Lab Chemistry A Curriculum Map 2022

updated 9/1/2022

Unit	Topics	Time Frame

1- Safety, Measurement & Modeling	• Lab Safety & Equipment
	  ○ identification of safety equipment
	  ○ identification of lab equipment
	• Measuring Matter
	  ○ metric system
	  ○ metric conversions
	  ○ scientific notation
	  ○ temperature scales and conversions
	  ○ density
	• Classification of Matter
	  ○ element, compound, mixture
	  ○ pure substance vs. mixture
	  ○ types of mixtures
	• Physical/Chemical Changes
	  ○ physical/chemical properties
	  ○ indicators of change
		18 periods
		5 weeks (9/6-10/7)

2 - Components of Matter	• Periodic Table
	  ○ History of the development of P.T.
	  ○ Labeling the P.T.
	  ○ Properties of metals, nonmetals, & metalloid
	• Atomic Structure & Theory
	  ○ History & evolution of atomic model
	  ○ Law of Conservation of Mass
	  ○ Structure of the Atom (protons, neutrons, electrons)
	  ○ Isotopes
	  ○ Calculating Atomic Mass
	• Electrons
	  ○ Electromagnetic Spectrum
	  ○ Wavelength, Frequency, & Radiation
	  ○ Electron Configurations - standard,
		15 periods
		4 weeks (10/10-11/4)

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	orbital, & noble gas notation	

3 - Bonding Concepts	• Octet Rule & Diatomic Molecules
	• Ionic Bonding
	  ○ Cations, Anions, Polyatomic Ions
	  ○ Oxidation numbers
	  ○ Formula Writing & Nomenclature
	• Covalent Bonding
	  ○ Single, double, & triple bonds
	  ○ Molecular/electron geometry
	  ○ Lewis Structures
	  ○ Formula Writing & Nomenclature
		12 periods
		3 weeks (11/7-12/2)

4 - Reactions in Aqueous Solutions	• Chemical Symbols
	  ○ subscripts vs coefficients
	• Types of Chemical Reactions
	  ○ Identifying 5 types
	  ○ Writing reactions from words
	  ○ balancing reactions
	  ○ Predicting Products from reactants
		12 periods
		3 weeks (12/5-12/22)

5 - Mass Relationships (Stoichiometry)	• Mole Concept
	  ○ calculating molar mass
	  ○ molar conversions (mass to moles, molecules to moles)
	• Percent Composition
	• Percent yield
	  ○ Actual vs Theoretical
	• Empirical vs Molecular Formula
	• Product Calculation from Reactant
	  ○ Mole Ratios
	  ○ Moles A to Moles B
	  ○ Mass of A to Moles B
	  ○ Mass of A to Mass B
	• Limiting & Excess Reactant
	  ○ One product
	  ○ Two products
		30 periods
		8 weeks (1/3-2/24)

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6 - States of Matter (Gas Laws & Solutions)	• Gas Properties - P, V, T, & n
	• Gas Laws
	  ○ Boyle's Law
	  ○ Charles' Law
	  ○ Gay-Lussac's Law
	  ○ Combined Gas Law
	  ○ Ideal Gas Law
		15 periods
		4 weeks (2/27-3/24)

7 - Thermochemistry	• Energy, work, & heat
	  ○ Types of energy
	  ○ direction of heat flow
	  ○ system vs surroundings
	• Specific Heat
	• Enthalpy
	  ○ Endothermic vs Exothermic
	  ○ heat of reaction
	  ○ Hess's Law
	• Changes to rates of reactions
	  ○ catalyst
		15 periods
		4 weeks (3/27-4/28)

8 - Acid/Base & Equilibrium	• Properties acids
	  ○ H^+, H_3O^+ producers
	• Properties bases
	  ○ OH^- producers
	• Reaction of acids & bases
	• pH scale
	  ○ acids pH 0-6
	  ○ neutral pH 7
	  ○ basic pH 8-14
	• Equilibrium
	  ○ Forward vs reverse reaction
	  ○ Le Chatelier's Principle changes to equilibrium
		12 periods
		3 weeks (5/1-5/19)

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9 - Nuclear Chemistry	• Radioactive Particles - Nuclear Decay
	  ○ alpha
	  ○ beta
	  ○ gamma
	• Nuclear Fusion vs Nuclear Fission
	• Half-life
	• Sources of Radiation
	• Nuclear Power
		12 periods
		3 weeks (5/22-6/9)

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Unit 1 Summary: Safety, Measurement, & Modeling

This unit will introduce chemistry having students apply steps of the scientific method to a safe lab setting, which will be reinforced throughout the year. Once lab safety is established, students will utilize this to explore and classify the states of matter based on their physical and chemical properties/changes. Measurements will be made of different quantities of matter and conversions will be made using the factor-label method.

