

Reviewing Content

10.1 The Mole: A Measurement of Matter

47. List three common ways that matter is measured. Give examples of each.
48. Name the representative particle (atom, molecule, or formula unit) of each substance.
a. oxygen gas b. sodium sulfide
c. sulfur dioxide d. potassium
49. How many hydrogen atoms are in a representative particle of each substance?
a. $\text{Al}(\text{OH})_3$ b. $\text{H}_2\text{C}_2\text{O}_4$
c. $(\text{NH}_4)_2\text{HPO}_4$ d. $\text{C}_4\text{H}_{10}\text{O}$
50. Which contains more molecules: 1.00 mol H_2O_2 , 1.00 mol C_2H_6 , or 1.00 mol CO ?
51. Which contains more atoms: 1.00 mol H_2O_2 , 1.00 mol C_2H_6 , or 1.00 mol CO ?
52. Find the number of representative particles in each substance.
a. 3.00 mol Sn b. 0.400 mol KCl
c. 7.50 mol SO_2 d. 4.80×10^{-3} mol NaI
53. Calculate the molar mass of each substance.
a. H_3PO_4 b. N_2O_3 c. CaCO_3
d. $(\text{NH}_4)_2\text{SO}_4$ e. $\text{C}_4\text{H}_9\text{O}_2$ f. Br₂
54. Calculate the mass of 1.00 mol of each of these substances.
a. silicon dioxide (SiO_2)
b. diatomic nitrogen (N_2)
c. iron(III) hydroxide ($\text{Fe}(\text{OH})_3$)
d. copper (Cu)
55. List the steps you would take to calculate the molar mass of any compound.
56. What is the molar mass of chlorine?
57. Construct a numerical problem to illustrate the size of Avogadro's number. Exchange problems with a classmate and then compare your answers.

10.2 Mole-Mass and Mole-Volume Relationships

58. How many moles is each of the following?
a. 15.5 g SiO_2 b. 0.0688 g AgCl
c. 79.3 g Cl_2 d. 5.96 g KOH
e. 937 g $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$ f. 0.800 g Ca
59. Find the mass of each substance.
a. 1.50 mol C_5H_{12} b. 14.4 mol F_2
c. 0.780 mol $\text{Ca}(\text{CN})_2$ d. 7.00 mol H_2O_2
e. 5.60 mol NaOH f. 3.21×10^{-2} mol Ni

61. a. 1.96 g/L
b. 0.902 g/L
c. 2.05 g/L
62. a. 234 L SO_3
b. 2.99×10^{-22} g $\text{C}_9\text{H}_8\text{O}_4$
c. 3.13×10^{25} atoms
63. a. 5.9% H, 94.1% S
b. 22.6% N, 6.5% H, 19.4% C, 51.6% O
c. 41.7% Mg, 54.9% O, 3.4% H
d. 42.1% Na, 18.9% P, 39.0% O
64. a. 3.33 g S
b. 5.65 g N

60. Calculate the volume of each of the following gases at STP.
a. 7.6 mol Ar b. 0.44 mol C_2H_6
61. What is the density of each of the following gases at STP?
a. C_3H_8 b. Ne c. NO_2
62. Find each of the following quantities.
a. the volume, in liters, of 835 g SO_3 at STP
b. the mass, in grams, of a molecule of aspirin ($\text{C}_9\text{H}_8\text{O}_4$)
c. the number of atoms in 5.78 mol NH_4NO_3

10.3 Percent Composition and Chemical Formulas

63. Calculate the percent composition of each compound.
a. H_2S b. $(\text{NH}_4)_2\text{C}_2\text{O}_4$
c. $\text{Mg}(\text{OH})_2$ d. Na_3PO_4
64. Using your answers from Problem 63, calculate the number of grams of these elements.
a. sulfur in 3.54 g H_2S
b. nitrogen in 25.0 g $(\text{NH}_4)_2\text{C}_2\text{O}_4$
c. magnesium in 97.4 g $\text{Mg}(\text{OH})_2$
d. phosphorus in 804 g Na_3PO_4
65. Which of the following compounds has the highest iron content?
a. FeCl_2 b. $\text{Fe}(\text{C}_2\text{H}_3\text{O}_2)_3$
c. $\text{Fe}(\text{OH})_2$ d. FeO
66. You find that 7.36 g of a compound has decomposed to give 6.93 g of oxygen. The only other element in the compound is hydrogen. If the molar mass of the compound is 34.0 g/mol, what is its molecular formula?
67. Which of the following can be classified as an empirical formula?
a. S_2Cl_2 b. $\text{C}_6\text{H}_{10}\text{O}_4$ c. Na_2SO_3
68. What is the molecular formula for each compound? Each compound's empirical formula and molar mass is given.
a. CH_2O , 90 g/mol b. HgCl , 472.2 g/mol
69. Determine the molecular formula for each compound.
a. 94.1% O and 5.9% H; molar mass = 34 g
b. 50.7% C, 4.2% H, and 45.1% O; molar mass = 142 g

- c. 40.6 g Mg
d. 152 g P
65. d. 77.7% Fe in FeO
66. H_2O_2
67. a. molecular
b. molecular
c. empirical
68. a. $\text{C}_3\text{H}_6\text{O}_3$
b. Hg_2Cl_2
69. a. H_2O_2
b. $\text{C}_6\text{H}_6\text{O}_4$

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47. Number, mass, or volume; examples will vary.
48. a. molecule
b. formula unit
c. molecule
d. atom
49. a. 3
b. 2
c. 9
d. 10
50. All contain 6.02×10^{23} molecules
51. 1.00 mol C_2H_6
52. a. 1.81×10^{24} atoms Sn
b. 2.41×10^{23} formula units KCl
c. 4.52×10^{24} molecules SO_2
d. 2.89×10^{21} formula units NaI
53. a. 98.0 g/mol
b. 76.0 g/mol
c. 100.1 g/mol
d. 132.1 g/mol
e. 89.0 g/mol
f. 159.8 g/mol
54. a. 60.1 g/mol
b. 28.0 g/mol
c. 106.8 g/mol
d. 63.5 g/mol
55. Answers will vary but should include
1. Determine the moles of each atom from the formula.
2. Look up the atomic mass of each element.
3. Multiply the number of moles of each atom by its molar mass.
4. Sum these products.
56. 71.0 g/mol Cl_2
57. Answers will vary.
58. a. 0.258 mol SiO_2
b. 4.80×10^{-4} mol AgCl
c. 1.12 mol Cl_2
d. 0.106 mol KOH
e. 5.93 mol $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$
f. 2.00×10^{-2} mol Ca
59. a. 108 g C_5H_{12}
b. 547 g F_2
c. 71.8 g $\text{Ca}(\text{CN})_2$
d. 238 g H_2O_2
e. 224 g NaOH
f. 1.88 g Ni
60. a. 1.7×10^2 L Ar
b. 9.9 L C_2H_6