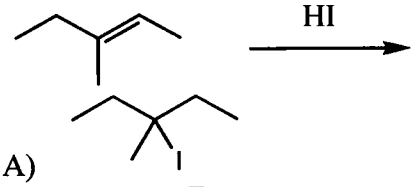
ORGANIC CHEMISTRY-2323; REVIEW 4; FALL 2010

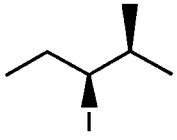
1. The interaction of the π bond of an alkene with an electrophile can initially result in the formation of a species termed a π complex. Which of these cannot combine with an alkene to form a π complex?
   A) H^+
   B) NH_3
   C) Ag^+
   D) Hg^{2+}
   E) BF_3

2. Markovnikov addition of HI to 2-methyl-2-butene involves:
   A) initial attack by an iodide ion.
   B) initial attack by an iodine atom.
   C) isomerization of 2-iodo-2-methylbutene.
   D) formation of a carbocation at C-2.
   E) formation of carbocation at C-3.

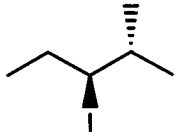
3. What is the *major* product for the following reaction?



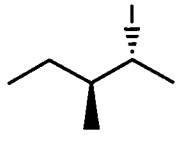
A)



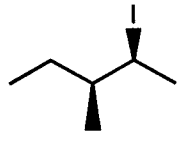
B) + enantiomer



C) + enantiomer

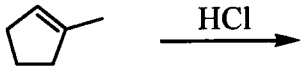


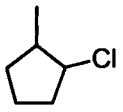
D) + enantiomer



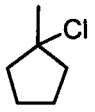
E) + enantiomer

4. What would be the major product of the following reaction?

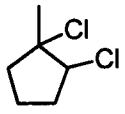




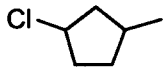
I



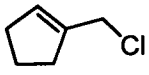
II



III



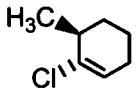
IV



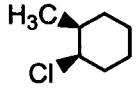
V

A) I
B) II
C) III
D) IV
E) V

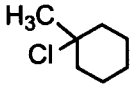
5. Treating 1-methylcyclohexene with HCl would yield primarily which of these?



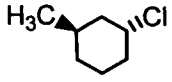
I



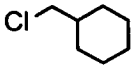
II



III



IV



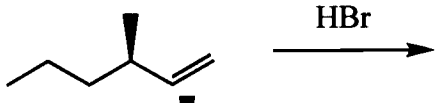
V

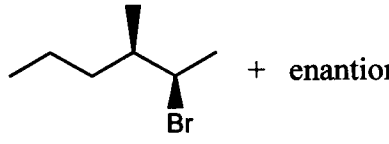
A) I
B) II
C) III
D) IV
E) V

6. How many compounds are possible from the addition of bromine to $CH_2{=}CHCH_2CH_3$ (counting stereoisomers separately)?
A) One
B) Two
C) Three
D) Four
E) Five

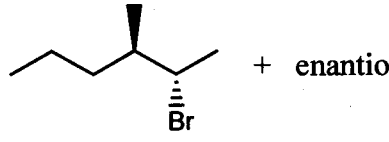
7. (R)-3-Chloro-1-butene reacts with HCl by Markovnikov addition, and the products are separated by gas chromatography. How many total fractions would be obtained and how many would be optically active?
   A) One optically active fraction only
   B) One optically active fraction and one optically inactive
   C) Two optically active fractions
   D) One optically active fraction and two optically inactive
   E) Two optically active fractions and one optically inactive

8. What is the *major* product for the following reaction?

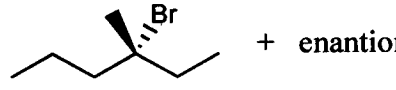


A) 

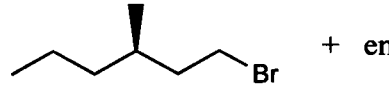
+ enantiomer

B) 

+ enantiomer

C) 

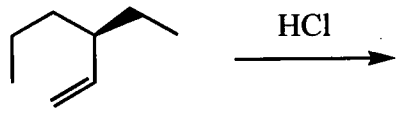
+ enantiomer

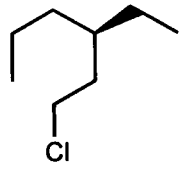
D) 

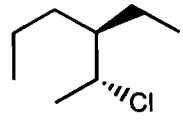
+ enantiomer

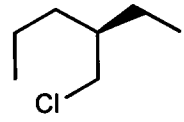
E) More than one of the above

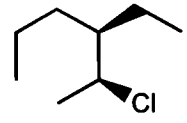
9. What is the *major* product for the following reaction?

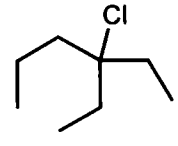


A) 

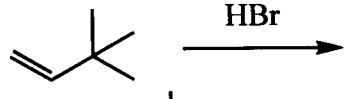
B) 

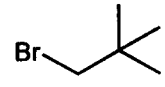
C) 

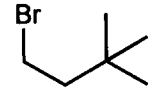
D) 

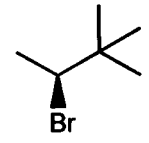
E) 

10. What is the *major* product for the following reaction?

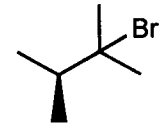


A) 

B) 

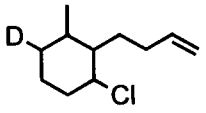
C) 

+ enantiomer

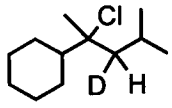
D) 

E) More than one of the above

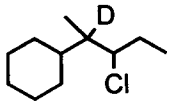
11. What product would you expect from addition of deuterium chloride to 2-cyclohexyl-4-methyl-2-pentene?



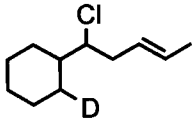
I



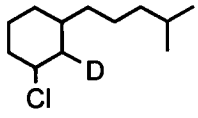
II



III



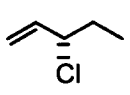
IV



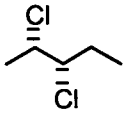
V

A) I
B) II
C) III
D) IV
E) V

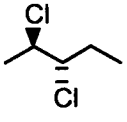
12. Addition of hydrogen chloride to the following molecule would produce:



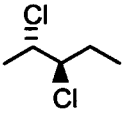
HCl → ?



