VERNON TOWNSHIP
SCHOOL DISTRICT

Chemistry Honors
Curriculum Map

Adapted from:
Understanding By Design

Reviewed by:
Vincent Gagliostro - Director of Curriculum & Instruction

Adopted:
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Raymond Zimmerman

Superintendent of Schools:
Russell Rogers

Vernon School District
PO Box 99
625 Route 517
Vernon, NJ 07462
www.vtsd.com/

Course Description

Chemistry Honors is recommended for college bound students who have the necessary math background and require a physical lab science for college admission. The course will provide students with an understanding of the major principles of chemistry and basic laboratory techniques as preparation for their college studies. The course will include topics such as the nature and properties of matter, formula writing, chemical reactions, chemical equations, stoichiometry, properties of solids, liquids and gasses, acids and bases. The course is also concerned with providing students with an understanding and appreciation of the impact of chemistry and technology in their everyday lives. Completion of a summer assignment is required.

Prerequisite: > 80% average in Biology Honors or >95% in Biology ACP with teacher recommendation

Based upon the following list of proficiencies, each student must demonstrate a minimum competency level of 65%. Competencies will be measured by way of an evaluation program consisting of teacher observations of student performance, tests, quizzes, classwork, homework, projects, and class participation, as well as class attendance in accordance with the high school's attendance policy.

Successful completion of this course earns 6 credits toward graduation.

New Jersey learning Standards covered throughout the course

In conjunction with the New Jersey Student Learning Standards, students enrolled in the Chemistry Honors courses will demonstrate the ability to:

HS-PS1: Matter and Its Interactions

- 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.
- 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-PS1-5 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.

- HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
- 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-PS2 Motion and Stability: Forces and Interactions

- HS-PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

HS-PS3 Energy

- HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects).

HS-ESS1 Earth's Place in the Universe

- 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 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.

HS-ESS2 Earth's Systems

- HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
- HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

HS-ESS3: Earth and Human Activity

- HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

HS-ETS1 Engineering Design

- 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.
- 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-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.

Grading Criteria
• Major Grades - 80% • Minor Grades - 20%

Course Resources
Core Text: • Chemistry 2e (Openstax/Rice University, 2020) **Technologies:** • BenQ Interactive Display, Chromebooks, Calculator • Software and web-based presentation resources **Supplemental Materials:** • For phenomena ideas: www.NGSSPhenomena.com • For readings, quizzes, and simulations: www.ck12.org • For simulation labs: https://learn.concord.org/collections, http://exeplorelearning.com/ • Learning Plans/Schoology • Formula sheet; conversion chart

Scope and Sequence- Topical Outline		
Unit	Title	Time
1	Structure and Properties of Matter *(with DEI mandate)*	40 Days
2	The Chemistry of Abiotic Systems	30 Days
3	Bonding and Chemical Reactions	50 Days
4	Nuclear Chemistry	30 Days
5	Human Impact: The Chemistry of Sustainability *(with Climate Change mandate)*	30 Days
		180 days total

The timeline is only an approximation. The inclusion of a classroom project in any one of the above units would extend the time allotment.

Subject Area: Science **Level: Chemistry Honors**	
Unit	**1**
Timeframe	40 Days
Established Goals	• Use investigations, simulations, and models to make sense of the substructure of atoms and to provide more mechanistic explanations of the properties of substances. • Use the periodic table as a tool to explain and predict the properties of elements. • Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. • Use developing and using models, planning and conducting investigations, using mathematical thinking, and constructing explanations and designing solutions. • Use the science and engineering practices to demonstrate proficiency with the core ideas.
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. ● 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, 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.
Essential Questions	● How can a substance be described on the atomic level based on observable properties? ● How can I use the properties of something (in bulk quantities) to predict what is happening with the subatomic particles? ● How can a periodic table tell me about the subatomic structure of a substance
Content Knowledge	*Students will learn:* ● Safety in a chemistry lab should be demonstrated at all times. ● Describe the differences in types of matter by classification of substances. ● Describe the physical and chemical properties of matter. ● Identify the differences among particle properties in solids, liquids and gasses. ● Observe how matter changes between states. ● Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. ● An atom's nucleus is made of protons and neutrons and is surrounded by electrons. ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. ● Electrons that move among energy levels have predictable absorptions and emissions. ● Correct placement of electrons shows repetitive properties and patterns. ● studied, and these patterns can provide evidence for causality in explanations of phenomena. ● The periodic table orders elements horizontally by the number of protons in the nucleus of each element's atoms and places elements with similar chemical properties in columns. ● The repeating patterns of this table reflect patterns of outer electron states. ● Patterns of electrons in the outermost energy level of atoms can provide evidence for the relative

	properties of elements at different scales. ● Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. ● Different patterns may be observed at each of the scales at which a system is studied, and these patterns can provide evidence for causality in explanations of phenomena. ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. ● Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. ● When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, aesthetics, and to consider social, cultural, and environmental impacts. ● Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. ● Models (e.g., physical, mathematical, computer models) can be used to simulate why the molecular-level structure is important in the functioning of designed materials.
Skills	*Students will be able to:* ● Identify and successfully use lab safety equipment. ● Explain using models how smell works at the molecular level (Speedy Smell SIM). ● Explain using models how the properties and components of air allow for its behavior (Air Matters SIM). ● dents who understand the concepts are able to: ● Plan and conduct an investigation individually and collaboratively to produce data that can serve as the basis for evidence for comparing the structure of substances at the bulk scale to infer the strength of electrical forces between particles. In the investigation design, decide on types, how much, and accuracy of data needed to produce reliable measurements; consider limitations on the precision of the data (e.g., number of trials, cost, risk, time); and refine the design accordingly (Locate an Electron Lab, Solar Sails Project). ● Understand the idea that atoms have a charged substructure consisting of a nucleus that is composed of protons and neutrons surrounded by electrons using models, simulations, drawings or kits. ● Explain the source of element emission spectra and flame test colors (Atomic Colors SIM). ● Compare models of the atom and how they have developed over time (History of the Atom Timeline, Hydrogen Atom PhET). ● Create models of atoms by calculating protons, neutrons, and electrons in any given atom, isotope,

