Stoichiometry Practice

____1. How many moles of ammonia, NH_3, will react with 20.0 moles of oxygen, O_2?

$$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO(g) + 6\ H_2O(g)$$

(A) 10.0
(B) 16.0
(C) 20.0
(D) 24.0
(E) 25.0

____2. The mass of 1.00 mole of $(NH_4)_2CO_3$ is

(A) 43.0 g
(B) 53.0 g
(C) 72.0 g
(D) 78.0 g
(E) 96.0 g

____3. There are two known chlorides of copper.

	Sample	Copper	Chlorine
I	9.90 g	6.35 g	3.55
II	13.45 g	6.35 g	7.10

What is the empirical formulas of these two compounds?

(A) CuCl, $CuCl_2$
(B) $CuCl_2$, CuCl
(C) CuCl, Cu_2Cl
(D) $CuCl_2$, Cu_2Cl
(E) Cu_2Cl, CuCl

____4. What is the percentage composition, by mass, for calcium carbonate, $CaCO_3$?

	Calcium	Carbon	Oxygen
I	38	40	22
II	40	12	48
III	45	15	40
IV	50	10	40

(A) I
(B) II
(C) III
(D) IV
(E) None of the above.

____5. Mg reacts with aqueous silver nitrate to produce 2.16 grams of silver metal in an experiment. What is the mass of magnesium reacted?

$$Mg + 2\ AgNO_3 \rightarrow 2\ Ag + Mg(NO_3)_2$$

(A) 0.242 g
(B) 0.325 g
(C) 0.650 g
(D) 1.30 g
(E) 2.16 g

____6. 1.00 g of $H_2(g)$ at STP occupies

(A) 0.50 L
(B) 1.00 L
(C) 2.00 L
(D) 11.2 L
(E) 22.4 L

____7. The mass ratio of hydrogen to oxygen in water is

(A) 1:8
(B) 1:4
(C) 1:2
(D) 2:1
(E) 8:1

____8. An analysis of a compound is performed.

Percentage by mass

Carbon	Hydrogen	Oxygen
40%	6.7%	53.3%

The empirical formula of the compound is

(A) C_2HO
(B) CHO_2
(C) CH_2O
(D) C_2HO_2
(E) C_4HO_3

____9. How many molecules are contained in 0.20 mole of N_2 at STP?

(A) 1.2×10^{23}
(B) 2.0×10^{23}
(C) 2.4×10^{23}
(D) 3.0×10^{23}
(E) 6.0×10^{23}

____10. The percentage, by mass, of nitrogen in $(NH_4)_3PO_4$ is

(A) 9.40%
(B) 12.4%
(C) 28.2%
(D) 36.2%
(E) 37.6%

____11. Which gas has the highest density?

(A) Cl_2
(B) F_2
(C) NH_3
(D) CO_2
(E) Ar

____12. An empty flask (vacuum) has a mass of 110.02 g. Filled with $H_2(g)$ the flask has a mass of 110.06 g. Filled with an unknown gas the flask has a mass of 110.66 g. All massing is done at the same temperature and pressure. What is a possible formula for the unknown gas?

(A) F_2
(B) O_2
(C) He
(D) H_2O
(E) CO

____13. The number of molecules of $O_2(g)$ in 1.00 L of the gas at STP is

(A) $\frac{6.02 \times 10^{23}}{32.0}$
(B) $\frac{6.02 \times 10^{23}}{22.4}$
(C) $\frac{6.02 \times 10^{23}}{16}$
(D) 6.02×10^{23}
(E) $6.02 \times 10^{23} \times 22.4$

____14. What is the molar mass of a gas with a density at STP of 1.34 $g \cdot L^{-1}$?

(A) 22.4 g
(B) 24.4 g
(C) 30.0 g
(D) 59.8 g
(E) 0.598 g

____15. Sodium chloride reacts with $AgNO_3$ to produce solid silver chloride.

$NaCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

How many moles of AgCl(s) is formed by the reaction of 0.60 mole of NaCl with 0.40 mole of $AgNO_3$?

