Organic Chemistry 11th edition Carey Test Bank

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Organic Chemistry, 11e **(Carey)**
Chapter 2 Alkanes and Cycloalkanes: Introduction to Hydrocarbons

1) Which of the following statements is not true concerning hydrocarbons?
A) Hydrocarbons are compounds that carbon, hydrogen, and oxygen atoms.
B) Alkanes, alkenes, and alkynes are examples of aliphatic hydrocarbons.
C) Aromatic hydrocarbons are also referred to as arenes.
D) Hydrocarbons may contain sigma bonds and/or pi bonds.

Answer: A
Difficulty: 1 Easy
Section: 02.01
Topic: Functional Groups
Bloom's: 2. Understand
Chapter: 02
Subtopic: Hydrocarbons; Alkanes; Alkenes; Alkynes; Arenes (Aromatics)

2) Alkanes are characterized by the general molecular formula:
A) C_nH_{2n-2}
B) C_nH_{2n}
C) C_nH_{2n+2}
D) C_nH_{2n+4}

Answer: C
Difficulty: 1 Easy
Section: 02.05
Topic: Functional Groups; Alkanes (Acyclic and Cyclic)
Bloom's: 1. Remember
Chapter: 02
Subtopic: Hydrocarbons; Alkanes; Acyclic vs cyclic

3) The carbon-carbon sigma bond in ethane is formed by overlap of which two orbitals?
A) 2p-2p
B) sp-sp
C) sp^2-sp^2
D) sp^3-sp^3

Answer: D
Difficulty: 2 Medium
Section: 02.07
Topic: Molecular Shape
Bloom's: 2. Understand
Chapter: 02
Subtopic: Hybridization

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4) The sp^3 orbitals of carbon in CH_4 are formed from the

A) three 2p orbitals.
B) 2s and two of the 2p orbitals.
C) 2s and one of the 2p orbitals.
D) 2s and the three 2p orbitals.

Answer: D
Difficulty: 2 Medium
Section: 02.06
Topic: Molecular Shape
Bloom's: 2. Understand
Chapter: 02
Subtopic: Hybridization

5) The geometry of sp^3 hybrid orbitals can be described as pointing toward the corners of a
A) triangle.
B) square.
C) tetrahedron.
D) square pyramid.

Answer: C
Difficulty: 2 Medium
Section: 02.06
Topic: Molecular Shape
Bloom's: 2. Understand
Chapter: 02
Subtopic: Hybridization

6) What is the Cl-C-Cl bond angle in CCl_4?

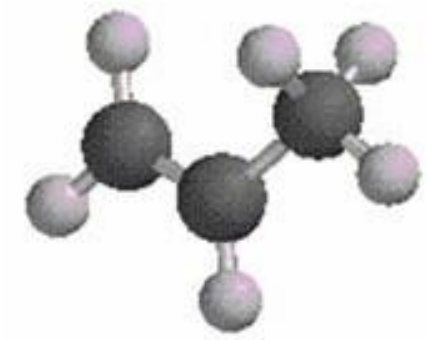
A) 60^o
B) 90^o
C) 109.5^o
D) 120^o

Answer: C
Difficulty: 2 Medium
Section: 02.06
Topic: Molecular Shape
Bloom's: 3. Apply
Chapter: 02
Subtopic: Hybridization

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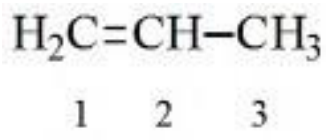
7) What is the estimated C-C-C bond angle in the following model?



A) 90°
B) 109.5°
C) 120°
D) 180°

Answer: C
Difficulty: 2 Medium
Section: 02.08
Topic: Molecular Shape
Bloom's: 2. Understand
Chapter: 02
Subtopic: Hybridization

8) The hybridization of carbon atoms 1, 2, and 3 in the following are, respectively,



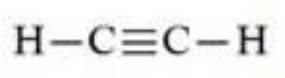
A) sp, sp, and sp^2.
B) sp, sp, and sp^3.
C) sp^2, sp^2, and sp^3.
D) sp^2, sp^3, and sp^3.

