

Study Guide: Chemical Equations, Reactions, & Stoichiometry

- ✓ Write a word equation and a formula equation for a given chemical equation.
- ✓ Balance chemical equations.
- ✓ Apply the use of state symbols (s), (l), (g) and (aq) in equations.
- ✓ Describe the relationship between the law of conservation of matter and balancing chemical equations.
- ✓ List observations that would indicate that a chemical reaction has taken place.
- ✓ Define and give general equations for synthesis, decomposition, single-displacement, and double displacement reactions.
- ✓ Classify reactions as synthesis, decomposition, single-displacement, double-displacement, or combustion reactions
- ✓ Predict products of simple reactions given the reactants.
- ✓ Use an activity series to predict whether a given reaction will occur and what the products will be.
- ✓ Describe the importance of the mole ratio in stoichiometric calculations
- ✓ Write a mole ratio relating two substances in a chemical equation.
- ✓ Use mole ratios to calculate the amount of reactants or products in a reaction (calculate moles and/or grams) given the mass or moles of a different reactant or product.
- ✓ Define acid and base according to Bronsted-Lowry theory
- ✓ List the general characteristics of acids and bases.
- ✓ Name common binary acids and oxyacids given their chemical formulas
- ✓ Explain the process and write balanced equations of neutralization reactions
- ✓ Explain and use the pH scale
- ✓ Perform molarity calculations
- ✓ Describe how acid rain is formed and the effects of acid rain on humans and ecosystems
- ✓ Use dimensional analysis to perform calculations
- ✓ Perform mathematical calculations involving significant figures.

To prepare for this test you should:

- Go over all past worksheets (especially the packet on types of reactions)
- Review/revise all of your notes for this topic
- Review/revise all quizzes from this topic (rework all problems missed)
- Do the practice problems below
- If needed: go back to resources on www.mrspage.com to get more help with topics

PRACTICE QUESTIONS:

1. Write the formula equation for the following reactions.
 - a. Hydrogen carbonate decomposes into water and carbon dioxide gas.
 - b. Sulfur dioxide and water yields hydrogen sulfate
 - c. Iron (II) sulfide plus hydrogen sulfate yields hydrogen sulfide and iron sulfate
 - d. Beryllium fluoride plus magnesium metal yields magnesium fluoride and beryllium metal
 - e. Copper (II) chloride plus 2 moles of silver (I) nitrate yields 1 mole of copper nitrate and 2 moles of solid silver chloride
 - f. Dinitrogen trioxide plus water yields hydrogen nitrite
2. Write the word equation for the following reactions.
 - a. $\text{Na}_2\text{SO}_{4(\text{aq})} + \text{SrCl}_{2(\text{aq})} \rightarrow 2\text{NaCl}_{(\text{aq})} + \text{SrSO}_{4(\text{s})}$
 - b. $\text{N}_2\text{O}_5 + \text{H}_2\text{O} \rightarrow \text{HNO}_3$
 - c. $\text{SrBr}_2 + (\text{NH}_4)_2\text{CO}_3 \rightarrow \text{SrCO}_3 + \text{NH}_4\text{Br}$
 - d. $\text{BaO}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + \text{H}_2\text{O}_2$
 - e. $\text{K}_2\text{O} + \text{H}_2\text{O} \rightarrow \text{KOH}$
 - f. $\text{Mg} + \text{N}_2 \rightarrow \text{Mg}_3\text{N}_2$
3. Balance the following equations, be sure to include appropriate state symbols.
 - a. $\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$
 - b. $\text{Ca}(\text{OH})_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 + \text{H}_2\text{O}$

