

12.2

CHEMICAL CALCULATIONS

Section Review

Objectives

- Construct mole ratios from balanced chemical equations and apply these ratios in mole-mole stoichiometric calculations
- Calculate stoichiometric quantities from balanced chemical equations, using units of moles, mass, representative particles, and volumes of gases at STP

Key Equations

- mole-mole relationship used in every stoichiometric calculation:



(given quantity) (wanted quantity)

- $x \text{ mol } G \times \frac{b \text{ mol } W}{a \text{ mol } G} = \frac{xb}{a} \text{ mol } W$

Given Mole Ratio Calculated

Part A Completion

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

Mole ratios from balanced equations may be used to solve **1.** _____
 problems with other units such as numbers of **1** and **2** **2.** _____
 of gases at STP. The **3** from the balanced equation are used **3.** _____
 to write conversion factors called **4**. These conversion factors **4.** _____
 are used to calculate the numbers of moles of **5** from a given **5.** _____
 number of moles of **6**. In mass-mass calculations, the molar **6.** _____
 mass is used to convert mass to **7**. **7.** _____

Part B True-False

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

- _____ **8.** In mass-mass calculations, the molar mass is used to convert mass to moles.
- _____ **9.** The mole ratio 2 mol HF/1 mol SnF₂ can be used to determine the mass of SnF₂ produced according to the equation:
 $\text{Sn}(s) + 2\text{HF}(g) \rightarrow \text{SnF}_2(s) + \text{H}_2(g)$

- _____ 10. In a volume-volume problem, the 22.4 L/mol factors always cancel out.
- _____ 11. In stoichiometric problems, volume is expressed in terms of liters.
- _____ 12. For a mass-mole problem, the first conversion from mass to moles is skipped.
- _____ 13. For a mass-mass problem, the first conversion is from moles to mass.
- _____ 14. Because mole ratios from balanced equations are exact numbers, they do not enter into the determination of significant figures.

Part C Matching

Match each conversion problem in Column A to the correct solution in Column B.

Column A

- _____ 15. moles O₂ → grams O₂
- _____ 16. liters SO₂ → grams SO₂ at STP
- _____ 17. molecules He → liters He(g) at STP
- _____ 18. grams Sn → molecules Sn
- _____ 19. molecules H₂O → grams H₂O

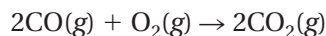
Column B

- a. molecules $\times \frac{\text{mol}}{6.02 \times 10^{23} \text{ molecules}} \times \frac{18.0 \text{ g}}{\text{mol}}$
- b. liters $\times \frac{\text{mol}}{22.4 \text{ L}} \times \frac{64.1 \text{ g}}{\text{mol}}$
- c. mol $\times \frac{32.0 \text{ g}}{\text{mol}}$
- d. molecules $\times \frac{\text{mol}}{6.02 \times 10^{23} \text{ molecules}} \times \frac{22.4 \text{ L}}{\text{mol}}$
- e. grams $\times \frac{\text{mol}}{119 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{\text{mol}}$

Part D Questions and Problems

Answer the following questions in the space provided.

20. How many liters of carbon monoxide (at STP) are needed to react with 4.8 g of oxygen gas to produce carbon dioxide?



21. What mass of ammonia, NH₃, is necessary to react with 2.1×10^{24} molecules of oxygen in the following reaction?

