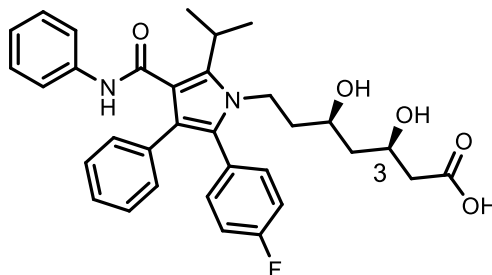


Problem Set #4, January 2018

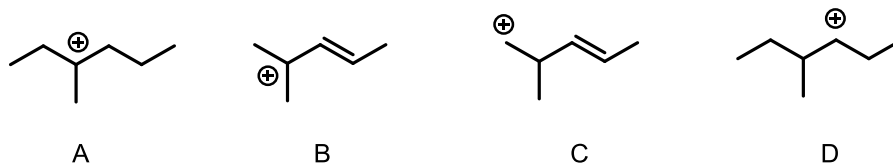
Questions 61-66 refer to the structure of atorvastatin, marketed under the trade name Lipitor, shown below. This statin is used to treat heart disease as a lipid-lowering drug and has been a blockbuster drug since its launch in 1996.



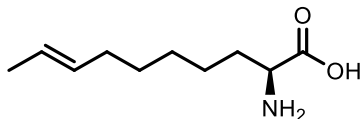
61. How many degrees of unsaturation are in the molecule?
- 11
 - 12
 - 13
 - 15
 - 17
62. How many sp^2 -hybridized carbon atoms are in the molecule?
- 18
 - 20
 - 22
 - 24
 - 26
63. Which of the following functional groups are NOT in the molecule?
- isopropyl
 - diol
 - ether
 - carboxylic acid
 - amide
64. What is the best way to describe the chirality of carbon 3?
- S
 - R
 - E
 - Z
 - The carbon is racemic

65. Would you expect to find a medium intensity infrared absorbance band at around 1550 cm^{-1} for atorvastatin? What functional group would this band correspond to?
- No – secondary alcohol
 - No – carboxylic acid
 - No – carbonyl
 - Yes – carbonyl
 - Yes – aromatic ring
66. If atorvastatin was treated with methanol and catalytic acid, what new functional group would be formed?
- methyl ether
 - ketal
 - methyl amide
 - methyl ester
 - tert*-butyl alkane

67. Rank the following carbocations in order of decreasing stability (most stable to least stable).

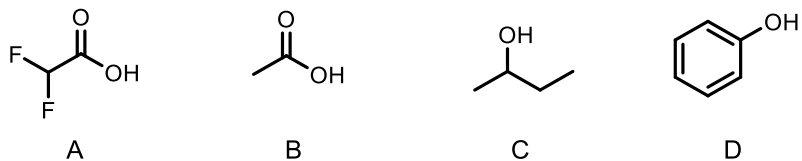


- $A > B > D > C$
 - $C > D > A > B$
 - $B > A > C > D$
 - $A > D > B > C$
 - $B > A > D > C$
68. Which of the following names represents the following molecule?



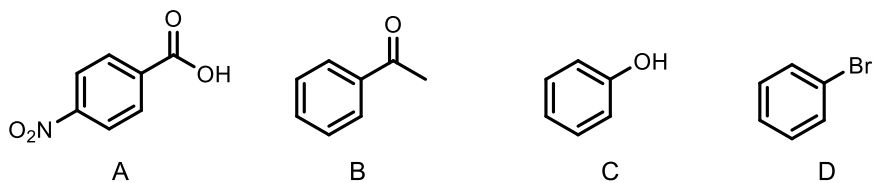
- (R,E)-2-aminodec-8-enoic acid
- (S,E)-2-aminodec-8-enoic acid
- (S,Z)-2-aminodec-8-enoic acid
- (R,Z)-2-aminodec-8-enoic acid
- None of the above

69. Rank the following compounds in order of decreasing acidity (most acidic to least acidic).



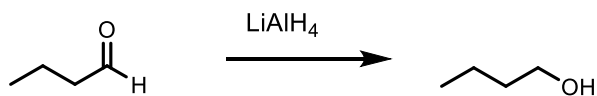
- a. A > B > D > C
- b. C > D > A > B
- c. C > D > B > A
- d. D > C > B > A
- e. A > B > C > D

70. Rank the following compounds in order of decreasing rate of electrophilic aromatic substitution (fastest to slowest).



