



Stoichiometry

- ___ 1. The total number of moles represented by 20 grams of calcium carbonate is (1) 1; (2) 2; (3) 0.1; (4) 0.2.
- ___ 2. A 4.4 gram sample of a hydrate was heated until the water of hydration was driven off. The anhydrous compound remaining had a mass of 3.3 grams. What is the percentage by mass of water in the hydrate? (1) 25%; (2) 33%; (3) 67%; (4) 75%.
- ___ 3. A sample of neon gas at STP has a mass of 20. grams. An equal volume of argon gas at STP will have a mass of (1) 10. g; (2) 20. g; (3) 30. g; (4) 40. g.
- ___ 4. Given the reaction: $2\text{KClO}_3 = 2\text{KCl} + 3\text{O}_2$. What is the total number of moles of KCl produced when 1.50 moles of potassium chlorate is decomposed? (1) 1.50; (2) 4.50; (3) 3.00; (4) 0.75.
- ___ 5. What is the freezing point of a solution that contains 1.00 mole of a nonelectrolyte dissolved in 1000 grams of water? (1) 0.00 °C; (2) 0.520 °C; (3) -1.86 °C; (4) -3.72 °C.
- ___ 6. If 500 cubic centimeters of 2.0M HCl is diluted with water to a volume of 1000 cubic centimeters then the molarity of the new solution will be (1) 1.0M; (2) 2.0M; (3) 0.25M; (4) 0.50M.
- ___ 7. A compound was found by analysis to consist of 85.6% carbon and 14.4% hydrogen. What is its empirical formula? (1) CH; (2) CH₂; (3) C₂H; (4) C₂H₂.
- ___ 8. Given the reaction: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$. How many liters of ammonia, measured at STP, are produced when 28.0 grams of nitrogen are completely consumed? (1) 5.60; (2) 11.2; (3) 22.4; (4) 44.8.
- ___ 9. The number of moles in 10 grams of calcium is equal to (1) 0.25; (2) 0.50; (3) 1.0; (4) 10.
- ___ 10. What is the molecular mass of a gas whose density is 1.25 grams per liter at STP? (1) 14.0; (2) 17.9; (3) 20.0; (4) 28.0.
- ___ 11. Given the reaction: $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$. How many moles of hydrogen will be formed when 4 moles of HCl are consumed? (1) 6; (2) 2; (3) 8; (4) 4.
- ___ 12. One mole of (NH₄)₂SO₄ has a mass in grams of (1) 50.; (2) 54; (3) 64; (4) 132.
- ___ 13. Which sample of neon contains a total of 1/2 mole of molecules at STP? (1) 11.2 l; (2) 22.4 l; (3) 20.0 g; (4) 40.0 g.
- ___ 14. A 15 gram sample of a gas has a volume of 30. liters at STP. What is the density of the gas? (1) 30. g/l; (2) 2.0 g/l; (3) 15. g/l; (4) 0.50 g/l.
- ___ 15. Ca(OH)₂ has a percent by mass of oxygen that is closest to (1) 16; (2) 22; (3) 43; (4) 74.

