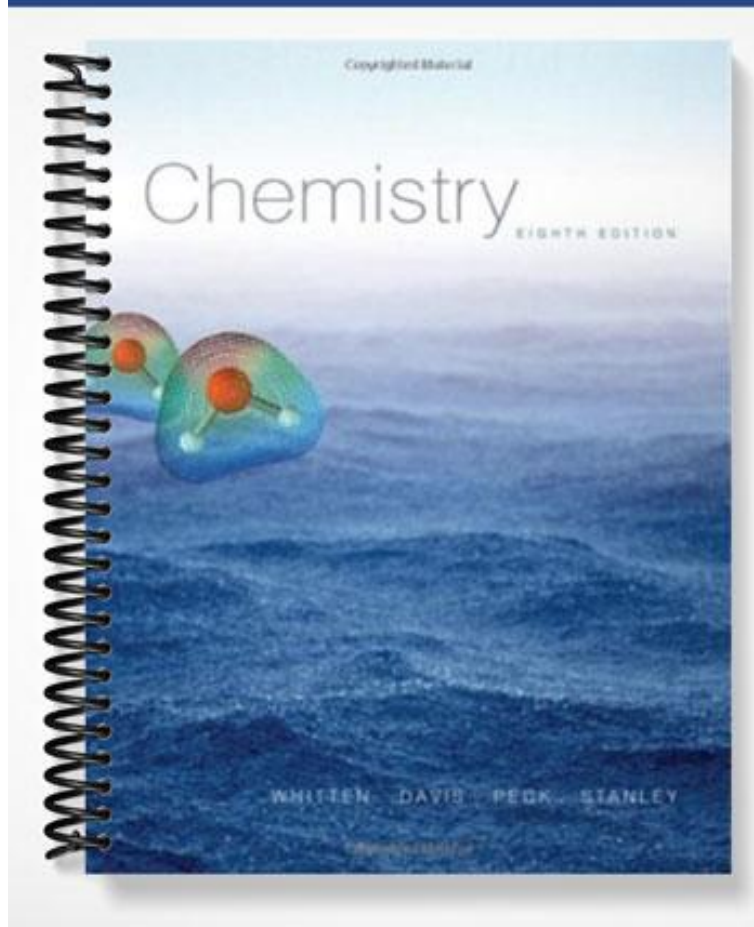


# TEST BANK



## Chapter 2--Chemical Formulas and Composition Stoichiometry

Student: \_\_\_\_\_

1. There are two different common crystalline forms of carbon  $\frac{3}{4}$  diamond and graphite. A less common form called fullerene,  $C_{60}$ , also exists. Different forms of the same element in the same physical state are called:  
  - A. isotopes.
  - B. isomers.
  - C. alloforms.
  - D. allotropes.
  - E. structural formulas.
2. How many atoms are in a sulfuric acid molecule?  
  - A. 1
  - B. 7
  - C. 5
  - D. 6
  - E. 8
3. If a sample of propane,  $C_3H_8$ , contains a total of  $6.0 \times 10^3$  atoms of carbon, how many molecules of propane are in the sample?  
  - A.  $6.0 \times 10^3$
  - B.  $3.0 \times 10^3$
  - C.  $8.0 \times 10^3$
  - D.  $1.1 \times 10^4$
  - E.  $2.0 \times 10^3$
4. Name the molecular compound,  $HNO_3$ .  
  - A. ammonia
  - B. nitric acid
  - C. nitrous acid
  - D. nitric oxide
  - E. methane
5. Name the molecular compound,  $SO_3$ .  
  - A. sulfur oxide
  - B. sulfurous acid
  - C. sulfur trioxide
  - D. sulfuric acid
  - E. none of the above

6. Which formula/name pair do not match?
- $\text{HNO}_3$  / nitric acid, used to produce explosives
  - $\text{CH}_3\text{OH}$  / methyl alcohol, wood alcohol
  - $\text{CH}_3\text{CH}_2\text{OH}$  / ethyl alcohol, alcohol in wine
  - $\text{CH}_3\text{COOH}$  / acetic acid, found in vinegar
  - $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$  / diethyl ether, an anesthetic
7. Name the molecular compound,  $\text{CH}_3\text{COCH}_3$ .
- acetone
  - ethanol
  - diethyl ether
  - propane
  - ethyl alcohol
8. What is the molecular formula for ethanol?
- $\text{CH}_3\text{COOH}$
  - $\text{CH}_3\text{COCH}_3$
  - $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
  - $\text{CH}_3\text{CH}_2\text{COH}$
  - $\text{CH}_3\text{CH}_2\text{OH}$
9. Butane, a highly combustible hydrocarbon found in disposable lighters, has the chemical formula:
- $\text{CO}_2$
  - $\text{C}_4\text{H}_{10}$
  - $\text{C}_4\text{H}_8$
  - $\text{C}_4\text{H}_{10}$
  - $\text{CH}_3\text{OCH}_3$
10. What is the molecular formula for hydrogen chloride?
- $\text{HCl}$
  - $\text{HClO}$
  - $\text{HClO}_2$
  - $\text{HClO}_2$
  - $\text{HClO}_4$
11. A compound contains only calcium and fluorine. A sample of the compound is determined to contain 2.00 g of calcium and 1.90 g of fluorine. According to the Law of Definite Proportions, how much calcium should another sample of this compound contain if it contains 2.85 g of fluorine?
- 2.71 g
  - 4.00 g
  - 3.00 g
  - 4.50 g
  - 6.00 g

12. A compound contains only magnesium and oxygen. A sample of the compound is determined to contain 3.50 g of magnesium and 2.30 g of oxygen. According to the Law of Definite Proportions, how much magnesium should another sample of this compound contain if it contains 6.91 g of oxygen?
- A. 1.16 g
  - B. 10.5 g
  - C. 4.54 g
  - D. 55.5 g
  - E. 0.858 g
13. Which of the following is **not** the name of a cation?
- A. sodium
  - B. iron (III)
  - C. aluminum
  - D. sulfide
  - E. ammonium
14. Which of the following statements is **incorrect**?
- A. A molecule of potassium chloride, KCl, consists of one  $\text{K}^+$  ion and one  $\text{Cl}^-$  ion.
  - B. Ions that possess a positive charge are called cations.
  - C. Polyatomic ions are groups of atoms that have an electric charge.
  - D. It is acceptable to use formula unit to refer to either an ionic compound or a molecular compound.
  - E. Ions that possess a negative charge are called anions.
15. What is the correct classification for  $\text{SCN}^-$ ?
- A. polyatomic molecule
  - B. monatomic cation
  - C. polyatomic cation
  - D. polyatomic anion
  - E. monatomic anion
16. What is the correct formula for the carbonate ion?
- A.  $\text{CH}_3\text{COO}^-$
  - B.  $\text{Cl}^{3-}$
  - C.  $\text{CO}^{2-}$
  - D.  $\text{CO}^{22-}$
  - E.  $(\text{CO}_3^-)_2$

17. Each response below lists an ion by name and by chemical symbol or formula. Also each ion is classified as monatomic or polyatomic and as a cation or anion. Which response contains an **error**?

A. hydroxide	$\text{OH}^-$	monatomic	anion
B. carbonate	$\text{CO}_3^{2-}$	polyatomic	anion
C. ammonium	$\text{NH}_4^+$	polyatomic	cation
D. magnesium	$\text{Mg}^{2+}$	monatomic	cation
E. sulfite	$\text{SO}_3^{2-}$	polyatomic	anion

18. Each response below lists an ion by name and by chemical symbol or formula. Also each ion is classified as monatomic or polyatomic and as a cation or anion. Which response contains an **error**?

