

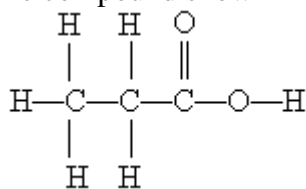
Chapter 9 Tro

1. Bromine tends to form simple ions which have the electronic configuration of a noble gas. What is the electronic configuration of the noble gas which the bromide ion mimics?
  - A)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4p^6$
  - B)  $1s^2 2s^2 2p^6 3s^2 3p^6 4p^6 4d^{10}$
  - C)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^6$
  - D)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6$
  - E)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^6 4d^{10}$
2. Which one of the ions below possesses a noble gas configuration?
  - A)  $\text{Fe}^{3+}$
  - B)  $\text{Sn}^{2+}$
  - C)  $\text{Ni}^{2+}$
  - D)  $\text{Ti}^{4+}$
  - E)  $\text{Cr}^{3+}$
3. The valence electrons in the potassium ions present in potassium nitrate are
  - A) the 2p electrons only
  - B) the 3s electrons only
  - C) the 3s and 3p electrons only
  - D) the 3p electrons only
  - E) there are no valence electrons in the potassium ions in the compound above
4. Which one of the ions below possesses a noble gas configuration?
  - A)  $\text{Fe}^{3+}$
  - B)  $\text{Ni}^{2+}$
  - C)  $\text{Sc}^{3+}$
  - D)  $\text{V}^{3+}$
  - E)  $\text{Cr}^{3+}$
5. The atoms in the oxygen molecule,  $\text{O}_2$ , are held together by
  - A) a single covalent bond
  - B) a double covalent bond
  - C) a triple covalent bond
  - D) an ionic bond
  - E) a magnetic dipole bond

6. Which one of the following bonds is the most polar one of the set?
- A) H—C
  - B) H—N
  - C) H—P
  - D) H—O
  - E) H—Se
7. Draw the Lewis structure for the  $\text{H}_2\text{CO}$  molecule. Based on this structure, the correct number of polar bonds and non-polar bonds is
- A) 3 polar bonds and no non-polar bonds
  - B) 2 polar bonds and 1 non-polar bond
  - C) 1 polar bonds and 2 non-polar bonds
  - D) no polar bonds and 3 non-polar bonds
  - E) 2 polar bonds and 2 non-polar bonds
8. The metaphosphate ion,  $\text{PO}_3^-$ , is the structural analog of the  $\text{NO}_3^-$  ion with respect to the geometric arrangement of the atoms in the ion. After drawing the "best" Lewis structure for the metaphosphate ion based on formal charge considerations, what is the formal charge on the phosphorus atom?
- A) -1
  - B) 0
  - C) +1
  - D) +2
  - E) +5
9. Which one of the elements below has 3 valence electrons in its Lewis symbol?
- A) gallium
  - B) fluorine
  - C) iron
  - D) nickel
  - E) sulfur
10. The atoms in the nitrogen molecule,  $\text{N}_2$ , are held together by
- A) a single covalent bond
  - B) a double covalent bond
  - C) a triple covalent bond
  - D) an ionic bond
  - E) a magnetic dipole bond

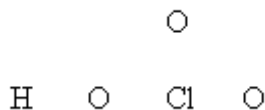
11. The Lewis symbol for the carbon atom shows \_\_\_ valence electrons. The number of bonds which carbon usually forms in order to complete its valence shell and obey the octet rule is \_\_\_
- A) 4, 1  
 B) 4, 2  
 C) 2, 4  
 D) 4, 3  
 E) 4, 4
12. Complete the Lewis structure for  $\text{HClO}_2$  from the skeletal template presented below by filling in the bonds and the remaining valence electrons (those which are not in the bonds). If the valence shells are filled to the *usual* limit, how many of these non-bonding valence electrons are there in the molecule?
- H O Cl O
- A) 14  
 B) 16  
 C) 18  
 D) 20  
 E) 26
13. The structural formula for a certain alcohol can be written in condensed form as  $\text{CH}_2\text{CHCH}_2\text{OH}$   
 How many bonds should there be in this molecule?
- A) 8  
 B) 9  
 C) 10  
 D) 11  
 E) 12
14. The compound shown immediately below is an example of
- $$\begin{array}{ccccccc}
 & \text{H} & \text{H} & \text{O} & & & \\
 & | & | & || & & & \\
 \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{H} & & \\
 & | & | & & & & \\
 & \text{H} & \text{H} & & & & 
 \end{array}$$
- A) an alcohol  
 B) a ketone  
 C) an aldehyde  
 D) an acid  
 E) an amine

15. The compound shown immediately below is an example of



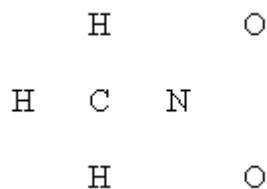
- A) an alcohol
  - B) a ketone
  - C) an aldehyde
  - D) an acid
  - E) an amine
16. Which one of the following bonds is the most polar one of the set?
- A) H—Br
  - B) H—Cl
  - C) H—F
  - D) H—I
  - E) H—N
17. Based on electronegativity considerations, which one of the following listed species should be the strongest oxidizing agent?
- A) Xe
  - B) As
  - C) Br<sub>2</sub>
  - D) I<sub>2</sub>
  - E) Sb
18. The formal charge on the nitrogen atom in the nitrate ion is
- A) -3
  - B) 0
  - C) +1
  - D) +3
  - E) +5

19. Complete the Lewis structure for  $\text{HClO}_3$  from the skeletal template presented below by filling in the bonds and the remaining valence electrons (those which are not in the bonds). If the valence shells are filled to the *usual* limit (maximum of 8), what is the formal charge on the chlorine atom?



- A) -1  
B) 0  
C) +1  
D) +2  
E) +3
20. How many resonance structures, if any, can be drawn for the nitrate ion?  
A) 1 (no resonance)  
B) 2  
C) 3  
D) 4  
E) 5
21. Based on the "best" Lewis structure from formal charge considerations, how many resonance structures, if any, can be drawn for the  $\text{NF}_3$  molecule?  
A) 1 (no resonance)  
B) 2  
C) 3  
D) 4  
E) 5

22. The structural template for the Lewis structure of nitromethane,  $\text{CH}_3\text{NO}_2$ , is shown below. Complete the Lewis structure by filling in the bonds and the remaining valence electrons which are not involved in bonds. Which assertion made about the nitromethane below is true?



Based on the structure of the nitromethane molecule, it should have \_\_\_ resonance hybrids and \_\_\_ atoms with residual formal charges on them.

- A) no, 2  
B) no, 3  
C) 2, 2  
D) 2, 3  
E) 3, 2
23. How many coordinate covalent bonds are there in the product of the reaction between  $\text{F}^-$  and  $\text{BF}_3$  which gives  $\text{BF}_4^-$  as the only product?
- A) 0  
B) 1  
C) 2  
D) 3  
E) 4
24. Draw the Lewis structure for the sulfite ion. When formal charge considerations are fully taken into account and adjustments made, if necessary, how many resonance structures, if any, can be drawn for this ion ( 1 for no resonance ) ? \_\_\_\_
25. There are two covalent bonds in the Lewis structure for calcium chloride. \_\_\_\_
- A) True  
B) False

## Answer Key

1. D
2. D
3. E
4. C
5. B
6. D
7. A
8. B
9. A
10. C
11. E
12. A
13. C
14. C
15. D
16. C
17. C
18. C
19. D
20. C
21. A
22. C
23. B
24. 3
25. B