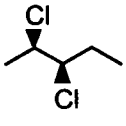
I



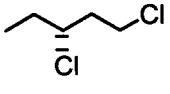
II



III



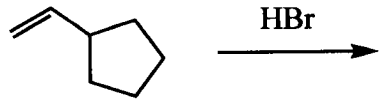
IV

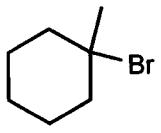


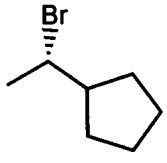
V

A) I and II
B) II and III
C) I and IV
D) V
E) All of the above are equally likely to be formed

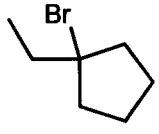
13. What are possible products for the following reaction?



A) 

B) 

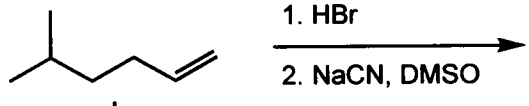
+ enantiomer

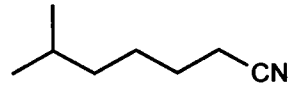
C) 

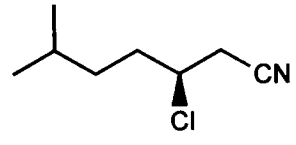
D) A) and C)

E) None of the above

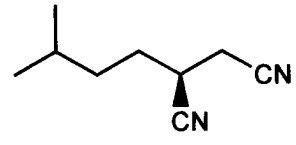
14. What is the *major* product of the following reaction sequence?



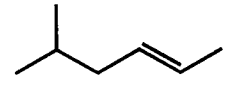
A) 

B) 

+ enantiomer

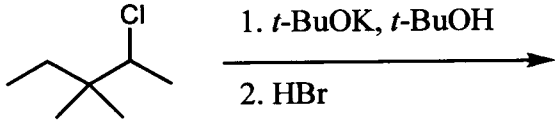
C) 

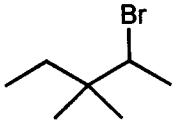
+ enantiomer

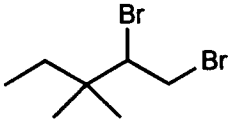
D) 

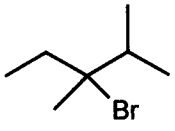
E) None of the above

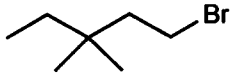
15. What is the *major* product of the following reaction sequence?



A) 

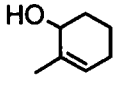
B) 

C) 

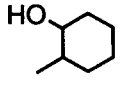
D) 

E) None of the above

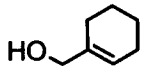
16. Treating 1-methylcyclohexene with H_3O^+ would yield primarily which of these?



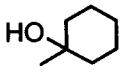
I



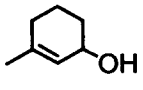
II



III



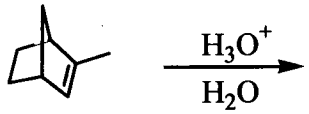
IV

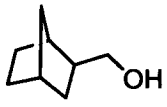


V

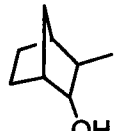
A) I and V
B) II
C) III and V
D) IV
E) I, III and V

17. Which product would you expect from the following reaction?

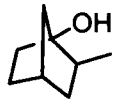




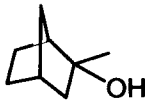
I



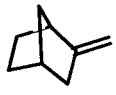
II



III



IV



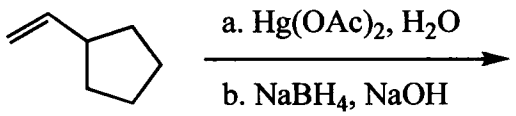
V

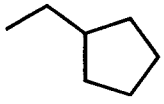
A) I
B) II
C) III
D) IV
E) V

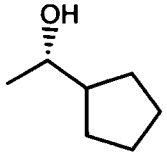
18. Acid-catalyzed hydration of 2-methyl-1-butene would yield which of the following?
A) $(CH_3)_2C(OH)CH_2CH_3$
B) $CH_2OHCH(CH_3)CH_2CH_3$
C) $(CH_3)_2CHCHOHCH_3$
D) $(CH_3)_2CHCH_2CH_2OH$
E) $CH_3CH_2CH(CH_3)CH_2OH$

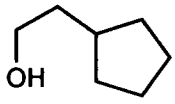
19. When either cis- or trans-2-butene is treated with hydrogen chloride in ethanol, the product mixture that results includes:
A) $CH_3CH_2CH_2CH_2Cl$
B) $CH_3CH_2CH_2CH_2OCH_2CH_3$
C) $CH_3CH_2CH(CH_3)OCH_2CH_3$
D) $(CH_3)_3CCl$
E) $(CH_3)_2CHCH_2OCH_2CH_3$

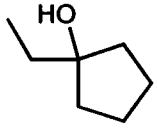
20. What is the *major* product for the following reaction?



A) 

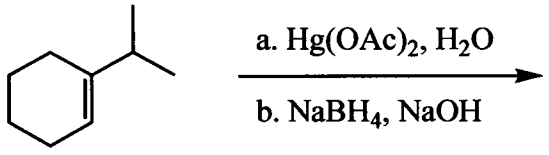
B)  + enantiomer

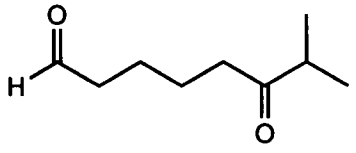
C) 

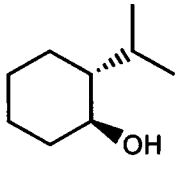
D) 

E) More than one of the above

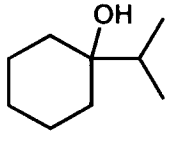
21. What is the *major* product for the following reaction?

