

Chapter 1 - Structure and Bonding (test bank) KEY

1. What is the ground-state electronic configuration of a carbon atom?

- A. $1s^2, 2s^2, 2p^5$
- B. $1s^2, 2s^2, 2p^2$**
- C. $1s^2, 2s^2, 2p^6$
- D. $1s^2, 2s^2, 2p^4$

Accessibility: Keyboard Navigation

Bloom's Level: 2. Understand

Difficulty: Easy

Gradable: automatic

Section: 01.01

Subtopic: Periodic table trends

Topic: Structure and Bonding

2. What is the ground-state electronic configuration of a fluorine atom?

- A. $1s^2, 2s^2, 2p^2$
- B. $1s^2, 2s^2, 2p^3$
- C. $1s^2, 2s^2, 2p^4$
- D. $1s^2, 2s^2, 2p^5$**

Accessibility: Keyboard Navigation

Bloom's Level: 2. Understand

Difficulty: Easy

Gradable: automatic

Section: 01.01

Subtopic: Periodic table trends

Topic: Structure and Bonding

3. What is the ground-state electronic configuration of a magnesium cation (Mg^{2+})?

- A. $1s^2, 2s^2, 2p^6$**
- B. $1s^2, 2s^2, 2p^6, 3s^1$
- C. $1s^2, 2s^2, 2p^6, 3s^2$
- D. $1s^2, 2s^2, 2p^6, 3s^2, 3p^2$

Accessibility: Keyboard Navigation

Bloom's Level: 2. Understand

Difficulty: Easy

Gradable: automatic

Section: 01.01

Subtopic: Periodic table trends

Topic: Structure and Bonding

4. What is the ground-state electronic configuration of a chlorine anion (Cl^-)?

- A. $1s^2, 2s^2, 2p^6$
- B. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$**
- C. $\text{C}^- 1s^2, 2s^2, 2p^6, 3s^2, 3p^5$
- D. $\text{D}^- 1s^2, 2s^2, 2p^6, 3s^2, 3p^4$

Accessibility: Keyboard
Navigation Bloom's Level: 2.
Understand Difficulty: Easy
Gradable: automatic Section:
01.01

Subtopic: Periodic table trends
Topic: Structure and Bonding

5. Which of the following statements about valence electrons is true?

- A. They are the most tightly held electrons.
- B. They do not participate in chemical reactions.
- C. They are the outermost electrons.**
- D. They reveal the period number of a second-row element.

Accessibility: Keyboard
Navigation Bloom's Level: 2.
Understand Difficulty: Easy
Gradable: automatic Section:
01.01

Subtopic: Periodic table trends
Topic: Structure and Bonding

6. Which of the following statements about bonding is true?

- A. Covalent bonds result from the transfer of electrons from one element to another.
- B. Ionic bonds result from the transfer of electrons from a metal to a non-metal.**
- C. Ionic bonds result from the sharing of electrons between two non-metals.
- D. Covalent bonds result from the sharing of electrons between two metals.

Accessibility: Keyboard
Navigation Bloom's Level: 1.
Remember Difficulty: Easy
Gradable: automatic Section:
01.02

Subtopic: Bond properties
Subtopic: Types of bonds
Topic: Structure and Bonding

7. Which of the following would you expect to have ionic bonds?

- A. CO
- B. FBr
- C. NF₃
- D. NaCl**

Accessibility: Keyboard Navigation

Bloom's Level: 3. Apply

Difficulty: Easy

Gradable: automatic

Section: 01.02

Subtopic: Bond properties

Subtopic: Types of bonds

Topic: Structure and Bonding

8. Which of the following molecules has nonpolar covalent bonds?

- A. HCl
- B. N₂**
- C. CHCl₃
- D. NO

Accessibility: Keyboard Navigation

Bloom's Level: 2. Understand

Difficulty: Easy

Gradable: automatic

Section: 01.12

Subtopic: Bond properties

Subtopic: Types of bonds

Topic: Structure and Bonding

9. Which of the following molecules contain both covalent and ionic bonds?

NaCl

NH₄OH

CH₃OH

MgCO₃

I

II

III

IV

- A. I, II
- B. I, IV
- C. II, III
- D. II, IV**

Bloom's Level: 3. Apply

Difficulty: Easy

Gradable: automatic

Section: 01.02

Subtopic: Bond properties

Subtopic: Types of bonds

Topic: Structure and Bonding

10. Arrange the following bonds in decreasing order of ionic character, putting the most ionic first.

C-C

C-N

C-O

Na-O

I

II

III

IV

- A. I > II > III > IV
B. IV > II > I > III
C. IV > III > II > I
D. IV > II > III > I

Bloom's Level: 3.

Apply

Difficulty:

Easy

Gradable:

automatic

Section:

01.12

Subtopic: Bond properties

*Subtopic: Types of
bonds*

Topic: Structure and Bonding

11. Which of the following statements correctly describes the typical number of bonds for carbon, nitrogen, and oxygen in most neutral organic molecules?

