Science Curriculum Map: Chemistry Honors 2024

updated 9/1/2024

Unit	Topics	Time Frame	Standards

Unit 1 - Introduction to Chemistry	• 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
		8 periods	HS-ETS1-3
			HS-ETS1-4
			HS-PS1-7

Unit 2 - Atomic structure, Elements, and the Periodic Table	• 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, orbital, & noble gas notation
		24 periods	HS-PS1-1
			HS-PS1-2
			HS-PS2-1
			HS-ETS1-3
			HS-ETS1-4
			HS-PS3-4

Unit 3 - Bonding/VSEPR theory	• Octet Rule & Diatomic Molecules
	• Ionic Bonding
	  ○ Cations, Anions, Polyatomic Ions
	  ○ Oxidation numbers
	• Covalent Bonding
	  ○ Single, double, & triple bonds
	  ○ Molecular/electron geometry
	  ○ Lewis Structures
		24 periods	HS-PS1-1
			HS-PS1-2
			HS-PS1-3
			HS-ETS1-2
			HS-ESS2-5

Unit 4 - Nomenclature	• Ionic Formula Writing & Nomenclature • Covalent Formula Writing & Nomenclature	8 periods	HS-PS1-1 HS-PS1-3 HS-PS2-6

Unit 5 - Reactions	• Chemical Symbols
	  ○ subscripts vs coefficients
	• Types of Chemical Reactions
	  ○ Identifying 5 types
	  ○ Writing reactions from words
	  ○ balancing reactions
	  ○ Predicting Products from reactants
		20 periods	HS-PS1-2
			HS-PS1-4
			HS-PS1-7
			HS-PS1-5
			HS-PS1-6
			HS-LS1-7

Unit 6 - The Mole and 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
		16 periods	HS-PS1-7
			HS-PS1-6
			HS-ETS1-2
			HS-PS1-4

Unit 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
		16 periods	HS-PS1-4
			HS-PS3-1
			HS-PS3-4

Unit 8 - States of matter (Solutions and Gas Laws)	• Gas Properties - P, V, T, & n
	• Gas Laws
	  ○ Boyle's Law
	  ○ Charles' Law
	  ○ Gay-Lussac's Law
	  ○ Combined Gas Law
	  ○ Ideal Gas Law
		20 periods	HS-PS1-3
			HS-ESS2-5
			HS-ESS3-2
			HS-ESS2-6
			HS-ETS1-1

Unit 9 - Nuclear	• Radioactive Particles - Nuclear Decay
	  ○ alpha
	  ○ beta
		12 periods	HS-PS1-8

Back to top

	○ gamma ● Nuclear Fusion vs Nuclear Fission ● Half-life ● Sources of Radiation ● Nuclear Power		HS-ESS1-1 HS-ESS1-2 HS-ESS1-3 HS-ESS1-6

Back to top

Unit 1: Introduction to Chemistry

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. Evidence of a chemical change (reaction) will be examined here. Measurements will be made of different quantities of matter and conversions will be made using factor-label method

Essential Questions:

1. How is the scientific method used to study real world phenomena?
2. How do the properties of matter aid in its classification?
3. Why is there a need for a universal system of measurement?

Vocabulary/Key Terms

Tier 2	Tier 3
element, compound, mixture, metric, matter, atom	homogeneous, heterogeneous, chemical change, physical change

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

Back to top

Resources

Textbook: *Introductory Chemistry: A Foundation*, Zumdahl, Zumdahl, DeCoste. Cengage. 9th 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

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

Back to top

- 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 Science	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS)**
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 to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. **HS-PS1-7** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.	**ELA** RI.CR.9–10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. W.IW.9–10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WP.9–10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience. W.WR.9–10.5. Conduct short as well as more	**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.

Back to top

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.

W.SE.9–10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals).

RI.CI.9–10.2. Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

SL.UM.9–10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest. 

Mathematics:
N.Q.A - Reason quantitatively and use units to solve problems.

S.ID.A - Summarize, represent, and interpret data on a single count or measurement variable.

S.CP.A Understand independence and conditional probability and use them to interpret data.

S.MD.A - Calculate expected values and use them to solve problems.

A.SSE.A - Interpret the structure of expressions

A.CED.A Create equations that describe numbers or relationships

Back to top

Sample Measurable Objectives for Lesson Planning
• The scientific method is a cyclic process used to investigate real world phenomena. • Physical and chemical properties of matter dictate how the matter can undergo physical and chemical changes. These properties also help in the process of classification of the matter. • The metric system is used around the world to communicate measurement universally. In order to use the metric system, one must be able to convert between units using dimensional analysis.