- ___ 16. The empirical formula of a compound is CH. Its molecular mass could be (1) 21; (2) 40; (3) 51; (4) 78.
- ___ 17. Which 1.0 liter sample has the greatest mass at STP? (1) H₂(g); (2) CO₂(g); (3) Cl₂(g); (4) CH₄(g).
- ___ 18. Given the reaction: N₂(g) + O₂(g) = 2NO(g). What is the total number of liters of NO(g) produced when 2.0 liters of nitrogen reacts completely with oxygen? (1) 1.0; (2) 2.0; (3) 0.50; (4) 4.0.
- ___ 19. What is the molarity of a solution that contains 112 grams of KOH in 2.00 liters of solution? (1) 1.00 M; (2) 2.00 M; (3) 3.00 M; (4) 4.00 M.
- ___ 20. A compound consists of 85% silver and 15% fluorine by mass. What is its empirical formula? (1) AgF; (2) AgF₂; (3) Ag₂F; (4) Ag₆F.
- ___ 21. One mole of an ideal gas occupies a volume of 22.4 liters at (1) 273 K and 760 mm.; (2) 273 K and 0 mm.; (3) 760 degrees C. and 273 mm.; (4) 0 degrees C. and 273 mm..
- ___ 22. If NO₂ is the empirical formula of a compound whose molecular mass is 92, then what is its molecular formula? (1) NO₂; (2) N₂O₄; (3) N₃O₆; (4) N₄O₈.
- ___ 23. Given the reaction: 2H₂ + O₂ -----> 2H₂O. In the above reaction the total number of grams of oxygen needed to produce 54 grams of water is (1) 36; (2) 48; (3) 61; (4) 75.
- ___ 24. There is one mole in a sample of (1) 14 g of Li; (2) 14 g of N₂; (3) 4.0 g of He; (4) 4.0 g of H₂.
- ___ 25. A solution that has 20. grams of calcium bromide in a 0.50 liter of solution has a molarity of (1) 0.50; (2) 0.20; (3) 5.0; (4) 10..
- ___ 26. The percent by mass of oxygen in MgO (formula mass = 40) is closest to (1) 16%; (2) 24%; (3) 40%; (4) 60%.
- ___ 27. A compound consists of 14.6% carbon and 85.5% chlorine by mass. What is the empirical formula? (1) CCl; (2) CCl₂; (3) CCl₃; (4) CCl₄.
- ___ 28. The gram-molecular mass of a gas is 56 grams. Its density at STP in grams per liter is (1) 1.0; (2) 5.6; (3) 2.5; (4) 0.40.
- ___ 29. What is the volume of 0.25 mole of oxygen at STP? (1) 0.25 liter; (2) 0.50 liter; (3) 5.6 liters; (4) 11.2 liters.
- ___ 30. CH₂ is the empirical formula of a compound with a molecular mass of 42. What is the molecular formula of the compound? (1) CH₂; (2) C₂H₄; (3) C₃H₆; (4) C₄H₈.
- ___ 31. The percent by mass of Li in LiNO₃ (formula mass = 69) is closest to (1) 6%; (2) 10%; (3) 18%; (4) 20%.
- ___ 32. Which gas is most dense at STP? (1) CO(g); (2) N₂(g); (3) NO(g); (4) O₂(g).
- ___ 33. A compound contains 0.50 mole of carbon for each 1.0 mole of hydrogen. The

empirical formula of this compound is (1) CH; (2) CH₂; (3) C₂H; (4) C₂H₂.