(A) 1.0 mol
(B) 0.20 mol
(C) 0.40 mol
(D) 0.60 mol
(E) 0.80 mol

____16. When 1.0 mole of potassium chlorate, $KClO_3$, decomposes the number of moles of O_2 produced is

$$2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$$

(A) 1.0.
(B) 2.0.
(C) 3.0.
(D) 1.5.
(E) 4.5.

____17. What mass of calcium carbonate,$CaCO_3$, is required to produce 168 kg of quicklime, CaO?

$$CaCO_3(s) \rightarrow CaO\ (s) + CO_2(g)$$

(A) $\frac{56}{100} \times 168$ kg
(B) $\frac{100}{168} \times 56$ kg
(C) $\frac{1}{1} \times 168$ kg
(D) $\frac{100}{56} \times 168$ kg
(E) $\frac{168}{100} \times 56$ kg

____18. What is the percentage by mass of hydrogen in propanol, C_3H_7OH (MM = 60.0)?

(A) 5.9%
(B) 11.7%
(C) 13.3%
(D) 26.6%
(E) 66.7%

____19. The percentage composition of a compound containing 30. g of carbon and 10. g of hydrogen is

(A) 10.% C and 30.% H
(B) 25% C and 75% H
(C) 30.% C and 10.% H
(D) 75% C and 25% H
(E) 80% C and 20% H

____20. The number of molecules of O_2 in 1.0 L of O_2 at STP is

(A) 6.02×10^{23}
(B) $\frac{6.02 \times 10^{23}}{16.0}$
(C) $\frac{6.02 \times 10^{23}}{32.0}$
(D) $\frac{6.02 \times 10^{23}}{22.4}$
(E) $6.02 \times 10^{23} \times 32.0$

____21. A compound was found to contain 80% carbon by mass, and 20% hydrogen by mass. The empirical formula of this compound is

(A) CH_2
(B) CH_3
(C) C_2H
(D) C_3H_2
(E) C_4H

____22. The molecular formula of a given compound is C_4H_{10}. The empirical formula of the same compound would be

(A) C_2H_5
(B) CH_2
(C) C_3H_7
(D) C_4H_{10}
(E) C_5H_2

____23. A 7.00 g sample of an ideal as occupies 5.60 L at STP. The molar mass in grams of this gas is

(A) 1.25
(B) 1.75
(C) 28.0
(D) 39.2
(E) 157

____24. The mole is

(A) grams of carbon
(B) liters of gas at STP
(C) a number of particles
(D) grams of oxygen gas at STP
(E) grams of nucleons

____25. What volume of $CO_2(g)$ measured at STP is required for the production of 159 g of $CaCO_3$ in the reaction.

$$CaCl_2 + CO_2(g) + H_2O \rightarrow CaCO_3 + 2HCl(aq)$$

(A) 22.4 L
(B) 32.0 L
(C) 35.6 L
(D) 44.8 L
(E) 69.9 L

____26. The empirical formula of a compound is CH_2N_2 and the molar mass is 126 $g \cdot mol^{-1}$. What is the molecular formula of the compound?

(A) CH_2N_2
(B) $C_2H_4N_4$
(C) $C_3H_6N_6$
(D) $C_3H_8N_6$
(E) $C_3H_6N_8$

____27. How many grams of water, H_2O, are contained in 244 g of $BaCl_2 \cdot 2\ H_2O$?

(A) 18.0
(B) 2.00
(C) 15.0
(D) 36.0
(E) 122

____28. A 6.2 g sample of a compound is composed of 4.6 g sodium, Na, and 1.6 g oxygen, O. The empirical formula of the compound is

(A) NaO
(B) NaO_2
(C) Na_2O
(D) Na_2O_2
(E) Na_4O_2

____29. If two containers of different ideal gases at the same temperature and pressure have the same number of molecules, the gases must have the same

(A) molecular masses
(B) volumes
(C) masses
(D) densities
(E) effusion rates

____30. What is the mass of a single atom of silver?

(A) 1.79×10^{-22} grams
(B) 108 grams
(C) 1.00 gram
(D) 5.57×10^{21} grams
(E) 6.02×10^{23} grams

