WILEY

Organic Chemistry

Third Edition

David Klein

Chapter 1

A Review of General Chemistry

Chapter 1

Please note:

If your clicker system can only hold 5 multiple choice answers, we have provided ‘alternate answers’ for those questions in which the author originally had more than 5 choices. These answers appear on the slides with a green background.

If your clicker system can hold more than 5 multiple choice answers, please delete the slides with the green backgrounds, and use the original answers the author has listed.

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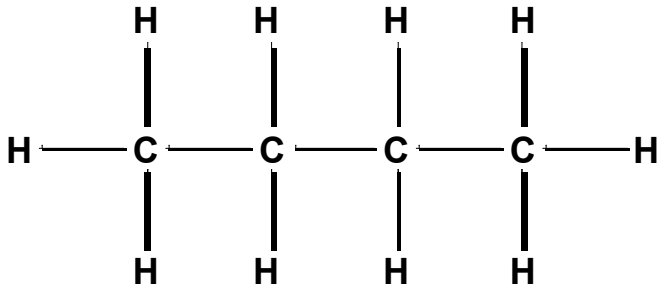
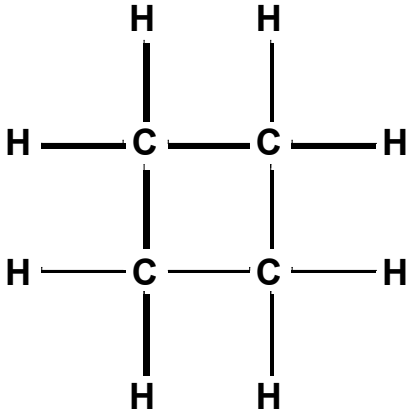
Section 1.2

1. Which of the following are constitutional isomers of C_4H_{10}?

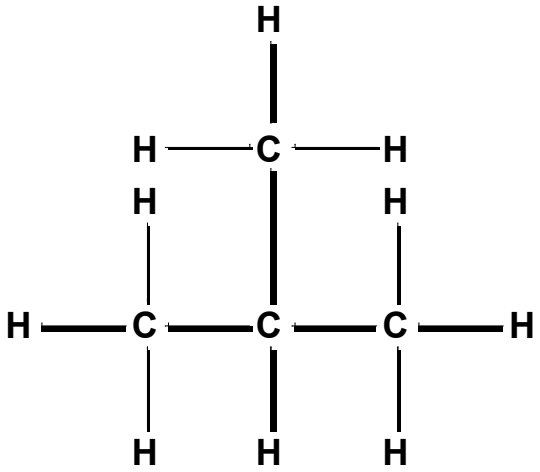
A.



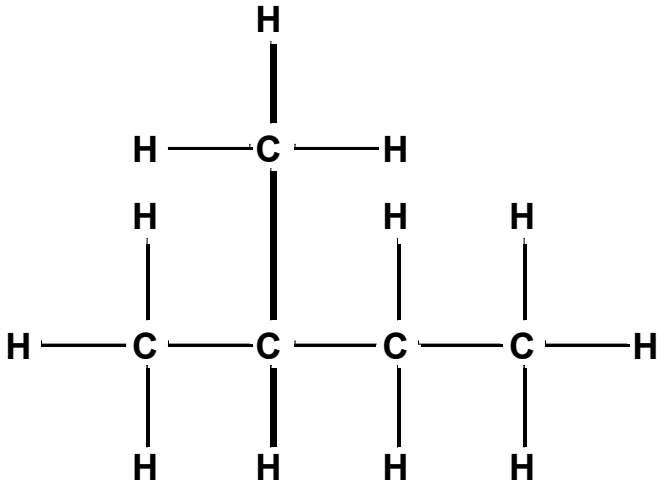
B.



C.



D.



Section 1.2

1. Which of the following are constitutional isomers of C_4H_{10}?

1. Answer: a and c

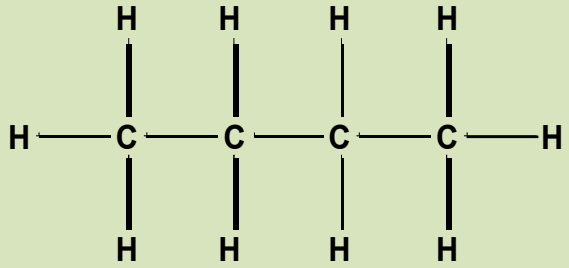
The molecular formula indicates which and how many atoms are in the compound. Each carbon is tetravalent and each hydrogen is monovalent. For more examples of this type of problem, see SkillBuilder 1.1.

Alternate Answers:

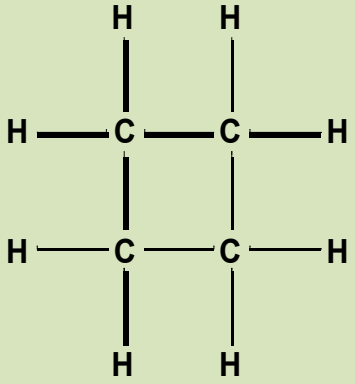
Section 1.2

1. Which of the following are constitutional isomers of C_4H_{10}?

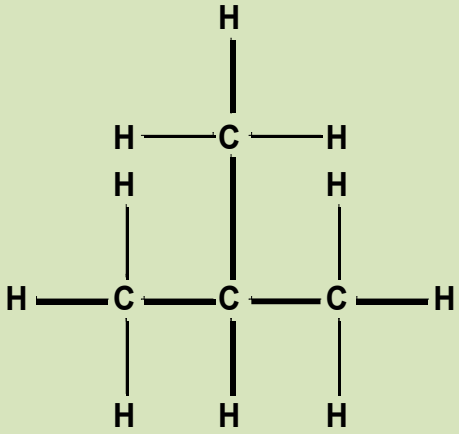
A.



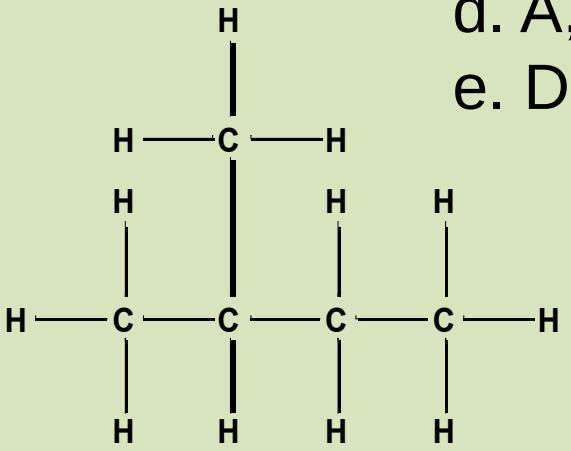
B.



C.



D.



a. A and B
b. B and C
c. A and C
d. A, B and C
e. D

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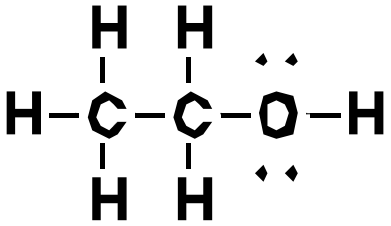
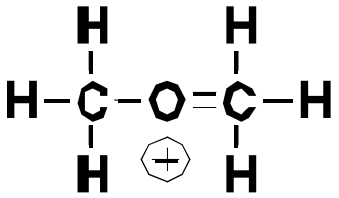
1. Answer : c

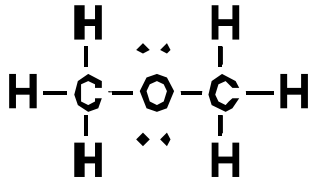
The molecular formula indicates which and how many atoms are in the compound. Each carbon is tetravalent and each hydrogen is monovalent. For more examples of this type of problem, see SkillBuilder 1.1.

