

Chapter 2 -- Alkanes and Cycloalkanes

MULTIPLE CHOICE

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) $C_{14}H_{26}$

ANS: B

TOP: Alkane Nomenclature and Structural Formulas

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

ANS: A

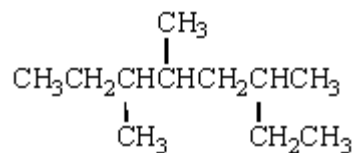
TOP: Alkane Nomenclature and Structural Formulas

3. What is the name of the alkane that has three carbon atoms?
- A) methane
 - B) ethane
 - C) propane
 - D) butane
 - E) isobutane

ANS: C

TOP: Alkane Nomenclature and Structural Formulas

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

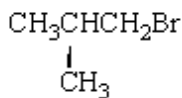


- A) 6-ethyl-3,4,-dimethylheptane
- B) 2-ethyl-4,5-dimethylheptane
- C) 3,4,6-trimethyloctane
- D) 3,5,6-trimethyloctane
- E) none of these

ANS: C

TOP: Alkane Nomenclature and Structural Formulas

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

ANS: A

TOP: Alkane Nomenclature and Structural Formulas

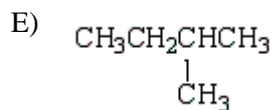
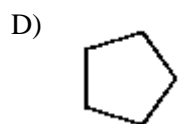
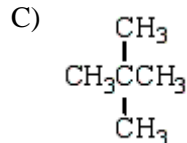
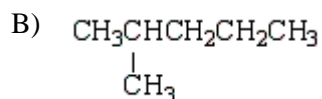
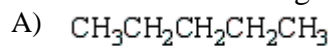
6. The name of the alkyl group that contains three carbons is:

- A) methyl
- B) ethyl
- C) propyl
- D) isopropyl
- E) none of these

ANS: C

TOP: Alkane Nomenclature and Structural Formulas

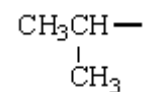
7. Which of the following structures is 2-methylpentane?



ANS: B

TOP: Alkane Nomenclature and Structural Formulas

8. The name of the alkyl group below is:



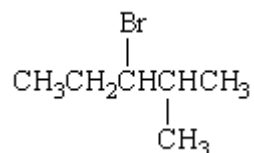
- A) ethyl
- B) propyl
- C) isopropyl
- D) butyl

E) isobutyl

ANS: C

TOP: Alkane Nomenclature and Structural Formulas

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

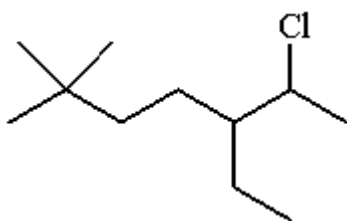


- A) isohexyl bromide
- B) 3-bromo-4-methylpentane
- C) 1-bromopropylpropane
- D) 3-bromo-2-methylpentane
- E) 2-methyl-3-bromopentane

ANS: D

TOP: Alkane Nomenclature and Structural Formulas

10. The IUPAC name for the following molecule is:

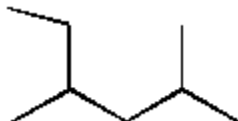


- A) 2-chloro-3-ethyl-6,6-dimethylheptane
- B) 6-chloro-5-ethyl-2,2-dimethylheptane
- C) 6-chloro-2,2-dimethyl-5-ethylheptane
- D) 2,2-dimethyl-5-chloroethylheptane
- E) 6-chloro-5-ethyl-2-dimethylheptane

ANS: B

TOP: Alkane Nomenclature and Structural Formulas

11. The IUPAC name for the following molecule is:

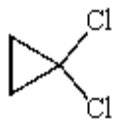


- A) 2-ethyl-4-methylpentane
- B) 4-methyl-2-methylpentane
- C) 2,4-dimethylhexane
- D) 1-isopropyl-2-methylbutane
- E) 2,4-methylhexane

ANS: C

TOP: Alkane Nomenclature and Structural Formulas

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



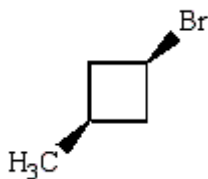
- A) 2,2-dichlorocyclopropane
- B) 1,1-dichlorocyclopentane
- C) 1,1-dichloropropane
- D) *trans*-1,1-dichlorocyclopropane
- E) 1,1-dichlorocyclopropane

ANS: E

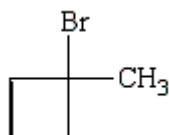
TOP: Alkane Nomenclature and Structural Formulas

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

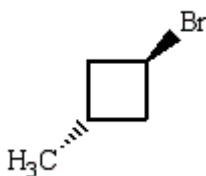
A)



