

Chapter 2 -- Alkanes and Cycloalkanes

Student: _____

1. What is the molecular formula of an alkane that has fourteen carbon atoms?

- A. C₁₄H₂₈
- B. C₁₄H₃₀
- C. C₁₄H₃₂
- D. C₁₄H₃₄
- E. C₁₄H₂₆

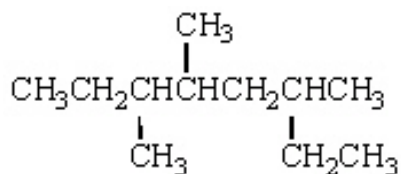
2. What is the molecular formula of a cycloalkane that has six carbon atoms?

- A. C₆H₁₂
- B. C₆H₁₄
- C. C₆H₁₆
- D. C₆H₁₈
- E. C₆H₁₀

3. What is the name of the alkane that has three carbon atoms?

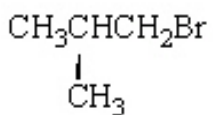
- A. methane
- B. ethane
- C. propane
- D. butane
- E. isobutane

4. The correct IUPAC name for the following molecule is:



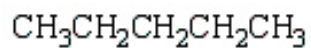
- A. 6-ethyl-3,4,-dimethylheptane
- B. 2-ethyl-4,5-dimethylheptane
- C. 3,4,6-trimethyloctane
- D. 3,5,6-trimethyloctane
- E. none of these

5. What is the common name for the following molecule?

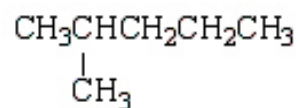


- A. isobutyl bromide
 - B. *tert*-butyl bromide
 - C. butyl bromide
 - D. *sec*-butyl bromide
 - E. bromo-*sec*-butane
6. The name of the alkyl group that contains three carbons is:
- A. methyl
 - B. ethyl
 - C. propyl
 - D. isopropyl
 - E. none of these
7. Which of the following structures is 2-methylpentane?

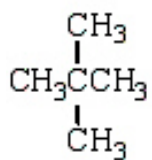
A.



B.



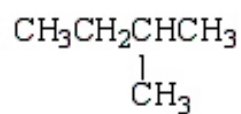
C.



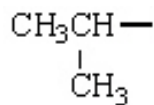
D.



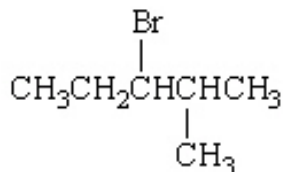
E.



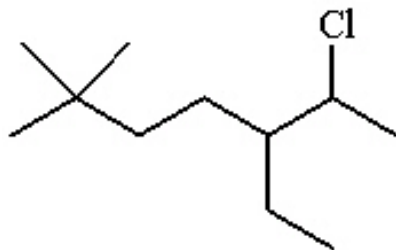
8. The name of the alkyl group below is:



- A. ethyl
 - B. propyl
 - C. isopropyl
 - D. butyl
 - E. isobutyl
9. What is the IUPAC name for the following compound?

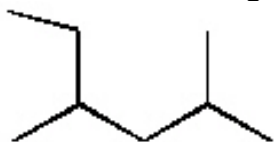


- A. isohexyl bromide
 - B. 3-bromo-4-methylpentane
 - C. 1-bromopropylpropane
 - D. 3-bromo-2-methylpentane
 - E. 2-methyl-3-bromopentane
10. The IUPAC name for the following molecule is:

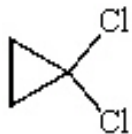


- A. 2-chloro-3-ethyl-6,6-dimethylheptane
- B. 6-chloro-5-ethyl-2,2-dimethylheptane
- C. 6-chloro-2,2-dimethyl-5-ethylheptane
- D. 2,2-dimethyl-5-chloroethylheptane
- E. 6-chloro-5-ethyl-2-dimethylheptane

11. The IUPAC name for the following molecule is:



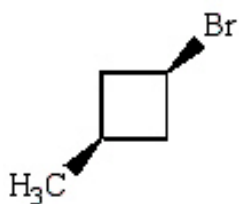
- A. 2-ethyl-4-methylpentane
 - B. 4-methyl-2-methylpentane
 - C. 2,4-dimethylhexane
 - D. 1-isopropyl-2-methylbutane
 - E. 2,4-methylhexane
12. What is a correct name for the following molecule?