Unit 2: Atomic Structure, Elements and the Periodic Table

This introductory 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:

1. How did the periodic table evolve over time and how can students discern important information about elements using the periodic table?
2. Who were the scientists and what were their contributions to the current model of the atom?
3. What are the major components of the atom and why are they important?
4. What are the importance of isotopes and their relative abundance? What is the importance of an ion?
5. How do the atomic spectra correlate with the energy levels of an atom?
6. How can students draw orbital diagrams and write electron configurations and how can these explain periodic trends?

Back to top

Vocabulary/Key Terms

Tier 2	Tier 3
atom, molecule, periodic table,	periodicity, ground state, excited state, quantum mechanical model, valence electron,

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

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: *Introductory Chemistry: A Foundation*, Zumdahl, Zumdahl, DeCoste. Cengage. 9th 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

Back to top

Science Recommended Accommodations & Modifications for Curriculum Implementation

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

- 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 Science	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS)**
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. **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-PS2-6** Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. **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,	**ELA** RI.CR.9–10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. W.IW.9–10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WP.9–10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to	**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.

Back to top

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 to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

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).

complete complex writing tasks; seeking out feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience.

W.WR.9–10.5. 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.

W.SE.9–10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals).

RI.CI.9–10.2. Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

SL.UM.9–10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest.

Mathematics:
N.Q.A - Reason quantitatively and use units to solve problems.

S.ID.A - Summarize, represent, and interpret data on a single count or measurement variable.

S.CP.A Understand independence and conditional probability and use them to interpret data.

S.MD.A - Calculate expected values and use

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.

Back to top

	them to solve problems. A.SSE.A - Interpret the structure of expressions A.CED.A Create equations that describe numbers or relationships

Sample Measurable Objectives for Lesson Planning
1. The periodic table is useful for discovering, learning, and remembering the different properties of the elements. 2. The contributions of the various scientists led to the current development of the periodic table. The current atomic model is based on the past history of the atom. 3. The major components of the atom led to the understanding of atomic number, mass number, ions, and isotopes. The nuclear atom is based on the principle of protons, neutrons and electrons. 4. The electromagnetic spectrum describes the wavelength of radiation and its energy. By studying the electromagnetic spectrum, the wavelength of radiation can be compared with its energy. 5. Atoms are composed of specific sublevels and orbitals, which fill in order of increasing energy. Electron configurations and orbital diagrams can help to explain periodic trends

Unit 3 Bonding/VSEPR theory

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 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:

1. What factors determine whether ionic bonding or covalent bonding will take place and how is each represented?
2. How does VSEPR theory dictate the arrangement of atoms in molecules and dictate the molecule's intermolecular behavior?

Vocabulary/Key Terms

Tier 2	Tier 3
chemical bonds, ionic bond, covalent bond, metallic bond, bond angle	electronegativity, polarity, VSEPR, nomenclature

Back to top

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 %)
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: *Introductory Chemistry: A Foundation*, Zumdahl, Zumdahl, DeCoste. Cengage. 9th 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

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

Back to top

- 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 Science	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS)**
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. **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 electrical forces between particles.	**ELA** RI.CR.9–10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. W.IW.9–10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WP.9–10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out	**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.

Back to top

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.  **HS-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes	feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience. W.WR.9–10.5. 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.  W.SE.9–10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals). RI.CI.9–10.2. Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text. SL.UM.9–10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest.  **Mathematics:** N.Q.A - Reason quantitatively and use units to solve problems. S.ID.A - Summarize, represent, and interpret data on a single count or measurement variable. S.CP.A Understand independence and conditional probability and use them to interpret data. S.MD.A - Calculate expected values and use them to solve problems.	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.

Back to top

A.SSE.A - Interpret the structure of expressions

A.CED.A Create equations that describe numbers or relationships

Sample Measurable Objectives for Lesson Planning
1. The octet rule is used to form ionic and covalent bonds. 2. Lewis structures are diagrams that use dots as electrons. 3. The three – dimensional structure of a molecule or polyatomic ion can be predicted by the arrangement of the electrons 4. Compounds can be classified as either polar or non-polar. 5. The attractive forces between ions, polar covalent molecules, and nonpolar covalent molecules are called intermolecular forces, such as dispersion forces, Dipole interactions, Vander Waals forces and hydrogen bonds.

Unit 4: Nomenclature

Once students understand the structure of formula units, molecules and ions, they will write formulas and name compounds considering the following: law of conservation of mass, law of definite proportions, law of multiple proportions. Formula writing and naming will be focused on: binary and ternary ionic compounds using both the stock system and classical system, molecular compounds, binary and ternary acids, and hydrates.