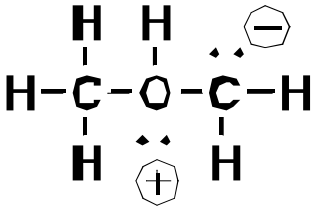
Section: 1.3

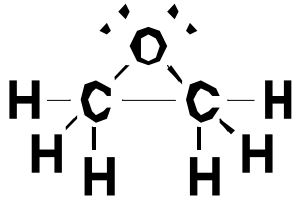
2. Which of the following is(are) not possible Lewis Structure(s) for C_2H_6O?

a. 

b. 

c. 

d. 

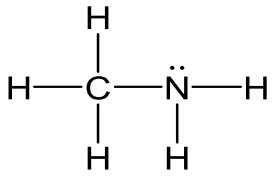
e. 

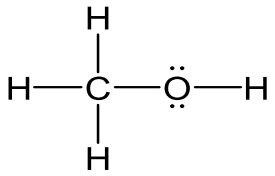
2. Answer: b, e

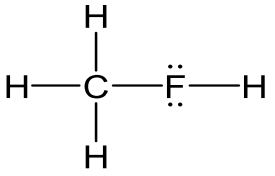
For more examples of this type of problem, see SkillBuilder 1.3 and 1.4.

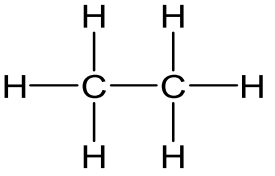
Section: 1.3

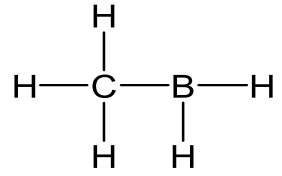
3. Which of the following is not a reasonable Lewis Structure?

a. 

b. 

c. 

d. 

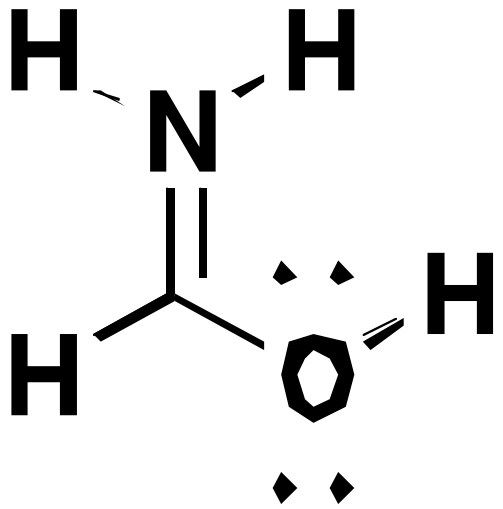
e. 

3. Answer: c, The fluorine atom only needs one electron added in a covalent bond not 2, so this structure is electron deficient

For more examples of this type of problem, see SkillBuilder 1.2, 1.3 and 1.4.

Section: 1.4

4. What is the formal charge of the nitrogen atom in the following structure?



a. +2

b. +1

c. 0

d. –1

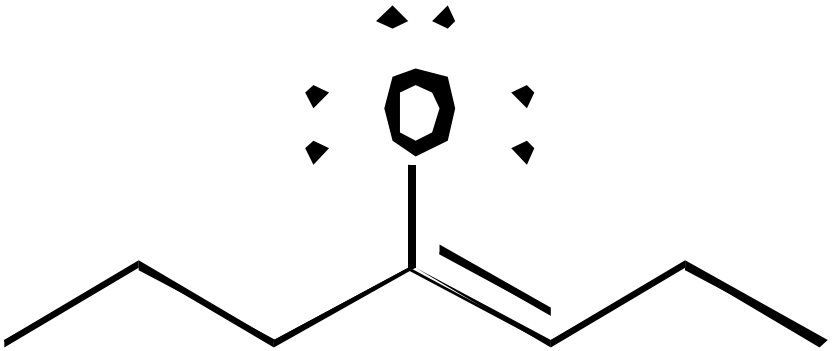
e. –2

4. Answer: b

For more examples of this type of problem, see SkillBuilder 1.4.

Section: 1.4

5. What is the formal charge of the oxygen atom in the following structure?



a. +2

b. +1

c. 0

d. –1

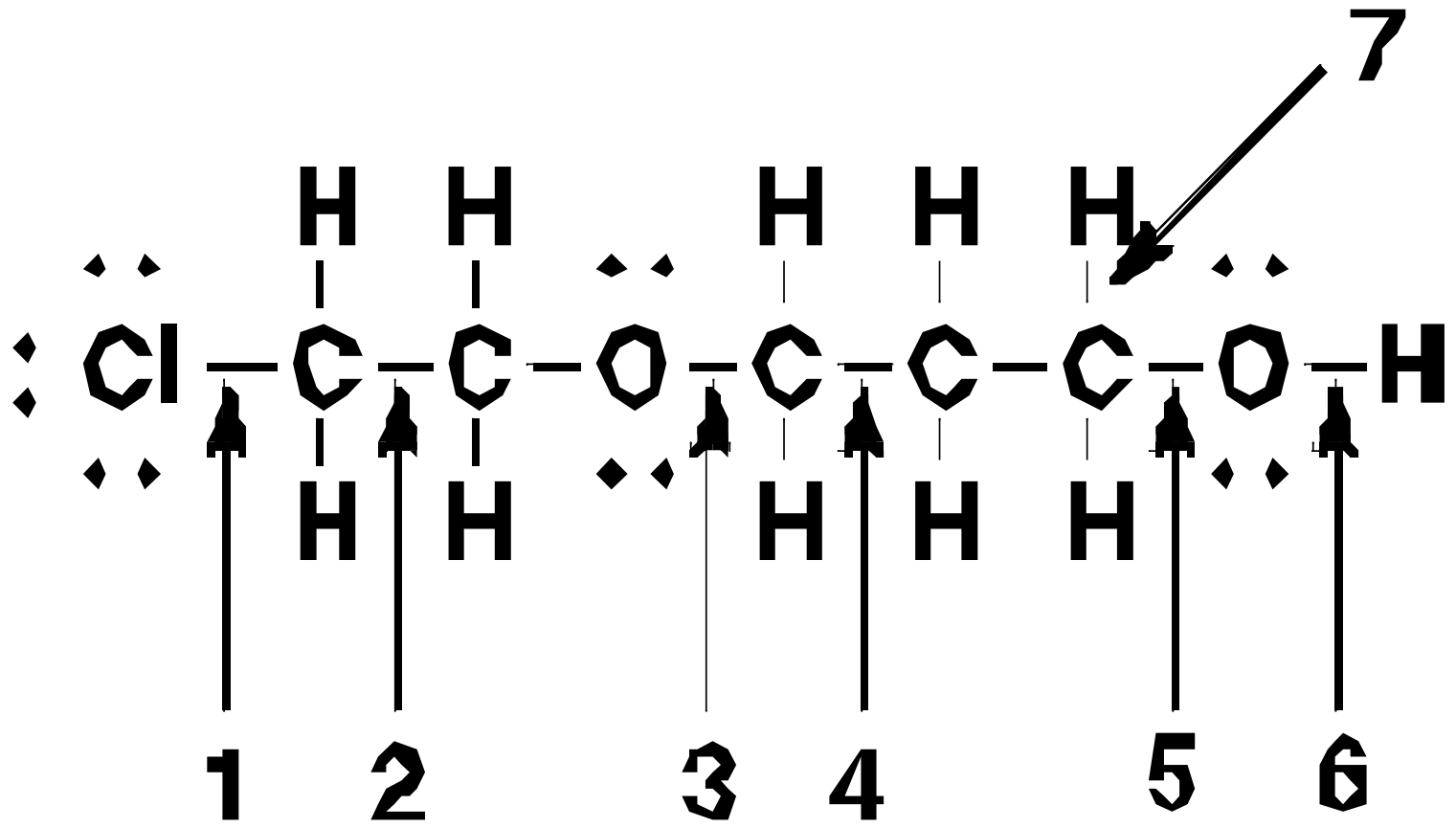
e. –2

4. Answer: d

For more examples of this type of problem, see SkillBuilder 1.4.

