Newark Board Of Education

Eighth Grade Science Curriculum

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Office of Teaching and Learning Philosophy

The Office of Teaching and Learning believes that educating our students requires children to pursue learning in ways that are culturally engaging and academically rigorous. In order to accomplish this goal, we understand the curriculum as dynamic rather than static. This means the teacher is always in conversation with the curriculum as informed by student voice, needs, strengths, culture, interests, and the world. Curriculum documents are not meant as scripts to dictate what happens each moment in the classroom, but instead serve as guides to create lived moments that are full of invention, inquiry, joy, creativity, and academic rigor. We believe that curriculum should be culturally responsive and sustaining, putting the student at the center of the learning process.

The success of curricular implementation calls for teachers to make informed choices as they use the materials in meaningful and purposeful ways. These choices include, but are not limited to making learning student-centered, differentiating learning, and infusing past and current events to critique the world. Both teachers and students bring with them a wealth of knowledge and experience to the classroom. These experiences are a resource that should be leveraged to make choices that continually invent and reinvent the curriculum.

The Office of Teaching & Learning values:

- Teachers as Intellectuals,
- Culturally Responsive and Sustaining Teaching,
- Equity, and
- Academic Rigor.

The Office of Teaching & Learning affirms the following beliefs:

- We believe in the power and freedom of inquiry, imagination, and joy.
- We believe that all students bring with them valuable knowledge.

- We believe that the knowledge and expertise of teachers is critical to the development, implementation, and success of the curriculum process.
- We believe that teachers should co-construct curriculum with students.
- We believe that teachers are advocates of students.
- We believe in teaching and learning that is culturally responsive and sustaining.
- We believe that teaching, learning, and curriculum, as Bettina Love reminds us, should help students thrive instead of merely survive.
- We believe that teaching, learning, and curriculum should move us toward social justice and a more equitable society.
- We believe teaching, learning, and curriculum should develop the critical consciousness of learners and ask them to identify, analyze, and deconstruct various forms of oppression that affect their lived realities.
- We believe teaching, learning, and curriculum should be trauma-informed and consider the ways young people are affected by their environments.
- We believe, as bell hooks reminds us, that teachers, like any helping professional, are healers and that curriculum should be a reflection of a healing environment.
- We believe that teaching, learning, and curriculum should be anti-racist and help students identify bias, reduce stereotypes, and develop a sense of social justice.
- We believe that curriculum and instruction should be inclusive, valuing all students as an asset to the learning environment.
- We believe in the importance of continuous professional growth for all educators in order to develop a growth mindset and remain intellectually stimulated.
- We believe in the importance of preparing students for college and careers in the twenty-first century.

Statement on Culturally Responsive-Sustaining Education

Through a Culturally Responsive-Sustaining Education (CR-SE) framework for curriculum and instruction, each content area includes inquiry-based, culturally responsive, and student-centered prekindergarten to grade twelve curricula that is designed to meet the needs of all students. In a districtwide effort to establish a culture of equity, *Clarity 2020* calls for a "A Rigorous and Relevant Framework for

Curriculum & Instruction" (Priority 2). This means reimagining the landscape of teaching and learning to see diversity and difference as indispensable assets that should be leveraged for student engagement in classrooms with high expectations.

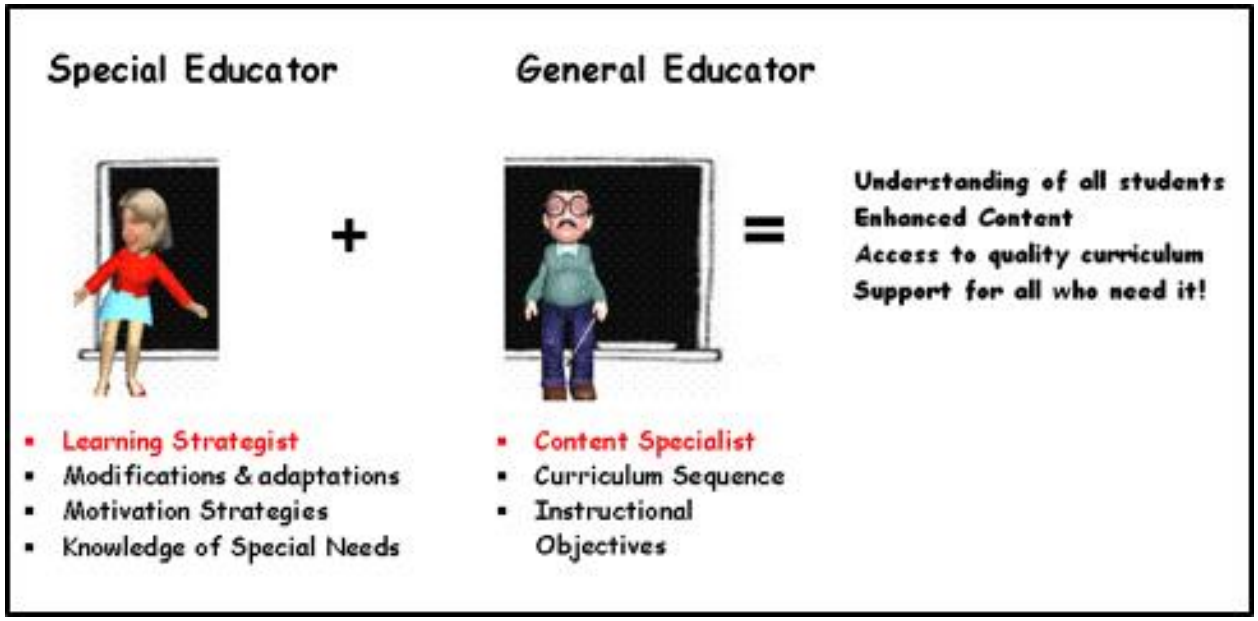
Our curriculum draws on the backgrounds, identities, and experiences of our students to make their connections to learning relevant and meaningful. Understanding the role of culture in the process of education means thinking about the ways identity (race, ethnicity, gender, sexual orientation, language, social class, nationality, ability, and religion) influences teaching and learning, gets reflected in the curriculum, and affects each individual student's educational experience.

Developing the media literacy, critical consciousness, and civic engagement of students in the twenty-first century is a priority that must happen alongside the growth of academic skills. This is an interdisciplinary, democratic, and socially just approach to culturally responsive teaching that highlights the injustices that have characterized vast inequalities in the education system. A culturally responsive-sustaining approach to teaching necessitates that teachers and students work alongside one another to confront bias and disrupt educational inequities.

Studies across the country have shown that Culturally Responsive-Sustaining Education (CR-SE), "increases student participation, attendance, grade point averages, graduation rates, civic engagement, self-image, and critical thinking skills" (NYC DOE). This approach to teaching and learning requires an inclusive curriculum that integrates support for English Language Learners, students with disabilities, students at risk of school failure, gifted and talented students, and students with 504 plans. It is a framework for teaching that means advocating for students who have been historically marginalized and denied access to an equal education by creating opportunities for these students to be educated alongside their general education peers. It also involves the identification of successful practices that reduce referrals and placements in more restrictive environments.

Through the implementation of a plan to integrate civics, the Amistad Curriculum, and Holocaust/Genocide studies at all grade levels across the district, students will learn about the history of Newark, the contributions of African Americans and other ethnic groups to the city, and how to become civically engaged, democratic citizens in the twenty first century. Further, students will learn about the evils of bias, prejudice and bigotry and how these may lead to a genocide and that the evil period of slavery in the United States exhibited a number of components seen in genocides throughout the centuries. This curriculum, project-based and interdisciplinary in nature, spans the content areas and grade levels.

Integrated Accommodations and Modifications for Special Education Students, English Language Learners, Students At Risk of School Failure, Gifted and Talented Students, and Students with 504 Plans



Co-Teaching Handbook

Co-Teaching Models

One Teach, One Observe: One of the advantages in co-teaching is that more detailed observation of students engaged in the learning process can occur. With this approach, for example, co-teachers can decide in advance what types of specific observational information to gather during instruction and can agree on a system for gathering the data. Afterward, the teachers should analyze the information together.

The teachers should take turns teaching and gathering data, rather than assuming that the special educator is the only person who should observe.

Station Teaching: In this co-teaching approach, teachers divide content and students. Each teacher then teaches the content to one group and subsequently repeats the instruction for the other group. If appropriate, a third "station" could give students an opportunity to work independently. As co-teachers become comfortable with their partnership, they may add groups or otherwise create variations of this model.

Parallel Teaching: On occasion, students' learning would be greatly facilitated if they just had more supervision by the teacher or more opportunity to respond. In parallel teaching, the teachers are both teaching the same information, but they do so to a divided class group within the same room. Parallel also may be used to vary learning experiences, for example, by providing manipulatives to one group but not the other or by having the groups read about the same topic but at different levels of difficulty.

Alternative Teaching: In most class groups, occasions arise in which several students need specialized attention. In alternative teaching, one teacher takes responsibility for the large group while the other works with a smaller group. These smaller groups could be used for conferences, remediation, pre-teaching, to help students who have been absent catch up on key instruction, assessment, and so on.

How can the various models and co-partner roles help?

- It increases the Instructional Intensity for students. Instruction is least effective if one teacher is “off” while the other teacher is “on”. For example the most common ICS model, “One Teach One Assist” is the least effective if implemented every day. For improved results, both teachers should be engaged with students at the same time.

- The use of various ICS Models promotes and embeds differentiation of instruction, flexible grouping, unique discussion and questioning techniques.

- Be sure to explain to students and parents the benefits of two teachers. Avoid using the term “special education or special education teacher” to describe the environment. Instead, use terms such as Content Specialist and Learning Strategist to define your roles.

- When providing feedback, consider using different pen/ink colors (stay away from red). This reduces confusion when students have a question to ask.

- It helps to establish a more balanced role of authority between co-partners. Students need to experience instruction and directives from both co-partners.

Adaptations

Instructional adaptations for students with disabilities, English Language Learners, students At Risk of School Failure, Gifted and Talented students, and students with 504 plans include, but are not limited to, the below approaches. For students with disabilities, self-determination and interdependence are two core principles of citizenship education that apply directly to their educational needs and interests.

Student Motivation: Expanding student motivation to learn content and acquire skills in English Language Arts can occur through: activity choice, appeal to diverse learning styles, choice to work with others or alone, hands-on activities, and multimodal activities.

Instructional Presentations: The primary purpose of these adaptations is to provide special education students with teacher-initiated and teacher-directed interventions that prepare students for learning and engage students in the learning process (Instructional Preparation); structure and organize information to aid comprehension and recall (Instructional Prompts); and foster understanding of new concepts and processes (Instructional Application) e.g. relating to personal experiences, advance organizers, pre-teaching vocabulary and/or strategies; visual demonstrations, illustrations, mode**ls.**

Instructional Monitoring: Social Studies and English Language Arts instruction should include opportunities for students to engage in goal setting, use of anchor papers, work with rubrics and checklists, reward systems, conferences.

Classroom Organization: The primary purpose of classroom organization adaptations is to maximize student attention, participation, independence, mobility, and comfort; to promote peer and adult communication and interaction; and to provide accessibility to information, materials, and equipment.

Student Response: The primary purpose of student performance responses is to provide students with disabilities a means of demonstrating progress toward the lesson objectives related to reading and writing activities.

SAMPLE DIFFERENTIATION STRATEGIES AND ACTIVITIES TO ENRICH LEARNING FOR ADVANCED STUDENTS

Anchor Activities: Self-directed specified ongoing activities in which students work independently.

Curriculum Compacting: Curriculum Compacting is an instructional technique that is specifically designed to make appropriate curricular adjustments for students in any curricular area and at any grade level. Essentially, the procedure involves (1) defining the goals and outcomes of a particular unit or segment of instruction, (2) determining and documenting which students have already mastered most or all of a specified set of learning outcomes, and (3) providing replacement strategies for material already mastered through the use of instructional options that enable a more challenging and productive use of the student's time.

Flexible Grouping: Flexible grouping is a range of grouping students together for delivering instruction. This can be as a whole class, a small group, or with a partner. Flexible grouping creates temporary groups that can last an hour, a week, or even a month.

Jigsaw Activities: Jigsaw is a strategy that emphasizes cooperative learning by providing students an opportunity to actively help each other build comprehension. Use this technique to assign students to reading groups composed of varying skill levels. Each group member is responsible for becoming an "expert" on one section of the assigned material and then "teaching" it to the other members of the team.

Differentiated Instruction - English Language Learners

English Language Development Standards

ENGLISH LANGUAGE LEARNERS

Instructional Supports:

- Hands-on materials
- bilingual dictionaries

- visual aids
- teacher made adaptations, outlines, study guides
- varied leveled texts of the same content
- assisted technologies

Preparing students for lessons:

1. Building Background Information through brainstorming, semantic webbing, use of visual aids and other comprehension strategies.
2. Simplifying Language for Presentation by using speech that is appropriate to students' language proficiency level. Avoid jargon and idiomatic speech.
3. Developing Content Area Vocabulary through the use of word walls and labeling classroom objects. Students encounter new academic vocabulary in literature, editing conventions, and the study of language arts.
4. Giving Directions - Stated clearly and distinctly and delivered in both written and oral forms to ensure that LEP students understand the task. In addition, students should be provided with/or have access to directional words such as: circle, write, draw, cut, underline, etc.
5. Leveraging assisted technologies.

WIDA Language Proficiency Levels

Performance Definitions for the levels of English language proficiency

At the given level of English language proficiency, English language learners will process, understand, produce, or use:

6 Reaching	• specialized or technical language reflective of the content area at grade level • a variety of sentence lengths of varying linguistic complexity in extended oral or written discourse as required by the specified grade level • oral or written communication in English comparable to proficient English peers
5 Bridging	• the technical language of the content areas; • a variety of sentence lengths of varying linguistic complexity in extended oral or written discourse, including stories, essays, or reports; • oral or written language approaching comparability to that of English proficient peers when presented with grade level material
4 Expanding	• specific and some technical language of the content areas; • a variety of sentence lengths of varying linguistic complexity in oral discourse or multiple, related paragraphs; • oral or written language with minimal phonological, syntactic, or semantic errors that do not impede the overall meaning of the communication when presented with oral or written connected discourse with occasional visual and graphic support
3 Developing	• general and some specific language of the content areas; • expanded sentences in oral interaction or written paragraphs; • oral or written language with phonological, syntactic, or semantic errors that may impede the communication but retain much of its meaning when presented with oral or written, narrative or expository descriptions with occasional visual and graphic support
2 Beginning	• general language related to the content areas; • phrases or short sentences; • oral or written language with phonological, syntactic, or semantic errors that often impede the meaning of the communication when presented with one to multiple-step commands, directions, questions, or a series of statements with visual and graphic support
1 Entering	• pictorial or graphic representation of the language of the content areas; • words, phrases, or chunks of language when presented with one-step commands, directions, WH-questions, or statements with visual and graphic support

The five language proficiency levels outline the progression of language development implied in the acquisition of English as an additional language, from 1, Entering the process, to 6, Reaching the attainment of English language proficiency. The language proficiency levels delineate expected performance and describe what ELLs can do within each domain of the standards. The Performance Definitions define the expectations of students at each proficiency level. The definitions encompass three criteria: linguistic complexity—the amount and quality of speech or writing for a given situation; vocabulary usage—the specificity of words or phrases for a given context; and language control—the comprehensibility of the communication based on the amount and types of errors.

Assessments (including, formative, summative, benchmark, and alternative assessments)

- *NJSLA* (Grades 5, 8, and 11)
- Daily Instructional Tasks
- Culminating Tasks
- Extended Learning Tasks
- Entry Tasks
- Independent Practice
- Observation
- Lab Reports
- Performance tasks
- Exhibitions and demonstrations
- Portfolios
- Journals/Notebooks
- Teacher-created tests
- Rubrics
- Self- and peer-evaluation

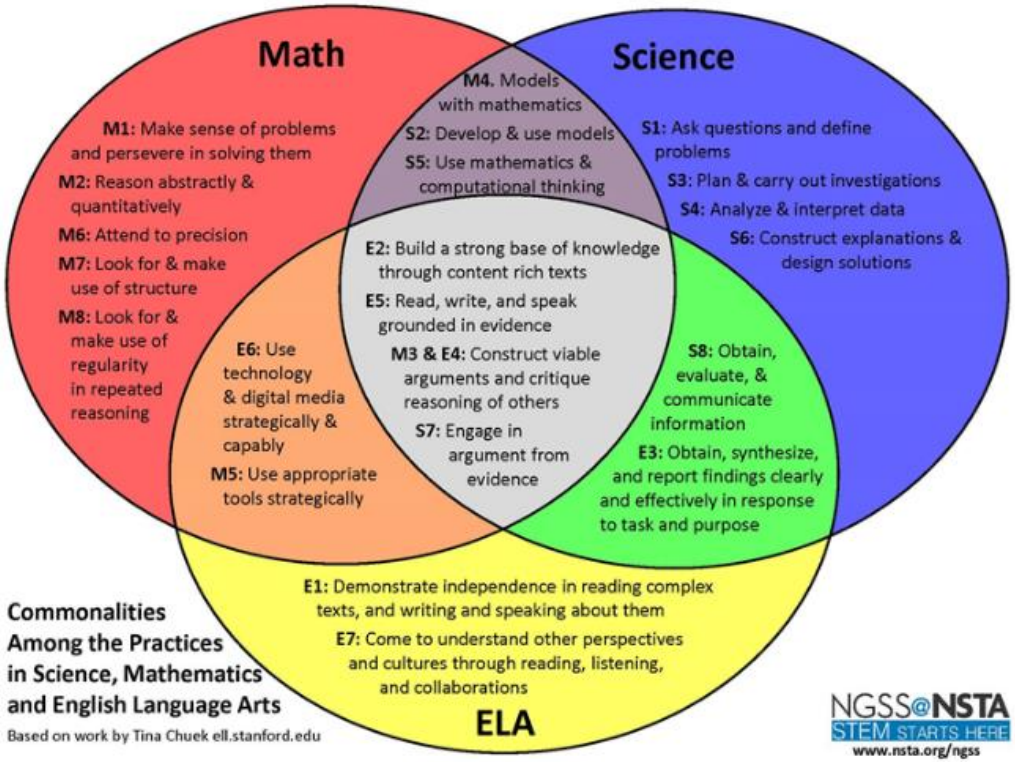
Core Instructional Materials

Grades 6-8: Activate Learning, (2019). *IQWST*. Greenwich, CT: Activate Learning.

