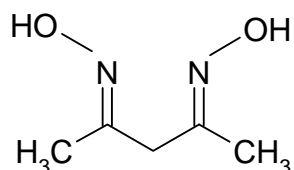


7. How many stereocentres does the following organic molecule contain?

- (a) 3
- (b) 4
- (c) 5
- (d) 6



8. Consider the compound below known as dimethylglyoxime:



Which one of the following statements best describes the hybridization of the atoms in this molecule?

- (a) There are two  $sp^3$  N atoms and two  $sp^3$  O atoms.
- (b) All of the C atoms are  $sp^3$  hybridized.
- (c) There are two  $sp^2$  C atoms and two  $sp^3$  N atoms.
- (d) There are three  $sp^3$  C atoms and two  $sp^2$  N atoms.

9. How many cis-trans diastereomers are possible for 1,2,3,4,5-pentachlorocyclopentane?

- a) 2
- b) 4
- c) 6
- d) 8

10. The *S* enantiomer of the amino acid alanine,  $\text{CH}_3\text{CH}(\text{NH}_2)\text{COOH}$ , rotates plane-polarized light to the left. How will the *R* enantiomer of alanine affect plane-polarized light?

- (a) The *R* enantiomer will rotate plane-polarized light to the left to a lesser degree.
- (b) The *R* enantiomer will rotate plane-polarized light to the left to a greater degree.
- (c) The *R* enantiomer will rotate plane-polarized light to the right.
- (d) The *R* enantiomer will not rotate plane-polarized light.

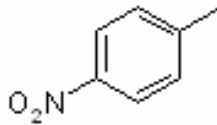
11. Which of the structures shown below contains the most deshielded proton?



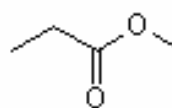
a)



b)



c)



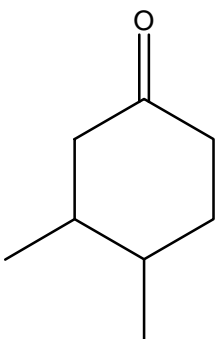
d)

12. Given the empirical formulae and spectroscopic data below, what is the structure of unknown I?

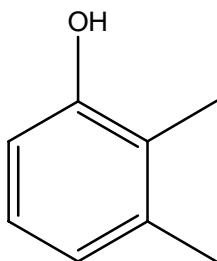
Unknown I ( $\text{C}_8\text{H}_{10}\text{O}$ )

IR: broad absorption band  $\sim 3300\text{cm}^{-1}$

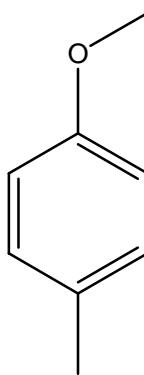
$^1\text{H NMR}$   $\delta$ : 7.8 d 2H; 7.4 d 2H; 3.8 s 1H; 3.3 q 2H; 1.8 t 3H



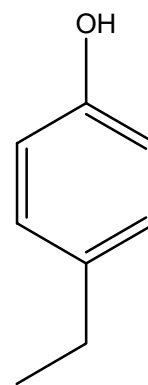
a)



b)



c)



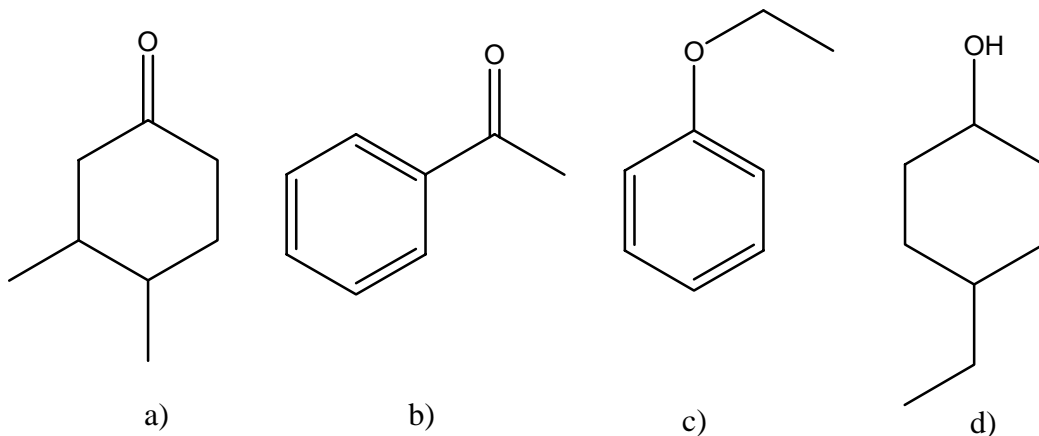
d)

13. Given the empirical formulae and spectroscopic data below, what is the structure of unknown II?

Unknown II ( $C_8H_8O$ )

IR: intense band at  $1666\text{cm}^{-1}$

$^1\text{H NMR}$   $\delta$ : 8.1 d 2H; 7.8 t 1H; 7.4 m 2H; 2.3 s 3H

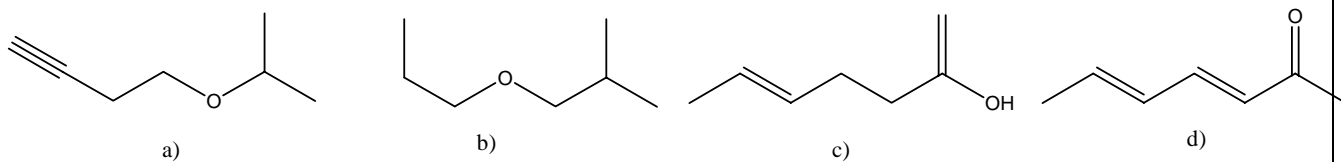


14. Given the empirical formulae and spectroscopic data below, what is the structure of unknown III?

Unknown III ( $C_7H_{12}O$ )

IR: weak absorption bands  $\sim 3300\text{cm}^{-1}$ ,  $2150\text{cm}^{-1}$  and  $1200\text{cm}^{-1}$

$^1\text{H NMR}$   $\delta$ : 4.3 heptet 1H; 4.1 t 2H; 3.8 t 2H; 2.1 s 1H; 1.8 d 6H

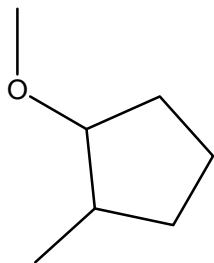


15. Given the empirical formulae and spectroscopic data below, what is the structure of unknown IV?

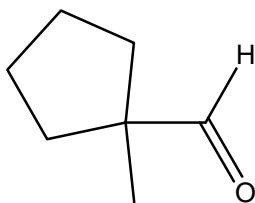
Unknown IV ( $C_7H_{12}O$ )

IR: intense bands  $1720\text{cm}^{-1}$

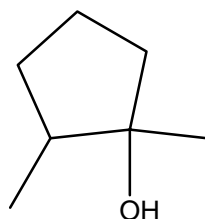
$^1\text{H NMR } \delta$ : 9.1 s 1H; 1.9 t 4H; 1.8 multiplet 4H; 1.6 s 3H



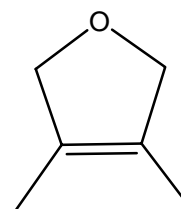
a)



b)



c)



d)

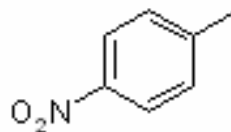
16. On the structures shown, what is the splitting pattern of the most deshielded proton (singlet (s), doublet (d), triplet (t), quartet (q), heptet (h) or multiplet (m))?



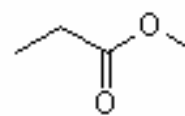
**A**



**B**



**C**



**D**

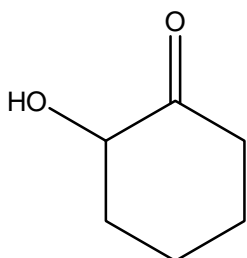
- a) A (s), B (s), C (t), D (s)  
 b) A (d), B (t), C (s), D (s)  
 c) A (t), B (d), C (d), D (d)  
 d) A (t), B (t), C (d), D (s)

17. Given the spectroscopic data and empirical formulae below, what is the structure of compound I? [Note: s = singlet, t = triplet, m = multiplet].

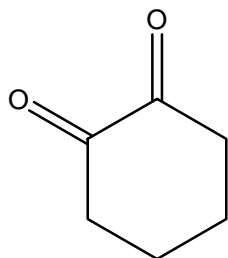
**Compound I (C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>)**

IR: intense absorption band at 1688 cm<sup>-1</sup>

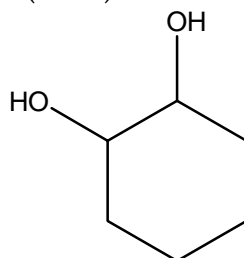
<sup>1</sup>H NMR (CDCl<sub>3</sub>): 4.1δ (t, 4H), 2.1δ (t, 4H)



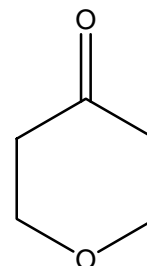
a)



b)



c)



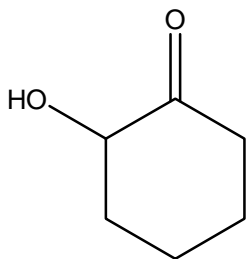
d)

18. Given the spectroscopic data and empirical formulae below, what is the structure of compound II? [Note: s = singlet, t = triplet, m = multiplet].

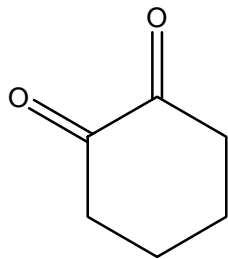
**Compound II (C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>)**

IR: broad absorption band 3200-3600 cm<sup>-1</sup>; intense absorption band at 1670 cm<sup>-1</sup>

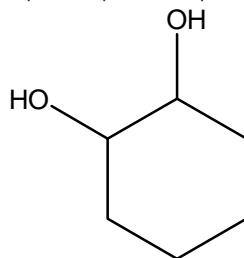
<sup>1</sup>H NMR (CDCl<sub>3</sub>): 4.5δ (t, 1H), 3.5δ (s, 1H), 2.2δ (t, 2H), 1.8δ (m, 4H)



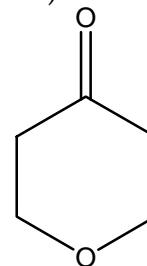
a)



b)



c)



d)

19. Which of the following solvents has the lowest boiling point?

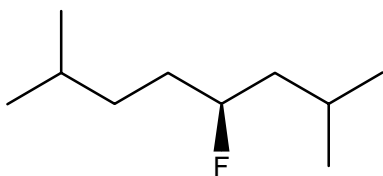
a) ethanol

b) hexane

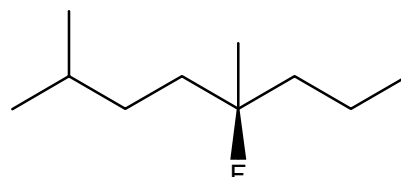
c) ether

d) water

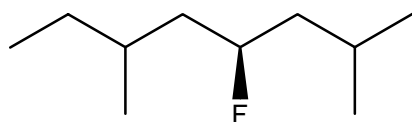
20. Which molecule is (4S)-fluoro-2,7-dimethyloctane?