Answer: C
Difficulty: 2 Medium
Section: 02.08
Topic: Molecular Shape
Bloom's: 3. Apply
Chapter: 02
Subtopic: Hybridization

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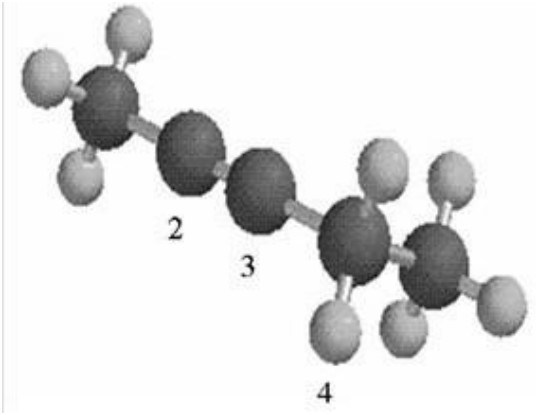
9) The C-C sigma bond in acetylene is formed by the overlap of which two orbitals?



A) 2p-2p
B) sp-sp
C) sp^2-sp^2
D) sp^3-sp^3

Answer: B
Difficulty: 2 Medium
Section: 02.09
Topic: Molecular Shape
Bloom's: 2. Understand
Chapter: 02
Subtopic: Hybridization

10) What are the hybridizations of carbon atoms 2, 3, and 4 shown in the model below?



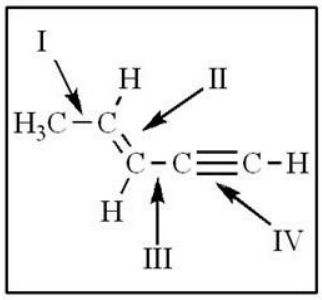
A) sp, sp^2, sp^2
B) sp, sp^2, sp^3
C) sp, sp, sp^2
D) sp, sp, sp^3

Answer: D
Difficulty: 2 Medium
Section: 02.09
Topic: Molecular Shape
Bloom's: 2. Understand
Chapter: 02
Subtopic: Hybridization

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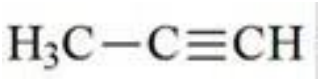
11) The shortest and longest carbon-carbon bonds, respectively, in this molecule are



A) II and III.
B) IV and III.
C) I and IV.
D) IV and I.

Answer: D
Difficulty: 2 Medium
Section: 02.09
Topic: Structure and Bonding
Bloom's: 2. Understand
Chapter: 02
Subtopic: Bond properties; Types of bonds

12) The C-C-C bond angle in propyne, shown below, is



A) 90°.
B) 109.5°.
C) 120°.
D) 180°.

Answer: D
Difficulty: 2 Medium
Section: 02.09
Topic: Molecular Shape
Bloom's: 3. Apply
Chapter: 02
Subtopic: Hybridization

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13) How many *pi* bonds are present in the following structure?



A) one
B) two
C) three
D) four

Answer: C
Difficulty: 1 Easy
Section: 02.09
Topic: Molecular Shape
Bloom's: 2. Understand
Chapter: 02
Subtopic: Hybridization

14) The carbon-carbon single bond in the following is formed by the overlap of which two orbitals?



A) sp-sp
B) sp^2-sp
C) sp^2-sp^2
D) sp^2-sp^3

Answer: B
Difficulty: 2 Medium
Section: 02.09
Topic: Molecular Shape
Bloom's: 2. Understand
Chapter: 02
Subtopic: Hybridization

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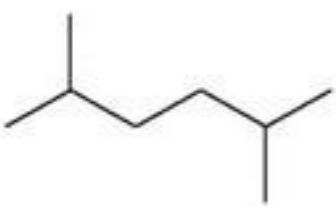
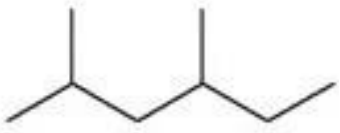
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15) How many isomers of C_4H_9Cl are possible?

