Stoichiometry

True/False
Indicate whether the statement is true or false.

____ 1. The mass of a single atom of an element (in amu) is numerically EQUAL to the mass in grams of 1 mole of that element.

____ 2. The molecular weight is ALWAYS a whole-number multiple of the empirical formula weight.

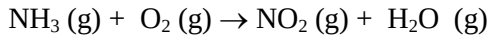
____ 3. Carbon dioxide called a greenhouse gas because bacterial degradation of fertilizers in a greenhouse environment produce large quantities of carbon dioxide.

____ 4. A great deal of the carbon dioxide produced by the combustion of fossil fuels is absorbed into the oceans.

____ 5. The quantity of product that is calculated to form when all of the limiting reagent reacts is called the actual yield.

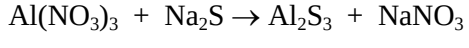
Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 6. When the following equation is balanced, the coefficients are _____.



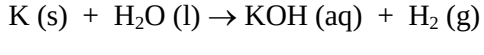
a. 1, 1, 1, 1
b. 4, 7, 4, 6
c. 2, 3, 2, 3
d. 1, 3, 1, 2
e. 4, 3, 4, 3

____ 7. When the following equation is balanced, the coefficients are _____.



a. 2, 3, 1, 6
b. 2, 1, 3, 2
c. 1, 1, 1, 1
d. 4, 6, 3, 2
e. 2, 3, 2, 3

____ 8. When the following equation is balanced, the coefficient of H_2 is _____.



a. 1
b. 2
c. 3
d. 4

e. 5

____ 9. When the following equation is balanced, the coefficient of Al is _____.

$Al\ (s) + H_2O\ (l) \rightarrow Al(OH)_3\ (s) + H_2\ (g)$

a. 1
b. 2
c. 3
d. 5
e. 4

____ 10. When the following equation is balanced, the coefficient of H_2O is _____.

$Ca\ (s) + H_2O\ (l) \rightarrow Ca(OH)_2\ (aq) + H_2\ (g)$

a. 1
b. 2
c. 3
d. 5
e. 4

____ 11. When the following equation is balanced, the coefficient of Al_2O_3 is _____.

$Al_2O_3\ (s) + C\ (s) + Cl_2\ (g) \rightarrow AlCl_3\ (s) + CO\ (g)$

a. 1
b. 2
c. 3
d. 4
e. 5

____ 12. When the following equation is balanced, the coefficient of H_2S is _____.

$FeCl_3\ (aq) + H_2S\ (g) \rightarrow Fe_2S_3\ (s) + HCl\ (aq)$

a. 1
b. 2
c. 3
d. 5
e. 4

____ 13. When the following equation is balanced, the coefficient of HCl is _____.

$CaCO_3\ (s) + HCl\ (aq) \rightarrow CaCl_2\ (aq) + CO_2\ (g) + H_2O\ (l)$

a. 1
b. 2
c. 3
d. 4
e. 0

____ 14. When the following equation is balanced, the coefficient of HNO_3 is _____.

$HNO_3\ (aq) + CaCO_3\ (s) \rightarrow Ca(NO_3)_2\ (aq) + CO_2\ (g) + H_2O\ (l)$

a. 1
b. 2
c. 3
d. 5
e. 4

____ 15. When the following equation is balanced, the coefficient of H_3PO_4 is _____.

$H_3PO_4\ (aq) + NaOH\ (aq) \rightarrow Na_3PO_4\ (aq) + H_2O\ (l)$

a. 1
b. 2
c. 3
d. 4
e. 0

____ 16. When the following equation is balanced, the coefficient of $C_3H_8O_3$ is _____.

$C_3H_8O_3\ (g) + O_2\ (g) \rightarrow CO_2\ (g) + H_2O\ (g)$

a. 1
b. 2
c. 3
d. 7
e. 5

____ 17. When the following equation is balanced, the coefficient of O_2 is _____.

$C_2H_4O\ (g) + O_2\ (g) \rightarrow CO_2\ (g) + H_2O\ (g)$

a. 2
b. 3
c. 4
d. 5
e. 1

____ 18. When the following equation is balanced, the coefficient of H_2 is _____.

$CO\ (g) + H_2\ (g) \rightarrow H_2O\ (g) + CH_4\ (g)$

a. 1
b. 2
c. 3
d. 4
e. 0

____ 19. When the following equation is balanced, the coefficient of H_2SO_4 is _____.

$H_2SO_4\ (aq) + NaOH\ (aq) \rightarrow Na_2SO_4\ (aq) + H_2O\ (l)$

a. 1
b. 2
c. 3
d. 4
e. 0.5

____ 20. When the following equation is balanced, the coefficient of water is _____.

$K\ (s)\ +\ H_2O\ (l) \rightarrow KOH\ (aq)\ +\ H_2\ (g)$

a. 1
b. 2
c. 3
d. 4
e. 5

____ 21. When the following equation is balanced, the coefficient of hydrogen is _____.

$K\ (s)\ +\ H_2O\ (l)\ \rightarrow KOH\ (aq)\ +\ H_2\ (g)$

a. 1
b. 2
c. 3
d. 4
e. 5

____ 22. When the following equation is balanced, the coefficient of oxygen is _____.

$PbS\ (s)\ +\ O_2\ (g) \rightarrow PbO\ (s) + SO_2\ (g)$

a. 1
b. 3
c. 2
d. 4
e. 5

____ 23. When the following equation is balanced, the coefficient of sulfur dioxide is _____.

$PbS\ (s)\ +\ O_2\ (g) \rightarrow PbO\ (s)\ +\ SO_2\ (g)$

a. 5
b. 1
c. 3
d. 2
e. 4

____ 24. When the following equation is balanced, the coefficient of dinitrogen pentoxide is _____.

$N_2O_5\ (g)\ +\ H_2O\ (l) \rightarrow HNO_3\ (aq)$

a. 1

b. 2
c. 3
d. 4
e. 5

____ 25. When the following equation is balanced, the coefficient of water is _____.

N_2O_5 (g) + H_2O (l) $\rightarrow$ HNO_3 (aq)

