Pascack Valley Regional High School District

Pascack Hills High School, Montvale, New Jersey
Pascack Valley High School, Hillsdale, New Jersey

Course Name: Elements of Chemistry in the Community

Born On: August, 2015
Revised On: August, 2020
Current Revision: August, 2023
Board Approval: 8/28/2023

New Jersey Curricular Mandates for Science Instruction

Disabled & LGBT:
18A:35-4.35 - History of disabled and LGBT persons included in middle and high school curriculum. A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards.

Diversity, Equity, and Inclusion (DEI):
C.18A:35-4.36a - Curriculum to include instruction on diversity and inclusion. 1. a. Beginning in the 2021-2022 school year, each school district shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards. b. The instruction shall: (1) highlight and promote diversity, including economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance; (2) examine the impact that unconscious bias and economic disparities have at both an individual level and on society as a whole; and (3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs. c. The Commissioner of Education shall provide school districts with sample learning activities and resources designed to promote diversity and inclusion.

Amistad Law:
N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Climate Change:
2020 NJSLS-Science: Earth's climate is now changing faster than at any point in the history of modern civilization, primarily as a result of human activities. Global climate change has already resulted in a wide range of impacts across New Jersey and in many sectors of its economy. The addition of academic standards that focus on climate change is important so that all students will have a basic understanding of the climate system, including the natural and human-caused factors that affect it. The underpinnings of climate change span across physical, life, as well as Earth and space sciences. The goal is for students to understand climate science as a way to inform decisions that improve quality of life for themselves, their community, and globally and to know how engineering solutions can allow us to mitigate impacts, adapt practices, and build resilient systems.

Dissection Law
N.J.S.A. 18A:35-4.25 and N.J.S.A. 18A:35-4.24 authorizes parents or guardians to assert the right of their children to refuse to dissect, vivisect, incubate, capture or otherwise harm or destroy animals or any parts thereof as part of a course of instruction.

Elements of Chemistry in the Community			
Introduction: Scientific Method and Measurements			
Time Allotted: Approximately 4- 6 Weeks			
New Jersey Student Learning Standards (NJSLS)			
Scientific and Engineering Practices 1-8			
Science & Engineering Practices • **Constructing Explanations and Designing Solutions** • **Asking Questions and Defining Problems** • **Developing and Using Models** • **Planning and Carrying Out Investigations** • **Analyzing and Interpreting Data** • **Using Mathematical and Computational Thinking** • **Engaging in Argument from Evidence** • **Obtaining, Evaluating, and Communicating Information**			
Essential Questions	**Student Learning Objectives**	**Suggested Tasks/Activities**	**Evidence of Learning (Assessment)**
• What are the safety rules that must • be followed when conducting experiments? • How can you solve a problem or answer a question using the Scientific Method? • How is data generated, displayed, and analyzed? • What are the basic units of measurements in the SI System? • How do we use technology in science?	Students will be able to: • Understand and apply information, skills, and procedures developed from the district safety program as it directly relates to the student of science. • Solve a problem using the Scientific Method. • Demonstrate how to create and interpret graphs using a line, pie and bar graphs using sample data. • Define length, weight, volume and temperature and their units.	• Read aloud the district- wide safety rules. • Show lab safety equipment in the classroom: fire extinguisher, fume hood, safety shower, eyewash, and fire blanket and demonstrate how to use them. • Provide the students with illustrations of safety procedures not being followed. Students then circle and verbally explain what is wrong and what would be the correct procedure. • Role play the safety procedures correctly. • Group Activity: Organize students in groups to solve a problem using the scientific	• Provide a lab that will demonstrate the use of appropriate equipment, techniques, and safety. • Observe students during the actual lab and review their procedures in regards to techniques and safety. • Students must sign and have parental signature of the safety contract. • Students must pass a safety quiz. • Students present the group activity and have a discussion. • Verbal quiz on Scientific

