CHM 1321 (prof. S. Gambarotta) Suppl. Exam July 11 – 2008

Your Name: _____ Student #: _____

Your course TA (Steve, Jenn C, Jenn P): _____

Exercise	key	Exercise	key	Exercise	key
1		25		49	
2		26		50	
3		27		51	
4		28		52	
5		29			
6		30			
7		31			
8		32			
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23		47			
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1. You can keep the text. The solution key will be posted today on the web.

Open book exam. Only a clean textbook is allowed. Molecular models are also allowed. Blank pages at the end.

1. According to molecular orbital theory, in the case of a carbon-carbon double bond, the carbon-carbon bonding electrons of higher energy occupy this molecular orbital.

A. σ bonding MO

B. π bonding MO

C. σ^* antibonding MO

D. π^* antibonding MO

E. π^* bonding MO

2. Identify the atomic orbitals in the C-C sigma bond in ethyne.

A. ($2sp^2$, $2sp^2$)

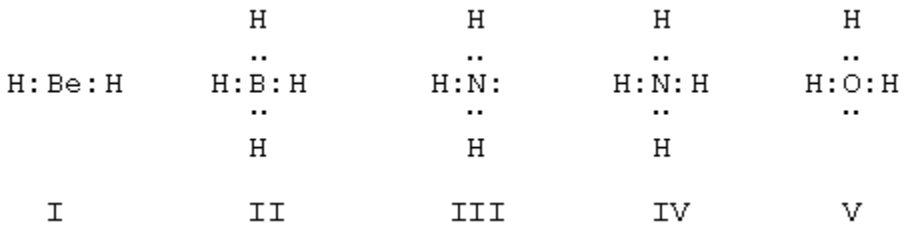
B. ($2sp^3$, $2sp^3$)

C. (2sp, 2sp)

D. (2p, 2p)

E. (2sp, 1s)

3. Listed below are electron dot formulas for several simple molecules and ions. All valence electrons are shown; however, electrical charges have been omitted deliberately.



Which of the structures actually bear(s) a positive charge?

A. I

B. II

C. III

D. III and V

E. IV and V

4. Based on VSEPR theory, which of the following would have a trigonal planar shape?

A. $(CH_3)_3N$

B. HCN

C. NH_4^+

D. CH_3^-

E. CH_3^+

5. What shape does the methyl cation, CH_3^+, have?

A. Octahedral

B. Tetrahedral

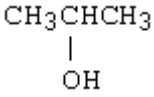
C. Trigonal planar

D. Linear

E. Trigonal pyramidal

6. Which of these would you expect to have the lowest boiling point?

A. $CH_3CH_2CH_2OH$

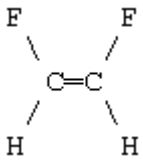
B.


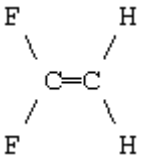
C. $CH_3OCH_2CH_3$

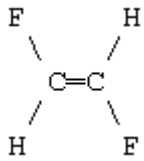
D. $CH_3CH_2CH_2CH_2OH$

E. $CH_3CH_2OCH_2CH_3$

7. Which molecule has dipole moment greater than zero?

A.


B.


C.


D. More than one of these

E. None of these

8. Which of the following is not a Lewis base?

A. NH_3

B. H^-

C. BF_3

D. H_2O

E. H_3C^-

9. Which acid-base reaction would not take place as written?

A. $CH_3Li + CH_3CH_2OH \rightarrow CH_4 + CH_3CH_2OLi$

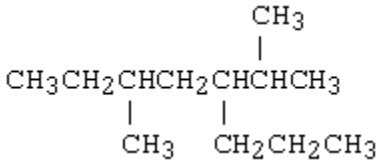
B. $HC{\equiv}CH + NaOH \rightarrow HC{\equiv}CNa + H_2O$

C. $HC{\equiv}CNa + H_2O \rightarrow HC{\equiv}CH + NaOH$

D. $CH_3OH + NaH \rightarrow CH_3ONa + H_2$

E. $CH_3CO_2H + CH_3ONa \rightarrow CH_3CO_2Na + CH_3OH$

10. A correct IUPAC name for the following compound is:



A. 2,5-Dimethyl-3-propylheptane

B. 3,6-Dimethyl-5-propylheptane

C. 6-Methyl-4-(1-methylethyl)octane

D. 2-Methyl-3-(2-methylbutyl)hexane

E. 3-Methyl-5-(1-methylethyl)octane

11. Which isomer of C_5H_{10} would you expect to have the smallest heat of combustion?

A. Cyclopentane

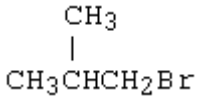
B. Methylcyclobutane

C. 1,1-Dimethylcyclopropane

D. cis-1,2-Dimethylcyclopropane

E. trans-1,2-Dimethylcyclopropane

12. What is the common name for this compound?



A. Isobutyl bromide

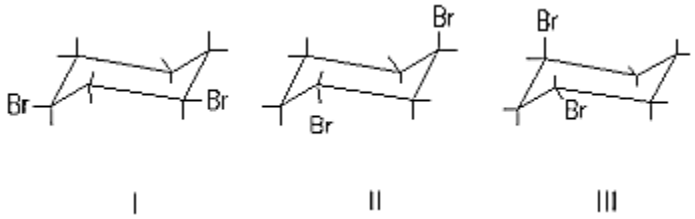
B. tert-Butyl bromide

C. Butyl bromide

D. sec-Butyl bromide

E. Bromo-sec-butane

13. cis-1,3-Dibromocyclohexane is represented by structure(s):



