

07 - Chemical Reactions

Content Area: **Science**
Course(s):
Time Period: **Full Year**
Length: **9 Blocks**
Status: **Published**

General Overview, Course Description or Course Philosophy

Chemistry CP aims to provide students with a fundamental understanding of the composition, structure, properties, and transformations of matter. Through a combination of theoretical concepts, laboratory investigations, and real-world applications, students will explore the principles and laws that govern chemical reactions and interactions. The course emphasizes the development of scientific inquiry skills, critical thinking abilities, and the application of problem-solving strategies. Students will actively engage in the process of scientific discovery, asking questions, seeking answers, and making connections between theory and practical applications. Laboratory experiences will integrate with theoretical knowledge, fostering the development of practical skills, scientific inquiry, and responsible practices. Students will also explore the ethical considerations and societal implications of chemistry, promoting informed decision-making as responsible citizens. By the end of the course, students will have a deepened appreciation for the relevance of chemistry in everyday life and will be prepared for further study and careers in scientific fields.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Objectives:

- Identify and describe the key features and components of chemical reactions, including reactants, products, and the rearrangement of atoms.
- Write and interpret chemical equations to represent the identities and quantities of reactants and products in a chemical reaction.
- Balance chemical equations by adjusting coefficients to ensure the conservation of atoms and mass.
- Classify chemical reactions into different types, such as synthesis, decomposition, single replacement, double replacement, and combustion reactions.
- Apply the principles of stoichiometry to determine the quantities of reactants and products in a chemical reaction.
- Understand and apply the Law of Conservation of Mass to chemical reactions, emphasizing that atoms are neither created nor destroyed.
- Analyze and interpret chemical equations and reaction patterns to predict the products of chemical reactions.
- Use evidence and data to support claims about the conservation of atoms and mass in chemical reactions.
- Engage in hands-on experiments and activities to observe and investigate chemical reactions and their balancing.
- Communicate scientific ideas and findings effectively using appropriate terminology, chemical symbols, and equations.

Essential Questions:

- How do chemical reactions involve the rearrangement of atoms to form new substances?

- How are chemical equations used to represent and communicate the identities and quantities of reactants and products?
- Why is it necessary to balance chemical equations, and how does it ensure the conservation of atoms and mass?
- What are the different types of chemical reactions, and how can they be classified based on their patterns and characteristics?
- How does the Law of Conservation of Mass apply to chemical reactions, and why are atoms neither created nor destroyed?

Enduring Understandings:

- Chemical reactions involve the rearrangement of atoms to form new substances with different properties.
- Chemical equations are used to represent and communicate the identities and quantities of reactants and products in a chemical reaction.
- Balancing chemical equations is necessary to ensure the conservation of atoms and mass.
- Chemical reactions can be classified into different types based on their patterns and characteristics.
- The Law of Conservation of Mass applies to all chemical reactions, and atoms are neither created nor destroyed.

CONTENT AREA STANDARDS

SCI.9-12.HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
SCI.9-12.HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
SCI.9-12.HS-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
SCI.9-12.HS-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
TECH.K-12.1.3.d	build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.
LA.RST.9-10.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.

LA.RST.9-10.2	Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
TECH.K-12.1.4.a	know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.
LA.RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

STUDENT LEARNING TARGETS

Refer to the 'Declarative Knowledge' and 'Procedural Knowledge' sections.

Declarative Knowledge

Students will understand that:

- A reaction can be identified by observing changes in color, odor, phase, or heat
- There are several ways in which elements and compounds combine to form new substances.
- Chemical reactions can be classified by considering what the reactants are, what the products are, or how they change from one to the other. Classes of chemical reactions include synthesis, decomposition, combustion, and single/double replacement.
- Chemical equations are balanced to satisfy the law of conservation of matter/mass.
- Chemical reactions that occur in solution can form a precipitate, a gas, or a covalent compound like water. [Honors]
- Solubility rules of ionic compounds can be used to predict the outcome of reactions in solution, i.e. double replacement. [Honors]
- Electron transfer is a driving force in many reactions and causes atoms to either be oxidized or reduced. [Honors]
- Neutralization reactions involve the combination of acids and bases. [Honors]

Procedural Knowledge

Students will be able to:

- Identify and describe the components of the model that are relevant for their predictions, including:
 - Elements and their arrangement in the periodic table;
 - A positively-charged nucleus composed of both protons and neutrons, surrounded by negatively-charged electrons;
 - Electrons in the outermost energy level of atoms (i.e., valence electrons);
 - The number of protons in each element.
- Construct an explanation of the outcome of the given reaction, including:
 - The idea that the total number of atoms of each element in the reactant and products is the same;

- The numbers and types of bonds (i.e., ionic, covalent) that each atom forms, as determined by the outermost electron states and the electronegativity;
- The outermost (valence) electron state of the atoms that make up both the reactants and the products of the reaction is based on their position in the periodic table;
- A discussion of how the patterns of attraction allow the prediction of the type of reaction that occurs (e.g., formation of ionic compounds, combustion of hydrocarbons).
- Given a chemical reaction, use mathematical representations to
 - Predict the relative number of atoms in the reactants versus the products at the atomic-molecular scale; and
 - Calculate the mass of any component of a reaction, given any other component.

EVIDENCE OF LEARNING

Refer to the 'Formative Assessments' and 'Summative Assessments' sections.

Formative Assessments

- POGIL Activities:
 - Types of Chemical Reactions
 - The Activity Series
- Labs
 - Types of Chemical Reactions
 - Formation of Ionic Compounds
- Group practice
 - Converting Between Word Equations and Formula Equations
 - Balancing Chemical Equations
 - Balancing and Identifying Types of Chemical Reactions
 - Synthesis
 - Decomposition
 - Single Replacement
 - Double Replacement
 - Combustion
- Performance Scale/ Student Tracking Chart
- Whiteboards
- Exit Tickets
- Homework

Summative Assessments

- Benchmarks – departmental benchmark given at the end of MP1, MP2, and MP3 based on lab practices

- Alternative Assessments
 - Lab inquiries and investigations
 - Lab Practicals
 - Exploratory activities based on phenomenon
 - Gallery walks of student work
 - Creative Extension Projects
 - Build a model of a proposed solution
 - Let students design their own flashcards to test each other
 - Keynote presentations made by students on a topic
 - Portfolio
- Predicting Reactions Quiz
- Chemical Reactions Test
- Types of Chemical Reactions Lab Report

RESOURCES (Instructional, Supplemental, Intervention Materials)

[CK-12 Online Textbook](#)

POGIL Chemistry

Gizmos Simulations

PhET Simulations

Khan Academy

Bozeman Science

American Chemical Society

INTERDISCIPLINARY CONNECTIONS

ELA/Literacy

Mathematics

Technology

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.