A) two
B) three
C) four
D) five

Answer: C
Difficulty: 2 Medium
Section: 02.12
Topic: Drawing Organic Molecules
Bloom's: 3. Apply
Chapter: 02
Subtopic: Constitutional isomers

16) What is the relationship between the two structures below?

 and 

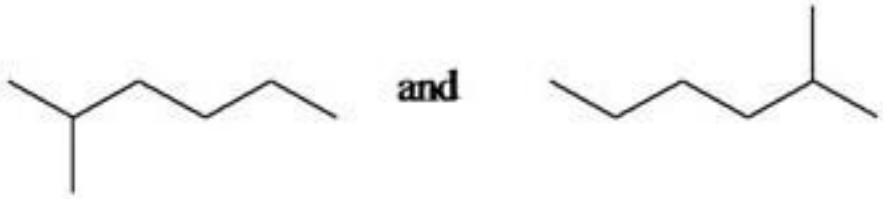
A) identical structures
B) resonance forms
C) constitutional isomers
D) different compounds with different compositions

Answer: C
Difficulty: 2 Medium
Section: 02.13
Topic: Drawing Organic Molecules
Bloom's: 2. Understand
Chapter: 02
Subtopic: Constitutional isomers

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17) What is the relationship between the following two structures?



A) identical structures
B) resonance forms
C) constitutional isomers
D) different compounds with different compositions

Answer: A
Difficulty: 1 Easy
Section: 02.13
Topic: Drawing Organic Molecules
Bloom's: 2. Understand
Chapter: 02
Subtopic: Skeletal/bond-line structures

18) What is the total number of constitutional isomers with the formula C_5H_{12}?
A) two
B) three
C) four
D) five

Answer: B
Difficulty: 2 Medium
Section: 02.14
Topic: Drawing Organic Molecules
Bloom's: 3. Apply
Chapter: 02
Subtopic: Constitutional isomers

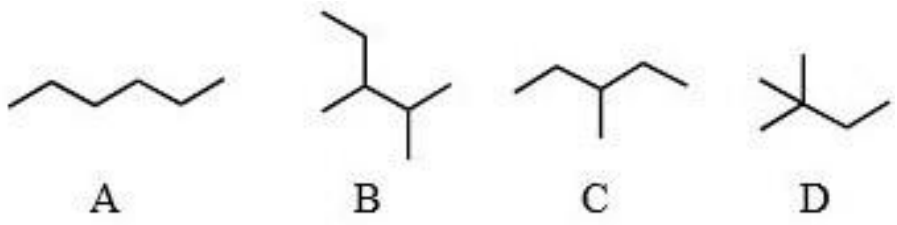
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19) How many isomers of C6H14 are possible?
A) four
B) five
C) six
D) seven

Answer: B
Difficulty: 2 Medium
Section: 02.16
Topic: Drawing Organic Molecules
Bloom's: 3. Apply
Chapter: 02
Subtopic: Constitutional isomers

20) Which of the molecules below is NOT an isomer of formula C_6H_{14}?



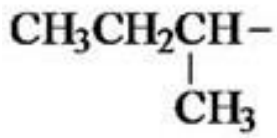
A) A
B) B
C) C
D) D

Answer: B
Difficulty: 1 Easy
Section: 02.16
Topic: Drawing Organic Molecules
Bloom's: 3. Apply
Chapter: 02
Subtopic: Constitutional isomers; Skeletal/bond-line structures

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21) The common name of the following group is



A) *n*-butyl.
B) *sec*-butyl.
C) isobutyl.
D) *tert*-butyl.

Answer: B
Difficulty: 2 Medium
Section: 02.17
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 1. Remember
Chapter: 02
Subtopic: Alkyl groups

22) The *tert*-butyl group can also be called
A) 1,1-dimethylpropyl.
B) 1,1-dimethylethyl.
C) 2,2-dimethylpropyl.
D) 2,2-dimethylethyl.

Answer: B
Difficulty: 2 Medium
Section: 02.17
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 2. Understand
Chapter: 02
Subtopic: Alkyl groups

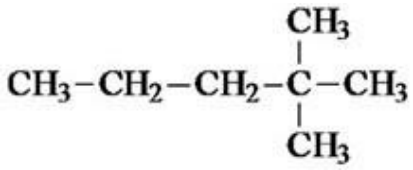
23) The 1,1-dimethylethyl group, $-C(CH_3)_3$, can also be called
A) butyl.
B) isobutyl.
C) *sec*-butyl.
D) *tert*-butyl.