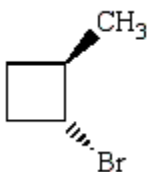
B)



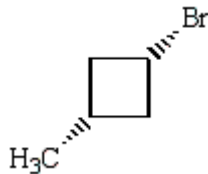
C)



D)



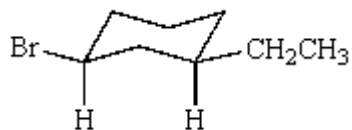
E)



ANS: C

TOP: Alkane Nomenclature and Structural Formulas

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

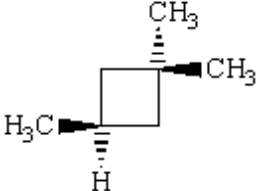


- A) bromoethylcyclohexane
- B) *trans*-1-ethyl-3-bromocyclohexane
- C) *cis*-3-bromo-1-ethylhexane
- D) 1-bromo-3-ethylcyclohexane
- E) *cis*-1-bromo-3-ethylcyclohexane

ANS: E TOP: Alkane Nomenclature and Structural Formulas

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.

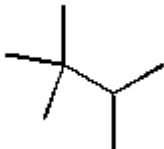
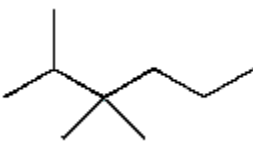

ANS: D TOP: Alkane Nomenclature and Structural Formulas

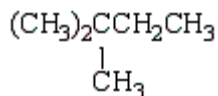
16. The correct IUPAC name for  is:

- 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.

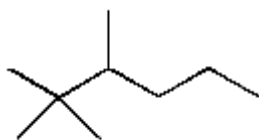
ANS: D TOP: Alkane Nomenclature and Structural Formulas

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

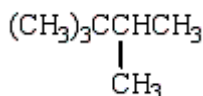
- A) 
- B) 
- C) 



D)



E)



ANS: D

TOP: Alkane Nomenclature and Structural Formulas

18. Which of the following would exhibit hydrogen bonding?

- A) CH_3Cl
- B) CH_3OH
- C) CH_4
- D) CH_2Cl_2
- E) CH_3CH_3

ANS: B

TOP: Alkane Properties

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

ANS: D

TOP: Alkane Properties

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.

ANS: E

TOP: Alkane Properties

21. Which cycloalkane has the highest boiling point?

- A) cyclopropane
- B) cyclobutane
- C) cyclopentane
- D) cyclohexane
- E) cyclooctane

ANS: E

TOP: Alkane Properties

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

ANS: D TOP: Alkane Properties

23. The most stable conformation of propane is:
- A) staggered
 - B) chair
 - C) planar
 - D) eclipsed
 - E) boat

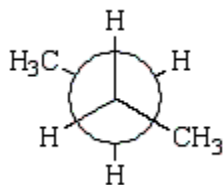
ANS: A TOP: Conformations of Alkanes

24. The least stable conformation of propane is:
- A) staggered
 - B) chair
 - C) planar
 - D) eclipsed
 - E) boat

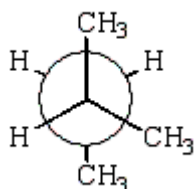
ANS: D TOP: Conformations of Alkanes

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

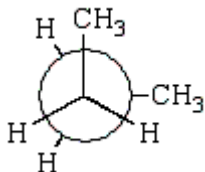
A)



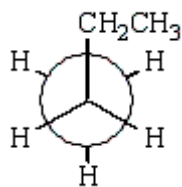
B)



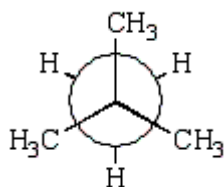
C)



D)



E)

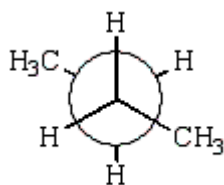


ANS: A

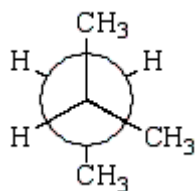
TOP: Conformations of Alkanes

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

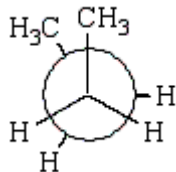
A)



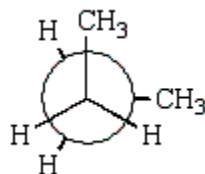
B)



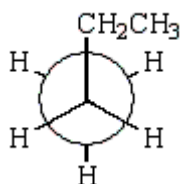
C)



D)



E)



