**WKS**
**Avogadro's Principle**

**NAME** Answer Key
**Period** _____ **Date** _____

1. Describe what Avogadro's Principle means.
   It means that, regardless of the identity or molar mass of a gas, the volume of the gas and the number of molecules or moles of the gas are directly related.

2. What does STP stand for and what are the conditions it describes?
   STP stands for Standard Temperature and Pressure, and indicates that T = 0°C (273 K) and P = 1 atm.

3. What is the molar volume of a gas at STP?
   The volume of one mole of a gas at STP is 22.4 L/mol.

4. What is the volume of a container that holds 2.4 mol of gas at STP?

$$?\ \text{L} = 2.4\ \text{mol} \times \frac{22.4\ \text{L}}{1\ \text{mol}} = \boxed{54\ \text{L}}$$

5. How many moles of CO are in 26.8 L of CO at STP?

$$?\ \text{mol CO} = 26.8\ \text{L CO} \times \frac{1\ \text{mol CO}}{22.4\ \text{L CO}} = \boxed{1.20\ \text{mol CO}}$$

6. If a balloon will rise off the ground when it contains 0.0226 mol of helium in a volume of 0.460 L, how many moles of helium are needed to make the balloon rise when its volume is 0.865 L? Assume that temperature and pressure stay constant.

$$\text{Use } \frac{V_1}{n_1} = \frac{V_2}{n_2} \Rightarrow \frac{0.460\ \text{L}}{0.0226\ \text{mol}} = \frac{0.865\ \text{L}}{n_2};\ n_2 = \frac{(0.0226\ \text{mol})(0.865\ \text{L})}{0.460\ \text{L}} = \boxed{0.0425\ \text{mol}}$$

7. How many grams of carbon dioxide gas are in a 1.0-L balloon at STP?

$$?\ \text{g CO}_2 = \underbrace{1.0\ \text{L CO}_2 \times \frac{1\ \text{mol CO}_2}{22.4\ \text{L CO}_2}}_{0.045\ \text{mol CO}_2} \times \frac{44.01\ \text{g CO}_2}{1\ \text{mol CO}_2} = \boxed{2.0\ \text{g CO}_2}$$

8. What volume will 0.416 g of krypton gas occupy at STP?

$$?\ \text{L Kr} = \underbrace{0.416\ \text{g Kr} \times \frac{1\ \text{mol Kr}}{83.80\ \text{g Kr}}}_{0.00496\ \text{mol Kr}} \times \frac{22.4\ \text{L Kr}}{1\ \text{mol Kr}} = \boxed{0.111\ \text{L Kr}}$$

9. Calculate the volume that 4.5 kg of ethylene gas ($C_2H_4$) will occupy at STP.

$$?\ \text{mol } C_2H_4 = \underbrace{4.5\ \text{kg } C_2H_4 \times \frac{1000\ \text{g}}{1\ \text{kg}} \times \frac{1\ \text{mol } C_2H_4}{28.05\ \text{g } C_2H_4}}_{160\ \text{mol}} \times \frac{22.4\ \text{L } C_2H_4}{1\ \text{mol } C_2H_4} = \boxed{3600\ \text{L } C_2H_4}$$

10. **Thinking Critically** Think about what happens when a bottle of carbonated soft drink is shaken before being opened. Use the gas laws to explain whether the effect will be greater when the liquid is warm or cold.
    Shaking the bottle increases the motion of the gas particles, raising the temperature and thus the pressure. Opening the bottle will cause the gas bubbles, originally under higher pressure, to be released. This effect will be greater at higher temperature because the pressure will be higher.