Chapter 5 Gases

Student: ____

1. A pressure that will support a column of Hg to a height of 256 mm would support a column of water to what height? The density of mercury is 13.6 g/cm^3; the density of water is 1.00 g/cm^3.

   A. 348 cm
   B. 1.00×10^2 ft
   C. 18.8 mm
   D. 33.8 ft
   E. 76.0 cm

2. Which of the following is/are characteristic(s) of gases?

   A. High compressibility
   B. Relatively large distances between molecules
   C. Formation of homogeneous mixtures regardless of the nature of gases
   D. High compressibility AND relatively large distances between molecules
   E. High compressibility, relatively large distances between molecules AND formation of homogeneous mixtures regardless of the nature of gases

3. A sample of a gas occupies 1.40×10^3 mL at 25°C and 760 mmHg. What volume will it occupy at the same temperature and 380 mmHg?

   A. 2,800 mL
   B. 2,100 mL
   C. 1,400 mL
   D. 1,050 mL
   E. 700 mL

4. A sample of nitrogen gas has a volume of 32.4 L at 20°C. The gas is heated to 220ºC at constant pressure. What is the final volume of nitrogen?

   A. 2.94 L
   B. 19.3 L
   C. 31.4 L
   D. 54.5 L
   E. 356 L

5. If 30.0 L of oxygen are cooled from 200ºC to 1°C at constant pressure, what is the new volume of oxygen?

   A. 0.150 L
   B. 17.4 L
   C. 23.0 L
   D. 51.8 L
   E. 6.00×10^3 L

6. A sample of N_2 gas occupies 2.40 L at 20°C. If the gas is in a container that can contract or expand at constant pressure, at what temperature will the N_2 occupy 4.80 L?

   A. 10°C
   B. 40°C
   C. 146°C
   D. 313°C
   E. 685°C

7. The gas pressure in an aerosol can is 1.8 atm at 25°C. If the gas is an ideal gas, what pressure would develop in the can if it were heated to 475°C?

   A. 0.095 atm
   B. 0.717 atm
   C. 3.26 atm
   D. 4.52 atm
   E. 34.2 atm

8. If the pressure of a gas sample is quadrupled and the absolute temperature is doubled, by what factor does the volume of the sample change?

   A. 8
   B. 2
   C. 1/2
   D. 1/4
   E. 1/8

9. If the pressure on a gas sample is tripled and the absolute temperature is quadrupled, by what factor will the volume of the sample change?

   A. 12
   B. 4/3
   C. 3/4
   D. 1/3
   E. 4

10. A small bubble rises from the bottom of a lake, where the temperature and pressure are 4°C and 3.0 atm, to the water's surface, where the temperature is 25°C and the pressure is 0.95 atm. Calculate the final volume of the bubble if its initial volume was 2.1 mL.

    A. 0.72 mL
    B. 6.2 mL
    C. 41.4 mL
    D. 22.4 mL
    E. 7.1 mL

11. The temperature of an ideal gas in a 5.00 L container originally at 1 atm pressure and 25°C is lowered to 220 K. Calculate the new pressure of the gas.

    A. 1.0 atm
    B. 1.35 atm
    C. 8.8 atm
    D. 0.738 atm
    E. 0.114 atm

12. 0.820 mole of hydrogen gas has a volume of 2.00 L at a certain temperature and pressure. What is the volume of 0.125 mol of this gas at the same temperature and pressure?

    A. 0.0512 L
    B. 0.250 L
    C. 0.305 L
    D. 4.01 L
    E. 19.5 L

13. At what temperature will a fixed amount of gas with a volume of 175 L at 15°C and 760 mmHg occupy a volume of 198 L at a pressure of 640 mm Hg?

    A. 274°C
    B. 214°C
    C. 114°C
    D. 1°C
    E. -59°C

14. At what temperature will a fixed mass of gas with a volume of 125 L at 15°C and 750 mmHg occupy a volume of 101 L at a pressure of 645 mm Hg?