A. phosphate	$\text{PO}_4^{3-}$	polyatomic	anion
B. sulfite	$\text{SO}_4^{2-}$	polyatomic	anion
C. nitrite	$\text{NO}_3^-$	polyatomic	anion
D. iron(II)	$\text{Fe}^{2+}$	monatomic	cation
E. bromide	$\text{Br}^-$	monatomic	anion

19. What is the formula for aluminum fluoride?

- A.  $\text{AlF}$
- B.  $\text{Al F}$
- C.  $\text{Al}^2\text{F}^3$
- D.  $\text{Al}^3\text{F}$
- E.  $\text{AlF}_3$

20. What is the formula for manganese(III) oxide?

- A.  $\text{MgO}$
- B.  $\text{MnO}$
- C.  $\text{MnO}$
- D.  $\text{Mg}_2\text{O}_4$
- E.  $\text{Mn}_2\text{O}_3$

21. What is the formula for aluminum oxide?

- A.  $\text{Al}_2\text{O}_3$
- B.  $\text{Al}_2\text{O}_3$
- C.  $\text{AlO}_3$
- D.  $\text{AlO}^3$
- E.  $\text{AlO}_2$

22. What is the name of  $\text{Fe}(\text{OH})_3$ ?

- A. iron hydroxide
- B. iron trihydroxide
- C. iron (III) hydroxide
- D. iron (II) hydroxide
- E. none of these

23. What is the formula for copper(II) nitrate?

- A.  $\text{CuNO}$
- B.  $\text{Cu}_2\text{NO}_3$
- C.  $\text{CuNO}_3$
- D.  $\text{Cu}_2\text{NO}_2$
- E.  $\text{Cu}(\text{NO}_3)_2$

24. Choose the name-formula pair that does not correctly match.

- |                        |                           |
|------------------------|---------------------------|
| A. aluminum phosphate  | $\text{AlPO}$             |
| B. calcium acetate     | $\text{CaCH}_3\text{COO}$ |
| C. ammonium sulfide    | $(\text{NH}_4)_3\text{S}$ |
| D. magnesium hydroxide | $\text{Mg}(\text{OH})_2$  |
| E. zinc carbonate      | $\text{ZnCO}_3$           |

25. From the following ionic compounds, choose the name-formula pair that is not correctly matched.

- |                     |                          |
|---------------------|--------------------------|
| A. sodium sulfide   | $\text{Na}_2\text{S}$    |
| B. ammonium nitrate | $\text{NH}_4\text{NO}_3$ |
| C. zinc hydroxide   | $\text{Zn}(\text{OH})_2$ |
| D. sodium sulfate   | $\text{Na}_2\text{SO}_3$ |
| E. calcium oxide    | $\text{CaO}$             |

26. From the following compounds choose the name-formula pair that is incorrectly matched.

- |                         |                          |
|-------------------------|--------------------------|
| A. sodium sulfite       | $\text{Na}_2\text{SO}_3$ |
| B. ammonium fluoride    | $\text{NH}_4\text{F}$    |
| C. copper(II) carbonate | $\text{CuCO}_3$          |
| D. ferric chloride      | $\text{FeCl}_3$          |
| E. cuprous sulfide      | $\text{Co}_2\text{S}_3$  |

27. Which element has a mass that is 7.30 times that of carbon-12?

- A. Mg
- B. Sr
- C. Ca
- D. Br
- E. Rb

28. Which element has a mass approximately 32 times that of a H atom?

- A. C
- B. S
- C. Mo
- D. Cu
- E. Ar

29. The molecular formula for a compound is  $CX_4$ . If 2.819 g of this compound contains 0.102 g of carbon, what is the atomic weight of X?
- A. 320
  - B. 160
  - C. 35.5
  - D. 79.9
  - E. 39.9
30. How many atoms are in 1.00 mole of water?
- A.  $6.02 \times 10^{23}$
  - B.  $1.20 \times 10^{24}$
  - C.  $1.81 \times 10^{24}$
  - D.  $2.41 \times 10^{24}$
  - E.  $3.01 \times 10^{23}$
31. Calculate the number of moles of oxygen atoms in 35.2 grams of oxygen.
- A. 2.20 moles
  - B. 4.42 moles
  - C. 0.54 moles
  - D. 2.57 moles
  - E. 1.13 moles
32. How many grams are contained in 0.644 mol oxygen?
- A. 10.3 g
  - B. 20.6 g
  - C. 0.0201 g
  - D. 0.0403 g
  - E. 0.644 g
33. Calculate the mass of one bromine atom.
- A.  $2.654 \times 10^{-22}$  g
  - B.  $6.022 \times 10^{23}$  g
  - C.  $1.661 \times 10^{-24}$  g
  - D.  $4.812 \times 10^{25}$  g
  - E.  $1.327 \times 10^{-22}$  g
34. Determine the number of sulfur atoms in 27.1 g of molecular sulfur ( $S_8$ ).
- A. 0.845
  - B.  $5.27 \times 10^{23}$
  - C.  $5.09 \times 10^{23}$
  - D.  $2.07 \times 10^{23}$
  - E. 0.106

35. Calculate the formula weight of  $\text{Na}_2\text{SO}_4$ .
- A. 193 amu
  - B. 119 amu
  - C. 142 amu
  - D. 215 amu
  - E. 185 amu
36. Determine the formula weight of  $\text{Ca}_3(\text{PO}_4)_2$ .
- A. 230 amu
  - B. 279 amu
  - C. 215 amu
  - D. 310 amu
  - E. 135 amu
37. What is the mass of  $2.2 \times 10^9$   $\text{CO}_2$  molecules?
- A.  $9.7 \times 10^{10}$  g
  - B.  $1.0 \times 10^{-12}$  g
  - C.  $1.2 \times 10^6$  g
  - D.  $4.4 \times 10^{-14}$  g
  - E.  $1.6 \times 10^{-13}$  g
38. What is the mass of 0.432 moles of  $\text{C}_8\text{H}_9\text{O}_4$ ?
- A. 86.9 g
  - B. 391 g
  - C. 169 g
  - D. 113.8 g
  - E. 73.0 g
39. How many grams of  $\text{CaCl}_2$  equal 4.26 moles of  $\text{CaCl}_2$ ?
- A. 26.1 g
  - B. 170 g
  - C. 302 g
  - D. 473 g
  - E. 322 g
40. How many moles of  $\text{POCl}_3$  are there in 10.0 grams of  $\text{POCl}_3$ ?
- A.  $6.51 \times 10^{-2}$  mol
  - B.  $3.68 \times 10^{-1}$  mol
  - C.  $4.09 \times 10^{-2}$  mol
  - D.  $1.21 \times 10^{-1}$  mol
  - E.  $1.17 \times 10^{-3}$  mol



41. How many moles  $\text{CCl}_4$  are present in 118. g of carbon tetrachloride?
- 0.839
  - 1.19
  - 0.538
  - 1.30
  - 0.767
42. How many molecules are contained in 5.00 grams of  $\text{NH}_3$ ?
- $5.42 \times 10^{22}$
  - $3.00 \times 10^{24}$
  - $3.40 \times 10^{22}$
  - $1.77 \times 10^{23}$
  - $9.45 \times 10^{22}$
43. A 12.0-gram sample of  $\text{Cr}_2(\text{SO}_4)_3$  contains how many sulfur atoms?
- $1.84 \times 10^{22}$
  - $1.53 \times 10^{21}$
  - $4.82 \times 10^{21}$
  - $6.67 \times 10^{22}$
  - $5.52 \times 10^{22}$
44. How many atoms of carbon are present in 34.5 g of caffeine,  $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$ ?
- $8.57 \times 10^{23}$
  - $2.68 \times 10^{25}$
  - $1.08 \times 10^{24}$
  - $2.09 \times 10^{23}$
  - $4.83 \times 10^{23}$
45. What is the mass in grams of  $5.00 \times 10^{12}$  water molecules?
- $1.50 \times 10^{-10}$  g
  - $1.67 \times 10^{35}$  g
  - $2.17 \times 10^{12}$  g
  - $6.69 \times 10^9$  g
  - $4.61 \times 10^{-13}$  g
46. Which of the following is **not** a correct description of 16.0 grams of methane,  $\text{CH}_4$ ?
- It is one mole of methane.
  - It is the amount of methane that contains 12.0 g of carbon.
  - It is  $16.0 \times 6.02 \times 10^{23}$  molecules of methane.
  - It is the amount of methane that contains 4.0 grams of hydrogen.
  - It is the amount of methane that contains  $4 \times 6.02 \times 10^{23}$  hydrogen atoms.