	or ion. ● Gather isotopic data and use it to evaluate atomic structure (Isotope labs). ● Write electron configurations for main group elements, paying attention to patterns of electrons in the outermost energy level. ● Use the periodic table as a model to provide evidence for relative properties of elements at different scales based on the patterns of electrons in the outermost energy level of atoms in main group elements (Alkaline Earth Metal Lab). ● Use valid and reliable evidence (obtained from students' own investigations, models, theories, simulations, and peer review) showing the outermost electron states of atoms, trends in the periodic table, and patterns of chemical properties to construct and revise an explanation for the outcome of a simple chemical reaction. ● Observe patterns in the outermost electron states of atoms, trends in the periodic table, and chemical properties (Mendeleev for a Day Lab). ● Communicate scientific and technical information about why the molecular - level structure is important in the functioning of designed materials. ● Evaluate a solution to a complex real-world problem based on scientific knowledge, student generated sources of evidence, prioritized criteria, and tradeoffs considerations to determine why the molecular level structure is important in the functioning of designed materials. ● Use mathematical models and/or computer simulations to show why the molecular level structure is important in the functioning of designed materials. ● Communicate scientific and technical information about the attractive and repulsive forces that determine the functioning of the material. ● Use mathematical models and/or computer simulations to show the attractive and repulsive forces that determine the functioning of the material. ● Examine in detail the properties of designed materials, the structure of the components of designed materials, and the connections of the components to reveal the function. ● Use models (e.g., physical, mathematical, computer models) to simulate systems of designed materials and interactions--including energy, matter, and information flows--within and between designed materials at different scales. ● Complete the Solar Sails Project. ***Reference Goal 4 Opportunities when designing lessons to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all***
Performance Tasks	● Write 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 of elements using well-chosen, relevant, and sufficient facts; extended definitions; and concrete details from students' own investigations, models, theories, simulations, and peer review. ● Develop and strengthen explanations for the outcome of a simple chemical reaction by planning,

	revising, editing, rewriting, or trying a new approach, focusing on addressing the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties of elements. ● Draw evidence from informational texts about the outermost electron states of atoms, trends in the periodic table, and patterns of chemical properties of elements to construct a rigorous explanation of the outcome of a simple chemical reaction. ● Cite specific textual evidence comparing the structure of substances at the bulk scale to infer the strength of electrical forces between particles. ● Conduct short as well as more sustained research projects to compare the structure of substances at the bulk scale and use this research to infer the strength of electrical forces between particles. ● Gather applicable information from multiple reliable sources to support the claim that electrical forces between particles can be used to explain the structure of substances at the bulk scale. ● Develop evidence comparing the structure of substances at the bulk scale and the strength of electrical forces between particles. ● Determine a level of accuracy appropriate to limitations on measurement when reporting quantities representing periodic trends for main group elements based on patterns of electrons in the outermost energy level of atoms. ● Considering the outermost energy level of atoms, define appropriate quantities for descriptive modeling of periodic trends for main group elements based on patterns of electrons in outermost energy levels. ● Use units as a way to understand the outcome of a simple chemical reaction involving main group elements based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. Choose and interpret units consistently in chemical reactions. ● Determine and interpret the scale and origin in graphs and data displays representing patterns of chemical properties, outer electron states of atoms, trends in the periodic table, and patterns of chemical properties. ● Determine a level of accuracy appropriate to limitations on measurement when reporting quantities of simple chemical reactions. ● Use units as a simple way to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. Choose and interpret units comparing the structure of substances at the bulk scale to infer the strength of electrical forces between particles. Choose and interpret the scale and origin in graphs and data displays comparing the structure of substances and the bulk scale and electrical forces between particles.

	• Determine a level of accuracy appropriate to limitations on measurements of the strength of electrical forces between particles.
Other Assessment Evidence	***Formative Assessments for Chemistry review topics*** • Teacher check ins, exit tickets, observations of student groups, student conferences, etc. • Skill/homework sheets • Socratic discussion • Quiz- Lab Safety • Schoology discussion posts • On-line assignments (Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard) and simulations (https://concord.org/ and http://exeplorelearning.com/) • Current Event Article(s) ***Summative Assessment*** • CERs • Lab activities, experimental design, and reports • Unit exam - unit 1 topics ***Alternative Assessment*** Assessments will be differentiated in various ways based on the needs of the students. For example, differentiation could be in… • Content (texts, phenomena, graphs, datatables, vocabulary, etc.) • Process (scaffolding, guiding questions, small group instruction, etc.) • Product (individual components,student choice modality such as video, skit, etc) ***Benchmark*** Planning and Carrying out a Chemical Investigation: Students are presented with a chemical reaction problem. They will design and conduct an experiment testing how to most effectively determine solutions to a real world problem. • Students will be able to design and conduct a controlled experiment in order to identify significant figures in measurements and calculations of data. • Students will be able to effectively analyze and draw conclusions from their dataset. • Students will be able to make strong predictions based on trends in the data. • Students will be able to evaluate the effectiveness of their experimental design and reflect upon it. ***During each common, formative, and summative assessment, teachers will provide alternative assessment opportunities that adhere to 504 and IEP requirements. Alternative assessments are individualized for the needs of all students.***

Resources/Materials	**Core Text:** ● Chemistry 2e, Openstax Ch. 1-3 **Technologies:** ● BenQ Interactive Display, Chromebooks **Supplemental Materials:** ● For phenomena ideas: www.NGSSPhenomena.com ● For readings, quizzes, and simulations: www.ck12.org ● For simulation labs: https://learn.concord.org/collections , http://exeplorelearning.com/ ● Blooket, Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard, https://concord.org/ , www.ck12.org http://exeplorelearning.com/) ● Chromebook and calculator ● BenQ Interactive Display
Learning Activities	● Build an Atom ● Periodic Table Trends ● Path to Periodic Table ● Castle of Mendeleev ● Speedy Smells ● Taste and Smell Article ● Chemistry of Tide Pens ● Air Matters ● Atomic Colors
Diversity Equity and Inclusion Mandate (DEI)	● Explore the lives of scientists who faced significant hardships yet achieved remarkable success and inspiring insights into resilience and determination. Conduct a webquest and discuss the following: ○ Choose a scientist relevant to this field of science. ○ When did the scientist conduct their research? ○ What were their scientific discoveries or awards received? ○ What hardships regarding disabilities, race, culture, or gender were dealt with.
Interdisciplinary Connections	*English Language Arts/Literacy* ● Taste and Smell Article ○ W.IW.9-12.2. 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. (HS-PS1-2) Other ELA: ● RI.CR.11-12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. (HS-PS1-3) ● W.WP.9–12.4. 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. (HS-PS1-2),(HS-ETS1-3) ● W.WR.9–12.5. 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. 🌿 (HS-PS1-3) ● W.SE.11–12.6. 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 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 (MLA or APA Style Manuals). (HS-PS1-3),(HS-ETS1-3) ● SL.UM.9–12.5. 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. 🌿 (HS-PS1-4) *Mathematics* ● Periodic Table Trends ● MP.2 Reason abstractly and quantitatively. (HS-ETS1-3),(HS-ETS1-4) Other: ● 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 the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3)