Essential Questions:

How important is safety in the chemistry laboratory?
What does "Safety first!" demand from us?
Why is the scope of chemistry so vast?
What are the general reasons for studying chemistry?
What is an element?
Can atoms combine together?
What is a mixture?
What are solids and liquids?
What is a gas?

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

- Chapter Test on 1 & 2

Minor Assessments: Quizzes (20%)

- Pure substance vs Mixture & Changes Quiz
- Metric Conversion Quiz
- Lab Equipment Quiz

Labs (30%)

- Lab Equipment ID
- Separation of Mixtures Lab
- Kitchen Chemistry Lab
- Density of Metals Lab
- Density of Pennies Lab

Practice (Homework/Classwork =10 %)
Homework/Class work will reinforce the concepts taught in the class. Activities will be assigned as needed for students. Practice may be independent, partner, or small group depending on the level of rigor. Students will complete practice problems, lab data analysis, graphical analysis, or real-world scenarios. Students will complete practice until mastery is reached. Students requiring more practice will have it made available to them as needed.

Formative Assessments: *Will use one of the techniques listed below as necessary to assess students*
Do Nows, Exit Tickets, Question and Answer Techniques, Polling, Debate, Discussion

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Resources

Textbook: *World of Chemistry*, Zumdahl, Zumdahl, DeCoste. Cengage. 4th Edition.
Includes digital textbook, study questions, labs, powerpoint presentations, & test banks

Other Online Resources:

- PhET Simulations: https://phet.colorado.edu/
- Gizmo Virtual Labs: https://gizmos.explorelearning.com/
- NJCTL Chemistry Resources: https://njctl.org/materials/courses/chemistry/
- YouTube for lesson extension, clarification, and reteach

Science Recommended Accommodations & Modifications for Curriculum Implementation

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- 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).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tools such as Zoom, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understanding.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

STANDARDS for Learning Targets

NJSLS	Literacy	Cross curricular	CTE(NJSLS 9) Technology(NJSL8)
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. HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions	RST.11-12.1 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. (HS-PS1-3) WHST.9-12.2 - Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2)	Mathematics: MP.2 - Reason abstractly and quantitatively. (HS-ETS1-3), (HS-ETS1-4) MP.4 - Model with mathematics. (HS-ETS1-3), HS-ETS1-4) HSN-Q.A.1 - Use units as a way to understand problems and to guide the solution of multi-step	Technology 8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.NT.1 - Explain how different groups can contribute to the overall design of a product.

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to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	WHST.9-12.5 - 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-PS1-2),(HS-ETS1-3) WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3) WHST.11-12.8 - Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3), (HS-ETS1-3 WHST.9-12.9 - Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3), (HS-ETS1-3) SL.11-12.5 - Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4)	problems; choose and interpret units consistently in formulas; choose and interpret the scale and origin in graphs and data displays. (HS-PS1-2), (HS-PS1-3)	CTE 9.3.ST.2 - Use technology to acquire, manipulate, analyze, and report data. 9.3.ST.3 - Describe and follow safety, health and environmental standards related to science, technology, engineering, and mathematics (STEM) workplaces. 9.3.ST.6 - Demonstrate technical skills needed in the chosen STEM field. 9.3.ST-ET.2 - Display and communicate STEM information. 9.3.ST-SM.3 - Analyze the impact that science and mathematics has on society.

Sample Measurable Objectives for Lesson Planning
Use their learning of safety and lab procedures to make informed decisions when selecting and using equipment or tools.
Transfer their learning of the scientific method and data analysis to solve problems and identify sources of error.

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Calculate the density of a material from data.
Use density and other properties of matter to identify a substance.
Identify a property as either chemical or physical in nature.
Explain whether a chemical or physical change occurred based on observations and data.
Convert units of metric measurement.
Calculate the density of a material from data.

Unit 2 Summary: Components of Matter

This unit will focus on the history of atomic theory discussing the key contribution of each scientist and how that relates to the atom we study today. Subatomic particles including charge, location and mass will be discussed as well as electron configuration of both neutral atoms, isotopes and ions. Average atomic mass of isotopes will be calculated. Periodic trends which dictate arrangement of electrons will be discussed. Moreover, the quantum mechanics behind the energy transfer when electrons go from ground to excited states will be explored. This atomic/subatomic particle approach leads well into the next unit on bonding among atoms.