Interdisciplinary Connections

Integrating Language Arts Literacy and Mathematics

In order to support student learning, teachers need to emphasize the mutual skill sets that occur in two very important and nicely aligned subject areas. Making explicit connections to ELA and Mathematics will help students see the natural relationships to science. The curricular documents call out math and ELA standards that appear in each unit of study.


Math
Science
ELA
M1: Make sense of problems and persevere in solving them
M2: Reason abstractly & quantitatively
M6: Attend to precision
M7: Look for & make use of structure
M8: Look for & make use of regularity in repeated reasoning
M4. Models with mathematics
S2: Develop & use models
S5: Use mathematics & computational thinking
S1: Ask questions and define problems
S3: Plan & carry out investigations
S4: Analyze & interpret data
S6: Construct explanations & design solutions
E2: Build a strong base of knowledge through content rich texts
E5: Read, write, and speak grounded in evidence
M3 & E4: Construct viable arguments and critique reasoning of others
S7: Engage in argument from evidence
E6: Use technology & digital media strategically & capably
M5: Use appropriate tools strategically
S8: Obtain, evaluate, & communicate information
E3: Obtain, synthesize, and report findings clearly and effectively in response to task and purpose
E1: Demonstrate independence in reading complex texts, and writing and speaking about them
E7: Come to understand other perspectives and cultures through reading, listening, and collaborations
Commonalities Among the Practices in Science, Mathematics and English Language Arts
Based on work by Tina Chuek ell.stanford.edu
NGSS@NSTA
STEM STARTS HERE
www.nsta.org/ngss

Integration of 21st Century Skills

The following standards are addressed within the units:

- 9.1.4.A.1 Explain the difference between a career and a job and identify various jobs in the community and the related earnings.
- 9.1.4.A.2 Identify potential sources of income.
- 9.1.4.A.3 Explain how income affects spending and take-home pay.
- 9.2.4.A.1 Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals.
- 9.2.4.A.2 Identify various life roles and civic and work-related activities in the school, home, and community.
- 9.2.4.A.3 Investigate both traditional and nontraditional careers and relate information to personal likes and dislikes.
- 9.2.4.A.4 Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.

Office of Teaching and Learning
Eighth Grade Science

Course Description

Students examine geoscience data in order to understand processes and events in Earth's history. An important aspect of the history of Earth is that geologic events and conditions have affected the surface of Earth. Students will analyze and critique patterns and cause/effect relationships.

Students develop and use models to describe how gene mutations and sexual reproduction contribute to genetic variation. Students understand how genetic factors determine the growth of an individual organism. They also demonstrate understanding of the genetic implications of sexual and asexual reproduction. Students use data and conceptual models to understand how the environment and genetic factors determine the growth of an individual organism. Students provide evidence to support their understanding of the structures and behaviors that increase the likelihood of successful reproduction by organisms. Students construct explanations based on evidence to support fundamental understandings of natural selection and evolution. They will use ideas of genetic variation in a population to make sense of how organisms survive and reproduce, thus passing on the traits of the species.

Students develop their understanding of important qualitative ideas about the conservation of energy. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students also understand the difference between energy and temperature, and the relationship between forces and energy. They use the practices to make sense of how the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students provide a mechanistic account for how cells provide a structure for the plant process of photosynthesis in the movement of matter and energy needed for the cell. Students use conceptual and physical models to explain the transfer of energy and the cycling of matter as they construct explanations for the role of photosynthesis in cycling matter in ecosystems. They construct scientific explanations for the cycling of matter in organisms and the interactions of organisms to obtain matter and energy from an ecosystem to survive and grow. They understand that sustaining life requires substantial energy and matter inputs, and that the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy.

Curriculum Map

Standards	Unit 1 How Is The Earth Changing?	Unit 2 Why Do Organisms Look The Way They Do?	Unit 3 How Will it Move?	Unit 4 How Does Food provide Energy to Do Things?
MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.			✓	
MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.			✓	
MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.	✓			
MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	✓			
MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	✓			
MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.	✓			
Standards	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**
MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.	✓			
MS--ESS3--3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.		✓		
MS--LS1--2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.		✓		

MS--LS1--4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.		✓		
MS--LS1--5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.		✓		✓
MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.				✓
MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.				✓
MS--LS1--8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.		✓		
MS--LS2--1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.		✓		
MS--LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.		✓		
Standards	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**
MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.				✓
MS--LS2--4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.		✓		✓
MS--LS3--1. Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.		✓		
MS--LS3--2. Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.		✓		

MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.	✓			
MS--LS4--4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.		✓		
MS--LS4--5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.		✓		
MS--LS4--6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.		✓		
MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.				✓
MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.				✓
Standards	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**
MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.	✓			
MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	✓			✓
MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.				✓
MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.			✓	
MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.			✓	
MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.			✓	
MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of			✓	

interacting objects.				
MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.			✓	
MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.			✓	
MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.				✓
MS-PS3-5. Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.			✓	

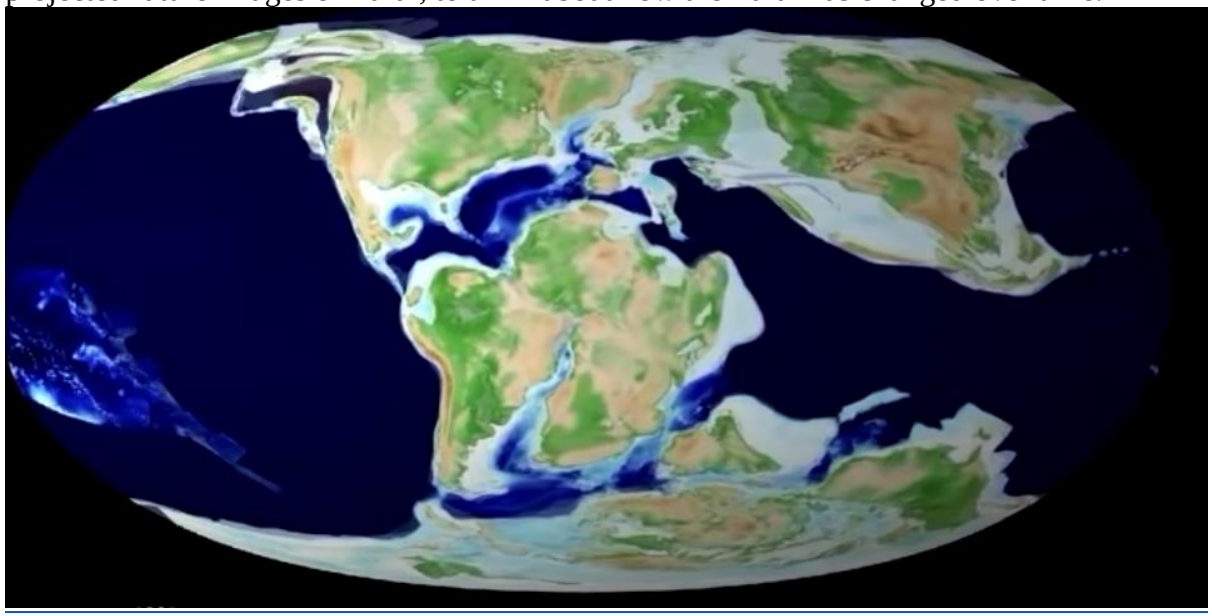
Pacing Guide

Units		Standards Areas	Pacing (# of lessons/ # of days)
1	How Is The Earth Changing?	MS-ESS1: Earth's Place in the Universe MS-ESS2: Earth's Systems MS-ESS3: Earth and Human Activity MS-LS4: Biological Evolution: Unity and Diversity MS-PS1: Matter and its Interactions	10 lessons/ 44 days
2	Why Do Organisms Look The Way They Do?	MS-ESS3: Earth and Human Activity MS-LS1: From Molecules to Organisms: Structures MS-LS2: Ecosystems: Interactions, Energy, and Dynamics MS-LS3: Heredity: Inheritance and Variation of Traits MS-LS4: Biological Evolution: Unity and Diversity	11 lessons/ 34 days
3	How Will it Move?	MS-ESS1: Earth's Place in the Universe MS-PS2: Motion and Stability: Forces and Interactions MS-PS3: Energy	8 lessons/ 25 days
4	How Does Food Provide Energy to Do Things?	MS-LS1: From Molecules to Organisms: Structures MS-LS2: Ecosystems: Interactions, Energy, and Dynamics MS-PS1: Matter and its Interactions MS-PS3: Energy	10 lessons/ 29 days

**key: Disciplinary Core Idea
Science and Engineering Practice
Cross Cutting Concept

Unit 1:Earth Science

Unit Plan- How is the Earth Changing?

Stage 1 – Desired Results	
ASSESSED FOCUS STANDARDS: **ESS1.C The History of Planet Earth** ● The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1- 4) ● Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3) **ESS2.A: Earth's Materials and Systems** ● All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1) ● The planet's systems interact over scales that range from microscopic to	*Unit Description* Anchoring Phenomenon Students observe time lapse video of Earth from 250 million years ago to present day and projected future images of Earth, to think about how the Earth has changed over time.  *How the Earth is Changing?* is a 8-10 week unit that focuses on plate tectonics and builds on the conceptual understanding including conservation of matter, convection and energy transfer. In order to contextualize Earth Science concepts and scientific inquiry in real-world situations, the unit focuses on ten case study sites that describe locations around the world with geologically interesting phenomena. The target science ideas and scientific practices

global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** ● Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3) **ESS2.C: The Roles of Water in Earth's Surface** ● Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2) **ESS3.B: Natural Hazards** ● Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2) **LS4.A: Evidence of Common Ancestry**	explored in the unit are instrumental to understanding and answering the Driving Question: How is the Earth Changing? Students complete multiple investigations and use their knowledge to consider why particular events and geologic formations are found in different areas of the world noted in the case study sites. *Meaning* **ENDURING UNDERSTANDINGS** **Scientific Principles:** 1. The earth's surface is made up of interlocking plates of various shapes and sizes. **(Lesson 1)** 2. New material is constantly being added to some edges of some plates, which has created new ocean floor between continents or forced them together. **(Lesson 2)** 3. Tectonic plates are mobile slabs of rock of various shapes and sizes that make up the surface of the earth. **(Lesson 3)** 4. Plates rest on the mantle, a hot, softer rock layer that can move and flow. Convection (cycling of hot and cold material) occurs in the mantle as hot material rises, because it is less dense, and cold material sinks because it is denser. Earth's plates ride on the moving mantle rock. (**Lesson 4)** 5. Plates move on Earth's surface in a variety of ways, including toward	**ESSENTIAL QUESTIONS** ● How Is the Earth's Surface Changing? ● What Causes the Features on Earth's Surface? ● How Are Plates Changing? ● How Does Plate Tectonics Explain Earth's Features? ● Why do the continents move, and what causes earthquakes and volcanoes? ● How do Earth's major systems interact?

and Diversity ● The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1) **PS1.A: Structure and Properties of Matter** ● Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4) ● In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4) ● The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4) **PS1.B Chemical Reactions** ● Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the	each other, away from each other, and alongside each other. **(Lesson 5)** 6. When two plates interact, the geologic features and events common on Earth occur (e.g., volcanoes, mountains, trenches, earthquakes). **(Lesson 5)** 7. There are two kinds of plates: oceanic plates (denser, thinner) and continental plates (less dense, thicker). **(Lesson 5)** 8. Volcanoes are the result of magma rising up through the crust at plate boundaries or over hotspots. **(Lesson 6)** 9. Due to the principle of conservation of matter, no new rock material is created or destroyed; rock is recycled as a result of moving plates. **(Lesson 8)**	
	What students will know and be able to do	
	KNOWLEDGE ● Earth has changed in the past, and it is still changing today. ● The Earth's surface is made of large, flat pieces of varying sizes called plates. ● The Earth is changing in relatively small ways due to activity of volcanoes and earthquakes that occur at the boundaries of plates.	**SKILLS** **NJSLS-S Performance Expectations:** ***Students who demonstrate understanding can…*** ● **MS-ESS1-4.** Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. [Clarification Statement: Emphasis is on how analyses of rock formations

original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-5) • The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5) **PS3.A: Definition of Energy** • The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depends on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4) **CONTENT CONNECTIONS:** **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-4), (MS-ESS2-2), (MS-ESS2-3), (MS-ESS3-2), (MS-LS4-1)	• There is some worldwide pattern of earthquakes and volcanoes. • Wegener believed that the continents were one large landmass called Pangea. • The continents moved apart, and this is called Continental Drift. Wegener had no mechanism for this to have happened. • The ocean floor rock is volcanic (specifically basalt) and is much younger than the continental rock. • The ages of the ocean floor rock were formed to vary significantly depending on the location. • Earth's surface is made of plates. • These plates are not all the same size or shape and they cover the entire surface of the earth. • The plates on the earth's surface move. • Plates rest on the mantle that is a hot, softer rock layer that can move and flow. • Earth's plates ride on the moving mantle rock. • Convection (cycling of hot and cold material) occurs in the mantle as hot, less dense material rises and cold material sinks because it is denser.	and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] • Patterns • Scale, Proportion, and Quantity • Systems and System Models • Developing and Using Models • Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions • **MS-ESS2-1.** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] • Patterns • Cause and Effect • Scale Proportion and Quantity

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS2-3), (MS-PS1-4), (MS-PS1-5), (MS-ESS3-2), (MS-LS4-1) **RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-3) **WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4), (MS-ESS2-2) **SL.8.5** Integrate multimedia and visual displays in presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1), (MS-ESS2-2) **MP.2** Reason abstractly and quantitatively. (MS-ESS2-2), (MS-ESS2-3), (MS-ESS3-2), (MS-PS1-5) **MP.4** Model with mathematics. (MS-PS1-5) **6.RP.A.3** Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS1-5)	• The solid material in the earth's mantle (beneath the plates) moves by convection. • The movement of the mantle acts like a conveyor belt as the plates slide around on top of this layer. • Plate boundaries are aligned to places of geologic activity such as earthquakes and volcanoes. • The different features on the earth are a result of the two different types of plates that exist on Earth: continental plates and oceanic plates—which have different densities and thicknesses. • Hotspots within the earth can form volcanoes in the middle of a plate. • Nearly all other geologic activity is centered on places where plates meet other plates (plate boundaries). • The different directions that plates move relative to one another are responsible for the formation of geologic features. • Movement of plates is also responsible for volcanoes, mountains, islands, trenches, and earthquakes on Earth. • The total amount of rock material on Earth is constant. This is all the rock material that will ever exist on Earth.	• Systems and System Models • Energy and Matter • Stability and Change • Developing and Using Models • Planning and Carrying Out Investigations • Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions • **MS-ESS2-2.** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.[Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.] • Patterns • Cause and Effect

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS1-4) **6.EE.B.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-4), (MS-ESS2-2), (MS-ESS2-3), (MS-ESS3-2), (MS-LS4-1) **7.EE.B.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-4), (MS-ESS2-2), (MS-ESS2-3), (MS-ESS3-2)	• Rock is not destroyed, but instead it can be cycled (melted, cooled, and reformed into solid rock). New plate material is formed from existing rock material that has melted. • Rock material (plates) can be cycled as plates are formed at divergent boundaries. • Plates are melted and then reformed into new continental rock (at volcanoes).	• Scale Proportion and Quantity • Systems and System Models • Energy and Matter • Stability and Change • Developing and Using Models • Planning and Carrying Out Investigations • Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions • **MS-ESS2-3.** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] • Patterns • Cause and Effect • Scale Proportion and Quantity • Systems and System Models • Energy and Matter • Stability and Change • Developing and Using Models: • Planning and Carrying Out Investigations • Analyzing and Interpreting Data • Constructing Explanations and

		Designing Solutions ● **MS-ESS3-2.** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).] ● Patterns ● Cause and Effect ● Scale Proportion and Quantity ● Systems and System Models ● Energy and Matter

		• Stability and Change • Asking Questions and Defining Problems • Analyzing and Interpreting Data: • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • **MS-LS4-1.** Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.[Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] • Patterns • Cause and Effect • Analyzing and Interpreting Data • Using Mathematics and Computational Thinking • Constructing Explanations and Designing Solutions • Obtaining, Evaluating, and Communicating Information • **MS-PS1-4.** Develop a model that predicts and describes changes in particle motion, temperature, and

		state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.] • Patterns • Cause and Effect • Scale, Proportion, and Quantity • Energy and Matter • Structure and Function • Developing and Using Models • Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions • Obtaining, Evaluating, and Communicating Information • **MS-PS1-5.** Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent

		atoms.] • Patterns • Cause and Effect • Scale, Proportion, and Quantity • Energy and Matter • Developing and Using Models: • Analyzing and Interpreting Data: • Constructing Explanations and Designing Solutions • Obtaining, Evaluating, and Communicating Information
Stage 2 – Evidence		
SUMMATIVE ASSESSMENT(S)		

The Unit Driving Questions: How is the Earth Changing?

