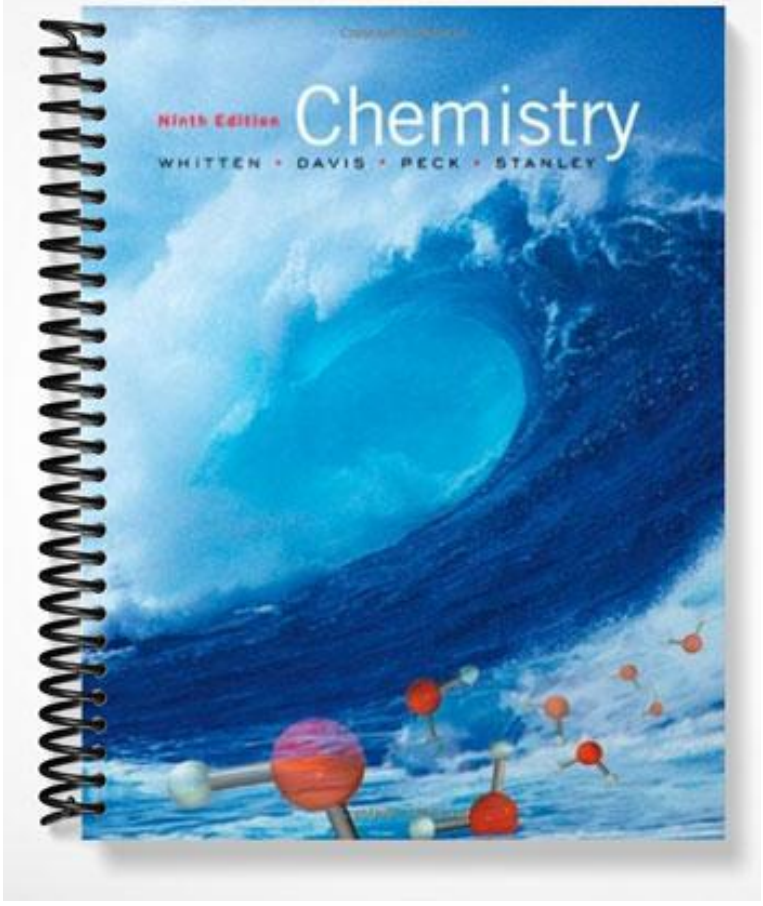
TEST BANK



Chapter 2--Chemical Formulas and Composition Stoichiometry

Student: _____

1. There are two different common crystalline forms of carbon¾diamond 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 butane, C_4H_{10}, contains a total of 8.0×10^3 atoms of carbon, how many molecules of butane are in the sample?

   A. 6.0×10^3
   B. 3.0×10^3
   C. 8.0×10^3
   D. 1.1×10^4
   E. 2.0×10^3

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 these

6. Which formula / name pair does not match?

   A. HNO_3 / nitric acid, used to produce explosives
   B. CH_3OH / methyl alcohol, wood alcohol
   C. CH_3CH_2OH / ethyl alcohol, alcohol in wine
   D. $CHCl_3$ / acetic acid, found in vinegar
   E. $CH_3CH_2OCH_2CH_3$ / diethyl ether, an anesthetic

7. Name the molecular compound, CH_3COCH_3.

   A. acetone
   B. ethanol
   C. diethyl ether
   D. propane
   E. ethyl alcohol

8. What is the molecular formula for ethanol?

   A. CH_3COOH
   B. CH_3COCH_3
   C. $CH_3CH_2OCH_2CH_3$
   D. $CH_3CH_2CO_2H$
   E. CH_3CH_2OH

9. Butane, a highly combustible hydrocarbon found in disposable lighters, has the chemical formula:

   A. CO_2
   B. C_4H
   C. C_4H_8
   D. C_4H_{10}
   E. CH_3OCH_3

10. What is the molecular formula for hydrogen chloride?

    A. HCl
    B. HClO
    C. $HClO_2$
    D. $HClO_3$
    E. $HClO_4$

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?

    A. 2.71 g
    B. 4.00 g
    C. 3.00 g
    D. 4.50 g
    E. 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. magnesium
    D. sulfide
    E. ammonium

14. Which of the following statements is **incorrect**?

    A. Potassium chloride forms molecules that consist 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 OCl^-?

    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^{2-}
    D. CO_2^{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**?