Essential Questions:

How does an atom differ from a molecule?
What developments have changed our understanding of atoms and molecules since Dalton's proposed atomic theory?
How do elements differ at the atomic level?
Are all atoms of a given element identical?
How are electrons arranged in an atom?
What is the difference between a ground state atom and an excited atom?
How does the pattern created by the quantum mechanical model aid in understanding the atom?
Why does each element have a unique atomic emission spectrum?
How can the periodic table tell me about the subatomic structure of a substance?
How can I use the periodic table to predict if I need to duck before mixing two elements?
How is the periodic table organized?
What are valence electrons and their significance to the chemical properties of elements?
How can I use the properties of something (in bulk quantities) to predict what is happening with the subatomic particles?
What trends are present within the periodic table?

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Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

- Atomic Theory/Periodic Table Test
- Electrons in Atoms Test

Minor Assessments: Quizzes (20%)

- Quiz on the Periodic Table
- Writing Electron Configurations Quiz

Labs (30%)

- Element Puzzle Activity
- Element ID Activity
- Law of Conservation of Mass Lab
- Rutherford Experiment Lab
- Isotopes Skittles Lab
- Quantum Leap Lab
- Flame Test Lab
- Gizmo Electron Configuration Lab
- S before D Lab

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STANDARDS for Learning Targets			
NJSLS	**Literacy**	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSL8)**
HS-PS1-1 Use the periodic table to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of an atom. 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. HS-PS1-3 Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of	RST.11-12.1 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. (HS-PS1-3) WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2) WHST.9-12.5 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-PS1-2),(HS-ETS1-3)	Mathematics: MP.2 - Reason abstractly and quantitatively. (HS-ETS1-3), (HS-ETS1-4) MP.4 - Model with mathematics. (HS-ETS1-3), HS-ETS1-4) HSN-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 origin in graphs and data displays. (HS-PS1-2), (HS-PS1-3)	Technology 8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.NT.1 - Explain how different groups can contribute to the overall design of a product. CTE 9.3.ST.2 - Use technology to acquire, manipulate, analyze, and report data.

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electrical forces between particles. HS-PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.	WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3) WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3), (HS-ETS1-3 WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3), (HS-ETS1-3)	9.3.ST.3 - Describe and follow safety, health and environmental standards related to science, technology, engineering, and mathematics (STEM) workplaces. 9.3.ST.6 - Demonstrate technical skills needed in the chosen STEM field. 9.3.ST-ET.2 - Display and communicate STEM information. 9.3.ST-SM.3 - Analyze the impact that science and mathematics has on society.

Sample Measurable Objectives for Lesson Planning
Explain how elements are arranged in the Periodic Table and how it differs from the original Periodic Table developed by Mendeleev.
Classify elements as metal, nonmetal, or metalloid based on characteristics/properties or location on the Periodic Table.
Describe changes made to the Periodic Table to better categorize the elements.
Identify the parts of an atom and their role.
Calculate the mass of an atom.
Describe how technology improved our understanding of the atom and vice versa.
Explain how electrons are arranged in an atom using the quantum mechanical model of the atom.
Determine the electron configuration for an element using standard notation, orbital notation, and noble gas notation.
Use the Law of Conservation of Mass to prove that atoms are not created or destroyed in chemical reactions.

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Unit 3 Summary: Bonding Concepts

Atoms are held together in compounds by chemical bonds, which result from a sharing of electrons in the covalent bond and transfer of electrons in the ionic bond to form the octet. In ionic bonds, the focus will be placed on the transfer of electrons; charge bookkeeping will be completed to achieve an overall charge of zero for the compound. The strong electrostatic interactions will be discussed as the strongest intermolecular force. Focus then will be placed on how this affects the structure and function of these compounds. In covalent bonds, the focus will be placed on how many and how equally electrons are shared depending on the electronegativity difference. These compounds will then arrange themselves in accordance with the Valence Shell Electron Pair Repulsion (VSEPR) theory. Lewis structures will be drawn to model this theory with focus placed on the octet rule, formal charge and resonance. Upon examination of the structure of one molecule, students will then investigate how these structures will arrange themselves due to intermolecular forces. Again focusing on how structure relates to function. Bonding theory related to atoms lays the groundwork for how chemical compounds interact in chemical reactions.

Essential Questions:

Why do bonds form?
What are the major similarities and differences between ionic and covalent bonds?
How do shape, electronegativity, and polarity relate to one another?
How can the shape, bond angles, and polarity be predicted using VSEPR theory?
How does metallic bonding structure affect the properties of a metal?
How does the shape of compound particles affect their properties?
What are the rules for ionic, covalent, and acid naming and formula writing?

