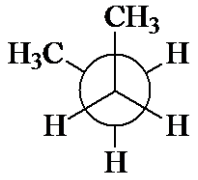
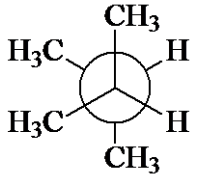
ACS Review Conformations of Alkanes and Cycloalkanes

1. Identify the conformation of butane shown below.



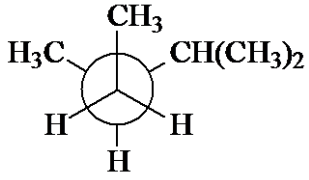
A. anti
B. gauche
C. skewed
D. eclipsed

2. What is the IUPAC name of the compound shown in the following Newman projection?



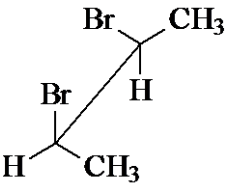
A. 1,1,2,2-tetramethylethane
B. 1,2-dimethylethane
C. 2,2,3,3-tetramethylbutane
D. 2,3-dimethylbutane

3. What is the IUPAC name of the compound shown below?



A. 1,2,3-trimethylbutane
B. 2,3-dimethylpentane
C. 2,3,4-trimethylpentane
D. 2-isopropylbutane

4. What is the dihedral (torsion) angle between the two bromine atoms in the following sawhorse drawing?

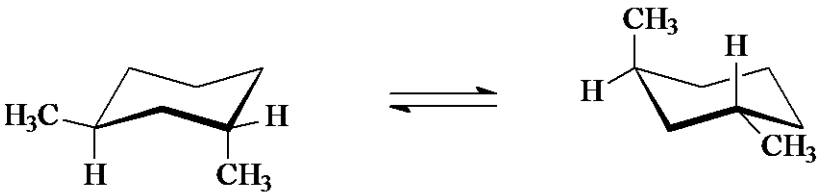


A. 0^o
B. 30^o
C. 60^o
D. 90^o

5. At room temperature, the various conformations of butane:

   A. do not interconvert, only the anti form is present
   B. do not interconvert, but all conformations are present
   C. interconvert very slowly
   D. interconvert very rapidly

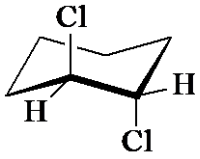
6. Which statement is correct concerning the relative stabilities of the two conformations, A and B, below?



A B

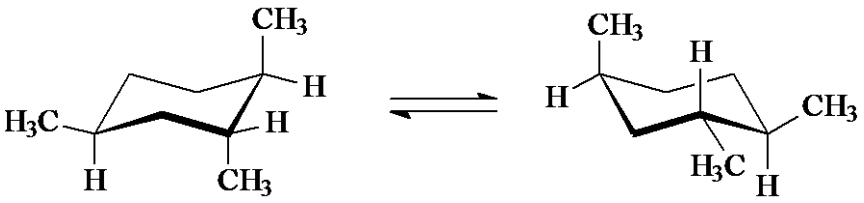
   A. A is more stable.
   B. B is more stable.
   C. A and B are equal in stabilities.
   D. A and B are not equal in stability, but the preferred conformation cannot be determined by inspection.

7. Identify the spatial relationship of the two chlorine atoms.



   A. gauche
   B. anti
   C. eclipsed
   D. twist

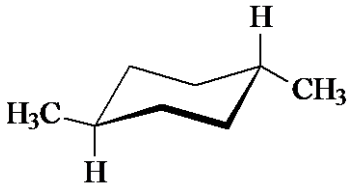
8. Which statement is correct concerning the relative stabilities of the two conformations, A and B, below?



A B

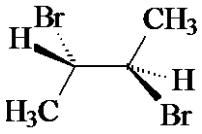
   A. A is more stable.
   B. B is more stable.
   C. A and B are equal in stabilities.
   D. A and B are not equal in stability, but the preferred conformation cannot be determined by inspection.

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



A. *trans*-1,4-dimethylcyclohexane
B. *cis*-1,4-dimethylcyclohexane
C. *trans*-1,3-dimethylcyclohexane
D. *cis*-1,3-dimethylcyclohexane

10. What is the dihedral (torsion) angle between the two bromine atoms in the wedge-and-dash drawing below?



A. 60^{o}
B. 90^{o}
C. 120^{o}
D. 180^{o}

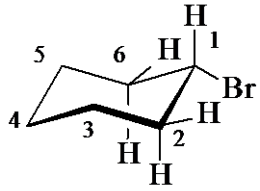
11. Identify the relationship between the following two structures.