- A.
Carbon forms 4 covalent bonds, nitrogen forms 2 covalent bonds, and oxygen forms 3 covalent bonds.
- B.**
Carbon forms 4 covalent bonds, nitrogen forms 3 covalent bonds, and oxygen forms 2 covalent bonds.
- C.
Carbon forms 4 covalent bonds, nitrogen forms 5 covalent bonds, and oxygen forms 2 covalent bonds.
- D.
Carbon forms 4 covalent bonds, nitrogen forms 5 covalent bonds, and oxygen forms 4 covalent bonds.

Accessibility: Keyboard Navigation

Bloom's Level: 1.

Remember

Difficulty:

Easy

Gradable:

automatic

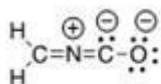
Section:

01.02

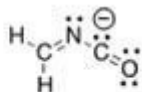
Subtopic: Bond properties

Topic: Structure and Bonding

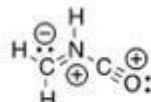
12. Which is not an acceptable Lewis structure for the anion CH_2NCO^- ?



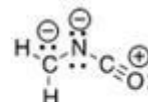
I



II



III



IV

- A. I
B. II
C. III
D. IV

Bloom's Level: 4.
Analyze

Difficulty: Medium
Gradable:
automatic

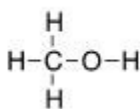
Section:
01.03

Subtopic: Drawing Lewis
structures

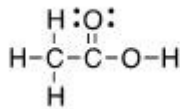
Subtopic:
Resonance

Topic: Structure and
Bonding

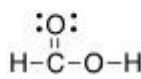
13. Which of the following Lewis structures is correct?



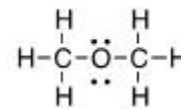
I



II



III



IV

- A. I
B. II
C. III
D. IV

Bloom's Level: 4.
Analyze

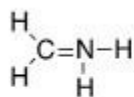
Difficulty: Medium
Gradable:
automatic

Section:
01.03

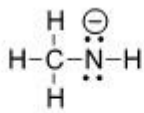
Subtopic: Drawing Lewis
structures

Topic: Structure and
Bonding

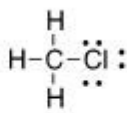
14. Which of the following Lewis structures is correct?



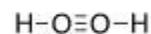
I



II



III



IV

- A. I, II
- B. I, III
- C. II, III**
- D. III, IV

Bloom's Level: 4.

Analyze Difficulty:

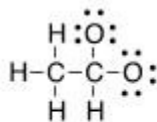
Medium Gradable:

automatic Section: 01.03

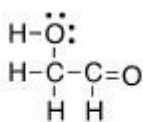
Subtopic: Drawing Lewis structures

Topic: Structure and Bonding

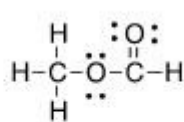
15. Which is the correct Lewis structure for acetic acid ($\text{CH}_3\text{CO}_2\text{H}$)?



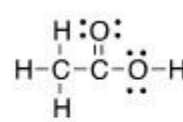
I



II



III



IV

- A. I
- B. II
- C. III
- D. IV**

Bloom's Level: 4.

Analyze Difficulty:

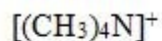
Medium Gradable:

automatic Section: 01.03

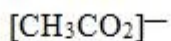
Subtopic: Drawing Lewis structures

Topic: Structure and Bonding

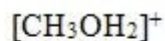
16. In which of the following ions does carbon have a formal charge?



I



II

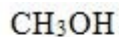


III

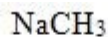
- A. I
B. II
C. III
D. None of these

Bloom's Level: 1. Remember
Difficulty: Easy
Gradable: automatic
Section: 01.03
Subtopic: Formal charges
Topic: Structure and Bonding

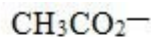
17. In which of the following ions does carbon have a formal charge?



I



II



III

- A. I
B. II
C. III
D. None of these

Bloom's Level: 1. Remember
Difficulty: Easy
Gradable: automatic
Section: 01.03
Subtopic: Formal charges
Topic: Structure and Bonding

18. What is the formal charge of carbon in carbon monoxide (CO) when drawn with a triple bond?

- A. 0
B. -2
C. -1
D. +1

Accessibility: Keyboard Navigation
Bloom's Level: 4. Analyze
Difficulty: Medium
Gradable: automatic
Section: 01.03
Subtopic: Drawing Lewis structures
Subtopic: Formal charges
Topic: Structure and Bonding

19. Which of the following statements about constitutional isomers is true?

- A. Constitutional isomers are different molecules having the different molecular formula.
- B. Constitutional isomers are different molecules having the same molecular formula.**
- C. Constitutional isomers are same molecules having the different molecular formula.
- D. Constitutional isomers are same molecules having the same molecular formula.