    A. -73°C
    B. 10.4°C
    C. 2°C
    D. 34°C
    E. 200°C

15. Calculate the volume occupied by 35.2 g of methane gas (CH_4) at 25°C and 1.0 atm. R = 0.0821 L • atm/K•mol.

A. 0.0186 L
B. 4.5 L
C. 11.2 L
D. 49.2 L
E. 53.7 L

16. Calculate the volume occupied by 25.2 g of CO_2 at 0.84 atm and 25°C.

A. 0.060 L
B. 1.34 L
C. 16.9 L
D. 24.2 L
E. 734 L

17. A gas evolved during the fermentation of sugar was collected at 22.5°C and 702 mmHg. After purification its volume was found to be 25.0 L. How many moles of gas were collected?

A. 0.95 mol
B. 1.05 mol
C. 12.5 mol
D. 22.4 mol
E. 724 mol

18. How many molecules of N_2 gas can be present in a 2.5 L flask at 50°C and 650 mmHg?

A. 2.1×10^{-23} molecules
B. 4.9×10^{22} molecules
C. 3.1×10^{23} molecules
D. 3.6×10^{25} molecules
E. 0.081 molecules

19. Calculate the mass, in grams, of 2.74 L of CO gas measured at 33°C and 945 mmHg.

A. 0.263 g
B. 2.46 g
C. 3.80 g
D. 35.2 g
E. 206 g

20. 0.500 mole of ammonia (NH_3) occupies a 1.2 L flask at 150°C. Calculate the pressure of the ammonia inside the flask.

    A. 6.91×10^{-2} atm
    B. 5.13 atm
    C. 12.2 atm
    D. 14.5 atm
    E. 22.4 atm

21. Gases are sold in large cylinders for laboratory use. What pressure, in atmospheres, will be exerted by 2,500 g of oxygen gas (O_2) when stored at 22°C in a 40.0 L cylinder?

    A. 3.55 atm
    B. 1,510 atm
    C. 47.3 atm
    D. 7.56×10^4 atm
    E. 10.2 atm

22. Calculate the number of kilograms of helium needed to inflate a balloon to a volume of 100,000 L at an atmospheric pressure of 250 mmHg and a temperature of -35°C.

    A. 1.68 kg
    B. 3.36 kg
    C. 5.21 kg
    D. 6.74 kg
    E. 5120 kg

23. Calculate the density, in g/L, of CO_2 gas at 27°C and 0.50 atm pressure.

    A. 0.89 g/L
    B. 1.12 g/L
    C. 9.93 g/L
    D. 46.0 g/L
    E. 2.17 kg/L

24. Calculate the density of $CO_2(g)$ at 100°C and 10.0 atm pressure.

    A. 1.44 g/L
    B. 134 g/L
    C. 44.0 g/L
    D. 53.6 g/L
    E. 14.4 g/L

25. Calculate the density of Br_2(g) at 59.0°C and 1.00 atm pressure.

A. 27.2 g/L
B. 5.83 g/L
C. 769 g/L
D. 22.4 g/L
E. 3.45 g/L

26. Calculate the density, in g/L, of SF_6 gas at 27°C and 0.500 atm pressure.

A. 3.38×10^{-3} g/L
B. 2.96 g/L
C. 22.4 g/L
D. 32.9 g/L
E. 3.38 kg/L

27. Calculate the density, in g/L, of chlorine (Cl_2) gas at STP.

A. 2.13×10^{-2} g/L
B. 46.9 g/L
C. 1.58 g/L
D. 3.16 g/L
E. 0.316 kg/L

28. Calculate the density of Ar(g) at -11°C and 675 mmHg.

A. 1.52 g/L
B. 1.65 g/L
C. -39.3 g/L
D. 39.95 g/L
E. 1254 g/L

29. Which of the following gases will have the greatest density at the same specified temperature and pressure?

A. H_2
B. $CClF_3$
C. CO_2
D. C_2H_6
E. CF_4

30. Which one of the following gases is "lighter-than-air"?

A. Cl_2
B. SO_2
C. PH_3
D. NO_2
E. Ne

31. Two moles of chlorine gas at 20.0°C are heated to 350°C while the volume is kept constant. The density of the gas

    A. increases.
    B. decreases.
    C. remains the same.
    D. Not enough information is given to correctly answer the question.