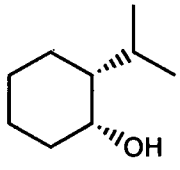


A) 

B) 

+ enantiomer

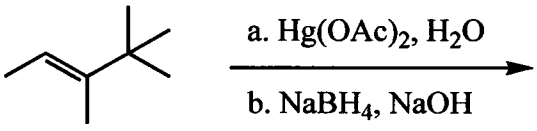
C) 

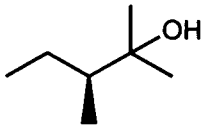
D) 

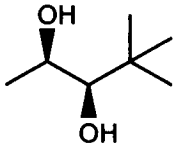
+ enantiomer

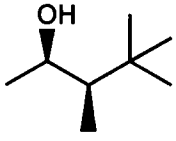
E) None of the above

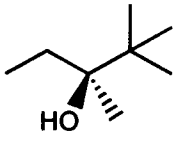
22. What is the *major* product for the following reaction?

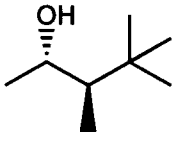


A)  + enantiomer

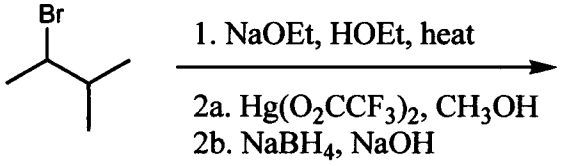
B)  + enantiomer

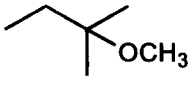
C)  + enantiomer

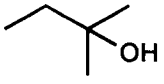
D)  + enantiomer

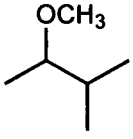
E)  + enantiomer

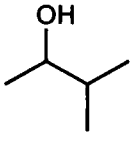
23. What is the *major* product of the following reaction sequence?



A) 

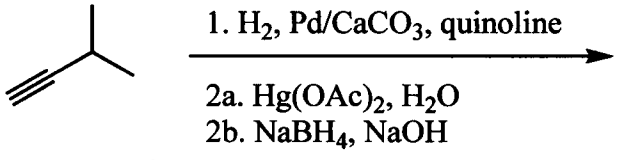
B) 

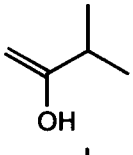
C) 

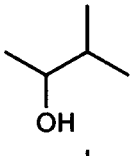
D) 

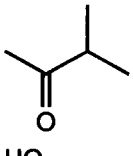
E) More than one of the above

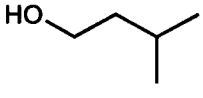
24. What is the *major* product of the following reaction sequence?

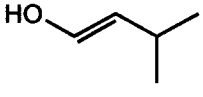


A) 

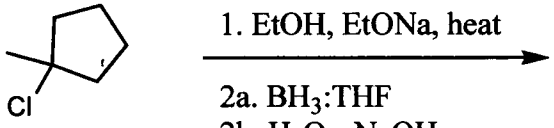
B) 

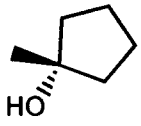
C) 

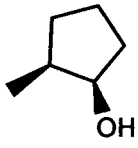
D) 

E) 

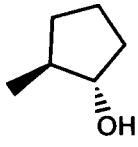
25. What is the *major* product of the following reaction sequence?



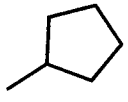
A) 

B) 

+ enantiomer

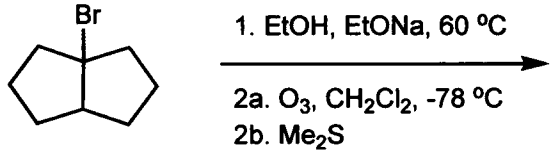
C) 

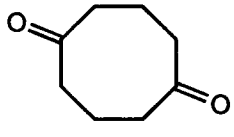
+ enantiomer

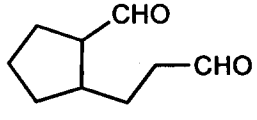
D) 

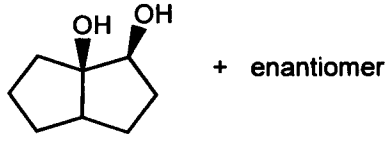
E) An equal mixture of B) and C)

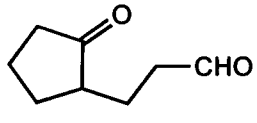
26. What is the *major* product of the following reaction sequence?



A) 

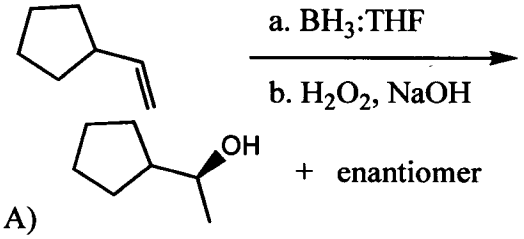
B) 

C) 

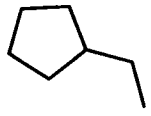
D) 

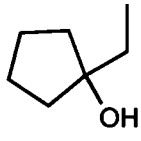
E) More than one of the above

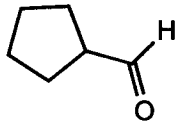
27. What is the *major* product for the following reaction?

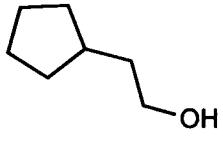


A) + enantiomer

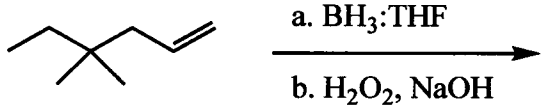
B) 

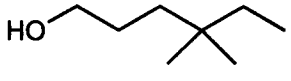
C) 

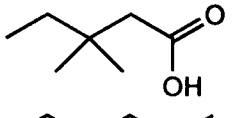
D)  + HCHO

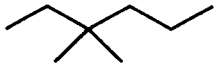
E) 

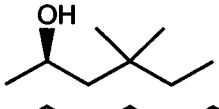
28. What is the *major* product for the following reaction?

