Englewood Public School District
Science
Chemistry
Second Marking Period

Unit 2: Bonding and Chemical Reactions

Overview: In this unit of study, students use investigations, simulations, and models to makes sense of how matter can change. Chemical reactions can be understood by students at this level in terms of the collisions of molecules and the rearrangements of atoms. Students are able to use the periodic table as a tool to explain and predict how elements will combine. The crosscutting concepts of *structure and function*, *patterns*, and *stability and change* are called out as the framework for understanding the disciplinary core ideas. Students use *developing and using models*, *planning and conducting investigations*, *using mathematical thinking*, and *constructing explanations and designing solutions*. Students are also expected to use the science and engineering practices to demonstrate proficiency with the core ideas.

Time Frame: 40 to 45 Days

Enduring Understandings:
The total amount of energy and matter in a chemical reaction system is conserved.
The knowledge of the chemical properties of the elements involved can be used to describe and predict chemical reactions.

Essential Questions:
How can one explain the structure, properties, and interactions of matter?
How can I use the periodic table to predict chemical reactions?
Where do the atoms go during a chemical reaction?

Standards	Topics and Objectives	Activities	Resources	Assessments
(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.**	**Topics** Chemical Formulas Chemical Reactions Mole Stoichiometry Twenty-First Century Themes and Skills include:	Students will complete the investigations, labs, and activities: 1. Watch Untamed Science Chapters 7-12 video introduction via https://www.successnetplus.com/ 2. Lab - Formulas and Oxidation Numbers 3. Reaction between Iron Filings and Copper Sulfate	**Text:** • Pearson Chemistry **Materials:** *See investigations, labs and activities material lists* For Mole Lab (For each lab station) • Aluminum foil • Beakers, 600-mL or cut	**Formative Assessments:** • Discussion Journals • Student portfolios will be used to monitor progress. **Summative Assessments:** • Written responses/ideas • Student needs will be

(HS-PS1-7) **Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.**	• The Four C's • Life and Career Skills • Information and Media literacy **Objectives** Students will: Use the conservation of atoms and the chemical properties of the elements involved to describe and predict the outcome of a chemical reaction. Use mathematical representations of chemical reaction systems to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. Describe change of matter in a chemical reaction system in terms of matter flow into, out of, and within that system.	solution 4. Reaction between a Lead Nitrate solution and a Sodium Iodide solution. 5. Lab - Avogadro's Hypothesis - "Beans Lab" 6. Formula of a Hydrate – Copper Sulfate Pentahydrate 7. Baking Soda Stoichiometry Students will watch the videos Bonding Models and Lewis Structures and Types of Chemical Bonds. Students will explore the different kinds of chemical bonds in the interactive simulation Chemical Bonds. (8.2.12.C.4) Students will test their ideas about Balancing Chemical Equations in an interactive game. (NJSLSA.W2) Students will play the Reactants, Products, and Leftovers game to test their understanding. Students identify and differentiate between four types of chemical reactions in the Shall We Dance? – Classifying Types of Chemical Reactions: activity. Students will practice creating	off 2-L soda bottles, 3 labeled • Ammonium sulfate, (NH4) 2SO4, 100 g • Cups, blue, clear, and red plastic, 2–3 of each • Sodium chloride, NaCl, 500 g • Pipets, Beral-type, 2–3 • Water, distilled, 500 mL • Spoons, plastic, 4–6 • Balance, electronic, 0.01-g (For the instructor's station) • Copper sheet, 12 pieces • Cups, blue, clear, and red plastic, 1 each • Balance, electronic, 0.01-g precision • Scoring Standard Table **Websites:** • Chemical Bonds • Balancing Chemical Equations • Reactants, Products, and Leftovers • Chemical Reactions and Stoichiometry • Creating a Connection between Everyday Life and Stoichiometry • https://www.successnetplus.com/ **Videos:** • Bonding Models and Lewis Structures • Types of Chemical Bonds • Law of Conservation of Mass	evaluated after completing the simulations *Chemical Bonds*, *Balancing Chemical Equations*, *Reactants, Products, and Leftovers*, and the *Snowman Challenge Activity.* • Students will receive a grade for the following lab activity conclusions: *Lab - Formulas and Oxidation Numbers, Lab - Avogadro's Hypothesis - "Beans Lab"*, and Mole Lab. **Benchmark Assessment:** A Common Formative Assessment will be given at the close of this unit to assess students' mastery of the skills identified. **Alternative Assessments:** • Graphic Organizers • Model/Projects • Practice Presentations • Kinesthetic Assessments • Observing • Think Pair Share • Simulations • Visual Representations • Students will construct explanations for how chemical reaction