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Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

- Nomenclature and Chemical Bonding Test

Minor Assessments: Quizzes (20%)

- Ionic Formula Writing Quiz
- Ionic Formula Writing and Naming Quiz
- Acids and Hydrates Quiz
- Polarity Quiz
- Drawing Lewis Structures Quiz

Labs (30%)

- Making Ionic Compounds Lab
- Forming and Naming Ionic Compounds Lab
- Ionic vs. Covalent Properties Lab
- Virtual: Analysis of Cations and Anions Lab
- Lewis Dot Skittles Lab
- Lewis Structure and Model Building Lab
- Virtual: pHet simulation of Molecular Shapes Lab

Practice (Homework/Classwork =10 %)
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STANDARDS for Learning Targets			
NJSLS	**Literacy**	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSL8)**
HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. HS-STS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 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 an atom. 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. HS-PS1-3 Plan and conduct an investigation to gather evidence to	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. (HS-PS1-1) RST.11-12.1 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. (HS-PS1-5) RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ETS1-1), (HS-ETS1-3) RST.11-12.8 Evaluate the hypotheses, data,	MATHEMATICS: MP.2 Reason abstractly and quantitatively. (HS-PS1-5),(HS-PS1-7),(HS-ETS1-1),(HS-ETS1-3),(HS-ETS1-4) MP.4 Model with mathematics. (HS-PS1-4), (HS-ETS1-1), (HS-ETS1-2),(HS-ETS1-3),(HS-ETS1-4) HSN-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-PS1-4), (HS-PS1-5), (HS- PS1-7), (HS-PS1-8) HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4), (HS-PS1-7)	Technology 8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.NT.1 - Explain how different groups can contribute to the overall design of a product. CTE 9.3.ST.2 - Use technology to acquire, manipulate, analyze, and report data. 9.3.ST.3 - Describe and follow safety, health and environmental standards related to science, technology, engineering, and mathematics (STEM) workplaces. 9.3.ST.6 - Demonstrate technical skills needed in the chosen STEM field.

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compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.	analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ETS1-1), (HS-ETS1-3) RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1), (HS-ETS1-3) WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-5) WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-6) SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4)	HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-4), (HS-PS1- 5), (HS-PS1-7)	9.3.ST-ET.2 - Display and communicate STEM information. 9.3.ST-SM.3 - Analyze the impact that science and mathematics has on society.

Sample Measurable Objectives for Lesson Planning
Identify differences between ionic and covalent bonds and compounds.

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Describe the role of electrons in ionic and covalent bonds.
Use chemical properties to identify a substance as ionic or covalent (conductivity).
Write chemical formulas and name substances using IUPAC nomenclature standards.
Determine the molecular structure of a covalent molecule.
Draw an acceptable Lewis Structure for a covalent molecule.

Unit 4 Summary: Reactions in Aqueous Solutions

Since solubility is at the forefront as to why most reactions occur, this will be examined first. In order to have a thorough understanding of this, students will examine the anatomy of a solution, how compounds dissociate in a solution and strong/weak electrolytes and acids/bases. Next students will interpret evidence to conclude if a chemical reaction has occurred. Students will then examine the anatomy of a chemical equation, symbolic notation, classify the chemical reactions and balance the equations to obey the law of conservation of mass. The reasoning behind evidence of a chemical reaction will be explored through linking predicted products and determining the type of reaction from the predicted products.

Essential Questions:

Does chemical bonding mimic any macroscopic processes?
Does one size fit all?
Why must the mass of the reactants be equal to the mass of the products in a chemical reaction?
What characteristics are used to classify chemical reactions?
Why is water an effective solvent for ionic compounds?

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Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

- Chemical Reactions Chapter Test

Minor Assessments: Quizzes (20%)

- Balancing Equations Quiz
- Electrolytes Quiz

Labs (30%)

- Conductivity of Solutions Lab
- Gizmo: Balancing Equations Lab
- PPT in Double Replacement Lab
- Aluminum and Copper (II) Chloride Single-Replacement Lab
- Activity Series of Metals Lab
- Types of Chemical Reactions Lab
- Edpuzzle: Chemical Reactions Lab

Practice (Homework/Classwork =10 %)

Homework/Class work will reinforce the concepts taught in the class. Activities will be assigned as needed for students. Practice may be independent, partner, or small group depending on the level of rigor. Students will complete practice problems, lab data analysis, graphical analysis, or real-world scenarios. Students will complete practice until mastery is reached. Students requiring more practice will have it made available to them as needed.

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Do Nows, Exit Tickets, Question and Answer Techniques, Polling, Debate, Discussion

Resources

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Includes digital textbook, study questions, labs, powerpoint presentations, & test banks

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Science Recommended Accommodations & Modifications for Curriculum Implementation

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- 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).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tools such as Zoom, experts from the community helping with a project, journal articles, and biographies).