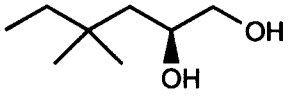


A) 

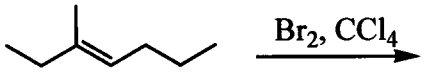
B)  + CO_2

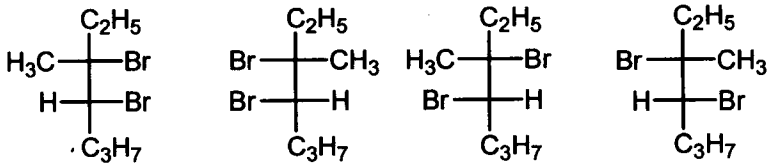
C) 

D)  + enantiomer

E)  + enantiomer

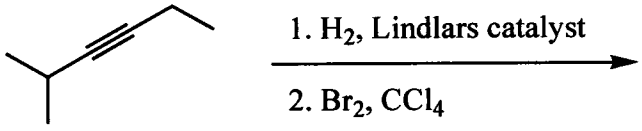
29. What would be the major product of the following reaction?

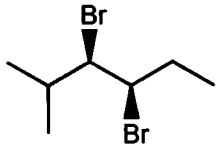




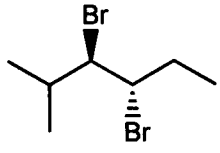
A) Equal amounts of I and II
B) Equal amounts of II and III
C) Equal amounts of III and IV
D) I and II as major products, III and IV as minor products
E) All of the above in equal amounts

30. What is the *major* product of the following reaction sequence?

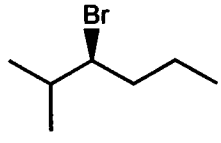


A) 

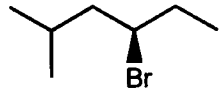
+ enantiomer

B) 

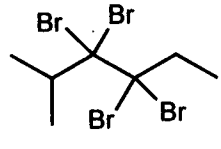
+ enantiomer

C) 

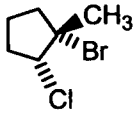
+ enantiomer

D) 

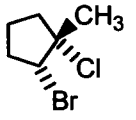
+ enantiomer

E) 

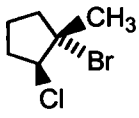
31. The reaction of BrCl (bromine monochloride) with 1-methylcyclopentene will produce as the predominant product:



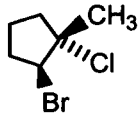
+ enantiomer I



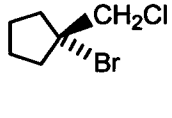
+ enantiomer II



+ enantiomer III



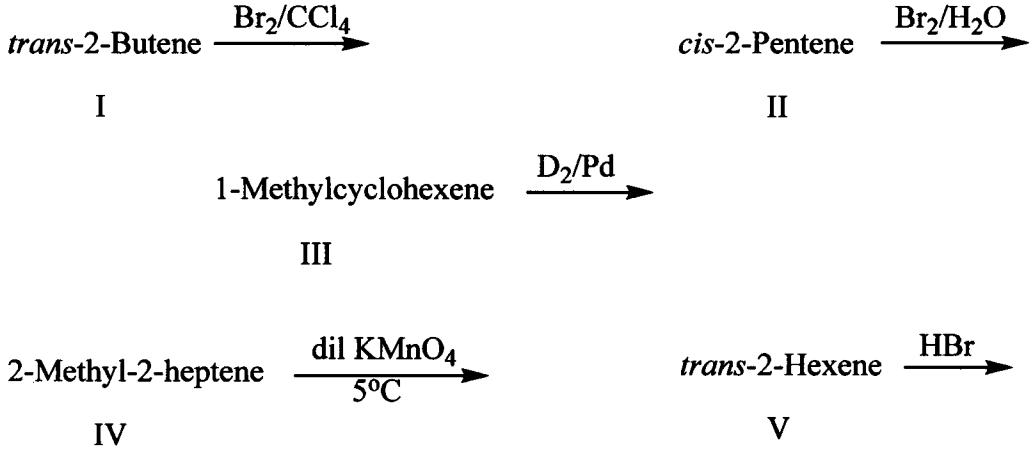
+ enantiomer IV



+ enantiomer V

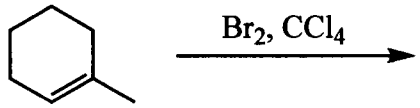
A) I
B) II
C) III
D) IV
E) V

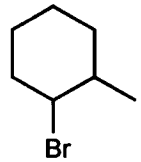
32. Which reaction is NOT stereospecific?

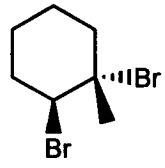


A) I
B) II
C) III
D) IV
E) V

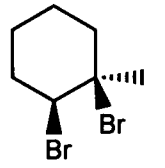
33. What is the *major* product for the following reaction?



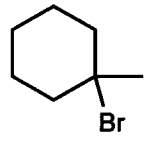
A) 

B) 

+ enantiomer

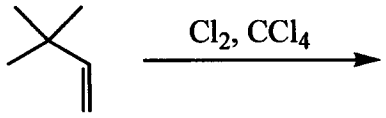
C) 

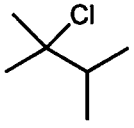
+ enantiomer

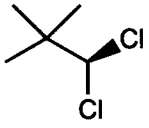
D) 

E) More than one of the above

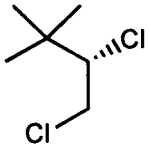
34. What is the *major* product for the following reaction?



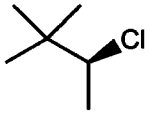
A) 

B) 

+ enantiomer

C) 

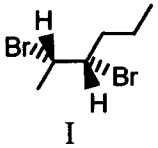
+ enantiomer

D) 

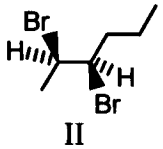
+ enantiomer

E) More than one of the above

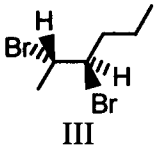
35. Reaction of <u>*trans*</u>-2-hexene with a solution of Br_2 in CCl_4 produces:



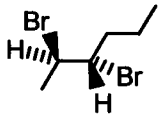
I



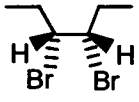
II



III



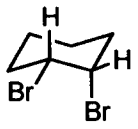
IV



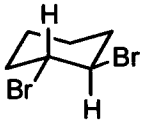
V

A) I and II
B) II and V
C) III and IV
D) IV and V
E) V

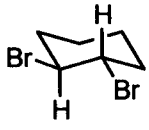
36. The reaction of Br_2/CCl_4 to cyclohexene would produce the compound(s) represented by structure(s):



