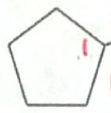
For more practice with naming cycloalkanes go to Supplemental Practice Problems in Appendix A.

PRACTICE PROBLEMS

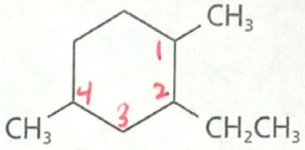
10. Use IUPAC rules to name the following structures.

a.

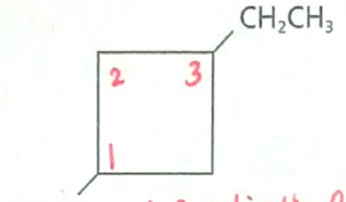


methyl cyclopentane

b.



c.



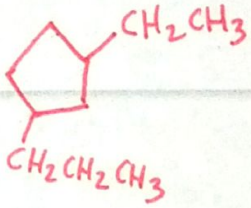
2-ethyl-1,4-dimethyl cyclohexane

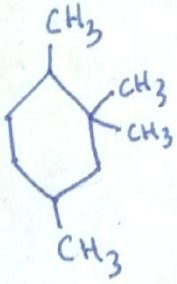
1,3-diethyl cyclobutane

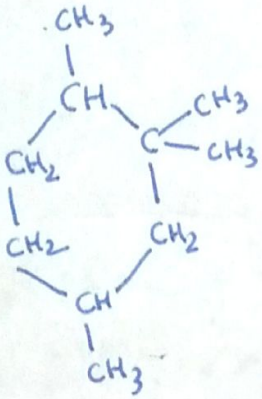
11. Draw the structures of the following cycloalkanes.

a. 1-ethyl-3-propylcyclopentane

b. 1,2,2,4-tetramethylcyclohexane







Properties of Alkanes

You have learned that the structure of a molecule affects its properties. For example, ammonia (NH_3) can accept a proton from an acid to become an ammonium ion (NH_4^+) because the nitrogen atom has an unshared pair of electrons. As another example, the O—H bonds in a water molecule are polar, and because the H—O—H molecule has a bent geometry, the molecule itself is polar. Thus water molecules are attracted to each other and can form hydrogen bonds with each other. As a result, the boiling and melting points of water are much higher than those of other substances having similar molecular mass and size.

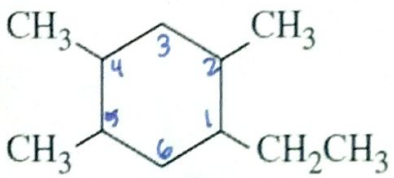
What properties would you predict for alkanes? All of the bonds in these hydrocarbons are between either a carbon atom and a hydrogen atom or two carbon atoms. Are these bonds polar? Remember, a bond between two atoms is polar only if the atoms differ by at least 0.5 in their Pauling electronegativity values. Carbon's electronegativity value is 2.55, and hydrogen's is 2.20, so a C—H bond has a difference of only 0.35. Thus, it is not polar. A bond between two identical atoms such as carbon can never be polar because the difference in their electronegativity values is zero. Because all of the bonds in alkanes are nonpolar, alkane molecules are nonpolar.

Physical properties of alkanes What types of physical properties do nonpolar compounds have? A comparison of two molecular substances—one

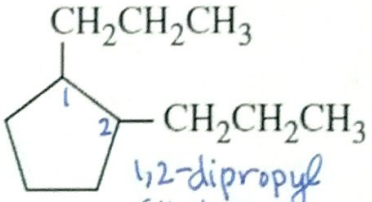
Table 22-3

Section 22.2 Assessment

12. Use IUPAC rules to name the following structures.

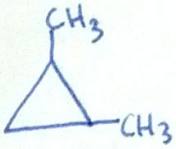
a. 

1-ethyl-2,4,5-trimethylcyclohexane

b. 

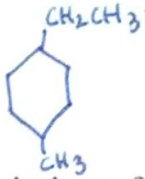
1,2-dipropyl cyclopentane

13. Write a condensed structural formula for each of the following.



a. 1-ethyl-4-methylcyclohexane

b. 1,2-dimethylcyclopropane



14. Describe the main structural characteristics of alkane molecules. Give two examples of how these characteristics determine the physical properties of alkanes.