32. Determine the molar mass of chloroform gas if a sample weighing 0.389 g is collected in a flask with a volume of 102 cm^3 at 97°C. The pressure of the chloroform is 728 mmHg.

    A. 187 g/mol
    B. 121 g/mol
    C. 112 g/mol
    D. 31.6 g/mol
    E. 8.28×10^{-3} g/mol

33. What is the molar mass of Freon-11 gas if its density is 6.13 g/L at STP?

    A. 0.274 g/mol
    B. 3.64 g/mol
    C. 78.2 g/mol
    D. 137 g/mol
    E. 365 g/mol

34. Determine the molar mass of Freon-11 gas if a sample weighing 0.597 g occupies 100. cm^3 at 95°C, and 1,000. mmHg.

    A. 0.19 g/mol
    B. 35.3 g/mol
    C. 70.9 g/mol
    D. 137 g/mol
    E. 384 g/mol

35. 1.018 g of Freon-113 gas is trapped in a 145 mL container at 760. mmHg and 50.0°C. What is the molar mass of Freon-113?

    A. 21.7 g/mol
    B. 28.8 g/mol
    C. 46.1 g/mol
    D. 186 g/mol
    E. 245 g/mol

36. A 0.271 g sample of an unknown vapor occupies 294 mL at 140°C and 847 mmHg. The empirical formula of the compound is CH_2. What is the molecular formula of the compound?

A. CH_2
B. C_2H_4
C. C_3H_6
D. C_4H_8
E. C_6H_{12}

37. A gaseous compound is 30.4% nitrogen and 69.6% oxygen by mass. A 5.25-g sample of the gas occupies a volume of 1.00 L and exerts a pressure of 1.26 atm at -4.0°C. Which of the following is its molecular formula?

A. NO
B. NO_2
C. N_3O_6
D. N_2O_4
E. N_2O_5

38. A mixture of three gases has a total pressure of 1,380 mmHg at 298 K. The mixture is analyzed and is found to contain 1.27 mol CO_2, 3.04 mol CO, and 1.50 mol Ar. What is the partial pressure of Ar?

A. 0.258 atm
B. 301 mmHg
C. 356 mmHg
D. 5,345 mmHg
E. 8,020 mmHg

39. A sample of hydrogen gas was collected over water at 21°C and 685 mmHg. The volume of the container was 7.80 L. Calculate the mass of $H_2(g)$ collected. (Vapor pressure of water = 18.6 mmHg at 21°C.)

A. 0.283 g
B. 0.572 g
C. 0.589 g
D. 7.14 g
E. 435 g

40. A sample of carbon monoxide gas was collected in a 2.0 L flask by displacing water at 28°C and 810 mmHg. Calculate the number of CO molecules in the flask. The vapor pressure of water at 28°C is 28.3 mmHg.

A. 5.0×10^{22}
B. 5.2×10^{22}
C. 3.8×10^{23}
D. 5.4×10^{23}
E. 3.8×10^{25}

41. Air contains 78% N_2, 21% O_2, and 1% Ar, by volume. What is the density of air at 1,000. torr and -10°C?

A. 1.0 g/L
B. 6.1 g/L
C. 1.3 g/L
D. 1.8 g/L
E. 0.56 g/L

42. What volume of oxygen gas at 320 K and 680 torr will react completely with 2.50 L of NO gas at the same temperature and pressure?

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$

A. 1.25 L
B. 2.50 L
C. 3.00 L
D. 1.00 L
E. 5.00 L

43. What volume of CO_2 gas at 645 torr and 800 K could be produced by the reaction of 45 g of $CaCO_3$ according to the equation?

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

A. 0.449 L
B. 22.4 L
C. 25.0 L
D. 34.8 L
E. 45.7 mL

44. How many liters of chlorine gas at 25°C and 0.950 atm can be produced by the reaction of 12.0 g of MnO_2?

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

A. 5.36×10^{-3} L
B. 0.138 L
C. 0.282 L
D. 3.09 L
E. 3.55 L

45. How many liters of chlorine gas at 200°C and 0.500 atm can be produced by the reaction of 12.0 g of MnO_2 with HCl as follows?