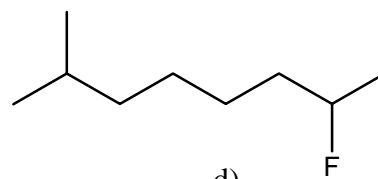
a)



b)

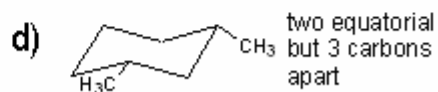
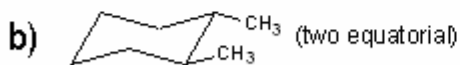
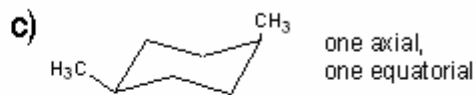
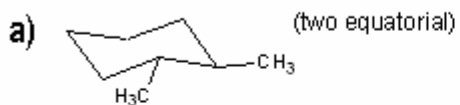


c)



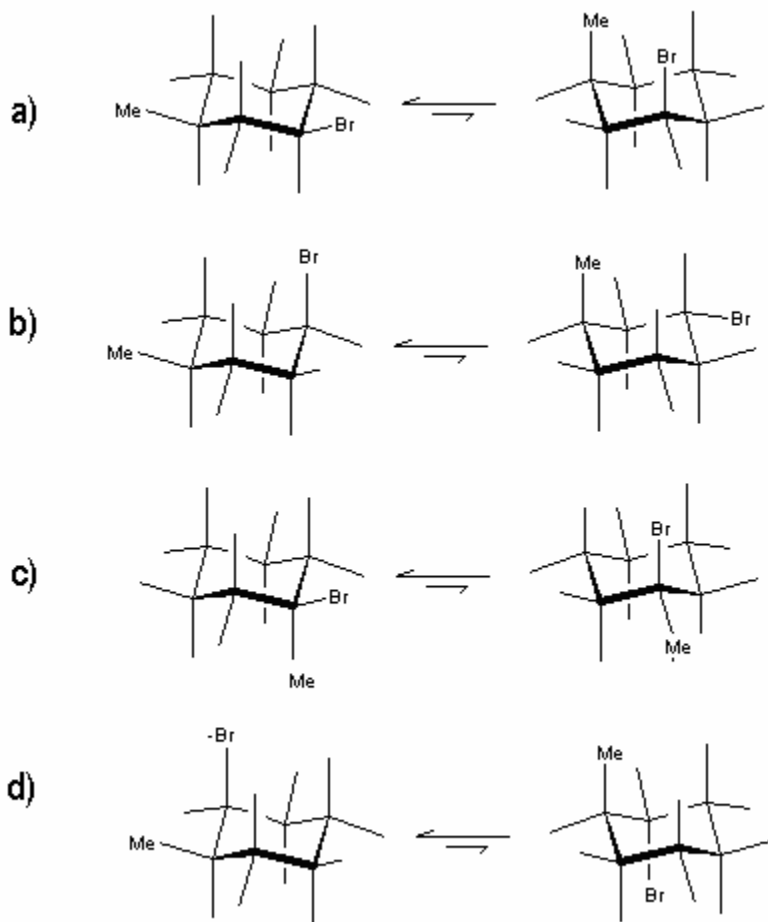
d)

21. For which of the below compounds will its two chair conformers be approximately of the same energy?

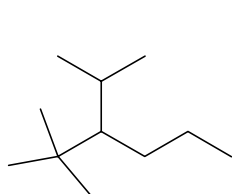




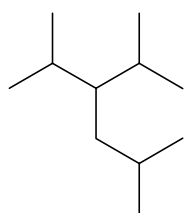
22. Which of the structures below represent the chair forms of cis-1-bromo-3-methylcyclohexane?



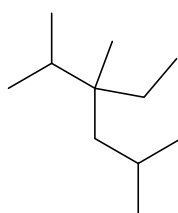
23. Which of the structures below is 2,5-dimethyl-s-isopropylhexane?



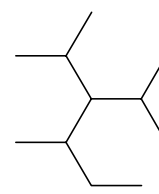
a)



b)

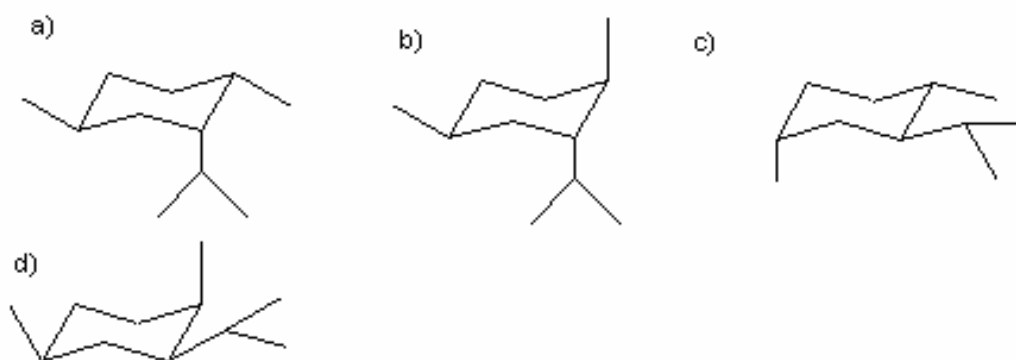
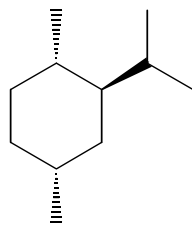


c)



d)

24. Which of the following structures represents the most stable conformation of the molecule shown below?

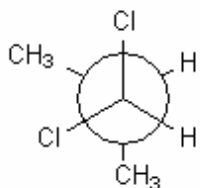


25. Which of the following statements about 1,1-dimethylcyclopentane are true?

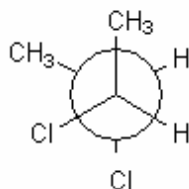
- (i) It is a saturated compound.
- (ii) It is a planar molecule.
- (iii) It has no ring strain.

- a) only (i) is true
- b) only (ii) is true
- c) only (iii) is true
- d) only (i) and (iii) are true

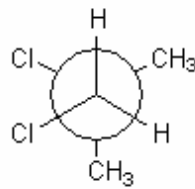
26. Which of the following structures is the Newman projection for the most stable conformation of (2*R*,3*R*)-2,3-dichlorobutane?



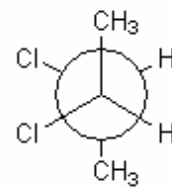
a)



b)

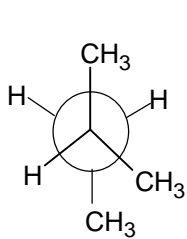


c)

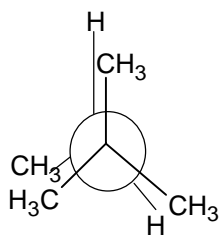


d)

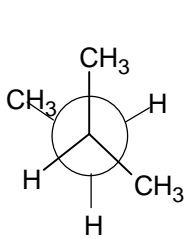
27. Consider the conformations of 2-methylbutane. Which structure(s) show(s) gauche interaction?



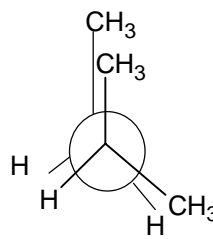
I



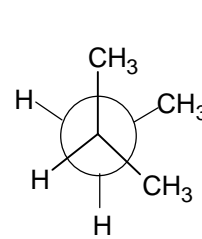
II



III



IV



V

- a) I, II, III  
 b) I, IV, V  
 c) II, III, V  
 d) I, III, V

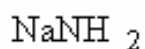
28. Which one of following statements about the radical mechanism of alkane chlorination is FALSE?

- (a) Light or heat is required in the chain initiation step.  
 (b) The chain termination step reduces the number of radicals present in the reaction  
 (c) The major product of radical monochlorination of 2,3-dimethylbutane will be 2-chloro-2,3-dimethylbutane.  
 (d) The alkyl radical intermediate generated during chain propagation is a positively charged species.

29. The number of constitutional isomers that could be generated by radical monochlorination of 1,3-diethylcyclopentane is

- a) 4    b) 5    c) 8    d) 9

30. Of the following compounds, which ones can be used to generate ethoxide ion ( $\text{C}_2\text{H}_5\text{O}^-$ ) from ethanol?



**a)**



**b)**



**c)**

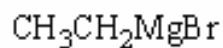


**d)**

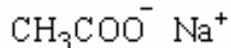
31. Which of the following reagents given will not deprotonate  $(\text{CH}_3)_3\text{COH}$  almost completely?



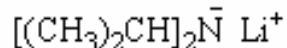
**a)**



**b)**

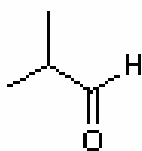


**c)**

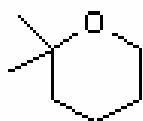


**d)**

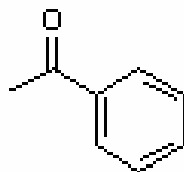
32. Of the following compounds, identify the ones that will react with one equivalent of a Grignard reagent to form a tertiary alcohol.



**a)**



**b)**

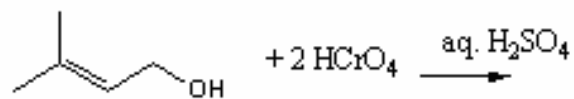


**c)**

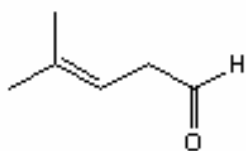


**d)**

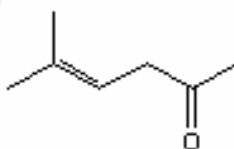
33. Which of the following is the major product of this oxidation reaction:



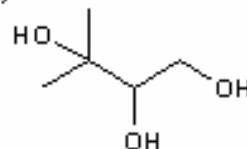
(a)



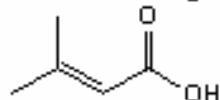
(b)



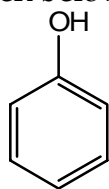
(c)



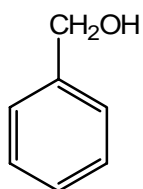
(d)



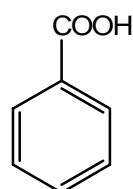
34. What is the order of increasing acid strength (weakest first, strongest last) of the set of compounds given below?



1



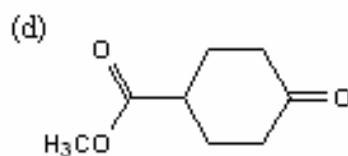
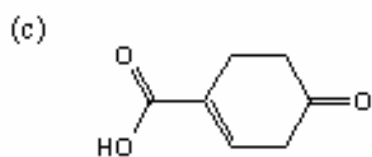
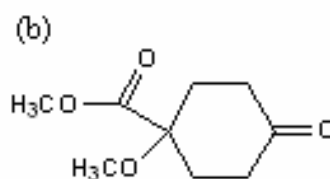
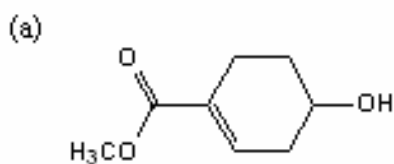
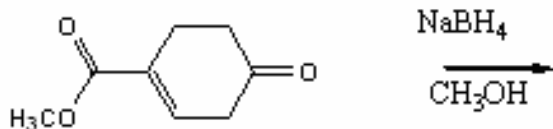
2



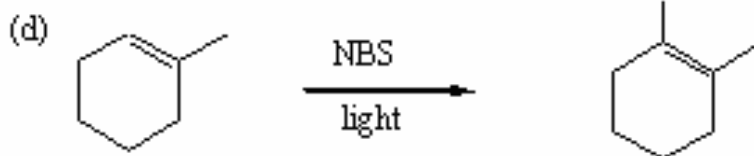
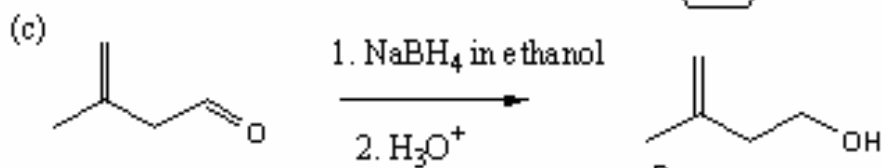
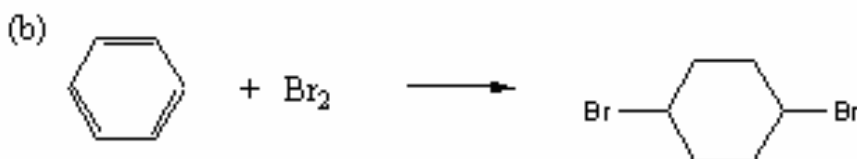
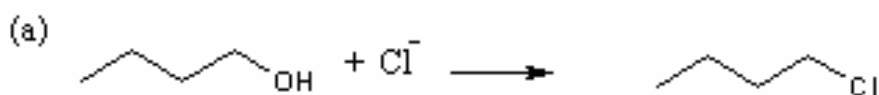
3

