

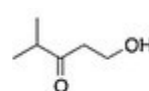
Student name: _____

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

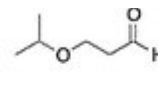
- A) 180°
- B) 90°

- C) 120°
- D) 109.5°

2) 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?



I



II



- A) IV
- B) II

- C) I
- D) III

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

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

- C) $\text{C}2p + \text{H}1s$
- D) $\text{C}sp + \text{H}1s$

4) Which of the following molecules has non-polar covalent bonds?

- A) HF
- B) N_2

- C) CCl_4
- D) CO_2

5) Which of the following covalent bonds has the largest dipole moment?

- A) C-H
B) C-C

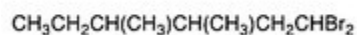
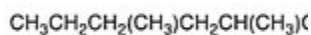
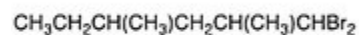
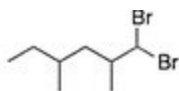
- C) H-F
D) C-O

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

- A) 2
B) 1

- C) 4
D) 3

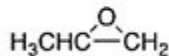
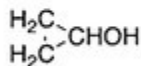
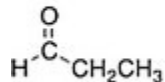
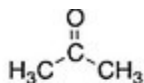
7) What is the condensed formula of the compound below?



- A) IV
B) II

- C) III
D) I

8) Which of the following is a resonance structure of the compound below?



I

II

III

- A) I

- B) III
C) II

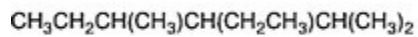
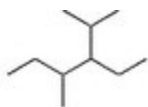
D) IV

9) Which atomic orbitals overlap to form the carbon-carbon s bonding molecular orbital of acetylene, C_2H_2 ?

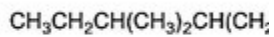
- A) $Csp^2 + Csp^2$
B) $C2p + C2p$

- C) $Csp^3 + Csp^3$
D) $Csp + Csp$

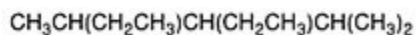
10) Convert the following skeletal structure to a condensed structure.



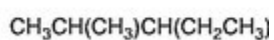
I



II



III



IV

- A) III
B) IV

- C) I
D) II

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

- A) $C2p + H1s$
B) $Csp^3 + H1s$

- C) $Csp^2 + H1s$
D) $Csp + H1s$

12) Which of the following statements about resonance structures is true?

A) Resonance

structures have the same placement of atoms but different arrangement of electrons.

B) Resonance structures have the same placement of electrons but different arrangement of atoms.

C) Resonance structures have different placement of atoms and different arrangement of electrons.

D) Resonance structures have the same placement of atoms and the same arrangement of electrons.

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

A) $1s^2, 2s^2, 2p^6, 3s^2, 3p^2$

B) $1s^2, 2s^2, 2p^6, 3s^1$

C) $1s^2, 2s^2, 2p^6$

D) $1s^2, 2s^2, 2p^6, 3s^2$

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

Si
I

N
II

O
III

C
IV

A) $\text{III} > \text{IV} > \text{II} > \text{I}$

B) $\text{I} > \text{IV} > \text{II} > \text{III}$

C) $\text{II} > \text{III} > \text{IV} > \text{I}$

D) $\text{III} > \text{II} > \text{IV} > \text{I}$

15) 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 same molecules having the same molecular formula.

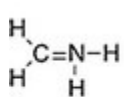
C) Constitutional isomers are different molecules having the same molecular formula.

D) Constitutional isomers are same molecules having the different molecular formula.

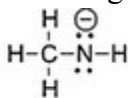
- A) CHCl_3
B) NO

- C) HCl
D) N_2

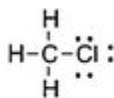
17) Which of the following Lewis structures is correct?



I



II



III



IV

- A) III, IV
B) I, II

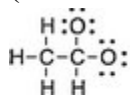
- C) II, III
D) I, III

18) What is the molecular geometry around the boron atom in BH_3 ?