A. constitutional isomers
B. stereoisomers
C. different conformations of the same compound
D. identical

12. Predict which of the following constitutional isomers of C_5H_{10} would have the highest heat of combustion?

A. methylcyclobutane
B. cyclopentane
C. *cis*-1,2-dimethylcyclopropane
D. *trans*-1,2-dimethylcyclopropane

13. Identify the two atoms *anti* to the bromine.



A. the equatorial H's on C-2 and C-6
B. the axial H's on C-2 and C-6
C. C-2 and C-6

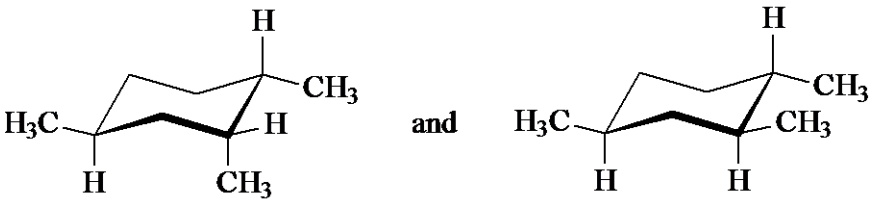
D. C-3 and C-5

14. Cyclohexane adopts the chair conformation rather than a planar structure because:

I. Torsional strain is minimized.
II. The C–C–C bond angles are close to 109.5°.
III. There are no 1,3-diaxial interactions in a planar structure.

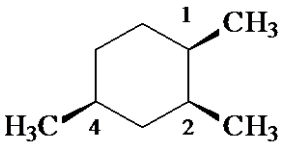
A. only I
B. only II
C. I and II
D. I, II, and III

15. Identify the relationship between the following two structures.



A. constitutional isomers
B. stereoisomers
C. different conformations of the same compound
D. identical

16. The most stable conformation of the compound shown has:

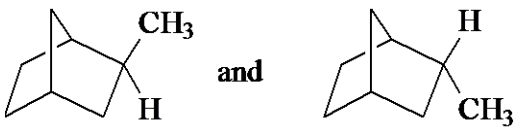


A. all methyl groups equatorial
B. equatorial methyl groups at C-1 and C-2, axial at C-4
C. equatorial methyl groups at C-1 and C-4, axial at C-2
D. equatorial methyl groups at C-2 and C-4, axial at C-1

17. The most stable chair conformation of *cis*-1-*tert*-butyl-3-methylcyclohexane has

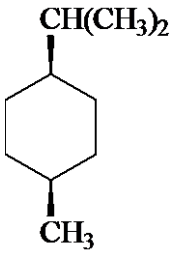
A. both groups equatorial.
B. both groups axial.
C. the *tert*-butyl group equatorial and the methyl group axial.
D. the *tert*-butyl group axial and the methyl group equatorial.

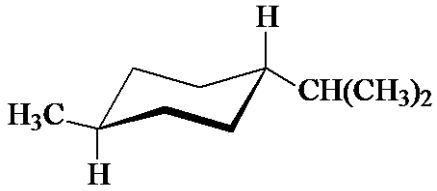
18. Identify the relationship of the two compounds below.

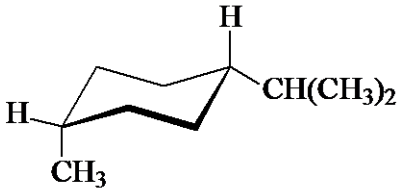


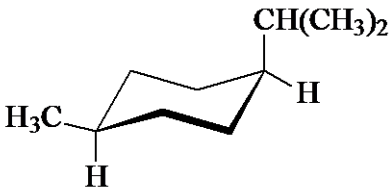
A. identical
B. constitutional isomers
C. stereoisomers
D. different conformations of the same compound

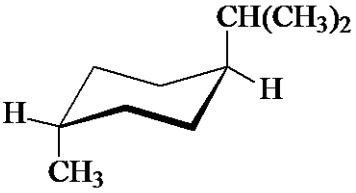
19. Identify the <u>correct</u> stereoisomer and the most stable conformation of the following compound.



