Practice Problems
Chapters 3, 4, 9, 10

1. An ionic bond is best described as:
   a. the sharing of electrons.
   b. the transfer of electrons from one atom to another.
   c. the attraction that holds the atoms together in a polyatomic ion.
   d. the attraction between 2 nonmetal atoms.
   e. the attraction between 2 metal atoms.

2. The empirical formula was determined to be C₄H₄O, if you know that the molecule has a mass between 130 and 140 g/mol, what is the molecular formula?

3. Which of the following is an atomic element?
   a. Br
   b. H
   c. N
   d. O
   e. Mg

4. Give the name for SnO.

5. Give the structure for sodium chlorate.
   a. NaClO
   b. NaClO₂
   c. NaClO₃
   d. NaClO₄

6. Calculate the molar mass of Al(C₂H₃O₂)₃.

7. How many N₂O₄ molecules are contained in 76.3 g N₂O₄? The molar mass of N₂O₄ is 92.02 g/mol.

8. Give the mass percent of carbon in C₁₄H₁₉NO₂.
   a. 38.89%
   b. 72.07%
   c. 5.17%
   d. 2.78%

9. Determine the empirical formula for a compound that contains C, H and O. It contains 52.14% C and 34.73% O by mass.
   a. C₂H₆O
   b. CHO
   c. C₄H₁₃O₂
   d. CH₄O₃
   e. CH₃O
10. Which of these compounds is most likely to be ionic?
   A. KF
   B. CCl₄
   C. CS₂
   D. CO₂
   E. ICl

11. A nonpolar covalent bond (i.e., pure covalent) would form in which of these pairs of atoms?
   A. Na – Cl
   B. H–Cl
   C. Li–Br
   D. Se–Br
   E. Br–Br

12. Which response includes all the molecules below that do not follow the octet rule?
    (1) H₂S    (2) BCl₃    (3) PH₃    (4) SF₄
    A. (2) and (4)
    B. (2) and (3)
    C. (1) and (2)
    D. (3) and (4)
    E. (1) and (4)

13. Determine the electron geometry (eg) and molecular geometry (mg) of BCl₃.
    A. eg=trigonal planar, mg=trigonal planar
    B. eg=tetrahedral, mg=trigonal planar
    C. eg=tetrahedral, mg=trigonal pyramidal
    D. eg=trigonal planar, mg=bent
    E. eg=trigonal bipyramidal, mg=trigonal bipyramidal

14. Determine the electron geometry (eg) and molecular geometry (mg) of PCl₃⁻.
    A. eg=tetrahedral, mg=bent
    B. eg=tetrahedral, mg=trigonal pyramidal
    C. eg=trigonal bipyramidal, mg=linear
    D. eg=trigonal bipyramidal, mg=trigonal planar
    E. eg=octahedral, mg=linear

15. How many of the following molecules are polar?
BCl$_3$   CH$_3$Cl   SiF$_4$   CO$_2$

A. 1
B. 2
C. 3
D. 4
E. 0

16. Draw the Lewis structure for NO$_2^-$ including any valid resonance structures.

17. What volume of 0.305 M AgNO$_3$ is required to react exactly with 155.0 mL of 0.274 M Na$_2$SO$_4$ solution? Hint: you will want to write a balanced reaction.

18. What precipitate is most likely formed from a solution containing Ba$^{+2}$, Na$^{+1}$, OH$^{-1}$, and CO$_3^{-2}$.  
A) NaOH 
B) BaCO$_3$
C) Na$_2$CO$_3$
D) Ba(OH)$_2$

19. According to the following reaction, what volume of 0.244 M KCl solution is required to react exactly with 50.0 mL of 0.210 M Pb(NO$_3$)$_2$ solution?

\[ 2 \text{ KCl(aq)} + \text{Pb(NO}_3\text{)}_2 \text{(aq)} \rightarrow \text{PbCl}_2(s) + 2 \text{KNO}_3(aq) \]

20. Is it possible for a molecule to be nonpolar even though it contains polar bonds? Explain your answer and give an example.
1. B
2. C₈H₈O₂
3. E
4. tin (II) oxide
5. C
6. 204.13 g/mol
7. 4.99 × 10²³ N₂O₄ molecules
8. B
9. A
10. A
11. E
12. A
13. A
14. B
15. A
16. 3 possible structures
17. 278 mL
18. B
19. 86 mL
20. yes – CF₄