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- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understanding.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

STANDARDS for Learning Targets

NJSLS	Literacy	Cross curricular	CTE(NJSLS 9) Technology(NJSL8)
HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. HS-PS1-4 Develop a model to illustrate the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.	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. (HS-PS1-1) RST.11-12.1 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. (HS-PS1-5) RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ETS1-1), (HS-ETS1-3) RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ETS1-1), (HS-ETS1-3) RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when	MATHEMATICS: MP.2 Reason abstractly and quantitatively. (HS-PS1-5), (HS-PS1-7), (HS-ETS1-1), (HS-ETS1-3), (HS-ETS1-4) MP.4 Model with mathematics. (HS-PS1-4), (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) HSN-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-PS1-4), (HS-PS1-5),(HS- PS1-7), (HS-PS1-8) HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4),(HS-PS1-7) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-4), (HS-PS1- 5), (HS-PS1-7)	Technology 8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.NT.1 - Explain how different groups can contribute to the overall design of a product. CTE 9.3.ST.2 - Use technology to acquire, manipulate, analyze, and report data. 9.3.ST.3 - Describe and follow safety, health and environmental standards related to science, technology, engineering, and mathematics (STEM) workplaces. 9.3.ST.6 - Demonstrate technical skills needed in the chosen STEM field. 9.3.ST-ET.2 - Display and communicate STEM information. 9.3.ST-SM.3 - Analyze the impact that science and mathematics has on society.

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possible. (HS-ETS1-1),(HS-ETS1-3)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-5)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-6)

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4)

Sample Measurable Objectives for Lesson Planning
Classify reactions as one of the five types.
Determine the type of reaction based on the given reactants and/or products.
Predict the products of a chemical reaction.
Balance a chemical reaction.
Determine the reactivity of a metal based on its location in the activity series.

Unit 5 Summary: Mass Relationships (Stoichiometry)

In this unit, dimensional analysis will be revisited with an application of mole conversions. Students will use molar mass calculations in conjunction with balanced equations, nomenclature and solubility to translate a quantity (grams, liters of gas, particle {atoms, molecules or formula units}) of one substance to a quantity of another substance. To accurately navigate this pathway, students must be able to determine the limiting reagent, theoretical yield and percent yield qualitatively as well quantitatively. Students will also determine the percent composition of elements in compounds and use this principle to determine the empirical and molecular formulas

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Essential Questions:

How does a chemist count?
Is it practical to count each grain of sand?
Avogadro's number which is equal to 1 mole of a substance is very large, why?
How can we quantify things that we cannot see?
How are conversions made among particles, mass, volume, and moles of any substance?
Why is the mole an important measurement of chemistry?
Is there a difference between empirical and molecular formulas?
In stoichiometry why is a balanced chemical equation necessary?
Is there a difference between actual yield and theoretical yield?
Why is percent composition important?

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

- Mole Chapter Test
- Stoichiometry Chapter Test

Minor Assessments: Quizzes (20%)

- Single Step Mole Conversions Quiz
- Mixed Single and Double Step Mole Conversions Quiz
- Mass or Mole A to Mass or Mole B Quiz

Labs (30%)

- Determining the Moles of Everyday Objects Lab
- Moles of Iron Filings and Copper (II) Sulfate Lab
- Moles of Iron Nails and Copper (II) Chloride Lab
- Gizmo: Moles Lab
- Mole Ratio Lab
- Mole Ratio of Chlorides Lab
- Vinegar and Baking Soda Stoichiometry Lab
- Reaction Stoichiometry and Percent Yield Lab
- Limiting Reagents Lab
- Determining the Percent Yield Lab
- Gizmo: Stoichiometry Lab

Practice (Homework/Classwork =10 %)
Homework/Class work will reinforce the concepts taught in the class. Activities will be assigned as needed for students. Practice may be independent, partner, or small group depending on the level of rigor. Students will complete practice problems, lab data analysis, graphical analysis, or real-world scenarios. Students will complete practice until mastery is reached. Students requiring more practice will have it made available to them as needed.

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STANDARDS for Learning Targets

NJSLS	Literacy	Cross curricular	CTE(NJSLS 9) Technology(NJSL8)
HS-PS1 -7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	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. (HS-PS1-1) RST.11-12.1 Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise	MATHEMATICS MP.2 Reason abstractly and quantitatively. (HS-PS1-5), (HS-PS1-7), (HS-ETS1-1), (HS-ETS1-3),(HS-ETS1-4) MP.4 Model with mathematics. (HS-PS1-4), (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4)	Technology 8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.NT.1 - Explain how different groups can contribute to the overall design of a product.