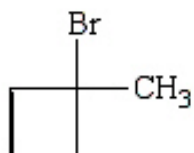
- A. 2,2-dichlorocyclopropane
- B. 1,1-dichlorocyclopentane
- C. 1,1-dichloropropane
- D. *trans*-1,1-dichlorocyclopropane
- E. 1,1-dichlorocyclopropane

13. *Trans*-1-bromo-3-methylcyclobutane is represented by which structure below?

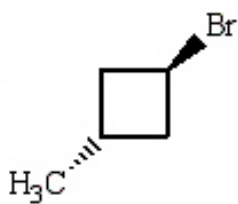
A.



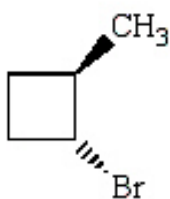
B.



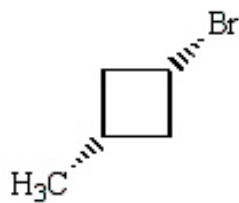
C.



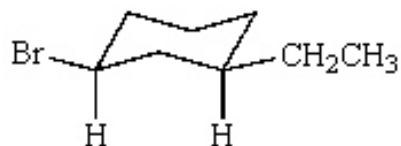
D.



E.

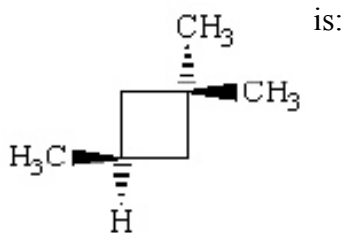


14. What is the correct name for the following cycloalkane?



- A. bromoethylcyclohexane
 - B. *trans*-1-ethyl-3-bromocyclohexane
 - C. *cis*-3-bromo-1-ethylhexane
 - D. 1-bromo-3-ethylcyclohexane
 - E. *cis*-1-bromo-3-ethylcyclohexane
15. The correct IUPAC name for $(\text{CH}_3)_2\text{CHCH}(\text{CH}_3)(\text{CH}_2)_3\text{CH}(\text{CH}_3)_2$ is
- A. diisopropylpentane.
 - B. 1,1,2,6,6-pentamethylhexane.
 - C. 2,5-diisopropylpentane.
 - D. 2,3,7-trimethyloctane.
 - E. 1,4-diisopropylpentane.

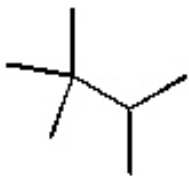
16. The correct IUPAC name for



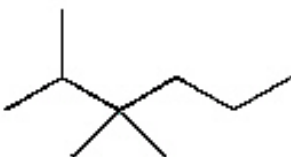
- A. 1,3,3-trimethylcyclobutane.
- B. *cis*-1,3,3-trimethylcyclobutane.
- C. *trans*-1,3,3-trimethylcyclobutane.
- D. 1,1,3-trimethylcyclobutane.
- E. 2,2,4-trimethylcyclobutane.

17. The structural formula for 2,2,3-trimethylhexane is

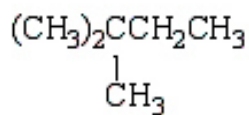
A.



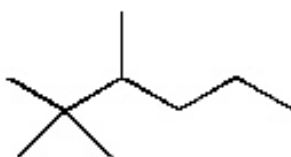
B.



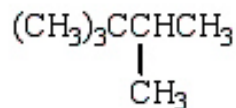
C.



D.



E.