Section: 1.5

6. Which of the indicated bonds are polar covalent bonds?



Section: 1.5

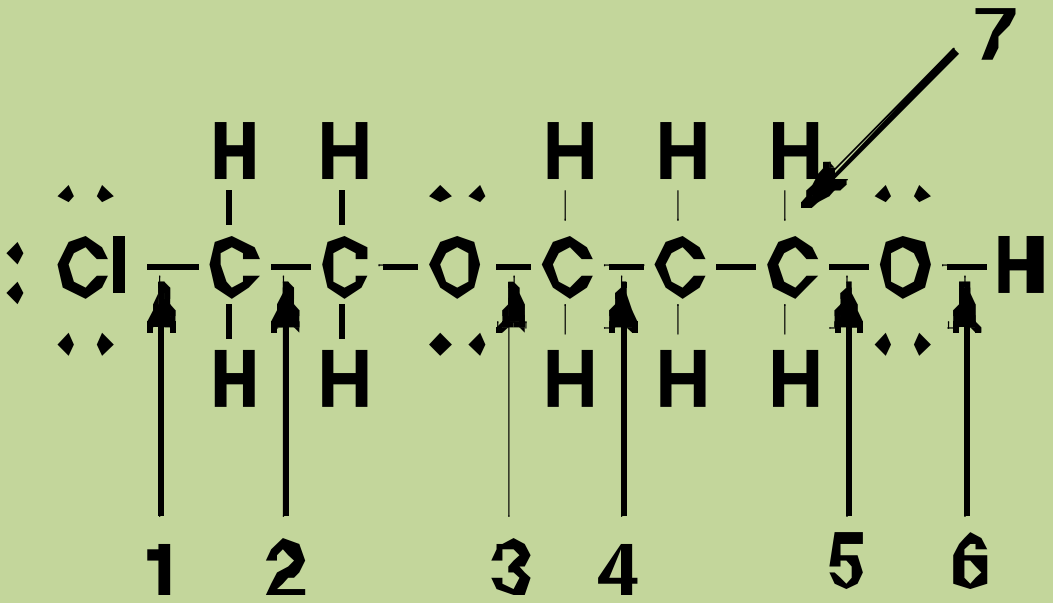
6. Answer: 1, 3, 5, 6

Carbon-carbon bonds, carbon-hydrogen bonds are nonpolar. Bonds between carbon and chlorine, carbon and oxygen, oxygen and hydrogen are all polar because the difference in electronegativity is between 0.5 and 1.7. For more examples of this type of problem, see SkillBuilder 1.5.

Alternate Answers:

Section: 1.5

6. Which of the indicated bonds are polar covalent bonds?



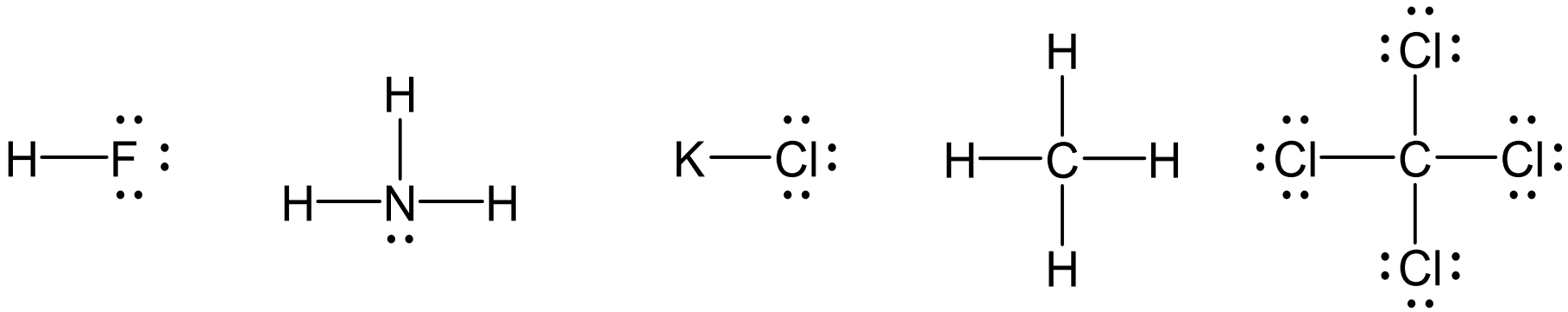
a. 1, 2, 3, 4, 5, 6, 7
b. 1, 3, 5, 6
c. 1, 3, 4, 7
d. 3, 5, 6, 7
e. 1, 3, 4, 5, 6

6. Answer: b

Carbon-carbon bonds, carbon-hydrogen bonds are nonpolar. Bonds between carbon and chlorine, carbon and oxygen, oxygen and hydrogen are all polar because the difference in electronegativity is between 0.5 and 1.7. For more examples of this type of problem, see SkillBuilder 1.5.

Section: 1.5

7. Using your knowledge of electronegativity determine the order of decreasing polarity for the bonds between dissimilar atoms in the following molecules



1. 2. 3. 4. 5.

a. 1>3>5>2>4

b. 3>1>5>4>2

c. 1>3>2>5>4

d. 5>4>2>1>3

e. 3>1>2>5>4

7. Answer: e
Section: 1.5

See section 1.5, the electronegativity difference for K and Cl is the largest for this series, and would be considered an ionic bond, as would the bond between H and F based on the Pauling electronegativities. The bonds between C and H would be considered to be covalent, and the rest are polar covalent

Section: 1.6

8. What is the electron configuration of a nitrogen ion with a single negative charge and what neutral atom shares the same electron configuration?

a. $1s^2 2s^2 2p^2$

b. $1s^2 2s^2 2p^3$

c. $1s^2 2s^2 2p^4$

d. $1s^2 2s^1 2p^3$

e. Carbon

f. Oxygen

g. Phosphorous

8. Answer: c and f

A negative charge will add one electron to the electron configuration of an atom. Nitrogen (atomic number 7) with a negative charge will have 8 electrons and have the same electron configuration as neutral oxygen. For more examples of this type of problem, see SkillBuilder 1.6.

Alternate Answers:

Section: 1.6

8. What is the electron configuration of a nitrogen ion with a single negative charge and what neutral atom shares the same electron configuration?

a. $1s^2 2s^2 2p^2$, oxygen

b. $1s^2 2s^2 2p^4$, oxygen

c. $1s^2 2s^2 2p^2$, carbon

d. $1s^2 2s^2 2p^4$, carbon

8. Answer: b

A negative charge will add one electron to the electron configuration of an atom. Nitrogen (atomic number 7) with a negative charge will have 8 electrons and have the same electron configuration as neutral oxygen. For more examples of this type of problem, see SkillBuilder 1.6.