	• Use proper equipment to measure length, weight, volume and temperature. • Identify instruments of technology used in science including microscopes, computers, balances, etc. • Identify scientific discoveries made possible through invention of technology as well as the evolution of technology through the advancement of science.	method. • Students manipulate steps into the correct order. • Read and interpret graphs containing data to which students may relate. • Give students a topic and survey the class to obtain data and have them develop a graph. • Provide graphing exercise with given data. • Complete worksheet, board work, or graphic organizer on measurement, base unit, and equipment. • Give worksheets with practice problems, allow students to identify the information. • Students identify items in the home measured in metrics or used in metric quantities. • Measurement Lab • Students identify names and uses of different instruments of technology. • Allow students to use as many types of technology as possible. • Discuss microscope and MRI machines as tools to advance science and vice versa. *Scientist Spotlight*: • **Dr. Krystal Vasquez** – The struggles of inaccessibility for physically disabled scientists. - NPR Podcast w/ Dr. Vasquez	Method. • Collect and grade graphs. • Quiz on graphing. • Written and oral responses to academic prompts. • Lab report • Quiz on Measurement • Quiz on technology instrument identification • Unit Test

		- "Excluded from the Lab" by Dr. Vasquez	
Resources/Materials	-District Safety Rules -Scientific Method Sorting Activity -Graphing Worksheets -Object to measure length, weight, volume and temperature along with the equipment -Microscope and images of MRI machines		
Interdisciplinary Connections	An understanding of measurement and data is essential in day-to-day life.		
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.		
Computer Science & Design Thinking	8.1.5.A.1 Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems 8.1.5.A.4 Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.		

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
• Model steps • Show examples vs.. non examples of student work • Small group instruction (partner up) • Lower reading level of text • Use sentence starters to give student practice with academic language • Pre- teach vocab using pictures	• Additional time for assignments and assessments • Use of mnemonics • Review of directions • Have students restate directions or information back to you • Concrete examples • Support auditory presentations with visuals • Review Sessions • Access to completed notes • Visual and verbal cues and prompts • Graphic organizers	• Incorporate student choice • Provide peer mentoring to improve understanding of the material.	• Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning • Use of open-ended questions rather than multiple choice questions. • Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen

	• Hands on activities • Frequent Check-ins		based on students' individual interests.

Elements of Chemistry in the Community
Unit 1: Structure and Properties of Matter
Time Allotted: Approximately 10 Weeks
New Jersey Student Learning Standards (NJSLS)
EE.HS-PS1-2 Make a claim supported by evidence to explain patterns of chemical properties that occur in a substance during a common chemical reaction (e.g., baking soda and vinegar). *(HS-PS1-2)*

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions • Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	**PS1.A: Structure and Properties of Matter** • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. **PS1.B: Chemical Reactions** • The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions.	**Patterns** • Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• What is matter? • What are the three states of matter? • What is an atom? • How does a chemical reaction occur? • What is the periodic table?	Students will be able to: • Identify the properties of a solid, liquid and gas. • Discuss atoms as the building block of matter. • Recognize the structure of an atom and the subatomic particles. • Observe and describe a chemical reaction.	• What Is Matter? - Students participate in a class discussion. • Students classify and sort objects to build a connection to how matter is classified. • Students create a reference material that will describe how matter is classified. (States of matter foldable)	• Label items/pictures as solid, liquid and gas & make a collage of pictures • Students draw a model of selected atoms with the correct number of protons, electrons, and neutrons. - Phet Simulator as a reference if needed. • Students complete a

	• Locate parts and trends of the periodic table. • Explain the importance of elements' placement on the periodic table. • Recognize the contribution of Dimitri Mendeleev regarding the periodic table.	• Demonstrate how water changes phases. Have students draw and label what is happening as they watch. (could be a youtube video) • Discuss with students what an atom is and composed of. • Students label an atom • Students practice drawing using Phet SImulator online interactive - Build an Atom Phet Simulator • Using metals containing rust- show students that oxygen and iron leads to rust. Explain this is a chemical reaction occurring. • Give other examples - baking soda and vinegar/ relate examples to everyday life • Students complete Chemical Reaction Notebook as notes • Color periodic table to demonstrate the different areas of classification i.e. blue = metals • Label one block of periodic table • Activity where students figure out as much as possible using only the Periodic Table i.e. Helium has 2 protons, 2 electrons or Potassium shares some of	Chemical Reactions Design Challenge.