- Claim: The Earth is Changing because…
- Evidence: focuses on plate tectonics, geological events and formations, conservation of matter, convection, and energy transfer evidence to support claim
- Reasoning: Integrates the Scientific Principles learned from analyzing and synthesizing the evidence to form a conclusion statement: the claim.

There are CERs built in throughout the unit that can be planned to build on one another to strengthen their written articulation of the standards. CER Poster CER Scaffold

Lesson Set 1: How is the Earth's Surface Changing?

Students are expected to assess their knowledge gained about the Theory of Plate Tectonics using evidence from Continental Drift Theory, Ocean Floor Spreading and Pangea to explain that the continents moved over the surface of the earth.

Lesson Set 2: What causes the Features on Earth's Surface?

Students will form a descriptive analysis to explain how the phase changes from liquid to solid rock material is associated with volcanic activity and the formation of new plate material using evidence of convection in the mantle, density of rock material, subducting plate movement, hotspot formation and the Ring of Fire.

Lesson Set 3: How are Plates Changing?

Students will organize and synthesize their understanding of Convection of solid material, how plates move and from where new plate material comes from, the Law of Conservation of Matter, and the geological formations of volcanoes and mountains to apply logic and reasoning to determine how plates must move on the surface of the earth.

Lesson Set 4: How does Plate tectonics explain Earth's Features?

Students will synthesize and summarize their understanding and knowledge of plate movement on Earth in several ways, each building on one another using evidence from a cross section of Earth, Case Study Sites and how plate tectonics can explain the process in how they look the way they do and are still changing. They will contribute to the understanding the Earth's surface is still changing and provide projections for what Earth may look like in the future.

STEM Gauge
137050A 182336A ; 137065A
182189A; 136653A; 13660A; 182088A; 136978A; 182188A;176779A

PRE-ASSESSMENT

Assessment Bank Questions can be useful for Pre/Post Assessment

Integration of 21st Century Skills	**Integration of Technology**	**Career Education**

- Critical thinking and problem solving
- Collaboration
- Agility and adaptability
- Initiatives and entrepreneurship
- Accessing and analyzing information
- Effective oral and written communications
- Curiosity and imagination

- 9.1.4.A.1 Explain the difference between a career and a job and identify various jobs in the community and the related earnings.
- 9.1.4.A.2 Identify potential sources of income.
- 9.1.4.A.3 Explain how income affects spending and take-home pay.
- 9.2.4.A.1 Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals.
- 9.2.4.A.2 Identify various life roles and civic and work-related activities in the school, home, and community. 9.2.4.A.3 Investigate both traditional and nontraditional careers and relate information to personal likes and dislikes.
- 9.2.4.A.4 Explain why knowledge and skills acquired in the elementary grades lay the foundation for future

- IQWST Projected Images
- IQWST Audio Recordings
- IQWST Lesson Videos
  - Ocean Floor Spreading (Lesson 2)
  - Plate Tectonics Demo: Paper (Lesson 3)
  - Plate Tectonics Demo: Saltine Crackers (Lesson 3)
  - Plate Tectonics Demo: Penciled (Lesson 3)
  - Plate Tectonics Demo: M&M's (Lesson 3)
  - Plate Tectonics Demo: Paper + Cracker (Lesson 3)
  - Plate Tectonics Demo: Hard-Boiled Egg (Lesson 3)
  - Liquid Convection: Demo 1 (Lesson 4)
  - Liquid Convection: Demo 2 (Lesson 4)
  - Metamorphic Rocks: Silly Putty Demo (Lesson 4)
  - Gelatin / Graham Cracker Model of Plate Tectonics (Lesson 5)
  - Plate Movement: Folder Demo (Lesson 5)
  - Bath Towels Tectonic Plate Converging Demo (Lesson 5)
  - Underwater Volcano Model (Lesson 6)

- Discovery Education Videos (linked in the Lesson in action resources)

V-Lab Activity: The Earth Moves Under My Feet (Tectonic Plate Movement)

Description: In this experiment, students will learn about continental drift, tectonic plates,

Career Connection:

Please use the above link to Login and access the Career Connection:

- Click on NJResident
- Select "Newark" and enter ZipCode
- After your login, click on the link below to access more information

Overview - Geologists and Geophysicists

Geologists study the history of the earth. They look at how rocks were formed and how they have changed since they were created. Geophysicists use physics to study the earth's surface and interior. In addition, they study forces that affect the earth, such as magnetism and gravity.

Geologists and geophysicists are sometimes called earth scientists and geoscientists. Other geoscientists include: Engineering geologists provide advice on ways to reduce the impact of major projects; Geochemists study the chemical elements in the earth and water; Volcanologists study volcanoes to predict eruptions; Petroleum geologists find ways to drill for fossil fuels; Seismologists study earthquakes.

Geologists and geophysicists conduct research to find ways to: Predict atmospheric conditions or earthquakes; Increase oil production or find minerals needed for national defense; Locate nuclear power plants and storage sites for carbon or nuclear

waste; Locate sources of heat in the earth that can be used to make electricity; Understand how dust from mining or minerals in groundwater affects human health.

Stage 3 – Learning Plan		
UNIT VOCABULARY		
Volcanoes Earthquakes Seismic activity Bathymetry Topography Pangaea Mid-Ocean Ridge Ocean Floor spreading Oceanic Trenches Scientific Models Tectonic Plates	Convection cell/cycle Mantle Density Viscous Metamorphic Rock Deformation Melting (phase change) Flow Transform Plate boundary Convergent Plate boundary Oceanic Plate Continental Plate Subduction	Hot Spot Non-plate boundary Island Chains Ring of Fire Magma Density = Mass/Volume Divergent Plate boundary
SUMMARY OF KEY LEARNING		

Lesson 1: Day 1 - Worldwide patterns in Volcanoes

- **Learning Intention:** I am learning that most earthquakes and volcanoes occur in bands along the boundaries between continents and oceans.
- **Success Criteria:** I can identify patterns in the locations of volcanoes around the world in their location in relations to each other.
  Brief Overview of Lesson: Students will examine data about the locations of volcanoes around the world and identify patterns in the data

Lesson 1: Day 2- Worldwide patterns of Earthquakes

- **Learning Intention:** I am learning that most earthquakes and volcanoes occur in bands along the boundaries between continents and oceans.
- **Success Criteria:** I can analyze earthquake data to identify patterns in their locations in relation to each other and to volcanoes.
  Brief Overview of Lesson: Students will examine data about the locations of earthquakes around the world and identify patterns in the data

Lesson 1: Day 3 - Where is the Earth Changing?

- **Learning Intention:** I am learning that most earthquakes and volcanoes occur in bands along the boundaries between continents and oceans.
- **Success Criteria:** I can examine elevation data and link patterns identified in volcano and earthquake data sets to begin to explain patterns of existence on the surface of Earth. I can develop questions about the Earth's changing surface for the purpose of investigating the cause of these patterns.

- **Brief Overview of Lesson:** Students will examine data about the locations of volcanoes around the world and identify patterns in the data

Lesson 2: Days 1-2 - The Theory of Continental Drift

- **Learning Intention:** I am learning that the continents on Earth's surface were once connected as one Supercontinent called Pangea.
- **Success Criteria:** I can evaluate Wegener's Phenomena to explain the Theory of Continental Drift.
- **Brief Overview of Lesson:** Students will examine various pieces of evidence that support Wegener's Continental Drift theory and use this evidence to explain what the theory is.

Lesson 2: Days 3-4: The Exploration of the Ocean Floor

- **Learning Intentions:** I am learning that the Earth's surface is made up of plates that move slowly, thus changing the appearance of the Earth's surface.
- **Success Criteria:** I can examine additional phenomena taken from the ocean floor that lead to the development of the theory of plate tectonics. I can explain Ocean Floor Spreading
- **Brief Overview of the Lesson:** Examine additional phenomena taken from the ocean floor that leads to the development of the theory of plate tectonics.

Lesson 3: Day 1 - What is the Composition of the Earth's Surface?/ The Theory of Plate Tectonics

- **Learning Intention:** I am learning that models can be used to explain what I know about the phenomena.
- **Success Criteria:** I can construct a simple model of Earth's plates.
- **Brief Overview of Lesson:** Students will evaluate models to determine how well the models communicate key ideas about the nature of Earth's plates.

Lesson 4: Day 1-2 - What Makes Plates Move?/Convection in Liquids

- **Learning Intention:** I am learning that convection currents within the Earth's mantle cause plate movement.
- **Success Criteria:** I can investigate convection in liquids through simulations. I can apply the principle of convection in air to liquids and solids.
- **Brief Overview of Lesson:** Students will explore the principles of convection in liquids and solid to draw conclusions about how convection results in plate movement. Students will simulate the reason that plates move on the earth's surface.

Lesson 4: Days 3-4 - What Makes Plates Move?/Silly Putty Rocks

- **Learning Intention:** I am learning how to design an experiment to explore the role of temperature in the form of plastic material.
- **Success Criteria:** I can model the formation of metamorphic rock to show bending and shifting. I can design an experiment to explore metamorphic rocks as evidence that solid rock material can deform under certain conditions.
- **Brief Overview of Lesson:** Students will examine a malleable plastic material (silly putty) and test which conditions will affect the ability to mold and form the material and draw conclusions about the convection in the mantle. Students will use Silly Putty® to simulate the formation of metamorphic rocks in order to draw conclusions about the nature of rock in Earth's mantle.

Lesson 5: Days 1-3 - How Do Plates Interact with Each other? / Map analysis

- **Learning Intention:** I am learning that plate movement leads to features and events on Earth.

- **Success Criteria:** I can analyze data to determine the pattern of earthquakes, volcanoes, and the location of plate boundaries. I can model plate movement in relation to one another.
- **Brief Overview of Lesson:** Students will analyze and interpret map data to identify patterns in Earthquakes and Volcanoes locations and their relation to plate movement. They will model plate movement with graham crackers and gelatin to explain how Earthquakes and Volcanoes are the result of plate movement.

Lesson 5: Days 4-7 - How Do Plates Interact with Each other? Types of Rock

- **Learning Intention:** I am learning plate movement leads to features and events on Earth.
- **Success Criteria:** I can identify types of Plate Rock to determine plate movement. I can explain plate movement by identifying less dense and denser rock material.
- **Brief Overview of Lesson:** Students will model plate movement with towels and a folder to determine based on "plate density" how plates will move in a system.

Lesson 6: Day 1-What causes Volcanoes?

- **Learning Intentions:** I am learning that mountains and volcanoes are different.
- **Success Criteria:** I can compare the formation of mountains with volcanoes. I can explain the process of subduction using evidence from previous lessons.
- **Brief Overview of Lesson:** Students will explore how volcanoes and mountains are different. They will simulate a volcanic eruption.

Lesson 6: Day 2-What causes Volcanoes?

- **Learning Intentions:** I am learning that mountains and volcanoes are different. I am learning that volcanoes form from subduction and hotspots.
- **Success Criteria:** I can describe hotspots as a mechanism that forms volcanic islands.
- **Brief Overview of Lesson:**. Students will examine other ways that volcanoes form at non plate boundary locations (hotspots).

Lesson 7: Day 1-How are Plates Moving?

- **Learning Intention:** I am learning to use geologic evidence to predict and determine how plates are moving in relation to one another.
- **Success Criteria:** I can determine the direction of plate movement according to the geologic features and events at different locations on Earth using evidence/artifacts from previous lessons.
- **Brief Overview of Lesson:** Students will engage in scientific discourse to make predictions about the direction and type of plate movement at different boundary locations based on evidence from previous lessons.

Lesson 8: Day 1- How Does New Plate Material Form?

- **Learning Intention:** I am learning that subduction as a method for cycling rock material on Earth.
- **Success Criteria:** I can write a scientific explanation about Earth's cycling system and how plate tectonics plays an important role (conservation of matter).
- I can use data about the phenomena to make sense of how the Earth is changing.

- **Brief Overview of the Lesson:** This lesson leads students through an investigation of how the Earth cycles rock through plate tectonics to form new plate material (including ocean floor and continents. They will learn about how Earth materials are cycled through the processes of plate tectonics
- Students will write scientific explanations about how Earth's cycling system and how plate tectonics plays an important role (Conservation of Matter).

Lesson 8: Day 2- How Does New Plate Material Form?

- **Learning Intention:** I am learning that subduction is a method for cycling rock material on Earth.
- **Success Criteria:** I can use data about the phenomena to make sense of how the Earth is changing.
- **Brief Overview of the Lesson:** This lesson leads students through an investigation of how the Earth cycles rock through plate tectonics to form new plate material (including ocean floor and continents. They will learn about how Earth materials are cycled through the processes of plate tectonics.
- Students will use data about the phenomena to make sense of how the Earth is changing.

Lesson 9: Day 1-What do we know about Plate Tectonics?

- **Learning Intention:** I am learning to apply knowledge of plate tectonics theory to a cross section of the earth to determine how different relative plate motions are associated and with (and result in) specific features and events.
- **Success Criteria:** I can label a detailed diagram of a cross section of Earth.
- **Brief Overview of Lesson:** Students will create and annotate a cross section of Earth.

Lesson 9: Day 2-What do we know about Plate Tectonics?

- **Learning Intention:** I am learning to explain how features and events are associated with plate boundary types.

- **Success Criteria:** I can synthesize and organize the concepts and processes that are associated with each type of plate boundary or location.
- **Brief Overview of Lesson:** Students will create a clear and organized description of the theory of plate tectonics.

Lesson 9: Days 3-5-What do we know about Plate Tectonics?

- **Learning Intention:** I am learning to build and explain physical models of Earth's plate boundary types
- **Success Criteria:** I can build a physical model showing the mechanism for plate tectonics and how it leads to features and events associated with different plate boundary types. I can construct an explanation of the model.
- **Brief Overview of Lesson:** Students will build physical models and construct written explanations describing their model.

Lesson 10: Days 1-3-What happens at the Case Study Sites?/Unit Culminating Project

- **Learning Intention:** I am learning how Plate Tectonics will affect the future of the earth.
- **Success Criteria:** I can explore a subset of case study sites and assign plate boundary types to each location. I can use models to explain how plate tectonics affects the earth.
- **Brief Overview of Lesson:** Students will use their knowledge of conservation of matter, the rock cycle, and convection and energy transformations, to assign boundary types to each case study site.

Lesson 10: Days 4-7-What happens at the Case Study Sites?/Unit Culminating Project

- **Learning Intention:** I am learning how Plate Tectonics will affect the future of the earth.
- **Success Criteria:** I can write a detailed scientific explanation of a single case study site. I can use diagrams, drawings, and physical models to support the explanation. I can conduct additional research to gather evidence about the assigned site.
- **Brief Overview of Lesson:** Students will explain how the earth is changing at a single case study site.

Lesson 10: Days 8-9-What happens at the Case Study Sites?/Unit Culminating Project

- **Learning Intention:** I am learning how Plate Tectonics will affect the future of the earth.
- **Success Criteria:** I can write a detailed scientific explanation to answer the Driving Questions: How is the Earth Changing? .
- **Brief Overview of Lesson:** Students will present their projects to the class. They will answer the Driving Questions: How is the Earth Changing? and consider how plate tectonics will affect the future of the Earth.

CULTURALLY RESPONSIVE TEACHING in PRACTICE	SOCIAL EMOTIONAL LEARNING in PRACTICE

Unit will encourage student engagement in virtual field trips using Google Earth/Google Maps. Unit will connect Students to Professional partnership with participation in Students to Science Virtual Labs. Unit will *establish inclusion* as lessons are engaging and require *collaboration and cooperation.* *Positive attitudes* will be a focus of the unit as the lessons are based on *prior knowledge and experience*, are s*et with clear learning goals* and *contain fair and clear criteria for evaluation.* The unit also includes *challenging experiences t*o enhance meaning and to *encourage self-assessment.*	**Set classroom norms for discussions** ● When having discussions in the classroom we open the floor to all students' perspectives. We want to make sure all of our students feel heard, and we also want to make sure all of our students feel safe enough to express their ideas within the space as well. By setting discussion norms for students that they can all contribute to, sets the tone that the classroom is a safe space and that all student ideas, perspective, opinions etc. are welcome while also setting guidelines for how the class will go about discussing counterpoints in a constructive manner. **Assign Group Roles** ● Whenever group work is being done all members of the group should have an assigned role. You can assign this role randomly to members in the group or let them pick their role. If groups/tables are the same every time roles can shift each time there is group work or remain the same for consistency depending on your classroom climate and preference. Having a role not only gives every student a designated task to do during that assignment/activity, it enforces a sense of self-worth to make them feel part of a larger community in that the role they are playing is essential to completion of the task as a whole group. **Acknowledge Students Ideas** ● During think-pair-share, discussions, eliciting ideas probes or any other time that you have students sharing ideas out loud you can write down key points from their ideas on the board. This shows that you are acknowledging their words and listening to what they are saying. From these key points you can use them to facilitate discussion, which makes for a much richer and authentic classroom discussion as you are pulling from what students have said directly.

	Promoting Growth Mindset ● Many times students will become confused or not fully understand the material right away. Often, students shut down, think that they have failed and automatically have a "fixed mindset" view. By promoting growth mindset and teaching students how to shift their thinking promotes not only students' social-emotional learning, but highlights the classroom community as a positive and safe place to cultivate learning.

Lesson 1:	**Lesson 1: Where is the Earth Changing**	**3 days-50 min each**

Brief Overview of Lesson:

Day 1: Students will examine data about the locations of volcanoes around the world and identify patterns in the data.