- a. A > B > D > C
- b. C > D > A > B
- c. C > D > B > A
- d. D > C > B > A
- e. A > B > C > D

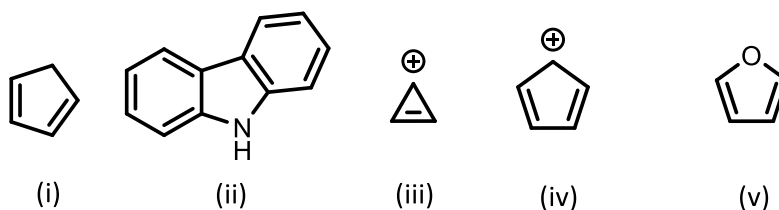
71. Which of the following statements is false about the reaction of butanal with lithium aluminium hydride?



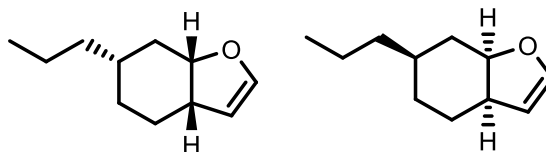
- a. The reaction requires aqueous workup.
- b. The reaction is a reduction.
- c. Lithium aluminium hydride reacts selectively with aldehydes in the presence of other carbonyls.
- d. The reaction should be done in an aprotic environment.
- e. Lithium aluminium hydride acts as a nucleophile.

72. Examining the proton(s) attached to carbon 1 in question 71, what would you expect from the starting material to the product in the ^1H NMR?
- There would be no change in the multiplicity, as both signals would be singlets.
 - The chemical shift would be shifted downfield.
 - The chemical shift would be shifted upfield.
 - The peak integration would remain the same.
 - The peak integration would decrease.
73. How many singlet signals would you expect in the ^1H NMR spectrum for 4-isobutyl-2-methylphenol?
- 1
 - 2
 - 3
 - 4
 - 5

74. Which of the following compounds are aromatic?

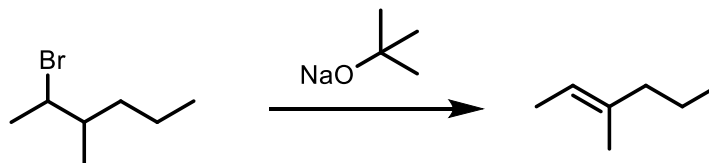


- i, iv, v
 - ii, iv, v
 - i, ii, iii
 - ii, iii, iv
 - ii, iii, v
75. The following structures represent which of the following?



- An achiral pair
- Enantiomers
- Diastereomers
- A racemic mixture
- Meso compounds

76. The mechanism of the following reaction is best described as...

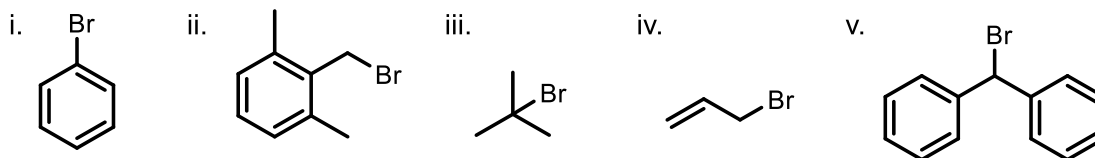


- a. S_N1 b. S_N2 c. E1 d. E2 e. radical

77. Which of the following is true for the reaction in 77?

- a. The reaction involves a carbocation intermediate.
b. The reaction requires an anti-periplanar configuration.
c. The reaction does not follow Zaitsev's rule.
d. The reaction involves a radical intermediate.
e. Two of the above statements are true.

78. Which of the following substrates will give the fastest S_N2 reaction?

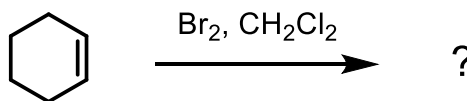


- a. i b. ii c. iii d. iv e. v

79. What reagent(s) could be used to convert (Z)-4-methyloct-4-ene to 4-methyloctan-4-ol in good yield?

- a. H₂O, H₂SO₄
b. H₂, Pd/C
c. 1) Hg(OAc)₂, H₂O 2) NaBH₄
d. 1) OsO₄ 2) NaHSO₃
e. 1) BH₃, THF 2) H₂O₂/NaOH

80. The product of the following reaction can be best described as...



- a. 1,2-dibromocyclohexane
b. 1,2-dichlorocyclohexane
c. 1,2-dibromocyclohex-1-ene
d. 1-bromocyclohex-1-ene
e. 3-bromocyclohex-1-ene