		the same characteristics as Sodium ● Utilize Periodic Table that contains pictures of elements as well as chemical symbols. ● Bring in samples of some elements to show students (ex. copper.) Place on Periodic Table. ● Text and pictures of Dimitri Mendeleev and his accomplishments. *Diversity, Equity, & Inclusion -AND- Disabled & LGBT* ● Neurodivergent in STEM – students will review profiles of neurodivergent individuals in the STEM field to learn about their experiences, advice, and opportunities.	
Resources/Materials	- Objects to sort - Student worksheets - Phet Simulator -Build an Atom - Internet Clips (crash course kids) - Bill Nye - Atoms - PowerPoint/Notes - Periodic Table - Colored Pencils - Chemical Reaction Design Challenge		
ELA Companion Standards	WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.		
Interdisciplinary Connections	Connections to NJSLS – Mathematics		

	HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Computer Science & Design Thinking	8.1.2.A.4 Demonstrate developmentally appropriate navigation skills in virtual environments (i.e. games, museums). 8.1.5.A.2 Format a document using a word processing application to enhance text and include graphics, symbols and/ or pictures.

Modifications

Multi-Lingual Learners	Special Education	At-Risk	Gifted and Talented
● Model steps ● Show examples vs. non examples of student work ● Small group instruction (partner up) ● Lower reading level of text ● Use sentence starters to give student practice with academic language ● Pre- teach vocab using pictures	● Additional time for assignments and assessments ● Use of mnemonics ● Review of directions ● Have students restate directions or information back to you ● Concrete examples ● Support auditory presentations with visuals ● Review Sessions ● Access to completed notes ● Visual and verbal cues and prompts ● Graphic organizers ● Hands on activities ● Frequent Check-ins	● Incorporate student choice ● Provide peer mentoring to improve understanding of the material.	● Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning ● Use of open-ended questions rather than multiple choice questions. ● Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen based on students' individual interests.

Elements of Chemistry in the Community

Unit 2: Conservation of Energy and Energy Transfer

Time Allotted: Approximately 10 Weeks

New Jersey Student Learning Standards (NJSLS)

EE.HS-PS3-4: Investigate and predict the temperatures of two liquids before and after combining to show uniform energy distribution. *(HS-PS3-4)*

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Planning and Carrying Out Investigations • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	**PS3.B: Conservation of Energy and Energy Transfer** • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. • Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). **PS3.D: Energy in Chemical Processes** • Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment.	**Systems and System Models** • 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.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• What is thermal energy? • How is thermal energy (heat) transferred? • What is temperature? • How is temperature measured?	Students will be able to: • Define thermal energy and explain the relationship between thermal energy, heat and temperature. • Describe three important ways heat (thermal energy) is generated? • Describe ways how thermal energy transfers from one object to another.	• Engage : 1. Ask students what does temperature mean? • 2. Demonstration: what is temperature? Fill a beaker with warm water and one with cold water. Place a beaker between them with room temperature water. Ask a student to place their hand in the hot beaker and another in the cold beaker. Don't tell the students which one is which. Have them keep their hands in the beakers for a few seconds, emphasizing that	• Students share their images with the class. • Observation of classwork • Quiz/test

		they are not allowed to speak or make visual demonstrations of what they are feeling. Then, ask one of the students to place their hand in the middle beaker and quietly without anyone seeing write on a sticky note if the water in the middle was hot or cold. Repeat this process with the other student. Have each student share with the class their sticky notes. The student whose hand was in the hot water will write, "*Cold*" and the student whose hand was in the cold water will write, "*Warm*". ● 3. Ask the students, "*How is that possible? If the definition of temperature is 'how hot or cold something is', how could they each say the temperatures were different?*". Provide wait time and let students think. Then, ask the student volunteers to explain what they experienced from the start to the finish of the demonstration. Then, allow students in the class to share their ideas of what occurred. Hopefully, students offer	