I



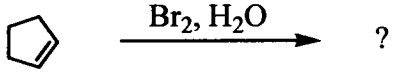
II

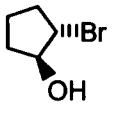


III

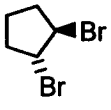
A) I alone
B) II alone
C) II and III
D) III alone
E) I , II and II

37. What would be the major product of the following reaction?

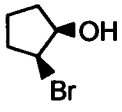




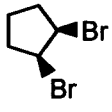
I



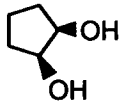
II



III



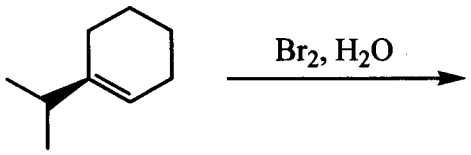
IV

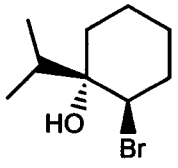


V

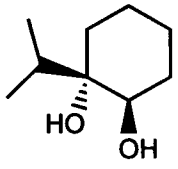
A) I
B) II
C) III
D) IV
E) V

38. What is the *major* product for the following reaction?

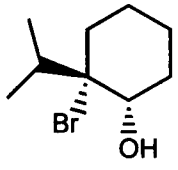


A) 

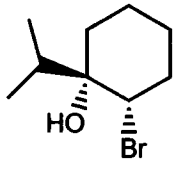
+ enantiomer

B) 

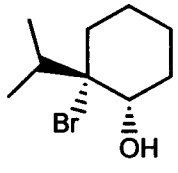
+ enantiomer

C) 

+ enantiomer

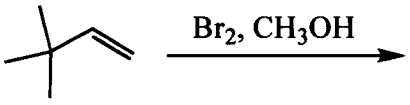
D) 

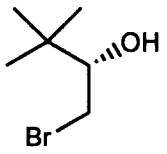
+ enantiomer

E) 

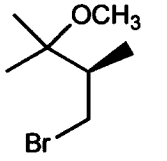
+ enantiomer

39. What is the *major* product for the following reaction?

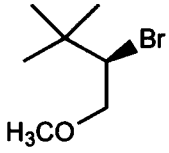


A) 

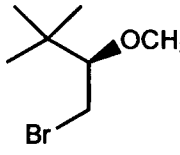
+ enantiomer

B) 

+ enantiomer

C) 

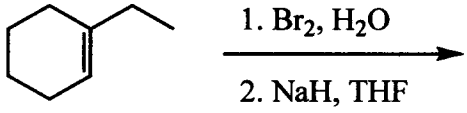
+ enantiomer

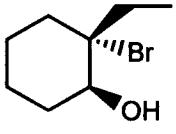
D) 

+ enantiomer

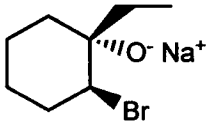
E) More than one of the above

40. What is the *major* product of the following reaction sequence?

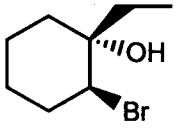


A) 

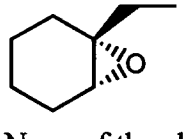
+ enantiomer

B) 

+ enantiomer

C) 

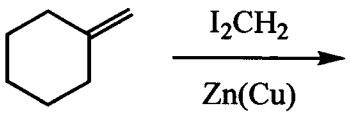
+ enantiomer

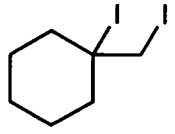
D) 

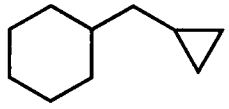
+ enantiomer

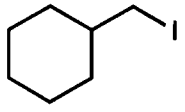
E) None of the above

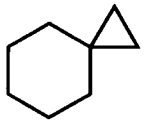
41. What is the *major* product for the following reaction?



A) 

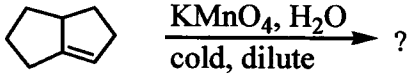
B) 

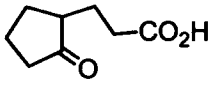
C) 

D) 

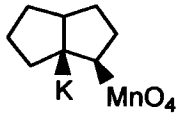
E) More than one of the above

42. What product would result from the following reaction?

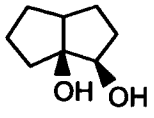




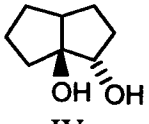
I



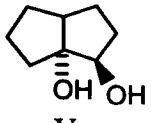
II



III



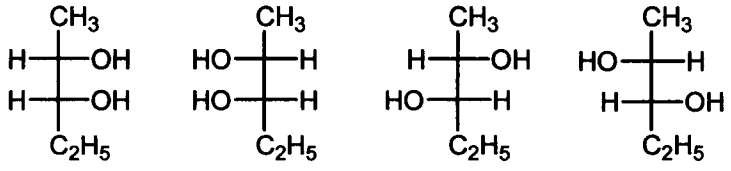
IV



V

A) I
B) II
C) III
D) IV
E) V

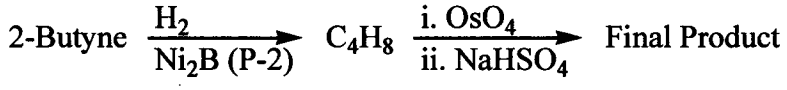
43. Hydroxylation of *cis*-2-pentene with cold alkaline $KMnO_4$ yields

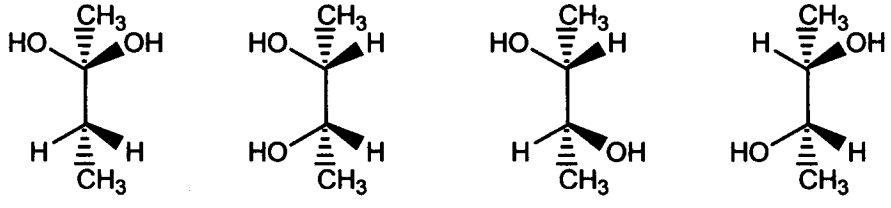


I II III IV

A) Equal amounts of I and II
B) Equal amounts of II and III
C) Equal amounts of III and IV
D) I and II as major products, III and IV as minor products
E) All of the above in equal amounts