A) 

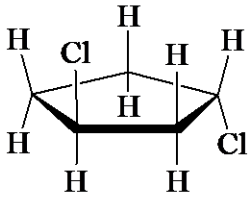
B) 

C) 

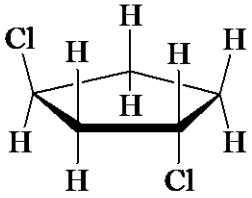
D) 

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

20. Identify the relationship of the two compounds below.

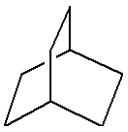


and



A. identical
B. constitutional isomers
C. stereoisomers
D. different conformations of the same compound

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

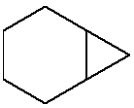


A. bicyclo[2.2.2]octane
B. bicyclo[2.2.2]hexane
C. bicyclo[3.3.3]octane
D. bicyclo[3.3.3]hexane

22. Which statement below is true concerning the conversion of *cis*-1,4-dimethylcyclohexane to *trans*-1,4-dimethylcyclohexane?

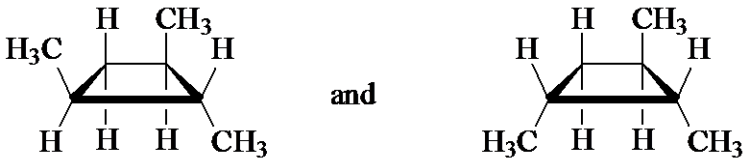
A. The conversion takes place by chair conformation ring-flipping.
B. You cannot do the conversion without breaking covalent bonds.
C. The conversions takes place by rotating the C(1)─C(2) bond by 180°.
D. The conversion takes place through the skew boat conformations.

23. What is the IUPAC name of the following bicycloalkane?



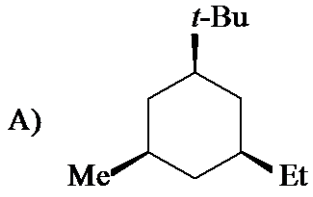
A. bicyclo[6.3.0]heptane
B. bicyclo[4.1.0]hexane
C. bicyclo[4.2.1]hexane
D. bicyclo[4.1.0]heptane

24. Identify the relationship between the following two structures.

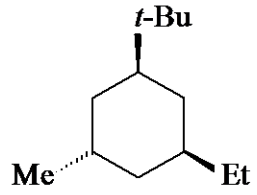


A. identical
B. different conformations of the same compound
C. stereoisomers
D. constitutional isomers

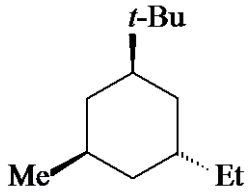
25. Which isomer of 1-*tert*-butyl-3-ethyl-5-methylcyclohexane below is thermodynamically the most stable?



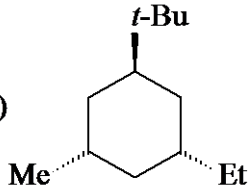
B)



C)



D)

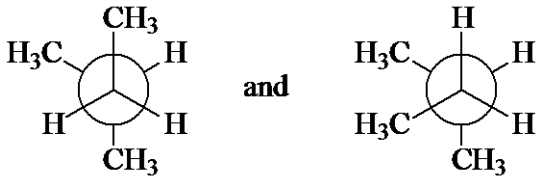


A. A
B. B
C. C
D. D

26. What would the C-C-C bond angles be in a planar cyclohexane?

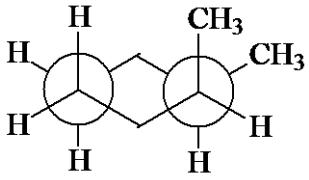
A. 60^{o}
B. 90^{o}
C. 109.5^{o}
D. 120^{o}

27. Identify the relationship between the following two Newman projections.



A. identical
B. stereoisomers
C. different conformations of the same compound
D. constitutional isomers

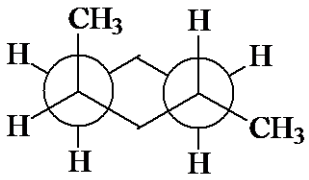
28. The IUPAC name of the following compound is:



A. *cis*-1,2-dimethylcyclohexane
B. *trans*-1,2-dimethylcyclohexane

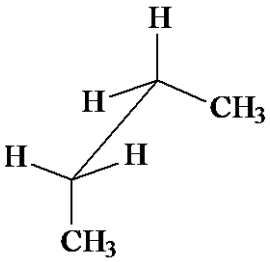
C. 1,1-dimethylcyclohexane
D. *cis*-1,3-dimethylcyclohexane

29. The following structure is:



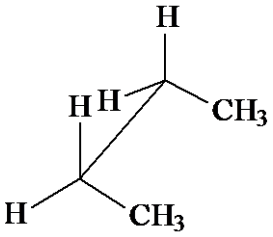
A. *cis*-1,3-dimethylcyclohexane
B. *cis*-1,4-dimethylcyclohexane
C. *trans*-1,3-dimethylcyclohexane
D. *trans*-1,4-dimethylcyclohexane