		suggestions about heat transferring from a higher temperature to a lower temperature. Explain that temperature is the measure of the kinetic energy of the particles in matter, it is not how hot or cold something is. "Hot" and "cold" are just terms we use that indicates the way the energy is transferring. ● Minlesson- Heat Transfer and Obtaining Information From Text - read with students Heat Transfer Reading ● Students create a reference material (foldable) for each type of way heat is transferred. ● Show demonstrations ● Students use info from demonstrations and reference material to draw examples of each type of heat transfer.	
Resources/Materials	- Items for demonstrations - Heat transfer reading - Foldable		
ELA Companion Standards	WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.		
Interdisciplinary Connections	Connections to NJSLS – Mathematics MP.4 Model with mathematics.		
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving.		

	9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Computer Science & Design Thinking	8.1.5.A.1 Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Model steps ● Show examples vs. non examples of student work ● Small group instruction (partner up) ● Lower reading level of text ● Use sentence starters to give student practice with academic language ● Pre- teach vocab using pictures	● Additional time for assignments and assessments ● Use of mnemonics ● Review of directions ● Have students restate directions or information back to you ● Concrete examples ● Support auditory presentations with visuals ● Review Sessions ● Access to completed notes ● Visual and verbal cues and prompts ● Graphic organizers ● Hands on activities ● Frequent Check-ins	● Incorporate student choice ● Provide peer mentoring to improve understanding of the material.	● Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning ● Use of open-ended questions rather than multiple choice questions. ● Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen based on students' individual interests.

Elements of Chemistry in the Community

Unit 3: Food - Energy for Life

Time Allotted: Approximately 4-6 Weeks

New Jersey Student Learning Standards (NJSLS)

HS-PS3-1-1 Create a model to describe that energy in animals' food was once energy from the Sun.

HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

EE.HS-PS3-4 Investigate and predict the temperatures of two liquids before and after combining to show uniform energy distribution. *(HS-PS3-4)*

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Using Mathematics and Computational Thinking • Create a computational model or simulation of a phenomenon, designed device, process, or system. **Constructing Explanations and Designing Solutions** • Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	**PS3.A: Definitions of Energy** • Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. • At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. **PS3.B: Conservation of Energy and Energy Transfer** • Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. • Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. • The availability of energy limits what can occur in any system. **PS3.D: Energy in Chemical Processes** • Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment.	**Systems and System Models** • Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models. **Energy and Matter** • 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. - ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Science assumes the universe is a vast single system in which basic laws are consistent. - ***Connections to Engineering,Technology, and Applications of Science*** **Influence of Science, Engineering and Technology on Society and the Natural World** • Modern civilization depends on major technological systems. Engineers continuously modify these technological systems by applying scientific knowledge

	ETS1.A: Defining and Delimiting an Engineering Problem • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. *(secondary)*	and engineering design practices to increase benefits while decreasing costs and risks.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• How could food be used as energy? • How is food stored in the body? • What is the role of vitamins, minerals, and additives in the body?	Students will be able to: • Identify all of the food groups. • Distinguish between the structures and functions of carbohydrates, fats and proteins. • Describe the role of vitamins in the diets. • Distinguish between vitamins and minerals. • Identify various food additives and their effect on food substances.	• Have students list the different food groups and find pictures of each. Circle foods that they commonly eat. • Students complete a three-day food inventory/analysis • Discuss the functions of each food group with students. Give examples. Have students make a reference material with information. • Nutrient Testing (laboratory experiment) Students will examine the presence of carbohydrates, proteins and fats in their 3- Day food inventories • Students will use internet resources to research the role of vitamins, minerals or other food additives and present their research to the class • Students will examine the presence of vitamins, minerals and additives in their 3-day food inventories	• Classwork/Homework • Discussions • Presentation • Quiz/Test

