South Pasadena • Chemistry

Name _____
Period ___ Date ___/___/___

12 • The Gas Laws

BOYLE'S LAW

Boyle's Law states that the volume of a gas varies inversely with its pressure if temperature is held constant. (If one goes up, the other goes down.) We use the formula:

$$P_1 \times V_1 = P_2 \times V_2$$

Solve the following problems (assuming constant temperature). Assume all number are 3 significant figures.

1. A sample of oxygen gas occupies a volume of 250 mL at 740 torr pressure. What volume will it occupy at 800 torr pressure?

2. A sample of carbon dioxide occupies a volume of 3.50 Liters at 125 kPa pressure. What pressure would the gas exert if the volume was decreased to 2.00 liters?

3. A 2.00-Liter container of nitrogen had a pressure of 3.20 atm. What volume would be necessary to decrease the pressure to 1.00 atm?

4. Ammonia gas occupies a volume of 450 mL as a pressure of 720 mmHg. What volume will it occupy at standard pressure (760 mmHg)?

5. A 175 mL sample of neon had its pressure changed from 75.0 kPa to 150 kPa. What is its new volume?

6. A sample of hydrogen at 1.50 atm had its pressure decreased to 0.50 atm producing a new volume of 750 mL. What was the sample's original volume?

7. Chlorine gas occupies a volume of 1.20 liters at 720 torr pressure. What volume will it occupy at 1 atm pressure?

8. Fluorine gas exerts a pressure of 900 torr. When the pressure is changed to 1.50 atm, its volume is 250 mL. What was the original volume?

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CHARLES'S LAW

Charles' Law states the volume of a gas varies directly with the Kelvin temperature, assuming the pressure is constant. We use the following formulas:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \text{or} \quad V_1 \times T_2 = V_2 \times T_1$$

$$K = °C + 273$$

Solve the following problems assuming a constant pressure. Assume all numbers are 3 significant figures.

1. A sample of nitrogen occupies a volume of 250 mL at 25 °C. What volume will it occupy at 95 °C?

2. Oxygen gas is at a temperature of 40 °C when it occupies a volume of 2.30 Liters. To what temperature should it be raised to occupy a volume of 6.50 Liters?

3. Hydrogen gas was cooled from 150 °C to 50 °C. Its new volume is 75.0 mL. What was its original volume?

4. Chlorine gas occupies a volume of 25.0 mL at 300 K. What volume will it occupy at 600 K?

5. A sample of neon gas at 50 °C and a volume of 2.50 Liters is cooled to 25 °C. What is the new volume?

6. Fluorine gas at 300 K occupies a volume of 500 mL. To what temperature should it be lowered to bring the volume to 300 mL?

7. Helium occupies a volume of 3.80 Liters at –45 °C. What volume will it occupy at 45 °C?

8. A sample of argon gas is cooled and its volume went from 380 mL to 250 mL. If its final temperature was –55 °C, what was its original temperature?

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THE IDEAL GAS LAW

PV = nRT where
P = pressure in atmosphere
V = volume in liters
n = number of moles of gas
R = Universal Gas Constant = 0.0821 L·atm/mol·K
T = Kelvin temperature

1. How many moles of oxygen will occupy a volume of 2.50 liters at 1.20 atm and 25 °C?
_____

2. What volume will 2.00 moles of nitrogen occupy at 720. torr and 20.°C?
_____

3. What pressure will be exerted by 25.0 g of CO_2 at temperature of 25 °C and a volume of 500. mL?
_____

4. At what temperature will 5.00 g of Cl_2 exert a pressure of 900. torr at a volume of 750. mL?
_____

5. What is the density of NH_3 at 800. torr and 25 °C? _____

6. If the density of a gas is 1.2 g/L at 745 torr and 20.°C, what is its molar mass?
_____

7. How many moles of nitrogen gas will occupy a volume of 347 mL at 6680 torr and 27 °C?
_____

8. What volume will 454 grams (1 lb) of hydrogen occupy at 1.05 atm and 25 °C?
_____

9. Find the number of grams of CO_2 that exert a pressure of 785 torr at a volume of 32.5 L and a temperature of 32 °C. _____

10. An elemental gas has a mass of 10.3 g. If the volume is 58.4 L and the pressure is 758 torr at a temperature of 2.5 °C, what is the gas? _____