Section: 1.6

9. What is the electron configuration of an oxygen ion with a single positive charge and what neutral atom shares the same electron configuration?

a. $1s^2 2s^2 2p^3$

b. $1s^2 2s^2 2p^4$

c. $1s^2 2s^2 2p^5$

d. $1s^2 2s^1 2p^4$

e. Nitrogen

f. Fluorine

g. Sulfur

9. Answer: a and e

A positive charge will subtract one electron from the electron configuration of an atom. Oxygen (atomic number 8) with a positive charge will have 7 electrons and have the same electron configuration as neutral nitrogen. For more examples of this type of problem, see SkillBuilder 1.6.

Alternate Answers:

Section: 1.6

9. What is the electron configuration of an oxygen ion with a single positive charge and what neutral atom shares the same electron configuration?

A. $1s^2 2s^2 2p^3$, nitrogen

B. $1s^2 2s^2 2p^3$, fluorine

C. $1s^2 2s^1 2p^4$, nitrogen

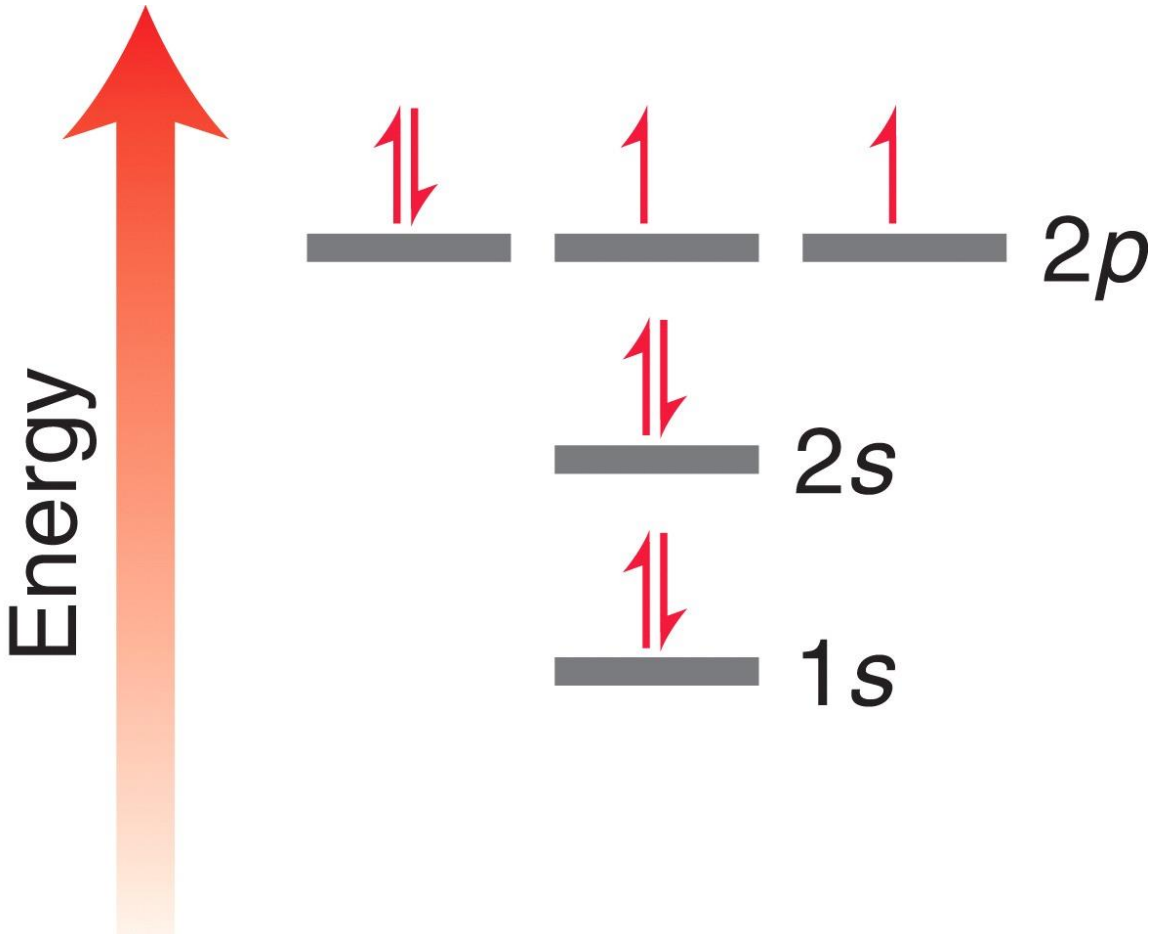
D. $1s^2 2s^1 2p^4$, fluorine

9. Answer: a

A positive charge will subtract one electron from the electron configuration of an atom. Oxygen (atomic number 8) with a positive charge will have 7 electrons and have the same electron configuration as neutral nitrogen. For more examples of this type of problem, see SkillBuilder 1.6.

Section: 1.6

10. What element would be expected to have the following energy diagram for the electron configuration in the ground state?



a. boron

b. carbon

c. nitrogen

d. oxygen

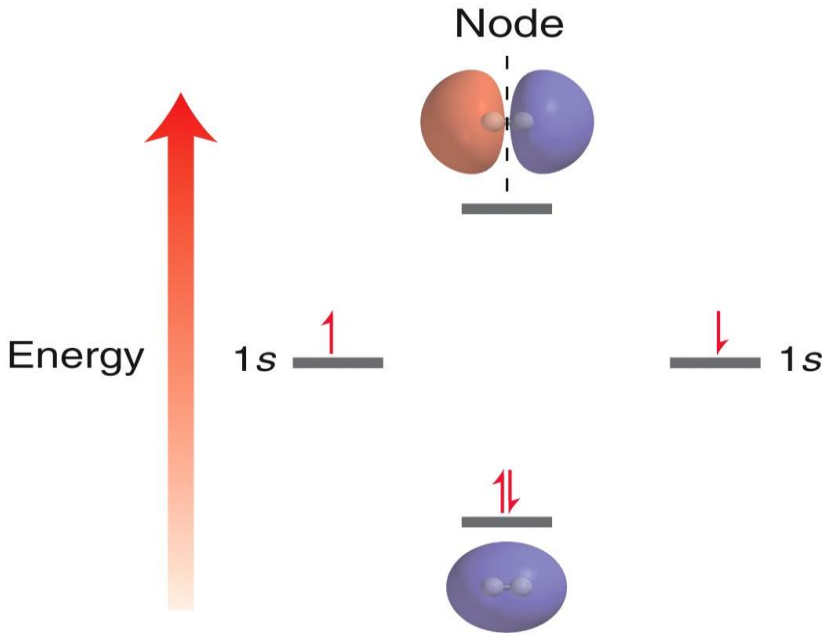
e. phosphorous

10. Answer: d

For more examples of this type of problem, see SkillBuilder 1.6 and problems 1.17and 1.18.

Section: 1.8

11. Give the names associated with the orbitals in the following molecular orbital diagram.



1. _____, 2. _____

3. _____, 4. _____

a. 1. bonding MO, 2. LUMO, 3. antibonding MO, 4. HOMO

b. 1. antibonding MO, 2. LUMO, 3. bonding MO, 4. HOMO

c. 1. bonding MO, 2. HOMO, 3. antibonding MO, 4. LUMO

d. 1. bonding MO, 2. HOMO, 3. antibonding MO, 4. LUMO

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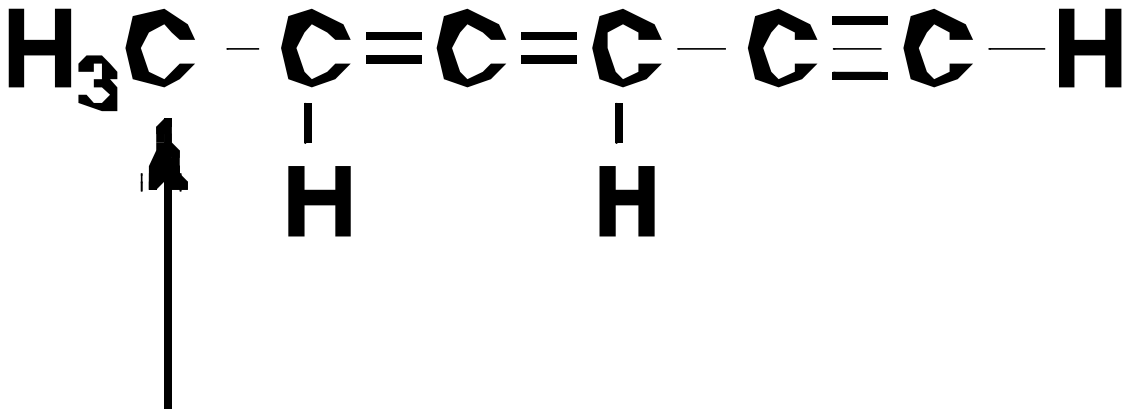
11. Answer: b

See section 1.8 for definitions.