Accessibility: Keyboard Navigation
Bloom's Level: 1. Remember
Difficulty: Easy
Gradable: automatic
Section: 01.04
Subtopic: Constitutional isomers
Topic: Structure and Bonding

20. How many constitutional isomers are there for a molecule having the molecular formula C_2H_6O ?

- A. 1
- B. 2**
- C. 3
- D. 4

Accessibility: Keyboard Navigation
Bloom's Level: 4. Analyze
Difficulty: Easy
Gradable: automatic
Section: 01.04
Subtopic: Constitutional isomers
Topic: Structure and Bonding

21. How many constitutional isomers are there for a molecule having the molecular formula C_3H_8O ?

- A. 1
- B. 2
- C. 3**
- D. 4

Accessibility: Keyboard Navigation
Bloom's Level: 4. Analyze
Difficulty: Easy
Gradable: automatic
Section: 01.04
Subtopic: Constitutional isomers
Topic: Structure and Bonding

22. How many constitutional isomers are there for a molecule having the molecular formula C_3H_6 ?

- A. 1
- B. 2**
- C. 3
- D. 4

Accessibility: Keyboard Navigation
Bloom's Level: 4. Analyze
Difficulty: Easy
Gradable: automatic
Section: 01.04
Subtopic: Constitutional isomers
Topic: Structure and Bonding

23. How many constitutional isomers are there for a molecule having the molecular formula $C_2H_4Cl_2$?

- A. 1
- B. 2**
- C. 3
- D. 4

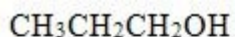
Accessibility: Keyboard Navigation
Bloom's Level: 4. Analyze
Difficulty: Medium
Gradable: automatic
Section: 01.04
Subtopic: Constitutional isomers
Topic: Structure and Bonding

24. How many different isomers are there for a compound having the molecular formula C_3H_6O ?

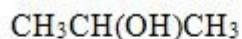
- A. 4
- B. 5
- C. 6
- D. 7**

Accessibility: Keyboard Navigation
Bloom's Level: 4. Analyze
Difficulty: Medium
Gradable: automatic
Section: 01.04
Subtopic: Constitutional isomers
Topic: Structure and Bonding

25. Which of the following molecules are constitutional isomers?



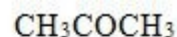
I



II



III



IV

- A. I, II, IV
- B. II, III, IV
- C. I, III, IV
- D. I, II, III**

Bloom's Level: 4. Analyze

Difficulty: Easy

Gradable: automatic

Section: 01.04

Subtopic: Constitutional isomers

Topic: Structure and Bonding

26. Which of the following compounds has an atom with an unfilled valence shell of electrons?

- A. H_2O
- B. BCl_3**
- C. CH_4
- D. CO_2

Accessibility: Keyboard Navigation

Bloom's Level: 4. Analyze

Difficulty: Medium

Gradable: automatic

Section: 01.05

Subtopic: Octet rule

Subtopic: Octet rule exception

Topic: Structure and Bonding

27. Which of the following statements about resonance structures is true?

- A. Resonance structures have the same placement of electrons but different arrangement of atoms.
- B. Resonance structures have the same placement of atoms but different arrangement of electrons.**
- C. Resonance structures have the same placement of atoms and the same arrangement of electrons.
- D. Resonance structures have different placement of atoms and different arrangement of electrons.

Accessibility: Keyboard Navigation

Bloom's Level: 2. Understand

Difficulty: Easy

Gradable: automatic

Section: 01.06

Subtopic: Constitutional isomers

Subtopic: Resonance

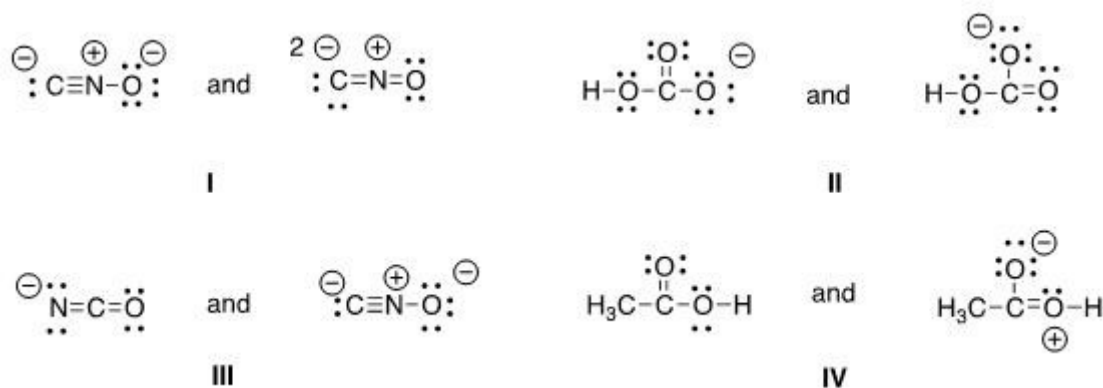
Topic: Structure and Bonding

28. Which of the following statements about resonance structures is *not* true?

- A. There is no movement of electrons from one form to another.
- B. Resonance structures are not isomers.
- C. Resonance structures differ only in the arrangement of electrons.
- D. Resonance structures are in equilibrium with each other.