18. Which of the following would exhibit hydrogen bonding?

A. CH_3Cl

B. CH_3OH

C. CH_3

D. CH_2Cl_2

E. CH_3CH_3

19. Which of the following alkanes would have the highest boiling point?

A. pentane

B. 2-methylbutane

C. 2,2-dimethylpropane

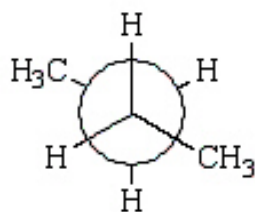
D. hexane

E. 2-methylpentane

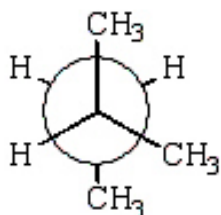
20. What statement does NOT apply to the boiling points of alkanes?
- A. The boiling point increases as the length of the carbon chain increases.
 - B. Straight chain alkanes have a higher boiling point than their branched isomers.
 - C. Because they are nonpolar, alkanes have lower boiling points than other organic compounds of similar molar mass.
 - D. The boiling points are affected by Van der Waals attractions.
 - E. The boiling points are influenced by hydrogen bonding.
21. Which cycloalkane has the highest boiling point?
- A. cyclopropane
 - B. cyclobutane
 - C. cyclopentane
 - D. cyclohexane
 - E. cyclooctane
22. The boiling points of normal alkanes
- A. rise as the length of the carbon chain increases.
 - B. rise as the length of the carbon chain decreases.
 - C. are higher than the boiling points of branched alkanes with the same molecular formula.
 - D. a and c
 - E. b and c
23. The most stable conformation of propane is:
- A. staggered
 - B. chair
 - C. planar
 - D. eclipsed
 - E. boat
24. The least stable conformation of propane is:
- A. staggered
 - B. chair
 - C. planar
 - D. eclipsed
 - E. boat

25. The preferred conformation of butane is given by which of the following Newman projection formulas?

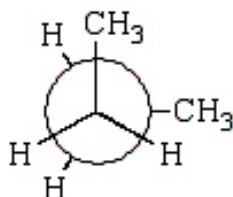
A.



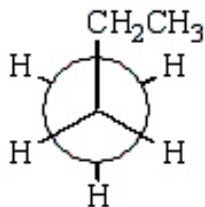
B.



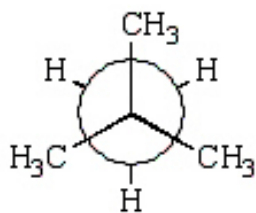
C.



D.

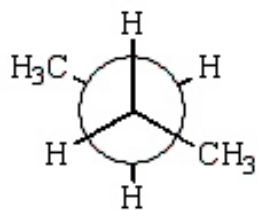


E.

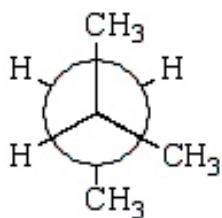


26. The least stable conformation of butane is given by which of the following Newman projections?

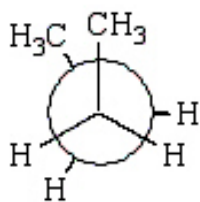
A.



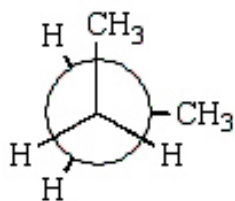
B.



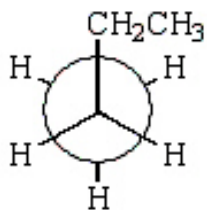
C.



D.

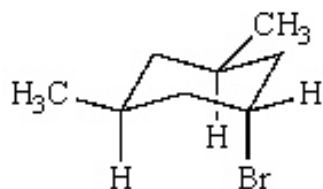


E.



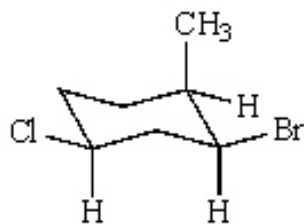
27. The preferred conformation of *cis*-3-*tert*-butyl-1-methylcyclohexane is the one in which:
- A. the *t*-butyl group is axial and the methyl group is equatorial
 - B. both groups are axial
 - C. both groups are equatorial
 - D. the methyl group is axial and the *t*-butyl group is equatorial
 - E. molecule exists in a boat conformation
28. The bond angle of a normal, tetrahedral, sp^3 hybridized carbon is 109.5° . What is the C–C–C bond angle of cyclobutane?
- A. 60°
 - B. 90°
 - C. 109.5°
 - D. 120°
 - E. 180°
29. For the most stable conformation of *cis*-1,3-dimethylcyclohexane:
- A. both methyls will occupy the axial position
 - B. both methyls will occupy the equatorial position
 - C. one methyl will occupy the axial position and the other an equatorial position
 - D. more than one answer is correct
30. Which of the following pairs are examples of conformational isomerism?
- A. chair and boat forms of cyclohexane
 - B. 1-iodopropane and 2-iodopropane
 - C. *sec*-butyl chloride and butyl iodide
 - D. *cis* and *trans*-1,2-dimethylcyclohexane
 - E. all of these

31. Consider this chair conformation:



When the ring flips,

- A. the bromine becomes axial and the methyls become equatorial.
 - B. all three substituents become equatorial.
 - C. the bromine becomes equatorial and the methyls become axial.
 - D. the ring opens up.
 - E. one methyl becomes axial, one becomes equatorial, and the bromine becomes equatorial.
32. Consider this chair conformation:

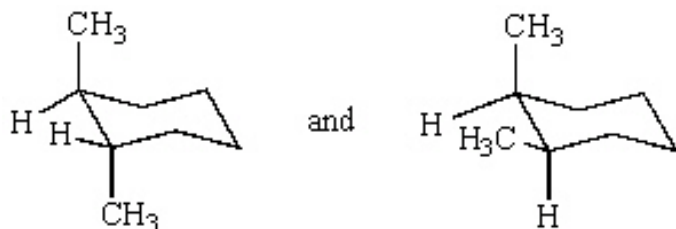


- A. The methyl and bromine are *cis* and the chlorine and bromine are *cis*.
 - B. The methyl and bromine are *trans* and the chlorine and bromine are *cis*.
 - C. The methyl and chlorine are *trans* and the methyl and bromine are *cis*.
 - D. The methyl and chlorine are *trans* and the methyl and bromine are *trans*.
 - E. The methyl and chlorine are *trans* and the bromine and chlorine are *cis*.
33. Cycloalkanes with _____ or more carbons in the ring are nonplanar.
- A. 2
 - B. 3
 - C. 4
 - D. 5
 - E. 6

34. 1-Bromopropane and 2-bromopropane are

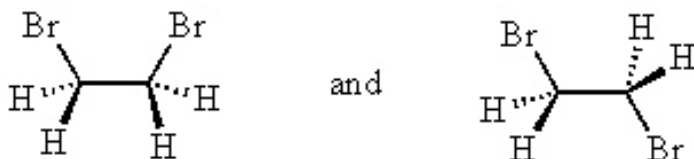
- A. constitutional isomers.
- B. homologs.
- C. configurational isomers.
- D. conformational isomers.
- E. stereoisomers.

35. The compounds represented by the structures below are:



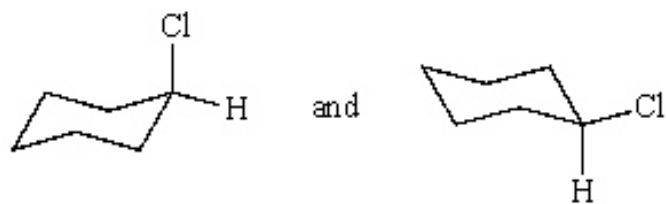
- A. structural isomers.
- B. identical.
- C. *cis-trans* isomers.
- D. conformers.
- E. constitutional isomers.

36. The compounds represented by the structures below are:

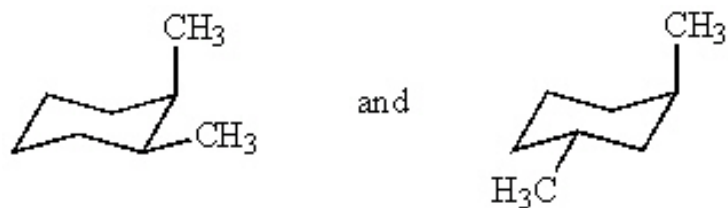


- A. structural isomers.
- B. different compounds.
- C. *cis-trans* isomers.
- D. conformers.
- E. constitutional isomers.

37. The compounds represented by the structures below are:



- A. structural isomers.
 - B. different compounds.
 - C. *cis-trans* isomers.
 - D. conformers.
 - E. constitutional isomers.
38. The compounds represented by the structures below are:



- A. constitutional isomers.
 - B. identical.
 - C. *cis-trans* isomers.
 - D. conformers.
 - E. different compounds (not isomers)..
39. In the chlorination of methane, the propagation steps involve forming:
- A. H radicals
 - B. methyl radicals
 - C. chlorine radicals
 - D. a, b, and c
 - E. b and c
40. How many monobromo products can be obtained from the bromination of cyclopentane?
- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5

41. How many isomeric dichloro products can be obtained from the chlorination of cyclopropane?
- A. 1
 - B. 2
 - C. 3
 - D. 4
 - E. 5
42. The number of possible monobromination products, including *cis-trans* isomers, of methylcyclopentane is
- A. 2
 - B. 3
 - C. 4
 - D. 5
 - E. 6
43. The number of possible dibromination products of 2-methylpropane is
- A. 2
 - B. 3
 - C. 4
 - D. 5
 - E. 6
44. The number of possible dichlorination products of propane is
- A. 2
 - B. 3
 - C. 4
 - D. 5
 - E. 6