- c. $\text{H}_3\text{PO}_4 \rightarrow \text{H}_4\text{P}_2\text{O}_7 + \text{H}_2\text{O}$
 - d. $\text{Na}_2\text{CO}_3 + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
 - e. $\text{AgNO}_3 + \text{FeCl}_3 \rightarrow \text{Fe}(\text{NO}_3)_3 + \text{AgCl}$
 - f. $\text{BaCl}_2 + \text{Al}_2(\text{SO}_4)_3 \rightarrow \text{BaSO}_4 + \text{AlCl}_3$
 - g. $\text{Al}(\text{OH})_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
 - h. $\text{Fe}_2(\text{SO}_4)_3 + \text{KOH} \rightarrow \text{K}_2\text{SO}_4 + \text{Fe}(\text{OH})_3$
 - i. $\text{C}_2\text{H}_2 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
 - j. $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \rightarrow \text{NH}_3 + \text{H}_2\text{O} + \text{Cr}_2\text{O}_3 + \text{O}_2$
4. Describe the relationship between the law of conservation of matter and balancing chemical equations.
 5. List 5 observations you would make in lab to tell that a chemical reaction had taken place.
 6. Define and give the general equation for the following types of reactions
 - a. Synthesis
 - b. Decomposition
 - c. Single displacement
 - d. Double Displacement
 - e. Combustion
 7. Identify which type of chemical reaction is shown. Then predict the products and write the balanced chemical reaction including state symbols
 - a. $\text{S}_8 + \text{O}_2 \rightarrow \text{SO}_3$
 - b. $\text{C}_7\text{H}_{10} + \text{O}_2 \rightarrow$
 - c. $\text{NaOH} + \text{FeCl}_2 \rightarrow$
 - d. $\text{K} + \text{Br}_2 \rightarrow$
 - e. $\text{V}_2\text{O}_5 + \text{Al} \rightarrow$
 - f. $\text{MgCO}_3 \rightarrow$
 - g. $\text{Zn} (\text{l}) + \text{Fe}(\text{NO}_3)_2 \rightarrow$
 - h. $\text{NaI} + \text{Cl}_2 \rightarrow$
 - i. $\text{CH}_3\text{CH}_2\text{OH} + \text{O}_2 \rightarrow$
 - j. $\text{AgCl} + \text{Au} \rightarrow$
 - k. $\text{BeSO}_4 + \text{NH}_4\text{OH} \rightarrow$
 8. Describe the importance of the mole ratio in a stoichiometric calculations.
 9. Write the mole ratios for the given equation

$$\text{C}_7\text{H}_{16} + 11 \text{O}_2 \rightarrow 7 \text{CO}_2 + 8 \text{H}_2\text{O}$$
 - a. $\text{C}_7\text{H}_{16} : \text{O}_2$
 - b. $\text{CO}_2 : \text{C}_7\text{H}_{16}$
 - c. $\text{O}_2 : \text{H}_2\text{O}$
 - d. $\text{CO}_2 : \text{H}_2\text{O}$
 - e. $\text{H}_2\text{O} : \text{C}_7\text{H}_{16}$
 - f. $\text{O}_2 : \text{CO}_2$
 10. Use dimensional analysis to solve the following problems.
 - a. Using the following formula, determine the number of moles of sulfur trioxide formed if you start with 19.0 moles of oxygen gas. $\text{S}_8 + \text{O}_2 \rightarrow \text{SO}_3$
 - b. Using the following formula, determine how many grams of hydrochloric acid are needed to produce 150 grams of iron chloride. $\text{FeS} + \text{HCl} \rightarrow \text{FeCl}_2 + \text{H}_2\text{S}$
 - c. Nitrogen gas reacts with hydrogen gas to produce ammonia (NH_3). What mass of ammonia is produced if you use 140 moles of nitrogen gas?
 - d. Carbon reacts with water to produce carbon monoxide and hydrogen gases. If the reaction generates 145 grams of carbon monoxide, how many grams of carbon did you start with?
 - e. When 85 grams of tricarbon octahydride combusts, how many grams of carbon dioxide is released?
 - f. In a synthesis reaction magnesium reacts with nitrogen to form magnesium nitride. How many grams of magnesium nitride are produced if you start with 45 grams of magnesium?

- g. Ammonium sulfate reacts with calcium carbonate. How many moles of product are produced if you start with 670 grams of ammonium sulfate?
11. What happens to the atoms during a chemical reaction?
12. Define acid and base according to **Bronsted-Lowry theory**.
13. List the general characteristics of acids and bases.