Essential Questions:

1. What does the nomenclature of a compound tell about how the compound is bonded together?
2. How does each compound achieve a net charge of zero and how does this affect formula writing?

Vocabulary/Key Terms

Tier 2	Tier 3
net charge, prefix, Roman Numeral	IUPAC

Back to top

Evidence of Learning:

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

- Nomenclature Chapter Test

Minor Assessments: Quizzes (20%)

- Ionic Naming Quiz Quiz
- Binary Molecule Naming Quiz

Labs (30%)

- Classifying Compounds Activity understanding, analyzing
- Formula of Ionic Compound Lab
- Family of Elements Lab
- Differences Between Ionic and Molecular Compounds Lab
- Ionic Compounds 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: *Introductory Chemistry: A Foundation*, Zumdahl, Zumdahl, DeCoste. Cengage. 9th 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

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

Back to top

- 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 Science	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS)**
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. **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 electrical forces between particles **HS-PS2-6** Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.	**ELA** RI.CR.9–10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. W.IW.9–10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WP.9–10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out	**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.

Back to top

	feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience. W.WR.9–10.5. 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. W.SE.9–10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals). RI.CI.9–10.2. Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text. SL.UM.9–10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest. **Mathematics:** N.Q.A - Reason quantitatively and use units to solve problems. S.ID.A - Summarize, represent, and interpret data on a single count or measurement variable. S.CP.A Understand independence and conditional probability and use them to interpret data. S.MD.A - Calculate expected values and use them to solve problems.	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.

Back to top

A.SSE.A - Interpret the structure of expressions

A.CED.A Create equations that describe numbers or relationships

Sample Measurable Objectives for Lesson Planning
1. Chemical symbols, formulas, and equations are understood internationally and are written based upon universally accepted guidelines. 2. Chemists use knowledge of the molecular model to create new reactions. 3. Chemists use combinations of chemical reactions to create new substances and materials designed to meet social needs.

Unit 5: Reactions

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 solubility to predict products and determine net ionic equations.

Essential Questions:

1. What are chemical reactions and why do they occur?
2. How can chemical reactions be represented?
3. How does a balanced chemical equation demonstrate the law of conservation of mass?
4. What are the four general types of chemical reactions?
5. What characteristics identify each type of chemical reaction?

Vocabulary/Key Terms

Tier 2	Tier 3
chemical reaction, conservation of mass, products, reactants	solvent, solute, synthesis, decomposition, combustion, single replacement, double replacement

Back to top

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.

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: *Introductory Chemistry: A Foundation*, Zumdahl, Zumdahl, DeCoste. Cengage. 9th 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

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

Back to top

- 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 Science	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS)**
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-PS1-4** 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 **HS-PS1-7** Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction **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. **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.	**ELA** RI.CR.9–10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. W.IW.9–10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WP.9–10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what	**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.

Back to top

HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.	is most significant for a specific purpose and audience. W.WR.9–10.5. 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. W.SE.9–10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals). RI.CI.9–10.2. Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text. SL.UM.9–10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest. **Mathematics:** N.Q.A - Reason quantitatively and use units to solve problems. S.ID.A - Summarize, represent, and interpret data on a single count or measurement variable. S.CP.A Understand independence and conditional probability and use them to interpret data. S.MD.A - Calculate expected values and use them to solve problems. A.SSE.A - Interpret the structure of expressions	9.3.ST-SM.3 - Analyze the impact that science and mathematics has on society.

Back to top

A.CED.A Create equations that describe numbers or relationships

Sample Measurable Objectives for Lesson Planning
1. Chemical symbols, formulas, and equations are understood internationally and are written based upon universally accepted guidelines. 2. Chemists use knowledge of the molecular model to create new reactions. 3. Chemists use combinations of chemical reactions to create new substances and materials designed to meet social needs.

Unit 6: The Mole & 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 qualitatively as well quantitatively determine the limiting reagent, theoretical yield and percent yield. Students will also determine the percent composition of elements in compounds and use this principle to determine the empirical and molecular formulas.

Essential Questions:

1. What is a mole and describe its importance in chemistry?
2. What is molar mass and why is it important in chemical calculations?
3. How can you convert among the number of moles, the mass of a sample, the volume of a gas, and the number of particles?
4. What is the percent composition of a substance and how is it calculated?
5. What is the difference between an empirical formula and a molecular formula and how are they calculated?
6. What is stoichiometry?
7. How are molar relationships represented in balanced chemical equations?
8. What are the main types of stoichiometry problems?
9. What determines the amount of products formed in a chemical reaction?
10. How is the percent yield of a chemical reaction determined?