47. A sample of ethane,  $\text{C}_2\text{H}_6$ , contains a total of  $16N$  atoms, where  $N = 6.02 \times 10^{23}$ . How much  $\text{C}_2\text{H}_6$  is in the sample?
- 2.0 g
  - 30 g
  - 60 g
  - 16 mol
  - 4 mol
48. Suppose you have a 100-gram sample of each of the following compounds. Which sample contains the smallest number of moles of compound?
- $\text{NH}_3$
  - $\text{MgCl}_2$
  - $\text{H}_3\text{PO}_4$
  - $\text{CrCl}_3$
  - $\text{NaCl}$
49. A mole of a compound composed of nitrogen and oxygen ( $\text{N}_x\text{O}_y$ ) has a molecular weight of 92.0 g/mol. What is its formula?
- NO
  - $\text{N}_2\text{O}$
  - $\text{NO}_2$
  - $\text{N}_2\text{O}_3$
  - $\text{NO}_2$
50. What is the percent by mass of sulfur in  $\text{Al}_2(\text{SO}_4)_3$ ?
- 9.38%
  - 18.8%
  - 24.6%
  - 28.1%
  - 35.4%
51. Calculate the percent by mass of nitrogen in ammonium carbonate,  $(\text{NH}_4)_2\text{CO}_3$ .
- 14.5%
  - 27.8%
  - 29.2%
  - 33.3%
  - 17.1%

52. Calculate the percent composition of  $K_2CO_3$ .

- |                |             |             |
|----------------|-------------|-------------|
| A. % K = 58.2% | % C = 17.9% | % O = 23.9% |
| B. % K = 28.2% | % C = 8.8%  | % O = 35.9% |
| C. % K = 56.6% | % C = 8.7%  | % O = 34.7% |
| D. % K = 39.4% | % C = 12.0% | % O = 48.4% |
| E. % K = 35.1% | % C = 21.6% | % O = 43.2% |

53. What is the percentage of carbon in potassium hydrogen phthalate,  $KC_6H_4(COO)(COOH)$ ?

- A. 35.2%
- B. 58.2%
- C. 47.1%
- D. 70.6%
- E. 19.2%

54. Analysis of a sample of a covalent compound showed that it contained 14.4% hydrogen and 85.6% carbon by mass. What is the empirical formula for this compound?

- A. CH
- B.  $CH_2$
- C.  $CH_3$
- D.  $C_2H_3$
- E.  $C_2H_5$

55. What is the empirical formula for a compound containing 68.3% lead, 10.6% sulfur and the remainder oxygen?

- A.  $PbSO_2$
- B.  $PbSO_3$
- C.  $PbS_2O_3$
- D.  $PbSO_4$
- E.  $Pb_2SO_4$

56. A compound contains sulfur, oxygen, and chlorine. Analysis shows that it contains by mass 26.95% sulfur and 59.61% chlorine. What is the simplest formula for this compound?

- A. SOCl
- B.  $SOCl_2$
- C.  $SO_2Cl$
- D.  $SO_2Cl_2$
- E.  $S_2OCl_2$

57. A compound contains carbon, oxygen, and hydrogen. Analysis of a sample showed that it contained by mass 68.9% carbon and 4.92% hydrogen. What is the simplest formula for this compound?
- $\text{C}_6\text{H}_6\text{O}_2$
  - $\text{C}_7\text{H}_6\text{O}_2$
  - $\text{C}_8\text{H}_6\text{O}_2$
  - $\text{C}_6\text{H}_4\text{O}_3$
  - $\text{C}_7\text{H}_8\text{O}_3$
58. A sample of a compound containing nitrogen, hydrogen, and oxygen is found to contain 22.2% nitrogen and 1.59% hydrogen. What is the simplest formula for this compound?
- $\text{HNO}$
  - $\text{H}_2\text{N}_2\text{O}_3$
  - $\text{H}_2\text{NO}_3$
  - $\text{HNO}_3$
  - $\text{HNO}_2$
59. A 4.628-g sample of an oxide of iron was found to contain 3.348 g of iron and 1.280 g of oxygen. What is simplest formula for this compound?
- $\text{FeO}$
  - $\text{Fe}_2\text{O}_3$
  - $\text{Fe}_2\text{O}_3$
  - $\text{Fe}_3\text{O}_4$
  - $\text{Fe}_3\text{O}_2$
60. A 2.086-g sample of a compound contains 0.884 g of cobalt, 0.482 g of sulfur, and 0.720 g of oxygen. What is its simplest formula?
- $\text{CoSO}_3$
  - $\text{CoSO}_3$
  - $\text{Co}(\text{SO}_4)_2$
  - $\text{Co}(\text{SO}_3)_2$
  - $\text{Co}_3(\text{SO}_4)_4$
61. What is the simplest formula for Chalcocite if a sample of this ore contains 8.274 g copper and 2.088 g sulfur?
- $\text{CuS}$
  - $\text{CuS}_3$
  - $\text{CuS}_2$
  - $\text{Cu}_2\text{S}_3$
  - $\text{Cu}_2\text{S}_3$

62. Determine the simplest formula for a hydrocarbon if the complete combustion of a sample produces 5.28 g of  $\text{CO}_2$  and 1.62 g of  $\text{H}_2\text{O}$ .
- $\text{C}_2\text{H}_3$
  - $\text{CH}_2$
  - $\text{CH}_2$
  - $\text{CH}_3$
  - $\text{C}_2\text{H}_5$
63. Determine the simplest formula for a hydrocarbon if the complete combustion of a sample produces 3.96 g of  $\text{CO}_2$  and 2.16 g of  $\text{H}_2\text{O}$ .
- $\text{C}_2\text{H}_3$
  - $\text{C}_2\text{H}_3$
  - $\text{CH}_3$
  - $\text{CH}_3$
  - $\text{C}_2\text{H}_5$
64. A compound is known to contain only carbon, hydrogen, and oxygen. If the complete combustion of a 0.150-g sample of this compound produces 0.225 g of  $\text{CO}_2$  and 0.0614 g of  $\text{H}_2\text{O}$ , what is the empirical formula of this compound?
- $\text{C}_3\text{H}_4\text{O}$
  - $\text{CH}_3\text{O}$
  - $\text{C}_3\text{H}_4\text{O}$
  - $\text{C}_3\text{H}_3\text{O}_3$
  - $\text{C}_3\text{H}_4\text{O}_3$
65. Glucose has a molecular weight of 180.2 g and an empirical formula  $\text{CH}_2\text{O}$ . What is its molecular formula?
- $\text{C}_6\text{H}_{12}\text{O}_6$
  - $\text{C}_8\text{H}_{16}\text{O}_8$
  - $\text{C}_6\text{H}_{12}\text{O}_6$
  - $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
  - $\text{CH}_2\text{O}$
66. A compound contains, by mass, 87.5% nitrogen and 12.5% hydrogen. Its molecular weight is found to be 32 g/mol. What is its molecular formula?
- $\text{N}_2\text{H}_6$
  - $\text{N}_2\text{H}_6$
  - $\text{N}_2\text{H}_4$
  - $\text{NH}_3$
  - $\text{NH}_3$