- (a) 1<2<3  
 (b) 1<3<2  
 (c) 2<1<3  
 (d) 2<3<1

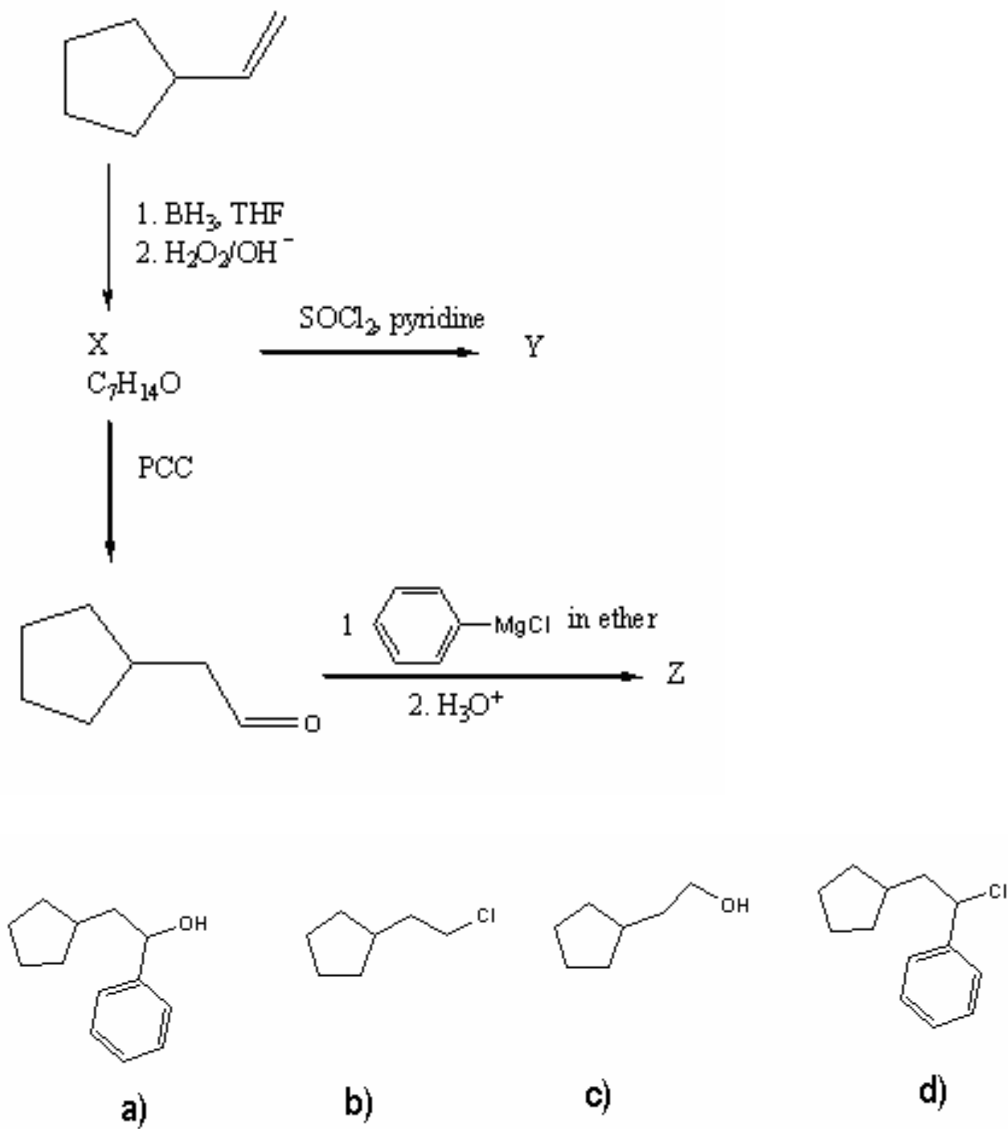
35. From the compounds below, choose the major product that will result from the following reaction:



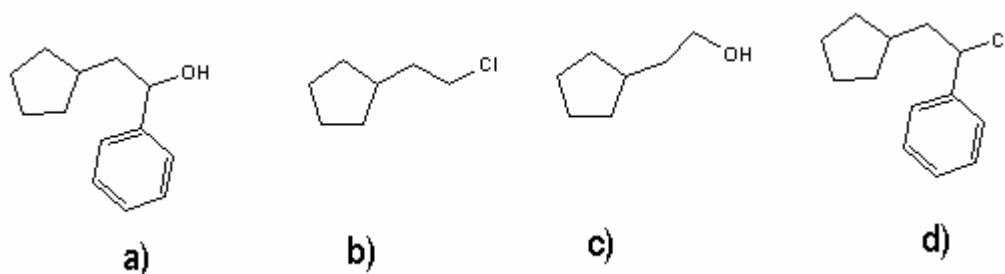
36. Which of the following reactions is most likely to occur?



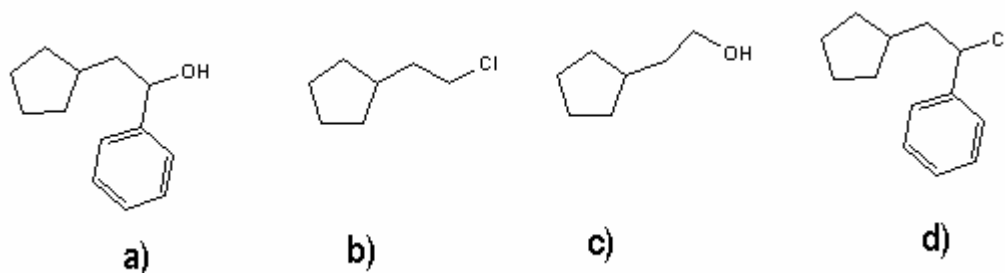
37. From the reaction scheme below, what is the structure of the major organic products X?



38. From the reaction scheme shown in question 37, what is the structure of the major organic product Y?



39. From the reaction scheme shown in question 37, what is the structure of the major organic product Z?



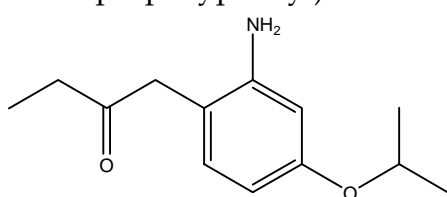
40. The conversion shown below may best described as which of the following types of reaction?



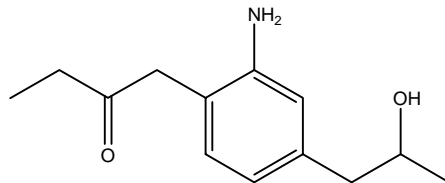
- (a) addition
- (b) substitution
- (c) reduction
- (d) addition and reduction



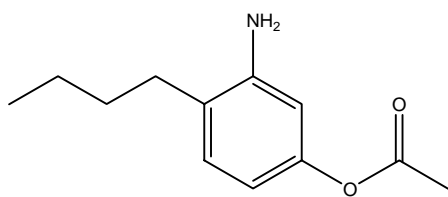
41. Which structure corresponds to the following chemical name: 1-(2-amino-4-isopropoxyphenyl)-2-butanone?



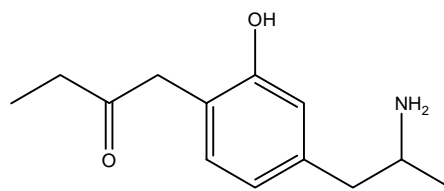
a)



b)

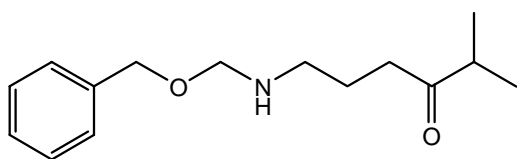
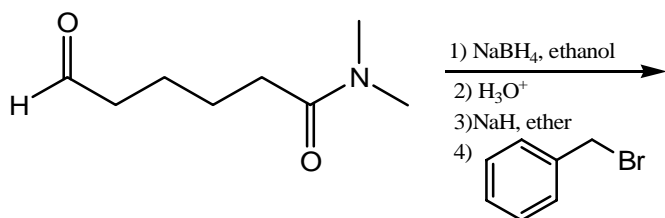


c)

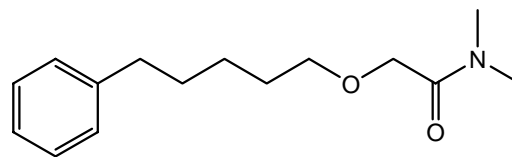


d)

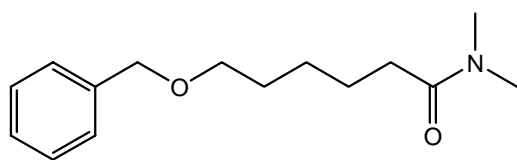
41. What is the major product for the following reaction?



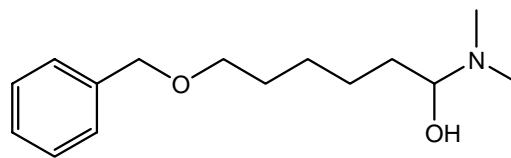
a)



b)

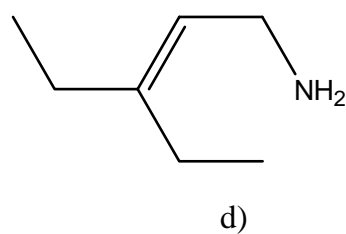
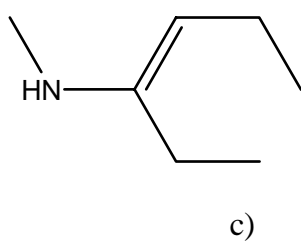
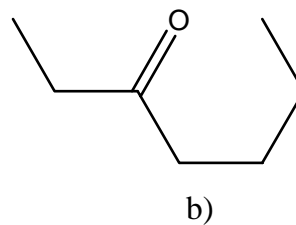
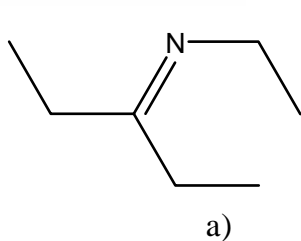
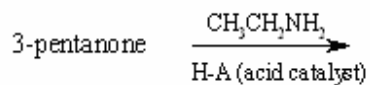


c)

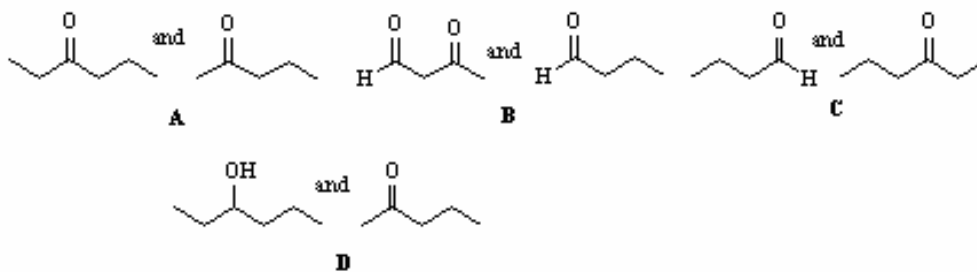


d)

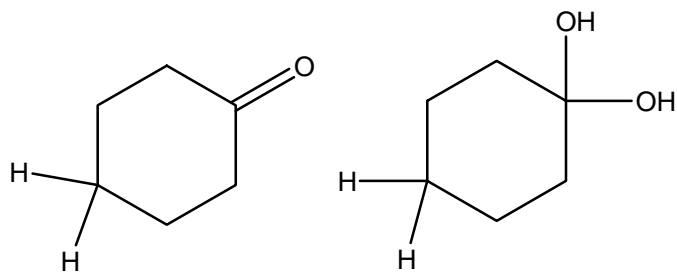
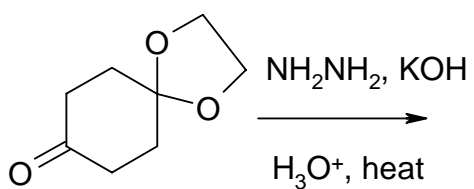
43. What is the major product for the following reaction?



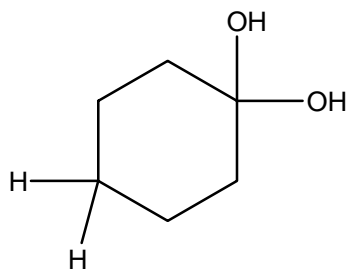
44. The Tollen's test (silver mirror test) can be used to distinguish between which pair of compounds?



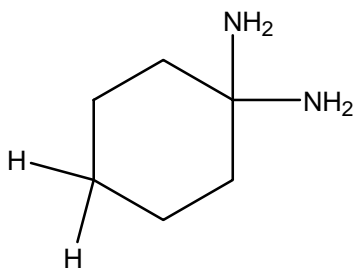
45. What is the predicted product of the following reaction sequence?