		• Students will construct a table of food additives, their purpose and examples. *Scientist Spotlight*: • **Lloyd Augustus Hall** – Used chemistry to invent a number of different ways to preserve food.	
Resources/Materials	- Materials for student lab - Internet clips - PowerPoint presentation for notes (Plate tectonics images) - Articles categorizing the effects of human activity on climate - World map showing various climates		
ELA Companion Standards	WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.		
Interdisciplinary Connections	Connections to ELA Essential Elements EE.SL.11-12.5: Use digital media strategically (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to support understanding and add interest. Connections to Mathematics Essential Elements EE.N-Q.1-3: Express quantities to the appropriate precision of measurement. EE.A-SSE.1: Identify an algebraic expression involving one arithmetic operation to represent a real-world problem. EE.A-CED.2-4: Solve one-step inequalities. EE.N-Q.1-3: Express quantities to the appropriate precision of measurement.		
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.		
Computer Science & Design Thinking	8.1.5.A.1 Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.		
Modifications			

Multi-Lingual Learners	Special Education	At-Risk	Gifted and Talented
● Model steps ● Show examples vs. non examples of student work ● Small group instruction (partner up) ● Lower reading level of text ● Use sentence starters to give student practice with academic language ● Pre- teach vocab using pictures	● Additional time for assignments and assessments ● Use of mnemonics ● Review of directions ● Have students restate directions or information back to you ● Concrete examples ● Support auditory presentations with visuals ● Review Sessions ● Access to completed notes ● Visual and verbal cues and prompts ● Graphic organizers ● Hands on activities ● Frequent Check-ins	● Incorporate student choice ● Provide peer mentoring to improve understanding of the material.	● Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning ● Use of open-ended questions rather than multiple choice questions. ● Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen based on students' individual interests.

Elements of Chemistry in the Community			
Unit 4: Atmospheric & Environmental Chemistry			
Time Allotted: Approximately 4-6 Weeks			
New Jersey Student Learning Standards (NJSLS)			
EE.HS-ESS1-4: Use a model of Earth and the Sun to show how Earth's tilt and orbit around the Sun cause changes in seasons. *(HS-ESS1-4)*			
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**	
Using Mathematical and Computational Thinking • Use mathematical or computational representations of phenomena to describe explanations.	**ESS1.B: Earth and the Solar System** • Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.	**Scale, Proportion, and Quantity** • Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). --- ***Connections to Engineering,Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.	
Essential Questions	**Student Learning Objectives**	**Suggested Tasks/Activities**	**Evidence of Learning (Assessment)**
• What are the parts of the Earth? • How is studying plate tectonics the framework for understanding earth's geologic history? • How does the ozone layer protect us? • How is the ozone layer changing? • What is erosion and deposition?	Students will be able to: • Identify parts of the Earth i.e. crust, mantle, outer core, inner core • Explain the theory of plate tectonics • Describe elements of and discuss relationships among the geosphere, hydrosphere and atmosphere. • Describe the role of greenhouse gasses and the ozone layer. • Explore the seasons on Earth	• Students label parts of the Earth on a blank diagram Students label parts of the atmosphere on a blank diagram Students list parts of the atmosphere with their altitude and temperatures. • When teaching plate tectonics use visuals- Teach with drawings • Show Plate Tectonics video • Group students. Give each group pictures representing each system. Ask students to	• Classwork/Homework • Discussions • Presentation • Quiz/Test

• What are the different seasons and what causes them? • How do weather and climate affect the earth? • How is human activity affecting the climate positively and negatively? • How is human activity affecting the ozone positively and negatively? • How can we contribute positively to our changing environment?	using graphs, videos, online reading, and demonstrations • Explain how the Earth's revolution and tilt affect the seasonal temperatures on Earth. • Define weather and climate • Give examples of different types of climate around the Earth. • Describe changes in climate over history Effects of climate (long term) and weather (short term) on Earth. • Describe the effects of human activity on climate	group them under the categories land, water and air. • List out the greenhouse gasses and describe the ozone layer using images. Explain to students how the ozone layer protects us. (Choose images that show increased greenhouse gasses enlarge the ozone layer.) • Provide a model of the Earth, one container each of water, soil, and an empty container labeled air. Point to portions of the model of the Earth that relate to contents of each container. • Engage: Turn to a peer and tell them everything you know about the seasons. Listen to student conversations to determine how much extra explanation they will need. (Ask students what the characteristics of each season are and why there are different seasons if it is not brought up by their responses.) • Ask students to think about the length of time it takes the Earth to complete 1 rotation. and ask: Who can tell us how many hours it takes? To think about it in time, those hours	