67. A compound contains only carbon, hydrogen, and oxygen. Analysis of a sample showed that it contained 54.53% C and 9.15% H. Its molecular weight was determined to be approximately 88 g/mol. What is its molecular formula?
- $\text{C}_4\text{H}_8\text{O}_2$
  - $\text{C}_4\text{H}_8\text{O}$
  - $\text{C}_4\text{H}_8\text{O}_2$
  - $\text{C}_4\text{H}_8\text{O}_2$
  - $\text{C}_4\text{H}_{12}\text{O}_2$
68. Butyric acid, found in rancid butter, has a molar mass of 88 g/mol. If butyric acid is 54.5% C, 9.09% H and 36.4% O, what is the molecular formula?
- $\text{C}_4\text{H}_8\text{O}_2$
  - $\text{C}_4\text{H}_8\text{O}_2$
  - $\text{C}_8\text{H}_{12}\text{O}_4$
  - $\text{C}_2\text{H}_4\text{O}$
  - $\text{CHO}_2$
69. A compound contains, by mass, 26.7% carbon, 71.1% oxygen and the remainder hydrogen. A 0.23 mole sample of this compound weighs 20.7 g. What is the molecular formula of this compound?
- $\text{C}_3\text{H}_6\text{O}_2$
  - $\text{C}_3\text{H}_6\text{O}_2$
  - $\text{C}_2\text{H}_2\text{O}_4$
  - $\text{CHO}_2$
  - $\text{C}_3\text{OH}$
70. The complete combustion of a 0.2864-g sample of a compound yielded 0.420 g of  $\text{CO}_2$  and 0.172 g of  $\text{H}_2\text{O}$ . The molecular weight was determined to be approximately 60 g/mol. What is the molecular formula of this compound if it contains only carbon, hydrogen, and oxygen?
- $\text{C}_2\text{H}_4\text{O}_2$
  - $\text{CH}_2\text{O}$
  - $\text{CH}_2\text{O}$
  - $\text{C}_2\text{H}_4\text{O}_2$
  - $\text{C}_3\text{H}_6\text{O}_3$
71. Which of the following sets illustrates the Law of Multiple Proportions?
- $\text{Li}_2\text{O}$ ,  $\text{Na}_2\text{O}$ ,  $\text{K}_2\text{O}$
  - $\text{KCl}$ ,  $\text{CaCl}_2$ ,  $\text{ScCl}_3$
  - $^1_1\text{H}$ ,  $^2_1\text{H}$ ,  $^3_1\text{H}$
  - $\text{O}$ ,  $\text{O}_2$ ,  $\text{O}_3$
  - $\text{BrF}$ ,  $\text{BrF}_3$ ,  $\text{BrF}_5$

72. What is the ratio of the masses of oxygen that combine with 1.00 gram of lead in the compounds  $\text{PbO}$ ,  $\text{PbO}_2$ , and  $\text{Pb}_2\text{O}_3$ ?
- A. 1:2:2
  - B. 1:2:1
  - C. 2:4:4
  - D. 6:12:8
  - E. 2:4:3
73. What mass of iron is contained in 86.6 grams of chalcopyrite,  $\text{CuFeS}_2$ ?
- A. 26.3 g
  - B. 30.4 g
  - C. 55.8 g
  - D. 28.5 g
  - E. 11.8 g
74. What mass of tungsten is present in 10.0 lbs of wolframite,  $\text{FeWO}_4$ ?
- A. 2.21 kg
  - B. 2.75 kg
  - C. 5.06 lb
  - D. 0.716 kg
  - E. 5.85 lb
75. What mass of cerussite,  $\text{PbCO}_3$ , would contain 25.0 grams of lead?
- A. 19.4 g
  - B. 32.2 g
  - C. 29.3 g
  - D. 25.4 g
  - E. 36.9 g
76. What mass of hematite,  $\text{Fe}_2\text{O}_3$ , would contain 24.0 kg of iron?
- A. 34.3 kg
  - B. 68.3 kg
  - C. 44.7 kg
  - D. 30.5 kg
  - E. 41.4 kg
77. What mass of fluoristan,  $\text{SnF}_2$ , would contain the same mass of tin as 306 grams of cassiterite,  $\text{SnO}_2$ ?
- A. 295 g
  - B. 318 g
  - C. 278 g
  - D. 367 g
  - E. 335 g

78. What mass of  $\text{FeCl}_3$  would contain the same **total** number of ions as 16.8 g of  $\text{Al}_2(\text{SO}_4)_3$ ?
- 7.96 g
  - 9.95 g
  - 10.8 g
  - 13.3 g
  - 8.01 g
79. Heating  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  at  $150^\circ\text{C}$  produces  $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$ . If heating 24.4 g of pure  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  at  $150^\circ\text{C}$  were to give 13.7 g of pure  $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$ , calculate the value for x.
- 5
  - 4
  - 3
  - 2
  - 1
80. An ore of lead is 45.0% pure lead sulfide,  $\text{PbS}$ , and 55.0% impurities in which no other lead compounds are present. What mass of lead is contained in 150.0 grams of this ore?
- 71.4 g
  - 67.5 g
  - 58.5 g
  - 9.05 g
  - 18.0 g
81. A chemical bottle containing  $\text{BaSO}_4$  is 98.7% pure. What mass of Ba is present in 162 g of this chemical?
- 47.1 g
  - 96.6 g
  - 94.1 g
  - 98.7 g
  - 95.3 g
82. What mass of calcium metal could be obtained from one kg of limestone that is 50.0% pure  $\text{CaCO}_3$ ? (No other calcium-containing compounds are present.)
- 0.05 kg
  - 0.2 kg
  - 0.4 kg
  - 0.5 kg
  - 0.1 kg



83. A dolomite ore contains 40.0% pure  $\text{MgCO}_3 \cdot \text{CaCO}_3$ . No other compounds of magnesium or calcium are present in the ore. What mass of magnesium and what mass calcium are contained in 100.0 grams of this ore?
- 18.3 g Mg - 21.7 g Ca
  - 7.91 g Mg - 13.0 g Ca
  - 8.70 g Mg - 31.3 g Ca
  - 5.27 g Mg - 8.69 g Ca
  - 34.5 g Mg - 5.30 g Ca
84. A sample of lead ore has a density of 8.80 g/mL. It is composed of two lead compounds: lead oxide,  $\text{PbO}$  (density 9.10 g/mL) and lead selenide,  $\text{PbS}$  (density 8.10 g/mL). What is the percent of the ore is lead oxide?
- 96.7 %
  - 89.0 %
  - 70.0 %
  - 92.0 %
  - 86.3 %
85. How do **nonmetals** form **negative** ions?
- by losing one or more electrons
  - by sharing electrons
  - by gaining one or more protons
  - by gaining one or more electrons
86. Which one of the following formulas represents a **polyatomic ion**?
- $\text{NO}_2$
  - $\text{RbNO}_2$
  - $\text{Rb}^+{}_2$
  - $\text{NO}_3^-$
87. What is the formula for the ionic compound formed by **calcium** and **bromine**?
- $\text{CaBr}$
  - $\text{Ca}_2\text{Br}$
  - $\text{CaBr}_2$
  - $\text{Ca}_3\text{Br}_2$
88. What is the name for  $\text{MgSe}$ ?
- magnesium selenate
  - selenium magneside
  - talc
  - magnesium selenide

89. Locate neon, **Ne**, on a periodic table. What is the **atomic weight** of neon?
- 10
  - 10.18
  - 18
  - 20.18
90. How many atoms are there in **43.2 g** of boron, **B**? (atomic weight = 10.81)
- $1.51 \times 10^{23}$  atoms
  - $6.64 \times 10^{-24}$  atoms
  - 4.00 atoms
  - $2.41 \times 10^{24}$  atoms
91. How many molecules are there in **50.0 g** of selenium disulfide, **SeS<sub>2</sub>**? (atomic weights: Se = 78.96, S = 32.06)
- 0.349 molecules
  - $2.10 \times 10^{25}$  molecules
  - $2.71 \times 10^{23}$  molecules
  - 2.86 molecules
92. Calculate the **percentage** of nitrogen, **N**, in dinitrogen trioxide, **N<sub>2</sub>O<sub>3</sub>**.
- 40%
  - 36.8%
  - 18.4%
  - 46.7%
93. A compound is found on analysis to contain **7.8 grams** of carbon, **C**, and **2.3 grams** of hydrogen, **H**. What is the **empirical formula**? (atomic weights: C = 12.01, H = 1.008)
- C<sub>2</sub>H<sub>7</sub>
  - CH<sub>3</sub>
  - C<sub>2</sub>H<sub>3</sub>
  - C<sub>10</sub>H<sub>3</sub>
94. The **empirical formula** of a compound is **CHBr** and its **molecular weight** is **185**. What is its **molecular formula**? (atomic weights: C = 12.01, H = 1.008, Br = 79.90)
- CH<sub>2</sub>Br
  - C<sub>2</sub>H<sub>2</sub>Br<sub>2</sub>
  - C<sub>2</sub>H<sub>2</sub>Br<sub>2</sub>
  - C<sub>3</sub>H<sub>3</sub>Br<sub>3</sub>

95. Discuss the accuracy of this statement: All matter in the universe is made of only three particles.
96. Why isn't it correct to refer to a molecule of aluminum chloride?
97. Would atomic weights of elements be different if another standard was chosen to represent the atomic mass unit (amu)? Would their relative masses change?