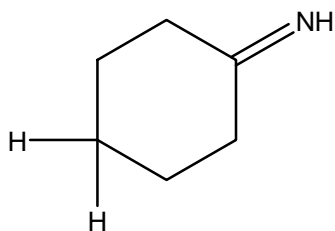
a)



b)

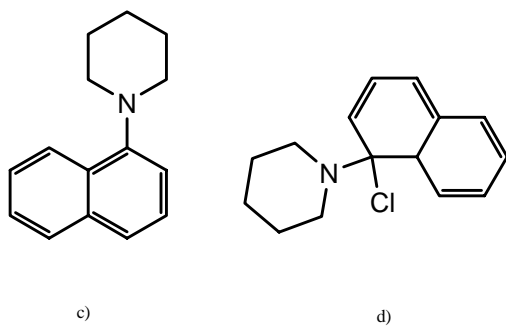
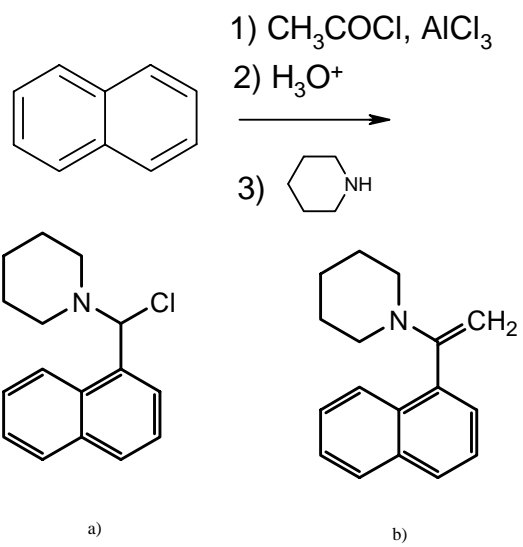


c)

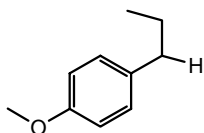
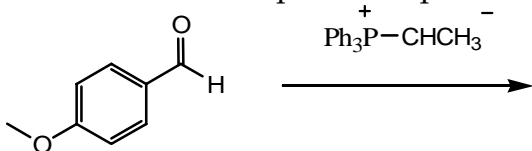


d)

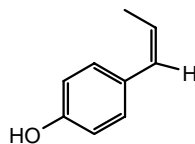
46. What is the predicted product of the following reaction sequence?



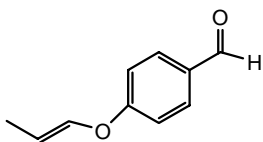
47. What is the predicted product of the following reaction sequence?



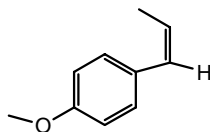
a)



b)

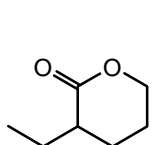
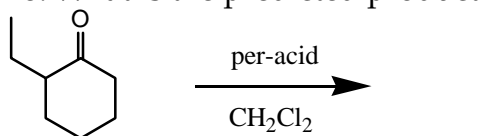


c)

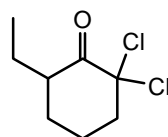


d)

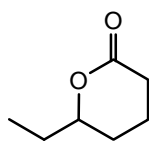
48. What is the predicted product of the following reaction scheme?



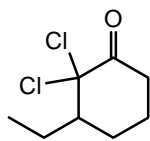
a)



b)

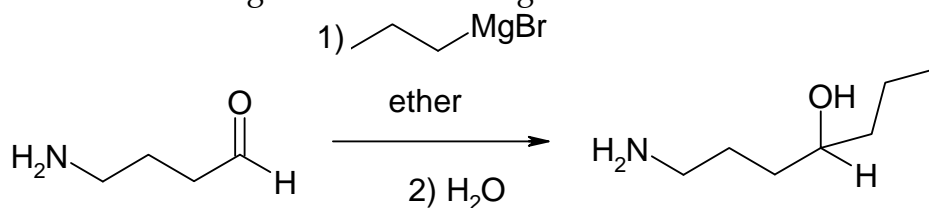


c)



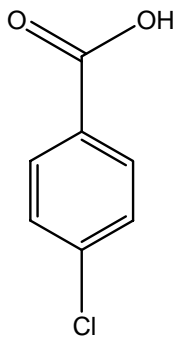
d)

49. What is wrong with the following reaction scheme?

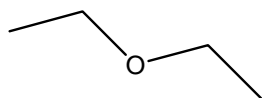


- The Grignard reagent will deprotonate the amine group, instead of attacking the carbonyl group.
- The Grignard reagent will deprotonate the aldehyde, instead of attacking the carbonyl group.
- The amine will be hydrolyzed off.
- Nothing. The scheme shown above is correct.

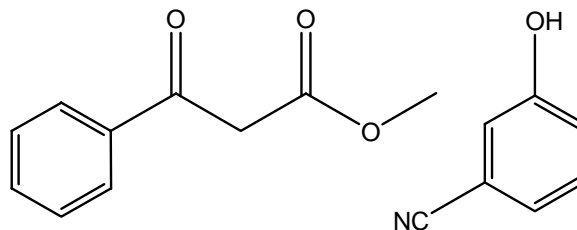
50. Of the following compounds, which will NOT be deprotonated by sodium methoxide ( $\text{NaOCH}_3$ )?



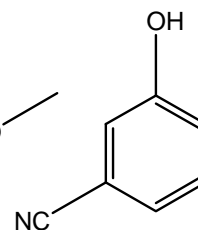
a)



b)

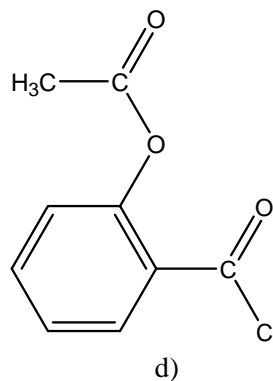
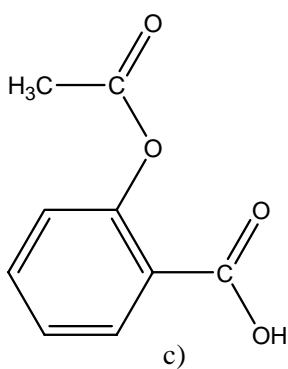
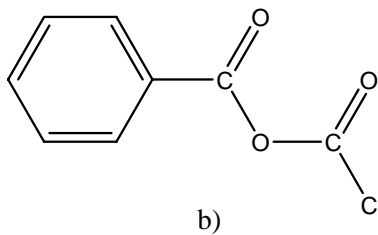
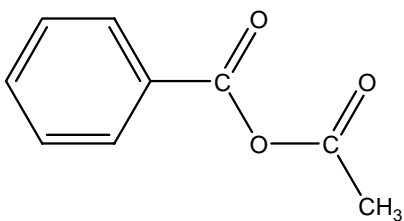
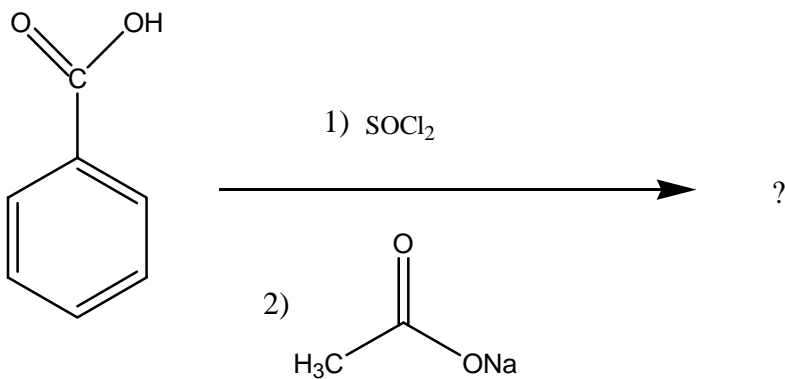


c)



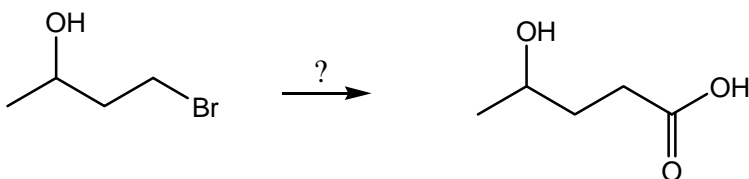
d)

51. What is the predicted product of the following reaction scheme?



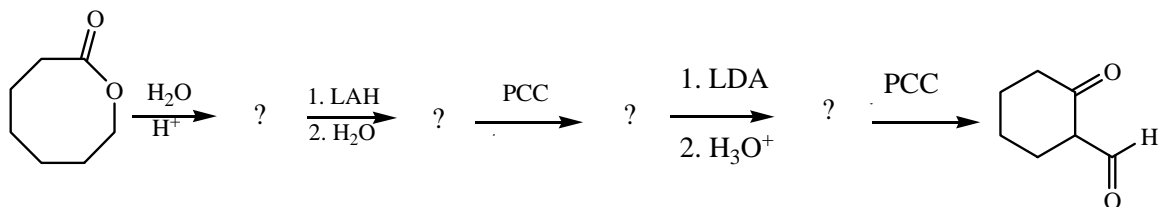


52. What are the necessary reagents and reaction conditions needed undertake the following functional group transformation (more than one step may be required)?



- a) 1)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{MgBr}$ , ether, 2)  $\text{H}_2\text{O}$   
 b) 1)  $\text{SOCl}_2$ , 2)  $\text{CH}_3\text{COONa}$   
 c)  $\text{H}_2\text{O}$ ,  $\text{NaOH}$   
 d) 1)  $\text{NaCN}$ , acetone, 2)  $\text{H}_3\text{O}^+$ ,  $\Delta$

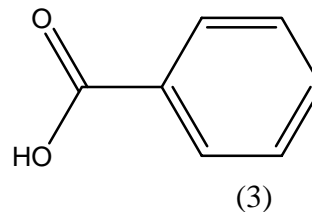
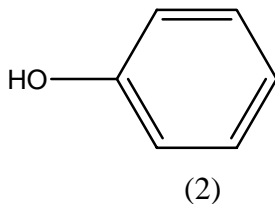
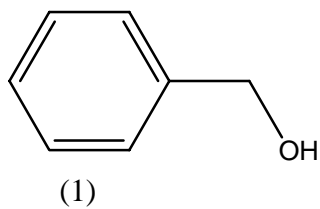
53. What is the order of the intermediates of the following reaction scheme?



- I
- II
- III
- IV

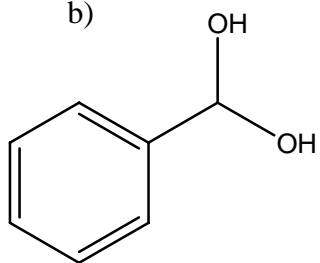
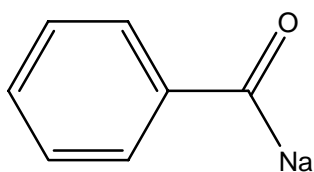
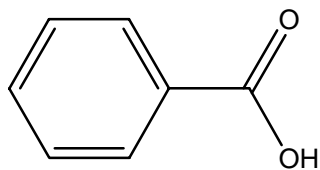
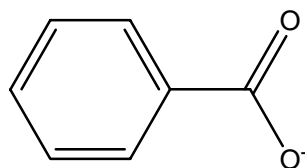
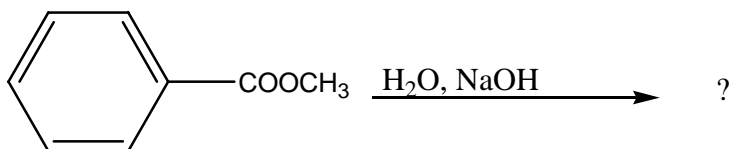
- a) I, III, II, IV  
 b) III, I, II, IV  
 c) II, III, I, IV  
 d) III, II, I, IV

54. What is the order of decreasing acidity of the following benzene derivatives?

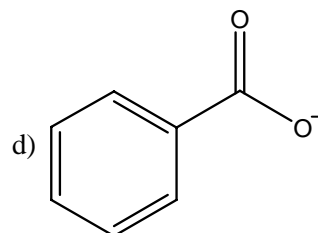
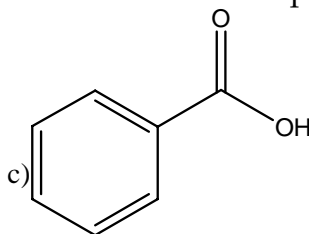
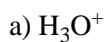


- a) (1)>(2)>(3)
- b) (3)>(2)>(1)
- c) (3)>(1)>(2)
- d) (2)>(3)>(1)

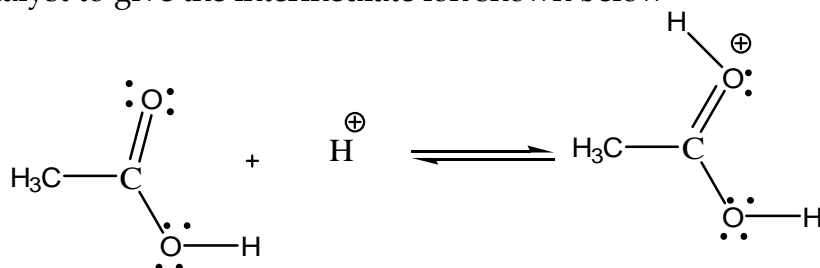
55. What is the predicted product of the following reaction scheme?



56. Equal molar amounts of benzoic acid and potassium hydroxide are dissolved in water. The most abundant of the four species below is.