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

A. 10.7 L
B. 3.09 L
C. 4.53 L
D. 0.138 L
E. 0.093 L

46. How many liters of chlorine gas at 650 mmHg and 25°C can be produced by the reaction of 2.00 L of 2.50 M HCl solution with excess MnO_2?

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

A. 1.25 L
B. 24.2 L
C. 35.7 L
D. 88.6 L
E. 143 L

47. Chlorine gas can be prepared in the laboratory by the reaction of solid manganese dioxide with hydrochloric acid. (The other reaction products are aqueous manganese chloride and water.) How much MnO_2 should be added to excess HCl to obtain 275 mL of chlorine gas at 5.0°C and 650 mmHg?

A. 1.18×10^{-4} g
B. 0.896 g
C. 1.22 g
D. 49.8 g
E. 8,440 g

48. How many liters of oxygen gas at 153°C and 0.820 atm can be produced by the decomposition of 22.4 g of solid $KClO_3$? (The other decomposition product is solid potassium chloride.)

A. 3.0 L
B. 0.085 L
C. 4.20 L
D. 7.79 L
E. 11.7 L

49. When active metals such as magnesium are immersed in acid solution, hydrogen gas is evolved. Calculate the volume of $H_2(g)$ at 30.1°C and 0.85 atm that can be formed when 275 mL of 0.725 M HCl solution reacts with excess Mg to give hydrogen gas and aqueous magnesium chloride.

A. 3.4×10^{-3} L
B. 2.2 L
C. 2.9 L
D. 5.8 L
E. 11.7 L

50. Calculate the volume of $H_2(g)$ at 273 K and 2.00 atm that will be formed when 275 mL of 0.725 M HCl solution reacts with excess Mg to give hydrogen gas and aqueous magnesium chloride.

A. 0.56 L
B. 1.12 L
C. 2.23 L
D. 4.47 L
E. 3.54 L

51. What mass of $KClO_3$ must be decomposed to produce 126 L of oxygen gas at 133°C and 0.880 atm? (The other reaction product is solid KCl.)

A. 24.6 g
B. 70.8 g
C. 272 g
D. 408 g
E. 612 g

52. Which statement is *false*?

A. The average kinetic energies of molecules from samples of different "ideal" gases is the same at the same temperature.
B. The molecules of an ideal gas are relatively far apart.
C. All molecules of an ideal gas have the same kinetic energy at constant temperature.
D. Molecules of a gas undergo many collisions with each other and the container walls.
E. Molecules of greater mass have a lower average speed than those of less mass at the same temperature.

53. Complete this sentence: The molecules of different samples of an ideal gas have the same average kinetic energies, at the same ________.

A. pressure
B. temperature
C. volume
D. density

54. If equal masses of O_2(g) and HBr(g) are in separate containers of equal volume and temperature, which one of the following statements is *true*?

    A. The pressure in the O_2 container is greater than that in the HBr container.
    B. There are more HBr molecules than O_2 molecules.
    C. The average velocity of the O_2 molecules is less than that of the HBr molecules.
    D. The average kinetic energy of HBr molecules is greater than that of O_2 molecules.
    E. The pressures of both gases are the same.

55. Which gas has molecules with the *greatest average molecular speed* at 25°C?

    A. CH_4
    B. Kr
    C. N_2
    D. CO_2
    E. Ar

56. Which of the following gas molecules have the *highest average kinetic energy* at 25°C?

    A. H_2
    B. O_2
    C. N_2
    D. Cl_2
    E. All the gases have the same average kinetic energy.

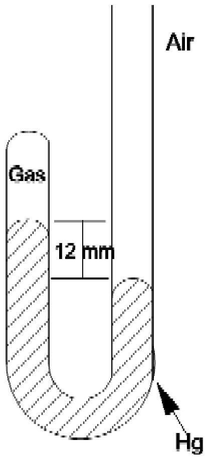
57. Deviations from the ideal gas law are greater at

    A. low temperatures and low pressures.
    B. low temperatures and high pressures.
    C. high temperatures and high pressures.
    D. high temperatures and low pressures.