Answer: D
Difficulty: 2 Medium
Section: 02.17
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 2. Understand
Chapter: 02
Subtopic: Alkyl groups

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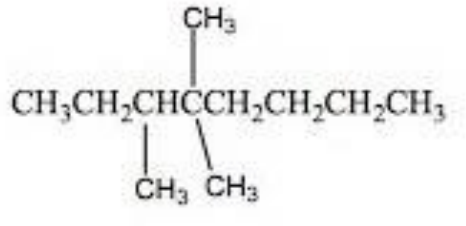
24) What is the IUPAC name of the following compound?



A) 4,4-dimethylpentane
B) 1-tert-butylpropane
C) 2,2-dimethylpentane
D) 1,1,1-trimethylbutane

Answer: C
Difficulty: 2 Medium
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes

25) The correct IUPAC name of the following compound is



A) 2-ethyl-3,5-dimethylheptane.
B) 6-ethyl-5,5-dimethylheptane.
C) 3,4,4-trimethyloctane.
D) 5,5,6-trimethyloctane.

Answer: C
Difficulty: 2 Medium
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes

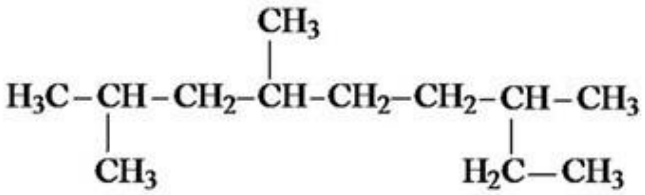
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26) Which one of the following is 2,2,5-trimethylhexane?
A) $(CH_3)_2CHCH_2C(CH_3)_3$
B) $(CH_3)_2CHCH_2CH_2C(CH_3)_3$
C) $CH_3CH_2CH(CH_3)C(CH_3)_3$
D) $(CH_3)_2CHCH_2CH_2CH_2C(CH_3)_3$

Answer: B
Difficulty: 2 Medium
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes

27) The correct IUPAC name of the following is



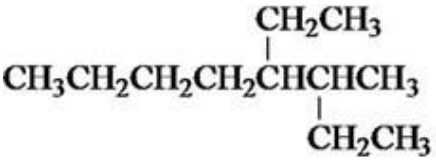
A) 2,4,7-trimethylnonane.
B) 7-ethyl-2,4-dimethyloctane.
C) 3,6,8-trimethylnonane.
D) 2-ethyl-5,7-dimethyloctane.

Answer: A
Difficulty: 2 Medium
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes

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28) What is the IUPAC name of the following?



A) 5,6-diethylhexane
B) 5-ethyl-6-methylheptane
C) 2,3-diethylhexane
D) 4-ethyl-3-methylheptane

Answer: D
Difficulty: 2 Medium
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes

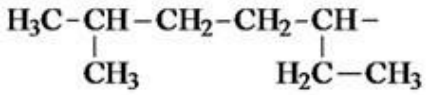
29) Identify the isomer of C_6H_{14} that only has primary and tertiary carbons.
A) hexane
B) 2,2-dimethylbutane
C) 3-methylpentane
D) 2,3-dimethylbutane

Answer: D
Difficulty: 3 Hard
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes

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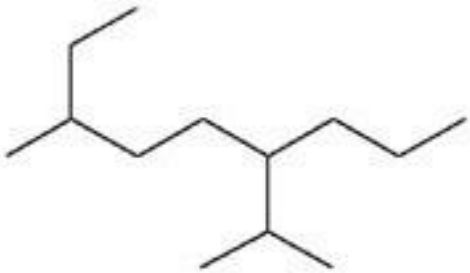
30) The systematic name of the following group is



A) 5-ethyl-2-methylpentyl.
B) 1-ethyl-4-methylpentyl.
C) 6-methyl-3-heptyl.
D) 2-methyl-5-heptyl.