Section: 1.9

12. What is the hybridization of the indicated atom in the following structure?



a. sp^3

b. sp^2

c. sp

d. sp^3d^2

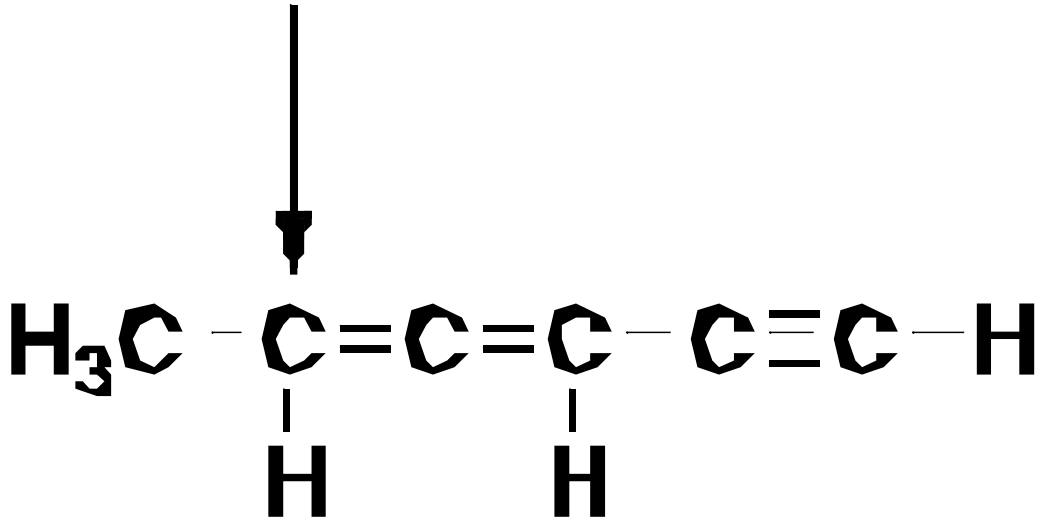
e. sp^3d

12. Answer: a

For more examples of this type of problem, see SkillBuilder 1.7.

Section: 1.9

13. What is the hybridization of the indicated atom in the following structure?



a. sp^3

b. sp^2

c. sp

d. sp^2d^2

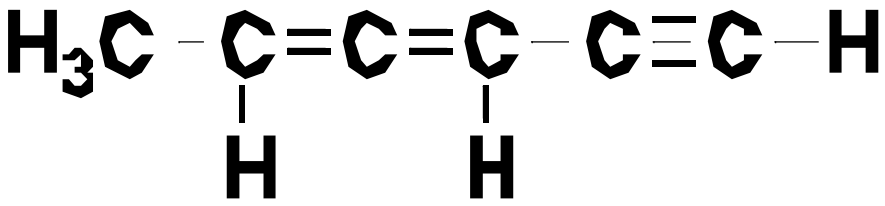
e. sp^3d^2

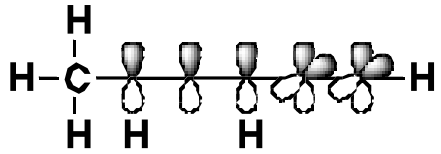
13. Answer: b

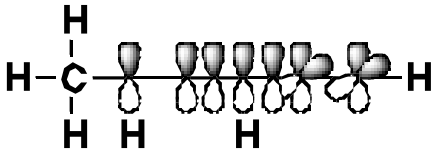
For more examples of this type of problem, see SkillBuilder 1.7.

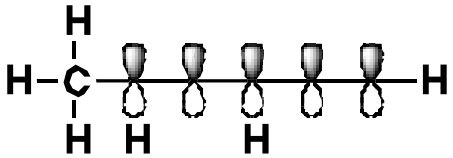
Section: 1.6, 1.7, 1.8, 1.9

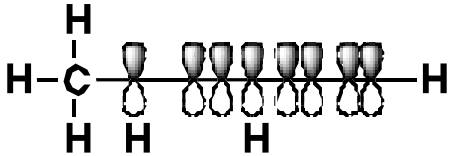
14. What is the correct diagram of overlapping atomic orbitals for the pi system of the following structure?

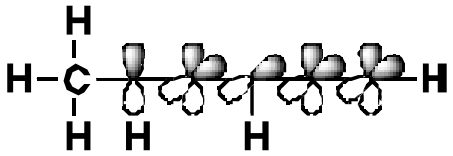


a. 

b. 

c. 

d. 

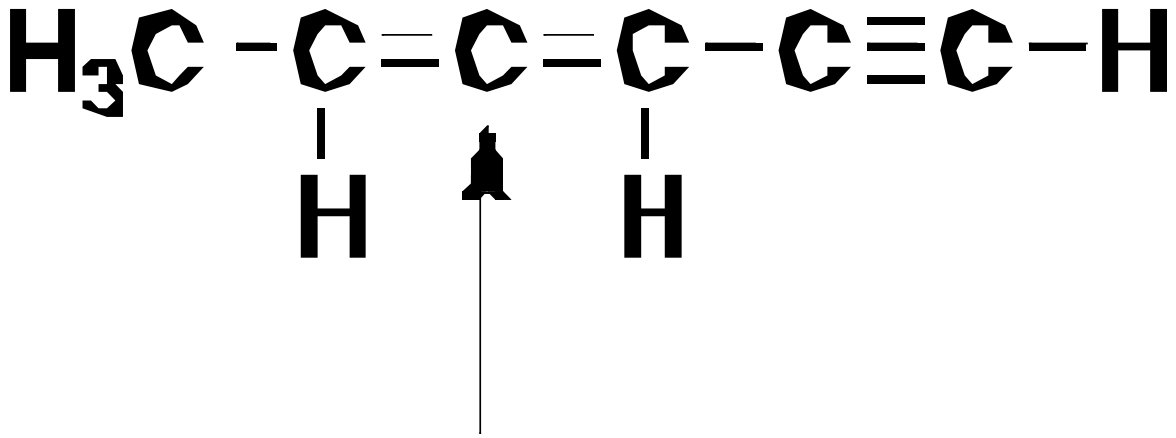
e. 

14. Answer : e

These diagrams use lines to indicate sigma bonds and atoms involved in multiple bonds have p-orbitals. An atom with a double bond is represented by a single pair of p-orbitals. An atom with a triple bond or a pair of double bonds is represented by a pair of p-orbitals. The pair of p-orbitals must be oriented at right angles to each other (i.e. one vertical and one horizontal as if on the x and y axis of a coordinate system).