Subject Area: Science **Level: Chemistry Honors**	
Unit	**2**

Timeframe	30 Days
Established Goals	• Develop and use models, plan and carry out investigations, analyze and interpret data, and engage in argument from evidence to make sense of energy as a quantitative property of a system—a property that depends on the motion and interactions of matter and radiation within that system. • Use the findings of investigations to provide a mechanistic explanation for the core idea that total change of energy in any system is always equal to the total energy transferred into or out of the system. • Develop an understanding that energy, at both the macroscopic and the atomic scales, can be accounted for as motions of particles or as energy associated with the configurations (relative positions) of particles. • Apply their understanding of energy to explain the role that water plays in affecting weather. Students examine the ways that human activities cause feedback that create changes to other systems. • Demonstrate proficiency in developing and using models, planning and carrying out investigations, analyzing and interpreting data, engaging in argument from evidence, and using these practices to demonstrate understanding of core ideas. • Develop possible solutions for major global problems. They begin by breaking these problems into smaller problems that can be tackled with engineering methods. • Evaluating potential solutions, students are expected not only to consider a wide range of criteria, but also to recognize that criteria need to be prioritized.
NJSLS	• HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative positions of particles (objects). • 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. • 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.
Essential Questions	• Does thermal energy always transfer or transform in predictable ways? • What makes water's properties essential to life on our planet? or Why do we look for water on other planets? or What makes water so special? • What is the best energy source for a home?

	• How would I meet the energy needs of the house of the future?
Content Knowledge	*Students will learn:* • When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. • Uncontrolled systems always move toward more stable states—that is, toward a more uniform energy distribution. • Although energy cannot be destroyed, it can be converted into less useful forms—for example, to thermal energy in the surrounding environment. • The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. • The functions and properties of water and water systems can be inferred from the overall structure, the way the components are shaped and used, and the molecular substructure. • These properties include water's exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing; dissolve and transport materials; and lower the viscosities and melting points of rocks. • All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. • Models can be used to simulate systems and interactions, including energy, matter, and information flows, within and between systems at different scales. • Engineers continuously modify design solutions to increase benefits while decreasing costs and risks. • Analysis of costs and benefits is a critical aspect of decisions about technology. • Scientific knowledge indicates what can happen in natural systems, not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. • New technologies can have deep impacts on society and the environment, including some that were not anticipated. • Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. • Many decisions are made not using science alone, but instead relying on social and cultural contexts to resolve issues.

Skills	*Students will be able to:* ● Plan and conduct an investigation individually or collaboratively to produce data on transfer of thermal energy in a closed system that can serve as a basis for evidence of uniform energy distribution among components of a system when two components of different temperatures are combined (Energy Transfer PhET). ● Use models to describe a system and define its boundaries, initial conditions, inputs, and outputs (Building Bridges SIM, Hot and Cold Pack SIM). ● Design an investigation to produce data on transfer of thermal energy in a closed system that can serve as a basis for evidence of uniform energy distribution among components of a system when two components of different temperatures are combined, considering types, how much, and the accuracy of data needed to produce reliable measurements. ● Consider the limitations of the precision of the data collected and refine the design accordingly (Building Bridges STEM design challenge). ● Plan and conduct an investigation individually and collaboratively of the properties of water and its effects on Earth materials and surface processes (Building Bridges STEM design challenge). ● Use models to describe a hydrological system and define its boundaries, initial conditions, inputs, and outputs (Boiling Water SIM). ● Design an investigation considering the types, how much, and accuracy of data needed to produce reliable measurements (Specific Heat Lab). ● Consider the limitations on the precision of the data collected and refine the design accordingly (Under Pressure Lab). ● Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost benefit ratios, scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g., economic, societal, environmental, and ethical considerations). ● Use models to evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost–benefit ratios, scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g., economic, societal, environmental, and ethical considerations). ● Demonstrate water's exceptional capacity to absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing; dissolve and transport materials; and lower the viscosities and melting points of rocks. ● Describe how water's abundance on Earth's surface, and its unique combination of physical and chemical properties, are central to the planet's dynamics. ***Reference Goal 4 Opportunities when designing lessons to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all***

Performance Tasks	• Ask and refine questions to support uniform energy distribution among the components in a system when two components of different temperature are combined, using specific textual evidence. • Conduct short as well as more sustained research projects to determine energy distribution in a system when two components of different temperature are combined. • Collect relevant data across a broad spectrum of sources about the distribution of energy in a system and assess the strengths and limitations of each source. • Synthesize findings from experimental data into a coherent understanding of energy distribution in a system. • Conduct short as well as more sustained research projects to determine how the properties of water affect Earth materials and surface processes. • Cite specific textual evidence to evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost–benefit ratios. • Evaluate the hypotheses, data, analysis, and conclusions of competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost–benefit ratios, verifying the data when possible and corroborating or challenging conclusions with other design solutions. • Integrate and evaluate multiple design solutions for developing, managing, and utilizing energy and mineral resources based on cost–benefit ratios in order to reveal meaningful patterns and trends. • Evaluate the hypotheses, data, analysis, and conclusions of competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost–benefit ratios, verifying the data when possible and corroborating or challenging conclusions with other design solutions. • Synthesize data from multiple sources of information in order to create data sets that inform design decisions and create a coherent understanding of developing, managing, and utilizing energy and mineral resources. • Use symbols to represent energy distribution in a system when two components of different temperature are combined, and manipulate the representing symbols. Make sense of quantities and relationships in the energy distribution in a system when two components of different temperature are combined. • Use a mathematical model to describe energy distribution in a system when two components of different temperatures are combined. Identify important quantities in energy distribution in a system when two components of different temperature are combined and map their relationships using tools. Analyze those relationships mathematically to draw conclusions, reflecting on the results and improving the model if it has not served its purpose.

	• Choose a level of accuracy appropriate to limitations on measurement when reporting quantities of the properties of water and their effects on Earth materials and surface processes. • Use symbols to represent an explanation of the best of multiple design solutions for developing, managing, and utilizing energy and mineral resources and manipulate the representing symbols. Make sense of quantities and relationships in cost–benefit ratios for multiple design solutions for developing, managing, and utilizing energy and mineral resources symbolically and manipulate the representing symbols. • Use a mathematical model to explain the evaluation of multiple design solutions for developing, managing, and utilizing energy and mineral resources. Identify important quantities in cost–benefit ratios for multiple design solutions for developing, managing, and utilizing energy and mineral resources and map their relationships using tools. Analyze those relationships mathematically to draw conclusions, reflecting on the results and improving the model if it has not served its purpose.
Other Assessment Evidence	***Formative Assessment*** • Teacher check ins, exit tickets, observations of student groups, student conferences, etc. • Skill/homework sheets • Quiz- Energy • Socratic discussion • Schoology discussion posts • On-line assignments (Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard) and simulations (https://concord.org/ and http://exeplorelearning.com/) • Current Event Article(s) ***Summative Assessment*** • CERs • Lab activities, experimental design, and reports • Unit exam - unit 2 topics ***Alternative Assessment*** Assessments will be differentiated in various ways based on the needs of the students. For example, differentiation could be in… • Content (texts, phenomena, graphs, datatables, vocabulary, etc.) • Process (scaffolding, guiding questions, small group instruction, etc.) • Product (individual components,student choice modality such as video, skit, etc)

