Name: _____
Period: ___

Gas Laws

I. Dalton's Law

$$P_{Total} = P_1 + P_2 + P_3 \ldots$$

(1) A mixture of helium and neon has a total pressure of 3.50 atm. If the partial pressure of helium is 1.25 atm, what is the partial pressure of neon?

(2) The gases found in the atmosphere have a total pressure of 1.00 atm. If the partial pressure of nitrogen is 0.780 atm and the partial pressure of oxygen is 0.163 atm, what is the partial pressure of the remaining components of air?

(3) A mixture contains carbon dioxide with a partial pressure of 3.85×10^5 Pa and oxygen with a partial pressure of 2.35×10^5 Pa. What is the total pressure of the mixture?

II. Boyle's Law, Charles' Law, Gay-Lussac's Law, and Combined Gas Law

$$P_1V_1 = P_2V_2 \qquad \frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad \frac{P_1}{T_1} = \frac{P_2}{T_2} \qquad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

(1) A sample of 2.5 L of helium at 1.05 atm of pressure is expanded to 3.8 L. What will the resulting pressure be if the temperature remains constant?

(2) A balloon contains 950 mL of air at 302 K. If the temperature is lowered to 280 K, what will the volume of the balloon be if the pressure remains constant?

(3) A gas cylinder has a pressure reading of 1.20 atm at 300 K. At what temperature will the pressure read 2.00 atm, if the volume remains constant?

(4) A hot air balloon contains 854 L of air at 25 °C. What will the volume of the balloon be if the temperature is lowered to 10 °C, if the pressure remains constant?

(5) An aerosol can is under a pressure of 4.5 atm at 12 °C. What pressure will the can reach if is heated to 35 °C if the volume remains constant?

(6) A sample of argon under 4.40×10^4 Pa of pressure occupies 405 mL. What volume will the sample occupy if the pressure is decreased to 1.50×10^4 Pa, if the temperature remains constant?

(7) A sample of carbon dioxide occupies 10 mL at 50 °C and 3.2 atm of pressure. What volume will the sample occupy at 30 °C and 1.5 atm of pressure?

(8) A tire occupies 6.0 L and has a pressure of 1.8 atm at 295 K. What will the pressure read if the tire has a volume of 5.9 L at 310 K?

(9) A sample of 30 mL of chlorine gas under 5.4×10^5 Pa of pressure at -5 °C is expanded to occupy 45 mL under 4.6×10^5 Pa of pressure. What will the temperature of the sample be?

III. Avagadro's Law and Ideal Gas Law

$1\ mole = 22.4\ L \qquad PV = nRT \qquad R = 0.0821\ L\,atm/mol\,K \qquad R = 8314\ L\,Pa/mol\,K$

(1) (a) State the conditions of STP.
(b) What volume does one mole of gas occupy at STP?

(2) Determine the volume of 0.22 mol of methane gas at STP.

(3) How many moles of argon gas are contained in 50.6 L at STP?

(4) What is the mass of 105 mL of krypton gas at STP? How many atoms of krypton are contained within this volume?

(5) A 1.8 L balloon at STP is filled with carbon dioxide. What is the mass of the gas contained within the balloon? How many molecules of carbon dioxide are present?

(6) What volume is occupied by 2.45 mol of water vapour at 0.850 atm and 450 K?

(7) What is the pressure (in atm) of 0.65 mol of fluorine gas contained in 450 mL at 37 °C?

(8) How many moles of radon are contained in 200 mL flask under 7.65×10^5 Pa of pressure at 250 K?

(9) What is the temperature if a 25.4 L balloon contains 6.24 mol of helium at 3.56 atm?

(10) What is the mass of nitrogen dioxide gas contained in an 860 mL sample under 4.35 atm of pressure at -15 °C?

(11) What is the volume occupied by 1.24×10^{22} atoms of argon under 6.54×10^5 Pa of pressure at 150 K?

(12) What is the pressure (in Pa) if 24.5 g of hydrogen gas occupy 424 L at 12 °C?

Answers:

I. Dalton's Law

(1) 2.25 atm

(2) 0.057 atm

(3) 6.20×10^5 Pa

II. Boyle's Law, Charles' Law, Gay-Lussac's Law, and Combined Gas Law

(1) 0.691 atm

(2) 0.881 L

(3) 500 K

(4) 8.1×10^2 L

(5) 4.9 atm

(6) 1.19 L

(7) 0.020 L

(8) 1.9 atm

(9) 3.4×10^2 K

III. Avagadro's Law and Ideal Gas Law

(1) (a) Temperature = 0 °C or 273 K

Pressure = 1.00 atm or 1.01325×10^5 Pa

(b) 1 mole = 22.4 L

(2) 4.9 L

(3) 2.26 mol

(4) 0.393 g, 2.82×10^{21} atoms

(5) 3.5 g, 4.9×10^{22} molecules

(6) 106 L

(7) 37 atm

(8) 7.36×10^{-2} mol

(9) 177 K

(10) 8.13 g

(11) 0.0393 L

(12) 6.79×10^4 Pa