I II III

A. I

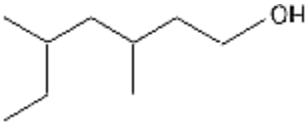
B. II

C. III

D. II and III

E. I and II

14. What is the correct IUPAC name for the following compound?



A. 5-Ethyl-3-methylhexanol

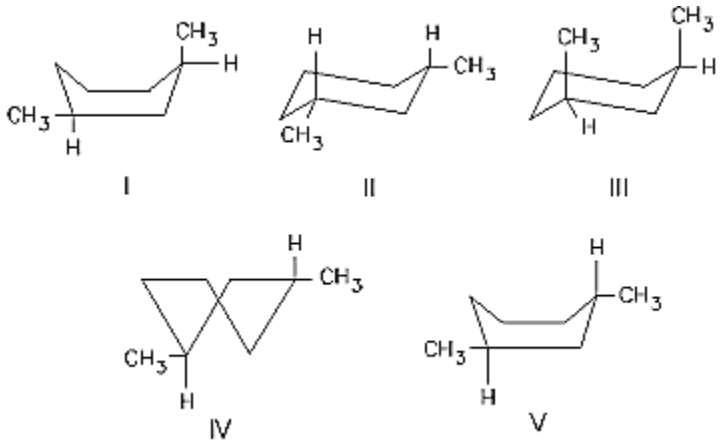
B. 5-Ethyl-3-methyl-1-hexanol

C. 2-Ethyl-4-methyl-6-hexanol

D. 3,5-Dimethyl-7-heptanol

E. 3,5-Dimethyl-1-heptanol

15. What structure represents the most stable conformation of cis-1,3-dimethylcyclohexane?



A. I

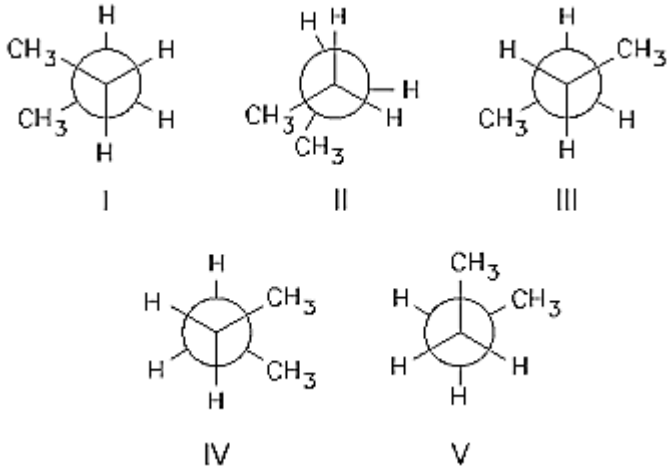
B. II

C. III

D. IV

E. V

16. The most stable conformation of butane is:



A. I

B. II

C. III

D. IV

E. V

17. The most stable conformation of trans-1-tert-butyl-3-methylcyclohexane is the one in which:

A. the tert-butyl group is axial and the methyl group is equatorial.

B. the methyl group is axial and the tert-butyl group is equatorial.

C. both groups are axial.

D. both groups are equatorial.

E. the twist boat conformation is adopted.

18. How many constitutional isomers are possible for the formula C_6H_{14}?

A. 2

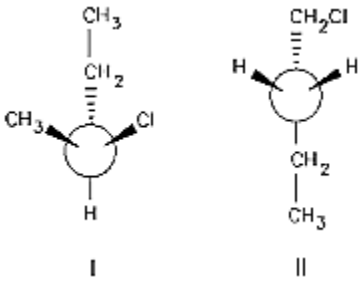
B. 3

C. 4

D. 5

E. 6

19. I and II are:



A. constitutional isomers.

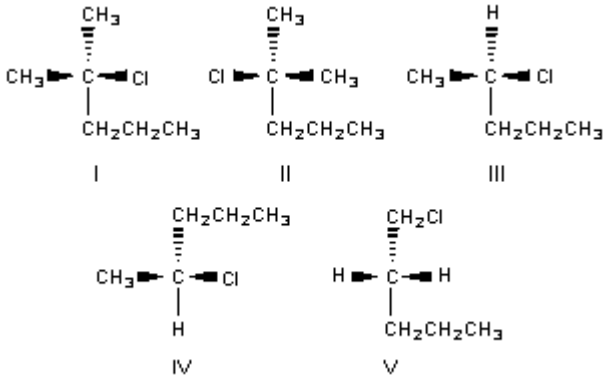
B. enantiomers.