Resources/Materials	**Core Text:** ● Chemistry 2e, Openstax Ch. 11 **Supplemental Materials:** ● For phenomena ideas: www.NGSSPhenomena.com ● For readings, quizzes, and simulations: www.ck12.org ● For simulation labs: https://learn.concord.org/collections , http://exeplorelearning.com/ ● Blooket, Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard, https://concord.org/ , www.ck12.org http://exeplorelearning.com/) ● Chromebook and calculator ● BenQ Interactive Display ● American Association for the Advancement of Science ● American Association of Physics Teachers ● American Chemical Society ● Concord Consortium: Virtual Simulations ● International Technology and Engineering Educators Association ● National Science Digital Library ● National Science Teachers Association ● North American Association for Environmental Education ● Phet: Interactive Simulation ● Physics Union Mathematics (PUM) ● Science NetLinks ● Slo-Mo explosion video
Learning Activities	● Baking soda/vinegar rocket ● Energy Transfers PhET ● Hot/cold pack SIM ● Heat of solution video ● Thermal expansion video ● Bridge building SIM ● LAB: “ Water on Mt. Everest Doesn't Boil” ● Salting roads ● Boiling water SIM ● Design an energy efficient house

Interdisciplinary Connections	*English Language Arts/Literacy* • Design an energy efficient house • W.IW.9-12.2. 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. (HS-PS1-2) Other: • RI.CR.11-12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. (HS-PS1-3) • W.WP.9–12.4. 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. (HS-PS1-2),(HS-ETS1-3) • W.WR.9–12.5. 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. 🌿 (HS-PS1-3) • W.SE.11–12.6. 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 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 (MLA or APA Style Manuals). (HS-PS1-3),(HS-ETS1-3) • SL.UM.9–12.5. 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. 🌿 (HS-PS1-4) *Mathematics* • Energy Transfers PhET • MP.2 Reason abstractly and quantitatively. (HS-ETS1-3),(HS-ETS1-4) Other: • 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 the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3)

Subject Area: Science Level: Chemistry Honors	
Unit	**3**
Timeframe	50 Days
Established Goals	• Develop and use models, plan and conduct investigations, use mathematical thinking, and construct explanations and design solutions as they develop an understanding of the substructure of atoms and to provide more mechanistic explanations of the properties of substances. Chemical reactions, including rates of reactions and energy changes, can be understood by students at this level in terms of the collisions of molecules and the rearrangements of atoms. • Apply an understanding of the process of optimization and engineering design to chemical reaction systems. • Demonstrate proficiency in developing and using models, planning and conducting investigations, using mathematical thinking, and constructing explanations and designing solutions.
NJSLS	• 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 that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. • 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. • 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.
Essential Questions	• How are atoms combined in chemical bonds? • Where do the atoms go during a chemical reaction? • How can we use a balanced chemical equation to solve chemical quantity problems? • How can conditions be manipulated to design the most effective and efficient airbag possible?

Content Knowledge	*Students will learn:* ● A stable molecule has less energy than the same set of atoms separated; at least this much energy must be provided in order to take the molecule apart. ● Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. ● Changes of energy and matter in a chemical reaction system can be described in terms of collisions of molecules and the rearrangements of atoms into new molecules, with subsequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. ● The fact that atoms are conserved, together with the knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. ● The total amount of energy and matter in closed systems is conserved. ● The total amount of energy and matter in a chemical reaction system is conserved. ● Changes of energy and matter in a chemical reaction system can be described in terms of energy and matter flows into, out of, and within that system. ● Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. ● Patterns in the effects of changing the temperature or concentration of the reacting particles can be used to provide evidence for causality in the rate at which a reaction occurs. ● Much of science deals with constructing explanations of how things change and how they remain stable. ● In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. ● Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others may be needed. ● Evaluate a chemical reaction to use quantities of reactants and products and mole ratios usefully. ● Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. ● Patterns in the effects of changing the temperature or concentration of the reacting particles can be

	used to provide evidence for causality in the rate at which a reaction occurs.
Skills	*Students will be able to:* ● Explain the idea that a stable molecule has less energy than the same set of atoms separated (Molecular Geometry Lab). ● Describe changes of energy and matter in a chemical reaction system in terms of energy and matter flows into, out of, and within that system (Chemical Reactions Lab). ● Describe chemical processes, their rates, and whether or not they store or release energy in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. ● Develop a model based on evidence to illustrate the relationship between the release or absorption of energy from a chemical reaction system and the changes in total bond energy. ● Analyze molecular-level drawings and tables showing energies in compounds with multiple bonds to show that energy is conserved in a chemical reaction creating bonds. ● Explain the outcomes of chemical reactions using the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties ● Use mathematical representations of chemical reaction systems to support the claim that atoms, and therefore mass, are conserved during a chemical reaction (Balancing Equations Gizmo). ● Use the fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, to describe and predict chemical reactions (Types of Reactions Lab). ● Describe changes of energy and matter in a chemical reaction system in terms of energy and matter flows into, out of, and within that system. ● Use the number and energy of collisions between molecules (particles) to explain the effects of changing the temperature or concentration of the reacting articles on the rate at which a reaction occurs. ● Use patterns in the effects of changing the temperature or concentration of the reactant particles to provide evidence for causality in the rate at which a reaction occurs. ● Break down and prioritize criteria for increasing amounts of products in a chemical system at equilibrium. ● Construct explanations for how chemical reaction systems change and how they remain stable. ● Use mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and products and the translation of these relationships to the macroscopic scale, using the mole as the conversion from the atomic to the macroscopic scale (Mole Gizmo).