- ___ 34. What is the molarity of a solution that contains 28 grams of KOH (formula mass = 56) in 2.0 liters of solution? (1) 1.0 M; (2) 2.0 M; (3) 0.25 M; (4) 0.50 M.
- ___ 35. Given the reaction: S + O₂ = SO₂. What is the total number of grams of oxygen needed to react completely with 2.0 moles of sulfur? (1) 20; (2) 32; (3) 64; (4) 128.
- ___ 36. A 22.0 gram sample of a gas occupies 11.2 liters at STP. What is the gram molecular mass of the gas? (1) 11.2 g; (2) 22.4 g; (3) 22.0 g; (4) 44.0 g.
- ___ 37. A 38 gram sample of F₂ contains about the same number of molecules as (1) 14 g of N₂; (2) 2.0 g of H₂; (3) 36 g of H₂O; (4) 40 g of Ne.
- ___ 38. Which compound contains the greatest percentage of oxygen by mass? (1) BaO; (2) CaO; (3) MgO; (4) SrO.
- ___ 39. Which gas is less dense than air at STP? (1) CO₂; (2) H₂S; (3) NH₃; (4) SO₂.
- ___ 40. A compound contains 50% sulfur and 50% oxygen by mass. The empirical formula of this compound is (1) SO; (2) SO₂; (3) SO₃; (4) SO₄.
- ___ 41. What is the total volume (in liters) occupied by 56.0 grams of nitrogen gas at STP? (1) 11.2; (2) 22.4; (3) 33.6; (4) 44.8.
- ___ 42. Given the reaction: N₂ + 3H₂ = 2NH₃. How many grams of ammonia are produced when 1.0 mole of nitrogen reacts? (1) 8.5; (2) 17; (3) 34; (4) 68.
- ___ 43. Which gas has a greater density at STP than air at STP? (1) H₂; (2) NH₃; (3) Cl₂; (4) CH₄.
- ___ 44. Eleven grams of a gas occupies 5.6 liters at STP. What is the molecular mass of this gas? (1) 11; (2) 22; (3) 44; (4) 88.
- ___ 45. A compound which contains 75% carbon and 25% hydrogen by mass has the formula (1) CH₄; (2) C₂H₂; (3) C₂H₆; (4) C₃H₈.
- ___ 46. Three moles of sulfur dioxide at 273 °K and 380 mM will have a mass of (1) 64 grams; (2) 96 grams; (3) 192 grams; (4) 384 grams..
- ___ 47. The mass in grams of 2.00 moles of sulfur dioxide gas is (1) 48.0; (2) 64.0; (3) 80.0; (4) 128.
- ___ 48. The empirical formula for a compound is CH. If the molecular mass of this compound is 78 grams then the molecular formula of the compound is (1) CH; (2) C₂H₂; (3) C₅H₁₈; (4) C₆H₆.
- ___ 49. The percentage of hydrogen in hydrogen sulfide is approximately (1) 1; (2) 2; (3) 6; (4) 34.
- ___ 50. The density of a gas at STP is 1.26 grams per liter. What is the molecular mass of this gas in grams per mole? (1) 1.26; (2) 6.02; (3) 17.8; (4) 28.2.

- ___ 51. One liter of a solution of nitric acid contains 126 grams of solute. The molarity of the solution is (1) 1.00; (2) 2.00; (3) 1.26; (4) 0.500.
- ___ 52. What is the mass in grams of 5.6 liters of neon gas at STP? (1) 5; (2) 10; (3) 15; (4) 20.
- ___ 53. A 500 mL. solution contains 10 grams of NaOH. The molarity of this solution is (1) 1.0 M; (2) 0.50 M; (3) 0.25 M; (4) 0.10 M.
- ___ 54. Nitrogen dioxide has a mass of 46.0 grams per mole. At STP its density would be approximately (1) 1.03 g./liter; (2) 2.05 g./liter; (3) 4.10 g./liter; (4) 23.0 g./liter.
- ___ 55. $\text{Cu}(\text{NO}_3)_2$ has a percentage by mass of (1) 8.50% oxygen; (2) 17.0% oxygen; (3) 25.6% oxygen; (4) 51.1% oxygen.
- ___ 56. Fourteen grams of a gas occupies 11.2 liters at STP. This gas may be (1) carbon dioxide; (2) hydrogen sulfide; (3) hydrogen chloride; (4) nitrogen.
- ___ 57. A compound is found by analysis to consist of 5% hydrogen and 95% fluorine. What is its empirical formula? (1) HF; (2) H_2F ; (3) H_2F_2 ; (4) H_3F .
- ___ 58. Which gas is least dense at STP? (1) NO; (2) NH_3 ; (3) HCl; (4) H_2S .
- ___ 59. What mass of NaOH (formula mass = 40g) is needed to prepare 500 ml. of an 0.50 M solution? (1) 10. grams; (2) 20. grams; (3) 25 grams; (4) 40. grams.
- ___ 60. A compound contains carbon and hydrogen in the mole ratio 1 to 2. The molecular mass of this compound could be (1) 42; (2) 21; (3) 15; (4) 12.
- ___ 61. When 20.0 grams of NaOH is dissolved in 500 mL of solution the concentration of this solution is (1) 1.0 M; (2) 0.50 M; (3) 20 M; (4) 4.0 M.
- ___ 62. Given the reaction: $2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) = 2\text{H}_2\text{O}(\text{g})$. According to the above equation how many liters of oxygen will combine with 3.0 liters of hydrogen to produce water? (1) 11.2; (2) 6.0; (3) 3.0; (4) 1.5.
- ___ 63. What is the volume of 4.00 moles of nitrogen gas at STP? (1) 11.2 l; (2) 22.4 l; (3) 44.8 l; (4) 89.6 l.
- ___ 64. What is the percent by mass of hydrogen in ammonia (formula mass = 17.0)? (1) 5.9%; (2) 17.6%; (3) 21.4%; (4) 82.4%.
- ___ 65. Which sample of oxygen gas contains a total of 0.5 moles at STP? (1) 1.00 mole; (2) 2.00 moles; (3) 16.0 grams; (4) 32.0 grams.
- ___ 66. Given the reaction: $\text{Ca}(\text{ClO}_3)_2 \rightarrow \text{CaCl}_2 + \text{O}_2$. When the equation is correctly balanced the coefficient in front of the oxygen will be (1) 1; (2) 2; (3) 3; (4) 4.
- ___ 67. If the density of gas X at S.T.P. is 1.00 gram per liter the mass of a mole of this gas is (1) 1.00 g.; (2) 2.00 g.; (3) 11.2 g.; (4) 22.4 g..
- ___ 68. Given the reaction: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$. How many liters of hydrogen are required to produce exactly 3.0 liters of ammonia? (1) 1.5; (2) 2.0; (3) 4.5; (4) 6.0.