44. What is the final product of the following synthesis?





I II III IV

A) I
B) II
C) III
D) IV
E) An equimolar mixture of III and IV

45. Which reaction would yield a meso compound?

A) *cis*-2-Butene $\xrightarrow{Br_2/CCl_4}$

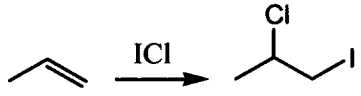
B) *cis*-2-Butene $\xrightarrow{H_2/Pd}$

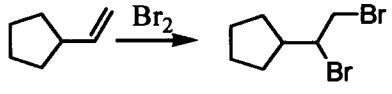
C) *cis*-2-Butene $\xrightarrow[ii)\ NaHSO_3]{i)\ OsO_4}$

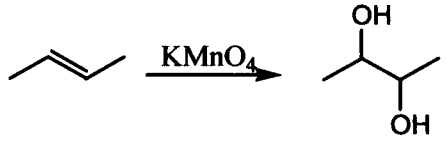
D) *trans*-2-Butene $\xrightarrow[5^oC]{dil\ KMnO_4}$

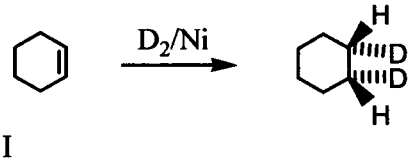
E) None of these

46. Which reaction is regioselective?

I 

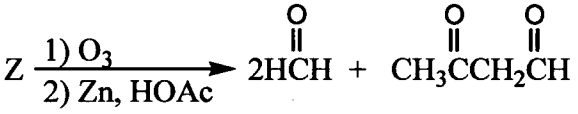
II 

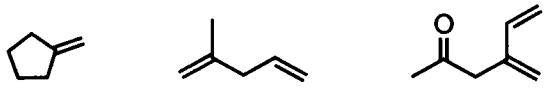
III 

IV 

A) I
B) II
C) III
D) IV
E) None of these

47. Ozonolysis of compound Z yields the products shown below. What is the structure of Z?





I II III

IV V

A) I
B) II
C) III
D) IV
E) V

48. An alkene adds hydrogen in the presence of a catalyst to give 3,4-dimethylhexane. Ozonolysis of the alkene followed by treatment with zinc and acetic acid gives a single organic product. The structure of the alkene is:

A) $CH_3CH{=}C(CH_3)CH(CH_3)CH_2CH_3$ (cis or trans)

B) $CH_3CH_2C(CH_3){=}CCH_3$ (cis or trans)

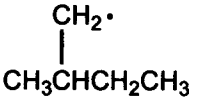
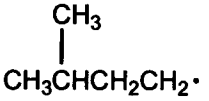
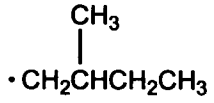
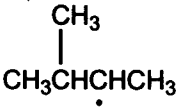
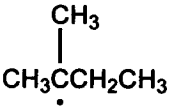
C) $CH_2{=}C(CH_3)CH_2CH(CH_3)CH_2CH_3$

D) $CH_3CH_2C(=CH_2)CH(CH_3)CH_2CH_3$

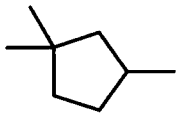
E) $CH_3CH_2CH(CH_3)CH(CH_3)CH{=}CH_2$

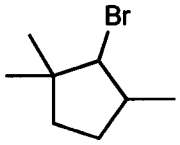
49. Addition of 2 mol of HCl to 1-butyne would yield:
    A) $CH_3CH_2CH_2CHCl_2$
    B) $CH_3CH_2CCl_2CH_3$
    C) $CH_3CH_2CHClCH_2Cl$
    D) $CH_3CH_2CH{=}CHCl$
    E) $CH_3CHClCHClCH_3$

50. As the term "peroxide" is used in Chapter 10, it can refer to which structure(s)?
    A) ROOR
    B) ROOH
    C) 
    D) Answers A) and B) only
    E) Answers A), B) and C)

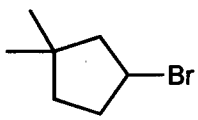
51. Which of the following free radicals is the most stable?
    A) 
    B) 
    C) 
    D) 
    E) 

52. Hydrogen atom abstraction from which position would yield the most stable free radical intermediate during the reaction of bromine with 2,2,3-trimethylpentane?
    A) C1
    B) C2
    C) C3
    D) C4
    E) C5

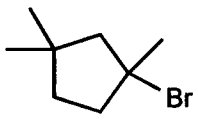
53. Mono-bromination of the following alkane,  , (using Br_2 with light) would be?



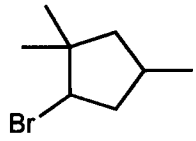
I



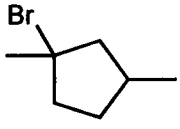
II



III

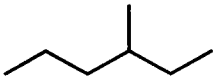


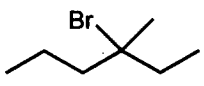
IV



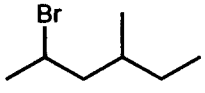
V

A) I
B) II
C) III
D) IV
E) V

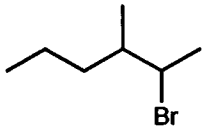
54. Mono-bromination of the following alkane,  , (using Br_2 with light) would be?



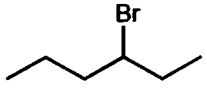
I



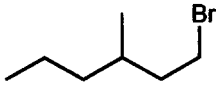
II



III

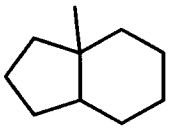


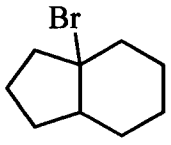
IV



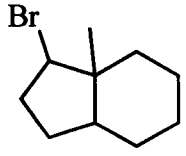
V

A) I
B) II
C) III
D) IV
E) V

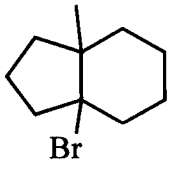
55. Mono-bromination of the following alkane,  , (using Br_2 with light) would be?