	• Design a solution to specify a change in conditions that would produce increased amounts of products in a chemical system based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations (Stoichiometry balloon races). • Use mathematics to demonstrate the thinking about proportional relationships among masses of reactants and products and to make connections between the atomic and macroscopic world. • Refine the design of a solution to specify a change in conditions that would produce increased amounts of products at equilibrium in a chemical system based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations (Airbag SIM). • Apply scientific principles and multiple and independent student-generated sources of evidence to provide an explanation of the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. • Refine the design of a solution to specify a change in conditions that would produce increased amounts of products at equilibrium in a chemical system based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations (Airbag Lab). ***Reference Goal 4 Opportunities when designing lessons to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all***
Performance Tasks	• Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations showing that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy to enhance understanding of findings, reasoning, and evidence and to add interest. • Cite specific textual evidence to support the concept that changing the temperature or concentration of the reacting particles affects the rate at which a reaction occurs. • Develop an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples. • Construct short as well as more sustained research projects to answer how to increase amounts of products at equilibrium in a chemical system. Synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. • Represent an explanation that atoms, and therefore mass, are conserved during a chemical reaction symbolically and manipulate the representing symbols. Make sense of quantities and relationships about the conservation of atoms and mass during chemical reactions symbolically and manipulate

	the representing symbols. ● Use units as a way to understand the conservation of atoms and mass during chemical reactions; choose and interpret units consistently in formulas representing proportional relationships between masses of atoms in the reactants and products and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale; choose and interpret the scale and origin in graphs and data displays representing the conservation of atoms and mass in chemical reactions. ● Define appropriate quantities for the purpose of descriptive modeling of the proportional relationships between masses of atoms in the reactants and products and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. ● Choose a level of accuracy appropriate to limitations on measurement when reporting quantities representing proportional relationships between masses of atoms in the reactants and products and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. ● Use a mathematical model to explain how the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy, and map their relationships using tools. Analyze those relationships mathematically to draw conclusions, reflecting on the results and improving the model if it has not served its purpose. ● Represent an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs symbolically and manipulate the representing symbols. Make sense of quantities and relationships about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs symbolically and manipulate the representing symbols. ● Use units as a way to understand an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. Choose and interpret units consistently in formulas representing the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. Choose and interpret the scale and the origin in graphs and data displays representing the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. ● Choose a level of accuracy appropriate to limitations on measurement when reporting quantities representing the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. ● Use a mathematical model to explain how to increase amounts of products at equilibrium in a

	chemical system. Identify important quantities in the cycling of matter and flow of energy among organisms in an ecosystem, and map their relationships using tools. Analyze those relationships mathematically to draw conclusions, reflecting on the results and improving the model if it has not served its purpose.
Other Assessment Evidence	***Formative Assessment*** ● Teacher check ins, exit tickets, observations of student groups, student conferences, etc. ● Skill/homework sheets ● Socratic discussion ● Quiz- Chemical bonds and reactions ● Schoology discussion posts ● On-line assignments (Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard) and simulations (https://concord.org/ and http://exeplorelearning.com/) ● Current Event Article(s) ***Summative Assessment*** ● CERs ● Lab activities, experimental design, and reports ● Unit exam - unit 3 topics ***Alternative Assessment*** Assessments will be differentiated in various ways based on the needs of the students. For example, differentiation could be in… ● Content (texts, phenomena, graphs, datatables, vocabulary, etc.) ● Process (scaffolding, guiding questions, small group instruction, etc.) ● Product (individual components,student choice modality such as video, skit, etc)
Resources/Materials	**Core Text:** ● Chemistry 2e, Openstax Ch. 4, 7, 8 **Supplemental Materials:** ● For phenomena ideas: www.NGSSPhenomena.com ● For readings, quizzes, and simulations: www.ck12.org ● For simulation labs: https://learn.concord.org/collections , http://exeplorelearning.com/ ● Blooket, Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard, https://concord.org/ , www.ck12.org http://exeplorelearning.com/) ● Chromebook and calculator ● BenQ Interactive Display

	• American Association for the Advancement of Science • American Chemical Society • Concord Consortium: Virtual Simulations • International Technology and Engineering Educators Association • National Science Digital Library • National Science Teachers Association • North American Association for Environmental Education • Phet: Interactive Simulation • Science NetLinks
Learning Activities	• Shall We Dance • SIMs of Le Chatelier's Principle • Indestructible Polyurea polymer • Light a match with a rubber band • Airbag SIM
Interdisciplinary Connections	*English Language Arts/Literacy* • Indestructible Polyurea polymer article response ○ W.IW.9-12.2. 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. (HS-PS1-2) Other: • RI.CR.11-12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. (HS-PS1-3) • W.WP.9–12.4. 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. (HS-PS1-2),(HS-ETS1-3) • W.WR.9–12.5. 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. 🌿 (HS-PS1-3) • W.SE.11–12.6. 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 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 (MLA or APA Style Manuals). (HS-PS1-3),(HS-ETS1-3) • SL.UM.9–12.5. 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. 🌿 (HS-PS1-4) *Mathematics* • SIMs of Le Chatelier's Principle • MP.2 Reason abstractly and quantitatively. (HS-ETS1-3),(HS-ETS1-4) Other: • 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 the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3)

Subject Area: Science **Level: Chemistry Honors**	
Unit	**4**
Timeframe	30 Days
Established Goals	• Study energy and matter further by investigating the processes of nuclear fusion and fission that govern the formation, evolution, and workings of the solar system in the universe. • Concepts studied are fundamental to science and demonstrate scale, proportion, and quantity, such as understanding how the matter of the world formed during the Big Bang and within the cores of stars over the cycle of their lives. • Understanding the concept of stability and change while making inferences about events in Earth's history based on a data record that is increasingly incomplete the farther one goes back in time. • Mathematical analysis of radiometric dating is used to comprehend how absolute ages are obtained for the geologic record. • Demonstrate proficiency in developing and using models; constructing explanations and designing solutions; using mathematical and computational thinking; and obtaining, evaluating, and communicating information; and they are expected to use these practices to demonstrate

	understanding of the core ideas.
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-ESS1-3 Communicate scientific ideas about the way stars, over their life cycle, produce elements. • 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 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-ESS1-6 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.
Essential Questions	• Why is fusion considered the Holy Grail for the production of electricity? • Why aren't all forms of radiation harmful to living things? • How do stars produce elements? • If there was nobody there to observe it, how do we know that there was a Big Bang? • How can chemistry help us to figure out ancient events?
Content Knowledge	*Students will learn:* • Nuclear processes, including fusion, fission, and radioactive decay of unstable nuclei, involve release or absorption of energy. • The total number of neutrons plus protons does not change in any nuclear process. • In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. • Spontaneous radioactive decay follows a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. • The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. • Nuclear fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. • The significance of the energy transfer mechanisms that allow energy from nuclear fusion in the sun's core to reach Earth is dependent on the scale, proportion, and quantity at which it occurs.