A. hydroxide / OH^- / monatomic / anion
B. carbonate / CO_3^{2-} / polyatomic / anion
C. ammonium / NH_4^+ / polyatomic / cation
D. magnesium / Mg^{2+} / monatomic / cation
E. sulfite / 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 / PO_4^{3-} / polyatomic / anion
B. sulfite / SO_3^{2-} / polyatomic / anion
C. nitrite / NO_2^- / polyatomic / anion
D. iron(II) / Fe^{2+} / monatomic / cation
E. bromide / Br^- / monatomic / anion

19. What is the formula for ammonium fluoride?

A. AlF
B. Al_2F_3
C. NH_4F
D. NH_3F
E. NH_4F_2

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

A. MgO
B. MnO
C. MnO_4
D. Mg_2O_3
E. Mn_2O_3

21. What is the formula for aluminum oxide?

A. Al_2O_3
B. Ag_2O_3
C. AlO_3
D. AlO
E. AlO_2

22. What is the name of $Fe(OH)_3$?

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) sulfate?

A. $CuSO_4$
B. Cu_2SO_3
C. $CuSO_2$
D. Cu_2SO_4
E. $Cu(SO_4)_2$

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

A. aluminum phosphate / $AlPO_4$
B. calcium acetate / $CaCH_3COO$
C. ammonium sulfide / $(NH_4)_2S$
D. magnesium hydroxide / $Mg(OH)_2$
E. zinc carbonate / $ZnCO_3$

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

A. sodium sulfide / Na_2S
B. ammonium nitrate / NH_4NO_3
C. zinc hydroxide / $Zn(OH)_2$
D. sodium sulfate / Na_2SO_3
E. calcium oxide / CaO

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

A. sodium sulfite / Na_2SO_3
B. ammonium fluoride / NH_4F
C. copper(II) carbonate / $CuCO_3$
D. ferric chloride / $FeCl_3$
E. cuprous sulfide / Co_2S

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 4 times that of an H atom?

A. Be
B. He
C. Li
D. Ti
E. K

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 of hydrogen are in 1.00 mole of water?

A. 6.02×10^{23}
B. 1.20×10^{24}
C. 1.81×10^{24}
D. 2.41×10^{24}
E. 3.01×10^{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. 2.654×10^{-22} g
B. 6.022×10^{23} g
C. 1.661×10^{-24} g
D. 4.812×10^{25} g
E. 1.327×10^{-22} g