58. For a substance that remains a gas under the conditions listed, deviation from the ideal gas law would be most pronounced at

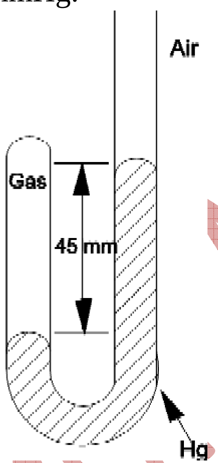
    A. 100°C and 2.0 atm.
    B. 0°C and 2.0 atm.
    C. -100°C and 2.0 atm.
    D. -100°C and 4.0 atm.
    E. 100°C and 4.0 atm.

59. What is the pressure of the gas trapped in the apparatus shown below when the atmospheric pressure is 720 mmHg?



A. 12 mmHg
B. 708 mmHg
C. 720 mmHg
D. 732 mmHg
E. 760 mmHg

60. Determine the pressure of the gas trapped in the apparatus shown below when the atmospheric pressure is 695 mmHg.



A. 45 mmHg
B. 650 mmHg
C. 695 mmHg
D. 740 mmHg
E. 760 mmHg

61. 10.0 g of gaseous ammonia and 6.50 g of oxygen gas are introduced into a previously evacuated 5.50 L vessel. If the ammonia and oxygen then react to yield NO gas and water vapor, what is the final gas pressure inside the vessel at 23ºC?

A. 1.79 atm
B. 6.48 atm
C. 3.50 atm
D. 0.285 atm
E. 3.67 atm

62. 5.00 g of hydrogen gas and 50.0 g of oxygen gas are introduced into an otherwise empty 9.00 L steel cylinder, and the hydrogen is ignited by an electric spark. If the reaction product is gaseous water and the temperature of the cylinder is maintained at 35ºC, what is the final gas pressure inside the cylinder?

A. 7.86 atm
B. 18.3 atm
C. 2.58 atm
D. 6.96 atm
E. 0.92 atm

63. 9.45 g of liquid hexane (C_6H_{14}) is introduced into a 10.0 L vessel containing 13.15 atm of oxygen gas at 21ºC and ignited, yielding carbon dioxide and water. If the vessel is then cooled to -10ºC, what will be the gas pressure inside the vessel?

A. 3.09 atm
B. 13.15 atm
C. 1.42 atm
D. 10.9 atm
E. 12.6 atm

64. 10.0 g of gaseous ammonia and 6.50 g of oxygen gas are introduced into a previously evacuated 5.50 L vessel. If the ammonia and oxygen then react to yield NO gas and water vapor, what is the final density of the gas mixture inside the vessel at 23ºC?

A. 1.68 g/L
B. 3.00 g/L
C. 1.32 g/L
D. 2.20 g/L
E. 16.5 g/L

65. A method of removing CO_2 from a spacecraft is to allow the CO_2 to react with sodium hydroxide. (The products of the reaction are sodium carbonate and water.) What volume of carbon dioxide at 25°C and 749 mmHg can be removed per kilogram of sodium hydroxide that reacts?

A. 301 L
B. 284 L
C. 276 L
D. 310 L
E. 620 L

66. A spacecraft is filled with 0.500 atm of N_2 and 0.500 atm of O_2. Suppose a micrometeor strikes this spacecraft and puts a very small hole in its side. Under these circumstances,

A. O_2 is lost from the craft 6.9% faster than N_2 is lost.
B. O_2 is lost from the craft 14% faster than N_2 is lost.
C. N_2 is lost from the craft 6.9% faster than O_2 is lost.
D. N_2 is lost from the craft 14% faster than O_2 is lost.
E. N_2 and O_2 are lost from the craft at the same rate.

67. A spacecraft is filled with 0.500 atm of O_2 and 0.500 atm of He. If there is a very small hole in the side of this craft such that gas is lost slowly into outer space,

A. He is lost 2.8 times faster than O_2 is lost.
B. He is lost 8 times faster than O_2 is lost.
C. He is lost twice as fast as O_2 is lost.
D. O_2 is lost 2.8 times faster than He is lost.
E. O_2 is lost 8 times faster than He is lost.