C. non-superposable mirror images.

D. diastereomers.

E. not isomeric.

20. Pairs of enantiomers are:



A. I, II and III, IV

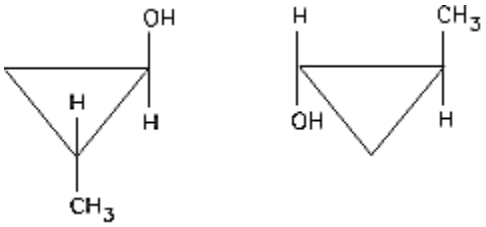
B. I, II

C. III, IV

D. IV, V

E. None of the structures

21. The molecules shown are:



A. constitutional isomers.

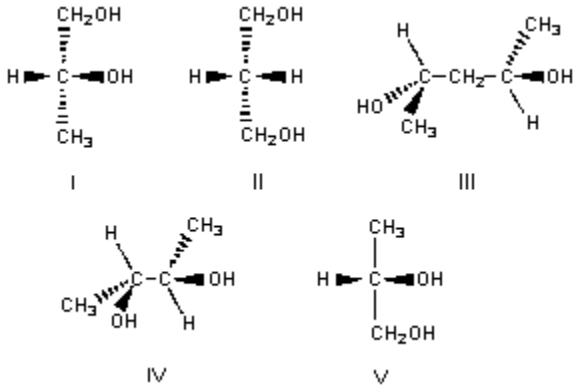
B. enantiomers.

