Unit 7 - Chemical Reactions

Content Area: **Science**
Course(s):
Time Period: **Marking Period 3**
Length: **40 days**
Status: **Published**

Summary

The hallmark of chemistry is the reaction itself. In this unit, students will learn what a chemical reaction is, how to identify it, and how to describe scientifically with words and as equations. The various types of chemical reactions and their properties will be investigated and students will know how to predict the outcome of them as well. The Law of Conservation of mass will be applied when balancing equations and also when quantitatively analyzing them via stoichiometry. The unit of "mole" will be utilized not only as the coefficients of a balanced equation, but also to calculate masses of reactants and products. Calculating this information is crucial for determining the efficiency of a reaction and what reactant, if any, limits the amount of product that can be produced.

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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.
P.3	Consider the environmental, social and economic impacts of decisions.
P.4	Demonstrate creativity and innovation.
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
9.4.12.CT	Critical Thinking and Problem-solving
P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
P.9	Work productively in teams while using cultural/global competence.
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.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
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.
LA.RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
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.
9.4.12.GCA	Global and Cultural Awareness

9.4.12.IML	Information and Media Literacy
HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
LA.WHST.9-10.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.9-10.2.C	Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
LA.WHST.9-10.2.D	Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
LA.WHST.9-10.2.E	Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
LA.WHST.9-10.2.F	Provide a concluding paragraph or section that supports the argument presented.
9.4.12.TL	Technology Literacy
LA.WHST.9-10.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-ESS2-6	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Essential Questions/Enduring Understandings

Essential Questions

- How does the Law of Conversation of Mass explain the interactions of atoms and compounds both conceptually and mathematically in chemical reactions?
- Why does there need to be a specific unit linked to the quantity of material present?
- How can stoichiometry predict the amount of reactant required or product formed in a chemical reaction?

Enduring Understandings

- Chemical reactions obey the law of conservation of mass where atoms that are part of the reactants will either become part of a product or end up unused (excess) during the reaction itself.

- Stoichiometry is the manner of quantitatively analyzing a chemical reaction and can be used to determine amounts of reactants needed, products formed, excess or limiting reagents, and even the efficiency of the reaction itself.

Objectives

Students Will Know

- Students will know the five types of chemical reactions by description.
- Students will know how to identify limiting or excess reagents.
- Students will know the standard setup for a mass-mass stoichiometry calculation.
- Students will know how to utilize the activity series to predict the outcome of chemical reactions.

Students Will Be Skilled At

- Students will be skilled at calculating molar masses and percent compositions of formulas.
- Students will be skilled at determining the efficiency of reactions (percent yield).
- Students will be skilled at identifying reactions when analyzing equations.
- Students will be skilled at writing balanced chemical equations.
- Students will be skilled at applying the law of conservation of mass.

Learning Plan

- Preview essential questions and connect them to the concepts we will cover in the unit.
- Identify reaction types by viewing short video clips with the only other supporting information being the chemical equation, or via pattern identification with introductory chemical reaction card sorting activity.
- Discover the indicators of a chemical reaction by investing the reaction between copper chloride and aluminum metal.
- Write chemical equations based on data (copper/aluminum lab) to first identify what is incorrect (number of atoms).
- Apply the law conservation of mass in the Conservation of Mass Modeling Lab (balancing chemical equations practice).
- Predict the outcome of chemical reactions using the Activity Series for metals and halogens.
- Complete the Activity of Metals Lab where students apply all knowledge of single replacement

reactions.
- Quantitatively analyze chemical formulas/compounds by introducing the unit mole.
- Use a formula to determine the formula mass and then the percent composition of elements in the compound.
- Identify substances by analyzing the percent composition of a substance.
- Determine the formula of magnesium oxide (and/or Epsom salt) by analyzing data acquired in an experiment.
- Calculate masses of reactants and products by utilizing stoichiometry.
- Determine the percent of acid in a sample of vinegar.
- Compare the efficiency of chemical reactions by calculating the percent yield of reactions.
- Identify limiting and excess reagents in chemical reactions.

Assessment

Formative Assessment

- Do Now Questions
- Exit Ticket Questions
- Whole Class Discussion Participation
- Small Group Discussion Participation
- Individual Student Questions/Responses
- Independent Tasks
    - Identify chemical reactions by analyzing equations.
    - Correctly format and balance chemical equations.
    - Use the activity series to predict the outcome of a reaction.
    - Calculate formula mass and percent composition and perform conversions using the unit mole.
    - Perform mass-mass stoichiometry and percent yield calculations.
- Lab Experiments

Summative Assessment

- Unit Quizzes
- Unit Tests
- Lab Reports

Benchmark Assessment

- CP Chemistry Final Exam

Alternative Assessment

- Determine the indicators of chemical reactions by experiment.
- Use stoichiometry and limiting/excess reagents to determine the percentage of acid in vinegar.
- Analyze acquired data to determine the formula of magnesium oxide and/or Epsom salt.

Materials

- SAVVAS Experience Chemistry 2021 Textbook Volumes 1 & 2
- Guided notes
- Teacher handouts
- Supplementary worksheets
- YouTube Reactions Links/Handout
- Chemical Reactions Cards (for activity stations)
- Lab Handouts (Single Replacement Reaction Lab, Conservation of Mass Molecular Modeling Lab, Metal/Nonmetal/Metalloid Lab, Empirical Formula of Magnesium Oxide Lab, Formula of a Hydrate Lab, Simple Stoichiometry Lab (Analysis of Vinegar), NOTE: Supplies for each lab included on handout.)
- Simulations:
    - "Balancing Chemical Equations" [https://phet.colorado.edu/en/simulation/balancing-chemical-equations]
    - Balancing Equations Simulation [https://see.phenomena.app/?app=-MjZwrULhE-hSiGRJHom]
    - Stoichiometry Simulation [https://see.phenomena.app/?app=-Mkxatg55sOzyUstVgot]
    - "Reactants, Products, and Leftovers" [https://phet.colorado.edu/en/simulation/reactants-products-and-leftovers]
- Safety Supplies (specifics to when they are required included in lab handouts)

Integrated Accommodation and Modifications, Special Education students, English Language Learners, At-Risk students, Gifted and Talented students, Career Education, and those with 504s

https://docs.google.com/spreadsheets/d/1mfe42JCam4Rlgd626vidMg54nDZ1ic055qKKGLvhcPg/edit?usp=sharing