	Characteristics of Acids	Characteristics of Bases
Taste		
Feel		
pH		
Turn Litmus Paper		
Conductivity?		
Corrosive?		
React with Metals?		

14. Name the following common binary acids and oxyacids given their chemical formulas
- HF
 - HCN
 - H_2SiO_3
 - H_3PO_3
 - HClO_2
 - $\text{H}_2\text{C}_4\text{H}_4\text{O}_6$
 - H_2S
 - H_3AsO_4
15. Write the chemical formula for the following acids
- Hydrophosphoric acid
 - Benzoic acid
 - Thiocyanic acid
 - Hypochlorous acid
 - Bromic acid
 - Dichromic acid
 - Hydro bromic acid
 - Sulfurous acid
16. Predict the products and balance chemical equations for the reactions with acids involving; reactive metals, metal oxides, metal hydroxides, hydrogen carbonates, and carbonates
- Zinc metal (I) and hydrofluoric acid
 - Acetic acid and sodium hydroxide
 - Copper (II) carbonate and sulfuric acid
 - Zinc hydroxide and nitrous acid
 - Calcium oxide and chloric acid
 - Barium carbonate and nitric acid
 - Hydrochloric acid and Iron (III) oxide
 - Copper (II) and phosphoric acid
 - Magnesium hydroxide and phosphorous acid
 - Sodium hydrogen carbonate and hydrochloric acid
17. Explain the process and write balanced equations of neutralization reactions
- Define neutralization. What two products are always formed from a neutralization reaction?
 - Is the pH of the resultant solution in a neutralization reaction always 7? Why or why not?
 - Write the balanced equation for the following neutralization reactions. Identify the acid, base and salt in each reaction.
 - hydrochloric acid and magnesium hydroxide
 - Sulfuric acid and lithium hydroxide

- iii. Calcium hydroxide and chloric acid
- iv. Sodium hydroxide and acetic acid

18. Explain and use the pH scale

- a. **Place the numbers along this pH scale. Label the pH scale: acidic, basic and neutral.**



- b. Where on this scale might you find a weak acid? A strong base?
- c. How acidic is lemon juice (pH = 2) in comparison to black coffee (pH = 5)?

19. Use a pH meter and universal indicators to determine the acidity or alkalinity of a substance

Name of Indicator/ Measurement Tool	How is it used?	What are the benefits of this tool?	What are the disadvantages of this tool?
Litmus Paper			
Universal Indicator Paper			
Bromothymol Blue			
Methylene Orange			
pH Sensor			

20. Calculate molarity

- a. Calculate the molarity of 29.0 g of ethanol (C₂H₅OH) in 545 mL of solution.
- b. Calculate the molarity of 9.0 g of sodium chloride in 86.4 mL of solution.
- c. Calculate the molarity of 6.57 g of methanol (CH₃OH) in 1.50 X 10² mL of solution.
- d. How many moles of MgCl₂ are present in 60.0 mL of 0.100 M MgCl₂ solution?
- e. Calculate the mass of potassium iodide in grams required to prepare 5.00 X 10² mL of a 2.80 M solution.
- f. How many grams of KOH are present in 35.0 mL of a 5.50 M solution?
- g. Calculate the volume in mL of a solution required to provide the following: 2.14 g of sodium chloride from a 0.270 M solution
- h. Determine how many grams of sulfuric acid would be needed to make 2.50 X 10² mL of a 0.100 M solution
- i. If I have 3.50 grams of sodium chloride in 1250 mL of a solution, what's the concentration?

21. Describe how acid rain is formed and the effects of acid rain on humans and ecosystems

- a. What is acid precipitation?
- b. How does acid rain form?
- c. Describe the damage acid rain causes.
- d. "Acid rain is an international pollutant." Explain what is meant by this statement.

IF YOU FEEL YOU NEED MORE PRACTICE THAN THIS THAN CREATE YOUR OWN PROBLEMS AND SHARE/TRADE WITH A FRIEND.

STUDY HARD! GOOD LUCK!

MRS. P