____31. What volume will 1.70 g of NH_3 (g) occupy at STP?

(A) 2.24 L
(B) 17.0 L
(C) 22.4 L
(D) 0.224 L
(E) 1.70 L

____32. The molar mass of $(NH_4)_2Cr_2O_7$ is

(A) 36.0
(B) 83.0
(C) 200
(D) 252
(E) 308

____33. When 100. Liters of butane, C_4H_{10}, are reacted at SP and 25°C, how many liters of oxygen are required under the same conditions?

$$2\ C_4H_{10}(g) + 13\ O_2(g) \rightarrow 8\ CO_2(g) + 10\ H_2O(l)$$

(A) 49.0 L
(B) 319 L
(C) 650. L
(D) 800. L
(E) 1300. L

____34. The number of moles in 1.41 g of Zn is
(A) 0.0108 mole
(B) 0.0216 mole
(C) 0.0324 mole
(D) 0.0432 mole
(E) 0.0653 mole

____35. The number of moles of sodium chloride, NaCl (MM = 58.5), in 8.82 g of sodium chloride is
(A) 0.151
(B) 0.248
(C) 0.303
(D) 0.383
(E) 0.479

____36. Calcium ions (Ca^{2+}) and sulfate ions (SO_4^{2-}) form an ionic compound. The empirical formula of the compound would be
(A) $CaSO_4$
(B) Ca_2SO_4
(C) $Ca(SO_4)_2$
(D) $Ca_2(SO_4)_2$
(E) None of the above

____37. How many atoms are represented in the formula $Mg(OH)_{2?}$
(A) 6
(B) 2
(C) 3
(D) 4
(E) 5

____38. What is the molar mass of a gas if 1.00 L, at STP, has a mass of 4.80 g?
(A) 0.210 g
(B) 4.80 g
(C) 10.8 g
(D) 48.0 g
(E) 108 g

____39. How many liters of carbon dioxide, $CO_2(g)$, at STP, will be formed by the complete combustion of 15.0 grams of ethane, C_2H_6?

$$2\ C_2H_6(g) + 7\ O_2(g) \rightarrow 4\ CO_2(g) + 6\ H_2O(l)$$

(A) 11.2 L
(B) 22.4 L
(C) 44.8 L
(D) 78.4 L
(E) 89.6 L

____40. What is the molar mass of elemental sulfur, $_{16}S$?
(A) 16 $g \cdot mol^{-1}$
(B) 32 $g \cdot mol^{-1}$
(C) 64 $g \cdot mol^{-1}$
(D) 16 amu
(E) 32 amu

____41. The mass of 6.02×10^{23} atoms of F_2 is
(A) 1.9 g
(B) 3.8 g
(C) 9.5 g
(D) 19 g
(E) 38 g

____42. How many mole(s) of calcium carbonate, $CaCO_3$, is represented by 50 grams of the compound ?

(A) 1.0 (D) 0.40
(B) 2.0 (E) 0.50
(C) 0.20

____43. What volume of O_2, oxygen, at STP is needed to burn 16 g of methanol, CH_3OH?

$$2\ CH_3OH + 3\ O_2 \rightarrow 2\ CO_2 + 4\ H_2O$$

(A) $\frac{3}{4} \times 22.4$ L
(B) $\frac{4}{3} \times 22.4$ L
(C) $\frac{3}{2} \times 22.4$ L
(D) $\frac{3}{1} \times 22.4$ L
(E) $\frac{3}{22.4} \times 4$ L

____44. When 1.00 L of a gas is massed at STP, it weighs 1.25 g. The molar mass of this gas is

(A) 1.25 (D) 22.4×1.25
(B) $1.25 \div 22.4$ (E) none of the above
(C) $22.4 \div 1.25$

____45. How many moles are there in 6.72 L of O_2 measured at STP?

(A) 0.210 (D) 6.72
(B) 0.300 (E) 21.0
(C) 3.00

____46.

Element	Percent by Mass
C	37.5%
H	12.5%
O	50.0%

What is the empirical formula of this compound?

