MULTIPLE CHOICE QUESTIONS
Part 4 – Nomenklatur -konformation
(Answers on pages 21-22) Upptäckta markerade * är överkurs
Topic: Nomenclature

1. The IUPAC name for
   A) 6-Ethyl-3,4-dimethylheptane
   B) 2-Ethyl-4,5-dimethylheptane
   C) 3,4,6-Trimethylheptane
   D) 3,5,6-Trimethylheptane
   E) 2-(1-Methylpropyl)-4-methylhexane

   is:

2. An IUPAC name for
   A) 5-Methyl-4-(1-methylpropyl)hexane
   B) 2-Methyl-3-(1-methylpropyl)hexane
   C) 2-Methyl-3-(2-methylpropyl)hexane
   D) 3-Methyl-4-(1-methylpropyl)heptane
   E) 5-Methyl-4-(1-methylethyl)heptane

   is:

3. A correct IUPAC name for the following compound is:
   A) 2,5-Dimethyl-3-propylheptane
   B) 3,6-Dimethyl-5-propylheptane
   C) 6-Methyl-4-(1-methylethyl)octane
   D) 2-Methyl-3-(2-methylbutyl)hexane
   E) 3-Methyl-5-(1-methylethyl)octane

4. A correct IUPAC name for the following compound is:

   OH
   Cl

   A) 4-propyl-5-chloro-3-heptanol
   B) 4-propyl-3-chloro-5-heptanol
   C) 4-(1-chloropropyl)-3-heptanol
   D) 5-chloro-4-propyl-3-heptanol
   E) 3-hydroxy-4-propyl-5-chloroheptane

Topic: Nomenclature

5. Which of the following pairs of compounds represent pairs of constitutional isomers?
   A) 2-Methylbutane and pentane
   B) 2-Chlorohexane and 3-chlorohexane
   C) sec-Butyl bromide and tert-butyl bromide
   D) Propyl chloride and isopropyl chloride
   E) All of the above

6. Which of the following is bicyclo[3.2.2]nonane?

   I
   II
   III

   IV
   V

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

7. Select the systematic name for

   Cl
   H
   O

   A) cis-1,3-Dichlorocyclopentane
   B) trans-1,4-Dichlorocyclopentane
   C) cis-1,2-Dichlorocyclopentane
   D) trans-1,3-Dichlorocyclopentane
   E) 1,3-Dichlorocyclopentane
9. Which isomer of C₅H₁₀ would you expect to have the smallest heat of combustion*?
A) Cyclopentane
B) Methylcyclobutane
C) 1,1-Dimethylcyclopropane
D) cis-1,2-Dimethylcyclopropane
E) trans-1,2-Dimethylcyclopropane

Topic: Nomenclature

12. What is the common name for this compound?

\[ \text{Br} \]

A) Isobutyl bromide
B) tert-Butyl bromide
C) Butyl bromide
D) sec-Butyl bromide
E) Bromo-sec-butane

13. A correct IUPAC name for the following compound is:

\[ \text{Br} \]

A) 3,6,7-trimethyl-4-bromo-1-octene
B) 4-bromo-3-methyl-6-isopropyl-1-heptene
C) 4-bromo-3,6,7-trimethyl-1-octene
D) 4-bromo-6-isopropyl-3-methyl-1-heptene

Use the following to answer questions 18-19:

\[ \text{Br} \]  
\[ \text{Br} \]  
\[ \text{Br} \]

18. trans-1,2-Dibromocyclohexane is represented by structure(s):
A) I
B) II
C) III
D) II and III
E) I and II

19. cis-1,2-Dibromocyclohexane is represented by structure(s):
A) I
B) II
C) III
D) II and III
E) I and II

20. cis-1,3-Dibromocyclohexane is represented by structure(s):

\[ \text{Br} \]

A) I
B) II
C) III
D) II and III
E) I and II

21. An IUPAC name for the group \( \text{CH}_3\text{CHCH}_2\text{CH}_3 \) is:
A) Isopentyl
B) Isooamyl
C) sec-Butylmethyl
D) 2-Methylbutyl
E) 2-Ethylpropyl