Section: 1.9

15. What is the hybridization of the indicated atom in the following structure?



a. sp^3

b. sp^2

c. sp

d. sp^2d^2

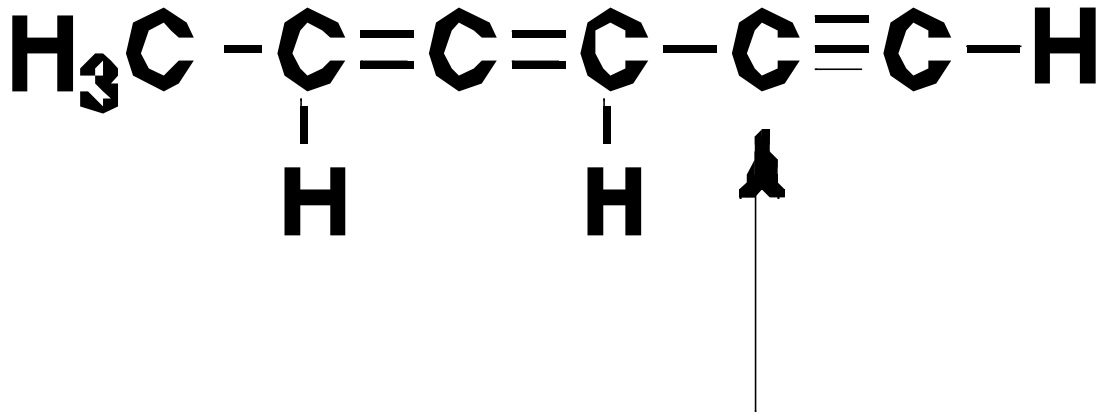
e. sp^2d

15. Answer : c

For more examples of this type of problem, see SkillBuilder 1.7.

Section: 1.9

16. What is the hybridization of the indicated atom in the following structure?



a. sp^3

b. sp^2

c. sp

d. sp^2d^2

e. sp^2d

16. Answer: c

For more examples of this type of problem, see SkillBuilder 1.7.

Section: 1.10

17. What is the molecular geometry at C in CO_2?

a. linear
b. trigonal planar
c. tetrahedral
d. trigonal bipyramidal
e. octahedral

17. Answer: a

For more examples of this type of problem, see SkillBuilder 1.8.

Section: 1.10

18. What is the molecular geometry at C in CH_4?

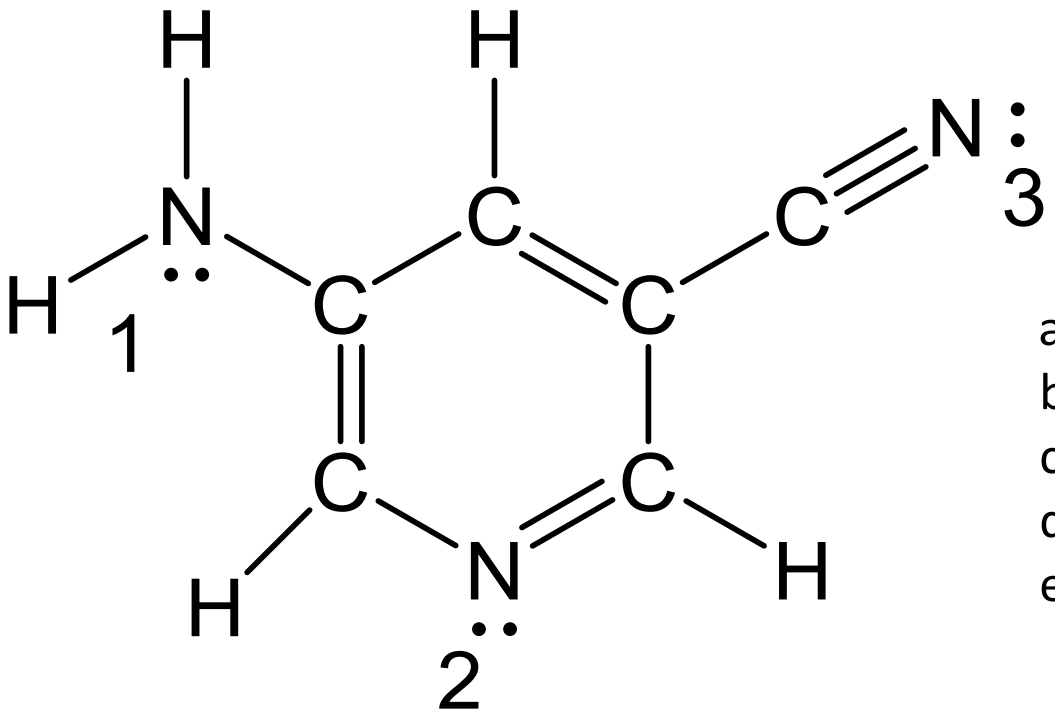
a. linear
b. square planar
c. square pyramidal
d. tetrahedral
e. octahedral

18. Answer: d

For more examples of this type of problem, see SkillBuilder 1.8.

Section: 1.10

19. What is the hybridization, electronic arrangement, and molecular geometry of the nitrogen atom 1 in the following molecule?



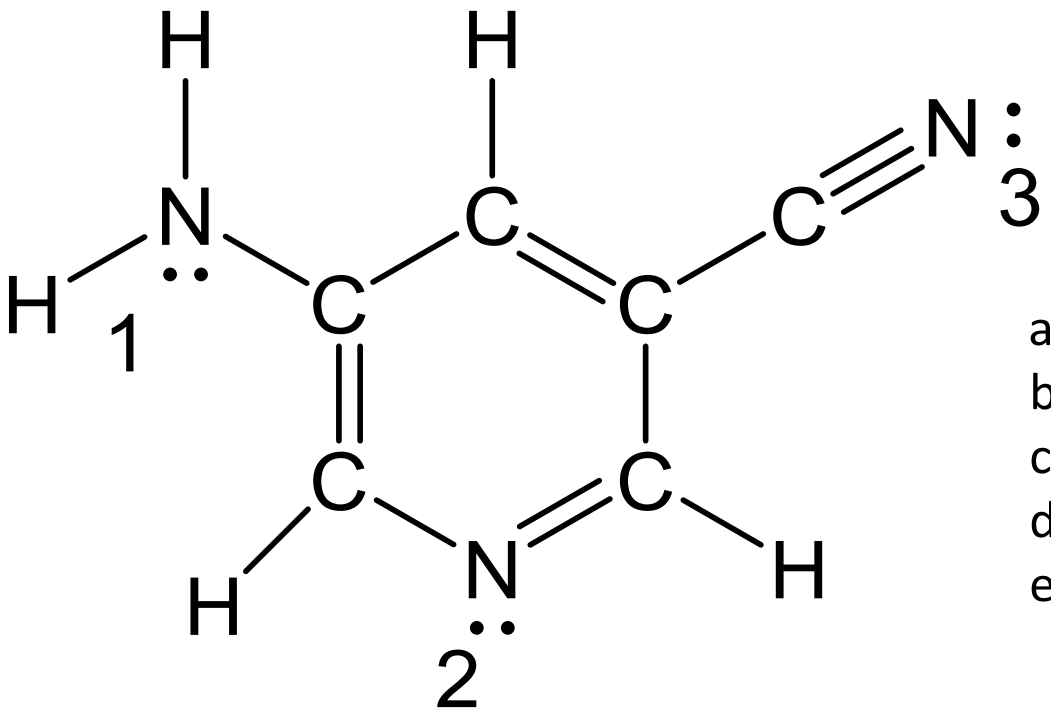
a. sp, tetrahedral, trigonal planar
b. sp^2, trigonal planar, trigonal planar
c. sp^2, trigonal planar, bent
d. sp^3, tetrahedral, trigonal planar
e. sp^3, tetrahedral, trigonal pyramidal

