MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) The eclipsed and staggered forms of ethane are said to differ in:
   A) molecular formula.
   B) configuration.
   C) conformation.
   D) constitution.
   E) structure.

2) Which of the following is the staggered conformation for rotation about the C₁–C₂ bond in the following structure?

   CH₃
   CH₃CHCH₂CH₃
   1  2  3  4

   I.  
   II. 
   III. 

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

3) Among the butane conformers, which occur at energy minima on a graph of potential energy versus dihedral angle?
   A) gauche only
   B) eclipsed and totally eclipsed
   C) gauche and anti
   D) eclipsed only
   E) anti only

4) Which of the following best explains the relative stabilities of the eclipsed and staggered forms of ethane? The ________ form has the most ________ strain.
   A) eclipsed; steric
   B) eclipsed; torsional
   C) staggered; steric
   D) staggered; torsional
5) Which of the following best explains the reason for the relative stabilities of the conformers shown?

A) I has more torsional strain.  
B) I has more steric strain.  
C) II has more torsional strain.  
D) II has more steric strain.

6) Which of the following statements about the conformers that result from rotation about the C2–C3 bond of butane is correct?

A) The highest energy conformer is one in which methyl groups are eclipsed by hydrogens.  
B) The gauche conformer is an eclipsed one.  
C) Steric strain is absent in the eclipsed forms.  
D) Torsional strain is absent in the eclipsed forms.  
E) none of the above

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

7) Draw the Newman projection that represents the most stable conformation of 3,3-dimethylhexane viewed along the C3–C4 bond.

8) Draw the Newman projection that represents the least stable conformation of 3,3-dimethylhexane viewed along the C3–C4 bond.

9) Draw the Newman structure for the most stable conformation of 1-bromopropane considering rotation about the C1–C2 bond.

10) Draw a Newman projection of the most stable conformation of 2-methylpropane.

11) Define the term conformation.

12) Use a sawhorse structure to depict the eclipsed conformer of ethane.

13) View a butane molecule along the C2–C3 bond and provide a Newman projection of the lowest energy conformer.

14) Provide a representation of the gauche conformer of butane.

15) Draw the Newman projection of the most stable conformation that results due to rotation about the C2–C3 bond in 2,3-dimethylbutane.
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

16) Which of the following correctly ranks the cycloalkanes in order of increasing ring strain per methylene?
   A) cyclopropane < cyclobutane < cyclohexane < cycloheptane
   B) cyclohexane < cyclopentane < cyclobutane < cyclopropane
   C) cyclopentane < cyclobutane < cyclopropane < cyclohexane
   D) cyclopentane < cyclopropane < cyclobutane < cyclohexane
   E) cyclopropane < cyclopentane < cyclobutane < cyclohexane

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

17) Describe the source of angle strain and torsional strain present in cyclopropane.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

18) Which of the following correctly lists the conformations of cyclohexane in order of increasing energy?
   A) chair < boat < twist-boat < half-chair
   B) half-chair < boat < twist-boat < chair
   C) chair < twist-boat < half-chair < boat
   D) chair < twist-boat < boat < half-chair
   E) half-chair < twist-boat < boat < chair

19) Which of the following is the most stable conformation of bromocyclohexane?
   A) I
   B) II
   C) III
   D) IV
   E) V

20) In the boat conformation of cyclohexane, the "flagpole" hydrogens are located:
   A) on the same carbon.
   B) on adjacent carbons.
   C) on C-1 and C-3.
   D) on C-1 and C-4.
   E) none of the above
21) Which conformer is at a local energy minimum on the potential energy diagram in the chair-chair interconversion of cyclohexane?
   A) half-chair
   B) planar
   C) boat
   D) twist-boat
   E) fully eclipsed

   SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

   22) Draw the chair conformer of cyclohexane. Label the axial hydrogens (Hₐ) and the equatorial hydrogens (Hₑ).

   MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

   23) The $K_{eq}$ for the interconversion for the two chair forms of methylcyclohexane at 25 °C is 18. What % of the chair conformers feature an axial methyl group?
   A) 95
   B) 75
   C) 50
   D) 25
   E) 5

   SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

   24) The equilibrium constant for the ring-flip of fluorocyclohexane is 1.5 at 25 °C. Calculate the percentage of the axial conformer at the temperature.

   MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

   25) Which of the following describes the most stable conformation of trans-1-tert-butyl-3-methylcyclohexane?
   A) Both groups are equatorial.
   B) Both groups are axial.
   C) The tert-butyl group is equatorial and the methyl group is axial.
   D) The tert-butyl group is axial and the methyl group is equatorial.
   E) none of the above

   26) Name the compound shown below.

   A) trans-1,2-dichlorocyclohexane
   B) cis-1,2-dichlorocyclohexane
   C) trans-1,3-dichlorocyclohexane
   D) cis-1,3-dichlorocyclohexane
   E) trans-1,4-dichlorocyclohexane

   27) Which of the following has two equatorial alkyl substituents in its most stable conformation?
   A) 1,1-dimethylcyclohexane
   B) cis-1,2-dimethylcyclohexane
   C) cis-1,3-diethylcyclohexane
   D) cis-1,4-diethylcyclohexane
   E) trans-1,3-diethylcyclohexane
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

28) Draw the most stable conformation of trans-1-tert-butyl-3-methylcyclohexane.  

29) Draw the most stable conformer of cis-1-isopropyl-2-methylcyclohexane.  

30) Draw the most stable conformation of cis-1-isopropyl-2-methylcyclohexane.  

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

31) How many constitutional isomers are possible for C\textsubscript{6}H\textsubscript{14}?  
   A) 4  
   B) 5  
   C) 6  
   D) 7  
   E) 8  

32) If an acyclic alkane hydrocarbon contains \( n \) carbon atoms, how many hydrogen atoms must it also contain?  
   A) \( n \)  
   B) \( n + 2 \)  
   C) \( n - 2 \)  
   D) \( 2n \)  
   E) \( 2n + 2 \)
Answer Key
Testname: CONFORMATIONS

1) C
   ID: oc5b 2-58
   Diff: 0
   Skill:

2) A
   ID: oc5b 2-59
   Diff: 0
   Skill:

3) C
   ID: oc5b 2-60
   Diff: 0
   Skill:

4) B
   ID: oc5b 2-61
   Diff: 0
   Skill:

5) D
   ID: oc5b 2-62
   Diff: 0
   Skill:

6) E
   ID: oc5b 2-63
   Diff: 0
   Skill:

7)

   CH₂CH₃
   H
   H
   H₃C
   CH₃
   CH₂CH₃

   ID: oc5b 2-64
   Diff: 0
   Skill:

8)

   H₃CH₂C
   CH₂CH₃
   H
   H₃C
   H
   CH₃
   CH₃

   eclipsed

   ID: oc5b 2-65
   Diff: 0
   Skill:
11) Conformations are different arrangements of the same molecule formed by rotations about single bonds.

12)
13) The angle strain arises from the compression of the ideal tetrahedral bond angle of 109.5° to 60°. The large torsional strain occurs since all C–H bonds on adjacent carbons are eclipsed.

14) B

17) The angle strain arises from the compression of the ideal tetrahedral bond angle of 109.5° to 60°. The large torsional strain occurs since all C–H bonds on adjacent carbons are eclipsed.
19) C
   ID: oc5b 2-76
   Diff: 0
   Skill:

20) D
   ID: oc5b 2-77
   Diff: 0
   Skill:

21) D
   ID: oc5b 2-78
   Diff: 0
   Skill:

22)

23) E
   ID: oc5b 2-80
   Diff: 0
   Skill:

24) \( K_{eq} = \frac{[eq]}{[ax]} = 1.5 \)

% axial = \( \frac{[ax]}{[eq] + [ax]} \approx 100\% \)

= \( \frac{[1]}{[1.5] + [1]} \approx 100\% \)

= 40%
   ID: oc5b 2-81
   Diff: 0
   Skill:

25) C
   ID: oc5b 2-82
   Diff: 0
   Skill:

26) D
   ID: oc5b 2-83
   Diff: 0
   Skill:

27) C
   ID: oc5b 2-84
   Diff: 0
   Skill:
Answer Key
Testname: CONFORMATIONS

28)

ID: oc5b 2–85
Diff: 0
Skill:

29)

ID: oc5b 2–86
Diff: 0
Skill:

30)

ID: oc5b 2–87
Diff: 0
Skill:

31) B
ID: oc5b 2–88
Diff: 0
Skill:

32) E
ID: oc5b 2–89
Diff: 0
Skill:
Name___________________________________

1) ______
2) ______
3) ______
4) ______
5) ______
6) ______
7) ______

8) ______

9) ______

10) ______

11) ______
12) ______