Chapter 2 -- Alkanes and Cycloalkanes **Key**

1. What is the molecular formula of an alkane that has fourteen carbon atoms?

- A. $C_{14}H_{28}$
- B. $C_{14}H_{30}$**
- C. $C_{14}H_{32}$
- D. $C_{14}H_{34}$
- E. $C_{14}H_{26}$

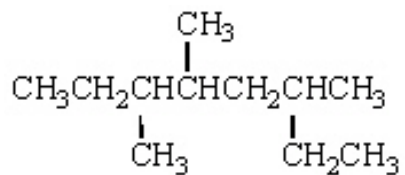
2. What is the molecular formula of a cycloalkane that has six carbon atoms?

- A. C_6H_{12}**
- B. C_6H_{14}
- C. C_6H_{16}
- D. C_6H_{10}
- E. C_6H_7

3. What is the name of the alkane that has three carbon atoms?

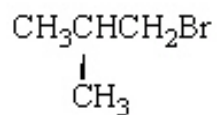
- A. methane
- B. ethane
- C. propane**
- D. butane
- E. isobutane

4. The correct IUPAC name for the following molecule is:



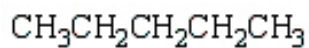
- A. 6-ethyl-3,4,-dimethylheptane
- B. 2-ethyl-4,5-dimethylheptane
- C. 3,4,6-trimethyloctane**
- D. 3,5,6-trimethyloctane
- E. none of these

5. What is the common name for the following molecule?

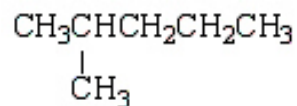


- A. isobutyl bromide
B. *tert*-butyl bromide
C. butyl bromide
D. *sec*-butyl bromide
E. bromo-*sec*-butane
6. The name of the alkyl group that contains three carbons is:
- A. methyl
B. ethyl
C. propyl
D. isopropyl
E. none of these
7. Which of the following structures is 2-methylpentane?

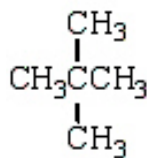
A.



B.



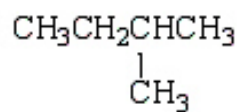
C.



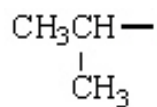
D.



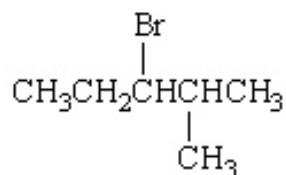
E.



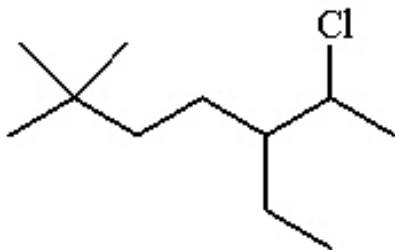
8. The name of the alkyl group below is:



- A. ethyl
B. propyl
C. isopropyl
D. butyl
E. isobutyl
9. What is the IUPAC name for the following compound?

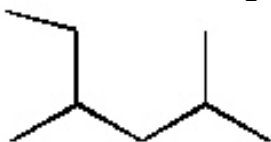


- A. isohexyl bromide
B. 3-bromo-4-methylpentane
C. 1-bromopropylpropane
D. 3-bromo-2-methylpentane
E. 2-methyl-3-bromopentane
10. The IUPAC name for the following molecule is:



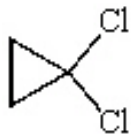
- A. 2-chloro-3-ethyl-6,6-dimethylheptane
B. 6-chloro-5-ethyl-2,2-dimethylheptane
C. 6-chloro-2,2-dimethyl-5-ethylheptane
D. 2,2-dimethyl-5-chloroethylheptane
E. 6-chloro-5-ethyl-2-dimethylheptane

11. The IUPAC name for the following molecule is:



- A. 2-ethyl-4-methylpentane
- B. 4-methyl-2-methylpentane
- C. 2,4-dimethylhexane**
- D. 1-isopropyl-2-methylbutane
- E. 2,4-methylhexane

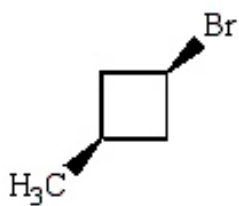
12. What is a correct name for the following molecule?