C. diastereomers.

D. identical.

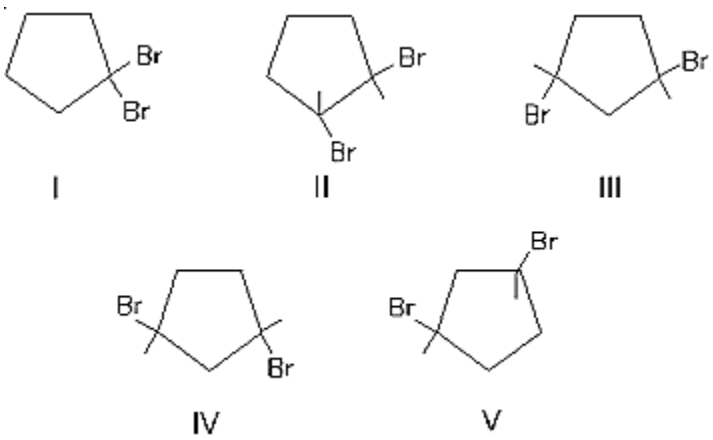
E. None of these

22. Which of the following is a meso compound?



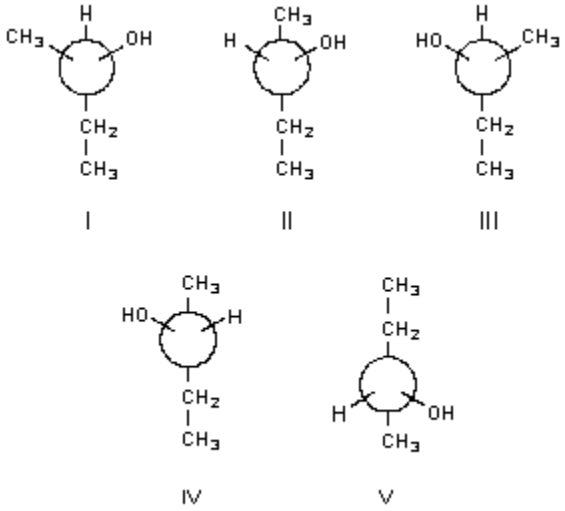
A. I
B. II
C. III
D. IV
E. V

23. Which of the following is a meso compound?



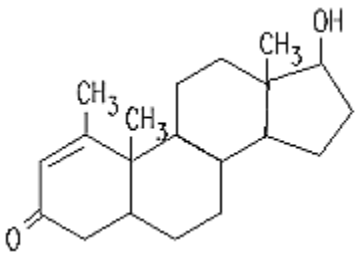
A. I
B. II
C. III
D. IV
E. V

24. Which of the following represent (R)-2-butanol?



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

25. How many stereogenic centers are there in the anabolic steroid methenolone?



A. 4
B. 5
C. 6
D. 7
E. 8

26. An example of a reaction having an $E_{act} = 0$ would be:
A. Br· + Br–Br → Br–Br + Br·

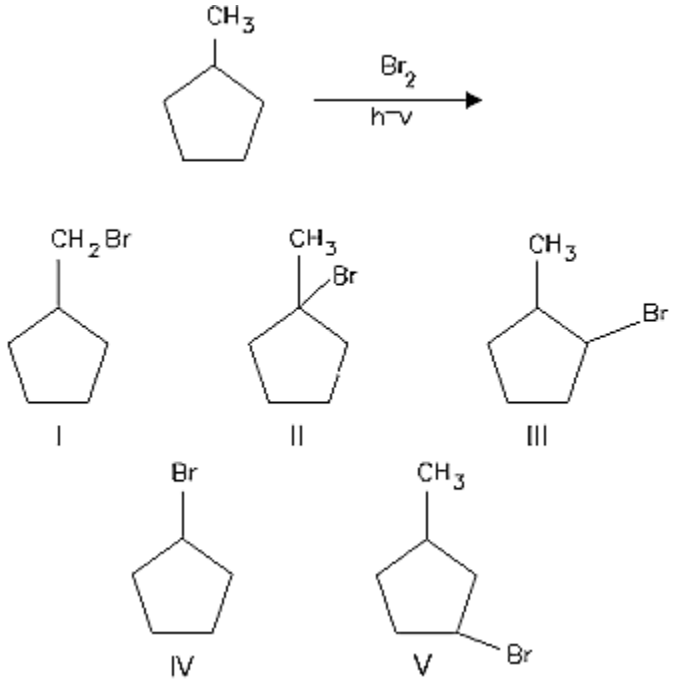
B. $F\cdot + CH_4 \rightarrow H–F + CH_3\cdot$

C. $CH_3\cdot + CH_3CH_3 \rightarrow CH_4 + CH_3CH_2\cdot$

D. $Br\cdot + H–Br \rightarrow H–Br + Br\cdot$

E. $CH_3\cdot + CH_3\cdot \rightarrow CH_3–CH_3$

27. Select the structure of the major product formed in the following reaction.



A. I

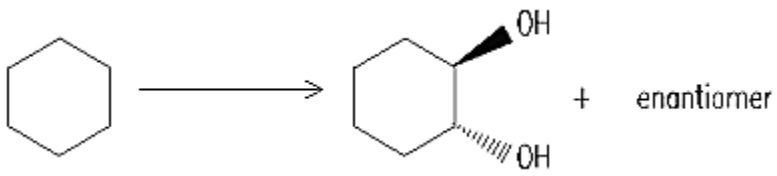
B. II

C. III

D. IV

E. V

28. How could the following synthesis be accomplished?



A. (1) Cl_2/hν; (2) t-BuOK; (3) peroxy acid; (4) H_3O^+

B. (1) t-BuOK; (2) Cl_2/hν; (3) peroxy acid; (4) H_3O^+

C. (1) H_3O^+; (2) t-BuOK; (3) peroxy acid; (4) H_2O

D. (1) Cl_2/hν; (2) peroxy acid; (3) t-BuOK; (4) H_3O^+

E. (1) Cl_2/hν; (2) H_3O^+; (3) t-BuOK; (4) peroxy acid

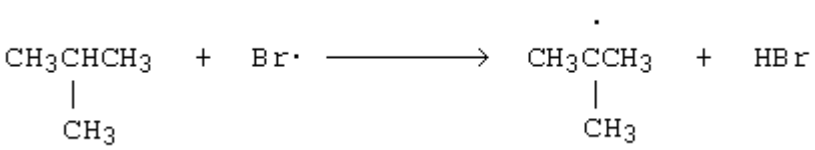
29. For which reaction would the transition state be most product-like?

A. $CH_4 + Br\cdot \rightarrow CH_3\cdot + HBr$

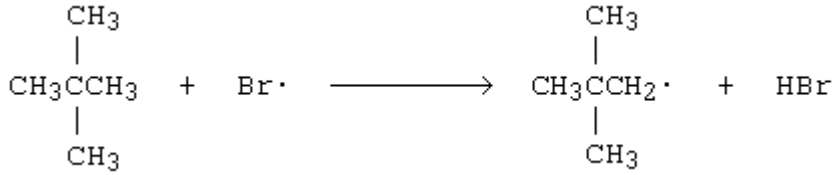
B. $CH_3CH_3 + Br\cdot \rightarrow CH_3CH_2\cdot + HBr$

C.

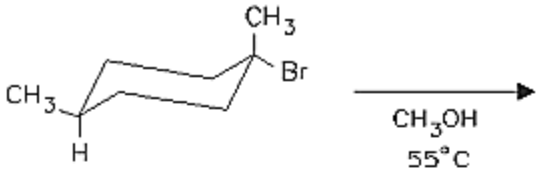
D.

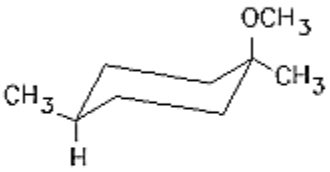


E.