a. 5
b. 2
c. 3
d. 4
e. 1

____ 26. When the following equation is balanced, the coefficient of nitric acid is _____.

N_2O_5 (g) + H_2O (l) $\rightarrow$ HNO_3 (aq)

a. 5
b. 2
c. 3
d. 4
e. 1

____ 27. Write the balanced equation for the reaction that occurs when methanol, CH_3OH (1), is burned in air. What is the coefficient of methanol in the balanced equation?
a. 1
b. 2
c. 3
d. 4
e. 3/2

____ 28. Write the balanced equation for the reaction that occurs when methanol, CH_3OH (1), is burned in air. What is the coefficient of oxygen in the balanced equation?
a. 1
b. 2
c. 3
d. 4
e. 3/2

____ 29. What is the coefficient of O_2 when the following equation is completed and balanced?

$C_4H_8O_2$ + O_2 $\rightarrow$ _____

a. 2
b. 3
c. 5
d. 6
e. 1

____ 30. Predict the product in the combination reaction below.

$Al\ (s)\ +\ N_2\ (g) \rightarrow$ _____

a. AlN
b. Al_3N
c. AlN_2
d. Al_3N_2
e. AlN_3

____ 31. The balanced equation for the decomposition of sodium azide is _____.
a. $2NaN_3\ (s) \rightarrow 2Na\ (s)\ +\ 3N_2\ (g)$
b. $2NaN_3\ (s) \rightarrow Na_2\ (s)\ +\ 3N_2\ (g)$
c. $NaN_3\ (s) \rightarrow Na\ (s)\ +\ N_2\ (g)$
d. $NaN_3\ (s) \rightarrow Na\ (s)\ +\ N_2\ (g)\ +\ N\ (g)$
e. $2NaN_3\ (s) \rightarrow 2Na\ (s)\ +\ 2N_2\ (g)$

____ 32. There are _____ mol of carbon atoms in 4 mol of dimethylsulfoxide (C_2H_6SO).
a. 2
b. 6
c. 8
d. 4
e. 3

____ 33. There are _____ sulfur atoms in 25 molecules of $C_4H_4S_2$.
a. 1.5×10^{25}
b. 4.8×10^{25}
c. 3.0×10^{25}
d. 50
e. 6.02×10^{23}

____ 34. There are _____ hydrogen atoms in 25 molecules of $C_4H_4S_2$.
a. 25
b. 3.8×10^{24}
c. 6.0×10^{25}
d. 100
e. 1.5×10^{25}

____ 35. A sample of C_3H_8O that contains 200 molecules contains _____ carbon atoms.
a. 600
b. 200
c. 3.61×10^{26}
d. 1.20×10^{26}
e. 4.01×10^{25}

____ 36. How many grams of hydrogen are in 46 g of CH_4O?
a. 5.8
b. 1.5
c. 2.8
d. 0.36
e. 184

____ 37. How many grams of oxygen are in 65 g of $C_2H_2O_2$?

a. 18
b. 29
c. 9.0
d. 36
e. 130

____ 38. How many moles of carbon dioxide are there in 52.06 g of carbon dioxide?
a. 0.8452
b. 1.183
c. 6.022×10^{23}
d. 8.648×10^{23}
e. 3.134×10^{25}

____ 39. There are _____ molecules of methane in 0.123 mol of methane (CH_4).
a. 5
b. 2.46×10^{-2}
c. 2.04×10^{-25}
d. 7.40×10^{22}
e. 0.615

____ 40. A 2.25-g sample of magnesium nitrate, $Mg(NO_3)_2$, contains _____ mol of this compound.
a. 38.4
b. 65.8
c. 148.3
d. 0.0261
e. 0.0152

____ 41. A 22.5-g sample of ammonium carbonate contains _____ mol of ammonium ions.
a. 0.468
b. 0.288
c. 0.234
d. 2.14
e. 3.47

____ 42. What is the empirical formula of a compound that contains 27.0% S, 13.4% O, and 59.6% Cl by mass?
a. SOCl
b. $SOCl_2$
c. S_2OCl
d. SO_2Cl
e. $ClSO_4$

____ 43. What is the empirical formula of a compound that contains 29% Na, 41% S, and 30% O by mass?
a. $Na_2S_2O_3$
b. $NaSO_2$
c. NaSO
d. $NaSO_3$
e. $Na_2S_2O_6$

____ 44. What is the empirical formula of a compound that contains 49.4% K, 20.3% S, and 30.3% O by mass?
a. KSO_2
b. KSO_3
c. K_2SO_4

d. K_2SO_3
e. KSO_4

____ 45. A compound contains 40.0% C, 6.71% H, and 53.29% O by mass. The molecular weight of the compound is 60.05 amu. The molecular formula of this compound is _____.
a. $C_2H_4O_2$
b. CH_2O
c. $C_2H_3O_4$
d. $C_2H_2O_4$
e. CHO_2