98. Explain how it is possible for many different compounds to have the same empirical formula.
99. Why is the purity of a chemical listed on the label? Are there any situations where purity is not very important?

## Chapter 2--Chemical Formulas and Composition Stoichiometry

### Key

- There are two different common crystalline forms of carbon  $\frac{3}{4}$  diamond and graphite. A less common form called fullerene,  $C_{60}$ , also exists. Different forms of the same element in the same physical state are called:  
A. isotopes.  
B. isomers.  
C. alloforms.  
**D. allotropes.**  
E. structural formulas.
- How many atoms are in a sulfuric acid molecule?  
A. 1  
**B. 7**  
C. 5  
D. 6  
E. 8
- If a sample of propane,  $C_3H_8$ , contains a total of  $6.0 \times 10^3$  atoms of carbon, how many molecules of propane are in the sample?  
A.  $6.0 \times 10^3$   
B.  $3.0 \times 10^3$   
C.  $8.0 \times 10^3$   
D.  $1.1 \times 10^4$   
**E.  $2.0 \times 10^3$**
- Name the molecular compound,  $HNO_3$ .  
A. ammonia  
**B. nitric acid**  
C. nitrous acid  
D. nitric oxide  
E. methane
- Name the molecular compound,  $SO_3$ .  
A. sulfur oxide  
B. sulfurous acid  
**C. sulfur trioxide**  
D. sulfuric acid  
E. none of the above

6. Which formula/name pair do not match?
- $\text{HNO}_3$  / nitric acid, used to produce explosives
  - $\text{CH}_3\text{OH}$  / methyl alcohol, wood alcohol
  - $\text{CH}_3\text{CH}_2\text{OH}$  / ethyl alcohol, alcohol in wine
  - $\text{CH}_3\text{COOH}$  / acetic acid, found in vinegar
  - $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$  / diethyl ether, an anesthetic
7. Name the molecular compound,  $\text{CH}_3\text{COCH}_3$ .
- acetone
  - ethanol
  - diethyl ether
  - propane
  - ethyl alcohol
8. What is the molecular formula for ethanol?
- $\text{CH}_3\text{COOH}$
  - $\text{CH}_3\text{COCH}_3$
  - $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
  - $\text{CH}_3\text{CH}_2\text{COH}$
  - $\text{CH}_3\text{CH}_2\text{OH}$
9. Butane, a highly combustible hydrocarbon found in disposable lighters, has the chemical formula:
- $\text{CO}_2$
  - $\text{C}_2\text{H}_6$
  - $\text{C}_4\text{H}_{10}$
  - $\text{C}_4\text{H}_8$
  - $\text{CH}_3\text{OCH}_3$
10. What is the molecular formula for hydrogen chloride?
- $\text{HCl}$
  - $\text{HClO}$
  - $\text{HClO}_2$
  - $\text{HClO}_3$
  - $\text{HClO}_4$
11. A compound contains only calcium and fluorine. A sample of the compound is determined to contain 2.00 g of calcium and 1.90 g of fluorine. According to the Law of Definite Proportions, how much calcium should another sample of this compound contain if it contains 2.85 g of fluorine?
- 2.71 g
  - 4.00 g
  - 3.00 g
  - 4.50 g
  - 6.00 g

12. A compound contains only magnesium and oxygen. A sample of the compound is determined to contain 3.50 g of magnesium and 2.30 g of oxygen. According to the Law of Definite Proportions, how much magnesium should another sample of this compound contain if it contains 6.91 g of oxygen?
- A. 1.16 g  
**B. 10.5 g**  
C. 4.54 g  
D. 55.5 g  
E. 0.858 g
13. Which of the following is **not** the name of a cation?
- A. sodium  
B. iron (III)  
C. aluminum  
**D. sulfide**  
E. ammonium
14. Which of the following statements is **incorrect**?
- A.** A molecule of potassium chloride, KCl, consists of one  $K^+$  ion and one  $Cl^-$  ion.  
B. Ions that possess a positive charge are called cations.  
C. Polyatomic ions are groups of atoms that have an electric charge.  
D. It is acceptable to use formula unit to refer to either an ionic compound or a molecular compound.  
E. Ions that possess a negative charge are called anions.
15. What is the correct classification for  $SCN^-$ ?
- A. polyatomic molecule  
B. monatomic cation  
C. polyatomic cation  
**D. polyatomic anion**  
E. monatomic anion
16. What is the correct formula for the carbonate ion?
- A.  $CH_3COO^-$   
B.  $Cl^-3$   
C.  $CO_2^-$   
**D.  $CO_3^{2-}$**   
E.  $(COO^-)_2$

17. Each response below lists an ion by name and by chemical symbol or formula. Also each ion is classified as monatomic or polyatomic and as a cation or anion. Which response contains an **error**?
- |                     |                    |            |        |
|---------------------|--------------------|------------|--------|
| <u>A.</u> hydroxide | $\text{OH}^-$      | monatomic  | anion  |
| B. carbonate        | $\text{CO}_3^{2-}$ | polyatomic | anion  |
| C. ammonium         | $\text{NH}_4^+$    | polyatomic | cation |
| D. magnesium        | $\text{Mg}^{2+}$   | monatomic  | cation |
| E. sulfite          | $\text{SO}_3^{2-}$ | polyatomic | anion  |
18. Each response below lists an ion by name and by chemical symbol or formula. Also each ion is classified as monatomic or polyatomic and as a cation or anion. Which response contains an **error**?
- |                   |                    |            |        |
|-------------------|--------------------|------------|--------|
| A. phosphate      | $\text{PO}_4^{3-}$ | polyatomic | anion  |
| B. sulfite        | $\text{SO}_4^{2-}$ | polyatomic | anion  |
| <u>C.</u> nitrite | $\text{NO}_3^{3-}$ | polyatomic | anion  |
| D. iron(II)       | $\text{Fe}^{2+}$   | monatomic  | cation |
| E. bromide        | $\text{Br}^-$      | monatomic  | anion  |
19. What is the formula for aluminum fluoride?
- A.  $\text{AlF}$   
 B.  $\text{Al}_2\text{F}$   
 C.  $\text{Al}^{2+}\text{F}^{3-}$   
 D.  $\text{Al}_3\text{F}_2$   
E.  $\text{AlF}_3$
20. What is the formula for manganese(III) oxide?
- A.  $\text{MgO}$   
 B.  $\text{MnO}$   
 C.  $\text{MnO}_4$   
 D.  $\text{Mg}_2\text{O}_3$   
E.  $\text{Mn}_2\text{O}_3$
21. What is the formula for aluminum oxide?
- A.  $\text{Al}_2\text{O}_3$   
 B.  $\text{Ag}_2\text{O}_3$   
 C.  $\text{AlO}_3$   
 D.  $\text{AlO}^3$   
 E.  $\text{AlO}_2$
22. What is the name of  $\text{Fe}(\text{OH})_3$ ?
- A. iron hydroxide  
 B. iron trihydroxide  
C. iron (III) hydroxide  
 D. iron (II) hydroxide  
 E. none of these