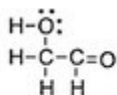
- A) Trigonal Planar
B) Trigonal Pyramidal

- C) Linear
D) Tetrahedral

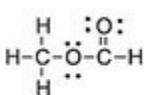
19) Which is the correct Lewis structure for acetic acid ($\text{CH}_3\text{CO}_2\text{H}$)?



I



II



III



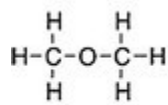
IV

- A) III
B) I

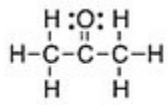
- C) IV
D) II

20) Which of the

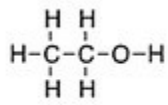
following is the appropriate conversion of the condensed structure, CH_3COCH_3 , to a Lewis structure?



I



II

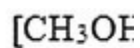
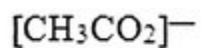
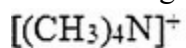


III

- A) IV
- B) II

- C) I
- D) III

21) In which of the following ions does carbon have a formal charge?



I

II

III

- A) None of these
- B) I

- C) II
- D) III

22) What is the hybridization of the carbon atom in the methyl cation, $(\text{CH}_3)^+$?

- A) sp^3
- B) p

- C) sp
- D) sp^2

23) Which of the following would most likely form an ionic bond?



I

II

III

IV

- A) II
- B) I

- C) IV
- D) III

- A) 0
- B) -2

- C) +1
- D) -1

25) 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 3 covalent bonds, and oxygen forms 2 covalent bonds.
- B) Carbon forms 4 covalent bonds, nitrogen forms 5 covalent bonds, and oxygen forms 4 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 2 covalent bonds, and oxygen forms 3 covalent bonds.

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

- A) 120°
- B) 90°

- C) 180°
- D) 109.5°

27) Which of the following molecules does *not* have a net dipole moment of zero?

- A) BF₃
- B) CO₂

- C) NH₃
- D) CCl₄

28) Which of the following compounds has an atom with an unfilled valence shell of electrons?

- A) H₂O
- B) CH₄

- C) BCl₃
- D) CO₂

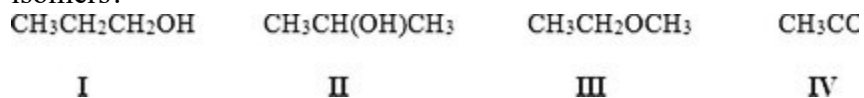
29) Which of the following resonance structures is the least important contributor to the resonance hybrid of the formate anion, HCOO^- ?



- A) I
B) IV

- C) III
D) II

30) Which of the following molecules are constitutional isomers?



- A) I, II, IV
B) I, II, III

- C) II, III, IV
D) I, III, IV

31) How many different isomers are there for a compound having the molecular formula $\text{C}_3\text{H}_6\text{O}$?

- A) 7
B) 4

- C) 5
D) 6

32) Which of the following molecules has a net dipole moment of zero?

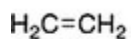


- A) I

- B) IV
C) III

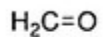
D) II

33) In which structure is the hybridization incorrect?



sp^2

I



sp

II



sp^2

III



s

I

- A) IV
B) I

- C) III
D) II

34) How many electrons are around phosphorus in phosphoric acid (H_3PO_4)?

- A) 10
B) 8

- C) 6
D) 12

35) What is the hybridization of the nitrogen atom in the ammonium cation, NH_4^+ ?

- A) sp
B) sp^3

- C) p
D) sp^2

36) 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) $Csp^3 + Csp^3$, and $C2p + C2p$
B) $Csp^3 + Csp^3$, and $Csp^2 + Csp^2$

- C) $Csp^2 + Csp^2$, and $C2p + C2p$
D) $Csp^2 + Csp^2$,

and $Csp2 + Csp2$

37) How many constitutional isomers are there for a molecule having the molecular formula C_3H_6 ?

- A) 4
- B) 1

- C) 3
- D) 2

38) How many constitutional isomers are there for a molecule having the molecular formula C_3H_8O ?