(A) CHO (D) $C_2H_3O_2$
(B) CH_3O_2 (E) C_3HO_4
(C) C_2H_3O

____47. If 22.4 L of a gas at STP has a mass of 44.0 g, its molar mass is

(A) 1.00 $g \cdot mol^{-1}$ (D) 88.0 $g \cdot mol^{-1}$
(B) 1.96 $g \cdot mol^{-1}$ (E) 986 $g \cdot mol^{-1}$
(C) 44.0 $g \cdot mol^{-1}$

____48. The molar mass of $C_6H_5OCOCH_3 \cdot COOH$ is

(A) 136 $g \cdot mol^{-1}$ (D) 193 $g \cdot mol^{-1}$
(B) 169 $g \cdot mol^{-1}$ (E) 295 $g \cdot mol^{-1}$
(C) 181 $g \cdot mol^{-1}$

____49. How many grams of $MgSO_4 \cdot 7\ H_2O$ is equivalent to 12.0 grams of anhydrous $MgSO_4$ in an aqueous reaction?

Molar Mass Of $MgSO_4 \cdot 7H_2O$
246 $g \cdot mole^{-1}$

(A) 2.05 (D) 36.9
(B) 5.85 (E) 49.2
(C) 24.6

____50. How many moles of ammonia, NH_3, will represent 18.0×10^{23} molecules of ammonia?

(A) 0.750
(B) 1.50
(C) 3.00
(D) 6.02
(E) 108

____51. What is the molar mass of magnesium phosphate, $Mg_3(PO_4)_2$?

(A) 59 g•mol^{-1}
(B) 119 g•mol^{-1}
(C) 130 g•mol^{-1}
(D) 238 g•mol^{-1}
(E) 260 g•mol^{-1}

____52. What is the molar mass of a gas if 2.00 L at 273 K and 760 mmHg pressure has a mass of 5.60 g?

(A) 6.27 g•mol^{-1}
(B) 24.5 g•mol^{-1}
(C) 62.7 g•mol^{-1}
(D) 245 g•mol^{-1}
(E) 251 g•mol^{-1}

____53. At standard conditions, 500. mL of an ideal gas has a mass of 0.984 g. The molar mass of this gas is

(A) 1.97 g
(B) 22.0 g
(C) 44.1 g
(D) 98.4 g
(E) 0.0220 g

____54. How many grams of carbon dioxide are produced by burning 0.400 mole of butane, C_4H_{10}, in excess oxygen?

$$C_4H_{10} + {}^{13}/_{2}\, O_2 \rightarrow 4\, CO_2 + 5\, H_2O$$

(A) 4.40 g
(B) 17.6 g
(C) 44.0 g
(D) 70.4 g
(E) 88.0 g

____55. The number of moles of CO_2 (carbon dioxide) in 0.66 g of the gas is

(A) 0.015 mole
(B) 0.12 mole
(C) 0.44 mole
(D) 1.5 moles
(E) 2.2 moles

____56. The number of molecules of oxygen in 1.00 L of O_2 at 760 mmHg and 273°C is

(A) 6.02×10^{23}
(B) $\dfrac{6.02 \times 10^{23}}{22.4}$
(C) $\dfrac{6.02 \times 10^{23}}{22.4} \times \dfrac{273}{546}$
(D) $\dfrac{6.02 \times 10^{23}}{22.4} \times \dfrac{546}{273}$
(E) $\dfrac{22.4}{6.02 \times 10^{23}} \times \dfrac{546}{273}$

____57. A 7.00 g sample of a gas occupies 5.60 L at STP. The molar mass of this gas is

(A) 5.60 × 7.00 g
(B) 7.00 × 22.4 g
(C) $\dfrac{5.60}{22.4} \times 7.00$ g
(D) $\dfrac{22.4}{5.60} \times 7.00$ g
(E) $\dfrac{22.4}{7.00} \times 5.60$ g

____58. Consider the reaction used in fueling the space shuttle:

$$5\ N_2O_4(l) + 4\ N_2H_3CH_3(l) \rightarrow 12\ H_2O(g) + 9\ N_2(g) + 4\ CO_2(g)$$

How many Liters of nitrogen gas at STP are produced by the oxidation of 1.00 mole of N_2O_4?