____ 46. A compound that is composed of carbon, hydrogen, and oxygen contains 70.6% C, 5.9% H, and 23.5% O by mass. The molecular weight of the compound is 136 amu. What is the molecular formula?
a. $C_8H_8O_2$
b. C_8H_4O
c. C_4H_4O
d. $C_9H_{12}O$
e. $C_5H_6O_2$

____ 47. A compound that is composed of only carbon and hydrogen contains 85.7% C and 14.3% H by mass. What is the empirical formula of the compound?
a. CH_2
b. C_2H_4
c. CH_4
d. C_4H_8
e. $C_{86}H_{14}$

____ 48. A compound that is composed of only carbon and hydrogen contains 80.0% C and 20.0% H by mass. What is the empirical formula of the compound?
a. $C_{20}H_{60}$
b. C_7H_{20}
c. CH_3
d. C_2H_6
e. CH_4

____ 49. A compound contains 38.7% K, 13.9% N, and 47.4% O by mass. What is the empirical formula of the compound?
a. KNO_3
b. $K_2N_2O_3$
c. KNO_2
d. K_2NO_3
e. K_4NO_5

____ 50. A compound is composed of only C, H, and O. The combustion of a 0.519-g sample of the compound yields 1.24 g of CO_2 and 0.255 g of H_2O. What is the empirical formula of the compound?
a. C_6H_6O
b. C_3H_3O
c. CH_3O
d. $C_2H_6O_5$
e. $C_2H_6O_2$

____ 51. Combustion of a 1.031-g sample of a compound containing only carbon, hydrogen, and oxygen produced 2.265 g of CO_2 and 1.236 g of H_2O. What is the empirical formula of the compound?

a. C_3H_8O
b. C_3H_5O
c. $C_6H_{16}O_2$
d. $C_3H_9O_3$
e. $C_3H_6O_3$

____ 52. Combustion of a 0.9835-g sample of a compound containing only carbon, hydrogen, and oxygen produced 1.900 g of CO_2 and 1.070 g of H_2O. What is the empirical formula of the compound?
a. C_2H_5O
b. $C_4H_{10}O_2$
c. $C_4H_{11}O_2$
d. $C_4H_{10}O$
e. $C_2H_5O_2$

____ 53. Magnesium and nitrogen react in a combination reaction to produce magnesium nitride:

$3\ Mg\ +\ N_2 \rightarrow Mg_3N_2$

In a particular experiment, a 9.27-g sample of N_2 reacts completely. The mass of Mg consumed is _____ g.
a. 8.04
b. 24.1
c. 16.1
d. 0.92
e. 13.9

____ 54. The combustion of ammonia in the presence of excess oxygen yields NO_2 and H_2O:

$4\ NH_3\ (g)\ +\ 7\ O_2\ (g) \rightarrow 4\ NO_2\ (g)\ +\ 6\ H_2O\ (g)$

The combustion of 28.8 g of ammonia consumes _____ g of oxygen.
a. 94.7
b. 54.1
c. 108
d. 15.3
e. 28.8

____ 55. The combustion of ammonia in the presence of excess oxygen yields NO_2 and H_2O:

$4\ NH_3\ (g)\ +\ 7\ O_2\ (g) \rightarrow 4\ NO_2\ (g)\ +\ 6\ H_2O\ (g)$

The combustion of 43.9 g of ammonia produces _____ g of NO_2.
a. 2.58
b. 178
c. 119
d. 0.954
e. 43.9

____ 56. The combustion of propane (C_3H_8) produces CO_2 and H_2O:

$C_3H_8\ (g)\ +\ 5O_2\ (g) \rightarrow 3CO_2\ (g)\ +\ 4H_2O\ (g)$

The reaction of 2.5 mol of O_2 will produce _____ mol of H_2O.

a. 4.0
b. 3.0
c. 2.5
d. 2.0
e. 1.0

____ 57. The combustion of propane (C_3H_8) in the presence of excess oxygen yields CO_2 and H_2O:

$$C_3H_8\,(g) + 5O_2\,(g) \rightarrow 3CO_2\,(g) + 4H_2O\,(g)$$

When 2.5 mol of O_2 are consumed in their reaction, _____ mol of CO_2 are produced.

a. 1.5
b. 3.0
c. 5.0
d. 6.0
e. 2.5

____ 58. Calcium carbide (CaC_2) reacts with water to produce acetylene (C_2H_2):

$$CaC_2\,(s) + 2H_2O\,(g) \rightarrow Ca(OH)_2\,(s) + C_2H_2\,(g)$$

Production of 13 g of C_2H_2 requires consumption of _____ g of H_2O.

a. 4.5
b. 9.0
c. 18
d. 4.8×10^{2}
e. 4.8×10^{-2}

____ 59. Under appropriate conditions, nitrogen and hydrogen undergo a combination reaction to yield ammonia:

$$N_2\,(g) + 3H_2\,(g) \rightarrow 2NH_3\,(g)$$

A 7.1-g sample of N_2 requires _____ g of H_2 for complete reaction.

a. 0.51
b. 0.76
c. 1.2
d. 1.5
e. 17.2

____ 60. Lead (II) carbonate decomposes to give lead (II) oxide and carbon dioxide:

$$PbCO_3\,(s) \rightarrow PbO\,(s) + CO_2\,(g)$$

How many grams of lead (II) oxide will be produced by the decomposition of 2.50 g of lead (II) carbonate?