- A) 1
- B) 4

- C) 2
- D) 3

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

- A) $C2p + H1s$
- B) $Csp^3 + H1s$

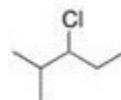
- C) $Csp + H1s$
- D) $Csp^2 + H1s$

40) What is the ground-state electronic configuration of a fluorine atom?

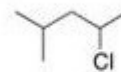
- A) $1s^2, 2s^2, 2p^2$
- B) $1s^2, 2s^2, 2p^5$

- C) $1s^2, 2s^2, 2p^3$
- D) $1s^2, 2s^2, 2p^4$

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



I

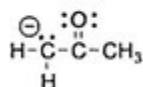
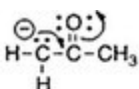


II

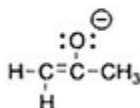
- A) I
- B) IV

- C) II
- D) III

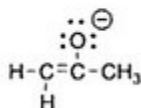
42) Follow the curved arrows to draw the second resonance structure for the ion below.



I



II



III

- A) III
- B) II

- C) IV
- D) I

43) What is the molecular geometry around the carbon atom in CH_4 ?

- A) Trigonal Pyramidal
- B) Trigonal Planar

- C) Linear
- D) Tetrahedral

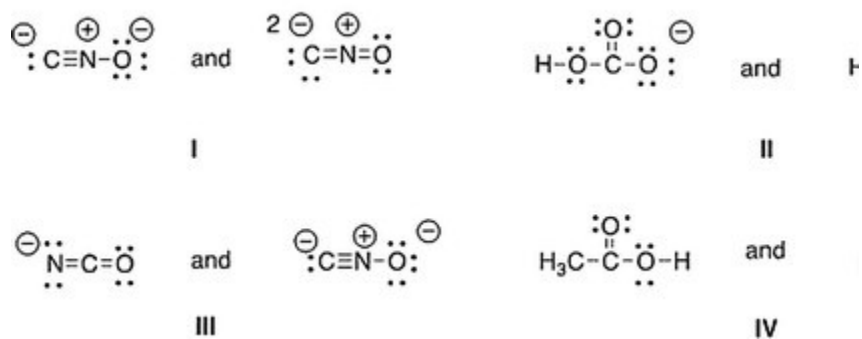
44) How many constitutional isomers are there for a molecule having the molecular formula $\text{C}_2\text{H}_6\text{O}$?

- A) 3

B) 1
C) 4

D) 2

45) Which of the following pair does not represent resonance structures?



A) IV
B) II

C) III
D) I

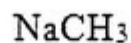
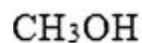
46) Rank the following atoms in order of increasing electronegativity, putting the least electronegative first.



A) III < II < IV < I
B) I < IV < II < III

C) I < II < III < IV
D) I < II < IV < III

47) In which of the following ions does carbon have a formal charge?



I

II

A) II

B) I

C) None of these

D) III

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

A) 0

B) +1

C) -2

D) -1

49) Which of the following statements about bonding is true?

A) Covalent bonds result from the transfer of electrons from one element to another.

B) Covalent bonds result from the sharing of electrons between two metals.

C) Ionic bonds result from the sharing of electrons

between two non-metals.

D) Ionic bonds result from the transfer of electrons from a metal to a non-metal.

50) What is the approximate H-C-O bond angle in formaldehyde, H_2CO ?

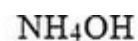
A) 109.5°

B) 120°

C) 180°

D) 90°

51) Which of the following molecules contain both covalent and ionic bonds?



I

II

III

- A) I, IV
B) II, IV

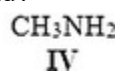
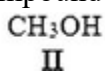
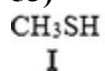
- C) I, II
D) II, III

52) What is the approximate bond angle for the C-C-N bond in acetonitrile, CH₃CN?

- A) 90°
B) 109.5°

- C) 180°
D) 120°

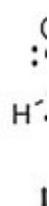
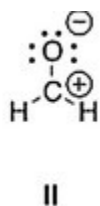
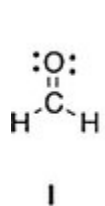
53) Which compound contains the most polar bond?



