

12.1 THE ARITHMETIC OF EQUATIONS

Section Review

Objectives

- Calculate the amount of reactants required or product formed in a nonchemical process
- Interpret balanced chemical equations in terms of interacting moles, representative particles, masses, and gas volume at STP

Vocabulary

- stoichiometry

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.

- The coefficients of a balanced chemical equation indicate the relative number of 1 of reactants and products. All stoichiometric calculations begin with a 2. Only 3 and 4 are conserved in every reaction; moles, volumes, and representative particles may not be.
- In solving stoichiometric problems, conversion factors relating moles of reactants to 5 of products are used.
- If you assume 6, the balanced equation also tells you about the volumes of gases.

Part B True-False

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

- AT 7. The coefficients in a balanced chemical equation can be used to form mole ratios relating reactants to products.
- ST 8. The coefficients in a balanced chemical equation tell the relative volumes of reactants and products, expressed in any suitable unit of volume.
- AT 9. To calculate the mass of a molecule in grams, you can use the molar mass and Avogadro's number.

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- ST 10. Because the mass of the reactants equals the mass of the products of a reaction, the number of moles will be conserved.

AT 11. If the ratio of molecules in the reaction, $2A_2 + B_2 \rightarrow 2A_2B$ is 2:1:2, we can predict that 4 molecules of A_2 react with 2 molecules B_2 to produce 4 molecules of A_2B .

ST 12. One mole of any gas occupies a volume of 22.4 L.

Part C Matching

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

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| Column A | Column B |
| <u>b</u> 13. stoichiometry | a. Avogadro's number |
| <u>d</u> 14. product | b. the calculations of quantities in chemical reactions |
| <u>e</u> 15. coefficient | c. STP |
| <u>a</u> 16. 6.02×10^{23} | d. a substance formed in a chemical reaction |
| <u>c</u> 17. $0^\circ\text{C}, 101.3 \text{ kPa}$ | e. gives the relative number of molecules involved in a reaction |

Part D Questions and Problems

Answer the following in the space provided. Show your work.

18. Interpret the following equation using moles, molecules, and volumes (assume STP). Compare the mass of the reactants to the mass of the product.
- $2\text{N}_2(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{N}_2\text{O}_3(\text{g})$
- 2 moles of nitrogen gas react w/ 3 moles of oxygen gas to produce 2 mol of dinitrogen trioxide.
19. How many moles of chlorine gas will be required to react with sufficient iron to produce 14 moles of iron(III) chloride?
- $2\text{Fe}(\text{s}) + 3\text{Cl}_2(\text{g}) \rightarrow 2\text{FeCl}_3(\text{g})$

$\frac{14 \text{ mol FeCl}_3}{3 \text{ mol Cl}_2} = 21 \text{ mol Cl}_2$

$\frac{2 \text{ mol FeCl}_3}{1} = 21 \text{ mol Cl}_2$

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