22. The neopentyl group has the alternative name:
A) 1,1-Dimethylpropyl
B) 1,2-Dimethylpropyl
C) 2,2-Dimethylpropyl
D) 1-Methylbutyl
E) 2-Methylbutyl
23. The correct IUPAC name for the given compound is:
A) 2-Bromo-4-chloro-4-isopropylpentane  
B) 4-Bromo-2-chloro-2-isopropylpentane  
C) 5-Bromo-3-chloro-2,3-dimethylhexane  
D) 2-Bromo-4-chloro-4,5-dimethylhexane  
E) 2-(2-Bromopropyl)-2-chloro-3-methylbutane

24. Which of the following is a correct name which corresponds to the common name tert-butyl alcohol?  
A) 2,2-Dimethyl-1-propanol  
B) 2-Ethyl-2-propanol  
C) 2-Methyl-2-butanol  
D) 3-Methyl-1-butanol  
E) Methyl 1-tert-butanol

Topic: Nomenclature

25. The correct IUPAC name for the given compound is:
A) 1-Hydroxy-3-sec-butylcyclopentane  
B) 3-sec-Butyl-1-cyclopentanol  
C) 1-sec-Butyl-3-cyclopentanol  
D) 4-sec-Butyl-1-cyclopentanol  
E) 3-Isobutyl-1-cyclopentanol

26. What is a correct name for the given compound?  
A) 3-Isobutyl-2-methylheptane  
B) 3-sec-Butyl-2-methyloctane  
C) 5-Isobutyl-6-methylheptane  
D) 2-Ethyl-3-isopropylcyclohexane  
E) 4-Isopropyl-3-methylnonane

28. What is the correct IUPAC name for the following compound?  

A) 3-Hydroxymethylheptane  
B) 3-Hydroxymethylhexane  
C) 3-Methyloxyheptane  
D) 2-Ethyl-1-hexanol  
E) 2-Ethyl-1-heptanol

30. Which of these is the common name for the 1,1-dimethylpropyl group?  
A) tert-Butyl  
B) sec-Pentyl  
C) Isopentyl  
D) Neopentyl  
E) tert-Pentyl

31. Neglecting stereochemistry, which of these common group names is ambiguous, i.e., does not refer to one specific group?  
A) Butyl  
B) sec-Butyl  
C) tert-Butyl  
D) Neopentyl  
E) tert-Pentyl

32. What is the correct IUPAC name for the following compound?  

A) 5-Ethyl-3-methylhexanol  
B) 5-Ethyl-3-methyl-1-hexanol  
C) 2-Ethyl-4-methyl-1-hexanol  
D) 3,5-Dimethyl-7-heptanol  
E) 3,5-Dimethyl-1-heptanol
33. Isopentyl is the common name for which alkyl group?
A) CH₃CH₂CH₂CHCH₃
B) CH₃CH₂CHCH₂CH₃
C) CH₃CH₂CH₂CH₂CH₂CH₃
D) CH₃CH₂CH₂CH₃
E) CH₃CH₂CH₂CH₂CH₂CH₃

34. An IUPAC name for

\[
\begin{align*}
\text{HO} & \quad \text{(Compound)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₂CH₂} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\end{align*}
\]

is:
A) 3-Hydroxymethyl-2-heptene
B) 3-(1-Methylethyl)-2-heptene
C) 3-(1-Methylethyl)-2-heptene
D) 3-Hydroxymethyl-2-heptene
E) 3-(1-Methylethyl)-2-heptene

35. An IUPAC name for the following compound is:

\[
\begin{align*}
\text{HO} & \quad \text{(Compound)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₂CH₂} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\end{align*}
\]

A) 4-Isobutyl-3,4-dimethylheptane
B) 4-sec-Butyl-2,4-dimethylheptane
C) 2,4,5-Trimethyl-4-propylheptane
D) 3,4,6-Trimethyl-4-propylheptane
E) 4-Isobutyl-4,5-dimethylheptane

36. What is the correct IUPAC name for the following compound?

\[
\begin{align*}
\text{HO} & \quad \text{(Compound)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₂CH₂} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\end{align*}
\]

A) 3-Hydroxymethyl-2-heptene
B) 2-(1-Methylethyl)-4-hexen-1-ol
C) 5-(1-Methylethyl)-2-hexen-6-ol
D) 5-Isopropyl-2,6-hexenol
E) 2-(1-Methylethyl)-4-hept-1-en-1-ol