68. 1.000 atm of dry nitrogen, placed in a container having a pinhole opening in its side, leaks from the container 3.54 times faster than does 1.000 atm of an unknown gas placed in this same apparatus. Which of the following species could be the unknown gas?

A. NH_3
B. C_4H_{10}
C. SF_6
D. UF_6
E. Rn

69. 1.000 atm of oxygen gas, placed in a container having a pinhole opening in its side, leaks from the container 2.14 times faster than does 1.000 atm of an unknown gas placed in this same apparatus. Which of the following species could be the unknown gas?

A. Cl_2
B. SF_6
C. Kr
D. UF_6
E. Xe

70. Samples of the following volatile liquids are opened simultaneously at one end of a room. If you are standing at the opposite end of this room, which species would you smell first?
[Assume that your nose is equally sensitive to all these species.]

A. ethyl acetate ($CH_3COOC_2H_5$)
B. camphor ($C_{10}H_{16}O$)
C. diethyl ether ($C_2H_5OC_2H_5$)
D. naphthalene ($C_{10}H_8$)
E. pentanethiol ($C_5H_{11}SH$)

71. A sample of mercury(II) oxide is placed in a 5.00 L evacuated container and heated until it decomposes entirely to mercury metal and oxygen gas. After the container is cooled to 25°C, the pressure of the gas inside is 1.73 atm. What mass of mercury(II) oxide was originally placed into the container?

A. 913 g
B. 76.6 g
C. 1.51 g
D. 45.6 g
E. 153 g

72. The mole fraction of oxygen molecules in dry air is 0.2095. What volume of dry air at 1.00 atm and 25°C is required for burning 1.00 L of hexane (C_6H_{14}, density = 0.660 g/mL) completely, yielding carbon dioxide and water?

A. 187 L
B. 712 L
C. 1780 L
D. 894 L
E. 8490 L

73. The mole fraction of oxygen molecules in dry air is 0.2095. What volume of dry air at 1.00 atm and 25°C is required for burning 1.00 L of octane (C_8H_{18}, density = 0.7025 g/mL) completely, yielding carbon dioxide and water?

A. 718 L
B. 367 L
C. 8980 L
D. 1880 L
E. 150 L

74. A block of dry ice (solid CO_2, density = 1.56 g/mL) of dimensions 25.0 cm × 25.0 cm × 25.0 cm is left to sublime (i.e., to pass from the solid phase to the gas phase) in a closed chamber of dimensions 4.00 m × 5.00 m × 3.00 m. The partial pressure of carbon dioxide in this chamber at 25°C will be

A. 171 mmHg.
B. 107 mmHg.
C. 0.225 mmHg.
D. 0.171 mmHg.
E. 14.4 mmHg.

75. A 2.50-L flask contains a mixture of methane (CH_4) and propane (C_3H_8) at a pressure of 1.45 atm and 20°C. When this gas mixture is then burned in excess oxygen, 8.60 g of carbon dioxide is formed. (The other product is water.) What is the mole fraction of methane in the original gas mixture?

A. 0.34
B. 1.00
C. 0.66
D. 0.85
E. 0.15

76. What is the definition of "gas"?

77. What is standard temperature and standard pressure?

78. What is the significance of the magnitude of the van der Waals "a" constant?

79. Liquid oxygen boils at -183°C. What is this temperature in kelvins?

80. How many grams of N_2O, nitrous oxide, are contained in 500. mL of the gas at STP?

81. Calculate the density of N_2O gas, in grams per liter, at 110°C and 12 atm.

82. Calculate the molar mass of a gaseous substance if 0.125 g of the gas occupies 93.3 mL at STP.

83. What is the density, in molecules per cubic centimeter, of N_2 gas at 25°C and 650 mmHg?

84. An aerosol can with a volume of 0.50 L has a bursting point of 2.6 atm. If the can contains 1.0 g CO_2 and is heated to 400°C, will it burst?