Accessibility: Keyboard Navigation
 Bloom's Level: 2. Understand
 Difficulty: Easy
 Gradable: automatic
 Section: 01.06
 Subtopic: Constitutional isomers
 Subtopic: Resonance
 Topic: Structure and Bonding

29. Which of the following pair does not represent resonance structures?



- A. I
- B. II
- C. III
- D. IV

Bloom's Level: 4. Analyze
 Difficulty: Medium
 Gradable: automatic
 Section: 01.06
 Subtopic: Drawing Lewis structures
 Subtopic: Resonance
 Topic: Structure and Bonding

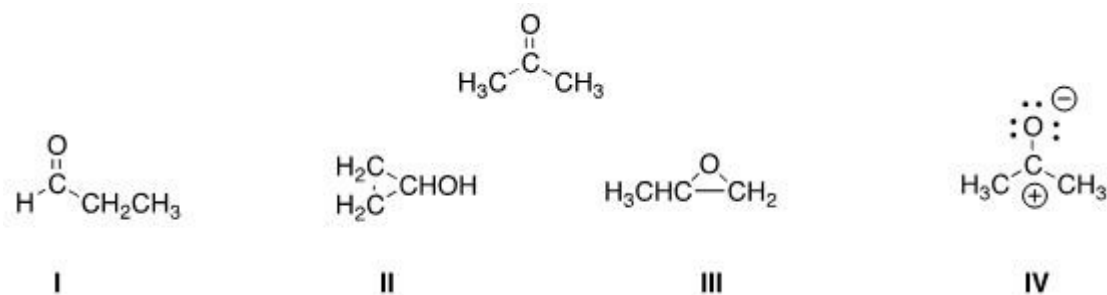
30. What 2 things will change between two resonance structures?

- A. The position of multiple bonds and non-bonded electrons.
- B. The position of multiple bonds and single bonds.
- C. The placement of atoms and single bonds.
- D. The placement of atoms and non-bonded electrons.

Accessibility: Keyboard
Navigation Bloom's Level: 2.
Understand Difficulty: Easy
Gradable: automatic Section:
01.06 Subtopic: Resonance

Topic: Structure and Bonding

31. Which of the following is a resonance structure of the compound below?



- A. I
- B. II
- C. III
- D. IV

Bloom's Level: 3.
Apply Difficulty:
Medium Gradable:
automatic Section:
01.06
Subtopic: Drawing Lewis
structures Subtopic: Resonance
Topic: Structure and Bonding

32. Which of the following resonance structures is the least important contributor to the resonance hybrid of the formate anion, HCOO^- ?



- A. I
- B. II**
- C. III
- D. IV

Bloom's Level: 3. Apply

Difficulty: Hard

Gradable: automatic

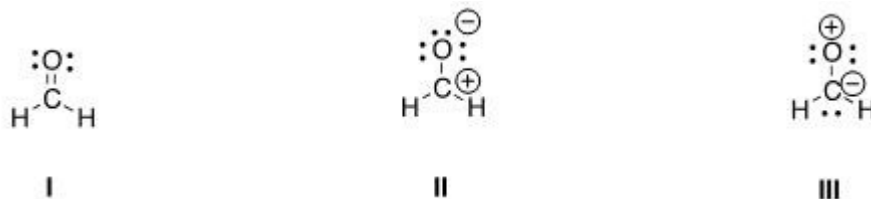
Section: 01.06

Subtopic: Drawing Lewis structures

Subtopic: Resonance

Topic: Structure and Bonding

33. Rank the following in order of decreasing importance as contributing structures to the resonance hybrid of formaldehyde, H_2CO .



- A. I > II > III**
- B. I > III > II
- C. II > I > III
- D. III > II > I

Bloom's Level: 3. Apply

Difficulty: Hard

Gradable: automatic

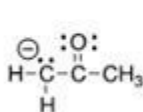
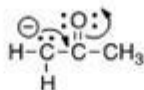
Section: 01.06

Subtopic: Drawing Lewis structures

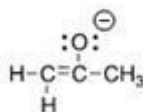
Subtopic: Resonance

Topic: Structure and Bonding

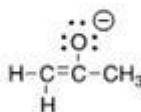
34. Follow the curved arrows to draw the second resonance structure for the ion below.