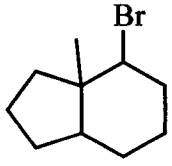
I



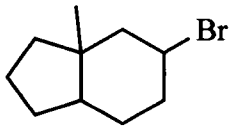
II



III



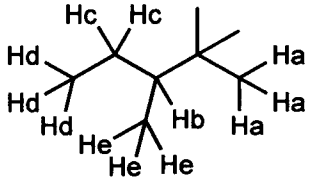
IV



V

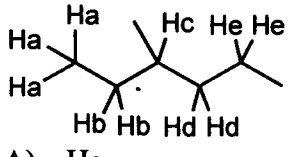
A) I
B) II
C) III
D) IV
E) V

56. Which hydrogen would be abstracted first when mono-brominating with Br_2 and light?



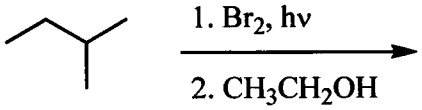
A) Ha
B) Hb
C) Hc
D) Hd
E) He

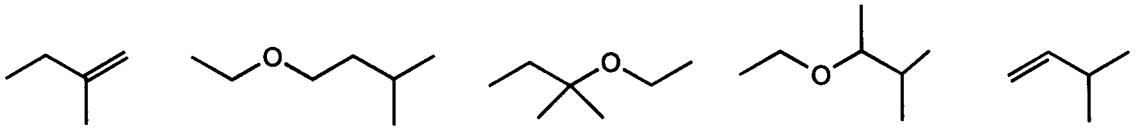
57. Which hydrogen would be abstracted first when mono-brominating with Br_2 and light?