(A) 12.4 L
(B) 22.4 L
(C) 40.3 L
(D) 89.6 L
(E) 202 L

____59. What would the volume ratio in which H_2 combines with O_2 to form water?

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

(A) 1:8
(B) 1:2
(C) 1:1
(D) 2:1
(E) 4:1

____60. A 71–gram sample of Cl_2 contains approximately the same number of molecules as

(A) 1.0 g of H_2
(B) 32 g of O_2
(C) 40 g of Ne
(D) 36 g of H_2O
(E) 2 g of He

____61. What is the *total* mass of products formed when 1.00 mole of methanol, CH_3OH, is completely burned?

$$2\ CH_3OH + 3\ O_2 \rightarrow 2\ CO_2 + 4\ H_2O$$

(A) 67.2 g
(B) 80. 0 g
(C) 134.4 g
(D) 160. g
(E) 201. g

____62. Equal masses of $H_2(g)$ and $O_2(g)$ are placed in a container and the container is tightly sealed. Which is true?

(A) Both gases exert the same pressure on the walls of the container.
(B) There are more hydrogen molecules than oxygen molecules in the container.
(C) Both the $H_2(g)$ and $O_2(g)$ molecules have the same velocity in the container.
(D) Both the $H_2(g)$ and $O_2(g)$ molecules strike the walls of the container with the same force.
(E) The oxygen is at a greater pressure than the hydrogen.

____63. How many moles of boron oxide, B_2O_3, are required to produce 6.00 moles B_4C?

$$2\ B_2O_3(s) + 7\ C(s) \rightarrow B_4C(s) + 6\ CO(g)$$

(A) 6.00
(B) 12.0
(C) 3.00
(D) 4.00
(E) 15.0

____64. A compound is found to contain 80.0% carbon and 20.0% hydrogen by mass. The empirical formula of the compound is

(A) CH
(B) CH_2
(C) CH_3
(D) CH_4
(E) C_2H_6

____65. The molar mass of molecular hydrogen is

(A) 1.0
(B) 2.0
(C) 22.4
(D) 44.8
(E) 760

____66. The molecular formula of a compound is known to be C_4H_{10}. Which is its empirical formula?

(A) CH_2
(B) $CH_{2.5}$
(C) C_2H_5
(D) C_4H_{10}
(E) $C_{40}H_{100}$

____67. Consider the equation

$$MnO_2 + 4\ HCl(aq) \rightarrow MnCl_2 + 2\ H_2O + Cl_2(g)$$

How many moles of HCl are necessary to produce two molar volumes of $Cl_2(g)$?

(A) $\frac{1}{2}$
(B) 2
(C) 2.5
(D) 4
(E) 8

____68. In an experiment, 0.0032 mole of maleic acid, $C_4H_4O_4$, reacts completely with 0.0064 mole of sodium hydroxide, NaOH. Which balanced equation describes this reaction?

(A) $C_4H_4O_4 + NaOH \rightarrow NaC_4H_3O_4 + H_2O$
(B) $2\ C_4H_4O_4 + NaOH \rightarrow 2\ Na_2C_4H_2O_4 + 2\ H_2O$
(C) $C_4H_4O_4 + 3\ NaOH \rightarrow Na_3C_4HO_4 + 3\ H_2O$
(D) $C_4H_4O_4 + 4\ NaOH \rightarrow Na_4C_4O_4 + 4\ H_2O$
(E) $C_4H_4O_4 + 2\ NaOH \rightarrow Na_2C_4H_2O_4 + 2\ H_2O$

____69. What is the minimum volume in mL of 0.50 M $AgNO_3$ that is required to react *completely* with 40.0 mL of 0.50 M K_2CrO_4 to make solid Ag_2CrO_4?

$$2\ Ag^+(aq) + CrO_4^{2-}(aq) \rightarrow Ag_2CrO_4(s)$$

(A) 10.0 mL
(B) 20.0 mL
(C) 40.0 mL
(D) 60.0 mL
(E) 80.0 mL

____70. 7.0 g, of CO(g) reacts completely with 4.0 g of O_2 (g) to yield 11.0 g of CO_2(g).” This statement is an illustration of the

I. Law of Multiple Proportions.
II. Law of Constant Composition.
III. Law of Conservation of Mass.
IV. Law of Combining Gas Volumes.