a. 0.41
b. 2.50
c. 0.00936
d. 2.09
e. 2.61

____ 61. GeF_3H is formed from GeH_4 and GeF_4 in the combination reaction:

$GeH_4 + 3GeF_4 \rightarrow 4GeF_3H$

If the reaction yield is 92.6%, how many moles of GeF_4 are needed to produce 8.00 mol of GeF_3H?

a. 3.24
b. 5.56
c. 6.48
d. 2.78
e. 2.16

____ 62. What mass in grams of hydrogen is produced by the reaction of 4.73 g of magnesium with 1.83 g of water?

$Mg\ (s) + 2H_2O\ (l) \rightarrow Mg(OH)_2\ (s) + H_2\ (g)$

a. 0.102
b. 0.0162
c. 0.0485
d. 0.219
e. 0.204

____ 63. Silver nitrate and aluminum chloride react with each other by exchanging anions:

$3AgNO_3\ (aq) + AlCl_3\ (aq) \rightarrow Al(NO_3)_3\ (aq) + 3AgCl\ (s)$

What mass in grams of AgCl is produced when 4.22 g of $AgNO_3$ react with 7.73 g of $A1C1_3$?

a. 17.6
b. 4.22
c. 24.9
d. 3.56
e. 11.9

____ 64. How many moles of magnesium oxide are produced by the reaction of 3.82 g of magnesium nitride with 7.73 g of water?

$Mg_3N_2 + 3H_2O \rightarrow 2NH_3 + 3MgO$

a. 0.114
b. 0.0378
c. 0.429
d. 0.0756
e. 4.57

____ 65. A 3.82-g sample of magnesium nitride is reacted with 7.73 g of water.

$Mg_3N_2 + 3H_2O \rightarrow 2NH_3 + 3MgO$

The yield of MgO is 3.60 g. What is the percent yield in the reaction?

a. 94.5
b. 78.7
c. 46.6
d. 49.4

e. 99.9

____ 66. Pentacarbonyliron ($Fe(CO)_5$) reacts with phosphorous trifluoride (PF_3) and hydrogen, releasing carbon monoxide:

$Fe(CO)_5 + PF_3 + H_2 \rightarrow Fe(CO)_2(PF_3)_2(H)_2 + CO$ (not balanced)

The reaction of 5.0 mol of $Fe(CO)_5$, 8.0 mol of PF_3 and 6.0 mol of H_2 will release _____ mol of CO.
a. 15
b. 5.0
c. 24
d. 6.0
e. 12

____ 67. What is the maximum mass in grams of NH_3 that can be produced by the reaction of 1.0 g of N_2 with 3.0 g of H_2 via the equation below?

$N_2 (g) + H_2 (g) \rightarrow NH_3 (g)$ (not balanced)

a. 2.0
b. 1.2
c. 0.61
d. 17
e. 4.0

____ 68. What is the maximum amount in grams of SO_3 that can be produced by the reaction of 1.0 g of S with 1.0 g of O_2 via the equation below?

$S (s) + O_2 (g) \rightarrow SO_3 (g)$ (not balanced)

a. 0.27
b. 1.7
c. 2.5
d. 3.8
e. 2.0

____ 69. Solid aluminum and gaseous oxygen react in a combination reaction to produce aluminum oxide:

$4Al (s) + 3O_2 (g) \rightarrow 2Al_2O_3 (s)$

The maximum amount of Al_2O_3 that can be produced from 2.5 g of Al and 2.5 g of O_2 is _____ g.
a. 9.4
b. 7.4
c. 4.7
d. 5.3
e. 5.0

____ 70. Sulfur and fluorine react in a combination reaction to produce sulfur hexafluoride:

$S (s) + 3F_2 (g) \rightarrow SF_6(g)$
The maximum amount of SF_6 that can be produced from the reaction of 3.5 g of sulfur with 4.5 g of fluorine is _____ g.

a. 12
b. 3.2
c. 5.8
d. 16
e. 8.0

____ 71. Solid aluminum and gaseous oxygen react in a combination reaction to produce aluminum oxide:

$4Al\ (s) + 3O_2\ (g) \rightarrow 2Al_2O_3\ (s)$

In a particular experiment, the reaction of 2.5 g of Al with 2.5 g of O_2 produced 3.5 g of Al_2O_3. The % yield of the reaction is _____.
a. 74
b. 37
c. 47
d. 66
e. 26

____ 72. Sulfur and oxygen react in a combination reaction to produce sulfur trioxide, an environmental pollutant:

$2S\ (s) + 3O_2\ (g) \rightarrow 2SO_3\ (g)$

In a particular experiment, the reaction of 1.0 g S with 1.0 g O_2 produced 0.80 g of SO_3. The % yield in this experiment is _____.
a. 30
b. 29
c. 21
d. 88
e. 48

____ 73. Sulfur and fluorine react in a combination reaction to produce sulfur hexafluoride:

$S\ (s) + 3F_2\ (g) \rightarrow SF_6\ (g)$

In a particular experiment, the percent yield is 79.0%. This means that in this experiment, a 7.90-g sample of fluorine yields _____ g of SF_6.
a. 30.3
b. 10.1
c. 7.99
d. 24.0
e. 0.110