		and balancing equations during the Snowman Challenge Activity. (N-Q.A.1) Students will watch the Law of Conservation of Mass, complete and online quiz and participate in a digital discussion. Student will watch the video How Big is a Mole? and complete an online quiz. Students will complete the Mole Lab. Students will control the concentrations of molecules and temperatures of reactions to explore reaction rate and balancing chemical equations in the simulation Chemical Reactions and Stoichiometry. (MP.2, CRP8, 6.1.12.C.3.a) Students will watch the video Stoichiometry: Chemistry for Massive Creatures. Students will use webpages to help them in Creating a Connection between Everyday Life and Stoichiometry. (NJSLSA.W5, 8.2.12.A.2) **Enrichment Activities:** Students will discover the Stoichiometry of S'mores. Students will explore ways to	• How Big is a Mole? • Mole Lab • Stoichiometry: Chemistry for Massive Creatures **Enrichment Lesson Plan:** See Stoichiometry of S'mores	systems change and how they remain stable. • Students will design a solution to specify a change in conditions that would produce increased amounts of products at equilibrium in a chemical system based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. • Students will describe changes of energy and matter in a chemical reaction system in terms of energy and matter flows into, out of, and within that system. • Students will develop a model based on evidence to illustrate the relationship between the release or absorption of energy from a chemical reaction system and the changes in total bond energy.

	test for steroids in the Chapter 10 CHEMYSTERY: A Formula for Cheating. (CRP4, 8.2.2.C.1)

Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/. This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the complexity in planning and carrying out investigations and analyzing and interpreting data.

English Language Learners	Special Education	At-Risk	Gifted and Talented
● Provide a computer for written work Speak and display terminology ● Teacher modeling ● Peer modeling ● Provide ELL students with multiple literacy strategies. ● Word walls ● Use peer readers ● Give page numbers to help the students find	● Provide a computer for written work ● Utilize modifications & accommodations delineated in the student's IEP ● Work with paraprofessional ● Use multi-sensory teaching approaches. ● Work with a partner ● Provide concrete examples	● Increase one on one and small group time ● Using visual demonstrations, illustrations, and models ● Give directions/instructions verbally and in simple written format. Oral prompts can be given. ● Peer Support ● Teachers may modify instructions by modeling what the student is expected to do ● Instructions may be printed out in	● Real world scenarios ● Curriculum compacting ● Inquiry-based instruction ● Independent study ● Higher order thinking skills ● Adjusting the pace of lessons ● Interest based content ● Student Driven Instruction ● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their

answers ● Provide two sets of textbooks, one for home and one for school ● Provide visual aides ● Provide additional time to complete a task ● Use graphic organizers	● Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA). ● Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).	large print and hung up for the student to see during the time of the lesson. ● Review behavior expectations and make adjustments for personal space or other behaviors as needed. ● Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).	understandings. ● Use project-based science learning to connect science with observable phenomena. ● Structure the learning around explaining or solving a social or community-based issue. ● Collaborate with after-school programs or clubs to extend learning opportunities.

Interdisciplinary Connections:

ELA-NJSLS/ELA:
NJSLSA.W2: Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. WHST.9-12.2 (HS-PS1-2)
NJSLSA.W5: Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. WHST.9-12.5 (HS-ETS1-3)

Mathematics:
MP.2: Reason abstractly and quantitatively. (HS-PS1-8), (HS-ETS1-3), (HS-ETS1-4)
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. (HS-PS1-3)

Social Studies:
6.1.12.C.3.a: Analyze how technological developments transformed the economy, created international markets, and affected the environment in New Jersey and the nation.

Career Ready Practices:
CRP4: Communicate clearly and effectively and with reason.
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.

Integration of Technology Standards NJSLS 8:
8.2.12.A.2: Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
8.2.12.C.4: Explain and identify interdependent systems and their functions.

Integration of 21st Century Skills:
9.3.ST-ET.2: Display and communicate STEM information.
9.3.ST.2: Use technology to acquire, manipulate, analyze and report data.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models • Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4),(HS-PS1-8) • Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1) **Planning and Carrying Out Investigations** • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3) **Using Mathematics and Computational Thinking** • Use mathematical representations of phenomena to support claims. (HS-PS1-7) **Constructing Explanations and Designing**	**PS1.A: Structure and Properties of Matter** • Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1) • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1),(HS-PS1-2) • The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3),*(secondary to HS-PS2-6)* • A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4) **PS1.B: Chemical Reactions** • Chemical processes, their rates, and	**Patterns** • Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1),(HS-PS1-2),(HS-PS1-3),(HS-PS1-5) **Energy and Matter** • In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8) • The total amount of energy and matter in closed systems is conserved. (HS-PS1-7) • Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4) **Stability and Change** • Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6) - - - -

Solutions • Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2) • Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6) **Asking Questions and Defining Problems** • Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1) **Using Mathematics and Computational Thinking** • Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. (HS-ETS1-4) **Constructing Explanations and Designing Solutions** • Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2) • Evaluate a solution to a complex real-world problem, based on scientific knowledge,	whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4),(HS-PS1-5) • In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6) • The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7) **PS1.C: Nuclear Processes** • Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8) **PS2.B: Types of Interactions** • Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects.*(secondary to HS-PS1-1),(secondary to HS-PS1-3)* **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (secondary to	***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)	HS-PS1-6) **ETS1.A: Defining and Delimiting Engineering Problems** • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) • Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1) **ETS1.B: Developing Possible Solutions** • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3) • Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4) **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the	

	priority of certain criteria over others (trade-offs) may be needed. (HS-ETS1-2)	