- A) II
B) IV

- C) III
D) I

54) Rank the following in order of decreasing importance as contributing structures to the resonance hybrid of formaldehyde, H₂CO.



- A) I > III > II
B) II > I > III

- C) III > II > I
D) I > II > III

55) When forming molecular orbitals from

atomic orbitals, what is the order of increasing C-H bond strength for the following set?

sp^3
I

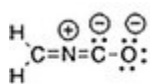
sp^2
II

sp
III

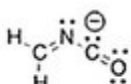
- A) I < II < III
B) III < II < I

- C) II < I < III
D) III < I < II

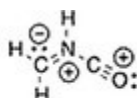
56) Which is not an acceptable Lewis structure for the anion CH_2NCO^- ?



I



II



III

- A) II
B) III

- C) I
D) IV

57) Which of the following compounds are non-polar?



I



II



III



I

- A) I, II
B) I, IV

- C) II, III
D) II, IV

58) Which of the following molecules has polar covalent bonds?

- A) NaBr
B) NH_3

- C) Cl_2
D) MgO

- A) $1s^2, 2s^2, 2p^6$
- B) $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$
- C) $1s^2, 2s^2, 2p^6, 3s^2, 3p^4$

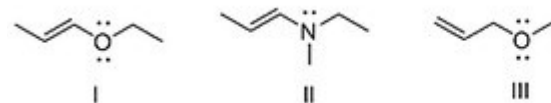
D) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$

60) Which of the following molecules has the smallest dipole moment?

- A) CO_2
- B) NH_3

- C) H_2O
- D) HCl

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



- A) II
- B) I

- C) III
- D) IV

62) Which of the following compounds has an atom with more than eight valence electrons?

- A) H_2CO_3
- B) H_2SO_4

- C) HBr
- D) H_2O

63) Which of the following would you expect to have ionic bonds?

- A) CO
- B) NaCl

- C) FBr
- D) NF_3

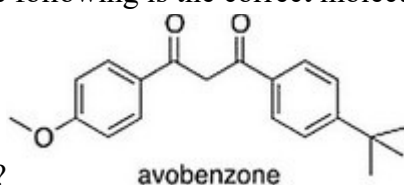
64) Which of the following atoms will have a full 3s orbital in the ground state?

- A) Lithium
- B) Potassium

- C) Hydrogen
- D) Rubidium

65) Avobenzone is an active ingredient in some common sunscreens. Which of the following is the correct molecular

formula for avobenzone?

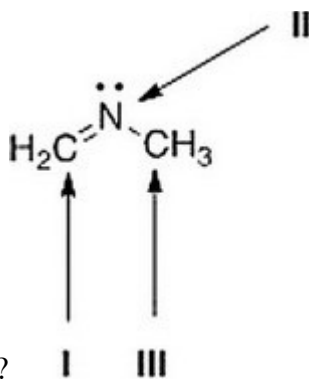


- A) C₂₀H₂₄O₃
- B) C₂₀H₂₂O₃

- C) C₂₁H₂₃O₃
- D) C₂₂O₂₂O₃

66) What is the hybridization for each of the indicated

atoms in the following compound?



- A) I = *sp*; II = *sp*²; III = *sp*³.
- B) I = *sp*²; II = *sp*²; III = *sp*³.
- C) I = *sp*²; II = *sp*³; III = *sp*³.

- D) I = *sp*²; II = *sp*²; III = *sp*².

67) Which of the following statements about electronegativity and the periodic table is true?

A) Electronegativity increases down a column of the periodic table.

B) Electronegativity does not change down a column of the periodic table.

C) Electronegativity increases across a row of the

periodic table.

D)

Electronegativity decreases across a row of the periodic table.

68) Which of the following statements about valence electrons is true?

A) They are the outermost electrons.

B) They are the most tightly held electrons.

C) They do not participate in chemical reactions.

D) They reveal the period number of a second-row element.

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

sp^3-sp^3
I

sp^2-sp^2
II

A) I > II > III

B) I > III > II

C) III > II > I

D) II > III > I

70) What 2 things will change between two resonance structures?

A) The position of multiple bonds and single bonds.