____ 74. When the following equation is balanced, the coefficients are _____.

$C_8H_{18} + O_2 \rightarrow CO_2 + H_2O$

a. 2, 3, 4, 4
b. 1, 4, 8, 9
c. 2, 12, 8, 9
d. 4, 4, 32, 36
e. 2, 25, 16, 18

____ 75. Of the reactions below, which one is <u>not</u> a combination reaction?
a. $C + O_2 \rightarrow CO_2$
b. $2Mg + O_2 \rightarrow 2MgO$
c. $2N_2 + 3H_2 \rightarrow 2NH_3$
d. $CaO + H_2O \rightarrow Ca(OH)_2$
e. $2CH_4 + 4O_2 \rightarrow 2CO_2 + 4H_2O$

____ 76. When a hydrocarbon burns in air, what component of air reacts?
a. oxygen
b. nitrogen
c. carbon dioxide
d. water
e. argon

____ 77. Of the reactions below, which one is a decomposition reaction?
a. $NH_4Cl \rightarrow NH_3 + HCl$
b. $2Mg + O_2 \rightarrow 2MgO$
c. $2N_2 + 3H_2 \rightarrow 2NH_3$
d. $2CH_4 + 4O_2 \rightarrow 2CO_2 + 4H_2O$
e. $Cd(NO_3)_2 + Na_2S \rightarrow CdS + 2NaNO_3$

____ 78. Which one of the following substances is the product of this combination reaction?

$Al\ (s) + I_2\ (s) \rightarrow$ _____

a. AlI_2
b. AlI
c. AlI_3
d. Al_2I_3
e. Al_3I_2

____ 79. Which one of the following is <u>not</u> true concerning automotive air bags?
a. They are inflated as a result of a decomposition reaction
b. They are loaded with sodium azide initially
c. The gas used for inflating them is oxygen
d. The two products of the decomposition reaction are sodium and nitrogen
e. A gas is produced when the air bag activates.

____ 80. The reaction used to inflate automobile airbags _____.
a. produces sodium gas
b. is a combustion reaction
c. is a combination reaction
d. violates the law of conservation of mass
e. is a decomposition reaction

____ 81. Which of the following are combination reactions?
1) $CH_4\ (g) + O_2\ (g) \rightarrow CO_2\ (g) + H_2O\ (l)$
2) $CaO\ (s) + CO_2\ (g) \rightarrow CaCO_3\ (s)$
3) $Mg\ (s) + O_2\ (g) \rightarrow MgO\ (s)$
4) $PbCO_3\ (s) \rightarrow PbO\ (s) + CO_2\ (g)$
a. 1, 2, and 3

b. 2 and 3
c. 1, 2, 3, and 4
d. 4 only
e. 2, 3, and 4

____ 82. Which of the following are combustion reactions?
1) CH_4 (g) + O_2 (g) → CO_2 (g) + H_2O (l)
2) CaO (s) + CO_2 (g) → $CaCO_3$ (s)
3) $PbCO_3$ (s) → PbO (s) + CO_2 (g)
4) CH_3OH (l) + O_2 (g) → CO_2 (g) + H_2O (l)
a. 1 and 4
b. 1, 2, 3, and 4
c. 1, 3, and 4
d. 2, 3, and 4
e. 3 and 4

____ 83. Which of the following are decomposition reactions?
1) CH_4 (g) + O_2 (g) → CO_2 (g) + H_2O (l)
2) CaO (s) + CO_2 (g) → $CaCO_3$ (s)
3) Mg (s) + O_2 (g) → MgO (s)
4) $PbCO_3$ (s) → PbO (s) + CO_2 (g)
a. 1, 2, and 3
b. 4 only
c. 1, 2, 3, and 4
d. 2 and 3
e. 2, 3, and 4

____ 84. The formula of nitrobenzene is $C_6H_5NO_2$. The molecular weight of this compound is _____ amu.
a. 107.11
b. 43.03
c. 109.10
d. 123.11
e. 3.06

____ 85. The formula weight of potassium dichromate ($K_2Cr_2O_7$) is _____ amu.
a. 107.09
b. 255.08
c. 242.18
d. 294.18
e. 333.08

____ 86. The formula weight of potassium phosphate (K_3PO_4) is _____ amu.
a. 173.17
b. 251.37
c. 212.27
d. 196.27
e. 86.07

____ 87. The formula weight of aluminum sulfate ($Al_2(SO_4)_3$) is _____ amu.
a. 342.15
b. 123.04
c. 59.04

d. 150.14
e. 273.06

____ 88. The formula weight of silver chromate (Ag_2CrO_4) is _____ amu.
a. 159.87
b. 223.87
c. 331.73
d. 339.86
e. 175.87

____ 89. The formula weight of ammonium sulfate ($(NH_4)_2SO_4$), rounded to the nearest integer, is _____ amu.
a. 100
b. 118
c. 116
d. 132
e. 264

____ 90. The molecular weight of the acetic acid (CH_3CO_2H), rounded to the nearest integer, is _____ amu.
a. 60
b. 48
c. 44
d. 32

____ 91. The molecular weight of the ethanol (C_2H_5OH), rounded to the nearest integer, is _____ amu.
a. 34
b. 41
c. 30
d. 46
e. 92

____ 92. The molecular weight of glucose ($C_6H_{12}O_6$), rounded to the nearest integer, is _____ amu.
a. 24
b. 96
c. 136
d. 180
e. 224

