Worksheet 3.1: Introduction to Gases & Dalton's Gas Law

1. What are three physical properties of all gases?

2. What three variables affect gases?

3. What instrument measures pressure?

4. What is the SI unit for pressure?

5. What unit expresses the average kinetic energy of a gas?

6. A 1.00 L bottle of gas contains oxygen at 10.0 kPa, nitrogen at 12.1 kPa & hydrogen at 97.5 kPa

    a. What is the total pressure?

    b. What percent of each gas is present? (HINT % = P_{gas}/P_{total} x 100)

    c. What is the volume of each gas?

7. Four gases (A, B, C and D) make up a mixture with a pressure of 150 kPa. What is the partial pressure of gas A, if gas B has a pressure of 58.0 kPa, gas C has a pressure of 23.8 kPa and gas D has a pressure of 15.9 kPa.

8. Three gases make up a mixture. At a particular pressure, the partial pressures are measured: Gas A = 67.00 kPa, Gas B, 6.70 kPa, and Gas C = 0.67 kPa. What is the pressure conditions under which this measurement is taken?

Worksheet 3.2: Boyles' Gas Law

1. What is the pressure when: (temperature is constant)

    a. 130 mL of a gas at 740 mmHg is changed to 150 mL?

    b. 25 mL of gas at 65 atm is changed to 30.0 mL?

    c. 1.0 L of gas at 70 kPa is changed to 1.2 L?

2. What is the volume when: (temperature is constant)

    a. 75 mL of gas at 4.1 atm is changed to 7.0 atm?

    b. 60.0 mL of gas at 760 mmHg is changed to 10 mmHg?

    c. 400.0 mL of gas at 760 kPa is changed to 300 kPa?

Worksheet 3.3: Charles' Gas Law

1. What is the volume when: (pressure is constant)

    a. 125 mL of gas at 25° C is cooled to Standard temperature?

    b. 300.0 mL of gas at 0.0°C is heated to 30.0°C?

    c. 220.0 mL of gas at 10.0°C is heated to 100.0°C?

2. What is the temperature when: (pressure is constant)

   a. 30.0 mL of gas at 14°C is compressed to 22 mL?

   b. 16.4 mL of gas at 28°C is expanded to 20.0 mL?
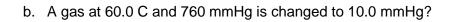
   c. 39 mL of gas at 0.0°C is compressed to 35 mL?

Worksheet 3.4: Lusac's Gas Law

1. What is the pressure when: (volume is constant)

    a. A gas at 130 C and 740 mmHg is changed to 150 C?

    b. A gas at 25 C and 65 atm is changed to 30.0 C?

    c. A gas at 1.0 K and 70 kPa is changed to 1.2 K?

2. What is the temperature in degrees Celsius when: (volume is constant)

    a. A gas at 75.0 C and 4.10 atm is changed to 7.00 atm?

    b. A gas at 60.0 C and 760 mmHg is changed to 10.0 mmHg?

    c. A gas at 113 K and 760 kPa is changed to 300 kPa?

Worksheet 3.5: Combined Gas Law

1. If 120 mL of oxygen is collected at 27°C and 740 mmHg, what will the volume of the dry gas be at STP?

2. If 500.0 mL of hydrogen is collected at 293.15 K and 95.0 kPa, what will the volume of the gas by at SATP?

3. 113 mL of oxygen is collected at 22°C and 98.0 kPa and left over night. The next day, the volume was 109 mL and the temperature was 21°C. What was the pressure?

4. 36 mL of nitrogen was collected at 25°C, but the barometer was broken so the pressure could not be read. Three days later, the new barometer arrived. The new volume was 32 mL, the temperature was 21°C and the pressure reading was 739 mmHg. What was the original pressure?

5. If 250 mL of helium was collected at STP, what will the temperature be if the volume is reduced to 200 mL and the pressure increased to 110 kPa?

6. A certain 1.0L sample of gas has a temperature of 23°C and a pressure of 0.96 atm. The sample was left overnight and the next day had a pressure of 1.00 atm and a volume of 1.1 L. What is the temperature on the second day?

Worksheet 3.6: Ideal Gas Law

1. What pressure (kPa) is exerted by 1.0 mol (of an ideal gas contained in a 1.0 L vessel at $0.0^{\circ}C$?

2. What volume will 5.0 mol of an ideal gas occupy at $25.0^{\circ}C$ and 1.5 atm of pressure?

3. Calculate the molar mass of gas if 4.5 L of the gas is at 785 mmHg, $23.5^{\circ}C$ and the gas has a mass of 13.5 g.

4. 0.453 mol of a gas confined to a 15.0 L container exerts a pressure of 1.24 atm on the walls of the container. What is the temperature of the gas?

5. 5.4 g of carbon dioxide gas is confined to a 20.0 L container at a temperature of 315.5 K. What pressure (kPa) does the gas exert?

6. 2.125 g of a gas in a 1.25 L container exerts a pressure of 86.0 kPa at 40.0°C. What is the molar mass of the gas?

7. To what temperature must 10.0 g of ammonia gas have to be heated in a 15.0 L container in order for it to exert a pressure of 3.50 atm?

8. 2.0 x 10⁻⁵g of hydrogen gas at 327 K exerts a pressure of 50.5 kPa on the walls of a small tube. What is the volume of the tube?

Worksheet 3.7: Gas Stoichiometry

1. What mass of propane from a tank can be burned using 50 L of oxygen at STP?

2. Hydrogen gas is burned in pollution-free vehicles to produce water vapor. What volume of hydrogen at 40°C and 150 kPa can be burned using 300 L of oxygen gas measured at the same conditions?

3. A Down's Cell is used in the industrial production of sodium from the decomposition of molten sodium chloride. What is the temperature of 250 L of chlorine gas produced at 100.1 kPa if 100 g of sodium is also produced?

4. A typical home is heated with natural gas and consumes 2.00 ML of natural gas during the month of December. What volume of oxygen at STP is required to burn 2.00 ML of methane measured at $0.00^{\circ}C$ and 120 kPa?

5. Methane reacts with steam to produce hydrogen gas and carbon dioxide gas. What volume of hydrogen gas, measured at $25^{\circ}C$ and 120 kPa, can be produced from 1.0 t of steam?

6. Hydrogen gas can be produced from the electrolytic decomposition of water. What volume of hydrogen gas is produced, along with 52 kL of oxygen gas, at $25^{\circ}C$ and 120kPa?

Worksheet 3.8: Review of Gases

1. A volume of 20.0 L of oxygen is warmed from -30.0 C to 85.0 C. What is the new volume, if the pressure is kept constant?

2. A mass of air occupies a volume of 5.7 L at a pressure of 0.52 atm. What is the new pressure if the same mass of air at the same temperature is transferred to a 2.0 L container?

3. Determine the total pressure of a gas mixture that contains CO, Ne and He if the partial pressures of the gases are P_{CO} = 1.53 atm, P_{Ne} = 0.82 atm, and P_{He} = 0.34 atm.

4. What is the volume of a sample of oxygen gas that has a mass of 50.0 g and is under a pressure of 1.20 atm at 27.0 C?

5. What is the volume at STP of a sample of carbon dioxide gas that has a volume of 75.0 mL at 30.0 C and 680 mmHg?

6. A rigid container holds a gas at a pressure of 0.55 atm at a temperature of -100 C. What will the pressure be when the temperature is increased to 200 C?

7. Explain why real gases deviate from the gas laws.