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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.

details for explanations or descriptions. (HS-PS1-5)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ETS1-1), (HS-ETS1-3)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ETS1-1), (HS-ETS1-3)

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1),(HS-ETS1-3)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-5)

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CTE
9.3.ST.2 - Use technology to acquire, manipulate, analyze, and report data.

9.3.ST.3 - Describe and follow safety, health and environmental standards related to science, technology, engineering, and mathematics (STEM) workplaces.

9.3.ST.6 - Demonstrate technical skills needed in the chosen STEM field.

9.3.ST-ET.2 - Display and communicate STEM information.

9.3.ST-SM.3 - Analyze the impact that science and mathematics has on society.

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Sample Measurable Objectives for Lesson Planning
Balance a chemical reaction.
Perform molar conversion calculations.
Calculate the moles of a substance from mass or number of molecules.
Determine the mole ratio of compounds in a chemical reaction from given data.
Calculate the percent yield of a product from a chemical reaction.
Determine the limiting reactant of a chemical process.

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Unit 6 Summary: States of Matter (Gas Laws & Solutions)

During this unit students will examine the states of matter, properties of each and what conditions are needed to transform from one state to another. After learning that all particles are in constant motion, students will relate kinetic energy to temperature, and phase changes. They will use kinetic molecular theory to discuss the differences in intermolecular forces of a solid, liquid and gas and what energy must be absorbed or released to change phase. Students will also examine heating curves to closer examine how energy, temperature and phase changes are related. Using phase diagrams, they will examine equilibrium and ability to change boiling points by changing pressure and how temperature and vapor pressure are related. Students will use the kinetic molecular theory to determine how gas molecules behave when conditions are varied, deriving gas laws from experimental data. Students quantitatively and qualitatively demonstrate an understanding of how solutions are made as well as how concentration is measured and how this concentration affects properties of the solution.

Essential Questions:

Should we continue to manufacture aerosol cans?
What are the characteristics of a gas?
What are intermolecular forces?
Are ideal gases real?
How is the Kinetic Molecular Theory used to explain the behavior of matter?
Do gases respond to changes in temperature, pressure and volume?
How is the average kinetic energy of a system related to the gas laws?

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

- Gas Laws and Solutions Chapter Test

Minor Assessments: Quizzes (20%)

- Boyle's, Charles's and Gay-Lussac Laws Quiz
- States of Matter Quiz

Labs (30%)

- Gas Laws Simulation Lab
- Introduction to Gas Laws Lab
- Gas Laws Activity Lab
- Boiling Point Elevation Lab
- Melting Point Determination Lab

Practice (Homework/Classwork =10 %)
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STANDARDS for Learning Targets

NJSLS	Literacy	Cross curricular	CTE(NJSLS 9) Technology(NJSL8)
HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined with a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).	RST.11-12.1 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. (HS-PS3-4), (HS-ESS3-2) RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a	MATHEMATICS: MP.2 Reason abstractly and quantitatively. (HS-PS3-4), (HS-ESS3-2), (HS-ETS1-3) MP.4 Model with mathematics. (HS-PS3-4), (HS-ETS1-3)	Technology 8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.NT.1 - Explain how different groups can contribute to the overall design of a product.

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HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, culture, and environmental impacts.

question or solve a problem. (HS-ETS1-3)

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2), (HS-PS3-4), (HS-ETS1-3)

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-3)

WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS3-4), (HS-ESS2-5)

WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS3-4)

CTE
9.3.ST.2 - Use technology to acquire, manipulate, analyze, and report data.

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Sample Measurable Objectives for Lesson Planning
Use the properties of a gas to perform gas law calculations.
Identify the relationships of pressure, volume, temperature, and moles of a gas through the gas law equations.
Identify the intermolecular forces present in a substance.
Use intermolecular forces to explain the differences in melting/boiling points of different substances.
Use kinetic molecular theory to explain the behavior of gases.

Unit 7 Summary: Thermochemistry

Continuing the macroscopic approach this unit focuses specifically on energy transfer between chemicals and that which holds them together. Students use the first and second laws of thermodynamics to investigate the law of conservation of energy and how energy transfers between the system and surroundings. Students will gain and demonstrate a working understanding of the kinetic molecular theory of molecules as well as the driving force of the universe toward an increase in entropy. Students will examine heat transfer qualitatively and quantitatively using calorimetry. State function will be examined using enthalpy and energy of a reaction using stoichiometry. This will also translate to Hess's law.

Essential Questions:

What is heat?
Does heat move?
What is (are) the difference(s) between endothermic and exothermic reactions?
Does adding heat to a system change its energy content?
What is the direction of energy flow in a chemical reaction?
How is energy transferred within a system?
What is the relationship between energy, work, and heat?
How can a balanced chemical equation be used to determine heats of reaction?
How useful are phase diagrams?