____ 93. What is the mass % of carbon in dimethylsulfoxide (C_2H_6SO) rounded to three significant figures?
a. 60.0
b. 20.6
c. 30.7
d. 7.74
e. 79.8

____ 94. The mass % of H in methane (CH_4) is _____.
a. 25.13
b. 4.032
c. 74.87
d. 92.26
e. 7.743

____ 95. The mass % of Al in aluminum sulfate ($Al_2(SO_4)_3$) is _____.
a. 7.886

b. 15.77
c. 21.93
d. 45.70
e. 35.94

____ 96. The formula weight of a substance is _____.
a. identical to the molar mass
b. the same as the percent by mass weight
c. determined by combustion analysis
d. the sum of the atomic weights of each atom in its chemical formula
e. the weight of a sample of the substance

____ 97. The formula weight of calcium nitrate ($Ca(NO_3)_2$), rounded to one decimal place, is _____ amu.
a. 102.1
b. 164.0
c. 204.2
d. 150.1
e. 116.1

____ 98. The formula weight of magnesium fluoride (MgF_2), rounded to one decimal place, is _____ amu.
a. 86.6
b. 43.3
c. 62.3
d. 67.6
e. 92.9

____ 99. The formula weight of lead nitrate ($Pb(NO_3)_2$) is _____ amu.
a. 269.2
b. 285.2
c. 317.2
d. 331.2
e. 538.4

____ 100. The mass % of C in methane (CH_4) is _____.
a. 25.13
b. 133.6
c. 74.87
d. 92.26
e. 7.743

____ 101. The mass % of F in the binary compound KrF_2 is _____.
a. 18.48
b. 45.38
c. 68.80
d. 81.52
e. 31.20

____ 102. Calculate the percentage by mass of nitrogen in $PtCl_2(NH_3)_2$.
a. 4.67
b. 9.34
c. 9.90
d. 4.95
e. 12.67

____ 103. Calculate the percentage by mass of lead in $Pb(NO_3)_2$.
a. 38.6
b. 44.5
c. 62.6
d. 65.3
e. 71.2

____ 104. Calculate the percentage by mass of nitrogen in $Pb(NO_3)_2$.
a. 4.2
b. 5.2
c. 8.5
d. 10.4
e. 12.6

____ 105. Calculate the percentage by mass of oxygen in $Pb(NO_3)_2$.
a. 9.7
b. 14.5
c. 19.3
d. 29.0
e. 33.4

____ 106. Calculate the percentage by mass of chlorine in $PtCl_2(NH_3)_2$.
a. 23.63
b. 11.82
c. 25.05
d. 12.53
e. 18.09

____ 107. Calculate the percentage by mass of hydrogen in $PtCl_2(NH_3)_2$.
a. 1.558
b. 1.008
c. 0.672
d. 0.034
e. 2.016

____ 108. One mole of _____ contains the largest number of atoms.
a. S_8
b. $C_{10}H_8$
c. $Al_2(SO_4)_3$
d. Na_3PO_4
e. Cl_2

____ 109. One million argon atoms is _____ mol (rounded to two significant figures) of argon atoms.
a. 3.0
b. 1.7×10^{-18}
c. 6.0×10^{23}
d. 1.0×10^{-6}
e. $1.0 \times 10^{+6}$

____ 110. There are _____ atoms of oxygen are in 300 molecules of CH_3CO_2H.
a. 300
b. 600

c. 3.01×10^{24}
d. 3.61×10^{26}
e. 1.80×10^{26}

____ 111. How many molecules of CH_4 are in 48.2 g of this compound?
a. 5.00×10^{24}
b. 3.00
c. 2.90×10^{25}
d. 1.81×10^{24}
e. 4.00

____ 112. A 30.5 gram sample of glucose ($C_6H_{12}O_6$) contains _____ mol of glucose.
a. 0.424
b. 0.169
c. 5.90
d. 2.36
e. 0.136

____ 113. A 30.5 gram sample of glucose ($C_6H_{12}O_6$) contains _____ atoms of carbon.
a. 1.02×10^{23}
b. 6.12×10^{23}
c. 6.02×10^{23}
d. 2.04×10^{23}
e. 1.22×10^{24}

____ 114. A sample of CH_2F_2 with a mass of 19 g contains _____ atoms of F.
a. 2.2×10^{23}
b. 38
c. 3.3×10^{24}
d. 4.4×10^{23}
e. 9.5

____ 115. A sample of CH_4O with a mass of 32.0 g contains _____ molecules of CH_4O.
a. 5.32×10^{-23}
b. 1.00
c. 1.88×10^{22}
d. 6.02×10^{23}
e. 32.0

____ 116. How many atoms of nitrogen are in 10 g of NH_4NO_3?
a. 3.5
b. 1.5×10^{23}
c. 3.0×10^{23}
d. 1.8
e. 2

____ 117. Gaseous argon has a density of 1.40 g/L at standard conditions. How many argon atoms are in 1.00 L of argon gas at standard conditions?
a. 4.76×10^{22}
b. 3.43×10^{25}
c. 2.11×10^{22}

d. 1.59×10^{25}
e. 6.02×10^{23}

____ 118. What is the mass in grams of 9.76×10^{12} atoms of naturally occurring sodium?
a. 22.99
b. 1.62×10^{-11}
c. 3.73×10^{-10}
d. 7.05×10^{-13}
e. 2.24×10^{14}