- ___ 69. Two moles of nitrogen gas are mixed with 3 moles of hydrogen gas at 273 °K and placed in a 22.4 liter container. The pressure of this mixture of gases is (1) 1 atm.; (2) 5 atm.; (3) 3 atm.; (4) 6 atm..
- ___ 70. What is the ratio by mass of hydrogen to oxygen in water? (1) 1-2; (2) 2-1; (3) 1-8; (4) 8-1.
- ___ 71. Given the reaction: $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$. How many liters of carbon dioxide are produced when 15 liters of oxygen are consumed? (1) 10; (2) 15; (3) 30; (4) 45.
- ___ 72. The percentage by mass of hydrogen in NH_3 is equal to (1) $1/17 \times 100$; (2) $3/17 \times 100$; (3) $17/3 \times 100$; (4) $6/17 \times 100$.
- ___ 73. The empirical formula of a compound is CH_4 . The molecular formula of the compound could be (1) CH_4 ; (2) C_2H_6 ; (3) C_3H_8 ; (4) C_4H_{10} .
- ___ 74. What is the total number of molecules contained in 0.50 mole of O_2 at STP? (1) 6.0×10^{23} ; (2) 4.5×10^{23} ; (3) 3.0×10^{23} ; (4) 1.5×10^{23} .
- ___ 75. Which solution contains the greatest number of moles of solute? (1) 0.5 L of 0.5 M; (2) 0.5 L of 2 M; (3) 2 L of 0.5 M; (4) 2 L of 2 M.
- ___ 76. Given the reaction at STP: $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$. What is the total number of liters of NH_3 formed when 20 liters of N_2 reacts completely? (1) 10 L; (2) 20 L; (3) 30 L; (4) 40 L.
- ___ 77. If 1.00 mole of $H_2(g)$ at STP is compared to 1.00 mole of $He(g)$ at STP, the volumes of the gases would be (1) equal and their masses unequal; (2) equal and their masses equal; (3) unequal and their masses unequal; (4) unequal and their masses equal.
- ___ 78. How many calories of heat are absorbed when 50. grams of water at 100 °C are completely vaporized? (Heat of vaporization = 540 cal/g) (1) 590; (2) 5400; (3) 27000; (4) 54000.
- ___ 79. At STP, what mass of CH_4 has the same number of molecules as 64 grams of SO_2 ? (1) 16 g; (2) 32 g; (3) 64 g; (4) 128 g.
- ___ 80. According to the equation: $HCl + NaOH \rightarrow NaCl + H_2O$. The total number of moles of HCl that can be neutralized by 80. grams of NaOH is (1) 1.0; (2) 2.0; (3) 36; (4) 72.
- ___ 81. The density of a gas is 3.00 grams per liter at STP. What is the gram molecular mass of the gas? (1) 7.47 g; (2) 11.2 g; (3) 22.4 g; (4) 67.2 g.
- ___ 82. A gas has a volume of 1400 milliliters at a temperature of 20 °K and a pressure of 760 mm Hg. What will be the volume when the temperature is changed to 40 °K and the pressure is changed to 380 mm Hg? (1) 350 mL; (2) 750 mL; (3) 1400 mL; (4) 5600 mL.
- ___ 83. Which quantity of helium may be represented by the symbol He? (1) 1 gram; (2) 2 moles; (3) 6×10^{23} atoms; (4) 4 liters.