23. What is the formula for copper(II) nitrate?
- $\text{CuNO}$
  - $\text{Cu}_2\text{NO}_3$
  - $\text{CuNO}_3$
  - $\text{Cu}_2\text{NO}_2$
  - E.**  $\text{Cu}(\text{NO}_3)_2$
24. Choose the name-formula pair that does not correctly match.
- |                                  |                           |
|----------------------------------|---------------------------|
| A. aluminum phosphate            | $\text{AlPO}$             |
| <b><u>B.</u></b> calcium acetate | $\text{CaCH}_3\text{COO}$ |
| C. ammonium sulfide              | $(\text{NH}_4)_3\text{S}$ |
| D. magnesium hydroxide           | $\text{Mg}(\text{OH})_2$  |
| E. zinc carbonate                | $\text{ZnCO}_3$           |
25. From the following ionic compounds, choose the name-formula pair that is not correctly matched.
- |                                 |                          |
|---------------------------------|--------------------------|
| A. sodium sulfide               | $\text{Na}_2\text{S}$    |
| B. ammonium nitrate             | $\text{NH}_4\text{NO}_3$ |
| C. zinc hydroxide               | $\text{Zn}(\text{OH})_2$ |
| <b><u>D.</u></b> sodium sulfate | $\text{Na}_2\text{SO}_3$ |
| E. calcium oxide                | $\text{CaO}$             |
26. From the following compounds choose the name-formula pair that is incorrectly matched.
- |                                  |                          |
|----------------------------------|--------------------------|
| A. sodium sulfite                | $\text{Na}_2\text{SO}_3$ |
| B. ammonium fluoride             | $\text{NH}_4\text{F}$    |
| C. copper(II) carbonate          | $\text{CuCO}_3$          |
| D. ferric chloride               | $\text{FeCl}_3$          |
| <b><u>E.</u></b> cuprous sulfide | $\text{Co}_2\text{S}_3$  |
27. Which element has a mass that is 7.30 times that of carbon-12?
- Mg
  - B.** Sr
  - Ca
  - Br
  - Rb
28. Which element has a mass approximately 32 times that of a H atom?
- C
  - B.** S
  - Mo
  - Cu
  - Ar

29. The molecular formula for a compound is  $CX_4$ . If 2.819 g of this compound contains 0.102 g of carbon, what is the atomic weight of X?
- A. 320  
B. 160  
C. 35.5  
**D. 79.9**  
E. 39.9
30. How many atoms are in 1.00 mole of water?
- A.  $6.02 \times 10^{23}$   
B.  $1.20 \times 10^{24}$   
**C.  $1.81 \times 10^{24}$**   
D.  $2.41 \times 10^{24}$   
E.  $3.01 \times 10^{23}$
31. Calculate the number of moles of oxygen atoms in 35.2 grams of oxygen.
- A. 2.20 moles**  
B. 4.42 moles  
C. 0.54 moles  
D. 2.57 moles  
E. 1.13 moles
32. How many grams are contained in 0.644 mol oxygen?
- A. 10.3 g  
**B. 20.6 g**  
C. 0.0201 g  
D. 0.0403 g  
E. 0.644 g
33. Calculate the mass of one bromine atom.
- A.  $2.654 \times 10^{-22}$  g  
B.  $6.022 \times 10^{23}$  g  
C.  $1.661 \times 10^{-24}$  g  
D.  $4.812 \times 10^{25}$  g  
**E.  $1.327 \times 10^{-22}$  g**
34. Determine the number of sulfur atoms in 27.1 g of molecular sulfur ( $S_8$ ).
- A. 0.845  
B.  $5.27 \times 10^{23}$   
**C.  $5.09 \times 10^{23}$**   
D.  $2.07 \times 10^{23}$   
E. 0.106

35. Calculate the formula weight of  $\text{Na}_2\text{SO}_4$ .
- A. 193 amu
  - B. 119 amu
  - C. 142 amu**
  - D. 215 amu
  - E. 185 amu
36. Determine the formula weight of  $\text{Ca}_3(\text{PO}_4)_2$ .
- A. 230 amu
  - B. 279 amu
  - C. 215 amu
  - D. 310 amu**
  - E. 135 amu
37. What is the mass of  $2.2 \times 10^9$   $\text{CO}_2$  molecules?
- A.  $9.7 \times 10^{10}$  g
  - B.  $1.0 \times 10^{-12}$  g
  - C.  $1.2 \times 10^6$  g
  - D.  $4.4 \times 10^{-14}$  g
  - E.  $1.6 \times 10^{-13}$  g**
38. What is the mass of 0.432 moles of  $\text{C}_8\text{H}_9\text{O}_4$ ?
- A. 86.9 g
  - B. 391 g
  - C. 169 g
  - D. 113.8 g
  - E. 73.0 g**
39. How many grams of  $\text{CaCl}_2$  equal 4.26 moles of  $\text{CaCl}_2$ ?
- A. 26.1 g
  - B. 170 g
  - C. 302 g
  - D. 473 g**
  - E. 322 g
40. How many moles of  $\text{POCl}_3$  are there in 10.0 grams of  $\text{POCl}_3$ ?
- A.  $6.51 \times 10^{-2}$  mol**
  - B.  $3.68 \times 10^{-1}$  mol
  - C.  $4.09 \times 10^{-2}$  mol
  - D.  $1.21 \times 10^{-1}$  mol
  - E.  $1.17 \times 10^{-3}$  mol

41. How many moles  $\text{CCl}_4$  are present in 118. g of carbon tetrachloride?
- A. 0.839  
B. 1.19  
C. 0.538  
D. 1.30  
**E. 0.767**
42. How many molecules are contained in 5.00 grams of  $\text{NH}_3$ ?
- A.  $5.42 \times 10^{22}$   
B.  $3.00 \times 10^{24}$   
C.  $3.40 \times 10^{22}$   
**D.  $1.77 \times 10^{23}$**   
E.  $9.45 \times 10^{22}$
43. A 12.0-gram sample of  $\text{Cr}_2(\text{SO}_4)_3$  contains how many sulfur atoms?
- A.  $1.84 \times 10^{22}$   
B.  $1.53 \times 10^{21}$   
C.  $4.82 \times 10^{21}$   
D.  $6.67 \times 10^{22}$   
**E.  $5.52 \times 10^{22}$**
44. How many atoms of carbon are present in 34.5 g of caffeine,  $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$ ?
- A.  $8.57 \times 10^{23}$**   
B.  $2.68 \times 10^{25}$   
C.  $1.08 \times 10^{24}$   
D.  $2.09 \times 10^{23}$   
E.  $4.83 \times 10^{23}$
45. What is the mass in grams of  $5.00 \times 10^{12}$  water molecules?
- A.  $1.50 \times 10^{-10}$  g**  
B.  $1.67 \times 10^{35}$  g  
C.  $2.17 \times 10^{12}$  g  
D.  $6.69 \times 10^9$  g  
E.  $4.61 \times 10^{-19}$  g
46. Which of the following is **not** a correct description of 16.0 grams of methane,  $\text{CH}_4$ ?
- A. It is one mole of methane.  
B. It is the amount of methane that contains 12.0 g of carbon.  
**C. It is  $16.0 \times 6.02 \times 10^{23}$  molecules of methane.**  
D. It is the amount of methane that contains 4.0 grams of hydrogen.  
E. It is the amount of methane that contains  $4 \times 6.02 \times 10^{23}$  hydrogen atoms.

47. A sample of ethane,  $\text{C}_2\text{H}_6$ , contains a total of  $16N$  atoms, where  $N = 6.02 \times 10^{23}$ . How much  $\text{C}_2\text{H}_6$  is in the sample?
- A. 2.0 g  
 B. 30 g  
**C. 60 g**  
 D. 16 mol  
 E. 4 mol
48. Suppose you have a 100-gram sample of each of the following compounds. Which sample contains the smallest number of moles of compound?
- A.  $\text{NH}_3$   
 B.  $\text{MgCl}_2$   
 C.  $\text{H}_3\text{PO}_4$   
**D.  $\text{CrCl}_3$**   
 E.  $\text{NaCl}$
49. A mole of a compound composed of nitrogen and oxygen ( $\text{N}_x\text{O}_y$ ) has a molecular weight of 92.0 g/mol. What is its formula?
- A. NO  
**B.  $\text{N}_2\text{O}_4$**   
 C.  $\text{NO}_4$   
 D.  $\text{N}_3\text{O}$   
 E.  $\text{NO}_2$
50. What is the percent by mass of sulfur in  $\text{Al}_2(\text{SO}_4)_3$ ?
- A. 9.38%  
 B. 18.8%  
 C. 24.6%  
**D. 28.1%**  
 E. 35.4%
51. Calculate the percent by mass of nitrogen in ammonium carbonate,  $(\text{NH}_4)_2\text{CO}_3$ .
- A. 14.5%  
 B. 27.8%  
**C. 29.2%**  
 D. 33.3%  
 E. 17.1%