____ 119. How many moles of pyridine (C_5H_5N) are contained in 3.13 g of pyridine?
a. 0.0396
b. 25.3
c. 0.319
d. 0.00404
e. 4.04×10^{3}

____ 120. How many oxygen atoms are contained in 2.74 g of $Al_2(SO_4)_3$?
a. 12
b. 6.02×10^{23}
c. 7.22×10^{24}
d. 5.79×10^{22}
e. 8.01×10^{-3}

____ 121. The total number of atoms in 0.111 mol of $Fe(CO)_3(PH_3)_2$ is _____.
a. 15.0
b. 1.00×10^{24}
c. 4.46×10^{21}
d. 1.67
e. 2.76×10^{-24}

____ 122. How many sulfur dioxide molecules are there in 1.80 mol of sulfur dioxide?
a. 1.08×10^{23}
b. 6.02×10^{24}
c. 1.80×10^{24}
d. 1.08×10^{24}
e. 6.02×10^{23}

____ 123. How many sulfur dioxide molecules are there in 0.180 mol of sulfur dioxide?
a. 1.80×10^{23}
b. 6.02×10^{24}
c. 6.02×10^{23}
d. 1.08×10^{24}
e. 1.08×10^{23}

____ 124. How many carbon atoms are there in 52.06 g of carbon dioxide?
a. 5.206×10^{24}
b. 3.134×10^{25}
c. 7.122×10^{23}
d. 8.648×10^{-23}
e. 1.424×10^{24}

____ 125. How many oxygen atoms are there in 52.06 g of carbon dioxide?
a. 1.424×10^{24}
b. 6.022×10^{23}
c. 1.204×10^{24}
d. 5.088×10^{23}
e. 1.018×10^{24}

____ 126. How many moles of sodium carbonate contain 1.773×10^{17} carbon atoms?
a. 5.890×10^{-7}
b. 2.945×10^{-7}
c. 1.473×10^{-7}
d. 8.836×10^{-7}
e. 9.817×10^{-8}

____ 127. How many grams of sodium carbonate contain 1.773×10^{17} carbon atoms?
a. 3.121×10^{-5}
b. 1.011×10^{-5}
c. 1.517×10^{-5}
d. 9.100×10^{-5}
e. 6.066×10^{-5}

____ 128. The compound responsible for the characteristic smell of garlic is allicin, $C_6H_{10}OS_2$. The mass of 1.00 mol of allicin, rounded to the nearest integer, is _____ g.
a. 34
b. 162
c. 86
d. 61
e. 19

____ 129. The molecular formula of aspartame, the generic name of NutraSweet®, is $C_{14}H_{18}N_2O_5$. The molar mass of aspartame, rounded to the nearest integer, is _____ g.
a. 24
b. 156
c. 294
d. 43
e. 39

____ 130. There are _____ oxygen atoms in 30 molecules of $C_{20}H_{42}S_3O_2$
a. 6.0×10^{23}
b. 1.8×10^{25}
c. 3.6×10^{25}
d. 1.2×10^{24}
e. 60

____ 131. A nitrogen oxide is 63.65% by mass nitrogen. The molecular formula could be _____.
a. NO
b. NO_2
c. N_2O
d. N_2O_4
e. either NO_2 or N_2O_4

____ 132. A sulfur oxide is 50.0% by mass sulfur. This molecular formula could be _____.
a. SO
b. SO_2
c. S_2O
d. S_2O_4
e. either SO_2 or S_2O_4

____ 133. Which hydrocarbon pair below have identical mass percentage of C?
a. C_3H_4 and C_3H_6
b. C_2H_4 and C_3H_4
c. C_2H_4 and C_4H_2
d. C_2H_4 and C_3H_6
e. none of the above

____ 134. Sulfur and oxygen react to produce sulfur trioxide. In a particular experiment, 7.9 grams of SO_3 are produced by the reaction of 5.0 grams of O_2 with 6.0 grams of S. What is the % yield of SO_3 in this experiment?

$S\ (s) + O_2\ (g) \rightarrow SO_3\ (g)$ (not balanced)

a. 32
b. 63
c. 75
d. 95
e. 99

____ 135. Propane (C_3H_8) reacts with oxygen in the air to produce carbon dioxide and water. In a particular experiment, 38.0 grams of carbon dioxide are produced from the reaction of 22.05 grams of propane with excess oxygen. What is the % yield in this reaction?
a. 38.0
b. 57.6
c. 66.0
d. 86.4
e. 94.5

____ 136. The molecular weight of urea ($(NH_2)_2CO$), a compound used as a nitrogen fertilizer, is _____ amu (rounded to one decimal place).
a. 44.0
b. 43.0
c. 60.1
d. 8.0
e. 32.0

____ 137. What is the empirical formula of a compound that is 62.0% C, 10.4% H, and 27.5% O by mass?
a. C_3HO
b. C_6HO_3
c. $C_6H_{12}O_2$
d. $C_5H_{10}O_2$
e. C_3H_6O

____ 138. Lithium and nitrogen react to produce lithium nitride:

$6Li\ (s) + N_2\ (g) \rightarrow 2Li_3N\ (s)$

How many moles of N_2 are needed to react with 0.500 mol of lithium?
a. 3.00
b. 0.500
c. 0.167
d. 1.50
e. 0.0833