	• The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non stellar gasses, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. • Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and will continue to do so in the future. • A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment, and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. • Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history. • Much of science deals with constructing explanations of how things change and how they remain stable.
Skills	*Students will be able to:* • Develop models based on evidence 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 (Nuclear fission PhET). • Use simple qualitative models based on evidence to illustrate the scale of energy released in nuclear processes relative to other kinds of transformations. • Develop models based on evidence to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of alpha, beta, and gamma radioactive decays. • Apply scientific reasoning to link evidence from ancient Earth materials, meteorites, and other planetary surfaces to claims about Earth's formation • and early history, and assess the extent to which the reasoning and data support the explanation or conclusion. • Communicate scientific ideas in multiple formats (including orally, graphically, textually, and mathematically) about the way stars, over their life cycles, produce elements. • Communicate scientific ideas about the way nucleosynthesis, and therefore the different elements it creates, vary as a function of the mass of a star and the stage of its lifetime. • Communicate scientific ideas about how in nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. • 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 in releasing energy that eventually reaches Earth in the form of radiation. ● Develop a model based on evidence to illustrate the relationships between nuclear fusion in the sun's core and radiation that reaches Earth. ● 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. ● 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. ● Use available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. ● Use available evidence within the solar system to construct explanations for how Earth has changed and how it remains stable. ● Big Bang Theory project ***Reference Goal 4 Opportunities when designing lessons to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all***
Performance Tasks	● Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. ● Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. ● Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. ● Reason abstractly and quantitatively ● Model with mathematics. ● 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. ● Define appropriate quantities for the purpose of descriptive modeling. ● Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. ● Interpret expressions that represent a quantity in terms of its context. ● Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ● Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Other Assessment Evidence	***Formative Assessment*** ● Teacher check ins, exit tickets, observations of student groups, student conferences, etc. ● Skill/homework sheets ● Socratic discussion ● Quiz- Fusion ● Schoology discussion posts ● On-line assignments (Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard) and simulations (https://concord.org/ and http://exeplorelearning.com/) ● Current Event Article(s) ***Summative Assessment*** ● CERs ● Lab activities, experimental design, and reports ● Unit exam - unit 4 topics ***Alternative Assessment*** Assessments will be differentiated in various ways based on the needs of the students. For example, differentiation could be in… ● Content (texts, phenomena, graphs, datatables, vocabulary, etc.) ● Process (scaffolding, guiding questions, small group instruction, etc.) ● Product (individual components,student choice modality such as video, skit, etc)
Resources/Materials	**Core Text:** ● Chemistry 2e, Openstax Ch. 21 **Supplemental Materials:** ● For phenomena ideas: www.NGSSPhenomena.com ● For readings, quizzes, and simulations: www.ck12.org ● For simulation labs: https://learn.concord.org/collections , http://exeplorelearning.com/ ● Blooket, Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard, https://concord.org/ , www.ck12.org http://exeplorelearning.com/) ● Chromebook and calculator ● BenQ Interactive Display ● American Association for the Advancement of Science ● American Chemical Society ● Concord Consortium: Virtual Simulations ● International Technology and Engineering Educators Association ● National Science Digital Library

	• National Science Teachers Association • North American Association for Environmental Education • Phet: Interactive Simulation • Science NetLinks
Learning Activities	• Marie Curie's Classroom SIM • Nuclear stability video • Radiocarbon dating SIM • Radioactive dating video • Sun's spectral lines activity • Light and stars video
Interdisciplinary Connections	*English Language Arts/Literacy* • Radioactive dating video response ○ W.IW.9-12.2. 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. (HS-PS1-2) Other: • RI.CR.11-12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. (HS-PS1-3) • W.WP.9–12.4. 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. (HS-PS1-2),(HS-ETS1-3) • W.WR.9–12.5. 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. 🌿 (HS-PS1-3) • W.SE.11–12.6. 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 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 (MLA or APA Style Manuals). (HS-PS1-3),(HS-ETS1-3) • SL.UM.9–12.5. 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. 🌿 (HS-PS1-4)

	Mathematics ● Radiocarbon dating SIM ○ MP.2 Reason abstractly and quantitatively. (HS-ETS1-3),(HS-ETS1-4) Other: • 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 the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3)

Subject Area: Science **Level: Chemistry Honors**	
Unit	**5**
Timeframe	30 Days
Established Goals	● Develop models and explanations for the ways that feedbacks among different Earth systems control the appearance of Earth's surface. Central to this is the tension between internal systems, which are largely responsible for creating land at Earth's surface (e.g., volcanism and mountain building), and the sun-driven surface systems that tear down the land through weathering and erosion. Examine the ways that human activities cause feedback that create changes to other systems. ● Understand the system interactions that control weather and climate, with a major emphasis on the mechanisms and implications of climate change. ● Model the flow of energy and matter between different components of the weather system and how this affects chemical cycles such as the carbon cycle. Engineering and technology figure prominently here, as students use mathematical thinking and the analysis of geoscience data to examine and construct solutions to the many challenges facing long-term human sustainability on Earth. ● Use these geoscience data to explain climate change over a wide range of timescales, including over one to ten years: large volcanic eruption, ocean circulation; ten to hundreds of years: changes in human activity, ocean circulation, solar output; tens of thousands to hundreds of thousands of years: changes to Earth's orbit and the orientation of its axis; and tens of millions to hundreds of

	millions of years: long-term changes in atmospheric composition).
NJSLS	• HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. • HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. • 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-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-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. • 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.
Essential Questions	• What happens if we change the chemical composition of our atmosphere? • How does carbon cycle among the hydrosphere, atmosphere, geosphere, and biosphere?
Content Knowledge	*Students will learn:* • The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. • Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. • The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. • Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and

	thus affect climate. ● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. ● Science arguments are strengthened by multiple lines of evidence supporting a single explanation. ● Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. ● Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. ● The total amount of energy and matter in closed systems is conserved. ● The total amount of carbon cycling among and between the hydrosphere, atmosphere, geosphere, and biosphere is conserved.
Skills	*Students will be able to:* ● Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. ● Use empirical evidence to differentiate between how variations in the flow of energy into and out of Earth's systems result in climate changes. ● Use multiple lines of evidence to support how variations in the flow of energy into and out of Earth's systems result in climate changes. ● Develop a model based on evidence to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere (Deforestation video). ● Develop a model based on evidence to illustrate the biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere, providing the foundation for living organisms. ***Reference Goal 4 Opportunities when designing lessons to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all***
Performance Tasks	● Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations describing how variations in the flow of energy into and out of Earth's systems result in changes in climate to enhance understanding of findings, reasoning, and evidence and to add interest. ● Cite specific textual evidence of the availability of natural resources, occurrence of natural hazards, and changes in climate and their influence on human activity. ● Use empirical evidence to write an explanation for how the availability of natural resources,