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

\[
\begin{align*}
\text{HO} & \quad \text{(Compound)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₂CH₂} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\end{align*}
\]

A) 5-Ethyl-3-fluorohexanol
B) 5-Ethyl-3-fluoro-1-hexanol
C) 2-Ethyl-4-fluoro-6-hexanol
D) 3-fluoro-5-methyl-7-heptanol
E) 3-fluoro-5-methyl-1-heptanol

38. A correct name for the following compound is:

\[
\begin{align*}
\text{HO} & \quad \text{(Compound)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₂CH₂} & \quad \text{(Carbon) (Carbon)} \\
\text{CH₃} & \quad \text{(Carbon) (Carbon)} \\
\end{align*}
\]

A) 3-Chloro-8-methylbicyclo[4.3.0]nonane
B) 8-Methyl-3-chlorobicyclo[4.3.1]nonane
C) 3-Methyl-7-chlorobicyclo[4.3.0]nonane
D) 3-Methyl-7-chlorobicyclo[4.3.1]decane
E) 3-Chloro-8-methyl[4.3.0]bicyclononane
Topic: Conformational Analysis

40. The least stable conformation of butane is:

\[ \text{H}_2\text{C} \quad \text{H}_2\text{C} \quad \text{H}_2\text{C} \]
\[ \text{H} \quad \text{CH}_3 \quad \text{CH}_3 \]
\[ \text{H} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{H} \quad \text{H} \]

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

41. The preferred conformation of cis-3-tert-butyl-1-methylocyclohexane is the one in which:
A) the tert-butyl group is axial and the methyl group is equatorial.
B) the methyl group is axial and the tert-butyl group is equatorial.
C) both groups are axial.
D) both groups are equatorial.
E) the molecule exists in a boat conformation.

42. What structure represents the most stable conformation of cis-1,3-dimethylocyclohexane?

\[ \text{H}_2\text{C} \quad \text{H}_2\text{C} \quad \text{H}_2\text{C} \]
\[ \text{H} \quad \text{CH}_3 \quad \text{CH}_3 \]
\[ \text{H} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{H} \quad \text{H} \]

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

Topic: Ring Strain 41-47

43. Which cycloalkane has the largest heat of combustion per CH₂ group*?

\[ \text{H}_2\text{C} \quad \text{H}_2\text{C} \quad \text{H}_2\text{C} \]
\[ \text{H} \quad \text{CH}_3 \quad \text{CH}_3 \]
\[ \text{H} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{H} \quad \text{H} \]

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

44. Which cycloalkane has the lowest heat of combustion per CH₂ group*?

\[ \text{H}_2\text{C} \quad \text{H}_2\text{C} \quad \text{H}_2\text{C} \]
\[ \text{H} \quad \text{CH}_3 \quad \text{CH}_3 \]
\[ \text{H} \quad \text{H} \quad \text{H} \]
\[ \text{H} \quad \text{H} \quad \text{H} \]

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

45. Which isomer would have the largest heat of combustion*?
A) Propylcyclopropane  
B) Ethylcyclobutane  
C) Methylcyclopentane  
D) Cyclohexane  
E) Since they are all isomers, all would have the same heat of combustion.
46. Which is the most stable conformation of cyclohexane?
A) Chair  
B) Twist  
C) Boat  
D) One-half chair  
E) Staggered  

47. Which cycloalkane has the greatest ring strain?
A) Cyclopropane  
B) Cyclobutane  
C) Cyclopentane  
D) Cyclohexane  
E) Cycloheptane  

Topic: Conformational Analysis

48. The most stable conformation of butane is:  
A) I  
B) II  
C) III  
D) IV  
E) V  

49. The most stable conformation of 1,2-dibromoethane is:  
A) I  
B) II  
C) III  
D) IV  
E) V  

50. The most stable conformation of 2,3-dibromobutane, viewed through the C-2—C-3 bond:  
A) I  
B) II  
C) III  
D) IV  
E) V  

51. The most stable conformation of 3-bromo-2-methylpentane, viewed through the C-3—C-4 bond (i.e., C-3 in the front, C-4 in the back):  
A) I  
B) II  
C) III  
D) IV  
E) V
52. The most stable conformation of 3-bromo-2-methylpentane, viewed through the C-2—C-3 bond (i.e., C-2 in the front, C-3 in the back):

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

53. The most stable conformation of 2,3-dimethylpentane, viewed through the C-2—C-3 bond (i.e., C-2 in the front, C-3 in the back):

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

54. Which cycloalkane has the least ring strain?
A) Cyclopropane  B) Cyclobutane  C) Cyclopentane  D) Cyclohexane  E) Cycloheptane

55. The most stable conformation of cis-1-tert-butyl-2-methylcyclohexane is the one in which:
A) the tert-butyl group is axial and the methyl group is equatorial.
B) the methyl group is axial and the tert-butyl group is equatorial.
C) both groups are axial.
D) both groups are equatorial.
E) the twist boat conformation is adopted.

