Name STURMAN Key Date _____ Class _____

12.2 CHEMICAL CALCULATIONS

23E

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:
  $aG \longrightarrow bW$
  (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 problems with other units such as numbers of 1. representative particles (atoms, moles) and 2. volumes of gases at STP. The 3. coefficients from the balanced equation are used to write conversion factors called 4. mole ratios. These conversion factors are used to calculate the numbers of moles of 5. product or reactant (switched is fine) from a given number of moles of 6. reactant. In mass-mass calculations, the molar mass is used to convert mass to 7. moles.

Part B True-False

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

AT 8. In mass-mass calculations, the molar mass is used to convert mass to moles.

NT 9. The mole ratio 2 mol HF/1 mol SnF_2 can be used to determine the mass of SnF_2 produced according to the equation: (should be switched)
$Sn(s) + 2HF(g) \rightarrow SnF_2(s) + H_2(g)$

Name _____ Date _____ Class _____

AT 10. In a volume-volume problem, the 22.4 L/mol factors always cancel out.

AT or ST 11. In stoichiometric problems, volume is expressed in terms of liters.

NT 12. For a mass-mole problem, the first conversion from mass to moles is skipped.

NT 13. For a mass-mass problem, the first conversion is from moles to mass. It's mass to moles

AT 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	Column B
C 15. moles O_2 → grams O_2	a. $\text{molecules} \times \frac{\text{mol}}{6.02 \times 10^{23} \text{ molecules}} \times \frac{18.0 \text{ g}}{\text{mol}}$
b 16. liters SO_2 → grams SO_2 at STP	b. $\text{liters} \times \frac{\text{mol}}{22.4 \text{ L}} \times \frac{64.1 \text{ g}}{\text{mol}}$
d 17. molecules He → liters He(g) at STP	c. $\text{mol} \times \frac{32.0 \text{ g}}{\text{mol}}$
e 18. grams Sn → molecules Sn	d. $\text{molecules} \times \frac{\text{mol}}{6.02 \times 10^{23} \text{molecules}} \times \frac{22.4 \text{ L}}{\text{mol}}$
a 19. molecules H_2O → grams H_2O	e. $\text{grams} \times \frac{\text{mol}}{119 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ molecules}}{\text{mol}}$

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?

$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$

$\frac{4.8 \text{ g } O_2}{1} \cdot \frac{1 \text{ mol } O_2}{32.00 \text{ g } O_2} \cdot \frac{2 \text{ mol } CO_2}{1 \text{ mol } O_2} \cdot \frac{22.4 \text{ L } CO_2}{1 \text{ mol } CO_2} = 6.7 \text{ L CO}$

21. What mass of ammonia, NH_3, is necessary to react with 2.1×10^{24} molecules of oxygen in the following reaction?

$4NH_3(g) + 7O_2(g) \rightarrow 6H_2O(g) + 4NO_2(g)$

$\frac{2.1 \times 10^{24} \text{ molecules } O_2}{1} \cdot \frac{1 \text{ mol } O_2}{6.02 \times 10^{23} \text{ molecules } O_2} \cdot \frac{4 \text{ mol } NH_3}{7 \text{ mol } O_2} \cdot \frac{17.04 \text{ g } NH_3}{1 \text{ mol } NH_3}$

$= 33.966$

$= 34 \text{ g } NH_3$

8