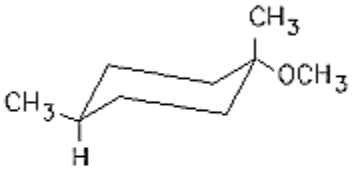


30. Which would be formed in the following reaction?

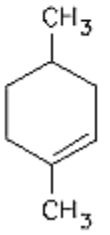




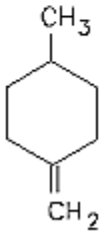
I



II



III



IV

A. I

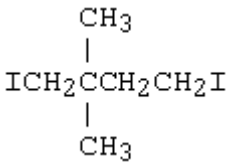
B. II

C. III

D. IV

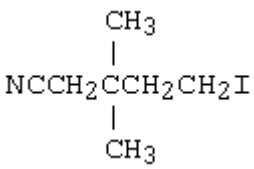
E. All of the above

31.

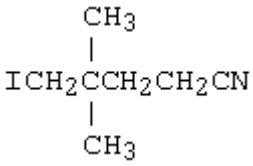


When (0.10 mol) is treated with 0.10 mol of NaCN in dimethyl sulfoxide at 30°C, the product formed is:

A.

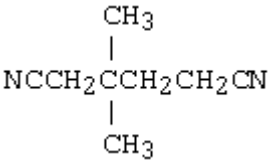


B.

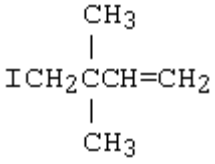


C. both A) and B).

D.

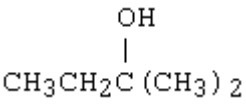


E.

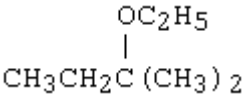


32. When tert-pentyl chloride undergoes solvolysis in aqueous ethanol at room temperature, there is/are formed:

A.

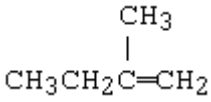


B.



C. $CH_3CH{=}C(CH_3)_2$

D.



E. All of these

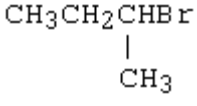
33. Which alkyl halide would give the highest yield of the elimination product when treated with sodium ethoxide in ethanol?

A. CH_3CH_2Br

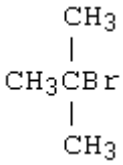
B. $CH_3CH_2CH_2Br$

C. $CH_3CH_2CH_2CH_2Br$

D.

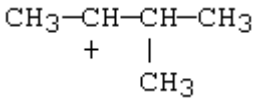


E.

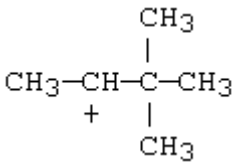


34. Which of the following carbocations would be likely to undergo rearrangement?

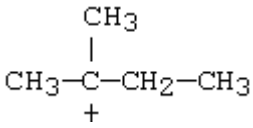
A.



B.



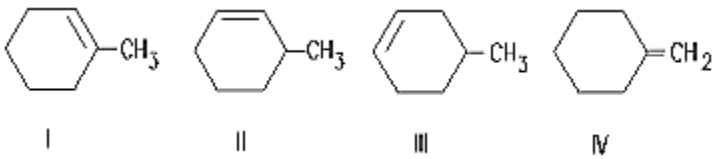
C.



D. More than one of the above

E. All of the above

35. Which product (or products) would be formed in appreciable amount(s) when trans-1-bromo-2-methylcyclohexane undergoes dehydrohalogenation upon treatment with sodium ethoxide in ethanol?



I II III IV

A. I

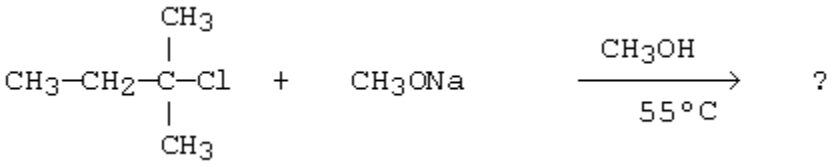
B. II

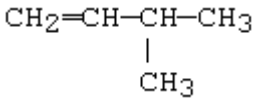
C. III

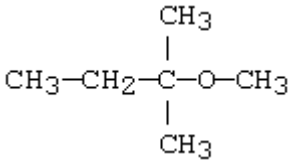
D. IV

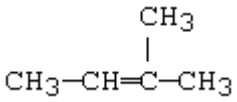
E. More than one of these

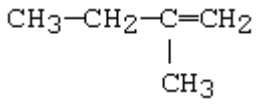
36. What would be the major product of the following reaction?

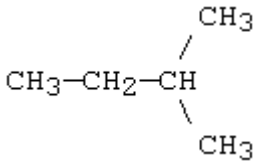


A. 

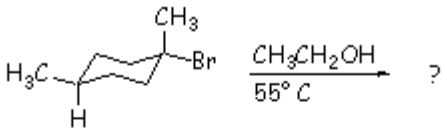
B. 

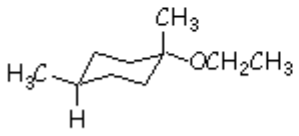
C. 

D. 

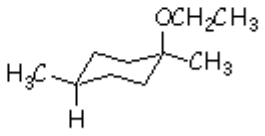
E. 