B) The placement of atoms and single bonds.

C) The placement of atoms and non-bonded electrons.

D) The position of multiple bonds and non-bonded electrons.

71) Which of the following is the

appropriate conversion of $(\text{CH}_3)_4\text{C}$ to a skeletal structure?



I



II



III

- A) I
B) III

- C) IV
D) II

72) What is the ground-state electronic configuration of a carbon atom?

- A) $1s^2, 2s^2, 2p^4$
B) $1s^2, 2s^2, 2p^5$

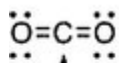
- C) $1s^2, 2s^2, 2p^2$
D) $1s^2, 2s^2, 2p^6$

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

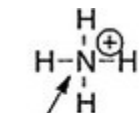
- A) CO_2
B) H_2S

- C) NH_3
D) H_2O

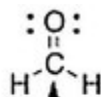
74) Determine the geometry around the indicated atom in each species.



I



II



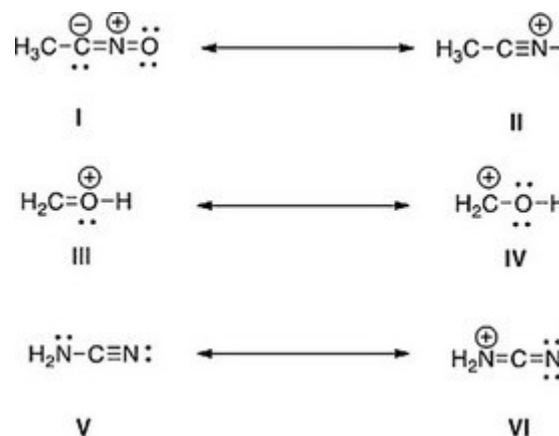
III

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

= tetrahedral

- D) I = Linear; II = tetrahedral; III = trigonal planar; IV = linear

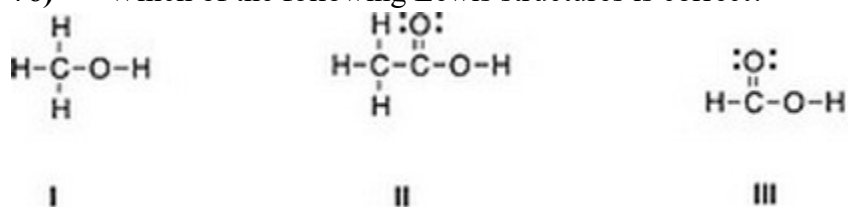
75) Which is more important in each pair of contributing resonance structures?



- A) II, III, V
B) II, IV, V

- C) II, III, VI
D) I, IV, V

76) Which of the following Lewis structures is correct?



- A) III
B) IV

- C) I
D) II

77) Which of the following statements about resonance structures is *not* true?

- A) Resonance structures differ only in the arrangement of electrons.
B) There is no movement of electrons from one form to another.

- C) Resonance

structures are not isomers.

D) Resonance structures are in equilibrium with each other.

78) Which of the following molecules has a net dipole moment of zero?

A) CO_2

B) All of these are correct.

C) CH_4

D) BH_3

Answer Key

Topics , Smith 6th
ch1

Test name: Organic Chemistry with Biological

- 1) C
- 2) A
- 3) B
- 4) B
- 5) C
- 6) A
- 7) D
- 8) D
- 9) D
- 10) C
- 11) D
- 12) A
- 13) C
- 14) D
- 15) C
- 16) D
- 17) C
- 18) A

19) C

20) B

21) A

22) D

23) C

24) A

25) A

26) D

27) C

28) C

29) D

30) B

31) A

32) D

33) D

34) A

35) B

36) C

37) D

38) D

39) B

40) B

41) C

42) A

43) D

44) D

45) C

46) B

47) A

48) D

49) D

50) B

51) B

52) C

53) A

54) D

55) A

56) B

57) B

58) B

59) D

60) A

61) C

62) B

63) B

64) D

65) B

66) B

67) C

68) A

69) A

70) D

71) C

72) C

73) D

74) C

75) A

76) B

77) D

78) B