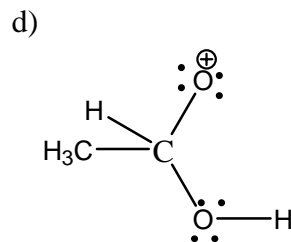
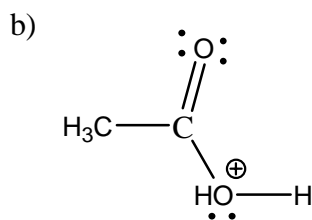
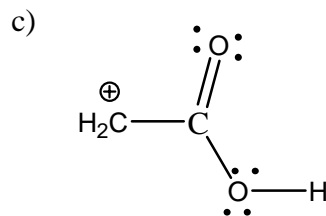
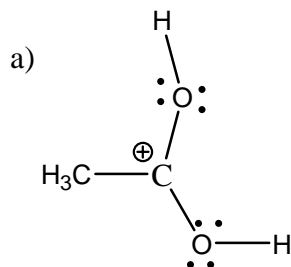
57. In the esterification of acetic acid (ethanoic acid) with an alcohol (for example, with ethyl alcohol to give ethyl acetate (ethyl ethanoate) sulfuric acid can act as a catalyst to give the intermediate ion shown below



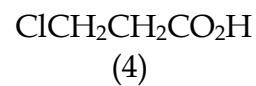
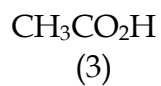
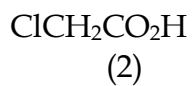
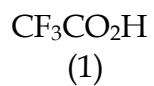
In this reaction, the acetic acid is behaving as

- a) an acid
- b) a base
- c) a carbocation
- d) an alcohol

58. Another resonance form of the following ion is

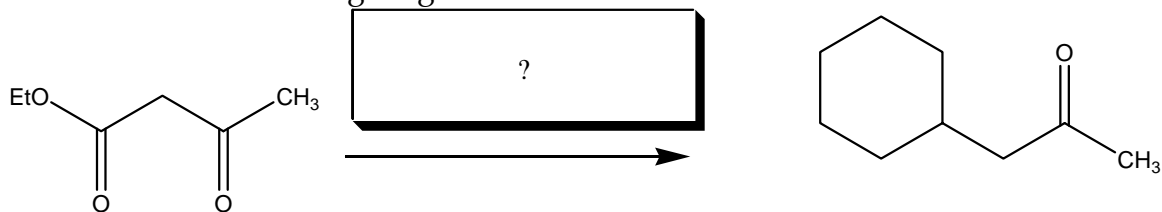


59. The order of decreasing acidity (i.e. the most acidic first) of the carboxylic acids (1)-(4) below is

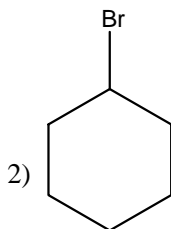


- a) (1)>(2)>(4)>(3)  
 b) (3)>(1)>(2)>(4)  
 c) (4)>(1)>(2)>(3)  
 d) (2)>(1)>(4)>(3)

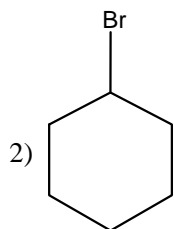
60. What are the missing reagents?



a) 1)  $\text{H}_2\text{O}/\text{H}^+$ ,  $\Delta$

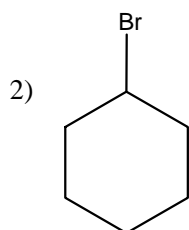


b) 1)  $\text{NaOEt}$ ,  $\text{EtOH}$



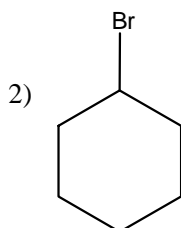
3)  $\text{H}^+$ ,  $\Delta$

c) 1)  $\text{H}_2\text{O}/\text{OH}^-$

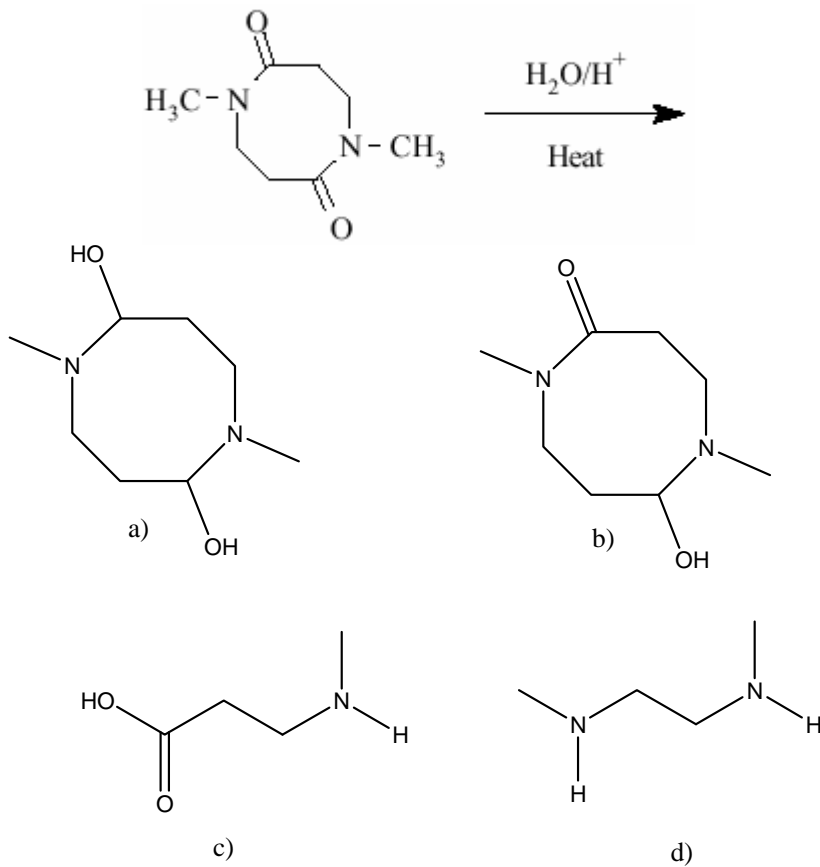


3)  $\text{H}^+$ ,  $\Delta$

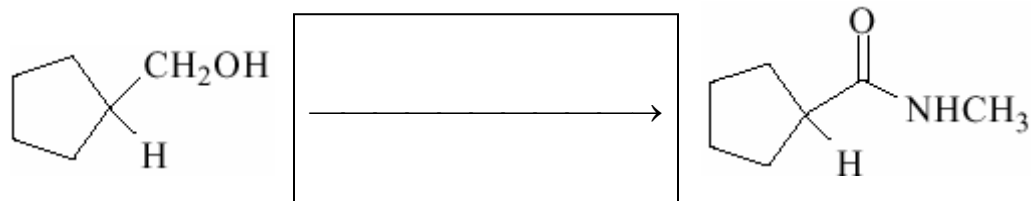
d) 1)  $\text{NaBH}_3$ ,  $\Delta$



61. What is the major organic product formed in the following reaction?

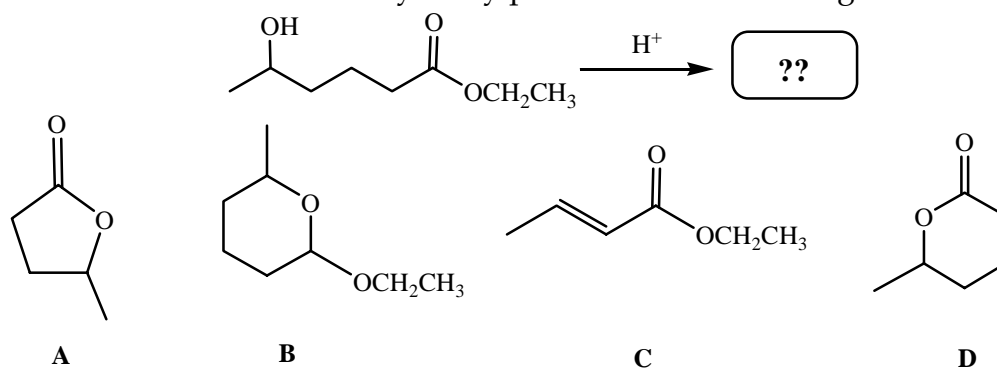


62. What are the missing reagents?

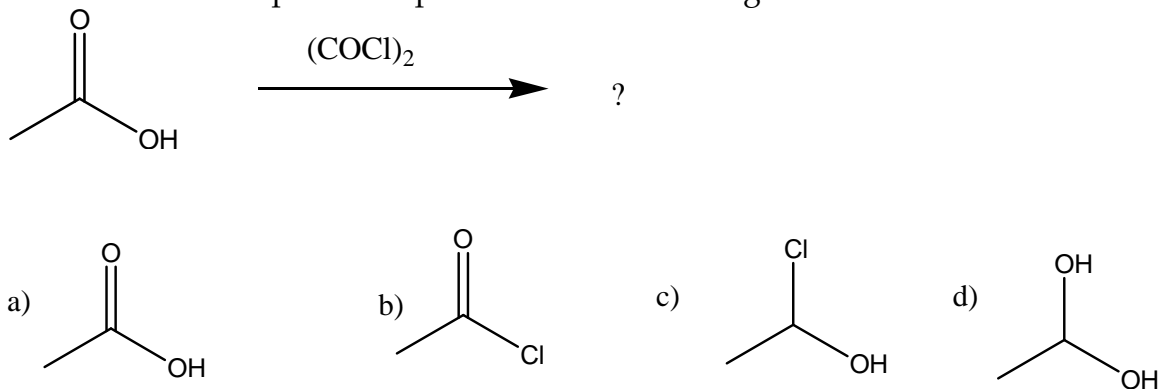


- a) 1)  $\text{H}_3\text{O}^+$ , 2)  $\text{NH}_2\text{CH}_3$
- b) 1)  $\text{OH}^-$ , 2)  $\text{NH}_2\text{CH}_3$
- c) 1)  $\text{KMnO}_4$ ,  $\text{H}^+$ , 2)  $\text{H}_2\text{SO}_4$ , 3)  $\text{NH}_2\text{CH}_3$
- d) 1)  $\text{KMnO}_4$ ,  $\text{H}^+$ , 2)  $\text{SOCl}_2$ , 3)  $\text{NH}_2\text{CH}_3$

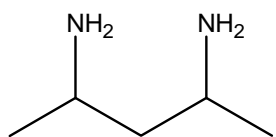
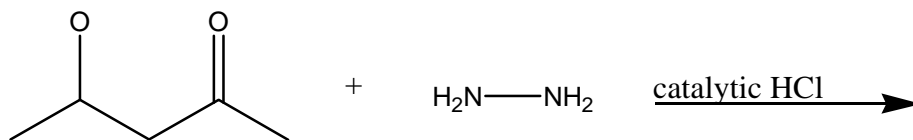
63. Which of A-D is the mostly likely product of the following reaction?



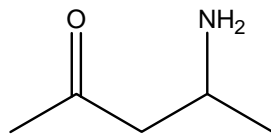
64. What is the predicted product of the following reaction?



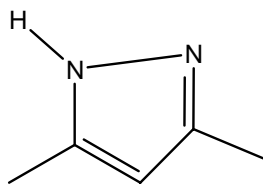
65. What is the predicted product of the following reaction?



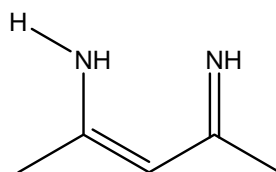
a)



b)

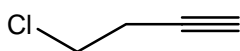


c)

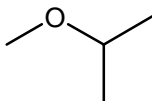


d)

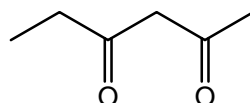
66. Of the following compounds, which ones that can be deprotonated by sodium ethoxide ( $\text{NaOC}_2\text{H}_5$ ) to form a monoanionic species?