A) Ha
B) Hb
C) Hc
D) Hd
E) He

58. What would be the major product of the following reaction sequence?

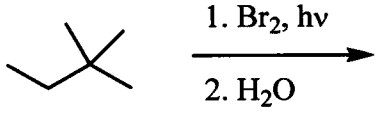


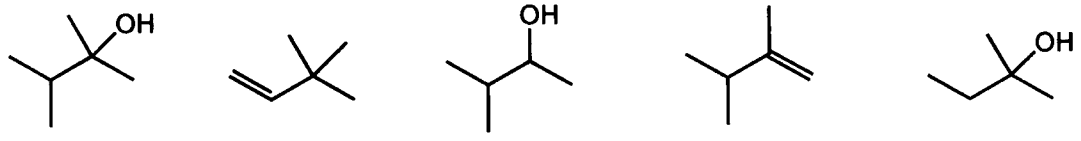


I II III IV V

A) I
B) II
C) III
D) IV
E) V

59. What is the product for the following reaction sequence?

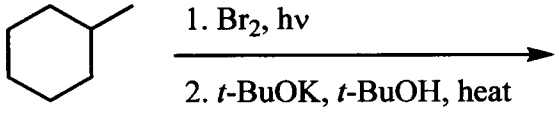


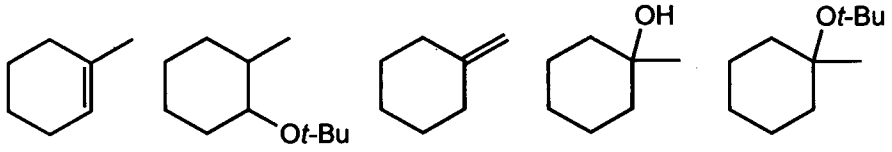


I II III IV V

A) I
B) II
C) III
D) IV
E) V

60. What would be the major product of the following reaction sequence?

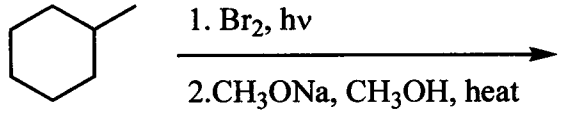


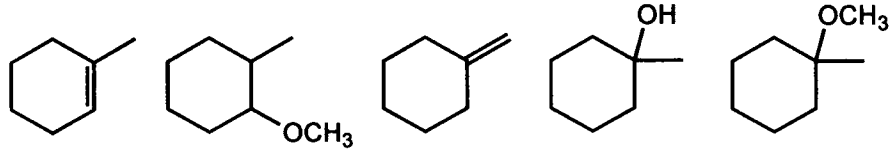


I II III IV V

A) I
B) II
C) III
D) IV
E) V

61. What would be the major product of the following reaction sequence?

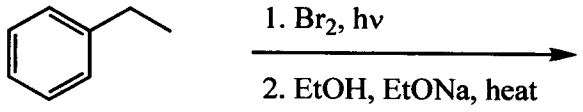


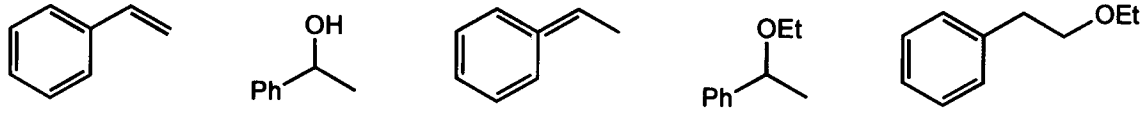


I II III IV V

A) I
B) II
C) III
D) IV
E) V

62. What would be the major product of the following reaction sequence?



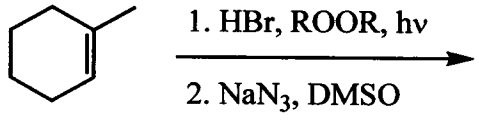


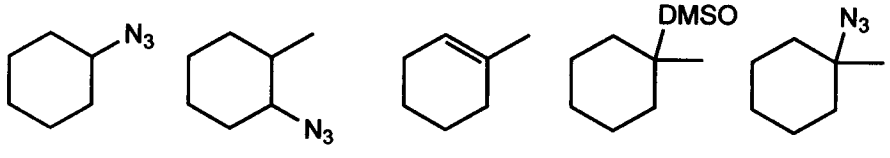
I II III IV V

A) I
B) II
C) III
D) IV
E) V

63. The p-orbital of a methyl radical carbon, $CH_3\cdot$, contains how many electrons?
A) 1
B) 2
C) 3
D) 4
E) 0

64. What would be the major product of the following reaction sequence?

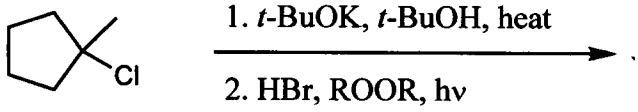


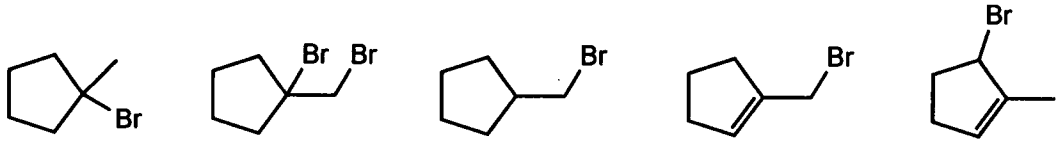


I II III IV V

A) I
B) II
C) III
D) IV
E) V

65. What would be the major product of the following reaction sequence?

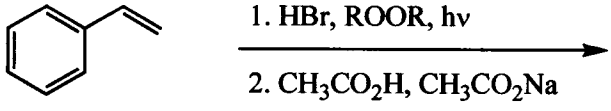


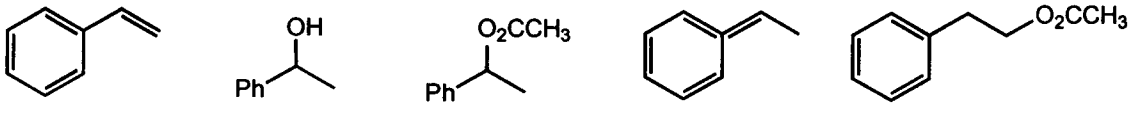


I II III IV V

A) I
B) II
C) III
D) IV
E) V

66. What would be the major product of the following reaction sequence?

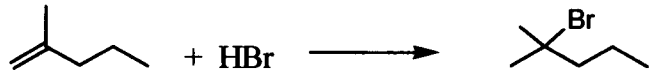


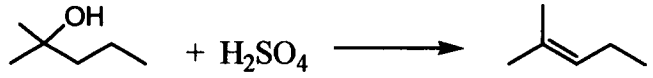


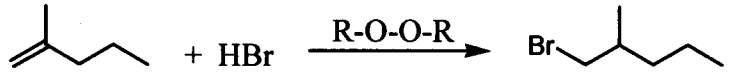
I II III IV V

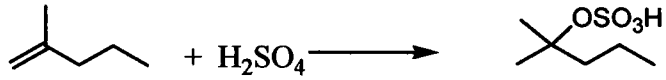
A) I
B) II
C) III
D) IV
E) V

67. Carbocations are NOT intermediates in which one of the following reactions?

A) 

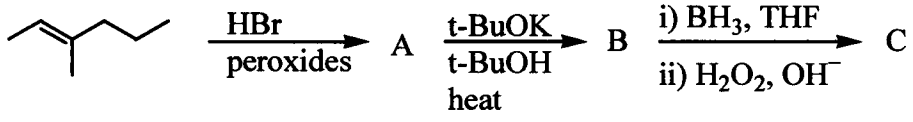
B) 

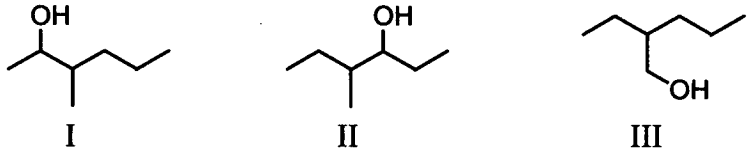
C) 

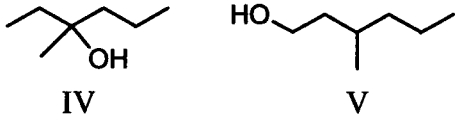
D) 

E) More than one of the above

68. What is the major product obtained from the following reaction sequence?

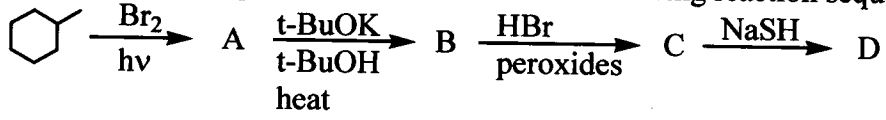


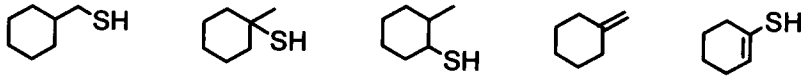




A) I
B) II
C) III
D) IV
E) V

69. What is the major product obtained from the following reaction sequence?

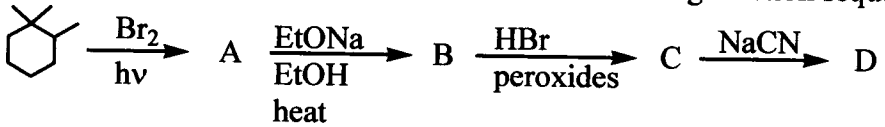


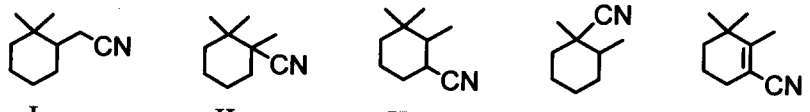


I II III IV V

A) I
B) II
C) III
D) IV
E) V

70. What is the major product obtained from the following reaction sequence?





I II III IV V

A) I
B) II
C) III
D) IV
E) V

Answer Key

1. B
2. D
3. A
4. B
5. C
6. B
7. B
8. C
9. E
10. D
11. B
12. A
13. D
14. E
15. C
16. D
17. D
18. A
19. C
20. B
21. C
22. D
23. A
24. B
25. C
26. D
27. E
28. A
29. A
30. B
31. D
32. E
33. B
34. C
35. C
36. C
37. A
38. A
39. D
40. D
41. D
42. C
43. A
44. B

45. C
46. A
47. B
48. B
49. B
50. E
51. E
52. C
53. C
54. A
55. C
56. B
57. C
58. C
59. A
60. C
61. A
62. A
63. A
64. B
65. C
66. E
67. C
68. E
69. A
70. C