Vocabulary/Key Terms

Tier 2	Tier 3
empirical formula, molecular formula, reaction yield	Avogadro's number, mole, percent composition

Back to top

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.

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: *Introductory Chemistry: A Foundation*, Zumdahl, Zumdahl, DeCoste. Cengage. 9th 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

Back to top

Science Recommended Accommodations & Modifications for Curriculum Implementation

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

- 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 Science	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS)**
HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction **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. **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. **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.	**ELA** RI.CR.9–10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. W.IW.9–10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WP.9–10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete	**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.

Back to top

	complex writing tasks; seeking out feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience. W.WR.9–10.5. 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.  W.SE.9–10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals). RI.CI.9–10.2. Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text. SL.UM.9–10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest.  **Mathematics:** N.Q.A - Reason quantitatively and use units to solve problems. S.ID.A - Summarize, represent, and interpret data on a single count or measurement variable. S.CP.A Understand independence and conditional probability and use them to interpret data. S.MD.A - Calculate expected values and use them to solve problems. A.SSE.A - Interpret the structure of expressions A.CED.A Create equations that describe numbers or relationships	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.

Back to top

Sample Measurable Objectives for Lesson Planning
1. The concept of the mole can be used to connect the concepts of volume, mass and number of particles. 2. Molar mass can be determined from the periodic table. 3. Mass percentage of each element in a compound can be calculated. 4. Chemical compounds have empirical and molecular formulas. 5. The interactions of substances with one another create new products in a predictable, quantifiable way. 6. The amount of matter in the universe is essentially constant. It is only rearranged 7. The role of the mole in chemical calculations, and the application of dimensional analysis in their solutions enable chemists to quantify the results of chemical reactions.

Unit 7: Thermochemistry

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. Evidence of a chemical change (reaction) will be examined here. Measurements will be made of different quantities of matter and conversions will be made using factor-label method

Essential Questions:

1. Why do you put salt on ice in the winter to melt it?
2. What are the forms of energy and how is it conserved?
3. How can students determine the difference between endothermic and exothermic reactions?
4. What is a calorimeter and how does it determine heats of reactions?

Vocabulary/Key Terms

Tier 2	Tier 3
heat, energy, work, phase diagram, energy diagram	endothermic, exothermic, enthalpy, entropy

Back to top

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.

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: *Introductory Chemistry: A Foundation*, Zumdahl, Zumdahl, DeCoste. Cengage. 9th 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

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.

Back to top

- 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 Science	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS)**
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 **HS-PS3-1** Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. **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).	**ELA** RI.CR.9–10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. W.IW.9–10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WP.9–10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience. W.WR.9–10.5. Conduct short as well as more sustained research projects to answer a question (including a self-generated question)	**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.

Back to top

or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

W.SE.9–10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals).

RI.CI.9–10.2. Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

SL.UM.9–10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest.

Mathematics:

N.Q.A - Reason quantitatively and use units to solve problems.

S.ID.A - Summarize, represent, and interpret data on a single count or measurement variable.

S.CP.A Understand independence and conditional probability and use them to interpret data.

S.MD.A - Calculate expected values and use them to solve problems.

A.SSE.A - Interpret the structure of expressions

A.CED.A Create equations that describe numbers or relationships

Back to top

Sample Measurable Objectives for Lesson Planning
1. Real world applications of energy exchange and law of conservation of energy are observed every day, such as putting a metal spoon in a cup of hot coffee. 2. Reactions involving heat can be exothermic or endothermic. The heat exchange is measured using a calorimeter.

Unit 8: States of Matter (Solutions & Gas Laws)

During this unit students will examine the states of matter, properties of each and what conditions are needed 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:

1. What are the three types of intermolecular forces of attraction?
2. What is involved in a change in phase?
3. What information is provided by heating curves and phase diagrams?
4. What is the kinetic molecular theory of gases?
5. What are some distinctive properties of gases?
6. How is gas pressure measured?
7. What is solubility and how do you determine if a substance is soluble? How do you interpret a solubility curve?
8. How can concentrations be calculated?
9. What factors affect the rate of dissolving?
10. What are colligative properties?
11. How do the gas laws relate the variables pressure, volume, moles, and temperature?

Back to top

12. What is the ideal gas law and how is it applied?
13. What is a real gas?
14. How is gas density related to molar mass and temperature?
15. How is Avogadro's law used to describe the relationship between the amount of a gas and its volume?
16. How is total pressure calculated, given the partial pressures of a gas mixture?