Day 2: Students will examine data about the locations of earthquakes around the world and identify patterns in the data.

Day 3: Students will examine data about the locations of earthquakes and volcanoes around the world and identify patterns in the data in relation to elevation levels.

What students should know and be able to do to engage in this lesson:

- Earth has changed in the past, and it is still changing today.
- The Earth's surface is made of large, flat pieces of varying sizes called plates.
- The Earth is changing in relatively small ways due to activity of volcanoes and earthquakes that occur at the boundaries of plates.
- There is some worldwide pattern of earthquakes and volcanoes.

LESSON FOUNDATION

Assessed Standards for this lesson	**Important content not included in the standards**
● MS-ESS2-2:The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. ● MS-ESS3-2: Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.	**5-ESS2A.1:** Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. *(5-ESS2-1)*

• ESS2.C: The Roles of Water in Earth's Surface Processes Water's movements—both on the land and underground — cause weathering and erosion, which change the land's surface features and create underground formations.	**4-ESS2B.1:** The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. *(4-ESS2-2)*
Focus Question for this Lesson	
What patterns appear in the location data?	
Learning Intention	**Success Criteria**
I am learning that most earthquakes and volcanoes occur in bands along the boundaries between continents and oceans.	*Day 1: I can analyze volcano data to identify patterns in their location in relation to each other.* *Day 2: I can analyze earthquake data to identify patterns in their location in relation to each other and volcanoes.* *Day 3:* • *I can examine elevation data about the locations of volcanoes around the world and identify patterns in the data.* • *I can develop questions about the earth changing to make sense of why there are patterns in the data.*
Assessment(s)	
Self-Assessment/Peer Assessment/Teacher Assessment Can identify clusters of earthquake data in relation to volcano data. Begin to generate sub questions about the recurrence of the data. Students may also provide insight to some of their prior knowledge or basic recognition about the topic/Unit. Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.	
Feedback (Peer to peer/student to teacher/teacher to student)	
Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add" I heard _____ ask/say _____ and I want to add on". This is a great resource to use. https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf	

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

- All plates are of the same size and move in a similar manner.
- Plate movement can be altered by the actions of man.
- All continents sit on their individual plates.
- Earthquakes always cause Volcanoes and vice versa.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks

- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 1 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening

Anchoring Phenomenon: Volcanoes and earthquakes largely occur in predictable patterns; observations of those patterns raise questions as to *why*, which leads to study of what is happening beneath our feet. Activity 1.1 focuses on volcanoes; Activity 1.2 focuses on earthquakes--natural phenomena that pique Ss interest and will be connected to the Driving Question: How is the Earth Changing?

Show/Share the video of volcanic eruptions. The video provides access to an engaging phenomenon to pique interest and foster questioning.

Discussion Prompts: Throughout the unit, teachers should: 1) choose discussion prompts applicable to remote learning and ability to discuss with Ss, or 2) have Ss write answers to teacher-selected prompts that can be added to the slide deck, if discussion is not possible, or 3) choose questions for Ss to discuss remotely, perhaps writing responses that are then submitted.

Questions in the SEs: Throughout the unit, teachers should decide on the method by which the lesson will be delivered, and then have Ss ignore any questions in their SEs that do not fit the way in which the lesson needs to be enacted remotely. Teachers may provide a handout for print-only Ss who cannot access the curriculum remotely, so that they know which questions in their SEs they should respond to.

Engage: Introducing the Lesson: Show PI: Physical Map of the Earth and have students describe—generally—what they see. Focus on detailed descriptions as students share ideas.

- **Do Now:** What do you know or have you heard about volcanoes?
- Show a brief movie clip or video to provide second-hand experience with volcanoes.

During the Lesson

Explore: Share Projected Images (PIs) available in the slide decks for each lesson or on the Teacher Portal:

- Physical Map of the Earth
- Volcano Locations

The teacher will give students a world map showing data about the location of volcanoes on Earth. Working in small groups, students should look for patterns in where volcanoes are found and identify places in which no volcanoes are found.

- As students are looking at the data, ask them to describe what they are seeing, prompting them to be detailed in their descriptions.
- Students will talk with their group about the patterns they see and about data (volcano locations) that do not seem to fit the patterns.

Explain: Discussion-Pressing for Understanding

- Students will highlight any patterns that students identify for the world map, and propose possible reasons for why these patterns exist.
- **ASK:** What patterns do you see in where volcanoes are located on the Earth? What ideas do you have about why volcanoes appear in these particular places?
- How are volcanoes located in relation to each other? Are they close together or spread out? What patterns do you see in how they are arranged?
- What ideas do you have about why there might be patterns in the volcano data (where volcanoes have erupted)?

Lesson Closing

Evaluate: Use PI: Physical Map of the Earth to lead the discussion.
Exit Ticket: How are volcanoes located in relation to each other? Are they close together or spread out? What patterns do you see in how they are arranged?

THE LESSON IN ACTION: Lesson 1 Day 2

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Engage:
Begin discussion by asking students the following questions:

Do Now:

- What do you know or have you heard about earthquakes?
- Where do you think earthquakes typically occur?

During the Lesson

Explore: Show PI: Earthquake locations and explain that this shows the locations where earthquakes have occurred around the world. The data represent medium (magnitude 4.0–5.9) and large (magnitude 6.0–9.0) earthquakes spanning 9 years between 1994 and 2003.

- Students should work in small groups to do the following:
  - Look at the map and identify patterns in locations where earthquakes occur around the world.
  - Identify earthquakes that do not seem to fit the patterns.

Discussion-Pressing for Understanding
Highlight patterns that students identify, and propose possible reasons why these patterns exist.

- PI: Earthquake Locations to lead the discussion.

• What patterns did you see in locations where earthquakes have occurred on the earth?

• Where do earthquakes occur in relation to each other? What patterns do you see in how they are arranged? What ideas do you have about why some earthquakes and volcano data do not fit the patterns you observed?

PI: Physical Map of Earth and Volcano Locations

In small groups, students will look at the images and see what they notice about the locations of volcanoes and earthquakes. They should be identifying patterns where earthquakes and volcanoes appear around the world. They should also be looking for locations where the data does not fit the patterns.

Discussion-Pressing for Understanding
• How do the patterns in earthquakes compare to the patterns in volcanoes? Why do you see earthquakes and volcanoes in similar locations?

Introducing the Driving Question-How is the Earth Changing?

Explain that volcanoes and earthquakes are examples of ways that the earth is changing. Ask if they have heard of any recent news in the past months/years about these events. There have been several in China, Japan and Chile. Elicit initial thoughts as to why this may be happening in these locations.

Lesson Closing

Evaluate: Students will compare patterns that they identify in the locations of volcanoes and earthquakes.

Exit Ticket: How do you think volcanoes and earthquakes relate to the earth changing?

Extend: Reading 1.2 – Volcanoes and Earthquakes https://d16dnhlej6sizh.cloudfront.net/assets/portal/Teacher-Portal-Resources/ES3_se_v2_0_5_audio-01_es3_reading_1-281.mp3

THE LESSON IN ACTION: Lesson 1 Day 3

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Do Now: What data do scientists use to determine when a volcano might erupt?

- Reading Follow Up**:** Review with students the types of data that scientists use to predict when volcanoes might erupt?

During the Lesson

Explore:

- Display PI: Earthquake and Volcano Locations and point out that students may have noticed much more volcano and earthquake activity in some areas than others. Ask: "What do you think Earth looks like in these areas?"
- Display PI: Elevation that shows how high different parts of the earth are compared to each other.

Discussion-Pressing for Understanding

Explain: Highlight patterns and propose possible reasons for why these patterns exist. Use PI: Earthquakes, Volcanoes, and Elevation which shows both location and relative elevation data on one map. Students will compare patterns in elevation with patterns of earthquakes and volcanoes.

Ask: What patterns do you see in elevation where we saw high earthquakes and volcanic activity? How are the following areas similar or different in terms of their elevation? Are there patterns you see where high levels of volcanic and earthquake activity occur? Why do you think we often see high or low elevation in areas where there are high earthquakes and volcanic activity? What do you think causes the earthquake/volcano/elevation? When we see large areas where there are few or no earthquakes or volcanoes, why do you think there is less activity in those areas?

Introducing Ideas about Plates

Display a dinner plate. Briefly identify characteristics of the familiar object. How big are plates? What are they made of? What shape are they? Can they be bent or broken?

- Use PI: Earth's Plates to continue discussion to compare dinner plates with the much larger plates that make up the earth's surface. Encourage students to consider ways in which these two types of plates are similar (rigid, different shapes and sizes, made up of different types of material).

Demonstration of Understanding:

Knowing that earthquakes and volcanic activity help us to see where the edges of plates are located, what can we conclude about plates based on the patterns we have seen so far? Students should be able to identify the following: Students can discuss in small groups or do a Turn & Talk to discuss. Ask each group to add to the list one idea using Scientific Discourse.

Ask: What information or ideas can we add to the DQB related to our Driving Question?

- There are many plates that make up the earth's surface.

- They are different shapes and sizes.
- Plate boundaries/borders are usually under oceans or along the edges of continents, rarely crossing continents.
- Continents do not define plates-both continent and ocean can be a part of the same plate.
- The entire surface is made of plates with no gaps or spaces between two plates.

Lesson Closing

Discussion-Summarizing

Summarize this discussion by concluding that on Earth there appear to be features that occur in clusters. Could it be possible that some features occur in clusters on Earth because of a similar cause?

- Discuss with students how scientists have developed some ideas about why Earth is changing more actively in some areas than others and how their explanations revolve around the idea that the surface of the Earth is made up of plates.

Scientific Principle: The Earth's surface is made up of interlocking plates of various shapes and sizes.

Exit Ticket: Identify the evidence that we have that the earth has changed.

Wrapping up the lesson:

- Earth has changed in the past, and it is still changing today.
- The Earth's surface is made of large, flat pieces of varying sizes called plates.
- The Earth is changing in relatively small ways due to activity of volcanoes and earthquakes that occur at the boundaries of plates.
- There is some worldwide pattern of earthquakes and volcanoes.

Lesson 1 Resources

IQWST

- Lesson 1 slide deck

- 01-ES3 Reading 1.2
- 01-ES3-PI-Physical Map of the Earth
- 01-ES3-PI-Physical Map of the Earth (large)
- 02-ES3-PI-Volcano Locations
- 03-ES3-PI-Earthquake Locations
- 04-ES3-PI-Earthquake and Volcano Locations
- 05-ES3-PI-Elevation
- 06-ES3-PI-Earthquakes, Volcanoes, and Elevation
- 06-ES3-PI-Tectonic Plates-Earthquakes, Volcanoes, and Elevation (large)
- 07-ES3-PI-Earth GCOs Plates

Unit Resources

- ES3 Storyline
- ES3 Teacher Edition (PDF)
- ES3 Student Edition (PDF)
- Remote Learning Overview

Discovery.com: Earthquake Videos: Two dozen videos of earthquakes, including one on Richter Scale

https://www.discovery.com/search/?q=earthquake+videos

Jamboard: Driving Question Board

- Video Volcanic eruptions: https://pmdvod.nationalgeographic.com/NG_Video/652/991/1667130947966_1578352034468_1667141187581_mp4_video_1024x576_1632000_primary_audio_eng_3.
- (Video) YouTube: PBS: 4 minute flyover of the geologic features of North America. A great intro for this unit to get the kids asking how did our continent change so much over time? https://www.youtube.com/watch?v=jwmE3QSBefs&feature=youtu.be
- YouTube: PBS: 4 minute flyover of the geologic features of North America.
- A great intro for this unit to get the kids asking how did our continent change so much over time?
- YouTube: PBS: 4 minute intro to the 3 part series The Making of North America.
- PBS Nova: Making North America:

- This link will take you to the first show in the series. If you look to the left, the other shows in the series are also linked, and if you scroll below, there are more articles and short videos that are related.
- AAS: ScienceNetLinks: Earthquakes: Middle-school students should be able to explain how waves, wind, water, and ice shape and reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers. The next step will be for them to examine how earthquakes are part of a system of crustal movements that also form and shape the surface of our planet.
- National Geographic Education: Ring of Fire: Article and excellent photos and diagram.

Lesson 2:	**How Did the Earth look in the Past?**	**Estimated Time: 4 (50 min sections)**

Day 1-2 - The Theory of Continental Drift

- **Brief Overview of Lesson:** Students will examine various pieces of evidence that support Wegener's Continental Drift theory and use this evidence to explain what the theory is.

Day 3& 4: The Exploration of the Ocean Floor

- **Brief Overview of the Lesson:** Examine additional phenomena taken from the ocean floor that leads to the development of the theory of plate tectonics.

What students should know and be able to do to engage in this lesson:

- That the Earth experiences relatively small and quick changes (earthquakes and volcanoes).
- Rock formation from ES1

LESSON FOUNDATION

Assessed Standards for this lesson	**Important content not included in the standards**
• **MS-ESS1- 4:** The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. • **MS-ESS2-3:** Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. • **MS-ESS2-3:** Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. • **MS-LS4-1:** The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through	**4-ESS1C.1:** Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. *(4-ESS1-1)* **2-ESS1C.1:** Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. *(2-ESS1-1)* **3-LS4A.1:** Some kinds of plants and animals that once lived on Earth are no longer found anywhere. *(Note: moved from K-2) (3-LS4-1)* **3-LS4A.2:** Fossils provide evidence about the types of organisms that lived long ago and also about the nature of

radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth.	their environments. (3-LS4-1)

Focus Question for this Lesson

What is Continental Drift Theory? How Does the Evidence in Wegener's Phenomena Support the Theory of continental Drift?

Learning Intention	**Success Criteria**
Day 1-2: I am learning that the continents on Earth's surface were once connected as one Supercontinent called Pangea. *Day 3-4: I am learning that the Earth's surface is made up of plates that move slowly, thus changing the appearance of the Earth's surface.*	*Days 1-2:* ● *I can evaluate Wegener's Phenomena to explain the Theory of Continental Drift.* *Days 3-4:* ● *I can examine additional phenomena taken from the ocean floor that lead to the development of the Theory of Plate Tectonics.* ● *I can explain Ocean Floor Spreading*

Assessment(s)

Exit Ticket
Stem Gauge
137050A.pdf Stem Gauge 136660A.pdfStem Gauge 137065A.pdfStem Gauge 182189A.pdf

Synthesize the six phenomena presented to determine what they suggest the earth was like in the past.
Student models of Pangea based on details from evidence (fossils found in South America and Africa mean that they were connected)

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Preconceptions/Misconceptions

Earth's crust is made up only of land.
There are only two types of plates - either just continental or just ocean crust

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials

- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

Activity 2.1 (Part 1A): If some groups complete this task quickly, they will be asked to explore another piece of evidence. Teacher ensures that students have filled out their information table completely and thoroughly and are prepared to present their evidence to the class. Students may also be assigned to do additional research on Wegener's theory. Scaffolding can be employed and multiple texts can be incorporated into instruction, providing texts with differing reading levels, points of view, etc.

THE LESSON IN ACTION: Lesson 2 Days 1 & 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Do Now: Discussion: Students can Turn & Talk: How do you think scientists learn about Earth as it was in the past (millions of years ago)? How might the way Earth is now help us to understand what it was like in the past? **The theory of Continental Drift** Engage: https://www.youtube.com/watch?v=uLahVJNnoZ4&feature=emb_logo Video of time lapse of changing earth past to present.
During the Lesson
Explore: Day 1 ● Students will jigsaw to examine the main ideas of Wegener's Phenomena to link back to the Driving Question: How is the Earth changing? (Supplemental Packet of 6 Phenomena: Fit of Continents, Animal Fossils, Plant Fossils, Glacial Evidence, Rock Sequence, Antarctica Climate Change) ○ What does your phenomena show? ○ What are the three main takeaway points from this information? ○ How does this phenomenon help you understand what Earth was like in the past and how it has changed over time?

- Assign each member in a group one phenomenon to examine carefully. The group needs to become experts about their particular phenomenon. Students will partner up to examine their phenomena together and return to their main group to share out.

Day 2

Explain:

Group Presentations**:** Share out content from Jigsaw (alternative is to do a gallery walk to examine the main ideas of the phenomena)

Discussion-Synthesizing

Evaluate: Synthesize the six phenomena presented to determine what they suggest the Earth was like in the past.

- What similarities did you find in the various phenomena presented?
- What was the conclusion?
- What is the takeaway message from the phenomena presented?

Elaborate:

- Immediately following each group's presentation, ask students what information they could take away from the presentation that could be added to the Driving Question Board map.

Creating a Model of Pangea

- Explain that Wegener's theory placed all the continents together in one large supercontinent to help students get a sense of what this really meant for the earth.
- There may be many versions of Pangea created by students.
    - Look at all the ways the past and the present maps are different. What caused these changes?

Lesson Closing

Day 1: Reading 2.1: What is Continental Drift?

Day 2: **Evaluate:** This is a great opportunity to engage students in Scientific writing with evidence. Begin using the CE(R) format.

- Why is the theory of continental drift a reasonable explanation that continents move over the surface of the Earth?

After students write/discuss the evidence that supports this explanation, ask them to think of any other ways that they think continents could have changed position over the Earth's history. (Students should begin to link their prior knowledge of earthquakes or volcanic activity from Lesson 1). Have them make some revisions to the CE. (Save this writing sample to be revised again after the next part of Lesson 2. Students can then continue to make revisions and add their ideas (Scientific Principles) to it.

THE LESSON IN ACTION: Lesson 2 Day 3-4

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Do Now: After reading "What is Continental Drift?", explain a weakness in the theory.