Answer: B
Difficulty: 2 Medium
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: Alkyl groups

31) What is the IUPAC name of the following?



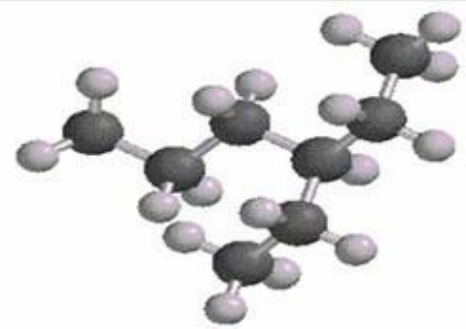
A) 6-isopropyl-3-methylnonane
B) 2-ethyl-5-isopropyloctane
C) 6-propyl-3-methylnonane
D) 2-ethyl-5-propyloctane

Answer: A
Difficulty: 2 Medium
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes

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32) What is the IUPAC name of the following structure?



A) 3-propylpentane
B) 3-ethylhexane
C) 2-ethylheptane
D) 4-ethylpentane

Answer: B
Difficulty: 2 Medium
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes

33) Which of the following are constitutional isomers?

I. 2,3,3-dimethylhexane
II. 2,2-diethylpentane
III. 3-ethyl-2-methylheptane
A) I and II
B) I and III
C) II and III
D) They are all constitutional isomers.

Answer: A
Difficulty: 2 Medium
Section: 02.18
Topic: Alkanes (Acyclic and Cyclic); Drawing Organic Molecules
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes; Constitutional isomers

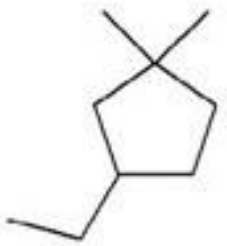
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34) Cycloalkanes are characterized by the general molecular formula
A) C_nH_{2n-2}·
B) C_nH_{2n}·
C) C_nH_{2n+2}·
D) C_nH_{2n+4}·

Answer: B
Difficulty: 1 Easy
Section: 02.19
Topic: Functional Groups; Alkanes (Acyclic and Cyclic)
Bloom's: 1. Remember
Chapter: 02
Subtopic: Hydrocarbons; Alkanes; Acyclic vs cyclic

35) What is the IUPAC name of the following?



A) 1-ethyl-4.4-dimethylcyclopentane
B) 1-ethyl-3,3-dimethylcyclopentane
C) 3-ethyl-1,1-dimethylcyclopentane
D) 4-ethyl-1,1-dimethylcyclopentane

Answer: C
Difficulty: 2 Medium
Section: 02.19
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of cycloalkanes

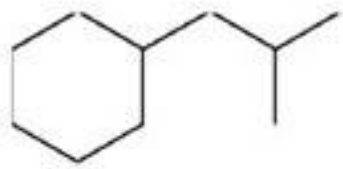
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36) All the carbons in cyclopentane are
A) primary carbons.
B) secondary carbons.
C) tertiary carbons.
D) quaternary carbons.

Answer: B
Difficulty: 2 Medium
Section: 02.19
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 2. Understand
Chapter: 02
Subtopic: IUPAC Nomenclature of cycloalkanes

37) The correct name of the following compound is



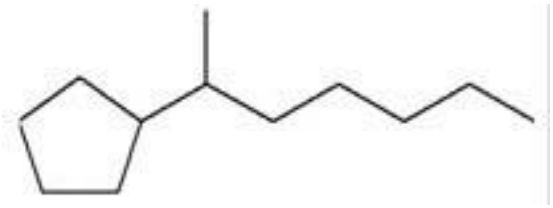
A) (1-methylpropyl)cyclohexane.
B) (2-methylpropyl)cyclohexane.
C) (2,2-dimethylethyl)cyclohexane.
D) (2,2-dimethylpropyl)cyclohexane.

Answer: B
Difficulty: 2 Medium
Section: 02.19
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of cycloalkanes

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38) The correct IUPAC name of the following compound is



A) (1-methylhexyl)cyclopentane.
B) (1-pentylethyl)cyclopentane.
C) 2-cyclopentylheptane.
D) 1-cyclopentyl-2-heptane.