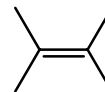
a)



b)



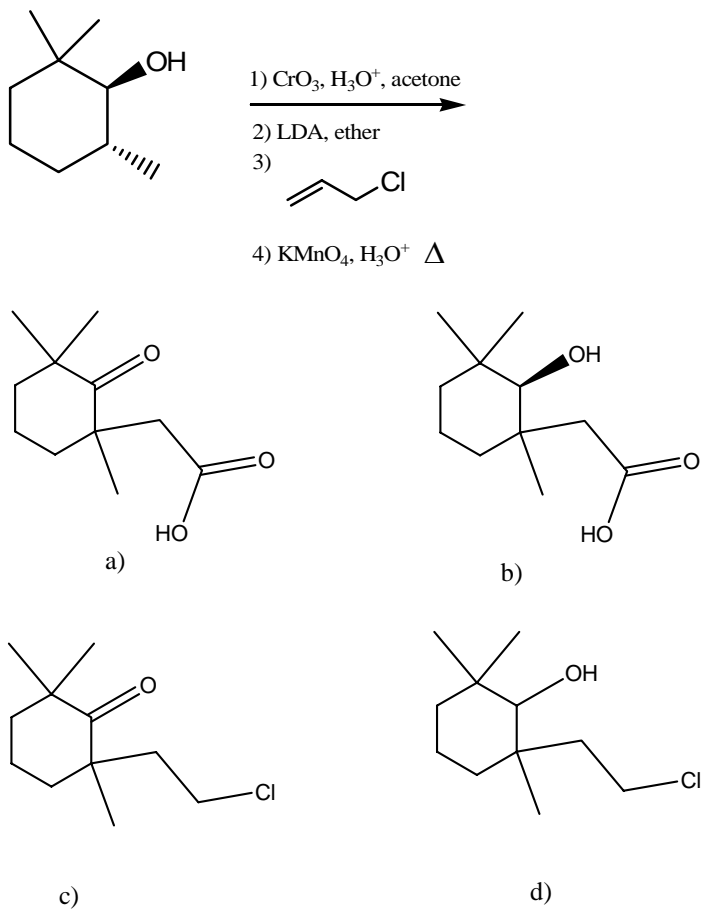
c)



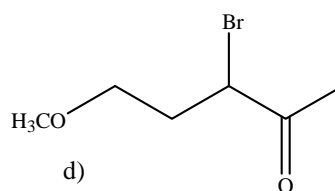
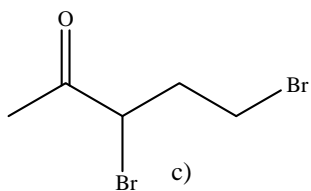
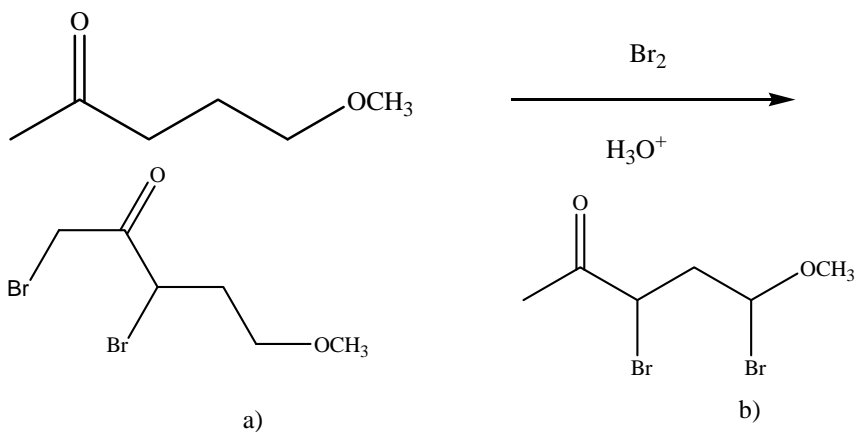
d)



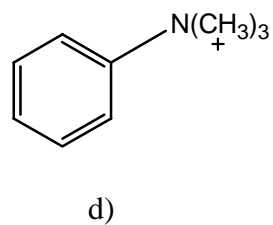
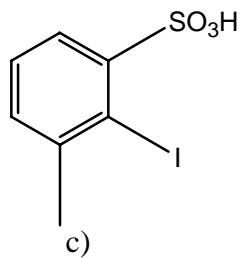
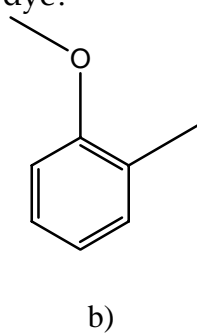
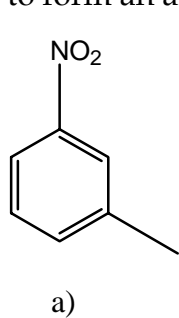
67. What is the major products of the following reaction?



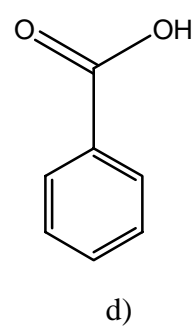
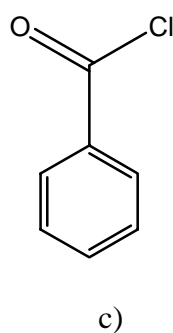
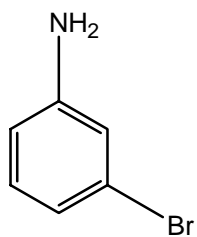
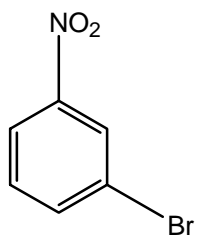
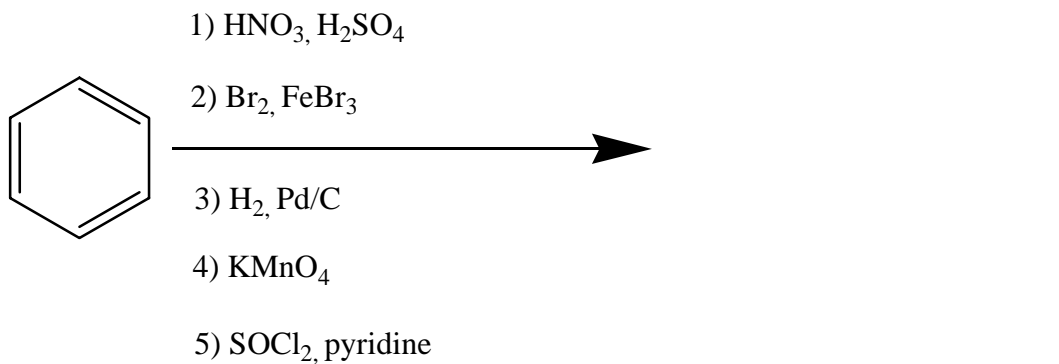
68. What is the product of the following reaction?



69. Of the following species, which one can react with an aromatic diazonium ion to form an azo dye?

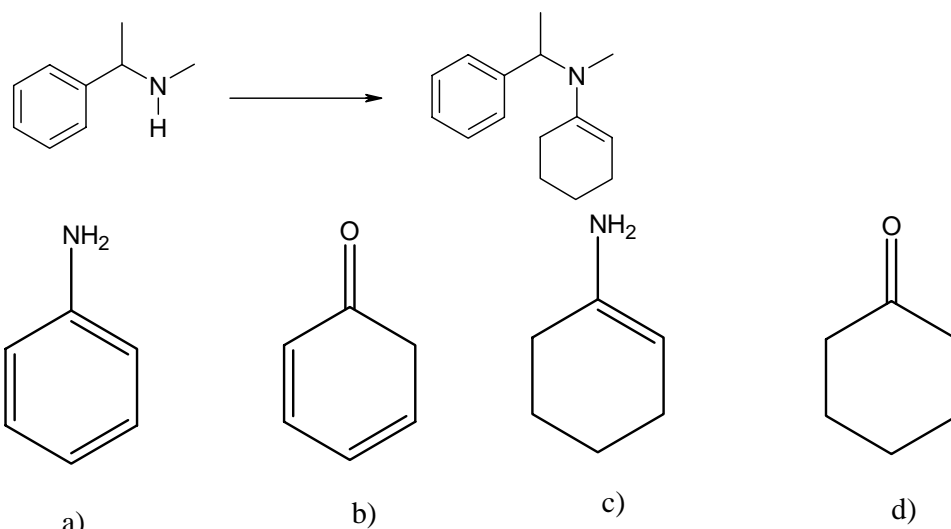


70. What is the product of the following reaction?

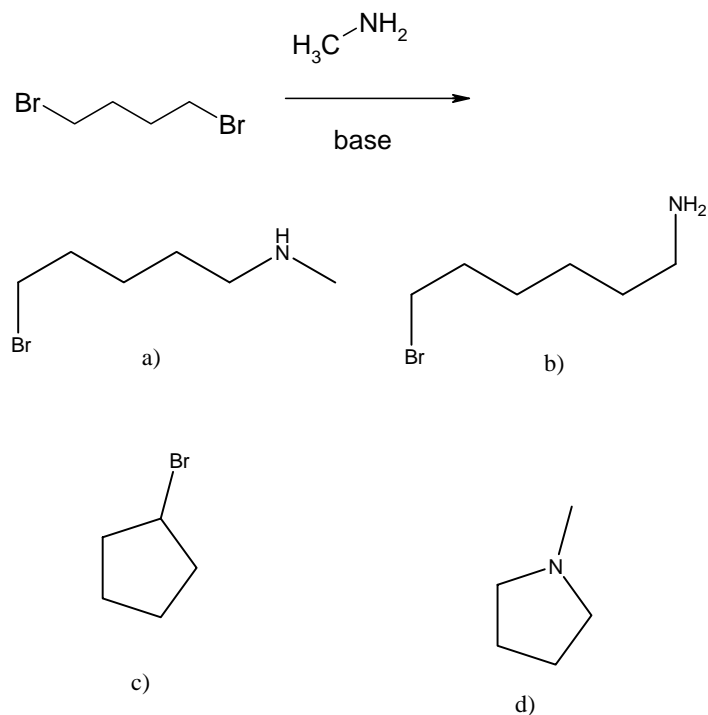




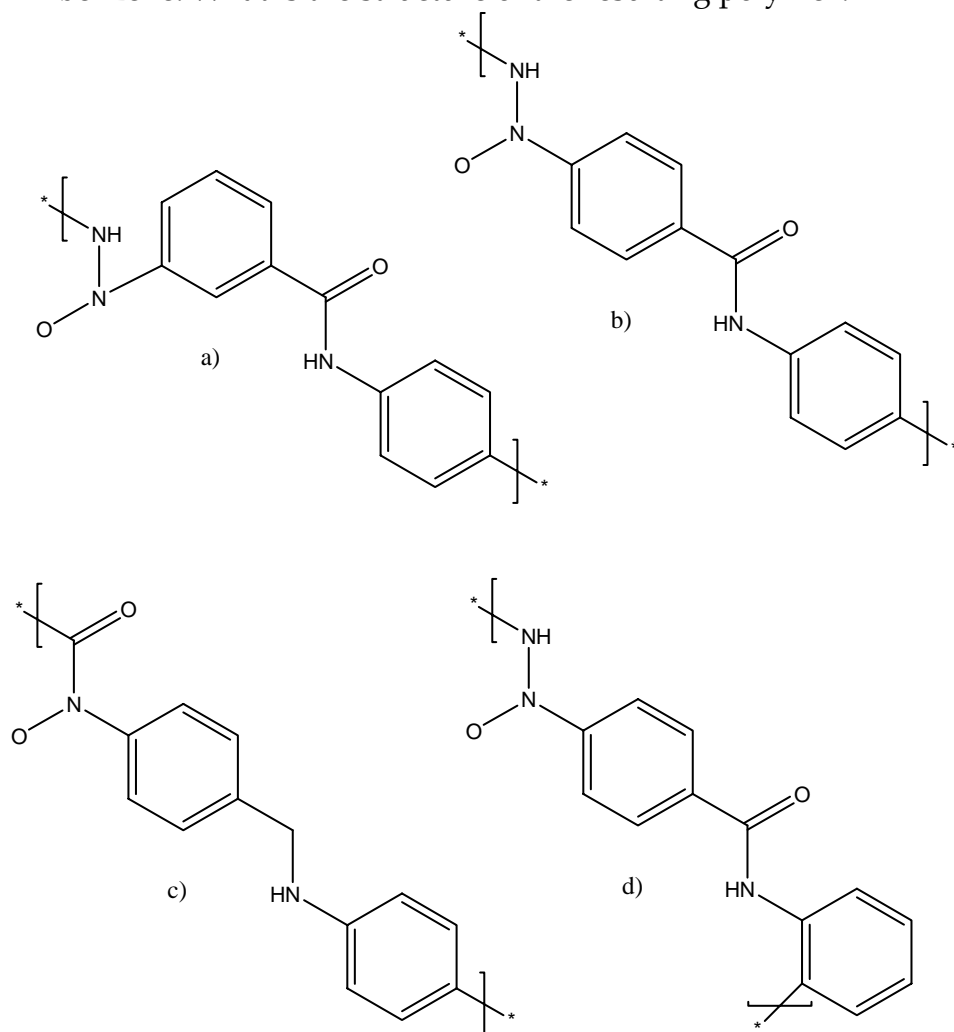
73. What is the missing reagent in the following reaction?



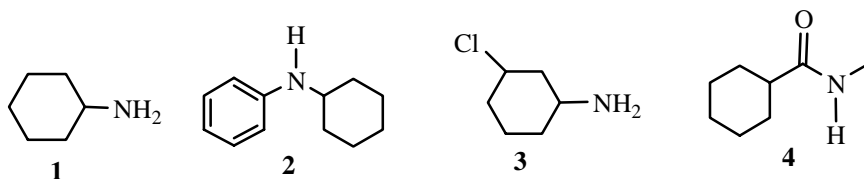
74. What is the product of the following reaction?