- only single covalent bonds
- nonpolar C–C and C–H bonds; insoluble in H_2O
- strong & stable bonds ∴ relatively unreactive

15. What structural char
rated from unsaturat

16. Thinking Critically
described as "hydrog
means that the oils r
presence of a catalys
explain why hydroge

17. Modeling Construc
models of the follow

a. isopropylcyclobu

b. 1,2,4-trimethylcy

8.50 x 10.88 in

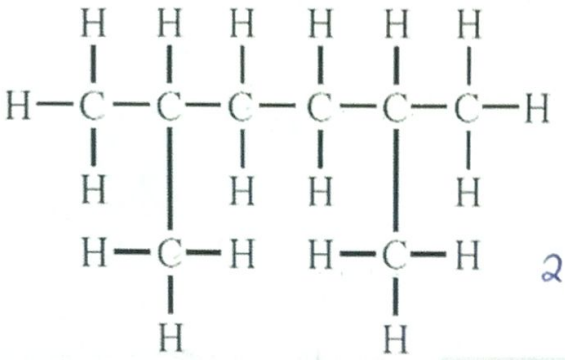
15. Saturated hydrocarbons have only single C–C bonds. Unsaturated hydrocarbons contain double or triple bonds

61. Name the compound represented by each of the following structural formulas.

a. $CH_3CH_2CH_2CH_2CH_3$ pentane

b. $CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2CH_3$ 3-methyl pentane

c.



2,5-dimethyl hexane

d.

2,3-dimethyl butane

62. Draw full structural formulas for the following compounds.

a. heptane
b. 2-methylhexane
c. 2,3-dimethylpentane
d. 2,2-dimethylpropane

Cyclic Alkanes and Alkane Properties (22.2)

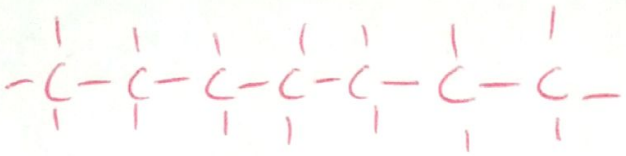
63. Draw condensed structural formulas for the following compounds. Use line structures for rings.

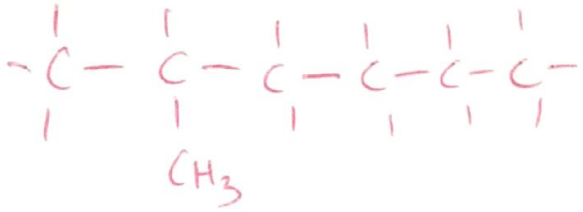
a. 1,2-dimethylcyclopropane
b. 1,1-diethyl-2-methylcyclopentane

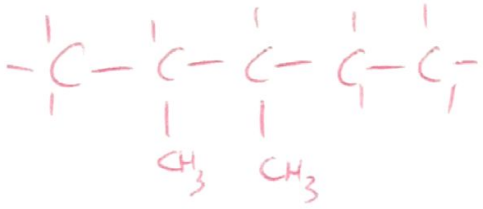
b

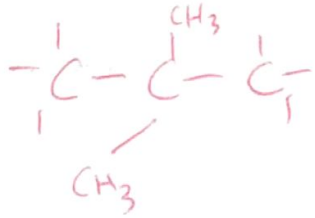
Isom

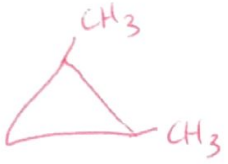
68. Ic
gr
a.

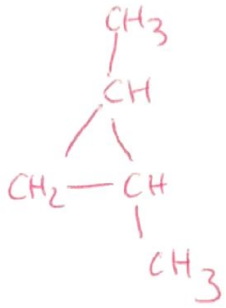
62 a) 

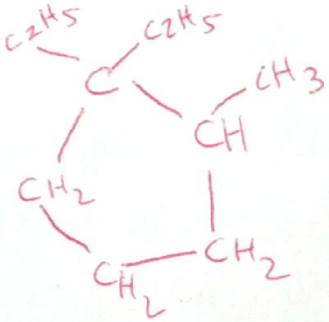
b) 

c) 

d) 

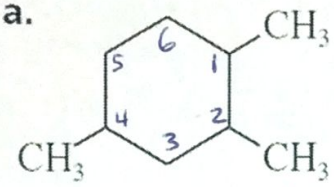
63. a) 



b) 

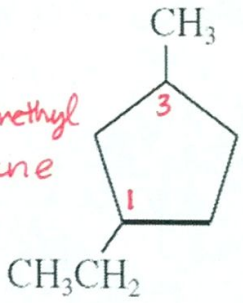
64. Name the compound represented by each of the following structural formulas.

a.



