

Reviewing Content

36. a. Two formula units KClO_3 decompose to form two formula units KCl and three molecules O_2 .
 b. Four molecules NH_3 react with six molecules NO to form five molecules N_2 and six molecules H_2O .
 c. Four atoms K react with one molecule O_2 to form two formula units K_2O .
37. a. Two mol KClO_3 decompose to form two mol KCl and three mol O_2 .
 b. Four mol NH_3 react with six mol NO to form five mol N_2 and six mol H_2O .
 c. Four mol K react with one mol O_2 to form two mol K_2O .
38. a. 245.2 g b. 248.0 g
 c. 188.4 g
 All obey the law of conservation of mass.
39. Acceptable answers include the idea of writing a ratio using the coefficients of two substances from a balanced equation as the number of moles of each substance reacting or being formed.
40. a. 0.54 mol b. 13.6 mol
 c. 0.984 mol d. 236 mol
41. a. 11.3 mol CO , 22.5 mol H_2
 b. 112 g CO , 16.0 g H_2
 c. 11.4 g H_2
42. a. 372 g F_2
 b. 1.32 g NH_3
 c. 123 g N_2F_4
43. The coefficients indicate the relative number of moles (or particles) of reactants and products.
44. a. 51.2 g H_2O
 b. 5.71×10^{23} molecules NH_3
 c. 23.2 g Li_3N
45. The amount of the limiting reagent determines the maximum amount of product that can be formed. The excess reagent is only partially consumed in the reaction.
46. To identify the limiting reagent, express quantities of reactants as moles; compare to the mole ratios from the balanced equation.
47. a. Al
 b. 6.0 mol AlCl_3
 c. 0.8 mol Cl_2
48. 91.5%

Understanding Concepts

49. a. 2.36 g H_3PO_4
 b. 1.89 g CO_2
50. a. 5.70×10^{21} atoms Zn
 b. 95.2 g Zn
51. a. 7.0×10^2 L N_2
 b. no reagent in excess
52. a. 96.4%
 b. 45.0 g
53. 10.7 kg CaSO_4
54. 224 L gas
55. a. Initially, the amount of NaCl formed increases as the amount of Na used increases. For this part of the curve, sodium is the limiting reagent. Beyond a mass of about 2.5 g of Na , the amount of product formed remains constant because chlorine is now the limiting reagent.
 b. Chlorine becomes the limiting reagent when the mass of sodium exceeds 2.5 g. This corresponds to a mass of about 3.9 g chlorine.
56. 50.0% yield; 0.500 mol; 0.0500 mol; 20.0% yield

Critical Thinking

57. The percent yield is 115%; such a yield could be attributed to experimenter error, or to unreacted starting material, or to outside materials contaminating the product.
58. Yes, a net ionic equation is balanced and thus obeys the law of conservation of mass.

59. a. 29 frames
b. 58 wheels
c. 174 pedals
d. 87 seats

60. 1.1×10^6 L air

61. 13 days

Concept Challenge

62. 1.86 g/L

63. 87.4% CaCO_3

64. KOH is the limiting reagent.

65. a. 347 g Fe

b. 239 g CO

66. 6.51 g SO_3

Cumulative Review

67. a. 22, 22, 25

b. 50, 50, 70

c. 8, 8, 10

d. 12, 12, 14

68. a. ultraviolet

b. ultraviolet

c. ultraviolet

69. a. sodium

b. arsenic

c. cesium

70. a. $\text{Cs}\cdot$

b. $\cdot\ddot{\text{Br}}\cdot$

c. $\cdot\text{Ca}\cdot$

d. $\cdot\ddot{\text{P}}\cdot$

71. c and d

72. single bond, one pair shared electrons;
double bond, two pairs of shared electrons;
triple bond, three pairs of shared electrons

73. Yes, an ionic compound has at least one polyatomic ion.

74. A cation has a positive charge, and an anion has a negative charge.

75. a. phosphate ion

b. aluminum ion

c. selenide ion

d. ammonium ion

76. a. silicon dioxide

b. potassium sulfate

c. carbonic acid

d. magnesium sulfide

77. a. $\text{Al}_2(\text{CO}_3)_3$

b. NO_2

c. K_2S

d. MnCrO_4

e. NaBr

78. 1.30×10^{-22} g

79. 7.38 g Be

80. $\text{C}_2\text{H}_2\text{O}_4$

81. a. 0.473 mol KNO_3

b. 9.91×10^{-2} mol SO_2

c. 3.74×10^{-2} mol PCl_3

82. a. $2\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$

b. $2\text{C}_3\text{H}_7\text{OH} + 9\text{O}_2 \rightarrow 6\text{CO}_2 + 8\text{H}_2\text{O}$

c. $2\text{Al} + 3\text{FeO} \rightarrow 3\text{Fe} + \text{Al}_2\text{O}_3$

83. a. 1, 1, 1, 2

b. 1, 3, 3, 1

c. 1, 1, 1, 2

84. a. $\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$

b. $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$

c. $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$

85. a. sodium ion and nitrate ion

b. aluminum ion and nitrate ion

c. magnesium ion and sulfate ion

86. $\text{C}_5\text{H}_{10}\text{O}_5 + 5\text{O}_2 \rightarrow 5\text{CO}_2 + 5\text{H}_2\text{O}$