19. Answer: e

For more examples of this type of problem, see SkillBuilder 1.8, and section 1.10

Section: 1.10

20. What is the hybridization, electronic arrangement, and molecular geometry of the nitrogen atom 2 in the following molecule?



a. sp, tetrahedral, trigonal planar
b. sp^2, trigonal planar, trigonal planar
c. sp^2, trigonal planar, bent
d. sp^3, tetrahedral, trigonal planar
e. sp^3, tetrahedral, trigonal pyramidal

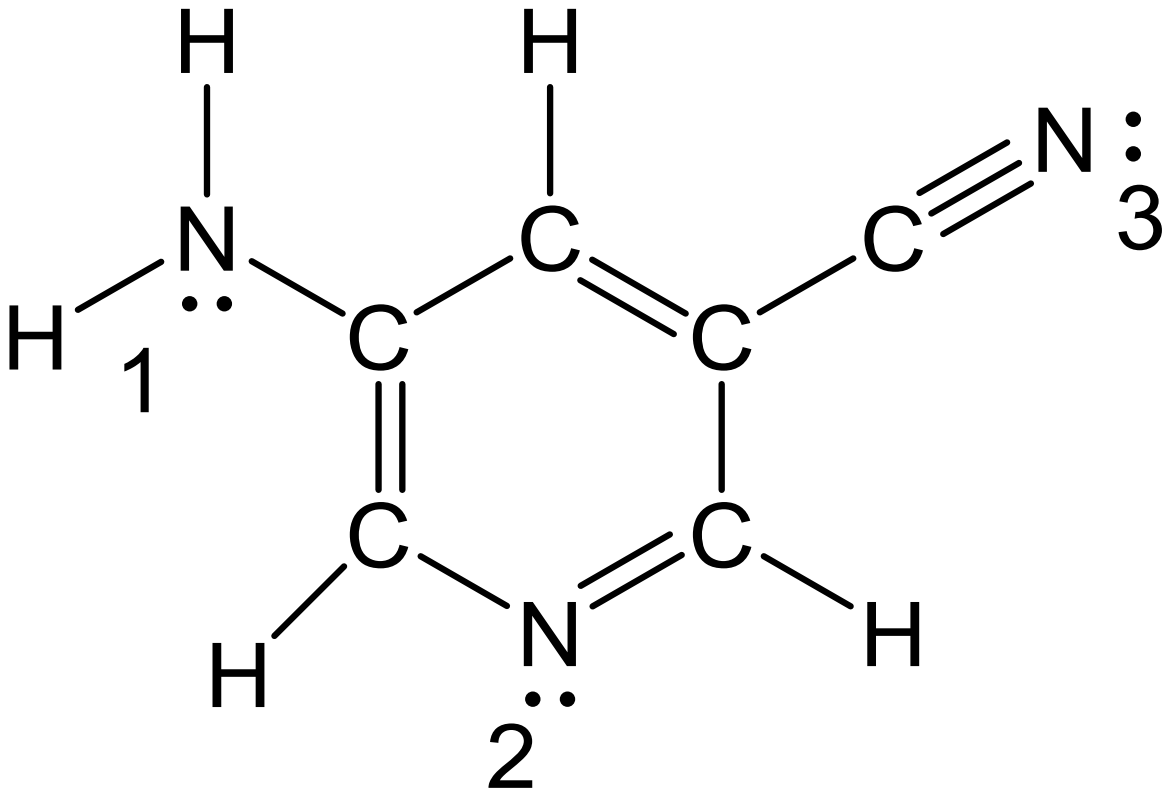
Section: 1.10

20. Answer: c

For more examples of this type of problem, see SkillBuilder 1.8.

Section: 1.10

21. What is the hybridization and molecular geometry of the nitrogen atom 3 in the following molecule?



a. sp, linear
b. sp, not relevant
c. sp^2, bent
d. sp^2, trigonal planar
e. sp^3, tetrahedral

21. Answer: b

For more examples of this type of problem, see SkillBuilder 1.8, and section 1.10

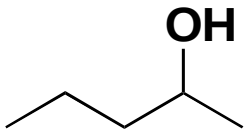
Section: 1.11

22 . Which of the following are polar molecules?

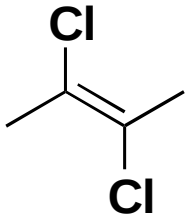
A. CCl_4

B. C_5H_{12}

C.



D.



E. CH_2Cl_2

a. A and B

b. C, D and E

c. C and E

d. D and E

e. all of the above

f. none of the above

Section: 1.11

22. Answer: c

Structures A and D have polar bonds but no net dipole. Structure B has no polar bonds. Structures C and E have polar bonds and a net dipole. For more examples of this type of problem, see SkillBuilder 1.9.

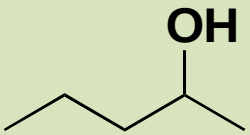
Alternate Answers:

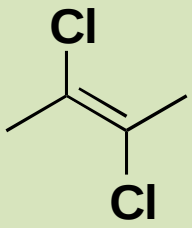
Section: 1.11

22. Which of the following are polar molecules?

A. CCl_4

B. C_5H_{12}

C. 

D. 

E. CH_2Cl_2

a. A and B
b. C, D and E
c. C and E
d. D and E
e. all of the above

Section: 1.11

22. Answer: c

Section 1.11

23. Using calculated and measured dipole moments can be used to give a rough approximation of % ionic character, which will be used later in the book as a measure of reactivity at certain atoms. Using the data in the table below, determine which of the carbons labeled 1 – 4 will have the highest partial positive charge.

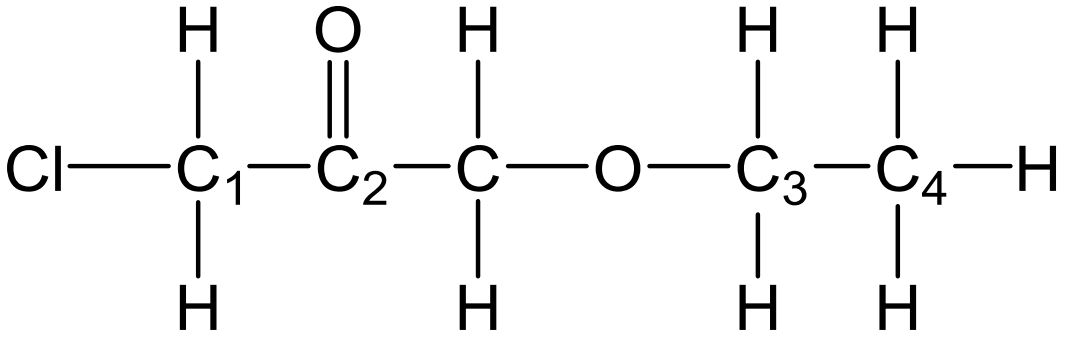
Bond type	% ionic character
C-O	10%
C-Cl	22%
O-H	33%
C=O	41%

a. carbon 1

b. carbon 2

c. carbon 3

d. carbon 4



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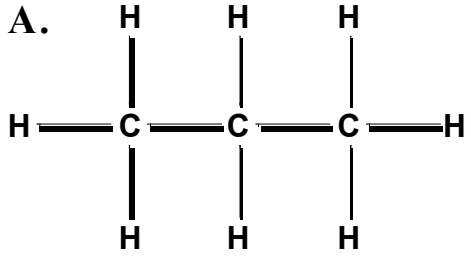
23. Answer: b

See section 1.11. The concept of % ionic character will be an important tool in determining the site of probable reaction as you learn more about reactions and mechanisms later in the book.