52. Calculate the percent composition of  $K_2CO_3$ .
- |                       |             |             |
|-----------------------|-------------|-------------|
| A. % K = 58.2%        | % C = 17.9% | % O = 23.9% |
| B. % K = 28.2%        | % C = 8.8%  | % O = 35.9% |
| <b>C. % K = 56.6%</b> | % C = 8.7%  | % O = 34.7% |
| D. % K = 39.4%        | % C = 12.0% | % O = 48.4% |
| E. % K = 35.1%        | % C = 21.6% | % O = 43.2% |
53. What is the percentage of carbon in potassium hydrogen phthalate,  $KC_6H_4(COO)(COOH)$ ?
- A. 35.2%  
 B. 58.2%  
**C. 47.1%**  
 D. 70.6%  
 E. 19.2%
54. Analysis of a sample of a covalent compound showed that it contained 14.4% hydrogen and 85.6% carbon by mass. What is the empirical formula for this compound?
- A. CH  
**B.  $CH_2$**   
 C.  $CH_2^2$   
 D.  $C_2H_3$   
 E.  $C_2H_5$
55. What is the empirical formula for a compound containing 68.3% lead, 10.6% sulfur and the remainder oxygen?
- A.  $PbSO_2$   
 B.  $PbSO_2^2$   
 C.  $PbS_2O_3$   
**D.  $PbSO_3^3$**   
 E.  $Pb_2SO_4^4$
56. A compound contains sulfur, oxygen, and chlorine. Analysis shows that it contains by mass 26.95% sulfur and 59.61% chlorine. What is the simplest formula for this compound?
- A. SOCl  
**B.  $SOCl_2$**   
 C.  $SO_2Cl_2$   
 D.  $SO_2Cl^2$   
 E.  $S_2O_2Cl_2$

57. A compound contains carbon, oxygen, and hydrogen. Analysis of a sample showed that it contained by mass 68.9% carbon and 4.92% hydrogen. What is the simplest formula for this compound?
- A.  $\text{C}_6\text{H}_6\text{O}_2$   
**B.**  $\text{C}_7\text{H}_6\text{O}_2$   
 C.  $\text{C}_8\text{H}_6\text{O}_2$   
 D.  $\text{C}_6\text{H}_4\text{O}_3$   
 E.  $\text{C}_7\text{H}_8\text{O}_3$
58. A sample of a compound containing nitrogen, hydrogen, and oxygen is found to contain 22.2% nitrogen and 1.59% hydrogen. What is the simplest formula for this compound?
- A.  $\text{HNO}$   
 B.  $\text{H}_2\text{N}_2\text{O}_3$   
 C.  $\text{H}^2\text{NO}_3$   
 D.  $\text{HNO}_3$   
**E.**  $\text{HNO}_2$
59. A 4.628-g sample of an oxide of iron was found to contain 3.348 g of iron and 1.280 g of oxygen. What is simplest formula for this compound?
- A.  $\text{FeO}$   
 B.  $\text{Fe}_2\text{O}_3$   
**C.**  $\text{Fe}_2\text{O}_3$   
 D.  $\text{Fe}_3\text{O}_4$   
 E.  $\text{Fe}_3\text{O}_2$
60. A 2.086-g sample of a compound contains 0.884 g of cobalt, 0.482 g of sulfur, and 0.720 g of oxygen. What is its simplest formula?
- A.**  $\text{CoSO}_3$   
 B.  $\text{CoSO}_3$   
 C.  $\text{Co}(\text{SO}_4)_2$   
 D.  $\text{Co}(\text{SO}_3)_2$   
 E.  $\text{Co}_3(\text{SO}_4)_4$
61. What is the simplest formula for Chalcocite if a sample of this ore contains 8.274 g copper and 2.088 g sulfur?
- A.  $\text{CuS}_3$   
 B.  $\text{CuS}_3$   
 C.  $\text{CuS}_2$   
 D.  $\text{Cu}_2\text{S}_3$   
**E.**  $\text{Cu}_2\text{S}_3$

62. Determine the simplest formula for a hydrocarbon if the complete combustion of a sample produces 5.28 g of  $\text{CO}_2$  and 1.62 g of  $\text{H}_2\text{O}$ .
- A.  $\text{C}_2\text{H}_3$   
 B.  $\text{CH}_2$   
 C.  $\text{CH}_3$   
 D.  $\text{CH}_2$   
 E.  $\text{C}_2\text{H}_5$
63. Determine the simplest formula for a hydrocarbon if the complete combustion of a sample produces 3.96 g of  $\text{CO}_2$  and 2.16 g of  $\text{H}_2\text{O}$ .
- A.  $\text{C}_2\text{H}_3$   
B.  $\text{C}_2\text{H}_3$   
 C.  $\text{CH}_3$   
 D.  $\text{CH}_3$   
 E.  $\text{C}_2\text{H}_5$
64. A compound is known to contain only carbon, hydrogen, and oxygen. If the complete combustion of a 0.150-g sample of this compound produces 0.225 g of  $\text{CO}_2$  and 0.0614 g of  $\text{H}_2\text{O}$ , what is the empirical formula of this compound?
- A.  $\text{C}_3\text{H}_4$   
 B.  $\text{CH}_3\text{O}$   
 C.  $\text{C}_3\text{H}_4\text{O}$   
D.  $\text{C}_3\text{H}_3\text{O}_3$   
 E.  $\text{C}_3\text{H}_4\text{O}_3$
65. Glucose has a molecular weight of 180.2 g and an empirical formula  $\text{CH}_2\text{O}$ . What is its molecular formula?
- A.  $\text{C}_6\text{H}_{12}\text{O}_6$   
B.  $\text{C}_6\text{H}_{12}\text{O}_6$   
 C.  $\text{C}_6\text{H}_{12}\text{O}_6$   
 D.  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$   
 E.  $\text{CH}_2\text{O}$
66. A compound contains, by mass, 87.5% nitrogen and 12.5% hydrogen. Its molecular weight is found to be 32 g/mol. What is its molecular formula?
- A.  $\text{N}_2\text{H}_6$   
B.  $\text{N}_2\text{H}_6$   
 C.  $\text{N}_2\text{H}_4$   
 D.  $\text{NH}_3$   
 E.  $\text{NH}_2$



67. A compound contains only carbon, hydrogen, and oxygen. Analysis of a sample showed that it contained 54.53% C and 9.15% H. Its molecular weight was determined to be approximately 88 g/mol. What is its molecular formula?
- A.  $\text{C}_2\text{H}_4\text{O}$   
 B.  $\text{C}^2\text{H}^4\text{O}$   
 C.  $\text{C}^4\text{H}^8$   
**D.  $\text{C}^4\text{H}^8\text{O}_2$**   
 E.  $\text{C}^4\text{H}^8\text{O}_2$
68. Butyric acid, found in rancid butter, has a molar mass of 88 g/mol. If butyric acid is 54.5% C, 9.09% H and 36.4% O, what is the molecular formula?
- A.  $\text{C}_4\text{H}_8\text{O}_2$**   
 B.  $\text{C}^4\text{H}^8\text{O}_2$   
 C.  $\text{C}^8\text{H}^{12}\text{O}^4$   
 D.  $\text{C}^2\text{H}^4\text{O}$   
 E.  $\text{C}^{12}\text{H}^6\text{O}_2$
69. A compound contains, by mass, 26.7% carbon, 71.1% oxygen and the remainder hydrogen. A 0.23 mole sample of this compound weighs 20.7 g. What is the molecular formula of this compound?
- A.  $\text{C}_3\text{H}_6\text{O}_2$   
**B.  $\text{C}^3\text{H}^6\text{O}^2$**   
 C.  $\text{C}^2\text{H}^2\text{O}^4$   
 D.  $\text{C}^2\text{H}^4$   
 E.  $\text{C}_3\text{OH}_2$
70. The complete combustion of a 0.2864-g sample of a compound yielded 0.420 g of  $\text{CO}_2$  and 0.172 g of  $\text{H}_2\text{O}$ . The molecular weight was determined to be approximately 60 g/mol. What is the molecular formula of this compound if it contains only carbon, hydrogen, and oxygen?
- A.  $\text{C}_2\text{H}_4\text{O}_2$**   
 B.  $\text{C}^2\text{H}^4\text{O}^2$   
 C.  $\text{CH}^2\text{O}$   
 D.  $\text{C}^4\text{H}^8\text{O}_3$   
 E.  $\text{C}^3\text{H}^6\text{O}_3$
71. Which of the following sets illustrates the Law of Multiple Proportions?
- A.  $\text{Li}_2\text{O}$ ,  $\text{Na}_2\text{O}$ ,  $\text{K}_2\text{O}$   
 B.  $\text{KCl}$ ,  $\text{CaCl}_2$ ,  $\text{ScCl}_3$   
 C.  $^1_1\text{H}$ ,  $^2_1\text{H}$ ,  $^3_1\text{H}$   
 D.  $\text{O}$ ,  $\text{O}_2$ ,  $\text{O}_3$   
**E.  $\text{BrF}$ ,  $\text{BrF}_3$ ,  $\text{BrF}_5$**