		equals ...? ● Once 1 rotation takes one day has been established, ask: "How many days will it take the Earth to revolve once around the sun?" (look for students to make the connection that it takes about 365 days for the Earth to revolve around the sun) ● Explore: Students need to create a model to simulate the seasonal changes using a ping pong ball as the Earth, a flashlight as the sun, and a diagram that illustrates the four positions of earth during the year. Questions to follow ● Explain: To develop more of an understanding about seasons, read - What Causes Seasons - read it together and stop at different parts to check in. ● Display seasons simulation to illustrate the tilt of the Earth and the angle of the sun's rays through each season. I pause at each change of the season to discuss what they notice about the tilt of the Earth, amount of sun on certain parts of the Earth and how many hours of daylight certain parts of the world	

		experience as a result. ● Have students write an explanation to the question "what causes seasons to occur?" pair students up to share their answer. ● Evaluate: For homework give students poster paper. Have them draw models that show the four seasonal positions of earth during the year. Diagrams should include a sun and earth's tilt. They must accurately illustrate Earth's tilted position at each seasonal point and show the amount of sunlight. ● Students color map to demonstrate different types of climates in the world. ● Discuss with students how people have adapted to climate change. ● Students research changes in climate over history and possible reasons for the changes. ● Students select one natural disaster and do research to find out more about the disaster. They can either write a report or create a presentation on the natural disaster. ● Brainstorm ways in which	

		students may help to protect the environment. • Students research and evaluate Alternate-Fuel Options and ways of helping the environment *Scientist Spotlight*: • **Winifred Burks-Houck**: An environmental organic chemist and the first woman president of the National Organization for the Professional Advancement of Black Chemists and chemical Engineers. • **Warren Washington** – atmospheric climate scientist	
Resources/Materials	- Materials for student lab - Internet clips - PowerPoint presentation for notes (Plate tectonics images) - Articles categorizing the effects of human activity on climate - World map showing various climates		
ELA Companion Standards	WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.		
Interdisciplinary Connections	Connections to ELA Essential Elements EE.SL.11-12.5: Use digital media strategically (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to support understanding and add interest. Connections to Mathematics Essential Elements EE.N-Q.1-3: Express quantities to the appropriate precision of measurement. EE.A-SSE.1: Identify an algebraic expression involving one arithmetic operation to represent a real-world problem. EE.A-CED.2-4: Solve one-step inequalities. EE.N-Q.1-3: Express quantities to the appropriate precision of measurement.		
Career Readiness, Life Literacies,	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.		

and Key Skills	9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Computer Science & Design Thinking	8.1.5.A.1 Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.

Modifications

Multi-Lingual Learners	Special Education	At-Risk	Gifted and Talented
• Model steps • Show examples vs. non examples of student work • Small group instruction (partner up) • Lower reading level of text • Use sentence starters to give student practice with academic language • Pre- teach vocab using pictures	• Additional time for assignments and assessments • Use of mnemonics • Review of directions • Have students restate directions or information back to you • Concrete examples • Support auditory presentations with visuals • Review Sessions • Access to completed notes • Visual and verbal cues and prompts • Graphic organizers • Hands on activities • Frequent Check-ins	• Incorporate student choice • Provide peer mentoring to improve understanding of the material.	• Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning • Use of open-ended questions rather than multiple choice questions. • Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen based on students' individual interests.

Additional Resources to promote DEI:

- Structure Matters: Twenty-One Teaching Strategies to Promote Student Engagement and Cultivate Classroom Equity
- Race Matters
- Inclusive Teaching