30. The sawhorse drawing of butane below is:



A. a gauche conformation
B. the anti conformation
C. the least stable eclipsed conformation
D. the most stable eclipsed conformation

31. The sawhorse drawing of butane below is the:

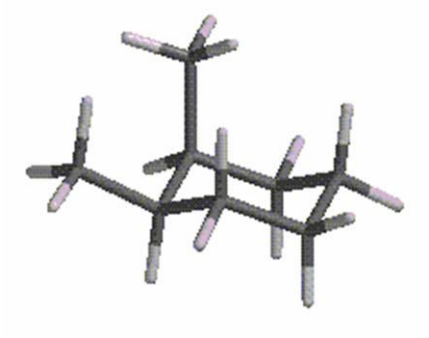


A. least stable staggered conformation
B. most stable staggered conformation
C. least stable eclipsed conformation
D. most stable eclipsed conformation

32. Which constitutional isomer of dimethylcyclohexane does not exhibit *cis*-*trans* isomerism?

A. 1,1-dimethylcyclohexane
B. 1,2-dimethylcyclohexane
C. 1,3-dimethylcyclohexane
D. 1,4-dimethylcyclohexane

33. What is the estimated dihedral angle between the two methyl groups on the structure shown below?

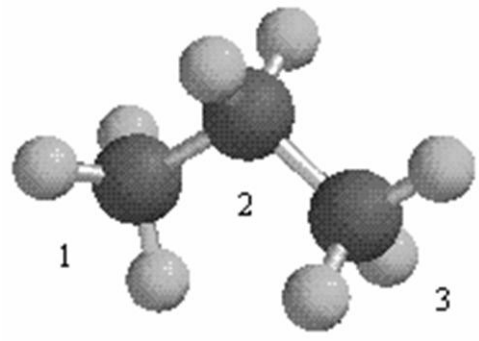


A. 30^o
B. 60^o
C. 90^o
D. 120^o

34. Which one of the following is not a constitutional isomer of *trans*-1,3-dimethylcyclopentane?

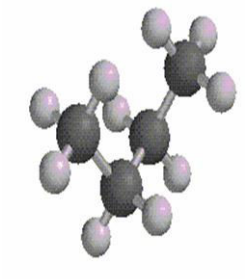
A. 1,1-dimethylcyclopentane
B. *cis*-1,2-dimethylcyclopentane
C. ethylcyclopentane
D. *cis*-1,3-dimethylcyclopentane

35. Which of the following best describes the conformation of propane shown below?



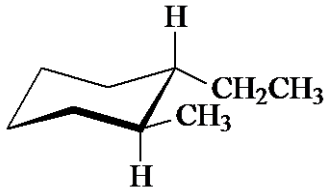
A. C(1) - C(2) staggered and C(2) - C(3) staggered
B. C(1) - C(2) staggered and C(2) - C(3) eclipsed
C. C(1) - C(2) eclipsed and C(2) - C(3) staggered
D. C(1) - C(2) eclipsed and C(2) - C(3) eclipsed

36. Which one of the following is the butane conformation shown below?



A. gauche
B. anti
C. skew
D. eclipsed

37. What is the correct IUPAC name of the following compound?



A. *cis*-1-ethyl-2-methylcyclohexane
B. *trans*-1-ethyl-2-methylcyclohexane
C. *cis*-1-ethyl-6-methylcyclohexane
D. *trans*-1-ethyl-6-methylcyclohexane

38. Which of the following can have *cis-trans* stereoisomers?

A. 1,1-dimethylcyclobutane
B. 1,3-dimethylcyclobutane
C. 1,1,3-trimethylcyclobutane
D. 1,1,3,3-tetramethylcylclobutane

39. The C-C-C bond angle in cyclopropane is:

A. 60^o
B. 90^o
C. 109.5^o
D. 120^o

40. The most stable conformation of *cis*-4-methyl-1-*tert*-butylcyclohexane is a chair conformation with:

A. both the $-CH_3$ and $-C(CH_3)_3$ equatorial
B. both the $-CH_3$ and $-C(CH_3)_3$ axial
C. the $-CH_3$ equatorial and the $-C(CH_3)_3$ axial
D. the $-CH_3$ axial and $-C(CH_3)_3$ equatorial

ACS Review Conformations of Alkanes and Cycloalkanes KEY

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