75. Kevlar is formed by combining benzene-1,4-dicarboxylic acid with *p*-diaminobenzene. What is the structure of the resulting polymer?

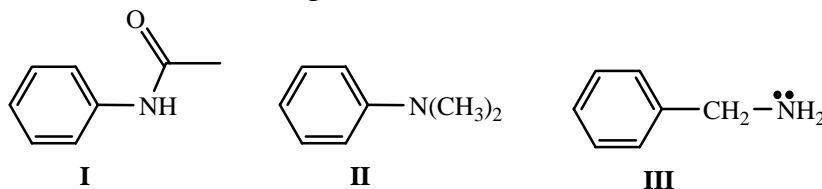


76. Which of A-D properly indicates which of the following molecules is the most basic and the least basic?



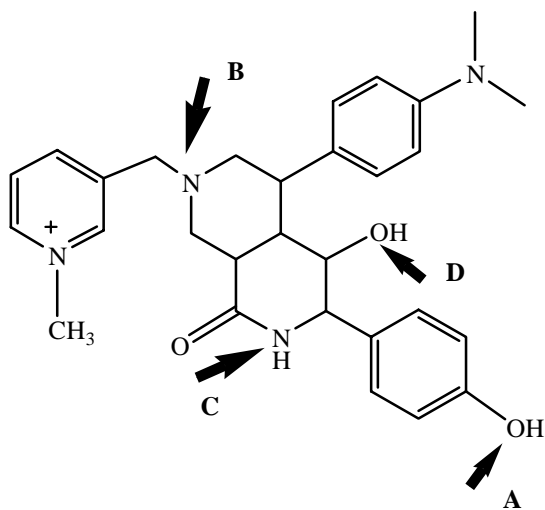
	Most Basic	Least Basic
A	1	4
B	2	3
C	3	2
D	4	1

77. Which of A-D correctly ranks the following in order of increasing basicity, from weakest base to strongest?

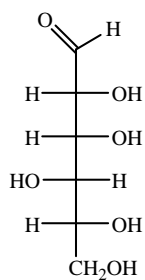


- A. I < II < III
- B. III < II < I
- C. II < III < I
- D. III < I < II

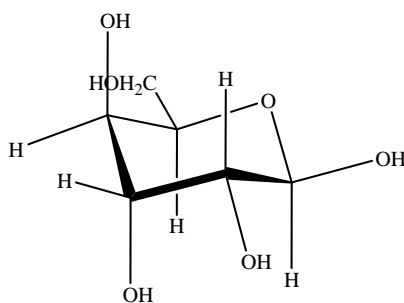
78. Which atom indicated below is the most basic site?



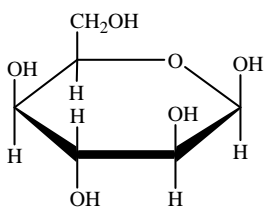
79. Which is NOT  $\beta$ -D-gulopyranose?



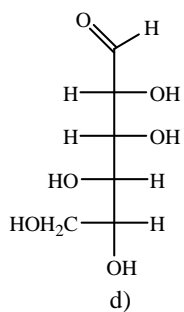
a)



b)



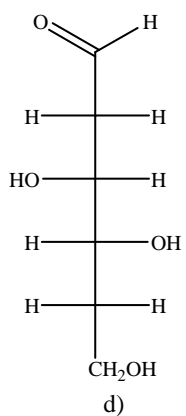
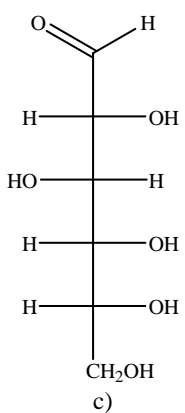
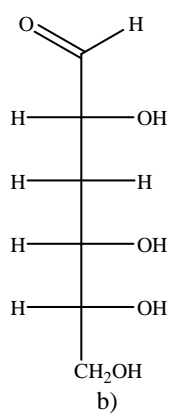
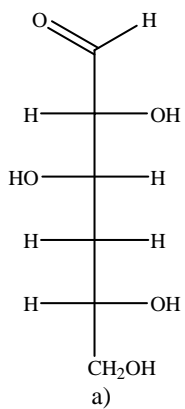
c)



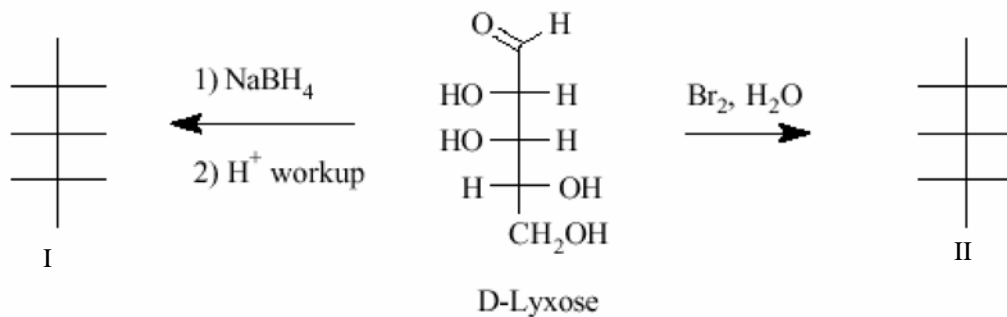
d)

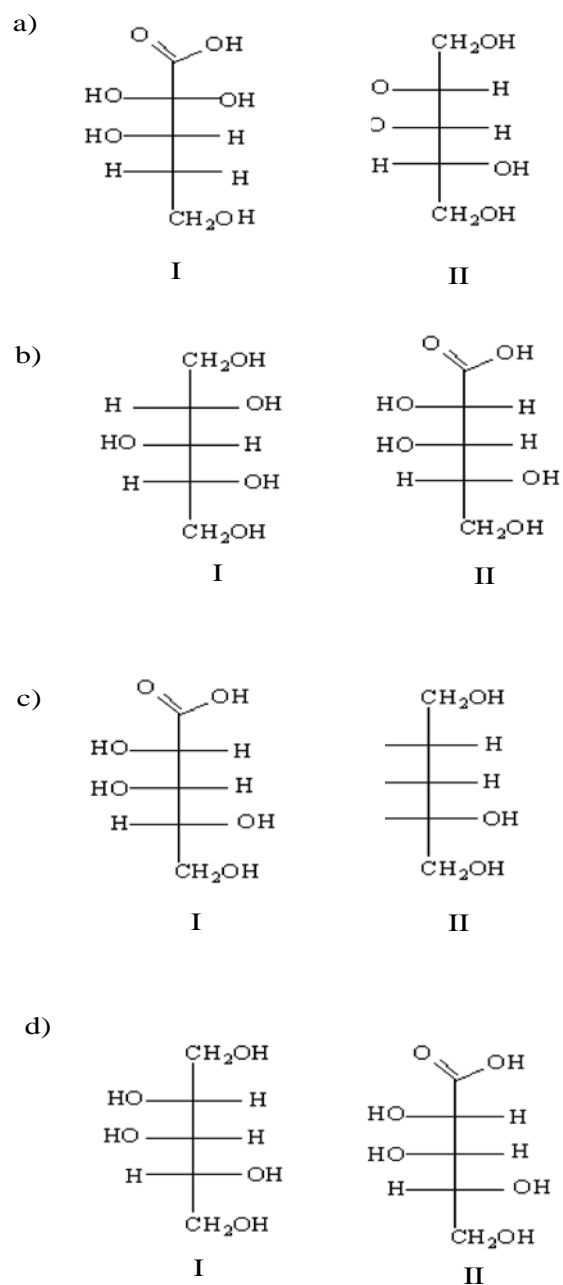


80. Which is the product when two aldoses are reduced with  $\text{NaBH}_4$ ?

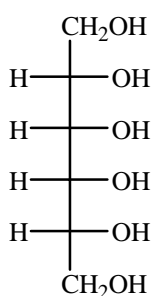
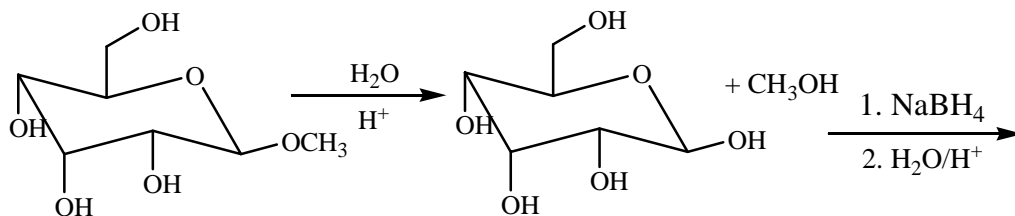


81. What are the Fischer Projection formulas (I and II) for the compounds formed by the following two reactions of D-lyxose?

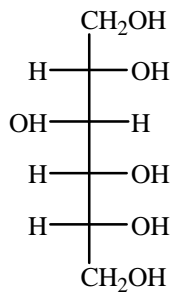




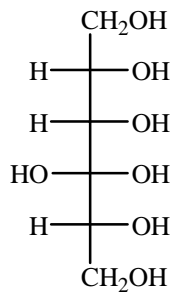
82. What is the product of the following reaction?



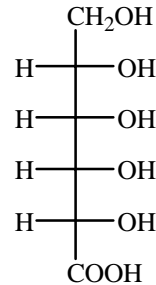
a)



b)

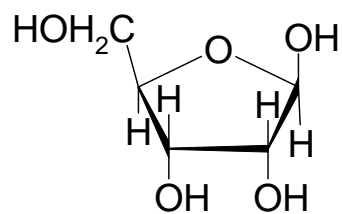


c)



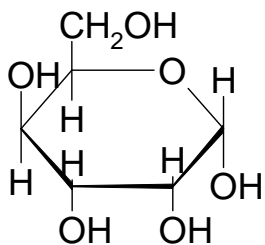
d)

83. What is the systematic name for the following?



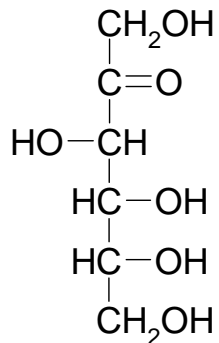
- a) Beta-D-ribofuranose
- b) Alpha-D-ribofuranose
- c) Beta-L-ribofuranose
- d) Alpha-L-ribofuranose

84. What is the systematic name for the following?



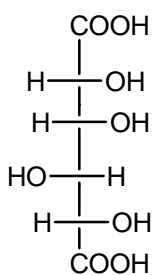
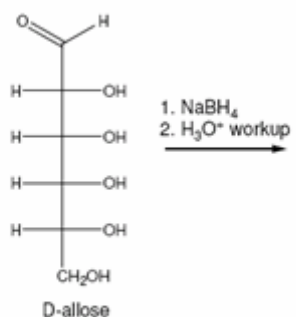
- a) Beta-D-gulopyranose
- b) Alpha-D-gulopyranose
- c) Beta-L-gulopyranose
- d) Alpha-L-gulopyranose

85. What is the systematic name for the following?

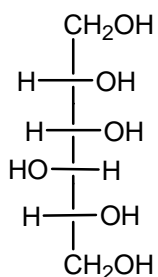


- a) L-glucose
- b) D-glucose
- c) L-fructose
- d) D-fructose

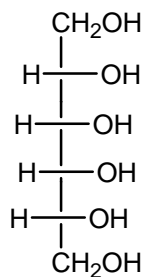
86. What is the product of the following reaction?



