

# Exercise 11.2a

## Basic Gas Laws

Name: \_\_\_\_\_

Date: \_\_\_\_\_ Per: \_\_\_\_\_

**DIRECTIONS:** Answer the following in the space provided.

1. Convert each of the following measurements as directed.

a. 960. mmHg to atmospheres.

c. 785 mmHg to atmospheres.

b. 3.40 atmospheres to mmHg.

d. 7.80 atmospheres to mmHg.

### Boyle's Law

Boyle's Law states that for a fixed mass of gas at constant temperature, the volume is *inversely proportional* to the pressure. Basically, it means that if the pressure of a gas is doubled, the volume will be halved. If the pressure is increased 12 times, the volume will be decreased 12 times. The pressure and volume of a fixed mass of gas at constant temperature are related by the formula:

$$P_1V_1 = P_2V_2$$

**DIRECTIONS:** Answer the following in the space provided. Assume constant temperature.

2. Suppose that two quantities, A and B, are inversely related. If the value of A becomes five times as great, what will happen to the value of B? \_\_\_\_\_

3. Give the multiplicative inverse (reciprocal) of

a. 7 \_\_\_\_\_

b. 1/3 \_\_\_\_\_

c. 0.280 \_\_\_\_\_

4. A quantity of gas has a volume of 200. mL ( $V_1$ ) when confined under a pressure of 4.00 atm( $P_1$ ). What will be the new volume ( $V_2$ ) of the gas if the pressure is reduced to 1.00 atm( $P_2$ ) at constant temperature?

5. A sample of gas has a volume of 500. mL ( $V_1$ ) at a pressure of 1.00 atm ( $P_1$ ). What will the new volume ( $V_2$ ) be if the pressure is increased to 3.00 atm ( $P_2$ )?

6. A quantity of gas has a volume of 400. mL when confined under a pressure of 600. mmHg. What will be the new volume of the gas if the pressure is reduced to 200. mmHg at constant temperature?

7. A sample of gas has a volume of 300. L at a pressure of 760. mmHg. What pressure will be required to reduce the volume of the gas to 20.0 L?

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## Basic Gas Laws

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### Charles' Law

Charles' Law states that for a fixed mass of gas at constant pressure, the volume is **directly proportional** to the temperature. Basically, it means that if the temperature of a gas is doubled, the volume will be doubled. If the temperature is increased 12 times, the volume will be increased 12 times. The temperature and volume of a fixed mass of gas at constant pressure are related by the formula:

$$T_1V_2 = T_2V_1$$

**DIRECTIONS: Answer the following in the space provided. Assume constant pressure.**

- A sample of gas has a volume of 50.0 L ( $V_1$ ) at a temperature of 250. K ( $T_1$ ). What will the new volume ( $V_2$ ) be if the temperature is raised to 350. K ( $T_2$ )?
- A sample of gas has a volume of 300. mL ( $V_1$ ) when it is at a temperature of 300. K ( $T_1$ ). What will the new volume ( $V_2$ ) be if the temperature is raised to 400. K ( $T_2$ )?
- A sample of gas has a volume of 200. mL when it is at 400. K. To what temperature must you reduce it to have a volume of 50.0 mL?
- A gas sample has a volume of 20.0 L at 100. °C. To what temperature must you reduce it to have a volume of 5.00 L?

### Gay-Lussac's Law

Gay-Lussac's Law states that for a fixed mass of gas at constant volume, the pressure is **directly proportional** to the temperature. Basically, it means that if the temperature of a gas is doubled, the pressure will be doubled. If the temperature is increased 12 times, the pressure will be increased 12 times. The temperature and pressure of a fixed mass of gas at constant volume are related by the formula:

$$T_1P_2 = T_2P_1$$

**DIRECTIONS: Answer the following in the space provided. Assume constant volume.**

- A sample of gas has a pressure of 800. mmHg ( $P_1$ ) at 350. K ( $T_1$ ). What will the new pressure ( $P_2$ ) be if the temperature is made 600. K ( $T_2$ )?

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## Basic Gas Laws

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- A sample of gas has a pressure of 14.0 psi ( $P_1$ ) at a temperature of 300. K ( $T_1$ ). What will the new pressure ( $P_2$ ) be if the temperature is made 450. K ( $T_2$ )?
  - A sample of gas has a pressure of 740. mmHg at a temperature of 25.0 °C. What will the new pressure be if the temperature is raised to 40.0 °C? (Remember, gas laws always use K rather than °C, so convert.)
  - A sample of gas has a pressure of 760. mm Hg at a temperature of 40.0 °C. What will the new pressure be if the temperature is raised to 60.0 °C?

### Mixed Review

**DIRECTIONS:** Answer the following in the space provided.

- A sample of gas has a volume of 200.  $\text{cm}^3$  at a pressure of 30.0 kPa. What will the volume be if the pressure is reduced to 1.00 kPa?
- A sample of gas has a pressure of 50.0 atm at a temperature of 3000. °C. To what temperature would you have to cool the gas to reduce the pressure to 3.00 atm?
- A sample of gas has a volume of 2.00 L when it is at a temperature of 200. °C. What will the new volume be if the temperature is raised to 550. °C?
- The valve on a tank of pressurized oxygen is opened and the oxygen rushes out. After oxygen stops flowing from the tank, some gas remains inside. Explain what determines the amount of gas left in the tank.

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