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Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

- Thermochemistry Chapter Test

Minor Assessments: Quizzes (20%)

- Internal Energy and Specific Heat Quiz
- Enthalpy Quiz

Labs (30%)

- Specific Heat of Metals Lab
- Calorimetry Lab
- Enthalpy of Reactions Lab
- Hess's Law Lab

Practice (Homework/Classwork =10 %)
Homework/Class work will reinforce the concepts taught in the class. Activities will be assigned as needed for students. Practice may be independent, partner, or small group depending on the level of rigor. Students will complete practice problems, lab data analysis, graphical analysis, or real-world scenarios. Students will complete practice until mastery is reached. Students requiring more practice will have it made available to them as needed.

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STANDARDS for Learning Targets			
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HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.	RST.11-12.1 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. (HS-PS3-4), (HS-ESS3-2) RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ETS1-3) RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-2), (HS-PS3-4), (HS-ETS1-3) RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-3) WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject	MATHEMATICS: MP.2 Reason abstractly and quantitatively. (HS-PS3-4), (HS-ESS3-2), (HS-ETS1-3) MP.4 Model with mathematics. (HS-PS3-4), (HS-ETS1-3)	Technology 8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.NT.1 - Explain how different groups can contribute to the overall design of a product. CTE 9.3.ST.2 - Use technology to acquire, manipulate, analyze, and report data. 9.3.ST.3 - Describe and follow safety, health and environmental standards related to science, technology, engineering, and mathematics (STEM) workplaces. 9.3.ST.6 - Demonstrate technical skills needed in the chosen STEM field. 9.3.ST-ET.2 - Display and communicate STEM information. 9.3.ST-SM.3 - Analyze the impact that science and mathematics has on society.

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under investigation. (HS-PS3-4), (HS-ESS2-5)

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WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS3-4)

Sample Measurable Objectives for Lesson Planning
Calculate the specific heat of a substance.
Explain how heat flows between the system and surroundings.
Identify a chemical process as either endothermic or exothermic in nature.
Describe the relationship between heat, work, and energy.
Use a phase diagram to identify a substance's state of matter and high or low temperatures and pressures.
Calculate the enthalpy of a chemical process.
Use Hess's law to calculate the enthalpy of reaction.
Identify ways to change the rate of a chemical reaction.

Unit 8 Summary: Acid/Base & Equilibrium

In this unit students will explore the nature of acids and bases. They will see how acid and base are present in everyday life through the pH of Household items lab. They will see that substances with similar pHs are used for certain purposes in our daily life. They will also explore the differences between strong/weak acids and bases and how they react to form salts with different pHs as well as water in a special type of double replacement reaction called a neutralization. Students will also finally see that chemical reactions are not always left to right, we can reverse some chemical reactions through equilibrium shifts and using Le Chatelier's Principle.

Essential Questions:

What is the difference between an acid and a base?
What does pH tell us about a solution?
What is the pH range of an acidic, netural, or basic solution?

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What products are made when an acid and base are combined in a chemical reaction?
What is the relative pH of a salt formed from a neutralization reaction?
What is equilibrium?
How can we shift a reaction one way or the other?
How does Le Chatelier's Principle explain shifts in equilibrium?

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

- Unit assessment

Minor Assessments: Quizzes (20%)

- Strong Acid/Strong Base Identification Quiz
- Equilibrium Shift Quiz

Labs (30%)

- pH Household Items
- Indicators Lab
- Equilibrium Lab

Practice (Homework/Classwork =10 %)
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- 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).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tools such as Zoom, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understanding.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

STANDARDS for Learning Targets			
NJSLS	**Literacy**	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSL8)**
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.	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. (HS-PS1-1) RST.11-12.1 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. (HS-PS1-5) RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ETS1-1), (HS-ETS1-3) RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ETS1-1), (HS-ETS1-3)	MATHEMATICS MP.2 Reason abstractly and quantitatively. (HS-PS1-5), (HS-PS1-7), (HS-ETS1-1), (HS-ETS1-3), (HS-ETS1-4) MP.4 Model with mathematics. (HS-PS1-4), (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) HSN-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-PS1-4), (HS- PS1-5), (HS-PS1-7), (HS-PS1-8) HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4), (HS-PS1-7)	Technology 8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.NT.1 - Explain how different groups can contribute to the overall design of a product. CTE 9.3.ST.2 - Use technology to acquire, manipulate, analyze, and report data. 9.3.ST.3 - Describe and follow safety, health and environmental standards related to science, technology, engineering, and mathematics (STEM) workplaces. 9.3.ST.6 - Demonstrate technical skills needed in the chosen STEM field.