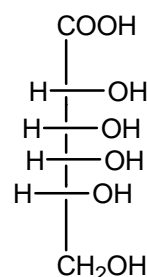
a)



b)

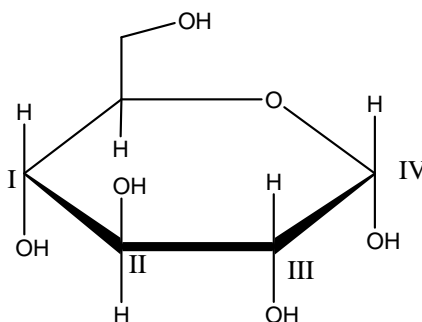
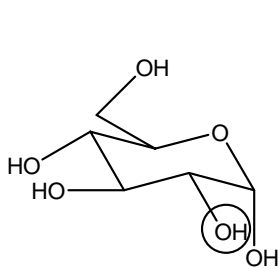


c)



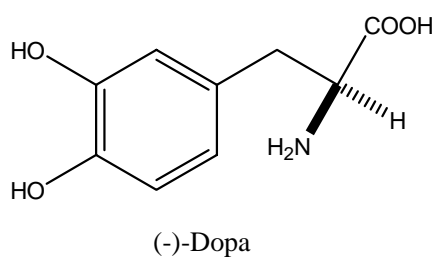
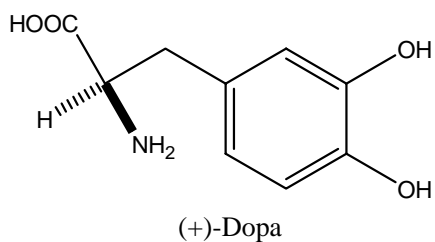
d)

87. The circled hydroxyl group in the top figure would be located in which position number in the bottom figure?



- a) I
- b) II
- c) III
- d) IV

88. The absolute configuration of (+)-dopa is \_\_\_\_, and the absolute configuration of its enantiomer is \_\_\_\_:



- a) R, R
- b) R, S
- c) S, R
- d) S, S

89. Naturally-occurring sugars may have which of the following configurations?

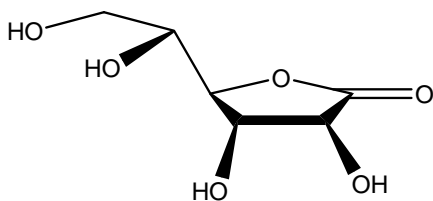
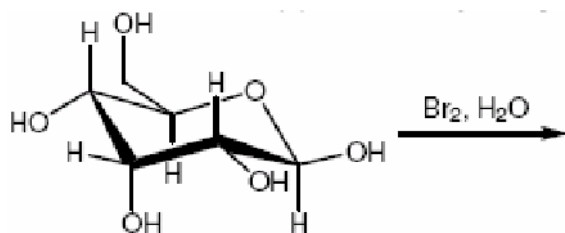
- I. D
- II. L
- III.  $\alpha$
- IV.  $\beta$

- a) I only
- b) II only
- c) I and IV only
- d) I, II, III, and IV

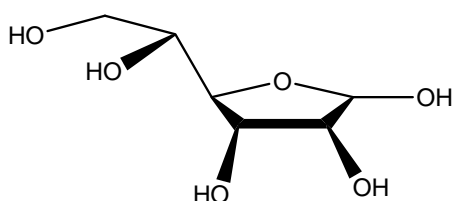
90. How many chiral centres must a meso compound have?

- a) 0
- b) 1
- c) 2
- d) Any even number greater than or equal to 2

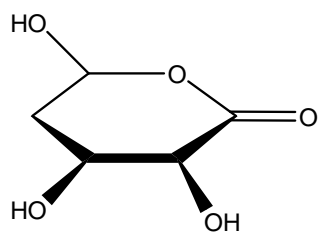
91. What is the major organic product of the reaction below?



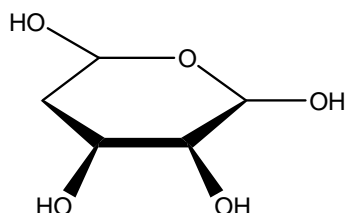
a)



b)



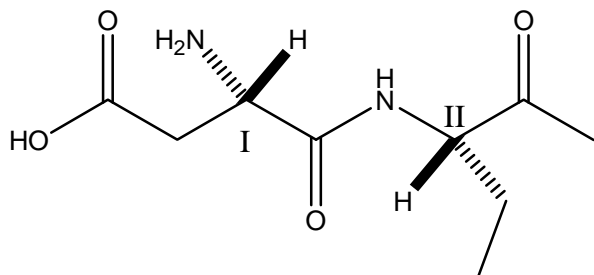
c)



d)

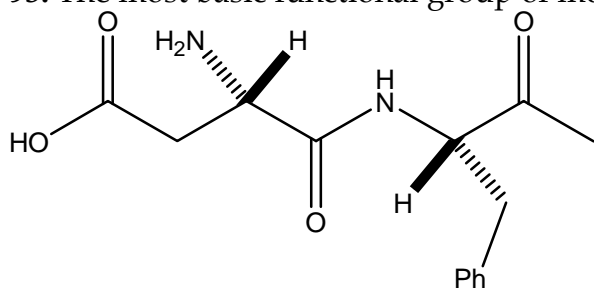


92. The absolute configurations of carbons I and II on the molecule below are, respectively:



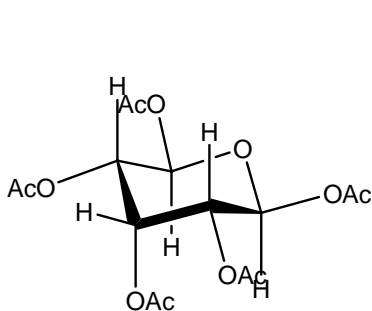
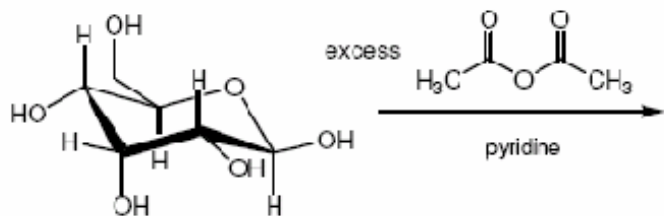
- a) R and R
- b) R and S
- c) S and R
- d) S and S

93. The most basic functional group of molecule below would be the:

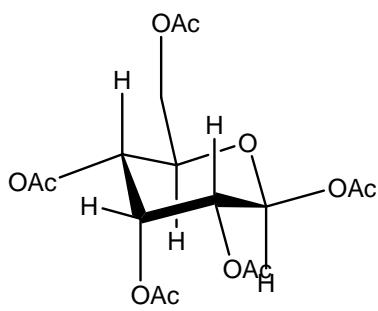


- a) aromatic ring
- b) ester carbonyl oxygen
- c) amino group
- d) amide nitrogen

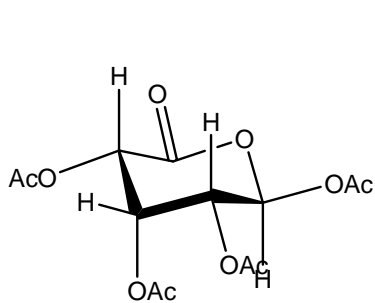
94. What is the major organic product of the reaction below?



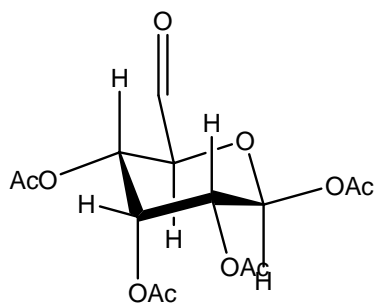
a)



b)

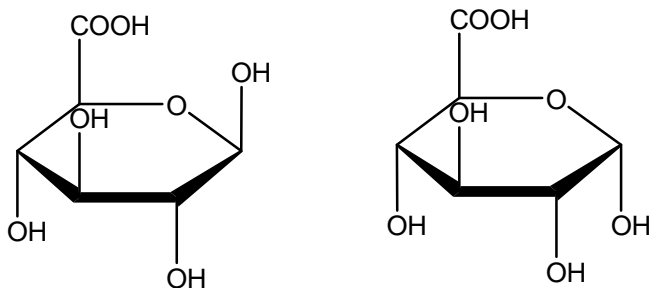


c)



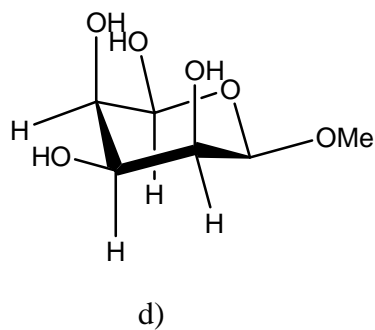
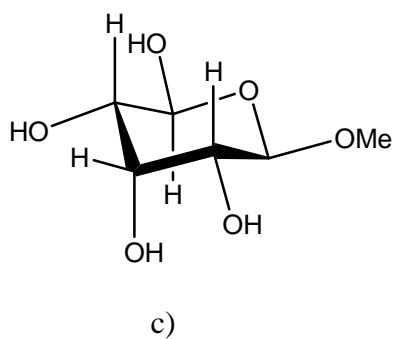
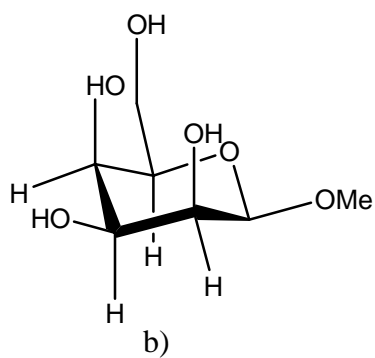
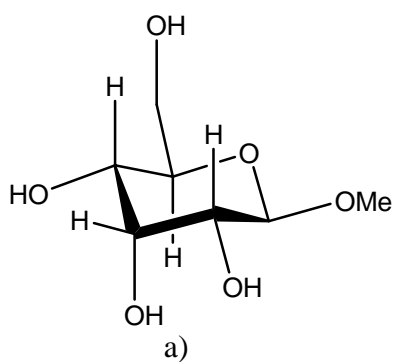
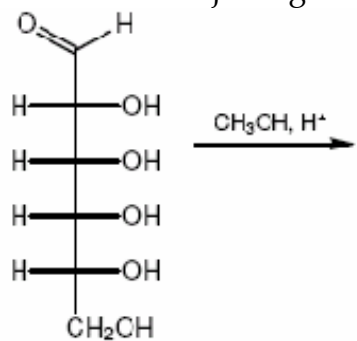
d)

95. The two molecules may accurately be described by which of the following?

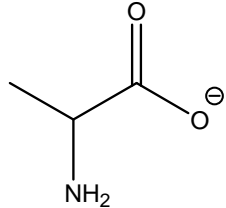
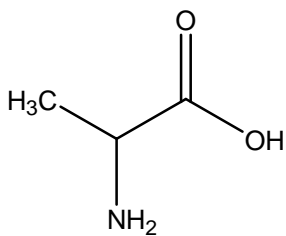


- I. Anomers
  - II. Diastereomers
  - III. Epimers
- a) I only  
b) II only  
c) I and III only  
d) I, II, and III

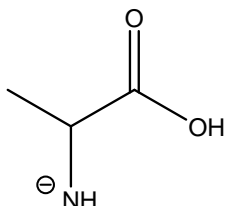
96. What is the major organic product of the reaction below?



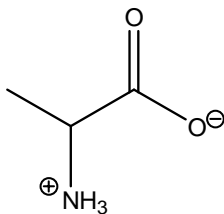
97. What is the zwitterionic form of the following amino acid?



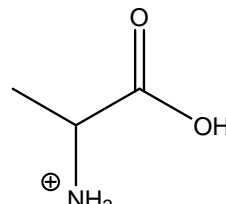
a)



b)

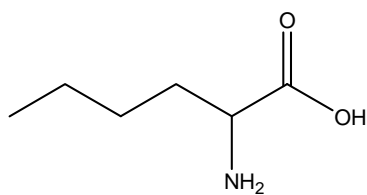


c)

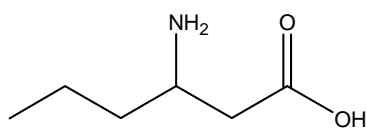


d)

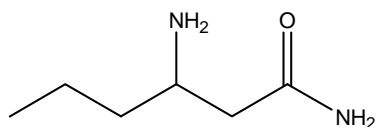
98. Which one of the following molecules would correctly be called an  $\alpha$ -amino acid?



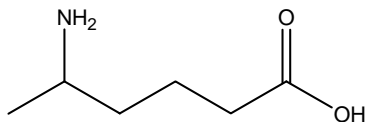
a)



b)



c)

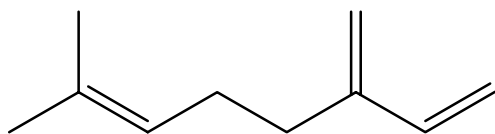


d)

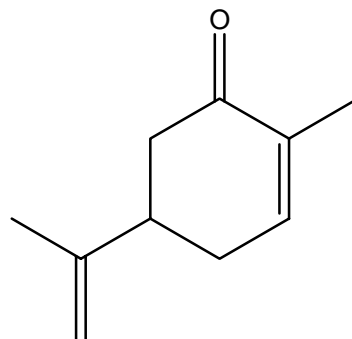
99. Which of the following fatty acids will be liquids at room temperature?

- a)  $\text{CH}_3(\text{CH}_2)_{10}\text{COOH}$
- b)  $\text{CH}_3(\text{CH}_2)_7\text{CH}_2\text{CH}(\text{CH}_2)_7\text{COOH}$
- c)  $\text{CH}_3(\text{CH}_2)_{18}\text{COOH}$
- d)  $\text{CH}_3(\text{CH}_2)_4(\text{CH}=\text{CHCH}_2)_4\text{CH}_2\text{CH}_2\text{COOH}$  (cis, trans)

100. How many isoprene units are in myrcene and carvone respectively?



myrcene



carvone

- a) 2, 3
- b) 4, 4
- c) 3, 3
- d) 2, 2