Answer: C
Difficulty: 2 Medium
Section: 02.19
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 3. Apply
Chapter: 02
Subtopic: IUPAC Nomenclature of cycloalkanes

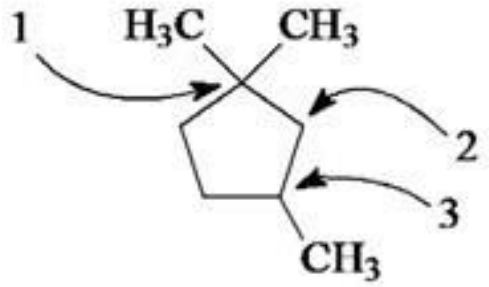
39) Cyclohexane is composed of
A) methine groups.
B) methylene groups.
C) methyl groups.
D) both methine and methylene groups.

Answer: B
Difficulty: 2 Medium
Section: 02.19
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 2. Understand
Chapter: 02
Subtopic: IUPAC Nomenclature of cycloalkanes

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40) Carbon atoms 1, 2, and 3 in the following structure are classified, respectively, as



A) tertiary, primary, secondary.
B) quaternary, secondary, secondary.
C) quaternary, primary, tertiary.
D) quaternary, secondary, tertiary.

Answer: D
Difficulty: 2 Medium
Section: 02.19
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 2. Understand
Chapter: 02
Subtopic: Alkyl groups

41) How many methine groups are there in isopropylcyclopentane?
A) one
B) two
C) three
D) four

Answer: B
Difficulty: 2 Medium
Section: 02.19
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 2. Understand
Chapter: 02
Subtopic: IUPAC Nomenclature of acyclic alkanes

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42) Which of the following describes an atom or group of atoms that has similar chemical properties when it occurs in different compounds?
A) hydrocarbon
B) functional group
C) paraffin
D) isomer

Answer: B
Difficulty: 1 Easy
Section: 02.20
Topic: Functional Groups
Bloom's: 1. Remember
Chapter: 02
Subtopic: Hydrocarbons; C-Z functional groups (Z = N, O, S, halogen)

43) The boiling point of isobutane (−10.2°C) is lower than *n*-butane (−0.4°C) because isobutane has
A) weaker intermolecular van der Waals forces.
B) stronger intermolecular van der Waals forces.
C) weaker dipole-dipole attractive forces.
D) stronger dipole-dipole attractive forces.

Answer: A
Difficulty: 2 Medium
Section: 02.22
Topic: Functional Groups
Bloom's: 2. Understand
Chapter: 02
Subtopic: Intermolecular forces

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44) Arrange the following hydrocarbons in order of increasing boiling point.

I. pentane
II. 2,2-dimethylpropane
III. 2-methylbutane
A) I < II < III
B) I < III < II
C) II < I < III
D) II < III < I

Answer: D
Difficulty: 2 Medium
Section: 02.22
Topic: Functional Groups
Bloom's: 4. Analyze
Chapter: 02
Subtopic: Intermolecular forces

45) Arrange the following isomeric alkanes in order of increasing boiling point.

I. *n*-heptane
II. 2,3-dimethylpentane
III. 2,2,3-trimethylbutane
A) I < II < III
B) II < III < I
C) III < I < II
D) III < II < I

Answer: D
Difficulty: 2 Medium
Section: 02.22
Topic: Functional Groups
Bloom's: 4. Analyze
Chapter: 02
Subtopic: Intermolecular forces

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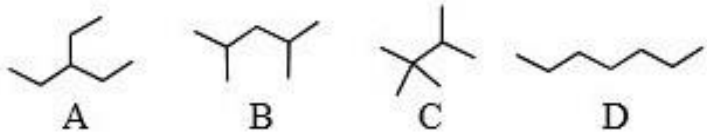
46) Which of the following has the lowest boiling point?
A) pentane
B) 2,2-dimethylpropane
C) 2-methylbutane
D) hexane

Answer: B
Difficulty: 2 Medium
Section: 02.22
Topic: Functional Groups
Bloom's: 2. Understand
Chapter: 02
Subtopic: Intermolecular forces

47) The smallest straight-chain alkane that is liquid at room temperature and atmospheric pressure is
A) propane.
B) butane.
C) pentane.
D) hexane.