34. Determine the number of sulfur atoms in 27.1 g of molecular sulfur (S_8).

A. 0.845
B. 5.27×10^{23}
C. 5.09×10^{23}
D. 2.07×10^{23}
E. 0.106

35. Calculate the formula weight of $NaHSO_4$.

A. 193 amu
B. 104 amu
C. 120 amu
D. 215 amu
E. 185 amu

36. Determine the formula weight of $Ca_3(PO_4)_2$.

A. 230 amu
B. 279 amu
C. 215 amu
D. 310 amu
E. 135 amu

37. What is the mass of 2.2×10^9 CO_2 molecules?

A. 9.7×10^{10} g
B. 1.0×10^{-12} g
C. 1.2×10^{6} g
D. 4.4×10^{-14} g
E. 1.6×10^{-13} g

38. What is the mass of 0.432 moles of $C_8H_9O_4$?

A. 86.9 g
B. 391 g
C. 169 g
D. 113.8 g
E. 73.0 g

39. How many grams of $CaCl_2$ equal 4.26 moles of $CaCl_2$?

A. 26.1 g
B. 170 g
C. 302 g
D. 473 g
E. 322 g

40. How many moles of $POCl_3$ are there in 10.0 grams of $POCl_3$?

A. 6.51×10^{-2} mol
B. 3.68×10^{-1} mol
C. 4.09×10^{-2} mol
D. 1.21×10^{-1} mol
E. 1.17×10^{-3} mol

41. How many moles of 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 NH_3?

A. 5.42×10^{22}
B. 3.00×10^{24}
C. 3.40×10^{22}
D. 1.77×10^{23}
E. 9.45×10^{22}

43. A 12.0-gram sample of $Cr_2(SO_4)_3$ contains how many sulfur atoms?

A. 1.84×10^{22}
B. 1.53×10^{21}
C. 4.82×10^{21}
D. 6.67×10^{22}
E. 5.52×10^{22}

44. How many atoms of carbon are present in 34.5 g of caffeine, $C_8H_{10}N_4O_2$?

A. 8.57×10^{23}
B. 2.68×10^{25}
C. 1.08×10^{24}
D. 2.09×10^{23}
E. 4.83×10^{23}

45. What is the mass in grams of 5.00×10^{12} water molecules?

A. 1.50×10^{-10} g
B. 1.67×10^{35} g
C. 2.17×10^{12} g
D. 6.69×10^{9} g
E. 4.61×10^{-15} g

46. Which of the following is **not** a correct description of 16.0 grams of methane, 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, C_2H_6, contains a total of $16N$ atoms, where $N = 6.02 \times 10^{23}$. How much C_2H_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. NH_3
B. $MgCl_2$
C. H_3PO_4
D. $CrCl_3$
E. $NaCl$

49. A mole of a compound composed of nitrogen and oxygen (N_xO_y) has a molecular weight of 92.0 g/mol. What is its formula?

A. NO
B. N_2O_4
C. NO_3
D. N_2O
E. NO_2

50. What is the percent by mass of sulfur in $Al_2(SO_4)_3$?

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, NH_4NO_3.

A. 17.5%
B. 27.8%
C. 29.2%
D. 35.0%
E. 2.86%

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_4
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?

A. $C_6H_6O_2$
B. $C_7H_6O_2$
C. $C_8H_6O_2$
D. $C_6H_4O_3$
E. C_7H_8O

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. HNO
B. $H_2N_2O_3$
C. H_2NO_3
D. HNO_3
E. 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. FeO
B. Fe_2O_3
C. Fe_3O_4
D. FeO_2
E. Fe_3O_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. $CoSO_3$
B. $CoSO_4$
C. $Co(SO_4)_2$
D. $Co(SO_3)_2$
E. $Co_3(SO_4)_4$

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. CuS_2
B. CuS_3
C. CuS
D. Cu_2S
E. Cu_2S_3

62. Determine the simplest formula for a hydrocarbon if the complete combustion of a sample produces 5.28 g of CO_2 and 1.62 g of H_2O.

A. C_2H_3
B. CH_3
C. CH_2
D. CH_3
E. C_2H_5

63. Determine the simplest formula for a hydrocarbon if the complete combustion of a sample produces 3.96 g of CO_2 and 2.16 g of H_2O.

A. C_2H_3
B. C_2H_3
C. C_3H_8
D. CH_3
E. C_2H_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 CO_2 and 0.0614 g of H_2O, what is the empirical formula of this compound?

A. C_3H_4
B. CH_4O
C. C_2HO_3
D. $C_3H_4O_3$
E. $C_5H_7O_5$

65. Glucose has a molecular weight of 180.2 g and an empirical formula CH_2O. What is its molecular formula?

A. $C_8H_4O_5$
B. $C_6H_{12}O_6$
C. $C_6H_{12}O_6$
D. $C_{12}H_{22}O_{11}$
E. $CH_{10}O_{12}O_3$

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. N_2H
B. N_2H_6
C. N_2H_4
D. NH_5
E. 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?

A. C_2H_4O
B. C_4H_8O
C. C_4H_8
D. $C_4H_8O_2$
E. $C_4H_{12}O_2$

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. $C_4H_8O_2$
B. $C_8H_{12}O_4$
C. C_2H_4O
D. $C_{12}H_6O_2$
E. CHO

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. $C_3H_6O_2$
B. $C_2H_2O_4$
C. $C_2H_4O_2$
D. CHO_2
E. C_3OH

70. What is the maximum amount of carbon dioxide that can be produced by the combustion of 0.450g of C_2H_5OH?

A. 0.861g
B. 0.430g
C. 1.62g
D. 44.0g
E. cannot be determined

71. Which of the following sets illustrates the Law of Multiple Proportions?

A. Li_2O, Na_2O, K_2O
B. KCl, $CaCl_2$, $ScCl_3$
C. $^{1}_{1}H$, $^{2}_{1}H$, $^{3}_{1}H$

D. O, O_2, O_3
E. BrF, BrF_3, BrF_5

72. What is the ratio of the masses of oxygen that combine with 1.00 gram of lead in the compounds PbO, PbO_2, and Pb_2O_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, $CuFeS_2$?

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, $FeWO_4$?

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, $PbCO_3$, 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, Fe_2O_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, SnF_2, would contain the same mass of tin as 306 grams of cassiterite, SnO_2?