37. Which compound(s) would be produced by the following reaction?

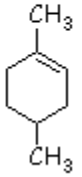




I



II



III

A. I

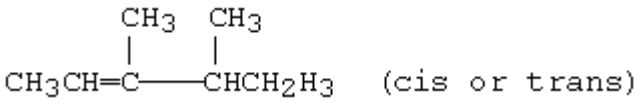
B. II

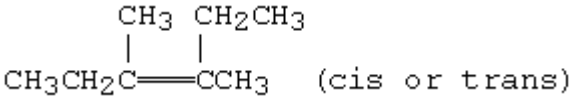
C. III

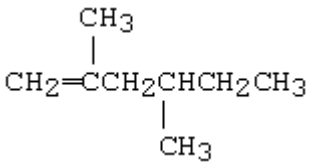
D. More than one of the above

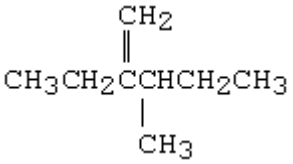
E. All of the above

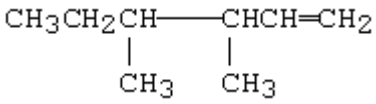
38. An alkene adds hydrogen in the presence of a catalyst to give 3,4-dimethylhexane. Ozonolysis of the alkene followed by treatment with zinc and acetic acid gives a single organic product. The structure of the alkene is:

A. 

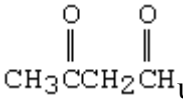
B. 

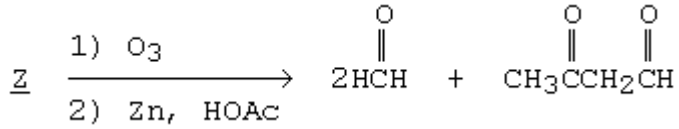
C. 

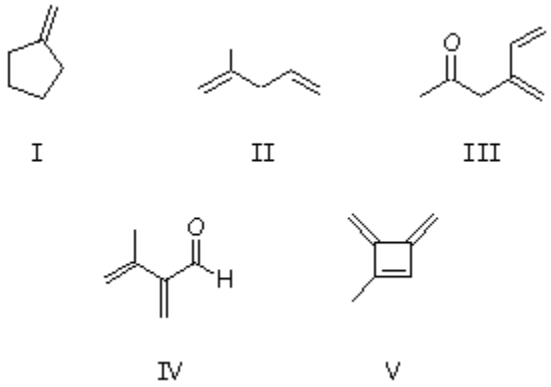
D. 

E. 

39.

What is the structure of the compound Z that yields 2 mol of formaldehyde,  , and 1 mol of  upon ozonolysis followed by treatment with zinc in acetic acid?





A. I

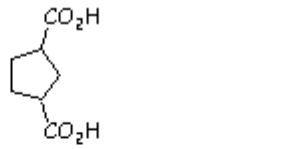
B. II

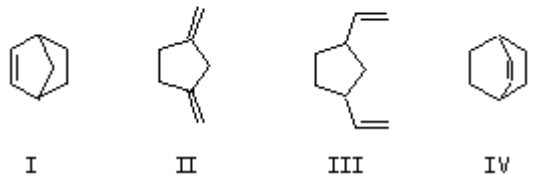
C. III

D. IV

E. V

40. An alkene, X, with the formula C_7H_{10} adds one mole of hydrogen on catalytic hydrogenation. On treatment with hot basic $KMnO_4$ followed by acidification, X yields





Which is a possible structure for X?

A. I

B. II

C. III

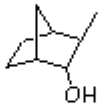
D. IV

E. None of these

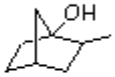
41. Which product would you expect from the acid-catalyzed addition of water to

?

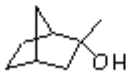
I



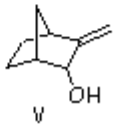
II



III



IV



V

A. I

B. II

C. III

D. IV

E. V

42. Cyclohexene is subjected to epoxidation followed by acid-catalyzed hydrolysis to yield 1,2-cyclohexanediol. In the most stable conformation of the product, the hydroxyl groups would be:

A. both axial

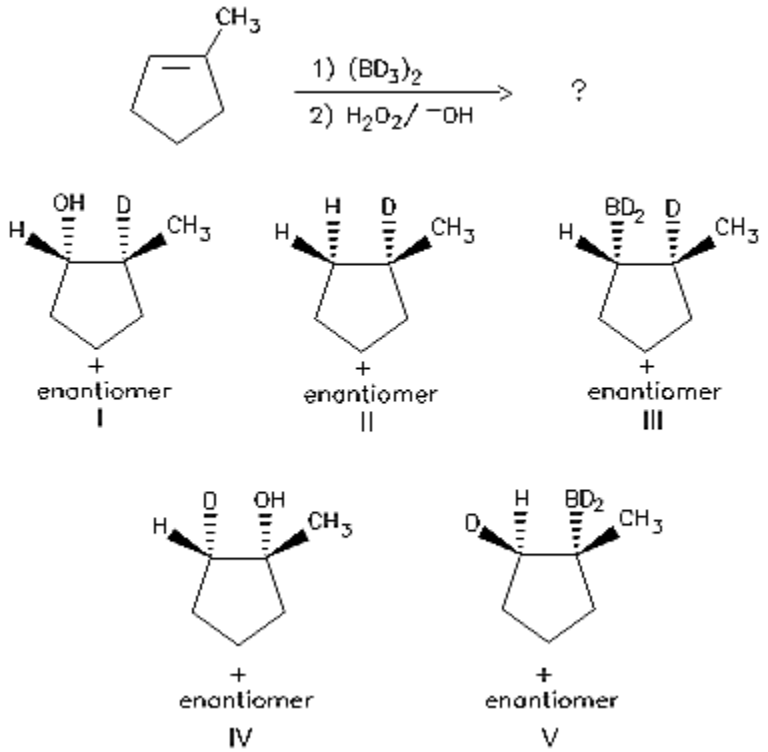
B. both equatorial

C. axial-equatorial

D. coplanar

E. None of these

43. What product would you expect from the following reaction?



A. I

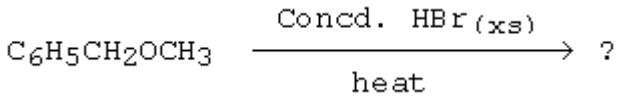
B. II

C. III

D. IV

E. V

44. What would be the major product of the following reaction



A. $C_6H_5Br + CH_3OH$

B. $C_6H_5CH_2Br + CH_3Br$

C. $C_6H_5CH_2OH + CH_3Br$

D. $C_6H_5CH_2Br + CH_3OH$

E. $C_6H_5CH_2CH_2Br$

45. Which of the following could be used to synthesize 2-bromopropene?

A. $CH_3CH{=}CH_2 + Br_2 \longrightarrow$

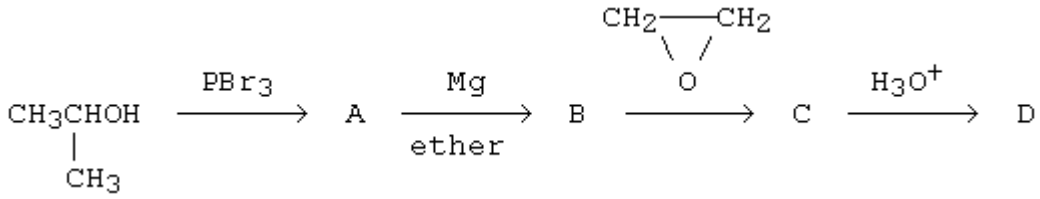
B. $CH_3CH(OH)CH_3 + PBr_3 \xrightarrow{H_2}$

C. $CH_3C{\equiv}CH + HBr \rightarrow$

D. $CH_3C{\equiv}CH + Br_2 \rightarrow$

E. $CH_3CH{=}CH_2 + HBr \rightarrow$

46. The final product, D, in the following reaction sequence,



, would be?

A. $CH_3CH(CH_3)OCH_2CH_2OH$

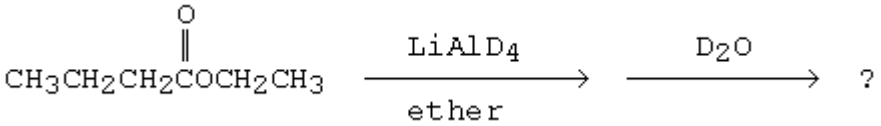
B. $CH_3CH(CH_3)CH_2CH_2Br$

C. $CH_3CH(CH_3)CH_2CH_2OH$

D. $CH_3CH(CH_3)OCH_2CH_3$

E. $CH_3CH(CH_3)CH_2CH_3$

47. What product(s) is/are formed in the following reaction:



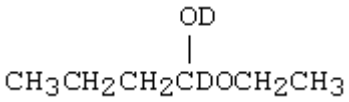
A. $CH_3CH_2CH_2CH_2OD + CH_3CH_2OD$

B. $CH_3CH_2CH_2CD_2OD + CH_3CH_2OD$

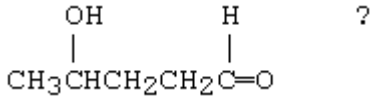
C. $CH_3CH_2CH_2CD_2OH + CH_3CH_2OH$

D. $CH_3CH_2CH_2CHDOD + CH_3CH_2OD$

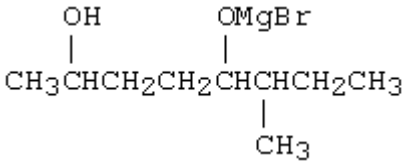
E.



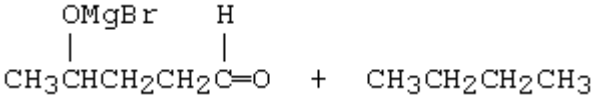
48. What product(s) is/are produced in the 1:1 reaction of <u>sec</u>-butylmagnesium bromide with



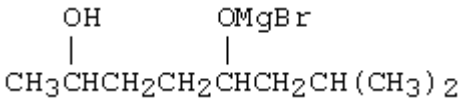
A.