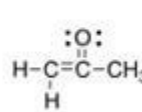
I



II



III



IV

- A. I
B. II
C. III
D. IV

Bloom's Level: 2.
Understand

Difficulty: Medium

Gradable:
automatic

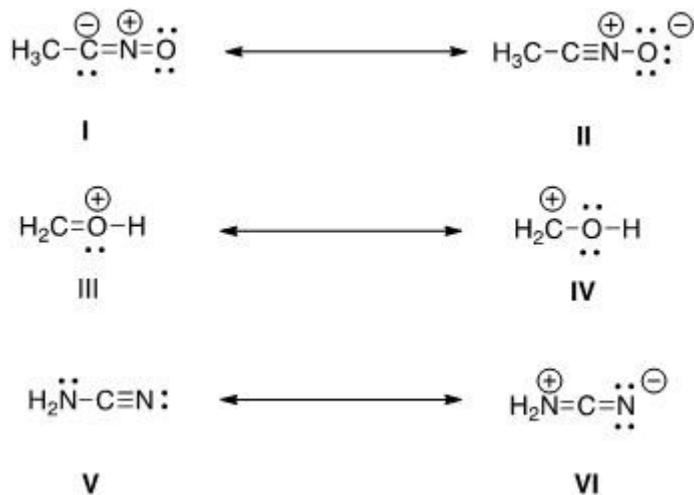
Section:
01.06

Subtopic: Drawing Lewis
structures

Subtopic:
Resonance

Topic: Structure and
Bonding

35. Which is more important in each pair of contributing resonance structures?



- A. II, IV, V
B. II, III, V
 C. II, III, VI
 D. I, IV, V

*Bloom's Level: 4. Analyze
 Difficulty: Medium
 Gradable: automatic
 Section: 01.06
 Subtopic: Drawing Lewis
 structures Subtopic: Resonance
 Topic: Structure and Bonding*

36. What is the approximate value of the H-C-H bond angle in methane, CH₄?

- A. 90°
B. 109.5°
 C. 120°
 D. 180°

*Accessibility: Keyboard
 Navigation Bloom's Level: 1.
 Remember Difficulty: Easy
 Gradable: automatic Section:
 01.07*

*Subtopic: Hybridization
 Subtopic: VSEPR theory
 Topic: Molecular Shape*

37. What is the approximate C-C-C bond angle in propene, $\text{CH}_3\text{CH} = \text{CH}_2$?

- A. 90°
- B. 109.5°
- C. 120°
- D. 180°

Accessibility: Keyboard
Navigation Bloom's Level: 2.
Understand Difficulty: Easy
Gradable: automatic Section:
01.07

Subtopic: Hybridization
Subtopic: VSEPR theory
Topic: Molecular Shape

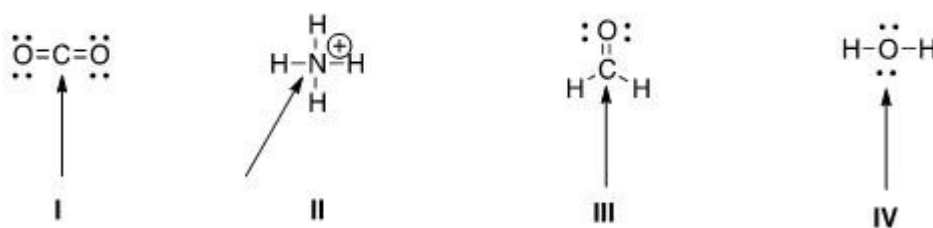
38. What is the approximate H-C-O bond angle in formaldehyde, H_2CO ?

- A. 90°
- B. 109.5°
- C. 120°
- D. 180°

Accessibility: Keyboard
Navigation Bloom's Level: 2.
Understand Difficulty: Medium
Gradable: automatic Section:
01.07

Subtopic: Hybridization
Subtopic: VSEPR theory
Topic: Molecular Shape

39. Determine the geometry around the indicated atom in each species.



- A. I = Linear; II = tetrahedral; III = trigonal planar; IV = tetrahedral
- B. I = Linear; II = tetrahedral; III = trigonal planar; IV = linear
- C. I = Trigonal planar; II = linear; III = tetrahedral; IV = trigonal planar
- D. I = Tetrahedral; II = trigonal planar; III = linear; IV = tetrahedral

Bloom's Level: 1. Remember
Difficulty: Easy Gradable:
automatic Section: 01.07

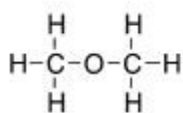
Subtopic: Hybridization
Subtopic: VSEPR theory
Topic: Molecular Shape

40. What is the approximate bond angle for the C-C-N bond in acetonitrile, CH₃CN?

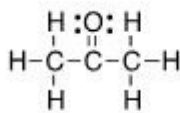
- A. 90°
- B. 109.5°
- C. 120°
- D. 180°

Accessibility: Keyboard Navigation
Bloom's Level: 4. Analyze
Difficulty: Medium
Gradable: automatic
Section: 01.07
Subtopic: Drawing Lewis structures
Subtopic: Hybridization
Subtopic: VSEPR theory
Topic: Molecular Shape

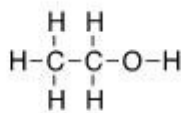
41. Which of the following is the appropriate conversion of the condensed structure, CH₃COCH₃, to a Lewis structure?



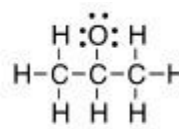
I



II



III

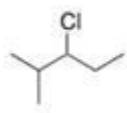


IV

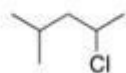
- A. I
- B. II
- C. III
- D. IV

Bloom's Level: 2. Understand
Difficulty: Medium
Gradable: automatic
Section: 01.08
Subtopic: Condensed formula
Subtopic: Drawing Lewis structure
Topic: Drawing Organic Molecules

42. Which of the following is the appropriate conversion of $(\text{CH}_3)_2\text{CHCH}_2\text{CHClCH}_3$ to a skeletal structure?