A. 295 g
B. 318 g
C. 278 g
D. 367 g
E. 335 g

78. What mass of $FeCl_3$ would contain the same **total** number of ions as 16.8 g of $Al_2(SO_4)_3$?

A. 7.96 g
B. 9.95 g
C. 10.8 g
D. 13.3 g
E. 8.01 g

79. Heating $MgSO_4 \cdot 7H_2O$ at 150°C produces $MgSO_4 \cdot xH_2O$. If heating 24.4 g of pure $MgSO_4 \cdot 7H_2O$ at 150°C were to give 13.7 g of pure $MgSO_4 \cdot xH_2O$, 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, 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 $BaSO_4$ 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 $CaCO_3$? (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 $MgCO_3 \cdot CaCO_3$. No other compounds of magnesium or calcium are present in the ore. What mass of magnesium and what mass of 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, PbO (density 9.10 g/mL) and lead selenide, 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. Discuss the accuracy of this statement: All matter in the universe in made of only three particles.

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

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

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

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

90. You are in charge of making a backup oxygen generator for the space shuttle. The chemical compounds that will decompose to give oxygen in your system are $LiClO_3$ or $KClO_3$. Which compound would you choose and why?

Chapter 2--Chemical Formulas and Composition Stoichiometry
Key

1. There are two different common crystalline forms of carbon¾diamond 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 butane, C_4H_{10}, contains a total of 8.0×10^3 atoms of carbon, how many molecules of butane are in the sample?

   A. 6.0×10^3
   B. 3.0×10^3
   C. 8.0×10^3
   D. 1.1×10^4
   E. 2.0×10^3

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 these

6. Which formula / name pair does not match?

A. HNO_3 / nitric acid, used to produce explosives
B. CH_3OH / methyl alcohol, wood alcohol
C. CH_3CH_2OH / ethyl alcohol, alcohol in wine
D. $CHCl_3$ / acetic acid, found in vinegar
E. $CH_3CH_2OCH_2CH_3$ / diethyl ether, an anesthetic

7. Name the molecular compound, CH_3COCH_3.

A. acetone
B. ethanol
C. diethyl ether
D. propane
E. ethyl alcohol

8. What is the molecular formula for ethanol?

A. CH_3COOH
B. CH_3COCH_3
C. $CH_3CH_2OCH_2CH_3$
D. $CH_3CH_2CO_2H$
E. CH_3CH_2OH

9. Butane, a highly combustible hydrocarbon found in disposable lighters, has the chemical formula:

A. CO_2
B. C_4H_4
C. C_4H_8
D. C_4H_{10}
E. CH_3OCH_3

10. What is the molecular formula for hydrogen chloride?

A. HCl
B. HClO
C. $HClO_2$
D. $HClO_3$
E. $HClO_4$

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?

A. 2.71 g
B. 4.00 g
C. 3.00 g
D. 4.50 g
E. 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. magnesium
D. sulfide
E. ammonium

14. Which of the following statements is **incorrect**?

A. Potassium chloride forms molecules that consist 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 OCl^-?

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**?

A. hydroxide / OH^- / monatomic / anion
B. carbonate / CO_3^{2-} / polyatomic / anion
C. ammonium / NH_4^+ / polyatomic / cation
D. magnesium / Mg^{2+} / monatomic / cation
E. sulfite / 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 / PO_4^{3-} / polyatomic / anion
B. sulfite / SO_3^{2-} / polyatomic / anion
C. nitrite / NO_3^- / polyatomic / anion
D. iron(II) / Fe^{2+} / monatomic / cation
E. bromide / Br^- / monatomic / anion

19. What is the formula for ammonium fluoride?

A. AlF
B. Al_2F_3
C. NH_4F
D. NH_3F
E. NH_4F_2

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

A. MgO
B. MnO
C. MnO_4
D. Mg_2O_3
E. Mn_2O_3

21. What is the formula for aluminum oxide?

A. Al_2O_3
B. Ag_2O_3
C. AlO_3
D. AlO^3
E. AlO_2

22. What is the name of $Fe(OH)_3$?

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) sulfate?