ANS: C

TOP: Conformations of Alkanes

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

ANS: C TOP: Conformations of Cycloalkanes

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°

ANS: B TOP: Conformations of Cycloalkanes

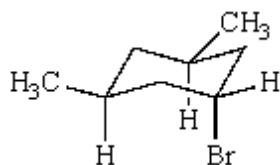
29. For the most stable conformation of *cis*-1,3-dimethylcyclohexane:
- A) both methyls will occupy the axial position
 - B) both methyls will occupy the equatorial position
 - C) one methyl will occupy the axial position and the other an equatorial position
 - D) more than one answer is correct

ANS: B TOP: Conformations of Cycloalkanes

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

ANS: A TOP: Conformations of Cycloalkanes

31. Consider this chair conformation:



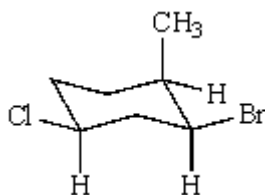
When the ring flips,

- 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.

ANS: C

TOP: Conformations of Cycloalkanes

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*.

ANS: A

TOP: Conformations of Cycloalkanes

33. Cycloalkanes with _____ or more carbons in the ring are nonplanar.

- A) 2
- B) 3
- C) 4
- D) 5
- E) 6

ANS: C

TOP: Conformations of Cycloalkanes

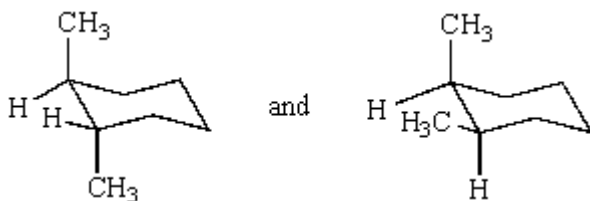
34. 1-Bromopropane and 2-bromopropane are

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

ANS: A

TOP: Isomerism

35. The compounds represented by the structures below are:

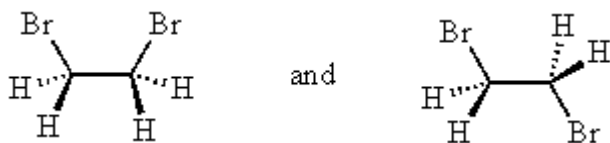


- A) structural isomers.
- B) identical.
- C) *cis-trans* isomers.
- D) conformers.
- E) constitutional isomers.

ANS: C

TOP: Isomerism

36. The compounds represented by the structures below are:

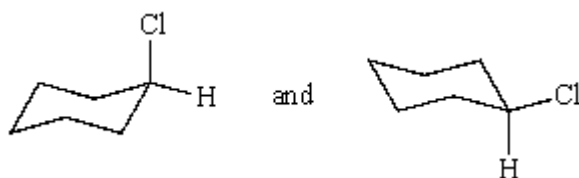


- A) structural isomers.
- B) different compounds.
- C) *cis-trans* isomers.
- D) conformers.
- E) constitutional isomers.

ANS: D

TOP: Isomerism

37. The compounds represented by the structures below are:

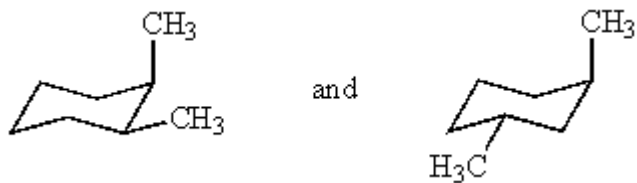


- A) structural isomers.
- B) different compounds.
- C) *cis-trans* isomers.
- D) conformers.
- E) constitutional isomers.

ANS: D

TOP: Isomerism

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)..

ANS: A

TOP: Isomerism

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

ANS: E TOP: Reactions of Alkanes

40. How many monobromo products can be obtained from the bromination of cyclopentane?
- A) 1
 - B) 2
 - C) 3
 - D) 4
 - E) 5

ANS: A TOP: Reactions of Alkanes

41. How many isomeric dichloro products can be obtained from the chlorination of cyclopropane?
- A) 1
 - B) 2
 - C) 3
 - D) 4
 - E) 5

ANS: C TOP: Reactions of Alkanes

42. The number of possible monobromination products, including *cis-trans* isomers, of methylcyclopentane is
- A) 2
 - B) 3
 - C) 4
 - D) 5
 - E) 6

ANS: E TOP: Reactions of Alkanes

43. The number of possible dibromination products of 2-methylpropane is
- A) 2
 - B) 3
 - C) 4
 - D) 5
 - E) 6

ANS: B TOP: Reactions of Alkanes

44. The number of possible dichlorination products of propane is
- A) 2
 - B) 3
 - C) 4
 - D) 5

E) 6

ANS: C

TOP: Reactions of Alkanes