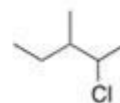
I



II



III



IV

- A. I
B. II
 C. III
 D. IV

Bloom's Level: 2. Understand

Difficulty: Medium

Gradable: automatic

Section: 01.08

Subtopic: Condensed formula

Subtopic: Skeletal/bond-line structures

Topic: Drawing Organic Molecules

43. Which of the following is the appropriate conversion of $(\text{CH}_3)_4\text{C}$ to a skeletal structure?



I



II



III



IV

- A. I
 B. II
 C. III
D. IV

Bloom's Level: 2. Understand

Difficulty: Easy

Gradable: automatic

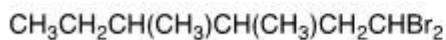
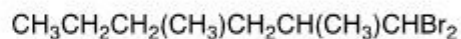
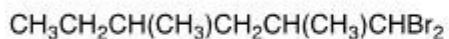
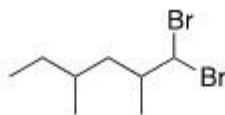
Section: 01.08

Subtopic: Condensed formula

Subtopic: Skeletal/bond-line structures

Topic: Drawing Organic Molecules

44. What is the condensed formula of the compound below?



- A. I
B. II
C. III
D. IV

Bloom's Level: 2. Understand

Difficulty: Medium

Gradable: automatic

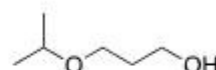
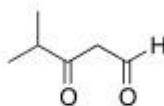
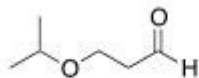
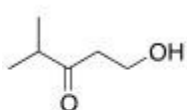
Section: 01.08

Subtopic: Condensed formula

Subtopic: Skeletal/bond-line structures

Topic: Drawing Organic Molecules

45. Which of the following is the appropriate conversion of $(\text{CH}_3)_2\text{CHOCH}_2\text{CH}_2\text{CH}_2\text{OH}$ to a skeletal structure?



- A. I
B. II
C. III
D. IV

Bloom's Level: 2. Understand

Difficulty: Medium

Gradable: automatic

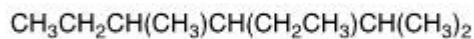
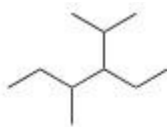
Section: 01.08

Subtopic: Condensed formula

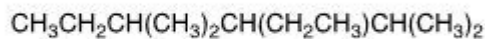
Subtopic: Skeletal/bond-line structures

Topic: Drawing Organic Molecules

46. Convert the following skeletal structure to a condensed structure.



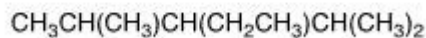
I



II



III



IV

- A. I
B. II
C. III
D. IV

Bloom's Level: 2.
Understand

Difficulty: Medium

Gradable:
automatic

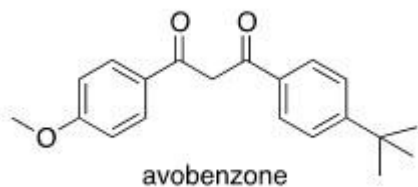
Section:
01.08

Subtopic: Condensed
formula

Subtopic: Skeletal/bond-line structures

Topic: Drawing Organic
Molecules

47. Avobenzene is an active ingredient in some common sunscreens. Which of the following is the correct molecular formula for avobenzene?



- A. $\text{C}_{22}\text{O}_{22}\text{O}_3$
B. $\text{C}_{20}\text{H}_{22}\text{O}_3$
C. $\text{C}_{21}\text{H}_{23}\text{O}_3$
D. $\text{C}_{20}\text{H}_{24}\text{O}_3$

Bloom's Level: 3.
Apply

Difficulty: Medium
Gradable:
automatic

Section:

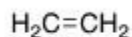
01.08

Subtopic: Condensed
formula

Subtopic: Skeletal/bond-line structures

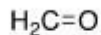
Topic: Drawing Organic
Molecules

48. In which structure is the hybridization incorrect?



sp^2

I



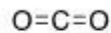
sp

II



sp^2

III



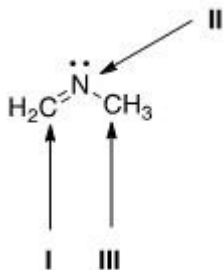
sp

IV

- A. I
B. II
 C. III
 D. IV

Bloom's Level: 2.
 Understand Difficulty:
 Medium Gradable:
 automatic Section: 01.09
 Subtopic: Hybridization
 Subtopic: Valence bond theory
 Topic: Molecular Shape

49. What is the hybridization for each of the indicated atoms in the following compound?



- A. I = sp^2 ; II = sp^2 ; III = sp^2 .
 B. I = sp^2 ; II = sp^3 ; III = sp^3 .
 C. I = sp ; II = sp^2 ; III = sp^3 .
D. I = sp^2 ; II = sp^2 ; III = sp^3 .

