

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

## Gas Laws

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

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

- (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  $4.40 \times 10^4$  Pa of pressure occupies 405 mL. What volume will the sample occupy if the pressure is decreased to  $1.50 \times 10^4$  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  $5.4 \times 10^5$  Pa of pressure at -5 °C is expanded to occupy 45 mL under  $4.6 \times 10^5$  Pa of pressure. What will the temperature of the sample be?

### II. Avagadro's Law and Ideal Gas Law

$$1 \text{ mole} = 22.4 \text{ L} \quad PV = nRT \quad R = 0.0821 \text{ L atm/mol K} \quad R = 8314 \text{ L Pa/mol K}$$

- (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  $7.65 \times 10^5$  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  $1.24 \times 10^{22}$  atoms of argon under  $6.54 \times 10^5$  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. Boyle's Law, Charles' Law, Gay-Lussac's Law, and Combined Gas Law

- (1) 0.691 atm  
 (2) 881 mL  
 (3) 500 K  
 (4) 811 L  
 (5) 4.9 atm  
 (6) 1.19 L  
 (7) 20 mL

(8) 1.9 atm

(9)  $3.4 \times 10^2$  K

II. Avogadro's Law and Ideal Gas Law

- (1) (a) Temperature = 0 °C or 273 K  
 Pressure = 1.00 atm or  $1.01325 \times 10^5$  Pa  
 (b) 1 mole = 22.4 L  
 (2) 4.9 L  
 (3) 2.26 mol

(4) 0.393 g,  $2.82 \times 10^{21}$  atoms

(5) 3.5 g,  $4.9 \times 10^{22}$  molecules

(6) 106 L

(7) 37 atm

(8)  $7.36 \times 10^{-2}$  mol

(9) 177 K

(10) 8.13 g

(11) 0.0393 L

(12)  $6.79 \times 10^4$  Pa