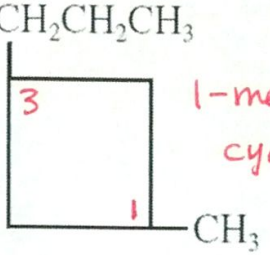
1,2,4-trimethylcyclohexane

b.



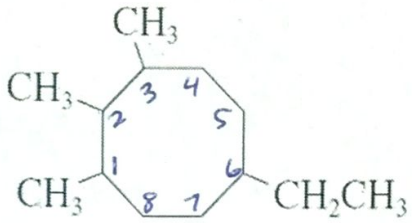
1-ethyl-3-methylcyclopentane

c.



1-methyl-3-propylcyclobutane

d.



6-ethyl-1,2,3-trimethylcyclooctane

69. Ic lc h

a

b

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Alkenes and Alkynes (22.3)

65. Name the compound represented by each of the following condensed structural formulas.

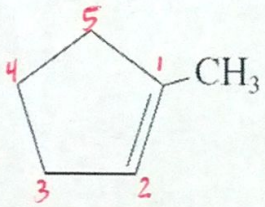
a. $CH_3C(CH_3)=CHCH_3$

2-methyl-2-butene

b. $CH_3CH_2C(CH_2CH_3)=CH_2$

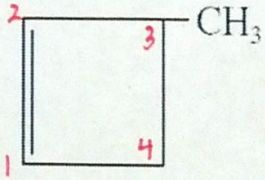
2-ethyl-1-butene

c.



1-methylcyclopentene

d.



3-methylcyclobutene

70. T th th m

a

c.

65a. 2-methyl-2-butene

b. 2-ethyl-1-butene

c. 1-methylcyclopentene

d. 3-methylcyclobutene

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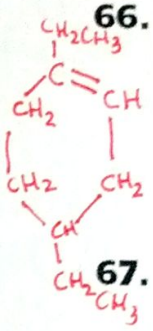
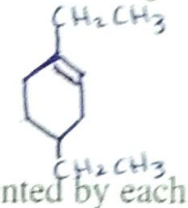
66. Draw condensed structural formulas for the following compounds. Use line structures for rings.

a. 1,4-diethylcyclohexene

b. 2,4-dimethyl-1-octene

c. 2,2-dimethyl-3-hexyne

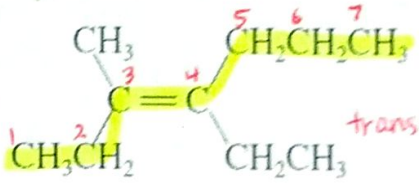




(b) $CH_2=C(CH_3)CH_2CH(CH_3)CH_2CH_2CH_2CH_3$ b

67. Name the compound represented by each of the following condensed structural formulas.

a.



trans-4-ethyl-3-methyl-3-heptene

71. D st

72. D e C

8.50 x 10.88 in

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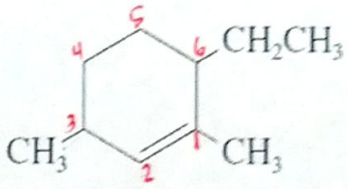
b.

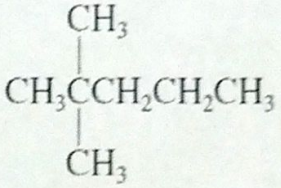


6-ethyl-1,3-dimethyl cyclohexene

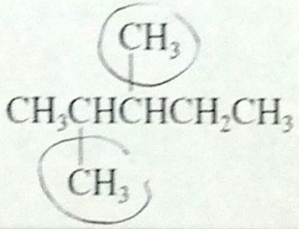
Isomers (22.4)

68. Identify the pair of structural isomers in the following group of condensed structural formulas.

a.



c.



68. (b) & (d) are geometric isomers (cis/trans)
(a) is a structural isomer of (b) & (d)