72. What is the ratio of the masses of oxygen that combine with 1.00 gram of lead in the compounds  $\text{PbO}$ ,  $\text{PbO}_2$ , and  $\text{Pb}_2\text{O}_3$ ?
- A. 1:2:2  
B. 1:2:1  
C. 2:4:4  
D. 6:12:8  
**E. 2:4:3**
73. What mass of iron is contained in 86.6 grams of chalcopyrite,  $\text{CuFeS}_2$ ?
- A. 26.3 g**  
B. 30.4 g  
C. 55.8 g  
D. 28.5 g  
E. 11.8 g
74. What mass of tungsten is present in 10.0 lbs of wolframite,  $\text{FeWO}_4$ ?
- A. 2.21 kg  
**B. 2.75 kg**  
C. 5.06 lb  
D. 0.716 kg  
E. 5.85 lb
75. What mass of cerussite,  $\text{PbCO}_3$ , would contain 25.0 grams of lead?
- A. 19.4 g  
**B. 32.2 g**  
C. 29.3 g  
D. 25.4 g  
E. 36.9 g
76. What mass of hematite,  $\text{Fe}_2\text{O}_3$ , would contain 24.0 kg of iron?
- A. 34.3 kg**  
B. 68.3 kg  
C. 44.7 kg  
D. 30.5 kg  
E. 41.4 kg
77. What mass of fluoristan,  $\text{SnF}_2$ , would contain the same mass of tin as 306 grams of cassiterite,  $\text{SnO}_2$ ?
- A. 295 g  
**B. 318 g**  
C. 278 g  
D. 367 g  
E. 335 g

78. What mass of  $\text{FeCl}_3$  would contain the same **total** number of ions as 16.8 g of  $\text{Al}_2(\text{SO}_4)_3$ ?
- A. 7.96 g  
**B. 9.95 g**  
 C. 10.8 g  
 D. 13.3 g  
 E. 8.01 g
79. Heating  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  at  $150^\circ\text{C}$  produces  $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$ . If heating 24.4 g of pure  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$  at  $150^\circ\text{C}$  were to give 13.7 g of pure  $\text{MgSO}_4 \cdot x\text{H}_2\text{O}$ , calculate the value for x.
- A. 5  
 B. 4  
 C. 3  
 D. 2  
**E. 1**
80. An ore of lead is 45.0% pure lead sulfide,  $\text{PbS}$ , and 55.0% impurities in which no other lead compounds are present. What mass of lead is contained in 150.0 grams of this ore?
- A. 71.4 g  
 B. 67.5 g  
**C. 58.5 g**  
 D. 9.05 g  
 E. 18.0 g
81. A chemical bottle containing  $\text{BaSO}_4$  is 98.7% pure. What mass of Ba is present in 162 g of this chemical?
- A. 47.1 g  
 B. 96.6 g  
**C. 94.1 g**  
 D. 98.7 g  
 E. 95.3 g
82. What mass of calcium metal could be obtained from one kg of limestone that is 50.0% pure  $\text{CaCO}_3$ ? (No other calcium-containing compounds are present.)
- A. 0.05 kg  
**B. 0.2 kg**  
 C. 0.4 kg  
 D. 0.5 kg  
 E. 0.1 kg

83. A dolomite ore contains 40.0% pure  $\text{MgCO}_3 \cdot \text{CaCO}_3$ . No other compounds of magnesium or calcium are present in the ore. What mass of magnesium and what mass calcium are contained in 100.0 grams of this ore?
- A. 18.3 g Mg - 21.7 g Ca  
 B. 7.91 g Mg - 13.0 g Ca  
 C. 8.70 g Mg - 31.3 g Ca  
D. 5.27 g Mg - 8.69 g Ca  
 E. 34.5 g Mg - 5.30 g Ca
84. A sample of lead ore has a density of 8.80 g/mL. It is composed of two lead compounds: lead oxide,  $\text{PbO}$  (density 9.10 g/mL) and lead selenide,  $\text{PbS}$  (density 8.10 g/mL). What is the percent of the ore is lead oxide?
- A. 96.7 %  
 B. 89.0 %  
C. 70.0 %  
 D. 92.0 %  
 E. 86.3 %
85. How do **nonmetals** form **negative** ions?
- A. by losing one or more electrons  
 B. by sharing electrons  
 C. by gaining one or more protons  
D. by gaining one or more electrons
86. Which one of the following formulas represents a **polyatomic ion**?
- A.  $\text{NO}_2$   
 B.  $\text{RbNO}_2$   
 C.  $\text{Rb}^+_2$   
D.  $\text{NO}_3^-$
87. What is the formula for the ionic compound formed by **calcium** and **bromine**?
- A.  $\text{CaBr}$   
 B.  $\text{Ca}_2\text{Br}$   
C.  $\text{CaBr}_2$   
 D.  $\text{Ca}_3\text{Br}_2$
88. What is the name for  $\text{MgSe}$ ?
- A. magnesium selenate  
 B. selenium magneside  
 C. talc  
D. magnesium selenide

89. Locate neon, **Ne**, on a periodic table. What is the **atomic weight** of neon?
- A. 10  
 B. 10.18  
 C. 18  
**D. 20.18**
90. How many atoms are there in **43.2 g** of boron, **B**? (atomic weight = 10.81)
- A.  $1.51 \times 10^{23}$  atoms  
 B.  $6.64 \times 10^{-24}$  atoms  
 C. 4.00 atoms  
**D.  $2.41 \times 10^{24}$  atoms**
91. How many molecules are there in **50.0 g** of selenium disulfide, **SeS<sub>2</sub>**? (atomic weights: Se = 78.96, S = 32.06)
- A. 0.349 molecules  
**B.  $2.10 \times 10^{23}$  molecules**  
 C.  $2.71 \times 10^{23}$  molecules  
 D. 2.86 molecules
92. Calculate the **percentage** of nitrogen, **N**, in dinitrogen trioxide, **N<sub>2</sub>O<sub>3</sub>**.
- A. 40%  
**B. 36.8%**  
 C. 18.4%  
 D. 46.7%
93. A compound is found on analysis to contain **7.8 grams** of carbon, **C**, and **2.3 grams** of hydrogen, **H**. What is the **empirical formula**? (atomic weights: C = 12.01, H = 1.008)
- A. C<sub>2</sub>H<sub>7</sub>**  
 B. CH<sub>3</sub>  
 C. C<sub>3</sub>H  
 D. C<sub>10</sub>H<sub>3</sub>
94. The **empirical formula** of a compound is **CHBr** and its **molecular weight** is **185**. What is its **molecular formula**? (atomic weights: C = 12.01, H = 1.008, Br = 79.90)
- A. CH<sub>2</sub>Br  
**B. C<sub>2</sub>H<sub>2</sub>Br<sub>2</sub>**  
 C. C<sub>2</sub>H<sub>2</sub>Br<sub>2</sub>  
 D. C<sub>2</sub>HBr<sub>3</sub>

95. Discuss the accuracy of this statement: All matter in the universe is made of only three particles.

Answer not provided.

96. Why isn't it correct to refer to a molecule of aluminum chloride?

Answer not provided.

97. Would atomic weights of elements be different if another standard was chosen to represent the atomic mass unit (amu)? Would their relative masses change?

Answer not provided.

98. Explain how it is possible for many different compounds to have the same empirical formula.

Answer not provided.

99. Why is the purity of a chemical listed on the label? Are there any situations where purity is not very important?

Answer not provided.