Vocabulary/Key Terms

Tier 2	Tier 3
pressure, volume, temperature, boiling point	intermolecular forces, ideal gas, kinetic molecular theory (KMT)

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 %)
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: *Introductory Chemistry: A Foundation*, Zumdahl, Zumdahl, DeCoste. Cengage. 9th 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/

Back to top

- NJCTL Chemistry Resources: https://njctl.org/materials/courses/chemistry/
- YouTube for lesson extension, clarification, and reteach

Science Recommended Accommodations & Modifications for Curriculum Implementation

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

- 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 Science	Cross curricular	CTE(NJSLS 9) Technology(NJSLS)
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 electrical forces between particles. **HS-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. **HS-ESS3-2** Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.	**ELA** RI.CR.9–10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. W.IW.9–10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WP.9–10.4. Develop and strengthen writing as	**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.

Back to top

HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience.

W.WR.9–10.5. 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. 

W.SE.9–10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals).

RI.CI.9–10.2. Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.

SL.UM.9–10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest. 

Mathematics:
N.Q.A - Reason quantitatively and use units to solve problems.

S.ID.A - Summarize, represent, and interpret data on a single count or measurement variable.

S.CP.A Understand independence and conditional probability and use them to interpret data.

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.

Back to top

S.MD.A - Calculate expected values and use them to solve problems.

A.SSE.A - Interpret the structure of expressions

A.CED.A Create equations that describe numbers or relationships

Sample Measurable Objectives for Lesson Planning
1. The physical properties of solids, gases, liquids are different, dependent upon intermolecular attraction. 2. Changes in state can be described in terms of energy changes involved. 3. Heating, cooling curves, phase diagrams can be interpreted to identify phase of matter. 4. The kinetic molecular theory can be used to describe the properties of gases. 5. Gas pressure can be measured and derived, and gas pressure units can be converted using dimensional analysis. 6. Solubility depends on the intermolecular forces between solute and solvent 7. Solubility curves are used to determine the capacity which a solute can dissolve in a solvent. Using this, it is possible to determine if a solution is saturated, unsaturated or supersaturated. 8. Concentration of a solution can be calculated in different ways such as molarity and molality. 9. Solubility of a gas or solid is dependent upon pressure and temperature conditions 10. Using molality, it is possible to determine how solute dissolved affects colligative properties. 11. Use the gas laws to explain behavior of gases. 12. Mathematically determine one variable in gas law word problems. 13. Derive the ideal gas law. 14. Use the ideal gas law to describe behavior of ideal gases and compare to behavior of real gases.

Back to top

Unit 9: 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:

1. How does fusion on our sun work?
2. How is energy generated in our nuclear power plants and what are the risks?
3. What is carbon dating and how is it used?

Vocabulary/Key Terms

Tier 2	Tier 3
radioactivity, half-life	radiocarbon dating

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,

Back to top

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: *Introductory Chemistry: A Foundation*, Zumdahl, Zumdahl, DeCoste. Cengage. 9th 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

General Classes
Special Education
504 Students
ML Students
At Risk Students
Gifted and Talented

- 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.

Back to top

STANDARDS for Learning Targets		
NJSLS Science	**Cross curricular**	**CTE(NJSLS 9) Technology(NJSLS)**
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. **HS-ESS1-2** Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. **HS-ESS1-3** Communicate scientific ideas about the way stars, over their life cycle, produce elements **HS-ESS1-6** Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.	**ELA** RI.CR.9–10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. W.IW.9–10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. W.WP.9–10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience. W.WR.9–10.5. 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. W.SE.9–10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals). RI.CI.9–10.2. Determine one or more central ideas of an informational text and analyze how it is developed and refined over the course of a text, including how it emerges and is shaped by specific details; provide an objective summary of the text.	**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.

Back to top

SL.UM.9–10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest. 

Mathematics:
N.Q.A - Reason quantitatively and use units to solve problems.

S.ID.A - Summarize, represent, and interpret data on a single count or measurement variable.

S.CP.A Understand independence and conditional probability and use them to interpret data.

S.MD.A - Calculate expected values and use them to solve problems.

A.SSE.A - Interpret the structure of expressions

A.CED.A Create equations that describe numbers or relationships

Sample Measurable Objectives for Lesson Planning
1. Fusion is a process that combines two smaller nuclei into a larger one. It requires incredibly hot temperatures to start which makes the fact that it is used on the sun and stars logical. 2. Fission splits a nucleus apart into two smaller nuclei. This is used by our power plants creating nuclear waste. If controls are not met, it can be disastrous (Chernobyl, Three Mile Island) 3. The energy released during nuclear decay can be in different forms such as alpha particles, beta particles, gamma rays. 4. The half live of a substance is how long it takes half the atoms in a given sample to decay. This is used in Carbon dating

Back to top