	occurrence of natural hazards, and changes in climate have influenced human activity. ● Represent symbolically an explanation for how variations in the flow of energy into and out of Earth's systems result in changes in climate, and manipulate the representing symbols. Use symbols to make sense of quantities and relationships about how variations in the flow of energy into and out of Earth's systems result in changes in climate, symbolically and manipulate the representing symbols. ● Use a mathematical model to explain how variations in the flow of energy into and out of Earth's systems result in changes in climate. Identify important quantities in variations in the flow of energy into and out of Earth's systems resulting in changes in climate and map their relationships using tools. Analyze those relationships mathematically to draw conclusions, reflecting on the results and improving the model if it has not served its purpose. ● Use units as a way to understand problems and to guide the solution of multistep problems about how variations in the flow of energy into and out of Earth's systems result in changes in climate; choose and interpret units consistently in formulas representing how variations in the flow of energy into and out of Earth's systems result in changes in climate; choose and interpret the scale and the origin in graphs and data displays representing how variations in the flow of energy into and out of Earth's systems result in changes in climate. ● Define appropriate quantities for the purpose of descriptive modeling of how variations in the flow of energy into and out of Earth's systems result in changes in climate. ● Choose a level of accuracy appropriate to limitations on measurement when reporting quantities to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. ● Represent symbolically the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere, and manipulate the representing symbols. Make sense of quantities and relationships in the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. ● Use a mathematical model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. Identify important quantities in the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere and map their relationships using tools. Analyze those relationships mathematically to draw conclusions, reflecting on the results and improving the model if it has not served its purpose.
Other Assessment Evidence	***Formative Assessment*** ● Teacher check ins, exit tickets, observations of student groups, student conferences, etc. ● Skill/homework sheets ● Socratic discussion

	• Quiz- Carbon Cycle • Schoology discussion posts • On-line assignments (Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard) and simulations (https://concord.org/ and http://exeplorelearning.com/) • Current Event Article(s) ***Summative Assessment*** • CERs • Lab activities, experimental design, and reports • Unit exam - unit 5 topics ***Alternative Assessment*** Assessments will be differentiated in various ways based on the needs of the students. For example, differentiation could be in… • Content (texts, phenomena, graphs, datatables, vocabulary, etc.) • Process (scaffolding, guiding questions, small group instruction, etc.) • Product (individual components,student choice modality such as video, skit, etc) ***Benchmark*** Planning and Carrying out a Chemical Investigation: Students are presented with a chemical reaction problem. They will design and conduct an experiment testing how to most effectively determine solutions to a real world problem. • Students will be able to design and conduct a controlled experiment in order to identify significant figures in measurements and calculations of data. • Students will be able to effectively analyze and draw conclusions from their dataset. • Students will be able to make strong predictions based on trends in the data. • Students will be able to evaluate the effectiveness of their experimental design and reflect upon it. ***During each common, formative, and summative assessment, teachers will provide alternative assessment opportunities that adhere to 504 and IEP requirements. Alternative assessments are individualized for the needs of all students.***
Resources/Materials	**Core Text:** • Chemistry 2e, Openstax Ch. 9, 10, 14, 16 **Supplemental Materials:** • For phenomena ideas: www.NGSSPhenomena.com • For readings, quizzes, and simulations: www.ck12.org • For simulation labs: https://learn.concord.org/collections , http://exeplorelearning.com/ • Blooket, Kahoot, Quizizz, EdPuzzle, Quizlet, TestWizard, https://concord.org/ , www.ck12.org

	http://exeplorelearning.com/) • Chromebook and calculator • BenQ Interactive Display • American Association for the Advancement of Science • American Chemical Society • Concord Consortium: Virtual Simulations • International Technology and Engineering Educators Association • National Science Digital Library • National Science Teachers Association • North American Association for Environmental Education • Phet: Interactive Simulation • Science NetLinks
Learning Activities	• LAB: "Sea Urchin" • Earth's changing climate • LAB: "The Atlantic City" • Rainforest deforestation and its effects
Interdisciplinary Mandates **Climate Change**	• RI.CT.11–12.8. Analyze and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) documents of historical and scientific significance for their purposes, including primary source documents relevant to U.S. and/or global history and texts proposing scientific or technical advancements. Climate Change Example: Students may analyze scientific and related informational texts for evidence-based explanations for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. • W.WR.11–12.5. 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. Climate Change Example: Students may research, analyze, and critique the role of the petroleum industry in world politics, the global economy, and global climate change. • SL.UM.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. **Lesson: Chemical Reactions Involved in Climate Change** • Discuss the combustion of fossil fuels:

	○ Reaction: $C_xH_y + O_2 \rightarrow CO_2 + H_2O$ + Energy ○ Explain how burning coal, oil, and gas releases CO_2 into the atmosphere. ● Introduce ocean acidification: ○ Reaction: $CO_2 + H_2O \rightarrow H_2CO_3$ (carbonic acid) ○ Discuss how this affects marine life (e.g., coral bleaching). ● Data Analysis & Solutions ○ Show real-world graphs of atmospheric CO_2 levels over time and global temperature trends. ○ Discuss potential solutions: renewable energy, carbon capture, and reducing individual carbon footprints. ○ Group activity: Have students brainstorm ways their community could reduce emissions. ● Wrap-Up & Assessment ○ Exit ticket: *"In one sentence, explain how chemistry helps us understand climate change."* ○ Homework: Research a real-world example of how chemistry is being used to combat climate change.
Interdisciplinary Connections	*English Language Arts/Literacy* ● Rainforest deforestation and its effects - articles and video response ○ W.IW.9-12.2. 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. (HS-PS1-2) Other: ● RI.CR.11-12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. (HS-PS1-3) ● W.WP.9–12.4. 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. (HS-PS1-2),(HS-ETS1-3) ● W.WR.9–12.5. 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. 🌿 (HS-PS1-3) ● W.SE.11–12.6. 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 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 (MLA or APA Style Manuals). (HS-PS1-3),(HS-ETS1-3)

	• SL.UM.9–12.5. 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. 🌿 (HS-PS1-4) *Mathematics* • LAB: "Sea Urchin" ○ MP.2 Reason abstractly and quantitatively. (HS-ETS1-3),(HS-ETS1-4) Other: • 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 the origin in graphs and data displays. (HS-PS1-2),(HS-PS1-3)

Additional Information

21st Century Skills Integration: Career Readiness, Life Literacies, and Key Skills	• 9.1.12.CFR.1: Compare and contrast the role of philanthropy, volunteer service, and charities in community development and quality of life in a variety of cultures. • 9.1.12.CFR.2: Summarize causes important to you and compare organizations you seek to support to other organizations with similar missions. • 9.1.12.CFR.3: Research companies with corporate governance policies supporting the common good and human rights. • 9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs. • 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans. • 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a). • 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3). • 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). • Our CTE offerings are extensive at the high school level. Currently, we offer 7 CTE programs at Vernon Township High School including: Engineering, Hospitality, Allied Health, Marketing, Computer Science, Cosmetology, and Graphic Design.