Answer: C
Difficulty: 2 Medium
Section: 02.22
Topic: Functional Groups
Bloom's: 2. Understand
Chapter: 02
Subtopic: Intermolecular forces

48) The lowest-boiling isomer of C_7H_{16} would be



A) A.
B) B.
C) C.
D) D.

Answer: C
Difficulty: 2 Medium
Section: 02.22
Topic: Functional Groups
Bloom's: 2. Understand
Chapter: 02
Subtopic: Intermolecular forces

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49) Why can heats of combustion of constitutional isomers of hydrocarbons be used to measure their stabilities?

I. Combustion of constitutional isomers gives different final states.
II. Combustion of constitutional isomers gives the same final states.
III. Constitutional isomers of hydrocarbons have the same potential energies.
IV. Constitutional isomers of hydrocarbons have different potential energies.
A) only I
B) only II
C) I and III
D) II and IV

Answer: D
Difficulty: 2 Medium
Section: 02.23
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 2. Understand
Chapter: 02
Subtopic: Reactions of alkanes

50) The heats of combustion ($-\Delta H^{\circ}$) of heptane and 3,3-dimethypentane are 4,817 and 4,809 kJ/mol, respectively. Which statement is true?
A) Heptane is 8 kJ/mol more stable then 3,3-dimethylpentane.
B) 3,3-Dimethylpentane is 8 kJ/mol more stable than heptane.
C) Stabilities cannot be compared since they are not isomers.
D) Stabilities cannot be compared since they give different combustion products.

Answer: B
Difficulty: 2 Medium
Section: 02.23
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 2. Understand
Chapter: 02
Subtopic: Reactions of alkanes

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51) How many moles of O_2 gas would be consumed in the complete combustion of 0.100 mole of C_5H_{12}?
A) 0.100 mole O_2
B) 0.400 mole O_2
C) 0.800 mole O_2
D) 1.60 mole O_2

Answer: C
Difficulty: 3 Hard
Section: 02.23
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 4. Analyze
Chapter: 02
Subtopic: Reactions of alkanes

52) Which of the following has(have) a higher oxidation state of carbon than the carbon in formaldehyde, $H_2C{=}O$?

I. CH_3OH
II. HCO_2H
III. H_2CO_3
A) I
B) III
C) II and III
D) I, II, and III

Answer: C
Difficulty: 2 Medium
Section: 02.24
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 4. Analyze
Chapter: 02
Subtopic: Acyclic vs cyclic

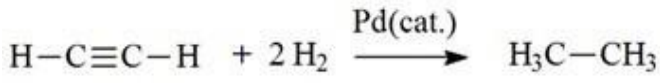
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53) The oxidation states of carbon range from
A) 0 to +2.
B) 0 to +4.
C) −4 to 0.
D) −4 to +4.

Answer: D
Difficulty: 1 Easy
Section: 02.24
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 1. Remember
Chapter: 02
Subtopic: Acyclic vs cyclic

54) The reaction of acetylene with hydrogen gas is shown below. Which statements are true concerning the reaction?



I. Acetylene is oxidized to ethane.
II. Acetylene is reduced to ethane.
III. Carbon changes oxidation state from −1 to −3.
IV. Hydrogen (from H_2) changes oxidation state from 0 to +1.
A) I and III
B) II and IV
C) I, III, and IV
D) II, III, and IV

Answer: D
Difficulty: 2 Medium
Section: 02.24
Topic: Alkanes (Acyclic and Cyclic)
Bloom's: 2. Understand
Chapter: 02
Subtopic: Reactions of alkanes

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55) How many constitutional isomers of C~6~H~14~ are possible?
A) four
B) five
C) six
D) seven

Answer: B
Difficulty: 2 Medium
Section: 02.15
Topic: Drawing Organic Molecules
Bloom's: 3. Apply
Chapter: 02
Subtopic: Constitutional isomers

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