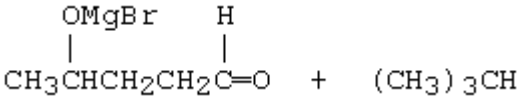
B.



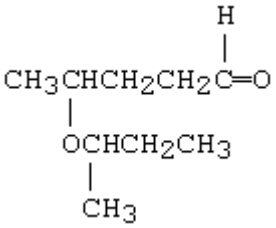
C.



D.

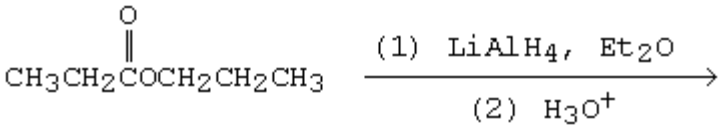


E.

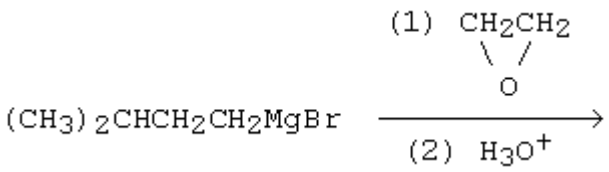


49. Which of these reactions will <u>not</u> produce a 1° alcohol?

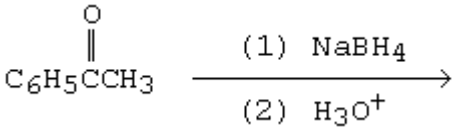
A.



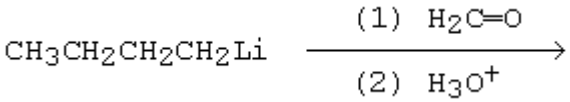
B.



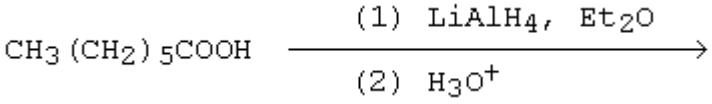
C.



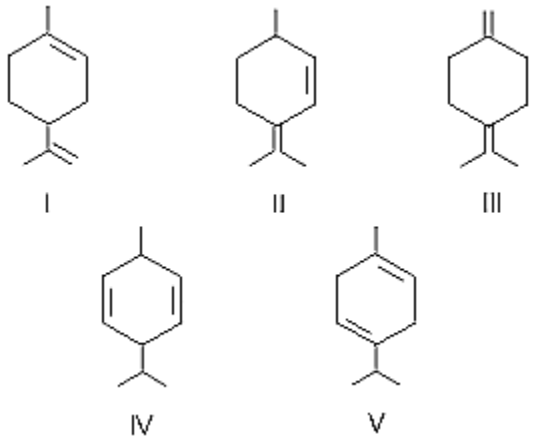
D.



E.



50. Select the structure of the conjugated diene.



A. I

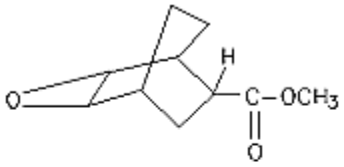
B. II

C. III

D. IV

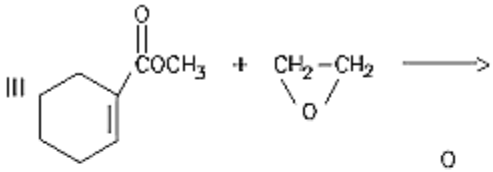
E. V

51. How would you synthesize:

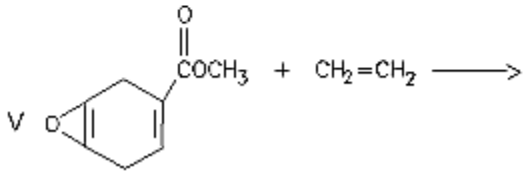


I 1,3–Cyclohexadiene + $CH_2=CHCOCH_3$, then RCOOH

II 1,3-Cyclohexadiene + RCOOH, then $CH_2=CHCOCH_3$



IV 1,4–Cyclohexadiene + $CH_2=CHCOCH_3$, then 



A. I

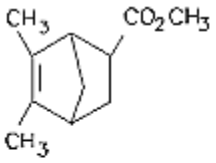
B. II

C. III

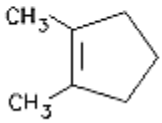
D. IV

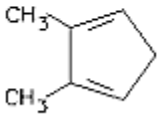
E. V

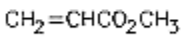
52. Which compounds could be used in a Diels-Alder synthesis of

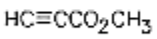


?









I II III IV

A. I and III

B. I and IV

C. II and III

D. II and IV

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

43. A
44. B
45. C
46. C
47. B
48. B
49. C
50. B
51. A
52. C