Engage: Discussion: Turn & Talk: What possible explanations do you have for how the continents could have changed position so drastically from the past to where they are today?

Introduction to Alfred Wegener: https://www.youtube.com/watch?v=T1-cES1Ekto
"Wegener continued to seek additional data to use evidence to support his claims and tried to come up with better explanations for how continents moved on Earth. However it wasn't until after his death that new evidence was discovered."

During the Lesson

Explore:

- Give students a table with images from those projected. Students should use this table to organize new ideas as presented and make notes on the images that can help them understand the new phenomena.
- Show/Share the video on seafloor spreading.
- Share PIs:
- Physical Map of the Earth
    - Where are the mountains located on the map? How do you know they are mountains?
    - Is there evidence of any mountains on the ocean floor?
- Mid-Ocean Ridge
    - Highlight the mountain range of the Mid-Ocean Ridge.
        - How could these mountains have formed? (Briefly explain the idea of the age of the ocean floor-how scientists thought that the ocean floor was smooth but realized after ocean exploration their theory was wrong. Emphasis is on the original theory and how that theory changed over time.)
- Ocean Floor Age
    - Identify and mark where the ocean floor is the youngest and where it is the oldest. (Students can mark up the DQB Map at the same time).
    - Why might it have been important to discover that the ages of the ocean floor vary depending on location?
    - **Turn & Talk:** How can you explain why the ocean floor is the youngest at the mid-ocean ridge?
- Activity Video 2.2 Ocean Floor Spreading

- Video: seafloor spreading
- Oceanic Trenches
    - Why do you think the trenches are only located in certain spots on Earth?
    - Turn & Talk: How can you explain how the trenches might form on the ocean floor?

Discussion-Synthesizing

Explain: After looking at this new data, what did scientists conclude about how continents appeared to be moving on the surface of the earth?

- Where are the mountains located on the map?
- Explain ocean floor spreading and how this process is related to the mid-ocean ridge.

Lesson Closing

Review & Revise: How can you revise by adding on to your thinking about the Theory of Continental Drift? Review the CE(R)'s from earlier in the lesson. Have students add evidence.

- Does your claim stay the same? What evidence can you now add?

Evaluate: Synthesize ideas and conclude that the ocean floors and the continents are moving**.**

- Summarize three conclusions the scientists reached as a result of the awareness of these new phenomena and data.
- Explain that their conclusion ideas can be used as reasoning to justify the evidence and claim statements. Have students add these conclusions to their CER. (This is a guided process to writing CER's).
- Review of DQB-Can we answer any questions? Can we add artifacts?
- We still need to discover how or why the plates move or grow? What are some of your ideas based on prior knowledge?

Wrapping up the Lesson:

Summarize key ideas so far, adding to the DQB and Notes:

- Wegener believed that the continents were one large landmass called Pangea.
- The continents moved apart, and this is called Continental Drift. Wegener had no mechanism for this to have happened.
- The ocean floor rock is volcanic (specifically basalt) and is much younger than the continental rock.
- The ages of the ocean floor rock were formed to vary significantly depending on the location.
- New material is constantly being added to the edges of some plates. This creates a new ocean floor between continents forcing them apart.

Since there is still the need to discover how or why the plates move or grow, if students produce questions related to the why or how of plate movement, the teacher will acknowledge these questions as identification of important gaps in what the class knows or can explain, and inform students that they will be the focus of future investigations.

Students should summarize all that they have explored in the lesson and record the *big ideas* on the Scientific Principles sheet at the front of their materials.

Lesson 2 Resources

IQWST: Digital Resources and Student Workbook

- Download Lesson 2 Teaching Slides
- Phenomena Information Packet
- Video: Plate Tectonics
- Activity Video 2.2 Ocean Floor Spreading
- Video: seafloor spreading
- PI-Pangaea to Present Earth
- PI-Mid-Ocean Ridge
- PI-Ocean Floor Age
- PI-Oceanic Trenches
- PI-PR Trench

Reading 2.1

240 Million years' Time Lapse video: https://www.youtube.com/watch?v=uLahVJNnoZ4&feature=emb_logo
Intro to Alfred Wegener: https://www.youtube.com/watch?v=T1-cES1Ekto

Discovery Education

- Pangaea
- Pangaea: The History of the Continents
- The Endless Voyage: Making the Pieces Fit
- What is the Mid Ocean Ridge?
- Features on the Ocean Floor
- The Ocean Floor: Clues about Continental Drift on Earth

Newsela

Afred Wegener

- https://newsela.com/read/BHP-U4-3-WEGENER-HESS/id/3641/?collection_id=2000000192&search_id=ed2acfc8-373f-40bf-a07a-90948ba21359
- You Tube Video: Bill Nye the Science Guy: Pangaea and Plate Tectonics: Segment of Earth's Crust on plate tectonics.
- NOAA: Ocean Explorer: Links to several articles on ocean exploration; Click on "Multimedia tab for ocean exploration videos.
- NOAA: National Ocean Service: Ocean Facts: To date, we have explored less than five percent of the ocean!

Lesson 3:	**What is the composition of the Earth's surface?**	**Estimated Time: 1-2 50 min each**

Brief Overview of Lesson: Students will evaluate models to determine how well the models communicate key ideas about the nature of Earth's plates.
The purpose of this lesson is to support students in integrating the ideas they have developed so far about the nature of plates into a simple model of Earth's plates. Students will evaluate models to determine how well the models communicate key ideas about the nature of Earth's plates.

What students should know and be able to do to engage in this lesson:

- There are many plates that make up the earth's surface.
- They are different shapes and sizes.
- Plate boundaries/borders are usually under oceans or along the edges of continents, rarely crossing continents.
- Continents do not define plates-both continent and ocean can be a part of the same plate.
- The entire surface is made of plates with no gaps or spaces between two plates.

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**

ESS1.C: The History of Planet Earth ● Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. **ESS2.B: Plate Tectonics and Large-Scale System Interactions** ● Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.	**4-ESS1C.1:** Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. *(4-ESS1-1)* **4-ESS2B.1:** The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. *(4-ESS2-2)*
Focus Question for this Lesson	
What is the composition of Earth's surface?	
Learning Intention	**Success Criteria**
I am learning that models can be used to explain what I know about the phenomena.	*I can construct a simple model of Earth's plates.*

Assessment(s)
Self-Assessment/Peer Assessment/Teacher Assessment Analyze and interpret data on the distribution of fossils & rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. Copy of Science Model Rubric Write an explanation as to how your model explains that the earth surface is moving. ○ Earth's surface is made of plates. ○ These plates are not all the same size or shape and they cover the entire surface of the earth. ○ The plates on the earth's surface move.
Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf

Rubric

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

- Models should represent the continents.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions.
- Utilize scaffolding strategies.
- Provide prompting and support.
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials.
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard.

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies.
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook.

- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks.
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which require students to sort.
- Use highlighter to guide students answering questions.
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard.
- Provide students mini-breaks when necessary.

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning.

Teachers may wish to have students propose their own models by asking them to construct a model that would be most representative of the earth's plates.
Teachers could provide any materials you have around the classroom or ask students to consider this the night before and bring in materials from home. This would allow for a richer discussion about the aspects of student models and why they constructed them as they did.
Teachers could first have students construct their own models based on their knowledge and then examine the prescribed models. This would provide a great variety of models to explore and compare.

THE LESSON IN ACTION

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Engage: You might ask what types of models they have worked with in past IQWST units, as well as what a model should/could be used for.

- What makes a good model?
- Compare a Globe of the Earth to the Class Map of the Earth on the DQB. Identify some of the limitations that each may have.

During the Lesson

Explore: Distribute materials and a card to each group. Students should follow the instructions on the card to create a model of the earth's plates. The instructions on the card are vague in order to allow students to adapt the materials to their ideas about plates.

Explain:

- Describe each of the models that the groups built. All models should be visible in the front of the room or can be passed around.
- What are the important features of a model of something?
- Based on your understanding of models, how would you determine which model is the best?
- Use PI: Earth's Plates to remind students that the surface of the earth is broken up into slabs of varying sizes and shapes.
    - What do we know so far about plates that would be important to include when constructing a model to explain what they are?
    - The purpose of this activity is to evaluate models for accuracy.

Lesson Closing

Discussion-Making Sense:

Elaborate: Evaluate models for accuracy. Lead this discussion as a debate in which each student must choose which model they believe is the best model of Earth's plates. Students then divide into groups around the classroom based on these opinions and argue for why their model is a better model.

- Which model do you think is the most accurate model? Why?
- What characteristics of that model are the most accurate?
- What are the limitations of that model?
- Does anyone believe that a different model is most accurate? Why?
- Can you come up with another way to model Earth's plates?
- Is there any way to improve any of these models to make them more accurate representations of Earth's plates? How?

Evaluate:

- Summarize all that they have explored in the lesson, and write down the big ideas on the Scientific Principles sheet at the front of their materials. Students built and explored models of Earth's plates to get a better sense of their characteristics and properties.
- Add scientific principles to the DQB.**Wrapping Up:**

To wrap up the lesson, ask students to help summarize all that they have explored in the lesson, and write down the big ideas on the Scientific Principles sheet at the front of their materials. Students built and explored models of Earth's plates to get a better sense of their characteristics and properties.

  - Earth's surface is made of plates.
  - These plates are not all the same size or shape and they cover the entire surface of the earth.
  - The plates on the earth's surface move.

Lesson 3 Resources

IQWST

- Lesson 3 slide deck

Digital Resource Videos

- Setup Video: 3.1
- Activity Video 3.1 Plate Tectonics Demo: Paper
- Activity Video 3.1 Plate Tectonics Demo: Saltine Crackers
- Activity Video 3.1 Plate Tectonics Demo: Penciled
- Activity Video 3.1 Plate Tectonics Demo: M&Ms
- Activity Video 3.1 Plate Tectonics Demo: Paper + Cracker
- Activity Video 3.1Plate Tectonics Demo: Hard-Boiled Eggs

Lesson 4	**Lesson 4.:What Makes the Plates Move?**	**Estimated Time: 2, 50 min sections**
Brief Overview of Lesson:		

Days 1-2: Students will explore the principles of convection in liquids and solid to draw conclusions about how convection results in plate movement. Students will simulate the reason that plates move on the earth's surface.
Days 3-4: Students will examine a malleable plastic material (silly putty) and test which conditions will affect the ability to mold and form the material and draw conclusions about the convection in the mantle. Students will use Silly Putty® to simulate the formation of metamorphic rocks in order to draw conclusions about the nature of rock in Earth's mantle.
What students should know and be able to do to engage in this lesson:

- Convection of air (from grade 7: Weather Unit: ES2)
- The plates on the earth's surface move.

LESSON FOUNDATION

Assessed Standards for this lesson	Important content not included in the standards
ESS2.A Earth Materials and Systems • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. **PS1.A Structure and Properties of Matter** • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. • In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. • The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.	**MS-ESS2C.5:** Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. *(MS-ESS2-2)* **MS-ESS2C.2:** The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. *(MS-ESS2-5)* **MS-ESS2C.3:** Global movements of water and its changes in form are propelled by sunlight and gravity. *(MS-ESS2-4)* **MS-ESS2D.1:** Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. *(MS-ESS2-6)* **MS-ESS2D.3:** The ocean exerts a major influence on weather and climate by absorbing energy from the Sun, releasing it over time, and globally redistributing it through ocean currents. *(MS-ESS2-6)* **MS-PS3B.3:** Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (*MS-PS3-3)*
Focus Question for this Lesson	

What makes the plates move?

Learning Intention	**Success Criteria**
Day 1-2: I am learning that convection currents within the Earth's mantle cause plate movement. *Day 3-4: I am learning to design an experiment to explore the role of temperature in the form of plastic material.*	*Day 1-2: I can apply the principle of convection in air to liquids and solids.* *Day 3-4: I can model the formation of metamorphic rock to show bending and shifting. I can design an experiment to explore metamorphic rocks as evidence that solid rock material can deform under certain conditions.*

Assessment(s)

DQB: Students listen to each other's questions and make connections while adding to the Driving Question Board (DQB).

The earth is made up of interlocking plates that move like conveyor belts over the ever changing surface. Construct an explanation for how convection of the earth's materials supports this phenomenon.

Development of Scientific Principles:

Students should now demonstrate an understanding that hot rocks become less dense than the surrounding materials and rise to the surface; whereas the hotter region spreads out and moves horizontally. They should also understand that Earth's plates ride along horizontally on the surface and move when the hot material in the solid mantle moves.

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

- A common student misconception is that the mantle is completely liquid.
- A common student misconception is that any hot material will rise.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support.
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials.
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard.

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies.
- Provide prompting and support.
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook.
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- Fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answers. choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
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- Allow students to use Google Read&Write for speech to text to construct sentences independently.
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- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION Lesson 4 Days 1-2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Do Now: How does convection occur in air, as it happens in weather phenomenon? Draw/Describe/Explain. **Engage:** ● Summarize some of the information that has already been added to the Driving Question Board map. ○ How do you think plates on the Earth's surface can move? How can you use your understanding of convection of air to help you? ● Introduction to case study sites that will motivate the study of the concepts in the unit. ● Students will be asked to summarize some of the information that has already been added to the Driving Question Board map.
During the Lesson
Explore: **Red and Blue Water Demonstration (Demo #1**) ● In this activity, the teacher will demonstrate for the class using the setup instructions in the preparation section, to conduct the demonstration with the red and blue water. **Explain**: Students will synthesize evidence from the demonstrations to understand how convection occurs. ● What did you observe in the first demonstration with the red and blue water from the beakers? ● What is happening to the hot and cold water? ● What did the tank look like after 10 minutes?

Convection with a Drop of Food Coloring Demonstration (Demo #2)

- You will conduct a second demonstration. Students will observe closely, and answer the questions that follow.

Explain: Students will synthesize evidence from the demonstrations to understand how convection occurs.

- What is happening to the water and drops of food coloring?
- How does this relate to the previous demonstration?
- What do the pieces of cardboard represent?
- Why do you think this happened?

Lesson Closing

Elaborate:

- Students will synthesize evidence from the demonstrations to understand how convection occurs.
- What did you observe in the first demonstration with the red and blue water from the beakers?
- What did you observe in the first demonstration with the red and blue water from the beakers?
- What do the pieces of cardboard represent?
- What does the water represent?
- What does the beaker of hot water represent?
- What is the purpose of the food coloring?

Evaluate:

- Students will draw conclusions from the demonstrations, based on observations and response to questions about the basic scientific principles of convection.
- EXIT TICKET: Construct an explanation for how convection of the earth's materials causes movement of earth's plates.

THE LESSON IN ACTION Lesson 4 Days 3-4

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Do Now: Identify the three types of rocks (metamorphic, igneous and sedimentary). Use pictures or samples of each to display. Ask what they already know about them.

Engage:

Pass out samples of metamorphic rock to each student/group. Each should get 2 samples. Students will make observations about the samples mainly focusing on the different band designs in the rocks.

- Using what you just learned about solid rock being heated, have students develop a hypothesis on why the rocks look the way they do.

During the Lesson

Explore: Silly Putty Rocks: Students will play around with the material, making observations about its behavior (stretching/pulling; breaking apart).

- Design an experiment to test the effects of temperature on the silly putty. Some may choose to make it hot while others choose to make it really cold.
- Carry out the designed experiment. Record findings.

Explain:

- Is the Silly Putty® a solid or a liquid?
- How will you determine the effects of the different temperatures on your putty?
- What is the relationship between temperature and rate of flow of the Silly Putty®?
- How does the flow of your putty compare with the metamorphic rocks you examined?
- What does the fact that they are similar in form suggest about what happened to the rock as it formed?

Lesson Closing

Evaluate:

- How do you think Silly Putty might be used as a model for metamorphic rocks?
- Consider what you know about convection. How can you use this activity as evidence to make a claim about the earth's mantle and convection?

Wrapping up the Lesson:

This is similar to the way that rocks can become deformed in the earth's mantle. Rocks are heated (they do not need to melt, just get very hot) so that they can flow and move.

- When this happens, students should now understand that the hot rocks become less dense and rise to the surface; whereas the hotter region spreads out and moves horizontally. Earth's plates ride along horizontally on the surface and move when the hot material in the solid mantle moves.

- Silly Putty can be deformed over very short time periods. In the mantle rocks of the earth, the deformation occurs over extremely long time periods. The rocks are very hot, but they are not melted (liquid)—instead they remain as solids but can slowly flow over time.

The following Scientific Principles should be added to the class list:

- Plates rest on the mantle that is a hot, softer rock layer that can move and flow.
- Earth's plates ride on the moving mantle rock.
- Convection (cycling of hot and cold material) occurs in the mantle as hot, less dense material rises and cold material sinks because it is denser.

Reading 4.2 – Formation of Metamorphic Rocks
Students will read about how metamorphic rocks form and why they look the way they do. Teacher will encourage students to think about the activities they have done with the hot and cold water and hot and cold Silly Putty® as they are reading. This reading should bring together the concepts about hot rock moving under Earth's plates and the plates riding along on the moving mantle rocks.