- ___ 84. When the equation $_Na(s) + _H_2O(l) \rightarrow _NaOH(aq) + _H_2(g)$ is correctly balanced using smallest whole numbers, the coefficient of the water is (1) 1; (2) 2; (3) 3; (4) 4.
- ___ 85. Given the reaction: $2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$. At STP, what is the total volume of $CO_2(g)$ formed when 6.0 liters (L) of $C_2H_6(g)$ are completely oxidized? (1) 24 L; (2) 12 L; (3) 6.0 L; (4) 4.0 L.
- ___ 86. The percent by mass of carbon in CO_2 is equal to (1) $44/12 \times 100$; (2) $12/44 \times 100$; (3) $28/12 \times 100$; (4) $12/28 \times 100$.
- ___ 87. How many grams of KOH are needed to prepare 250. milliliters of a 2.00 M solution of KOH (formula mass = 56.0)? (1) 1.00; (2) 2.00; (3) 28.0; (4) 112.
- ___ 88. What is the gram formula mass of $(NH_4)_2SO_4$? (1) 160. g; (2) 178 g; (3) 186 g; (4) 132 g.
- ___ 89. What is the maximum number of grams of NH_4Cl that will dissolve in 200 grams of water at 70 °C? (1) 60; (2) 70; (3) 100; (4) 120.
- ___ 90. Which of the following gases has the greatest density at STP? (1) SO_2 ; (2) CO_2 ; (3) Cl_2 ; (4) N_2 .
- ___ 91. At STP, which of the following gases diffuses most rapidly? (1) H_2 ; (2) F_2 ; (3) Ne; (4) Xe.
- ___ 92. The total number of molecules in 34.0 grams of NH_3 is equal to (1) 1.00×22.4 ; (2) 2.00×22.4 ; (3) $1.00 \times 6.02 \times 10^{23}$; (4) $2.00 \times 6.02 \times 10^{23}$.
- ___ 93. What is the empirical formula of a compound whose composition by mass is 50.% sulfur and 50.% oxygen? (1) SO; (2) SO_2 ; (3) SO_3 ; (4) S_2O_3 .
- ___ 94. What is the total number of kilocalories of heat needed to change 150 grams of ice to water at 0 degrees C? (Heat of fusion = 80. cal/g) (1) 12; (2) 2.0; (3) 70.; (4) 230.
- ___ 95. When the equation $C_2H_4 + O_2 \rightarrow CO_2 + H_2O$ is balanced using smallest whole numbers, what is the coefficient of the O_2 ? (1) 1; (2) 2; (3) 3; (4) 4.
- ___ 96. Which quantity is equivalent to 39 grams of LiF? (1) 1.0 mole; (2) 2.0 moles; (3) 0.50 mole; (4) 1.5 moles.
- ___ 97. If 0.50 liter of a 12-molar solution is diluted to 1.0 liter the molarity of the new solution is (1) 2.4; (2) 6.0; (3) 12; (4) 24.
- ___ 98. Given the reaction: $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$. At constant pressure, how many liters of $O_2(g)$ would be required to produce 40. liters of $NO(g)$? (1) 5.0; (2) 9.0; (3) 32; (4) 50..
- ___ 99. A 2.00-gram sample of helium gas at STP will occupy (1) 11.2 l; (2) 22.4 l; (3) 33.6 l; (4) 44.8 l.
- ___ 100. What is the molecular formula of a compound whose empirical formula is CH_4 and

molecular mass is 16? (1) CH_4 ; (2) C_2H_4 ; (3) C_4H_8 ; (4) C_8H_{18} .