85. Phosgene, a gas used in World War I, consists of 12.41% C, 16.17% O, and 71.69% Cl. 1.00 L of this gas at STP has a mass of 4.42 g. What is the molecular formula of phosgene?

86. The van der Waals equation is a modification of the ideal gas equation. For what two facts does this equation account?

87. On a spring morning (20°C) you fill your tires to a pressure of 2.25 atmospheres. As you ride along, the tire heats up to 45°C from the friction on the road. What is the pressure in your tires now?

88. A gas-filled balloon with a volume of 12.5 L at 0.90 atm and 21°C is allowed to rise to the stratosphere where the temperature is -5°C and the pressure is 1.0 millibar. What is the final volume of the balloon? 1.000 atm = 1.013 bar.

89. What volume of H_2 is formed at STP when 6.0 g of Al is treated with excess NaOH?

$$2NaOH + 2Al + 6H_2O \rightarrow 2NaAl(OH)_4 + 3H_2(g)$$

90. What is V in the table below?

	P	V	T
initial:	1,420 torr	75 mL	200 K
final:	760 torr	V	360 K

91. What is *P* in the table below?

	P	V
initial:	14 atm	1 L
final:	*P*	50 L

92. What is *T* in the table below?

	V	T
initial:	91.8 mL	365 K
final:	45.8 mL	*T*

93. What is *P* in the table below?

	V	P
initial:	91.8 mL	1 atm
final:	45.8 mL	*P*

94. Today is a beautiful day for a picnic in the mountains, so we seal our peanut butter sandwich in a plastic sandwich bag at the base of the mountain. The approximate volume of the sandwich bag not occupied by the sandwich is 200. mL. The pressure at the base of the mountain is 1.0 atm. If the pressure at the top of the mountain is 0.8 atm, what is the final volume of gas in our sandwich bag?

95. What is Boyle's law?

96. Give five examples of elements that occur as gases at room temperature and pressure?

97. Give five examples of compounds that exist as gases at room temperature and pressure.

98. Change 75°C to K.

99. What is Charles' law? What effect does the relationship described in Charles' law have on a balloon that is left in the sun?

100. A balloon is blown up in the morning (23°C) to a volume of 1.00 liter. If this balloon is left in a hot car with the windows left up and the car warms up to 35°C, what will be the final volume of the balloon?

101. At constant pressure, the density of a gas depends on temperature. Does the density increase or decrease as the temperature increases?

102. In a weather forecast on a Seattle radio station the barometric pressure was reported to be 29.4 inches. What is the pressure in SI units? (1 inch = 25.4 mm, 1 atm = 760 mmHg)

103. At STP, 1 mole of gas has a molar volume of 22.4 L. What is the density of oxygen at STP?

104. What is Gay-Lussac's Law? How will this affect the pressure in our car tires?

105. Ammonium nitrite undergoes decomposition to produce only gases as shown below.

$$NH_4NO_2(s) \rightarrow N_2(g) + 2H_2O(g)$$

How many liters of gas will be produced by the decomposition of 32.0 g of NH_4NO_2 at 525°C and 1.5 atm?

106. There is a power plant in Portland, Oregon that is very concerned about global warming. This plant takes all of its exhaust gases from its boilers and recycles the CO_2 using the Solvay process to make sodium hydrogen carbonate. The reaction is shown below.

$$NH_3(g) + H_2O(l) + CO_2(g) + NaCl(aq) \rightarrow NaHCO_3(aq) + NH_4Cl(aq)$$

How many liters each of NH_3 and CO_2 (both at STP) are needed to make 3.00 kg of sodium bicarbonate?

107. Baking powder is made up of sodium hydrogen carbonate and calcium hydrogen phosphate. When baking powder is wet, these components react to produce carbon dioxide. The equation for this reaction is given below.

$$NaHCO_3(aq) + CaHPO_4(aq) \rightarrow NaCaPO_4(aq) + CO_2(g) + H_2O(l)$$

How many liters of carbon dioxide can be formed at room temperature from 4.00 g of $NaHCO_3$ and excess $CaHPO_4$?