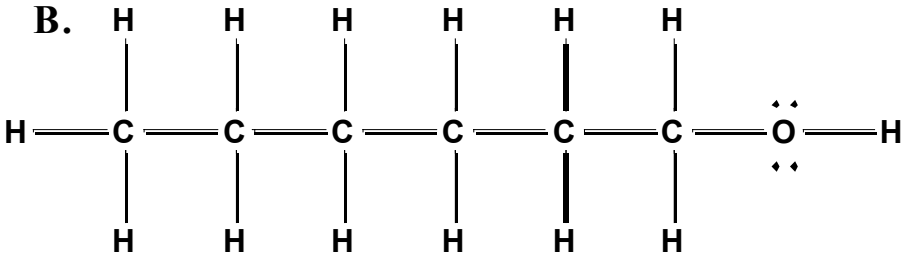
Section 1.12

24. Which of the following has the highest boiling point?

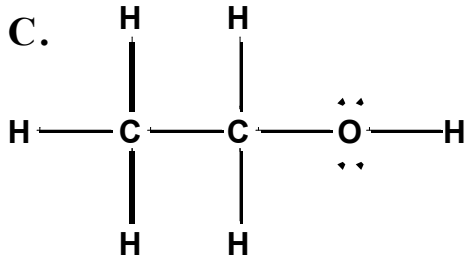
A.



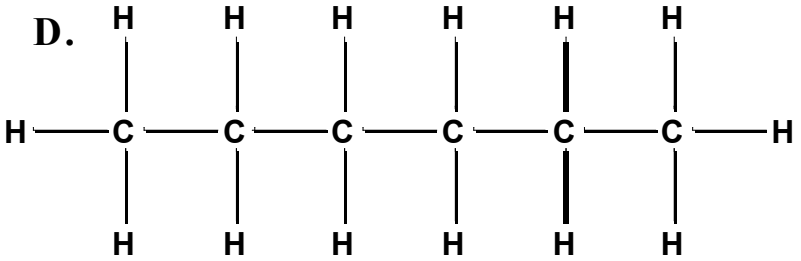
B.



C.



D.



a. propane

b. hexanol

c. ethyl alcohol

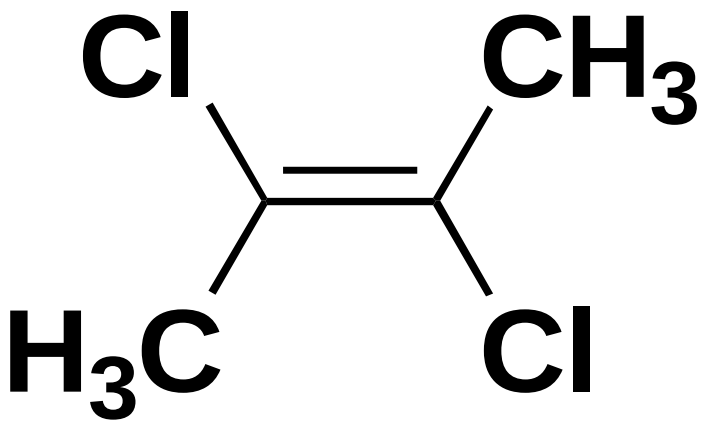
d. hexane

24. Answer: b

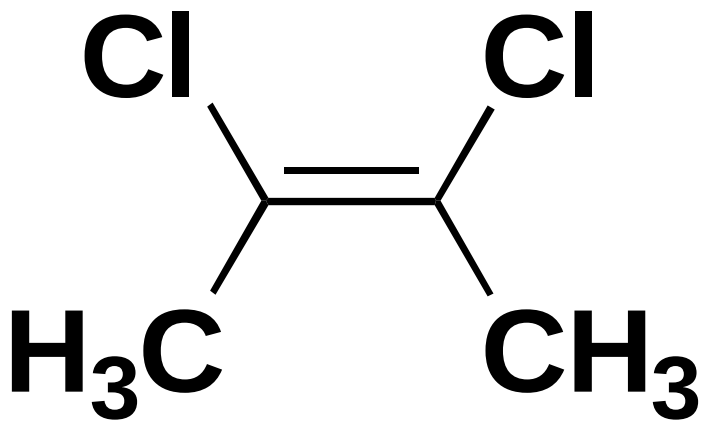
For boiling point, the hydrogen bonding of the alcohol is the most powerful intermolecular force. In this example, the alcohol with the largest molecular weight will have a higher boiling point due to greater dispersion forces. For more examples of this type of problem, see SkillBuilder 1.10.

25. Which of the following has the highest boiling point?

A.



B.

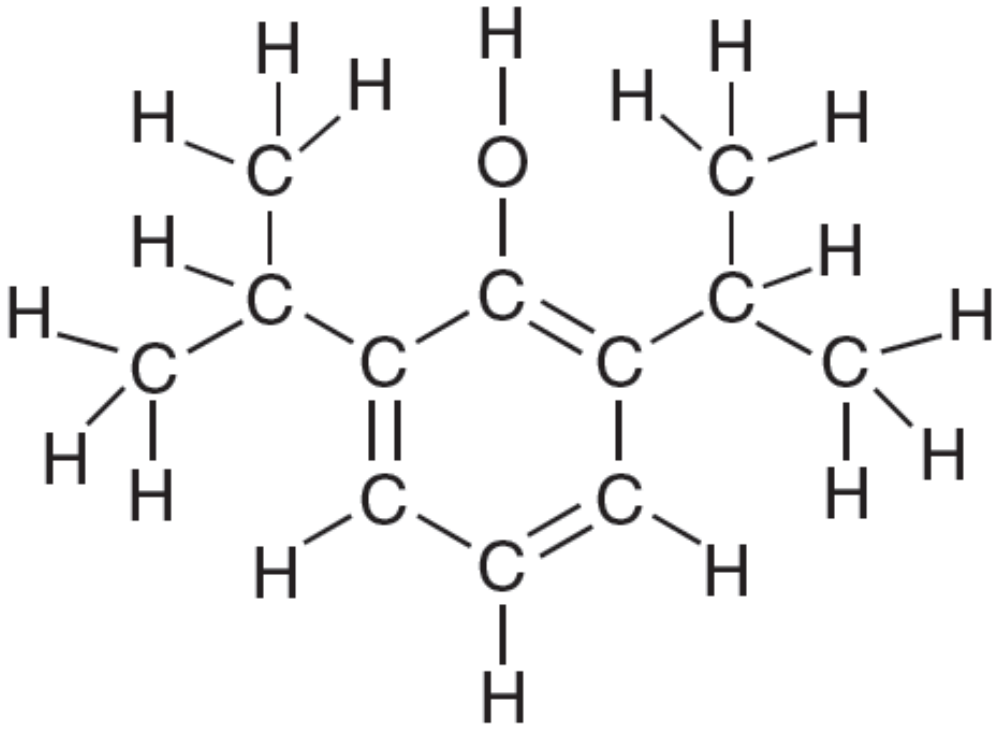


25. Answer: B

These compounds have the same molecular weight but different polarities. The polar compound B will have intermolecular dipole-dipole interactions whereas the nonpolar A compound will only have dispersion forces holding the molecules together. For more examples of this type of problem, see SkillBuilder 1.10.

Section 1.13

26. Which is the best solvent for propofol?



Propofol

a. water

b. carbon tetrachloride, CCl_4

c. olive oil

d. blood

26. Answer: B and C

Notice the molecule has a hydrophobic region much larger than the hydrophilic one (-OH), hence will not be soluble in water, but will be soluble in nonpolar solvents, like Olive oil or CCl_4.