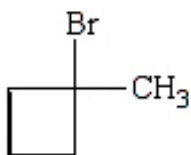
- A. 2,2-dichlorocyclopropane
- B. 1,1-dichlorocyclopentane
- C. 1,1-dichloropropane
- D. *trans*-1,1-dichlorocyclopropane
- E. 1,1-dichlorocyclopropane**

13. *Trans*-1-bromo-3-methylcyclobutane is represented by which structure below?

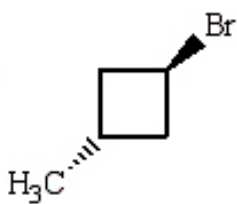
A.



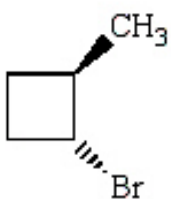
B.



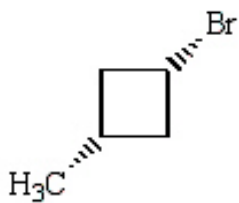
C.



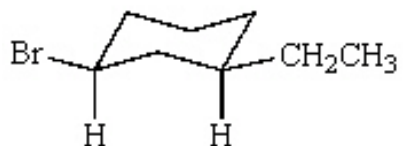
D.



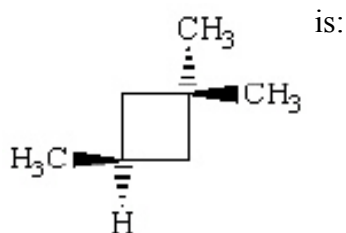
E.



14. What is the correct name for the following cycloalkane?



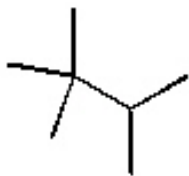
- A. bromoethylcyclohexane
B. *trans*-1-ethyl-3-bromocyclohexane
C. *cis*-3-bromo-1-ethylhexane
D. 1-bromo-3-ethylcyclohexane
E. *cis*-1-bromo-3-ethylcyclohexane
15. The correct IUPAC name for $(\text{CH}_3)_2\text{CHCH}(\text{CH}_3)(\text{CH}_2)_3\text{CH}(\text{CH}_3)_2$ is
- A. diisopropylpentane.
B. 1,1,2,6,6-pentamethylhexane.
C. 2,5-diisopropylpentane.
D. 2,3,7-trimethyloctane.
E. 1,4-diisopropylpentane.
16. The correct IUPAC name for



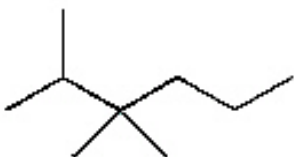
- A. 1,3,3-trimethylcyclobutane.
B. *cis*-1,3,3-trimethylcyclobutane.
C. *trans*-1,3,3-trimethylcyclobutane.
D. 1,1,3-trimethylcyclobutane.
E. 2,2,4-trimethylcyclobutane.

17. The structural formula for 2,2,3-trimethylhexane is

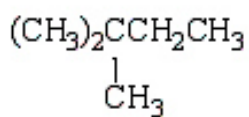
A.



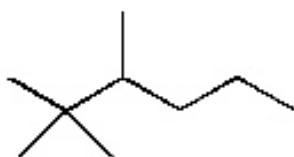
B.



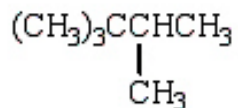
C.



D.



E.