Lesson 4 Resources

IQWST

- **Lesson 4 slide deck**
- **Liquid Convection: Demonstration 1**
- **Liquid Convection: Demonstration 2**
- **Metamorphic Rocks: Silly Putty Demo**
- **Reading 4.2**
- **PI-Case Study Sites**

Discovery Education

- Science Investigations: Earth Science: Investigating the Earth's Formations
- Mantle Convection and Pangaea Theory
- Inside the Earth
- You Tube Video: Teacher AJH: Convection Currents

- Using a small fish tank filled with water placed over a bowl of hot water and a bowl of ice, the convection currents can be seen using red and blue food dye.
- Science News for Students: Earth's tectonic plates won't slide forever. In a few billion years they'll grind to a halt
- You Tube Video: Plate Tectonics: From BBC documentary film "Earth The Power Of The Planet ".
- PHET Simulation: Plate Tectonics: Explore how plates move on the surface of the earth. Change temperature, composition, and thickness of plates. Discover how to create new mountains, volcanoes, or oceans!
- You Tube Video: Earth 100 Million Years from Now:
- Earth's landmasses were not always what they are today. Continents formed as Earth's crustal plates shifted and collided over long periods of time. This video shows how today's continents are thought to have evolved over the last 600 million years, and where they'll end up in the next 100 million years. Paleogeographic views of Earth's History provided by Ron Blakey, Professor of Geology, Northern Arizona University.

Lesson 5	**Lesson 5. How do Plates interact with each other?**	**Estimated Time: 6-7 50 min sections**

Brief Overview of Lesson: The purpose of this lesson is to help students understand how convection results in plate movement and some of the visible features and events on Earth. This lesson connects to convection in air as it relates to weather patterns, as well as the particle model of matter relating to the structure and movement of matter. This lesson will also explore aspects of the earth's plates related to density, a characteristic property of substances.

Day 1-3 - Map analysis

- Students will analyze and interpret map data to identify patterns in Earthquakes and Volcanoes locations and their relation to plate movement. Students will model plate movement with graham crackers and gelatin to explain how Earthquakes and Volcanoes are the result of plate movement.

Day 4-7 - Types of Rock

- Students will model plate movement with towels and a folder to determine based on "plate density" how plates will move in a system.

What students should know and be able to do to engage in this lesson:

- Convection in air as it relates to weather patterns.
- Particle model of matter relating to the structure and movement of matter.
- Understanding of density, a characteristic property of a substance.

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
ESS2.A Earth's Materials & Systems	• Students have learned about weather patterns in Grade 7. One weather pattern is caused by convection of air. The

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- The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.
- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms.

MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

</td><td>

main idea behind this scientific principle of convection is that hot air rises and cool air moves in to take its place. They also learn that the hot air rises because it is less dense, and cool air sinks because it is denser.

- Density, a characteristic property of a substance.

</td></tr>
<tr><td colspan="2">Focus Question for this Lesson</td></tr>
<tr><td colspan="2">How do plates interact with one another?
What happens when plates move?
What types of rock compose plates?</td></tr>
<tr><td>Learning Intention</td><td>Success Criteria</td></tr>
<tr><td>Day 1: I am learning that plate movement leads to features and events on Earth.</td><td>Day 1-3:
• I can analyze data to determine the pattern of earthquakes, volcanoes, and the location of plate boundaries.
• I can model plate movement in relation to one another.

Day 4-7:
• I can identify types of Plate Rock to determine plate movement.
• I can explain plate movement by identifying less dense and denser rock material.</td></tr>
</table>

Assessment(s)	
DQB: Students listen to each other's questions and make connections while adding to the Driving Question Board (DQB). **Development of Scientific Principles:** Students will be able to wrap up the lesson by recalling and explaining that the solid material in the earth's mantle (beneath the plates) moves by convection. They will also be able to demonstrate that plate boundaries are aligned to places of geologic activity such as earthquakes and volcanoes. **Sample questions/prompts:** ● Students can construct/communicate/critique the idea that two plates move toward each other for how the evidence supports the explanation for how the Earth is changing. ● How does the density of the plates affect the movement and its consequential features at convergent boundaries? ● Why is it that when two plates collide, sometimes one plate slides under another, and sometimes the plates crumple up and form mountains? What evidence can you use from this and previous lessons to support your thinking?	
Feedback (Peer to peer/student to teacher/teacher to student)	
Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf	

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS
Anticipated Student Pre-Conceptions/Misconceptions
● All locations of earthquakes on the map must be transformed plate boundaries where two plates slide alongside one another.
Integrated Accommodations & Modifications
English Language Learners/Socio Cultural Implications: ● Create a word wall. ● Create a Driving Question Board. ● Use partnering strategy to allow students to work in teams.

- Provide students with pictures as a visual reference when answering questions.
- Utilize scaffolding strategies.
- Provide prompting and support.
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials.
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard.

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions.
- Utilize scaffolding strategies.
- Provide prompting and support.
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook.
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks.
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which require students to sort.
- Use highlighter to guide students answering questions.
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction.
- Allow students to use Audio Recordings in digital format or any other reading materials.
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard.
- Provide students mini-breaks when necessary.

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning.

Some video clips found on the Internet will be accompanied by a verbal explanation. If the explanation is clear, the teacher can choose to play this audio for students. Teachers also have the option of preparing their own script or explanation to read or state out loud as students watch the video clip.

Use Google Earth/Maps for Virtual Field Trip

THE LESSON IN ACTION Lesson 5 Days 1-3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: Display PI: Earth's Plates, which shows the plate boundaries on the world map. **Do Now:** Table Talk/Share- What are the different ways that plates could move in relation to each other where they meet at plate boundaries? What do you think happens on Earth's surface when these kinds of movements occur? If students are struggling to understand the question, remind them that we know, based on Wegener's evidence and ocean floor spreading, that the plates move. They can also model a plate boundary by laying their hands flat and next to each other. What do you think happens on Earth's surface when these kinds of movements occur? **Assess Prior Knowledge:** Looking at the map- What kind of pattern do you observe? How might geologic events and features be related to plate tectonics?
During the Lesson
Explore: Students can explore various plate movements using models that represent plate movement towards each other, away from each other and sliding past each other (convergent, divergent, transform). Some suggestions are using graham crackers and gelatin or towels. Utilize videos and other simulations to explore more complex plate movement that leads to volcanoes. **With each exploration:** **Ask:** What did you observe? What do you think you have simulated? Describe what is happening?

Explain:
Discussion-Making Sense
Suggested prompts:

- How did the plates move in this simulation/model/video?
- What happens when the plates continue moving toward each other? Why do you think this happened?
- What happens to the end of the subducting plate?
- At the spot where two plates meet, an oceanic trench forms. What do you remember from Lesson 2 about oceanic trenches?
- What can happen when two plates move toward each other?
- What happens when two plates move alongside each other?

Lesson Closing

Elaborate/Evaluate:
Explain how might geologic events and features (such as earthquakes and volcanoes) be related to plate tectonics?
This is a great opportunity to have students write/discuss/revise.

Students will be able to wrap up the lesson by recalling and explaining that the solid material in the earth's mantle (beneath the plates) moves by convection. They will also be able to demonstrate that plate boundaries are aligned to places of geologic activity such as earthquakes and volcanoes.
Reading: Ring of Fire
Students will read about the Ring of Fire. Encourage students to look back at the map showing the position of the plate boundaries, volcanoes, and earthquakes. Can they locate the Ring of Fire on this map?

Have a student point out the Ring of Fire on the Driving Question Board class map.

THE LESSON IN ACTION Lesson 5 Days 4-7

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Do Now: Reading Follow up: Students will also summarize what they have learned in the reading last night while addressing the following; "What is the Ring of Fire? Why is this an important pattern on maps? What does this pattern tell us about plate tectonics?"
Discussion-Pressing for Understanding:
Students have explored two ways that plates can move: alongside each other, called transform boundary and toward each other, called convergent boundary.

During the Lesson

Explore:

Demonstration of Convergence:

Investigate what happens at different plate boundaries and why.

Simulate the convergence between two plates that have continental rock material on the top surfaces and edges of plates.

Simulate the formation of mountains using two bath towels folded.

Explain:

- Describe the two types of convergence that have been simulated.
- Why do you think that sometimes plates slide under other plates, and sometimes they don't?
- What would the earth look like if there were no water on its surface? (Connects to Lesson 2).

Labeling Plate Boundaries:

Students will view cross sections of convergent plate boundaries. One shows subduction and the other shows continental convergence.

Provide students with a small amount of data to demonstrate that continental rock and oceanic rock have different properties. Recall their understanding about density. Display the approximate densities of continental rock and oceanic plate material.

Pressing for Understanding:

Have students demonstrate their representation of a continental plate boundary, where one plate with oceanic rock material on the top edge slides underneath another plate with continental rock material on the top edge.

Discuss the mechanism of slab-pull where the denser and thinner portion of the rock slab subducts and pulls on the rest of the plate, adding to the overall movement.

- What formation does this movement eventually lead to?
- Describe the differences in the properties of oceanic and continental plates.

Lesson Closing

Evaluate:

Exit Ticket: Why is it that when two plates collide, sometimes one plate slides under another, and sometimes the plates crumple up and form mountains? What evidence can you use from this and previous lessons to support your thinking?

Wrapping up the Lesson:

- The solid material in the earth's mantle (beneath the plates) moves by convection.
- The movement of the mantle acts like a conveyor belt as the plates slide around on top of this layer.
- Plate boundaries are aligned to places of geologic activity such as earthquakes and volcanoes.

- The different features on the earth are a result of the two different types of plates that exist on Earth: continental plates and oceanic plates—which have different densities and thicknesses.

Update DQB

- Our understanding of Earth's surface became slightly more complex as scientists realized that the rock that makes up the ocean floor is different from the rock that makes up the continental landmasses.
- The main difference is that the rocks of the ocean floor are not only thinner but also denser.
- The rocks of the continental landmasses are both thicker and less dense.
- When the edges of two plates are both made of the lesser dense and thicker rock material (continents on the tops and edges of the plates), neither one will move into the interior (only dense plates slide under/subduct into the earth's interior). Therefore, they both stay at the surface and crumple to form mountains very slowly over long periods of time.
- As a plate with ocean floor rock material on the top edge subducts beneath another plate, it becomes even denser than the rock material surrounding it. This makes it sink in farther and pulls the rest of the plate in behind it.

At this point, several principles should be added to the Scientific Principles list:

- Plates move on the earth's surface in a variety of ways:
    - toward each other
    - alongside each other
    - away from each other
- When two plates interact, geologic features and events common on Earth occur (volcanoes, mountains, trenches, and earthquakes)
- There are two kinds of plates with specific characteristics:
    - oceanic plates (more dense and thinner)
    - continental plates (less dense and thicker)

Lesson 5 Resources

IQWST

- **Lesson 5 slide deck**
- **Reading 5.1**
- **Plate Movement: Gelatin and Cracker**

- **Plate Movement: Folder Demo**
- **Bath Towels Tectonic Plate Converging Demo**
- Earthquakes:
  What Is An Earthquake?

Discovery Education

- TEAMS: Earth Processes: Mountain Building
- Physical Geography: The Ever Changing Planet
- Earth's Tectonic Plates
- Plate Tectonics
- Science Kids: Plate Tectonics

- You Tube Video: Kilauea Erupts: Kilauea is the youngest and southeastern most volcano on the Big Island of Hawaii.
- NOVA: Japan's Killer Quake:
- In its worst crisis since World War II, Japan faces disaster on an epic scale: a death toll likely in the tens of thousands, massive destruction of homes and businesses, shortages of water and power, and the specter of nuclear meltdown.

- Plates on the Move: Look around you.
- It may seem that the Earth is perfectly still. But the Earth's outer shell or surface is actually moving all the time. Click on "Explore How Plates Affect Your World" to view plotted current earthquakes.
- ScienceNews for Students: The quake that shook up geology
- A huge earthquake in Alaska 50 years ago triggered a shift in what geologists know about Earth. Article explains how the study of earthquakes has changed since the Great Alaska Quake of '64.
- ScienceNews for Students: How Earth's surface morphs
- Partly melted rock acts like grease to help huge masses of the planet's surface slip up, around and down.
- Rock Identification Key:
- Includes information on the rock cycle, minerals, and a rock key.
- NEOK-12: Types of Rocks:
- 14 videos, games, photos and more on types of rocks, the rock cycle, and how crystals form.
- Geology.com
- Rocks: Igneous, Metamorphic, and Sedimentary: Photos, descriptions, and facts about the three rock types and example of each
- Exploring Earth: How Rocks Undergo Change:
- This cutaway view of Earth shows where some common rock-forming processes occur. Embedded animations will illustrate the path of a rock moving through the rock cycle.

Lesson 6	Lesson 6.:What Causes Volcanoes?	Estimated Time: 1-2, 50 min sections

Brief Overview of Lesson:
The purpose of this lesson is to further explore how volcanoes form due to subduction and to introduce a new process of how volcanoes form at hotspots. This lesson completes the second learning set by helping students make sense of an alternative way that volcanic features form on Earth's surface.

Day 1: Students will explore how volcanoes and mountains are different. They will simulate a volcanic eruption.

Day 2: Students will examine other ways that volcanoes form at non plate boundary locations (hotspots).

What students should know and be able to do to engage in this lesson:

- Plate boundary types/movement (transform, convergent, divergent)
- More dense oceanic plates will subduct under a less dense continental plate when they converge.

LESSON FOUNDATION

Assessed Standards for this lesson	Important content not included in the standards
ESS2.A Earth's Materials & Systems ● All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. ● The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. **ESS2.C The Role of Water in Earth's Surface Processes** ● Water's movements—both on the land and underground—cause weathering and erosion, which	**4-ESS2B.1:** The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. *(4-ESS2-2)*

change the land's surface features and create underground formations. **ESS3.B Natural Hazards** ● Mapping the history of natural hazards in a region combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)	

Focus Question for this Lesson

What causes volcanoes?
How are islands created?

Learning Intention	**Success Criteria**
Day 1: ● *I am learning that mountains and volcanoes are different.* *Day 2:* ● *I am learning that volcanoes form subduction and hotspots.*	*Day 1* ● *I can compare the formation of mountains with volcanoes. I can use a model to explain the process of subduction using evidence from previous lessons.* *Day 2* ● *I can examine another way that volcanoes format non-plate boundary locations (hotspots).*

Assessment(s)

Development of Scientific Principles

DQB: Students listen to each other's questions and make connections while adding to the Driving Question Board (DQB). Stem Gauge 182188A.pdfStem Gauge 136978A.pdf

Assessment opportunity to add a CER for the end of Lesson Set 2.

- What causes the features on Earth?
- How is the Earth Changing? (How might they answer this question at this point in the unit? At the end of the unit, the students can refer to all the CER's written from each lesson set, and respond to culminating questions sufficiently).

Students should demonstrate and understand that hotspots within the Earth can form volcanoes in the middle of a plate. They should recall that nearly all other geologic activity is centered on places where plates meet other plates (plate boundaries).

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf

CER Rubric

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

- Mountains and volcanoes are the same.
- All mountains are volcanoes.

Integrated Accommodations & Modifications

English Language Learners/Socio-Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions.
- Utilize scaffolding strategies.
- Provide prompting and support.
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading material.
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard.

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions.
- Utilize scaffolding strategies.
- Provide prompting and support.
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.

- Provide students with images/diagrams they can cut and paste into their notebook.
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks.
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which require students to sort.
- Use highlighter to guide students answering questions.
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction.
- Allow students to use Audio Recordings in digital format or any other reading materials.
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard.
- Provide students mini-breaks when necessary.

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning.

THE LESSON IN ACTION Lesson 6 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: **Do Now:** Complete Venn Diagram comparing Volcanoes and Mountains. Discuss ideas about the shared characteristics. ● What are some similarities between a mountain and a volcano? ● What are some differences between a mountain and a volcano? Point out locations on a map (or use Google Maps for a more virtual experience) the locations of Himalayan Mountains above India, the mid-ocean ridge mountain range, the Andes Mountains in South America, and the Japanese and Aleutian Islands, which are volcanic.

- Point out that sometimes volcanoes appear in the middle of a plate (not on a plate boundary).
    - How might this have occurred?
    - What might have happened that led to this formation?

During the Lesson

Explore: Simulate Volcano Formation

- What do the various parts of the model represent in the real world? The wax? The sand? The water? The flame/heat source?
- How could we form a volcano/mountain using this simulation?
- Why did the hot wax move up?
- Since not all of the melted wax reached the surface of the earth, what might the magma that cools beneath the earth's surface help you to understand?
- What are the limitations of this model? How is this model unlike the real world?

Explain:

Discussion-Pressing for Understanding Clarify and describe the observations in the volcano simulation model.

- What did we model with this actively?
- What do the various parts of the model represent in the real world?
- If we were to wait for the wax to cool down, and then run the simulation all over again, what do you think would happen?
- Why did the hot wax move up?
- Since not all of the melted wax reached the surface of the earth, what might the magma that cools beneath the earth's surface help you to understand?
- What are the limitations of this model? How is the model unlike the real world?

Lesson Closing

Exit Ticket: Stem Gauge

Students have stimulated the formation of a new feature on the surface of the earth.

- There are different ways that rock material can melt. In this activity, the actual mechanism of melting is not well understood by scientists, but it is likely related to the radioactive decay of atoms within the earth's interior. This decay releases energy, which causes the temperature of rock material to increase.
- It is important to stress that while the wax does not look like a mountain or volcano due to its flat shape, these features build up over long periods of time. A volcanic mountain is not created in one day.
- If students used this model again and again, it is possible that they would begin to see a volcano-shaped feature forming at the surface of the earth (above the solid rock layer).

- The feature was a result of the heating of material below the surface. This simulates what happens on Earth when rock material is heated, melts, and moves up toward the surface of the earth because the melted material has a relatively lower density than the material around it.