A. $CuSO_4$
B. Cu_2SO_3
C. $CuSO_2$
D. Cu_2SO_4
E. $Cu(SO_4)_2$

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

A. aluminum phosphate / $AlPO_4$
B. calcium acetate / $CaCH_3COO$
C. ammonium sulfide / $(NH_4)_2S$
D. magnesium hydroxide / $Mg(OH)_2$
E. zinc carbonate / $ZnCO_3$

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

A. sodium sulfide / Na_2S
B. ammonium nitrate / NH_4NO_3
C. zinc hydroxide / $Zn(OH)_2$
D. sodium sulfate / Na_2SO_3
E. calcium oxide / CaO

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

A. sodium sulfite / Na_2SO_3
B. ammonium fluoride / NH_4F
C. copper(II) carbonate / $CuCO_3$
D. ferric chloride / $FeCl_3$
E. cuprous sulfide / Co_2S

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 4 times that of an H atom?

A. Be
B. He
C. Li
D. Ti
E. K

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 of hydrogen are in 1.00 mole of water?

A. 6.02×10^{23}
B. 1.20×10^{24}
C. 1.81×10^{24}
D. 2.41×10^{24}
E. 3.01×10^{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. 2.654×10^{-22} g
B. 6.022×10^{23} g
C. 1.661×10^{-24} g
D. 4.812×10^{25} g
E. 1.327×10^{-22} g

34. Determine the number of sulfur atoms in 27.1 g of molecular sulfur (S_8).

A. 0.845
B. 5.27×10^{23}
C. 5.09×10^{23}
D. 2.07×10^{23}
E. 0.106

35. Calculate the formula weight of $NaHSO_4$.

A. 193 amu
B. 104 amu
C. 120 amu
D. 215 amu
E. 185 amu

36. Determine the formula weight of $Ca_3(PO_4)_2$.

A. 230 amu
B. 279 amu
C. 215 amu
D. 310 amu
E. 135 amu

37. What is the mass of 2.2×10^9 CO_2 molecules?

A. 9.7×10^{10} g
B. 1.0×10^{-12} g
C. 1.2×10^{6} g
D. 4.4×10^{-14} g
E. 1.6×10^{-13} g

38. What is the mass of 0.432 moles of $C_8H_9O_4$?

A. 86.9 g
B. 391 g
C. 169 g
D. 113.8 g
E. 73.0 g

39. How many grams of $CaCl_2$ equal 4.26 moles of $CaCl_2$?

A. 26.1 g
B. 170 g
C. 302 g
D. 473 g
E. 322 g

40. How many moles of $POCl_3$ are there in 10.0 grams of $POCl_3$?

A. 6.51×10^{-2} mol
B. 3.68×10^{-1} mol
C. 4.09×10^{-2} mol
D. 1.21×10^{-1} mol
E. 1.17×10^{-3} mol

41. How many moles of 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 NH_3?

A. 5.42×10^{22}
B. 3.00×10^{24}
C. 3.40×10^{22}
D. 1.77×10^{23}
E. 9.45×10^{22}

43. A 12.0-gram sample of $Cr_2(SO_4)_3$ contains how many sulfur atoms?

A. 1.84×10^{22}
B. 1.53×10^{21}
C. 4.82×10^{21}
D. 6.67×10^{22}
E. 5.52×10^{22}

44. How many atoms of carbon are present in 34.5 g of caffeine, $C_8H_{10}N_4O_2$?

A. 8.57×10^{23}
B. 2.68×10^{25}
C. 1.08×10^{24}
D. 2.09×10^{23}
E. 4.83×10^{23}

45. What is the mass in grams of 5.00×10^{12} water molecules?

A. 1.50×10^{-10} g
B. 1.67×10^{35} g
C. 2.17×10^{12} g
D. 6.69×10^{9} g
E. 4.61×10^{-15} g

46. Which of the following is **not** a correct description of 16.0 grams of methane, 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, C_2H_6, contains a total of $16N$ atoms, where $N = 6.02 \times 10^{23}$. How much C_2H_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. NH_3
B. $MgCl_2$
C. H_3PO_4
D. $CrCl_3$
E. $NaCl$

49. A mole of a compound composed of nitrogen and oxygen (N_xO_y) has a molecular weight of 92.0 g/mol. What is its formula?

A. NO
B. N_2O_4
C. NO_3
D. N_2O
E. NO_2

50. What is the percent by mass of sulfur in $Al_2(SO_4)_3$?

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, NH_4NO_3.

A. 17.5%
B. 27.8%
C. 29.2%
D. 35.0%
E. 2.86%

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
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?