____ 139. Lithium and nitrogen react to produce lithium nitride:

$6Li\ (s) + N_2\ (g) \rightarrow 2Li_3N\ (s)$

How many moles of lithium nitride are produced when 0.450 mol of lithium react in this fashion?
a. 0.150
b. 0.900
c. 0.0750
d. 1.35
e. 0.225

____ 140. Lithium and nitrogen react in a combination reaction to produce lithium nitride:

$6Li\ (s) + N_2\ (g) \rightarrow 2Li_3N\ (s)$

How many moles of lithium are needed to produce 0.60 mol of Li_3N when the reaction is carried out in the presence of excess nitrogen?
a. 0.30
b. 1.8
c. 0.20
d. 0.40
e. 3.6

____ 141. Automotive air bags inflate when sodium azide decomposes explosively to its constituent elements:

$2NaN_3\ (s) \rightarrow 2Na\ (s) + 3N_2\ (g)$

How many moles of N_2 are produced by the decomposition of 2.88 mol of sodium azide?
a. 1.92
b. 8.64
c. 4.32
d. 0.960
e. 1.44

____ 142. Automotive air bags inflate when sodium azide decomposes explosively to its constituent elements:

$2NaN_3\ (s) \rightarrow 2Na\ (s) + 3N_2\ (g)$

How many grams of sodium azide are required to produce 33.0 g of nitrogen?
a. 1.77
b. 0.785
c. 76.6
d. 51.1
e. 114.9

____ 143. Magnesium burns in air with a dazzling brilliance to produce magnesium oxide:

$2Mg\ (s) + O_2\ (g) \rightarrow 2MgO\ (s)$

How many moles of O_2 are consumed when 0.770 mol of magnesium burns?
a. 0.0317
b. 2.60
c. 0.770
d. 1.54
e. 0.385

____ 144. Lithium and nitrogen react in a combination reaction to produce lithium nitride:

$6Li\ (s) + N_2\ (g) \rightarrow 2Li_3N\ (s)$

In a particular experiment, 3.50-g samples of each reagent are reacted. The theoretical yield of lithium nitride is _____ g.
a. 3.52
b. 2.93
c. 17.6
d. 5.85
e. 8.7

____ 145. Magnesium burns in air with a dazzling brilliance to produce magnesium oxide:

$2Mg\ (s) + O_2\ (g) \rightarrow 2MgO\ (s)$

When 4.00 g of magnesium burns, the theoretical yield of magnesium oxide is _____ g.
a. 4.00
b. 6.63
c. 0.165
d. 3.32
e. 13.3

____ 146. Calcium oxide reacts with water in a combination reaction to produce calcium hydroxide:

$CaO\ (s) + H_2O\ (l) \rightarrow Ca(OH)_2\ (s)$

A 4.50-g sample of CaO is reacted with 4.34 g of H_2O. How many grams of water remains after completion of reaction?
a. 0.00
b. 0.00892
c. 2.90
d. 1.04
e. 0.161

____ 147. Calcium oxide reacts with water in a combination reaction to produce calcium hydroxide:

$CaO\ (s) + H_2O\ (l) \rightarrow Ca(OH)_2\ (s)$

In a particular experiment, a 5.00-g sample of CaO is reacted with excess water and 6.11 g of $Ca(OH)_2$ is recovered. What is the percent yield in this experiment?

a. 122
b. 1.22
c. 7.19
d. 92.5
e. 81.9

Completion

Complete each statement.

148. A compound was found to contain 90.6% lead (Pb) and 9.4% oxygen. The empirical formula for this compound is _____.

149. The combustion of propane (C_3H_8) in the presence of excess oxygen yields CO_2 and H_2O:

$C_3H_8\,(g) + 5O_2\,(g) \rightarrow 3CO_2\,(g) + 4H_2O\,(g)$

When 7.3 g of C_3H_8 burns in the presence of excess O_2, _____ g of CO_2 is produced.

150. Under appropriate conditions, nitrogen and hydrogen undergo a combination reaction to yield ammonia:

$N_2\,(g) + 3H_2\,(g) \rightarrow 2NH_3\,(g)$

A 9.3-g sample of hydrogen requires _____ g of N_2 for a complete reaction.

151. Water can be formed from the stoichiometric reaction of hydrogen with oxygen:

$2H_2\,(g) + O_2\,(g) \rightarrow 2H_2O\,(g)$

A complete reaction of 5.0 g of O_2 with excess hydrogen produces _____ g of H_2O.

152. The combustion of carbon disulfide in the presence of excess oxygen yields carbon dioxide and sulfur dioxide:

$CS_2\,(g) + 3O_2\,(g) \rightarrow CO_2\,(g) + 2SO_2\,(g)$

The combustion of 15 g of CS_2 in the presence of excess oxygen yields _____ g of SO_2.

153. Determine the mass percent (to the hundredth's place) of H in sodium bicarbonate ($NaHCO_3$).

154. A certain alcohol contains only three elements, carbon, hydrogen, and oxygen. Combustion of a 50.00 gram sample of the alcohol produced 95.50 grams of CO_2 and 58.70 grams of H_2O. What is the empirical formula of the alcohol?

155. If 294 grams of FeS_2 is allowed to react with 176 grams of O_2 according to the following equation, how many grams of Fe_2O_3 are produced?

$FeS_2 + O_2 \rightarrow Fe_2O_3 + SO_2$

Essay

156. Complete and balance the following reaction, given that elemental rubidium reacts with elemental sulfur to form Rb_2S (s).

$Na\ (s)\ +\ S\ (s) \rightarrow$ _____