108. Packaged cake mixes usually contain baking powder, a mixture of sodium hydrogen carbonate and calcium hydrogen phosphate that react to produce carbon dioxide gas when they come into contact with water. Many such mixes have special instructions for use at high altitudes. Why?

109. Many automobiles produce about 5 grams of NO for each mile they are driven. How many liters of NO gas at STP would be produced on a 100-mile trip?

110. A particular coal sample contains 2.32% S. When the coal is burned, the sulfur is converted to SO_2 (g). What volume of SO_2 (g), measured at 25°C and 749 mmHg, is produced by burning 2.0×10^6 lb of this coal? (1 lb = 454 g)

111. At standard temperature and pressure, a given sample of water vapor occupies a volume of 2.80 L. How many moles of water vapor are present?

112. At standard temperature and pressure, a given sample of water vapor occupies a volume of 2.80 L. What is the weight of the water?

113. At standard temperature and pressure, a given sample of water vapor occupies a volume of 2.80 L. How many hydrogen atoms are present in the container?

114. Gasoline (which can be considered to be octane, C_8H_{18}) burns in oxygen to produce carbon dioxide and water. What volume of oxygen at STP is necessary to react with 1.0 gal of gasoline? (The density of gasoline is 0.81 g/mL. 1 gal = 3.78 L)

115. Gasoline (which can be considered to be octane, C_8H_{18}) burns in oxygen to produce carbon dioxide and water. What volume of carbon dioxide at STP is generated as a result of the combustion of 1.0 gal of gasoline?
(The density of gasoline is 0.81 g/mL. 1 gal = 3.78 L)

Chapter 5 Gases Key

1.A

2.E

3.A

4.D

5.B

6.D

7.D

8.C

9.B

10.E

11.D

12.C

13.D

14.A

15.E

16.C

17.A

18.B

19.C

20.D

21.C

22.D

23.A

24.E

25.B

26.B

27.D

28.B

29.B

30.E

31.C

32.B

33.D

34.D

35.D

36.B

37.D

38.C

39.B

40.A

41.D

42.A

43.D

44.E

45.A

46.C

47.B

48.E

49.C

50.B

51.C

52.C

53.B

54.A

55.A

56.E

57.B

58.D

59.B

60.D

61.E

62.A

63.D

64.B

65.D

66.C

67.A

68.D

69.B

70.C

71.E

72.E

73.C

74.A

75.D

76.A "gas" is a substance in which the molecules are separated on the average by distances that are large compared with the sizes of the molecules.

77.0°C and 1 atm pressure

78.The magnitude of the van der Waals "a" constant reflects the strength of the attractions between molecules of a given type of gas.

79.90 K

80.0.982 g

81.16.8 g/L

82.30.0 g/mol

83.2.1 × 10^{19} molecules/cm^3

84.no

85.$COCl_2$

86.(1) Real gas molecules exert forces on each other. (2) Gas molecules have volume.

87.2.44 atmospheres

88.1.0 × 10^4 L

89. 7.5 L

90.250 mL

91.0.28 L

92.182 K *or* -91.0°C

93.2 atm

94.250 mL

95.At constant temperature, the volume of a gas is inversely proportional to the pressure.

96.(Answers will vary.) Oxygen, nitrogen, helium, hydrogen, argon, chlorine

97.(Answers will vary.) Ammonia, carbon dioxide, sulfur dioxide, nitrogen dioxide, methane

98.348 K

99.At constant pressure, volume is directly proportional to temperature. A balloon left in the sun will expand.

100.1.04 L

101.The density decreases.

102.0.983 atm

103.1.43 g/L

104.The law states that at constant volume, pressure is proportional to temperature. We can say that our tire pressure will increase as the friction heats up the air inside our tires.

105. 65 L

106.The volume of both NH_3 and CO_2 would be 800. liters.

107.Approximately 1.16 liters

108.The baking powder acts as a leavening agent. Due to the reduced atmospheric pressure, a greater volume of carbon dioxide is created.

109.400 liters of NO

110.1.6×10^7 liters

111.0.125 mol

112.2.25 g

113.1.51×10^{23} atoms

114.7,500 L

115.4,800 L