A. CHO
B. $C_6H_6O_2$
C. $C_7H_6O_2$
D. $C_8H_6O_2$
E. $C_{78}H_4O_3$

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. HNO
B. $H_2N_2O_3$
C. H_2NO_3
D. HNO_3
E. HNO_3

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. FeO
B. Fe_2O
C. Fe_2O_3
D. Fe_3O_4
E. Fe_3O_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. $CoSO_3$
B. $CoSO_3$
C. $Co(SO_4)$
D. $Co(SO_3)_2$
E. $Co_3(SO_4)_4$

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. CuS_3
B. CuS_3
C. CuS_2
D. Cu_2S
E. Cu_2S_3

62. Determine the simplest formula for a hydrocarbon if the complete combustion of a sample produces 5.28 g of CO_2 and 1.62 g of H_2O.

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

63. Determine the simplest formula for a hydrocarbon if the complete combustion of a sample produces 3.96 g of CO_2 and 2.16 g of H_2O.

A. C_2H_3
B. C_3H_8
C. CH_3
D. CH
E. C_2H_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 CO_2 and 0.0614 g of H_2O, what is the empirical formula of this compound?

A. C_3H_4
B. CH_4O
C. C_3HO_3
D. $C_3H_4O_3$
E. $C_5H_7O_5$

65. Glucose has a molecular weight of 180.2 g and an empirical formula CH_2O. What is its molecular formula?

A. $C_8H_4O_5$
B. $C_6H_{12}O_6$
C. $C_{12}H_{22}O_{11}$
D. $C_{10}H_{12}O_3$
E. CH_2O

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. N_2H_6
B. N_2H_4
C. N_2H_5
D. NH_3
E. 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. C_2H_4O
B. C_4H_8O
C. C_4H_8
D. $C_4H_8O_2$
E. $C_4H_{12}O_2$

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. $C_4H_8O_2$
B. $C_4H_8O_4$
C. $C_8H_{12}O_4$
D. C_2H_4O
E. 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?

A. $C_3H_6O_2$
B. $C_3H_6O_2$
C. $C_2H_2O_4$
D. CHO_2
E. C_3OH

70. What is the maximum amount of carbon dioxide that can be produced by the combustion of 0.450g of C_2H_5OH?

A. 0.861g
B. 0.430g
C. 1.62g
D. 44.0g
E. cannot be determined

71. Which of the following sets illustrates the Law of Multiple Proportions?

A. Li_2O, Na_2O, K_2O
B. KCl, $CaCl_2$, $ScCl_3$
C. ^1_1H, ^2_1H, ^3_1H

D. O, O_2, O_3
E. BrF, BrF_3, BrF_5

72. What is the ratio of the masses of oxygen that combine with 1.00 gram of lead in the compounds PbO, PbO_2, and Pb_2O_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, $CuFeS_2$?

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, $FeWO_4$?

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, $PbCO_3$, 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, Fe_2O_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, SnF_2, would contain the same mass of tin as 306 grams of cassiterite, SnO_2?

A. 295 g
B. 318 g
C. 278 g
D. 367 g
E. 335 g

78. What mass of $FeCl_3$ would contain the same **total** number of ions as 16.8 g of $Al_2(SO_4)_3$?

A. 7.96 g
B. 9.95 g
C. 10.8 g
D. 13.3 g
E. 8.01 g

79. Heating $MgSO_4 \cdot 7H_2O$ at 150°C produces $MgSO_4 \cdot xH_2O$. If heating 24.4 g of pure $MgSO_4 \cdot 7H_2O$ at 150°C were to give 13.7 g of pure $MgSO_4 \cdot xH_2O$, 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, 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 $BaSO_4$ 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 $CaCO_3$? (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 $MgCO_3 \cdot CaCO_3$. No other compounds of magnesium or calcium are present in the ore. What mass of magnesium and what mass of 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, PbO (density 9.10 g/mL) and lead selenide, 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. Discuss the accuracy of this statement: All matter in the universe in made of only three particles.

Answer not provided.

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

Answer not provided.

87. 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.

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

Answer not provided.

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

Answer not provided.

90. You are in charge of making a backup oxygen generator for the space shuttle. The chemical compounds that will decompose to give oxygen in your system are $LiClO_3$ or $KClO_3$. Which compound would you choose and why?

Answer not provided.