THE LESSON IN ACTION Lesson 6 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Do Now: Students can update DQB **Engage:** ● What is a hotspot? (Have you ever heard of this term?) ● How do you think a hotspot could have formed this chain of islands? Locate the Hawaiian island chain. Use google maps or a physical map to display for students.
During the Lesson
Explore: Demonstration Formation of Volcano Chains Students will do a quick demo to show how a hotspot and a plate work together to form a chain of volcanoes. View a map/photograph of Hawaii and note that the volcanic islands appear in a chain. **Explain:** What are the limitations of this model? How is this model unlike the real world? Students should demonstrate and understand that hotspots within the earth can form volcanoes in the middle of a plate. They should recall that nearly all other geologic activity is centered on places where plates meet other plates (plate boundaries).
Lesson Closing
Wrapping Up the Lesson Discussion – Summarizing ● Hotspots within the Earth can form volcanoes in the middle of a plate. ● Nearly all other geologic activity is centered on places where plates meet other plates (plate boundaries). ● How can we tell what direction plates are moving? ● How fast do they move? Evaluate: ● What causes the features on Earth? ● How is the Earth Changing? (How might they answer this question at this point in the unit? At the end of the unit, the students can refer to all the CER's written from each lesson set, and respond to culminating questions sufficiently). Reading- Is a Hotspot lurking beneath the continental United States?

Students will read about another hotspot that is present beneath the North American continent—the Yellowstone hotspot. The presence of this hotspot could mean a future disaster for those living all over the United States.

- What does it mean when the reading states that an eruption at the Yellowstone hotspot could be disastrous for those living in the United States?
- What evidence does a hotspot leave behind on the earth's surface?

Lesson 6 Resources

IQWST

- **Lesson 6 slide deck**
- **Kilauea, Hawaii (February 25, 2011)**
- **Kilauea, Hawaii (March 7, 2011)**
- **Life of HotSpot Volcanic Island**
- **What is a Hotspot?**
- **Reading 6.2**

Discovery Education

- Atlas 4D: Hawaii
- Why Volcanoes Occur
- Natural Phenomena: Earthquakes, Volcanoes, and Other Earth Movements
- Mountain Formation
- The Formation of a volcano
- Ss examine another way that volcanoes form at non plate boundary locations (hotspots)
- Reading 6.2
- *Is a Hotspot Lurking beneath the Continental United States?* - Ss read about the Yellowstone Hotspot

Supplements:

- NOAA: The Hawaiian Islands Were Formed By Volcanic Activity:
- The Earth's outer crust is made up of a series of tectonic plates that move over the surface of the planet. In areas where the plates come together, sometimes volcanoes will form. Volcanoes can also form in the middle of a plate, where magma rises upward until it erupts on the seafloor, at what is called a "hot spot."
- Geology.com: Plate Tectonics and the Hawaiian Hot Spot:
- Excellent article and illustrations plus links to other related topics.

- Oregon State University: Volcano World: What is a Hot Spot? Mantle plumes are areas of hot, upwelling mantle. A hot spot develops above the plume. Magma generated by the hot spot rises through the rigid plates of the lithosphere and produces active volcanoes at the Earth's surface.
- Oregon State University: Volcano World: Current Eruption Reports:
- This is not a comprehensive list of eruptions during the week, but rather a summary of activity that meets selected criteria. Carefully reviewed, detailed reports are published monthly in the Bulletin of the Global Volcanism Network.
- PBS Nova, Making North America: students can explore various sites around NA, or watch all 3 episodes of the Making North America Series.

Lesson 7	**Lesson 7:How are plates moving?**	**Estimated Time: 1, 50 min sections**

Brief Overview of Lesson:

- This lesson supports students in determining the direction of plate movement based on data regarding the types of features found and events that occur on the earth's surface. It also connects to Lessons 5 and 6, in which students learned about the features (volcanoes, islands, mountains, and oceanic trenches) and events (volcanic eruptions and earthquakes) produced by different kinds of plate interactions.

- Students will engage in scientific discourse to make predictions about the direction and type of plate movement at different boundary locations based on evidence from previous lessons.

What students should know and be able to do to engage in this lesson:

- The location and formation of volcanoes, mountains and islands, and oceanic trenches.
- The types of boundaries (transform, convergent, divergent).
- What features form at the various boundary types.
- Where similar fossils were found on different continents.

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
ESS1.C The History of Planet Earth ● Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. **ESS2.B Plate Tectonics and Large-Scale System Interactions**	**4-ESS2B.1:** The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth. *(4-ESS2-2)*

• Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.	

Focus Question for this Lesson	
How are the plates moving?	
Learning Intention	**Success Criteria**
I am learning that it is important to use geologic evidence to predict and determine how plates are moving in relation to one another.	*I can determine the direction of plate movement according to the geologic features and events at different locations on Earth using evidence/artifacts from previous lessons.*

Assessment(s)

DQB: Students listen to each other's questions and make connections while adding to the Driving Question Board (DQB).

Stem Gauge 136653A.pdf

Exit Ticket

Development of Scientific Principles

Students should have figured out that the movement of plates is responsible for the formation of volcanoes, mountains, islands, trenches, and earthquakes on Earth.

They should also demonstrate that plates are moving in a variety of directions, which can be determined based on boundary features and events.

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

- All plates move in the same direction and at the same speed.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.

- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION Lesson 7
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: Teacher asks students, 'based on your current knowledge, how could you determine the directions in which plates are moving on Earth?' Teacher guides students through this process by asking questions and adding information to the Driving Question Board, such as arrows showing direction of plate movement and different colors that represent different types of plate boundaries (subduction, convergent, divergent, and transform) and non-plate boundary locations (hotspots).
During the Lesson
Explore: Determine Plate movement Students will return to the Driving Question Board to add any new information and put together possible directions of plate movement based on their current understanding. **Explain:** Students work in groups or individually to deepen their understanding of the phenomenon through the use of pointed questions. Some questions include: ● What were two of the examples of hotspots that we discussed on Earth? ● Given the sequence of the islands that make up Hawaii, and knowing that the largest island is the youngest and most recently formed volcano, which direction is the plate moving over this hotspot?

- Concerning the trench just south of the Alaskan Islands (Aleutian Islands), what kind of plate boundary must this be and why did it form?
- Since we know the direction of the Pacific plate, in what direction is the North American plate moving? What is happening beneath the earth's surface?
- Concerning another trench just west of South America, what kind of plate boundary is this? What is happening beneath the earth's surface?
- How are those two plates moving relative to one another?
- What kind of plate boundary forms mountains, such as the very large mountain range north of India? What is happening beneath the earth's surface?
- If this is a convergence, then the plate that carries India must be moving in which direction?
- What type of plate boundary is the mid-ocean ridge in the Atlantic Ocean? What is happening beneath the earth's surface?
- Where else can you find evidence of divergent plate boundaries?

Lesson Closing

Evaluate: Students should have figured out that the movement of plates is responsible for the formation of volcanoes, mountains, islands, trenches, and earthquakes on Earth.
They should also demonstrate that plates are moving in a variety of directions, which can be determined based on boundary features and events.

Wrapping Up the Lesson

Students have updated the Driving Question Board with new information, including the directions of movement for some of Earth's plates. Some of these directions are more apparent than others based on the geologic features (e.g., trenches, lines of volcanoes, and age of ocean floor at spreading centers/divergent boundaries).

Students should also update their own Driving Question Board maps.

- The different directions that plates move relative to one another are responsible for the formation of geologic features.
- Movement of plates is also responsible for volcanoes, mountains, islands, trenches, and earthquakes on Earth.

Encourage students to share their questions and start a discussion among their peers in which they help each other answer challenging aspects of the unit.

- How do we identify plate boundaries?

- What happens to existing plates as new plates are being created?
- How does the new plate material form?

Lesson 7 Resources

IQWST

- **Lesson 7 slide deck**
- **PI-Direction of Plate Movement**
- **PI-Ocean Floor Age**

Discovery Education

- Plate Tectonics in Action
- Futurity: Earth and Environment: Predicting Earth's Tectonic Dance: A research team has put the finishing touches on a 20-year labor of love: a precise description of the relative movements of the interlocking tectonic plates that account for about 97 percent of Earth's surface.
- ScienceNews for Students:
- Ancient ocean linked to supercontinent breakup Shrinking Tethys Ocean could have ripped Pangaea apart
- Science News for Students: Explainer: Understanding plate tectonics.
- Earth slowly refashions itself over and over
- Smart Planet: Predicting the Movement of Earth's Tectonic Plates:
- The earthquakes that rocked Haiti and Chile this year were caused by the Earth's shifting tectonic plates, which float on the planet's molten core in constant sliding motion. Now, researchers have developed a new model of the Earth - two decades in the making - to predict the movement of one plate relative to another.

Lesson 8	**Lesson 8: How does new plate material form?**	**Estimated Time: 2 days/50 minutes sections**
Brief Overview of Lesson: This lesson leads students through an investigation of how the Earth cycles rock through plate tectonics to form new plate material (including ocean floor and continents. They will learn about how Earth materials are cycled through the processes of plate tectonics. Students will write scientific explanations about how Earth's cycling system and how plate tectonics plays an important role (Conservation of Matter). What students should know and be able to do to engage in this lesson:		

- Subduction is one method of volcano formation.
- Conservation of Matter

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
ESS2.A Earth's Materials and Systems • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. **PS1.B Chemical Reactions** • The total number of each type of atom is conserved, and thus the mass does not change. **ESS3.C: Human Impacts on Earth Systems** • Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	**5-LS2B.1:** Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases and water from the environment and release waste matter (gas, liquid, or solid) back into the environment. *(5-LS2-1)* **MS-PS3C.1:** When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (*MS-PS3-2)* **4-PS3C.1:** When objects collide, the contact forces transfer energy so as to change the objects' motions. *(4-PS3-3)* **4-PS3B.1:** Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. *(4-PS3-2), (4-PS3-3)* **MS-PS3B.3:** Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (*MS-PS3-3)*
Focus Question for this Lesson	
How does the Earth cycle rock material?	
Learning Intention	**Success Criteria**
I am learning that subduction as a method for cycling rock material on Earth. *I am learning that cycling occurs at Earth's plate boundaries as a result of conservation of matter and convection.*	*Day 1: I can write a scientific explanation about Earth's cycling system and how plate tectonics plays an important role (conservation of matter).* *Day 2: I can use data about the phenomena to make sense of how the Earth is changing.*

Assessment(s)

DQB: Students listen to each other's questions and make connections while adding to the Driving Question Board (DQB).

Scientific writing of explanations: Write a scientific explanation about Earth's cycling system and how plate tectonics plays an important role (conservation of matter).

Development of Scientific Principles

Since new plate is formed at divergent boundaries, as well as at subduction zones where the subducting plate melts and forms rock at volcanic eruptions, all the new rock material that forms on Earth is coming from rock material that already existed on or within the Earth.

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf

Rubric

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

- Plates cannot be broken down or destroyed
- The mass of the earth is increasing because of the formation of a new crust.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.

- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION Lesson 8 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: Students have now been exposed to all the possible ways that plates can move relative to one another on Earth's surface. However, they still need to understand a crucial piece of the plate tectonics puzzle—from where new plate material comes and its origins due to the cycling of plates. Students will learn about how Earth materials are cycled through the processes of plate tectonics and write a scientific explanation about the formation of new plate material from existing rock material. In other words, students need to explain where new plate material (including ocean floors and continents) comes from on Earth.
During the Lesson
Explore: Students will need to put together an explanation about how new plate material forms. Use this provided hint: Earth is not getting bigger or smaller. Students should use this hint and what they have previously learned about conservation of matter (matter is neither created nor destroyed) to decide how and from where new plate material is being formed on Earth. They need to support their claim with evidence and describe scientific principles that explain their ideas. **Explain: Discussion-Synthesizing-** Lead discussion about their completed scientific explanation. ● What was your claim about the origin of the rock that makes up Earth's plates? ● What evidence from phenomena and Earth events did you use to support your claim? ● What scientific principles did you use to explain the claim and evidence? ● How is the cycling of plate material related to scientific ideas you have learned about chemical reactions and phase changes? Allow students to provide any revisions necessary based on the discussion. **Elaborate:** Reading - Recycling for Earth and Cycling within Earth Students engage in discussion emanating from the following questions; ● What is the takeaway message from the unit thus far regarding the origin of new rock material? ● How can we use data about phenomena on Earth to make sense of how the Earth is changing?
Lesson Closing
Evaluate: Students must recall that "Due to the principle of conservation of matter, no new rock material is created or destroyed, rock is recycled as a result of moving plates. "

Since new plates are formed at divergent boundaries, as well as at subduction zones where the subducting plate melts and forms rock at volcanic eruptions, all the new rock material that forms on Earth is coming from rock material that already existed on or within the Earth.

Wrapping Up the Lesson

- The total amount of rock material on Earth is constant. This is all the rock material that will ever exist on Earth.
- Rock is not destroyed, but instead it can be cycled (melted, cooled, and reformed into solid rock). New plate material is formed from existing rock material that has melted.

How might you answer the Driving question, given what you learned about the cycling of plate material (rock) on and within the earth?

Lesson 8 Resources

IQWST

Lesson 8 slide deck

Reading 8.1

Earthguide Online Classroom: Scripps Institute of Oceanography:

Plate Tectonics: Subduction: An animated diagram of cross section of the earth's crust showing subduction

Earthguide Online Classroom: Scripps Institute of Oceanography:

Plate Tectonics: Seafloor Spreading: Seafloor spreading takes place at mid ocean ridges and produces basalt, the rock that makes up the oceanic crust. Animated illustration.

Lesson 9	**Lesson 9.:What do we know about Plate Tectonics?**	**Estimated Time: 9 days/50 minutes each**

Brief Overview of Lesson: The purpose of this lesson is to help students organize and further build their understanding related to the theory of plate tectonics before applying this knowledge to the case study sites. Students will also determine how different relative plate motions are associated with (and result in) specific features and events.

Day 1

- **Learning Intention:** I am learning that different relative plate motions are associated and with (and result in) specific features and events.
- **Success Criteria:** I can apply knowledge of plate tectonics theory to a cross section of the earth. I can label a detailed diagram of a cross section of Earth.

- **Brief Overview of Lesson:** Students will create and annotate a cross section of Earth.

Days 2-3

- **Learning Intention:** I am learning that different relative plate motions are associated with (and result in) specific features and events.
- **Success Criteria:** I can synthesize and organize the concepts and processes that are associated with each type of plate boundary or location. I explain how features and events are associated with plate boundary types.
- **Brief Overview of Lesson:** Students will create a clear and organized description of the theory of plate tectonics.

Days 4-6

- **Learning Intention:** I am learning how different relative plate motions are associated and with (and result in) specific features and events.
- **Success Criteria:** I can build a physical model showing the mechanism for plate tectonics and how it leads to features and events associated with different plate boundary types.
- **Brief Overview of Lesson:** Students will build physical models and construct written explanations describing their model.

Days 7-9

- **Learning Intention:** I am learning that different relative plate motions are associated with (and result in) specific features and events.
- **Success Criteria:** I can construct an explanation of the model.
- **Brief Overview of Lesson:** Students will construct written explanations describing their model.

What students should know and be able to do to engage in this lesson:

- This lesson connects to Lesson 1-8
- Scientific Principles
- Conservation of Matter and convection
- The seven options that cover all possible types of plate movement that can be found on Earth: continental convergent, oceanic-oceanic subduction, oceanic- continental subduction, divergent in ocean (ocean floor spreading), divergent on land, hotspots, and transform (plates slide alongside each other).

LESSON FOUNDATION

Assessed Standards for this lesson	Important content not included in the standards
• **MS-ESS1C.2:** Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. • **MS-ESS2B.1:** Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. *(MS-ESS2-3)* • **ESS2.A:** The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. • **ESS2.C:** Water's movements—both on the land and underground —cause weathering and erosion, which change the land's surface features and create underground formations. • **MS-ESS2A.1:** All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the Sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. *(MS-ESS2-1)*	**MS-PS1B.2**: The total number of each type of atom is conserved, and thus the mass does not change. *(MS-PS1-5)* **MS-PS1A.6**: The changes of state that occur with variations in temperature or pressure can be described and predicted using models of matter. *(MS-PS1-4)* **MS-PS3B.2:** The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. *(MS-PS3-4)* **MS-PS3B.3:** Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (*MS-PS3-3)* **MS-PS3C.1:** When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (*MS-PS3-2)* **MS-ESS1C.1:** The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (*MS-ESS1-4)*
Focus Question for this Lesson	
How do we know about Plate Tectonics?	
Learning Intention	**Success Criteria**
• *I am learning that different relative plate motions are associated with (and result in) specific features and events.*	*Day 1- I can apply knowledge of plate tectonics theory to a cross section of the earth. I can label a detailed diagram of a cross section of Earth.* *Day 2-3:*

	I can synthesize and organize the concepts and processes that are associated with each type of plate boundary or location. I explain how features and events are associated with plate boundary types. *Day 4-6:* *I can build a physical model showing the mechanism for plate tectonics and how it leads to features and events associated with different plate boundary types.* *Day 7-9* *I can construct an explanation of the model.*

Assessment(s)

Copy of Science Model Rubric

Exit Ticket

Development of Scientific Principles

Summary Table - Answer Key
How would you answer the Driving Question, How is the Earth changing? Is Earth Changing?

Students should be able to demonstrate that they know what causes plates to move and what happens as a result of this movement. They should also be able to demonstrate an understanding of how rock material (plates) can be cycled as plates are formed at divergent boundaries and then reformed into new continental rock (at volcanoes). Students should be able to demonstrate that they know what causes plates to move and what happens as a result of this movement. They should also be able to demonstrate an understanding of how rock material (plates) can be cycled as plates are formed at divergent boundaries and then reformed into new continental rock (at volcanoes).