Bloom's Level: 2.
 Understand Difficulty:
 Medium Gradable:
 automatic Section: 01.09
 Subtopic: Hybridization
 Subtopic: Valence bond theory
 Topic: Molecular Shape

50. What is the hybridization of the carbon atom in the methyl cation, (CH_3^+) ?

- A. sp^3
- B. sp^2**
- C. sp
- D. p

Accessibility: Keyboard Navigation
Bloom's Level: 2. Understand
Difficulty: Medium
Gradable: automatic
Section: 01.09
Subtopic: Hybridization
Subtopic: Valence bond theory
Topic: Molecular Shape

51. What is the hybridization of the nitrogen atom in the ammonium cation, NH_4^+ ?

- A. sp^3**
- B. sp^2
- C. sp
- D. p

Accessibility: Keyboard Navigation
Bloom's Level: 2. Understand
Difficulty: Medium
Gradable: automatic
Section: 01.09
Subtopic: Hybridization
Subtopic: Valence bond theory
Topic: Molecular Shape

52. Which atomic orbitals overlap to form the C-H σ bonding molecular orbitals of ethane, CH_3CH_3 ?

- A. $\text{C}sp^2 + \text{H}1s$
- B. $\text{C}sp^3 + \text{H}1s$**
- C. $\text{C}2p + \text{H}1s$
- D. $\text{C}sp + \text{H}1s$

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 01.10
Subtopic: Atomic orbitals
Subtopic: Hybridization
Subtopic: Valence bond theory
Topic: Molecular Shape

53. Which atomic orbitals overlap to form the C-H s bonding molecular orbitals of ethylene, $\text{H}_2\text{C}=\text{CH}_2$?

- A. $\text{C}2p + \text{H}1s$
- B. $\text{C}sp + \text{H}1s$
- C. $\text{C}sp^3 + \text{H}1s$
- D. $\text{C}sp^2 + \text{H}1s$

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 01.10
Subtopic: Atomic orbitals
Subtopic: Hybridization
Subtopic: Molecular orbital theory
Topic: Molecular Shape

54. Which atomic orbitals overlap to form the carbon-carbon s and p bonding molecular orbitals of ethylene, $\text{H}_2\text{C}=\text{CH}_2$?

- A. $\text{C}sp^3 + \text{C}sp^3$, and $\text{C}2p + \text{C}2p$
- B. $\text{C}sp^3 + \text{C}sp^3$, and $\text{C}sp^2 + \text{C}sp^2$
- C. $\text{C}sp^2 + \text{C}sp^2$, and $\text{C}2p + \text{C}2p$
- D. $\text{C}sp^2 + \text{C}sp^2$, and $\text{C}sp^2 + \text{C}sp^2$

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 01.10
Subtopic: Atomic orbitals
Subtopic: Hybridization
Subtopic: Molecular orbital theory
Topic: Molecular Shape

55. Which atomic orbitals overlap to form the C-H s bonding molecular orbitals of acetylene, C_2H_2 ?

- A. $\text{C}sp + \text{H}1s$
- B. $\text{C}2p + \text{H}1s$
- C. $\text{C}sp^3 + \text{H}1s$
- D. $\text{C}sp^2 + \text{H}1s$

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 01.10
Subtopic: Atomic orbitals
Subtopic: Hybridization
Subtopic: Molecular orbital theory
Topic: Molecular Shape

56. Which atomic orbitals overlap to form the carbon-carbon σ bonding molecular orbital of acetylene, C_2H_2 ?

- A. $\text{C}sp^2 + \text{C}sp^2$
- B. $\text{C}sp + \text{C}sp$
- C. $\text{C}sp^3 + \text{C}sp^3$
- D. $\text{C}2p + \text{C}2p$

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 01.10
Subtopic: Atomic orbitals
Subtopic: Hybridization
Subtopic: Molecular orbital theory
Topic: Molecular Shape

57. When forming molecular orbitals from atomic orbitals, what is the order of increasing C-H bond strength for the following set?

sp^3
I

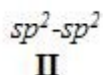
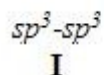
sp^2
II

sp
III

- A. $\text{II} < \text{I} < \text{III}$
- B. $\text{III} < \text{I} < \text{II}$
- C. $\text{III} < \text{II} < \text{I}$
- D. $\text{I} < \text{II} < \text{III}$

Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 01.11
Subtopic: Atomic orbitals
Subtopic: Hybridization
Subtopic: Molecular orbital theory
Topic: Molecular Shape

58. What is the order of decreasing bond length for a C-C bond composed of the following molecular orbitals?



- A. I > III > II
B. I > II > III
 C. III > II > I
 D. II > III > I

Bloom's
 Level:
 3.
 Apply

Difficulty: Medium
 Gradable:
 automatic

Section:
 01.12

Subtopic:
 Atomic
 orbitals
 Subtopic:
 Hybridization

Subtopic: Molecular orbital theory
 Topic:
 Molecular
 Shape

59. Which of the following statements about electronegativity and the periodic table is true?

- A. Electronegativity decreases across a row of the periodic table.
 B. Electronegativity increases down a column of the periodic table.
C. Electronegativity increases across a row of the periodic table.
 D. Electronegativity does not change down a column of the periodic table.