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	RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1), (HS-ETS1-3) WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-5) WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-6) SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS1-4)	HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-4), (HS-PS1-5), (HS-PS1-7)	9.3.ST-ET.2 - Display and communicate STEM information. 9.3.ST-SM.3 - Analyze the impact that science and mathematics has on society.

Sample Measurable Objectives for Lesson Planning
Identify the strong acids and bases.
Use the pH scale to determine if a substance is acidic, basic, or neutral.
Predict the pH of a salt formed in a neutralization reaction based on the strength of the parent acid and base.
Describe equilibrium in terms of rate of forward and reverse reactions.
Use Le Chatelier's Principle to explain how to shift equilibrium to make more reactant or product.

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Unit 9 Summary: Nuclear Chemistry

This course's culminating unit provides an opportunity to apply what has been learned to real world solutions. Students will discuss properties of radioactivity, the different particles emitted, the pathway in which they are emitted, how they are measured and what effects they have on the environment. Students will balance nuclear reactions involving nuclear fission, fusion, and half-life. They will also discuss the uses of radiation in the real world such as medical application and nuclear plants for electricity.

Essential Questions:

What is radioactivity?
What is radiocarbon dating?
Why is fusion considered the Holy Grail for the production of electricity?
Why aren't all forms of radiation harmful to living things?

Evidence of Learning:

Major Assessments: Summative/Performance Assessments (Tests/Projects = 40%)

- Nuclear Chemistry Chapter Test

Minor Assessments: Quizzes (20%)

- Nuclear Reaction Quiz
- Nuclear Decay Quiz

Labs (30%)

- Nuclear Marbles Lab
- Radioactivity Decay Lab
- Gizmo: Half-Life Lab
- Gizmo: Nuclear Decay Lab

Practice (Homework/Classwork =10 %)
Homework/Class work will reinforce the concepts taught in the class. Activities will be assigned as needed for students. Practice may be independent, partner, or small group depending on the level of rigor. Students will complete practice problems, lab data analysis, graphical analysis, or real-world scenarios. Students will complete practice until mastery is reached. Students requiring more practice will have it made available to them as needed.

Formative Assessments: *Will use one of the techniques listed below as necessary to assess students*
Do Nows, Exit Tickets, Question and Answer Techniques, Polling, Debate, Discussion

Resources

Textbook: *World of Chemistry*, Zumdahl, Zumdahl, DeCoste. Cengage. 4th Edition.
Includes digital textbook, study questions, labs, powerpoint presentations, & test banks

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Other Online Resources:

- PhET Simulations: https://phet.colorado.edu/
- Gizmo Virtual Labs: https://gizmos.explorelearning.com/
- NJCTL Chemistry Resources: https://njctl.org/materials/courses/chemistry/
- YouTube for lesson extension, clarification, and reteach

Science Recommended Accommodations & Modifications for Curriculum Implementation

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- 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).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tools such as Zoom, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
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STANDARDS for Learning Targets

NJSLS	Literacy	Cross curricular	CTE(NJSLS 9) Technology(NJSL8)
HS-PS1-8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.	RST.11-12.1 Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details from explanations or descriptions. (HS-ESS1-1) WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS1-3), (HS-ESS1-2) SL.11-12.4 Present information, findings and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience. (HS-ESS1-3)	MATHEMATICS: MP.2 Reason abstractly and quantitatively. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-3), (HS-PS1-8) MP.4 Model with mathematics. (HS-ESS1-1) HSN-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-ESS1-1), (HS-ESS1-2)	Technology 8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena. 8.2.12.NT.1 - Explain how different groups can contribute to the overall design of a product. CTE 9.3.ST.2 - Use technology to acquire, manipulate, analyze, and report data.

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	HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS1-1), (HS-ESS1-2) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS1-1), (HS-ESS1-2) HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1) HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-ESS1-1), (HS-ESS1-2) HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-ESS1-1), (HS-ESS1-2)	9.3.ST.3 - Describe and follow safety, health and environmental standards related to science, technology, engineering, and mathematics (STEM) workplaces. 9.3.ST.6 - Demonstrate technical skills needed in the chosen STEM field. 9.3.ST-ET.2 - Display and communicate STEM information. 9.3.ST-SM.3 - Analyze the impact that science and mathematics has on society.

Sample Measurable Objectives for Lesson Planning
Identify the radioactive particles produced in a nuclear decay reaction.
Calculate the half-life of a substance.
Identify sources of natural and manmade radiation.
Explain the difference between nuclear fusion and nuclear fission.
Determine the risks/benefits to nuclear power generation to the environment.

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