56. The most stable conformation of trans-1-tert-butyl-2-methylcyclohexane is the one in which:
A) the tert-butyl group is axial and the methyl group is equatorial.
B) the methyl group is axial and the tert-butyl group is equatorial.
C) both groups are axial.
D) both groups are equatorial.
E) the molecule is in the half chair conformation.

57. The most stable conformation of trans-1-tert-butyl-3-methylcyclohexane is the one in which:
A) the tert-butyl group is axial and the methyl group is equatorial.
B) the methyl group is axial and the tert-butyl group is equatorial.
C) both groups are axial.
D) both groups are equatorial.
E) the twist boat conformation is adopted.

58. In the most stable conformation of cis-1,4-dimethylcyclohexane, the methyl groups are:
A) one axial, one equatorial.
B) both axial.
C) both equatorial.
D) alternating between being both axial and both equatorial.
E) None of the above
59. The most stable conformation for 1,2-ethanediol (ethylene glycol) is shown below. It is the most stable conformation because:

H
\( \rightarrow \)
\( \rightarrow \)
H
\( \rightarrow \)
\( \rightarrow \)

A) This corresponds to an anti conformation.
B) In general, gauche conformations possess the minimum energy.
C) It is stabilized by intramolecular hydrogen bonding.
D) It is a staggered conformation.
E) It has the highest energy of all the possibilities.

60. The graph below is a plot of the relative energies of the various conformations of:

\[ \text{Energy vs. Angle of rotation} \]

A) Ethane
B) Propane
C) Chloroethane
D) 1-Chloropropane (C1-C2 rotation)
E) Butane (C1-C2 rotation)

61. The graph below is a plot of the relative energies of the various conformations of:

\[ \text{Energy vs. Angle of rotation} \]

A) 2-chloropropane
B) 1,3-dichloropropane
C) 2-methylpropane
D) Butane (C1-C2 rotation)
E) Butane (C2-C3 rotation)

Ans: E

62. Consider the graph below, which is a plot of the relative energies of the various conformations of hexane, viewed through the C2-C3 bond. The conformations corresponding to the 60° and 300° are:

\[ \text{Energy vs. Angle of rotation} \]

A) Eclipsed
B) Staggered, and gauche
C) Staggered and anti
D) More stable than the conformation at 180°
E) None of the above

63. Consider the graph below, which is a plot of the relative energies of the various conformations of 2,3-dimethylbutane, viewed through the C2-C3 bond. The conformations corresponding to the 120° and 240° are:

\[ \text{Energy vs. Angle of rotation} \]

A) Eclipsed, more stable than the conformation at 0°
B) Eclipsed, more stable than the conformation at 180°
C) Staggered, more stable than the conformation at 0°
D) Staggered, less stable than the conformation at 180°
E) Two of the above are true
Chapter 4

Topic: Conformational Analysis

64. Which conformation of trans-1-isopropyl-3-methylcyclohexane would be present in greatest amount at equilibrium?
   A) The conformation with the methyl group equatorial and the isopropyl group axial
   B) The conformation with the methyl group axial and the isopropyl group equatorial
   C) The conformation with both groups axial
   D) The conformation with both groups equatorial
   E) The twist boat conformation.

65. Which conformation represents the most stable conformation of trans-1-bromo-4-methylcyclohexane?

   I
   II
   III
   IV
   V

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

Topic: Cis-Trans Isomers

66. Which of the following can be described as cis isomers?

   I
   II
   III
   IV
   V

   A) I
   B) II, V
   C) III, IV
   D) I, III and IV
   E) None of the above are cis isomers.

67. Which of the following can be described as trans isomers?

   I  II  III  IV  V

   A) I
   B) II, V
   C) III, IV
   D) I, III and IV
   E) None of the above are trans isomers.