Use of Technology	• Course catalog includes CTE programs such as Engineering, Computer Science, and Graphic Arts to provide technological opportunities to prepare for careers • All students are one-to-one with Chromebooks for day-to-day use in the classroom • All classrooms have access to an interactive BenQ or Promethean Board with speaker system so lessons can include video, sound, and interactive lessons for all learners
Technology Integration: Computer Science & Design Thinking	• 8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. • 8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor). • 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints. • 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture

Career Education with Diversity, Equity and Inclusion	• Stephen Hawking (1942–2018) – ALS (Lou Gehrig's disease)
	  ○ One of the most famous theoretical physicists, Hawking contributed significantly to our understanding of black holes, general relativity, and cosmology. Diagnosed with ALS at 21, he gradually lost the ability to move and speak, but he continued to work using a speech-generating device.
	  ○ Career: physicist
	  ○ Unit 4 – Nuclear Chemistry
	• Henry Cavendish (1731–1810) – Possibly Autistic
	  ○ A brilliant yet reclusive scientist, Cavendish was known for discovering hydrogen. His behaviors suggest he may have had what is now recognized as autism.
	  ○ Career: chemist
	  ○ Unit 1 – Structure and Properties of Matter
	• Joshua Miele (b. 1969) – Blind
	  ○ A scientist and inventor specializing in adaptive technologies for people with visual impairments. He has worked on innovations such as screen readers and tactile maps.
	  ○ Career: scientist and engineer
	  ○ Unit 5 – Human Impact: The Chemistry of Sustainability
	• Donna Strickland (b. 1959) – Vision Impairment
	  ○ A physicist who won the Nobel Prize in 2018 for her work on laser physics. While not widely publicized, she has spoken about her severe myopia affecting her early education.
	  ○ Career: physicist
	  ○ Unit 3 – Bonding and Chemical Reactions

Access to Various levels of text	Various Levels of Text: • Grade level material is used for teaching whole group • various text levels used for small group and individual students depending on needs: above grade level, below grade level, on grade level

	• Use of AI tools to generate versions of text on various complexity levels to meet student needs for students who require above or below grade level text • Use of Text to Speech, such as Read and Write for Google, to allow students to listen to texts that are above their readability level.
Accommodations for: Special Education & 504	• Special Education modifications will be implemented as per the Individualized Education Programs of the students in the class. • Please click here for an overview of the variety of accommodations set in place. • Accommodations will be dictated by the general makeup of the class. Possible Science Instructional adjustments • small group instruction • modeling • Alternate assessments and class activities: drawing, discussion, performances, oral, 1:1, etc. • Speech to text (to listen to text) • Text to speech (to dictate essays or writing) • Reduce Unnecessary stimuli • Preferential Seating • Allow student movement to increase productivity Possible content adjustments - based on pre-assessment and benchmark assessment data • Provide copies of Periodic Table • Post formulas in areas visible to students • Provide formula sheets • Provide guided notes or outlines • Model concepts using manipulatives and technology
Multilingual Learners	• Coordinate activities with ESL teacher to accommodate individual learning needs • Provide appropriate leveled texts • Students complete the ACCESS 2.0 test yearly to measure growth and guide instruction
Risk for School-Failure	• Credit Retrieval Programs • Apex - virtual • Viking Success Academy • Counseling interventions • Parent meetings • Student meetings • Individual and Group counseling
Gifted and Talented Learners	• Inclusive Identification process that depicts the child as a whole in order to provide the best learning environment possible for each student. Click here for Identification Profile Sample

	• Tiered Services utilizing NAGC K-12 Programming standards to ensure individual needs are being met. Click here for services map. • Formative Assessment utilized in order to promote acceleration, curriculum compacting, grouping, and asynchronous learning where appropriate. • Dynamic Model for Gifted Program Improvement is utilized in order to verify that our program is employing not only up to date methods, but also effective ones. • Teacher training in Gifted Education. • Curriculum Compacting based on pre-assessments • Passion projects and presentations
MTSS/RTI	The VTSD Response to Intervention and MTSS Manual and the NJTSS Early Reading Screening Guidelines outline the policies and procedures that 'exist to ensure a coordinated system for planning, delivering, measurement, and modification of intervention and referral services implemented in each school by a multidisciplinary team to address the learning, behavioral, and health needs of all students. (N.J.A.C. 6A:16-8)' This requirement is fulfilled through the district New Jersey Tiered System of Support (NJTSS) Early Reading grant initiative and our Multi-Tiered Systems of Support (MTSS) Response to Intervention plan which includes a. A continuum of supports and interventions available in each school to support learning, behavior, and health needs; b. Action plans for interventions based on student data and desired outcomes; c. Professional development for multidisciplinary teams and staff who provide interventions; and d. Review and assessment of effectiveness of interventions (e.g., progress monitoring).
Diversity Equity and Inclusion Mandate (DEI)	• Explore the lives of scientists who faced significant hardships yet achieved remarkable success and inspiring insights into resilience and determination. Conduct a webquest and discuss the following: ○ Choose a scientist relevant to this field of science. ○ When did the scientist conduct their research? ○ What were their scientific discoveries or awards received? ○ What hardships regarding disabilities, race, culture, or gender were dealt with.
Interdisciplinary Mandates Climate Change	**Lesson: Chemical Reactions Involved in Climate Change** • Discuss the combustion of fossil fuels: ○ Reaction: $C_xH_y + O_2 \rightarrow CO_2 + H_2O$ + Energy ○ Explain how burning coal, oil, and gas releases CO_2 into the atmosphere. • Introduce ocean acidification: ○ Reaction: $CO_2 + H_2O \rightarrow H_2CO_3$ (carbonic acid) ○ Discuss how this affects marine life (e.g., coral bleaching). • Data Analysis & Solutions ○ Show real-world graphs of atmospheric CO_2 levels over time and global temperature trends. ○ Discuss potential solutions: renewable energy, carbon capture, and reducing individual carbon footprints. ○ Group activity: Have students brainstorm ways their community could reduce emissions. • Wrap-Up & Assessment

	○ Exit ticket: *"In one sentence, explain how chemistry helps us understand climate change."* ○ Homework: Research a real-world example of how chemistry is being used to combat climate change. ● RI.CT.11–12.8. Analyze and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) documents of historical and scientific significance for their purposes, including primary source documents relevant to U.S. and/or global history and texts proposing scientific or technical advancements. **Climate Change Example: Students may analyze scientific and related informational texts for evidence-based explanations for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.** ● W.WR.11–12.5. 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. **Climate Change Example: Students may research, analyze, and critique the role of the petroleum industry in world politics, the global economy, and global climate change.** ● SL.UM.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.