Accessibility: Keyboard Navigation
 Bloom's Level: 2. Understand
 Difficulty: Medium
 Gradable: automatic
 Section: 01.12
 Subtopic: Dipole moments
 Topic: Molecular Shape

- 60 Rank the following atoms in order of increasing electronegativity, putting the least electronegative first.



- A. I < II < III < IV
- B. I < IV < II < III**
- C. III < II < IV < I
- D. I < II < IV < III

Bloom's
Level:
 3.
Apply

Difficulty: Medium

Gradedable:
automatic

Section:
 :
 01
 .1
 2

Subtopic:
Dipole moments

Topic:
Molecular Shape

61. Rank the following atoms in order of decreasing electronegativity, putting the most electronegative first.

Si
I

N
II

O
III

C
IV

- A. I > IV > II > III
B. II > III > IV > I
C. III > IV > II > I
D. III > II > IV > I

Bloom's Level: 3. Apply

Difficulty: Medium

Gradable: automatic

Section: 01.12

Subtopic: Dipole moments

Topic: Molecular Shape

62. Which molecule has the greatest difference in electronegativity (DE) between the two different elements?

- A. CO₂
B. H₂S
C. NH₃
D. H₂O

Accessibility: Keyboard Navigation

Bloom's Level: 3. Apply

Difficulty: Medium

Gradable: automatic

Section: 01.12

Subtopic: Dipole moments

Topic: Molecular Shape

63. Which compound contains the most polar bond?

CH₃SH
I

CH₃OH
II

CH₃Cl
III

CH₃NH₂
IV

- A. I
B. II
C. III
D. IV

Bloom's Level: 3. Apply

Difficulty: Medium

Gradable: automatic

Section: 01.12

Subtopic: Dipole moments

Topic: Molecular Shape

64. Which of the following compounds are non-polar?



- A. I, IV
- B. I, II
- C. II, III
- D. II, IV

Bloom's Level: 3. Apply

Difficulty: Medium

Gradable: automatic

Section: 01.13

Subtopic: Dipole moments

Subtopic: Polarity of molecules

Topic: Molecular Shape

65. Which of the following molecules has non-polar covalent bonds?

- A. CO_2
- B. N_2
- C. CCl_4
- D. HF

Accessibility: Keyboard Navigation

Bloom's Level: 2. Understand

Difficulty: Medium

Gradable: automatic

Section: 01.12

Subtopic: Dipole moments

Topic: Molecular Shape

66. Which of the following molecules has polar covalent bonds?

- A. MgO
- B. NH_3
- C. Cl_2
- D. NaBr

Accessibility: Keyboard Navigation

Bloom's Level: 2. Understand

Difficulty: Medium

Gradable: automatic

Section: 01.12

Subtopic: Dipole moments

Topic: Molecular Shape

67. Which of the following covalent bonds has the largest dipole moment?

- A. C-H
- B. C-C
- C. C-O
- D. H-F**

Accessibility: Keyboard Navigation
Bloom's Level: 3. Apply
Difficulty: Medium
Gradable: automatic
Section: 01.12
Subtopic: Dipole moments
Topic: Molecular Shape

68. Which of the following molecules has the smallest dipole moment?

- A. CO₂**
- B. HCl
- C. H₂O
- D. NH₃

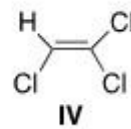
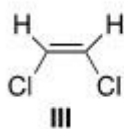
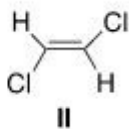
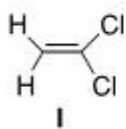
Accessibility: Keyboard Navigation
Bloom's Level: 2. Understand
Difficulty: Medium
Gradable: automatic
Section: 01.12
Subtopic: Dipole moments
Topic: Molecular Shape

69. Which of the following molecules does *not* have a net dipole moment of zero?

- A. CCl₄
- B. BF₃
- C. CO₂
- D. NH₃**

Accessibility: Keyboard Navigation
Bloom's Level: 2. Understand
Difficulty: Medium
Gradable: automatic
Section: 01.13
Subtopic: Dipole moments
Subtopic: Polarity of molecules
Topic: Molecular Shape

70. Which of the following molecules has a net dipole moment of zero?



- A. I
B. II
C. III
D. IV

Bloom's Level: 4.

Analyze

Difficulty: Medium

Gradable:
automatic

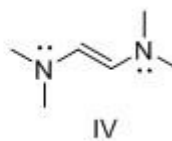
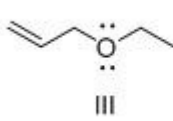
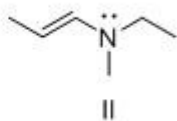
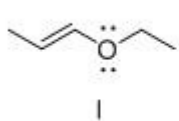
Section:
01.13

Subtopic: Dipole
moments

Subtopic: Polarity of
molecules

Topic: Molecular
Shape

71. Consider compounds which contain both a heteroatom and a double bond. For which compound is no additional Lewis structure possible?



- A. I
B. II
C. III
D. IV

Bloom's Level: 4.

Analyze

Difficulty:
Hard

Gradable:
automatic

Section:
01.06

Subtopic: Drawing Lewis
structures

Subtopic:
Resonance

Topic: Structure and
Bonding

