10.2 MOLE-MASS AND MOLE-VOLUME RELATIONSHIPS

Section Review

Objectives
- Convert the mass of a substance to the number of moles of a substance, and the number of moles of a substance to mass
- Calculate the volume of a quantity of gas at STP

Vocabulary
- Avogadro's hypothesis
- standard temperature and pressure (STP)
- molar volume

Key Equations
- $\text{mass (grams)} = \text{number of moles} \times \dfrac{\text{mass (grams)}}{1 \text{ mole}}$

- $\text{moles} = \text{mass (grams)} \times \dfrac{1 \text{ mole}}{\text{mass (grams)}}$

- $\dfrac{\text{grams}}{\text{mole}} = \dfrac{\text{grams}}{\text{L}} \times \dfrac{22.4 \text{ L}}{1 \text{ mole}}$

- $\text{volume of gas} = \text{moles of gas} \times \dfrac{22.4 \text{ L}}{1 \text{ mole}}$

Part A Completion

Use this completion exercise to check your knowledge of the terms and your understanding of the concepts introduced in this section. Each blank can be completed with a term, short phrase, or number.

At STP (0°C and 1 atmosphere pressure), one mole of any gas occupies a volume of __**1**__ L. This quantity is known as the __**2**__ of the gas. To determine the volume in liters of 2.00 mol of SO_2 gas at STP, you would use __**3**__ as a conversion factor. __**4**__, expressed in the units g/L, is used as a conversion factor when converting from volume to molar mass. When converting between numbers of representative particles, masses, and volumes, you must always convert to __**5**__ as an intermediate step.

1. _____

2. _____

3. _____

4. _____

5. _____

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

_____ **6.** One mole of any gas occupies a volume of 22.4 L.

_____ **7.** For a substance of known molar mass, the number of moles of a sample can be calculated from the mass of the sample.

_____ **8.** The volume occupied by one mole of a gas is dependent on the molar mass of the gas.

_____ **9.** The volume of a gas at STP can be calculated from the number of molecules of the gas.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A	Column B
_____ **10.** molar mass	**a.** 22.4 L of a gas at STP
_____ **11.** standard temperature	**b.** 101.3 kPa or 1 atm
_____ **12.** molar volume	**c.** 0°C
_____ **13.** standard pressure	**d.** mass (in grams) of one mole of a substance
_____ **14.** molar road map	**e.** a means of relating mass, number of representative particles, and gaseous volume of a substance

Part D Problems

Solve the following problems in the space provided. Show your work.

15. What is the density of N_2O, a gas, at STP?

16. What is the mass of two moles of NaCl?

17. How many moles are in 16 grams of O_2?

18. What is the volume of 16 grams of O_2 at STP?