(A) I and III
(B) I and IV
(C) II and III
(D) II and IV
(E) III and IV

____71. The mass of one molecule of acetylene, C_2H_2 (MM = 26.0) is:

(A) 4.32×10^{-23} g
(B) 2.3×10^{22} g
(C) 4.32 g
(D) 26.0 g
(E) 156 g

____72. How many moles of atoms are in 1.0 mole of $Fe_3(Fe(CN)_6)_2$?

(A) 16
(B) 17
(C) 26
(D) 29
(E) 39

____73. How many liters of $H_2(g)$ measured at 760 mmHg and 273 K react with 11.2 L of $N_2(g)$ measured at 760 mmHg and 273 K?

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

(A) 16.8
(B) 22.4
(C) 33.6
(D) 44.8
(E) 67.2

____74. A compound has the empirical formula CH_2O and the molar mass 180 grams per mole. What is its molecular formula?

(A) CH_8O_{10}
(B) $C_6H_{12}O_6$
(C) $C_6H_{12}O_{12}$
(D) $C_{12}H_4O_2$
(E) $C_{12}H_{24}O_{12}$

____75. A 100.0 g sample of a compound is composed of 26.5 g of potassium, 35.4 g of chromium and 38.1 g oxygen. The empirical formula of the compound is

(A) $KCrO_4$
(B) KCr_2O_7
(C) $K_2Cr_2O_7$
(D) $K_2Cr_2O_8$
(E) $K_{26}Cr_{35}O_{38}$

____76. The mass of Avogadro's number of copper atoms is

(A) 1.00 g
(B) 29.0 g
(C) 63.5 g
(D) 6.02×10^{23} g
(E) $63.5 \times 6.02 \times 10^{23}$ g

____77. Hydrogen gas reacts with hot copper (II) oxide.

$$CuO\ (s) + H_2\ (g) \rightarrow Cu\ (s) + H_2O(g)$$

How many moles of water is formed when 159 g of CuO (MM = 79.5) is completely reduced to copper?

(A) 1.00
(B) 2.00
(C) 1.50
(D) 4.00
(E) 1.59

____78. 1.70 g of $NH_3(g)$ at STP occupies

(A) 0.224 L
(B) 1.70 L
(C) 2.24 L
(D) 17.0 L
(E) 22.4 L

____79. An empty flask (vacuum) has a mass of 110.02 g. Filled with $O_2(g)$ the flask has a mass of 110.66 g. Filled with an unknown gas the flask has a mass of 110.38 g. All massing is done at the same temperature and pressure. What is a possible formula for the unknown gas?

(A) H_2O
(B) H_2
(C) He
(D) He_2
(E) SO_2

____80. The mass of 1.00 L of an ideal gas at STP is 4.82 g. The molar mass of the gas is

(A) 0.215 g
(B) 4.68 g
(C) 4.82 g
(D) 54.0 g
(E) 108 g

Answer Key
[New Exam]

1. B	26. C	51. E	76. C
2. E	27. D	52. C	77. B
3. A	28. C	53. C	78. C
4. B	29. B	54. D	79. A
5. A	30. A	55. A	80. E
6. D	31. A	56. C	
7. A	32. D	57. D	
8. C	33. C	58. C	
9. A	34. B	59. D	
10. C	35. A	60. B	
11. A	36. A	61. B	
12. B	37. E	62. B	
13. B	38. E	63. B	
14. C	39. B	64. C	
15. C	40. B	65. B	
16. D	41. D	66. C	
17. D	42. E	67. E	
18. C	43. A	68. E	
19. D	44. D	69. E	
20. D	45. B	70. A	
21. B	46. B	71. A	
22. A	47. C	72. D	
23. C	48. C	73. C	
24. C	49. C	74. B	
25. C	50. C	75. C	