- ___ 101. How many moles of hydrogen atoms are there in one mole of $\text{C}_6\text{H}_{12}\text{O}_6$ molecules?
(1) 1; (2) 6; (3) 24; (4) 12.
- ___ 102. The density of a gas is 2.0 grams per liter at STP. Its molecular mass is approximately (1) 67; (2) 45; (3) 22; (4) 8.0.
- ___ 103. A 5 gram sample of water is heated and the temperature rises from 10 °C to 15 °C. The total amount of heat energy absorbed by the water is (1) 25 cal; (2) 20 cal; (3) 15 cal; (4) 5 cal.
- ___ 104. What is the ratio by mass of carbon to hydrogen in the compound ethane C_2H_6 ?
(1) 6-2; (2) 2-6; (3) 1-4; (4) 4-1.
- ___ 105. When the equation $\text{NH}_3 + \text{O}_2 \rightarrow \text{HNO}_3 + \text{H}_2\text{O}$ is completely balanced using smallest whole numbers, the coefficient of O_2 would be (1) 1; (2) 2; (3) 3; (4) 4.
- ___ 106. The gram molecular mass of carbon dioxide is the same as the gram molecular mass of (1) CO ; (2) SO_2 ; (3) C_2H_6 ; (4) C_3H_8 .
- ___ 107. The molecular mass of a compound is 70 and its empirical formula is CH_2 . What is the molecular formula of the compound? (1) C_2H_2 ; (2) C_2H_4 ; (3) C_4H_{10} ; (4) C_5H_{10} .
- ___ 108. Given the reaction: $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$. What is the total number of moles of hydrogen produced when 4 moles of sodium react completely? (1) 1; (2) 2; (3) 3; (4) 4.
- ___ 109. What is the percent by mass of nitrogen in the following compound: $\text{Mg}(\text{CN})_2$?
(1) $14/76 \times 100$; (2) $14/50 \times 100$; (3) $28/76 \times 100$; (4) $28/50 \times 100$.
- ___ 110. At constant pressure, 50. milliliters (mL) of a gas at 20 °C is heated to 30 °C. The new volume of the gas in milliliters (mL) is equal to (1) $50. \times 20./30.$; (2) $50. \times 30./20.$; (3) $50. \times 293/303$; (4) $50. \times 303/293$.
- ___ 111. The heat of vaporization for water is 540. calories per gram. What is the minimum number of calories needed to change 40.0 grams of water at 100 °C to steam at the same temperature and pressure? (1) 43,200; (2) 32,600; (3) 540; (4) 21,600.
- ___ 112. A compound contains 40% calcium, 12% carbon, and 48% oxygen by mass. What is the empirical formula of this compound? (1) CaCO_3 ; (2) CaC_2O_4 ; (3) CaC_3O_6 ; (4) CaCO_2 .
- ___ 113. If the density of a gas at STP is 2.50 grams per liter what is the gram molecular mass of the gas? (1) 2.50; (2) 22.4; (3) 56.0; (4) 89.6.
- ___ 114. Which solution will freeze at the lowest temperature? (1) 1 mole of sugar in 500 g of water; (2) 1 mole of sugar in 1000 g of water; (3) 2 moles of sugar in 500 g of water; (4) 2 moles of sugar in 1000 g of water.
- ___ 115. What is the total number of carbon atoms contained in 22.4 liters of CO gas at STP? (1) 1.00; (2) 0.500; (3) 3.01×10^{23} ; (4) 6.02×10^{23} .
- ___ 116. The volume of an acid required to neutralize exactly 15.00 milliliters (mL) of a base

could be measured most precisely if it were added to the base solution from a (1) 100 mL graduate; (2) 125 mL Erlenmeyer flask; (3) 50 mL buret; (4) 50 mL beaker.