18. Which of the following would exhibit hydrogen bonding?

A. CH_3Cl

B. CH_3OH

C. CH_3

D. CH_2Cl_2

E. CH_3CH_3

19. Which of the following alkanes would have the highest boiling point?

A. pentane

B. 2-methylbutane

C. 2,2-dimethylpropane

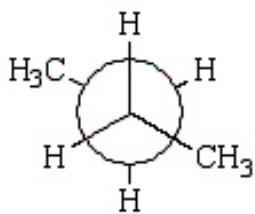
D. hexane

E. 2-methylpentane

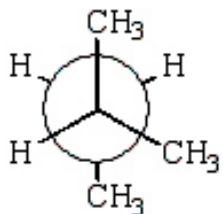
20. What statement does NOT apply to the boiling points of alkanes?
- A. The boiling point increases as the length of the carbon chain increases.
 - B. Straight chain alkanes have a higher boiling point than their branched isomers.
 - C. Because they are nonpolar, alkanes have lower boiling points than other organic compounds of similar molar mass.
 - D. The boiling points are affected by Van der Waals attractions.
 - E.** The boiling points are influenced by hydrogen bonding.
21. Which cycloalkane has the highest boiling point?
- A. cyclopropane
 - B. cyclobutane
 - C. cyclopentane
 - D. cyclohexane
 - E.** cyclooctane
22. The boiling points of normal alkanes
- A. rise as the length of the carbon chain increases.
 - B. rise as the length of the carbon chain decreases.
 - C. are higher than the boiling points of branched alkanes with the same molecular formula.
 - D.** a and c
 - E. b and c
23. The most stable conformation of propane is:
- A.** staggered
 - B. chair
 - C. planar
 - D. eclipsed
 - E. boat
24. The least stable conformation of propane is:
- A. staggered
 - B. chair
 - C. planar
 - D.** eclipsed
 - E. boat

25. The preferred conformation of butane is given by which of the following Newman projection formulas?

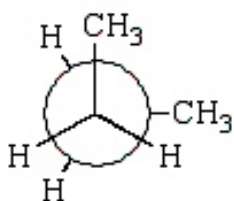
A.



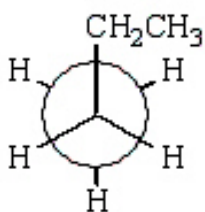
B.



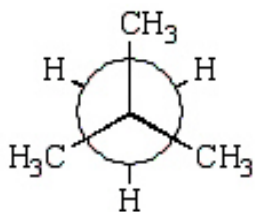
C.



D.

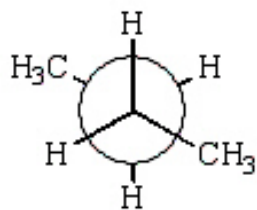


E.

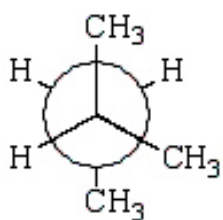


26. The least stable conformation of butane is given by which of the following Newman projections?

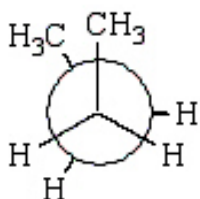
A.



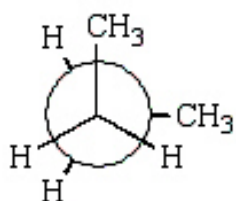
B.



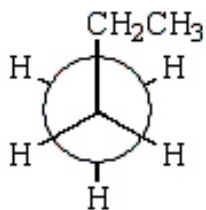
C.



D.

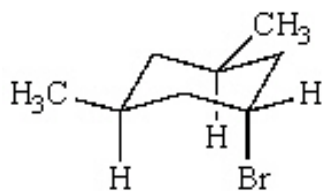


E.



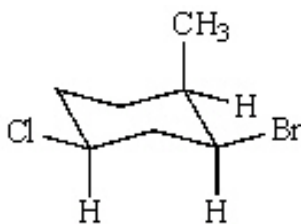
27. The preferred conformation of *cis*-3-*tert*-butyl-1-methylcyclohexane is the one in which:
- A. the *t*-butyl group is axial and the methyl group is equatorial
 - B. both groups are axial
 - C.** both groups are equatorial
 - D. the methyl group is axial and the *t*-butyl group is equatorial
 - E. molecule exists in a boat conformation
28. The bond angle of a normal, tetrahedral, sp^3 hybridized carbon is 109.5° . What is the C–C–C bond angle of cyclobutane?
- A. 60°
 - B.** 90°
 - C. 109.5°
 - D. 120°
 - E. 180°
29. For the most stable conformation of *cis*-1,3-dimethylcyclohexane:
- A. both methyls will occupy the axial position
 - B.** both methyls will occupy the equatorial position
 - C. one methyl will occupy the axial position and the other an equatorial position
 - D. more than one answer is correct
30. Which of the following pairs are examples of conformational isomerism?
- A.** chair and boat forms of cyclohexane
 - B. 1-iodopropane and 2-iodopropane
 - C. *sec*-butyl chloride and butyl iodide
 - D. *cis* and *trans*-1,2-dimethylcyclohexane
 - E. all of these

31. Consider this chair conformation:



When the ring flips,

- A. the bromine becomes axial and the methyls become equatorial.
 - B. all three substituents become equatorial.
 - C.** the bromine becomes equatorial and the methyls become axial.
 - D. the ring opens up.
 - E. one methyl becomes axial, one becomes equatorial, and the bromine becomes equatorial.
32. Consider this chair conformation:



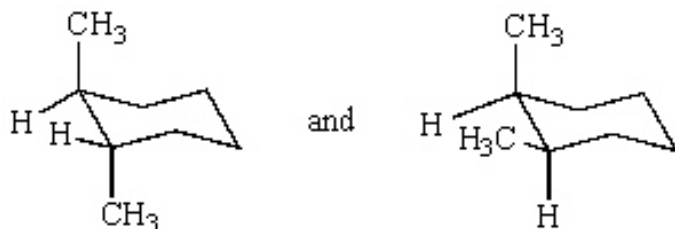
- A.** The methyl and bromine are *cis* and the chlorine and bromine are *cis*.
 - B. The methyl and bromine are *trans* and the chlorine and bromine are *cis*.
 - C. The methyl and chlorine are *trans* and the methyl and bromine are *cis*.
 - D. The methyl and chlorine are *trans* and the methyl and bromine are *trans*.
 - E. The methyl and chlorine are *trans* and the bromine and chlorine are *cis*.
33. Cycloalkanes with _____ or more carbons in the ring are nonplanar.

- A. 2
- B. 3
- C.** 4
- D. 5
- E. 6

34. 1-Bromopropane and 2-bromopropane are

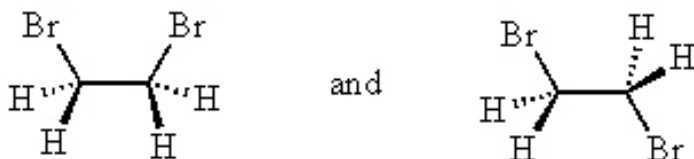
- A. constitutional isomers.
- B. homologs.
- C. configurational isomers.
- D. conformational isomers.
- E. stereoisomers.

35. The compounds represented by the structures below are:



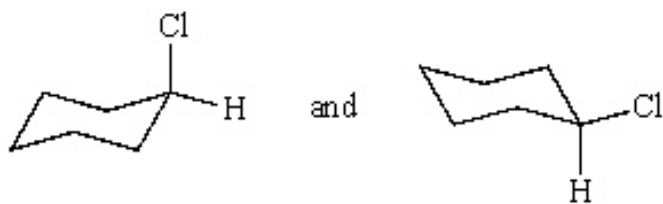
- A. structural isomers.
- B. identical.
- C. *cis-trans* isomers.
- D. conformers.
- E. constitutional isomers.

36. The compounds represented by the structures below are:



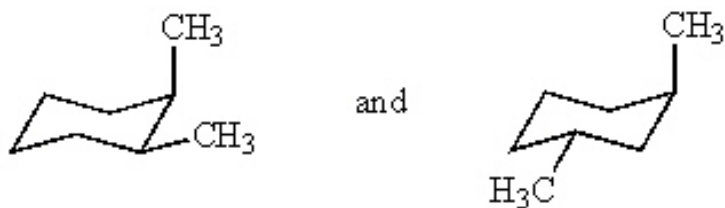
- A. structural isomers.
- B. different compounds.
- C. *cis-trans* isomers.
- D. conformers.
- E. constitutional isomers.

37. The compounds represented by the structures below are:



- A. structural isomers.
- B. different compounds.
- C. *cis-trans* isomers.
- D.** conformers.
- E. constitutional isomers.

38. The compounds represented by the structures below are:



- A.** constitutional isomers.
- B. identical.
- C. *cis-trans* isomers.
- D. conformers.
- E. different compounds (not isomers)..

39. In the chlorination of methane, the propagation steps involve forming:

- A. H radicals
- B. methyl radicals
- C. chlorine radicals
- D. a, b, and c
- E.** b and c

40. How many monobromo products can be obtained from the bromination of cyclopentane?

- A.** 1
- B. 2
- C. 3
- D. 4
- E. 5

41. How many isomeric dichloro products can be obtained from the chlorination of cyclopropane?
- A. 1
 - B. 2
 - C. 3**
 - D. 4
 - E. 5
42. The number of possible monobromination products, including *cis-trans* isomers, of methylcyclopentane is
- A. 2
 - B. 3
 - C. 4
 - D. 5
 - E. 6**
43. The number of possible dibromination products of 2-methylpropane is
- A. 2
 - B. 3**
 - C. 4
 - D. 5
 - E. 6
44. The number of possible dichlorination products of propane is
- A. 2
 - B. 3
 - C. 4**
 - D. 5
 - E. 6