68. Which of the following will have the same energy after undergoing ring flip?

   I  II  III  IV  V

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

69. The least stable conformation of cyclohexane is the:
   A) boat.
   B) twist boat.
   C) chair.
   D) half-chair.
   E) twist chair.

70. Express, quantitatively, the difference in stability of the two structures shown below.

   I  II

   A) I is more stable than II by 7.5 kJ mol⁻¹.
   B) I is more stable than II by 15 kJ mol⁻¹.
   C) II is more stable than I by 7.5 kJ mol⁻¹.
   D) II is more stable than I by 15 kJ mol⁻¹.
   E) The two are equal in stability.
Chapter 4

Topic: Conformational Analysis

71. The twist boat conformation is the preferred conformation for this compound.
A) cis-1,4-Di-tert-butylcyclohexane
B) trans-1,4-Di-tert-butylcyclohexane
C) cis-1,3-Di-tert-butylcyclohexane
D) trans-1,2-Di-tert-butylcyclohexane
E) None of these

72. Which of these C₁₀H₁₈ isomers is predicted to be the most stable?

\[\text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \]

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

Ans: E

Topic: Ring Strain

75. How many constitutional isomers are possible for the formula C₆H₁₂?
A) 2
B) 3
C) 4
D) 5
E) 6

76. How many compounds with the formula C₇H₁₆ (heptanes) contain a single 3° carbon atom?
A) 2
B) 3
C) 4
D) 5
E) 6

Chapter 4

Topic: Alkane Synthesis, Nomenclature

77. Catalytic hydrogenation of which of the following will yield 2-methylpentane?
A) 2-methyl-1-pentene
B) 2-methyl-2-pentene
C) 4-methyl-2-pentene
D) 4-methyl-1-pentene
E) All of the above

78. The synthesis of an alkyne precursor to 2,2-dimethylheptane is accomplished most effectively by the reaction between these two reagents:
A) CH₃CH₂CH₂CNa and (CH₃)₂CBr
B) CH₃CH₂C≡CNa and (CH₃)₂CBr
C) (CH₃)₂CC≡CNa and CH₂C=CH₂Br
D) (CH₃)₂CH₂CH₂C≡CH and CH₂CBr₂
E) HC≡CNa and (CH₃)₂CCH₂Br

79. The reaction of the Na salt of 3-methyl-1-pentene with 1-bromo-3-methylbutane produces which of these?
A) 3,8-dimethyl-4-nonene
B) 2,7-dimethyl-4-nonene
C) 3,8-dimethyl-5-nonene
D) 3,7-dimethyl-4-nonene
E) 3,7-dimethyl-5-nonene

Topic: General

80. What is the simplest alkane, i.e., the one with the smallest molecular weight, which possesses primary, secondary and tertiary carbon atoms?
A) 2-Methylpropane
B) 2-Methylbutane
C) 2-Methylpentane
D) 3-Methylpentane
E) 2,2-Dimethylbutane

81. How many alkanes of formula C₁₀H₂₀ possess a quaternary carbon atom?
A) 1
B) 2
C) 3
D) 4
E) 5
**SHORT ANSWER QUESTIONS**

**Topic: Nomenclature**

92. Give the IUPAC name corresponding to the following structure.

![Structure](image)

93. Give the IUPAC name corresponding to the following structure:

![Structure](image)

94. Give the IUPAC name corresponding to the following structure:

![Structure](image)

95. Give the IUPAC name corresponding to the following structure:

![Structure](image)

96. Draw the bond-line structural formula corresponding to the most stable conformation of the following substance: *trans*-1-bromo-3-(1-methylpropyl)cyclohexane

97. Draw the bond-line structural formula corresponding to the name: 2,5,9-trimethyl-2-dec-4-ene-7-yn

**Topic: Alkane Conformations**


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### Svar Part 4 - Nomenklatur, konformation

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</table>
**Svar Part 4 – Nomenklatur, konformation forts.:**

92. 5-bromo-6-cyclopentyl-2-hexanol
93. 3-(2-bromobuty)cyclopentanol
94. *trans*-1-bromo-2-fluorocyclohexane
95. 3-ethyl-6,7-dimethyl-2-octanol
96. Br
97: 
98: 
99: 