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf

Rubric

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

- Earth's plates are located deep within the earth and are not exposed at the earth's surface
- Plates are feet thick and made of melted rock
- Earth's plates are separated by empty gaps
- The solid rock of a cliff is not a part of a plate
- The earth has seven plates and there is one continent on each plate
- Plates are arranged like a stack of layers in the earth.
- Ocean basins are not part of earth's plates
- Continents sit on top of a layer of water, and the water is above a plate
- The earth has about one hundred plates
- Plate boundaries only occur where continents meet ocean basins
- Continents are on top of plates but are not part of plates
- Continents only move inches over hundreds of years, not feet or miles
- Continental plate material is pushed beneath oceanic plate material when two plates push together
- When two plates push into each other, both plates will stop moving

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

When doing the summary charts, “transform boundary” is a good choice for students who are struggling with concepts, as it is one of the simpler models to construct.

If a group finishes particularly quickly, you can assign them another location to explore or have the students in that group split up to help other groups complete their models.
Students can create models in groups or individually, enabling you to differentiate instruction in a number of ways. You can differentiate by complexity of models, for example, or by the number of models that students create.

THE LESSON IN ACTION Lesson 9 Days 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: Students will begin this lesson by brainstorming a list of concepts they have learned. Students may use different terms to describe the same idea (e.g., the concept of convergence could also be listed as plates moving together). ● Students will be bringing together all that they have learned and will organize it in various ways. ● This will help them in the final lesson, when students will apply their knowledge to the case study sites around the world and answer the Driving Question for the unit: How Is the Earth Changing?
During the Lesson
Explore: Students will use what we have learned to create a clear and organized description of the theory of plate tectonics. **Explain**: We will use what we have learned to create a clear and organized description of the theory of plate tectonics. ● Creating a List of Important Ideas and Annotating a Cross Section of Earth ● Labeling the Cross-Section Diagram ● Students will briefly describe the concept of cross section to ensure that all students are making sense of the concept.
Lesson Closing
Extend: Reading 9.1 – How Well Do Scientists Understand Plate Tectonics? Now that students are working to synthesize all that they have learned in this unit, it is important for them to be aware that all questions regarding plate tectonics theory are not answered. Scientists are still working to fully understand plate tectonics. Ask: “What questions do you still have about the theory of plate tectonics?” ● What evidence have you gathered in this unit that the outer Earth moves? ● What evidence do you have that the interior portion of the earth is in motion?

THE LESSON IN ACTION Lesson 9 Days 2-3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Engage: Reading Follow up

What were some of the remaining unanswered questions mentioned in Reading 9.1?

Were any of these questions similar to those you had before the reading?

As a review, how are plate tectonics and the rock cycle model interrelated?

During the Lesson

Explore: Students will synthesize and organize the concepts and processes we have been learning to better understand plate tectonics. Working in pairs, students will review concept maps and complete a Summary Table that describes where, how, and why plate movement is/has happened. Assign a boundary type/location (along the top of the chart) to each group in class. That group will be responsible for sharing their summary of that boundary type with the rest of the class (This is a great opportunity to Jigsaw the assignment and then have groups share information)

- They should try to be as descriptive and detailed as possible when filling out this table.
- They should include details about patterns in features—for example, for the box about volcanoes at a subduction zone, they should record Yes (there are volcanoes associated with a subduction zone) and in a line on the continental plate.
- This description should give enough detail to help another person interpret their ideas.

Explain:

Discussion-Synthesizing

Students will synthesize and organize the concepts and processes we have been learning to better understand plate tectonics.

- Students should feel comfortable demonstrating or explaining the various features and events associated with the seven different types of plate boundaries/locations found on Earth.

Lesson Closing

Elaborate: Reading 9.2 – How Does Plate Tectonics Affect Me?

- What are some negative aspects of plate tectonics?

Extend: This reading should have helped students better understand why scientists continue to study science—all questions are never fully answered.

- What were some of the remaining unanswered questions mentioned in Reading 9.1?

- Were any of these questions similar to those you had before the reading?
- As a review, how are plate tectonics and the rock cycle model interrelated?

THE LESSON IN ACTION Lesson 9 Days 4-6

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Engage: Students will build a physical model synthesizing what we have learned about plate boundaries.

Students should feel comfortable with the various features and events associated with the seven different types of plate boundaries/locations found on Earth. These are the seven options that cover all possible types of plate movement that can be found on Earth: continental convergent, oceanic- oceanic subduction, oceanic- continental subduction, divergent in ocean (ocean floor spreading), divergent on land, hotspots, and transform (plates slide alongside each other). Before students can explore the case study sites in the final lesson, they will construct a physical model to accompany one of the seven plate interactions they have been exploring.

Assign each group at least one (or more if time permits) physical model to build off their assigned plate interaction.
Students will plan out how they will construct their model.

During the Lesson

Explore: Students will construct their models from their plan using available materials in the classroom.
Explain: Students should use all of their available resources as evidence when building the most accurate physical model that they can.

- Students are encouraged to build their models in a way that illustrates their knowledge.
- Models must be able to demonstrate the movement of plates as this model is used to help understand HOW the plates are moving and what features change/form on the earth's surface as a result.
    - What is moving?
    - What is not moving?
    - What is changing?
    - How will the boundary look in the future (millions of years from now)

Lesson Closing

Explain: Students should use all of their available resources as evidence when building the most accurate physical model that they can.

- Students are encouraged to build their models in a way that illustrates their knowledge.

- Models must be able to demonstrate the movement of plates as this model is used to help understand HOW the plates are moving and what features change/form on the earth's surface as a result.
    - What is moving?
    - What is not moving?
    - What is changing?
    - How will the boundary look in the future (millions of years from now)?

THE LESSON IN ACTION Lesson 9 Days 7-9
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Explore: We will write a description and construct an explanation of the model. ● The explanation should describe what the model shows, the advantages and limitations of the model, and the underlying mechanism (convection) for plate movement. ● Students will also summarize and explain the various types of locations on Earth that are geologically active, and relate this activity to the unseen process of convection occurring beneath the plates.
During the Lesson
Explain: Describing the model- Provide a checklist to assist students to be sure they have all the necessary parts in their explanation. The explanations have to be complete and accurate. They should describe what the model shows, the advantages and limitations of the model, and the underlying mechanism for plate movement. They need a key/legend to accompany the physical model. **Discussion-Synthesizing** ● Why is it important to understand how plates can move relative to one another? ● What is the reason plates move? ● What would happen to Earth if convection were to stop? ● What would lead to convection stopping? ● Why types of energy transfers and transformations occur in relation to plate tectonics and the movement of Earth's plates? ● How could we put together all of the physical models that we built? Can they be in any order? OR do some types of boundaries have to be next to other types/ ● How does the earth's cycling system work
Lesson Closing

Wrapping Up the Lesson

- We know what causes plates to move.
- We know what happens as a result of this movement.
- We understand how rock material (plates) can be cycled as plates are formed at divergent boundaries.
- Plates are melted and then reformed into new continental rock (at volcanoes).

Evaluate: How would you answer the Driving Question, How is the Earth changing? Is Earth Changing?
Students should be able to demonstrate that they know what causes plates to move and what happens as a result of this movement. They should also be able to demonstrate an understanding of how rock material (plates) can be cycled as plates are formed at divergent boundaries and then reformed into new continental rock (at volcanoes).

Lesson 9 Resources

IQWST

- **Lesson 9 slide deck**
- **Reading 9.1**
- **Reading 9.2**
- **PI-Summary Table of Boundary Types 1**
- **PI-Summary Table of Boundary Types 2**
- **PI-Convection and Direction of Plate Movement**
- **Summary Table**
- **Summary Table - Answer Key**

Nature: Ancient Crust Rises from the Deep:
Earth recycles — but it takes its time. Chemical remnants of the rigid surface plates that plunge deep into the planet's interior at subduction zones can eventually resurface on distant volcanic islands. But the process may take more than two billion years, a study published in this issue suggests.
USGS: Volcano Hazards Program: Plate Tectonics in a Nutshell:
Article and description of plate tectonics illustration; links to other aspects of the Volcano Hazards program.
USGS: Understanding Plate Motions: Scientists now have a fairly good understanding of how the plates move and how such movements relate to earthquake activity. Most movement occurs along narrow zones between plates where the results of plate-tectonic forces are most evident.
USGS: Plate Tectonics and People:
Over geologic time, plate movements in concert with other geologic processes, such as glacial and stream erosion, have created some of nature's most magnificent scenery. The Himalayas, the Swiss Alps, and the Andes are some spectacular examples. Yet violent earthquakes

related to plate tectonics have caused terrible catastrophes -- such as the magnitude-7.7 earthquake that struck the Chinese province of Hebei in 1976 and killed as many as 800,000 people.
The Geological Society: How do Plates Move?
Teacher background information on a competing hypothesis to convection currents as the mechanism of plate tectonics. Can be introduced to students to highlight the tentative nature of science and/or to engage students in authentic argumentation.

Lesson 10	**Lesson 10: What is Happening at the Case Study sites?**	**Estimated Time: 9, 50 min sections**

Brief Overview of Lesson: The purpose of this lesson is to bring together all that students have learned about the theory of plate tectonics and apply this knowledge to 10 case study sites around the world. In addition, students will use their knowledge of conservation of matter, the rock cycle, and convection and energy transformations, all of which are applicable to the recycling of Earth's plate material.
Days 1-3- Students will use their knowledge of conservation of matter, the rock cycle, and convection and energy transformations, to assign boundary types to each case study site.

Days 4-7-Students will explain how the earth is changing at a single case study site.

Days 8-9- Students will present their projects to the class. They will answer the Driving Questions: How is the Earth Changing? and consider how plate tectonics will affect the future of the Earth.

What students should know and be able to do to engage in this lesson:

- Conservation of Matter
- Plate Tectonics
- Convection
- Energy Transformations

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
ESS1.C: The History of Planet Earth Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. (secondary to MS-ESS2-3) **ESS2.B:** Plate Tectonics and Large-Scale System Interactions Maps of ancient land and water patterns, based on investigations of	**MS-PS1B.2**: The total number of each type of atom is conserved, and thus the mass does not change. *(MS-PS1-5)* **MS-PS1A.6**: The changes of state that occur with variations in temperature or pressure can be described and predicted using models of matter. *(MS-PS1-4)*

rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. **ESS2.A:** Earth's Materials and Systems The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. **ESS2.C:** The Roles of Water in Earth's Surface Processes Water's movements—both on the land and underground —cause weathering and erosion, which change the land's surface features and create underground formations.	**MS-PS3B.2:** The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. *(MS-PS3-4)* **MS-PS3B.3:** Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (*MS-PS3-3)* **MS-PS3C.1:** When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (*MS-PS3-2)* **MS-ESS1C.1:** The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (*MS-ESS1-4)* **MS-ESS2A.1:** All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the Sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. *(MS-ESS2-1)* **MS-ESS2A.2:** The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. *(MS-ESS2-2)*
Focus Question for this Lesson	
Will the earth ever stop changing?	
Learning Intention	**Success Criteria**

I am learning that Plate Tectonics will affect the future of the earth.	*Day 1-3:* ● *I can explore a subset of case study sites and assign plate boundary types to each location.* ● *I can use models to explain how plate tectonics affects the earth.* *Day4-7:* ● *I can write a detailed scientific explanation of a single case study site.* ● *I can use diagrams, drawings, and physical models to support the explanation.* ● *I can conduct additional research to gather evidence about the assigned site.* *Day 8-9* ● *I can write a detailed scientific explanation to answer the Driving Questions: How is the Earth Changing?*

Assessment(s)

Written Explanations: Answer the Driving Questions in the form of a CER 8th CER Rubric

Project Presentation

Case Study Site Summary Table Answer Key

Students should be able to explain that the interior of Earth is hot and the heat moves outward. This phenomenon of convection explains why the hot material in the mantle moves upward, while cooler rock sinks (the mantle is solid but so hot that it can flow very slowly over time). Students should also be able to explain that the moving mantle supports plays a major role in causing plates to interact at boundaries.
Geologic features and events occur and can be seen/detected at the surface of the earth.
Cycling of rock material continues as plates continue to move on Earth's surface.

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf

8th CER Rubric

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

Case study sites are located on plate boundaries

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks

- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

When students are asked to share their ideas in class, sometimes certain students take over the discussion. When their ideas are shared, the class moves forward as they are deemed correct. One strategy to deal with this is to ask for several opinions without evaluating any of them. If one student says the boundary type is a collision, ask if there are any other ideas from other students. The teacher can also list all of the ideas on the board.

In this activity, students will write a scientific explanation about one case study site. The teacher has several options for assigning students to the sites.

- You can allow students to choose which site they will study. This is the preferred method, as students who have choices in the learning process have greater internal motivation to learn.
- You can assign students to a site to be sure each site is covered in the class. This is less important than allowing students the opportunity to choose what they would like to study in more detail.

Teachers may choose to have students work on computers and give them time to find any pictures/diagrams/additional information that would enrich their explanation and final project.
It is helpful and motivating to include students in the decision about the type of final project that the class will do. You can offer a few suggestions (class website, a field guide booklet, pamphlets, posters, and so on) and ask students to choose which type of project they want to complete

Some students may want to work together to build a website describing their case study sites, while other students may want to work alone and produce a pamphlet about their site. The teacher can have students present their explanations in a few different ways, depending on how the work is to be assessed.

Here are several options for the final project presentations.

- Have students form groups based on their case study sites (all students who studied a certain site should be together). Allow these students time to work together to form one explanation that covers all of the necessary ideas. This could then be presented to the class as a group.
- If you would rather have students not present their projects to the class, you can stage a science fair in the classroom or library, where the projects are on display, and students move around the room to learn from them during one class period. This type of presentation is more individualized and will allow you to assess students' individual understanding more easily.
- Have students form groups with different sites. Allow each student time to present in small groups (about three or four students in a group), and then rotate to form a new group of three or four students. Continue with this procedure until all students have met and talked with someone from each of the 10 case study sites. This way, all students will be exposed to the explanations of all sites.

THE LESSON IN ACTION Lesson 10 Days 1-3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: This lesson is the culminating lesson for the unit and will take approximately nine periods. Students have now explored the various types of phenomena associated with the theory of plate tectonics. ● It will help students solidify and deepen their understanding of this theory by applying it to actual locations on Earth—case study sites.
During the Lesson
Explore: Students have now explored the various types of phenomena associated with the theory of plate tectonics. It will help students solidify and deepen their understanding of this theory by applying it to actual locations on Earth—case study sites. Display PI-Direction of Plate movement to briefly help interpret the general direction of movement for each of Earth's major plates. Case Study: ● Students should try to characterize two or three case study sites each day. ● Emphasis the importance of gathering evidence to support their claim of the type of plate boundary at each site. **Explain:** Reach a consensus of how to characterize the case study sites.

- What type of boundary/location did you assign to the site?
- Does everyone agree with this characterization? If not, how did you characterize the site?
- What is your evidence to support this characterization?
- Do you have disconfirming evidence?
- Can we come to a consensus?

Lesson Closing

Elaborate: Reading 10.1: How are Case Studies Useful?

Due to the emphasis on case study sites in the final portion of this unit, students need to gain a better understanding of why case studies are important and useful to scientists. Ask students why they think they are studying certain locations on Earth in this unit.

- Why are case studies useful to scientists?
- How can case studies help us understand many places on Earth?

THE LESSON IN ACTION Lesson 10 Days 4-7

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Engage: Students review the identified boundary types that were characterized for each of the 10 case study sites. Review the claims and evidence that supports them from their summary table.

- What are some of the scientific principles that you have used in the unit?
- How could those scientific principles be used to explain the type of boundary chosen to associate with the features and events described?

During the Lesson

Explain: Students will write a scientific explanation for one of the case sites.

This is an individual activity.

- How have geologic events impacted life at that site?
- How has that site changed over geologic time?
- How quickly are the plates moving at that site?
- What else interests you?
- What are some of the scientific principles that you have used in the unit?
- How could those scientific principles be used to explain the type of boundary chosen to associate with the features and events described?

Lesson Closing

- Students should include diagrams to support their ideas; including captions to explain to another person what they should be noticing. They can include photos of the physical models that were built in class. Drawing arrows and pointing out important aspects of the models/photographs.

THE LESSON IN ACTION Lesson 10 Days 8-9

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

We will share our project with the class.

- Students should now have a written scientific explanation to describe how, and explain why, their case study site looks the way it does. Now they will present their findings to the class. (Refer to the Preparation section (Teaching Strategies) for suggestions about types of presentations.)
- The purpose of this activity is to highlight important concepts from the unit.
- Some of the Making Sense/Conclusion questions students are asked include

- What reasoning was used by most/all of the students, regardless of the case study site on which they focused?
- Were there different explanations provided for the same case study site?
- How could this difference be explored further to lead to a consensus?
- What other types of information might be useful when studying case study sites?

During the Lesson

We will undertake a presentation of projects undertaken during the case study.

Answering the Driving Questions

- How and why is the earth changing? What are some different ways to answer the questions?
- Will the earth ever stop changing?
- What could make this happen?

Lesson Closing

Evaluate: Case study sites around the world can help us apply the theory of Plate tectonics to explain the various features and events observed and experienced.

- (**Assessment Opportunity:** Students' individual scientific explanations can be used as an assessment of their understanding of the concepts of this unit).
- Case study sites around the world can be useful to help us understand how the theory of Plate tectonics explains the various features and events observed and experienced.

- Students should be able to explain that the interior of Earth is hot and the heat moves outward. This phenomenon of convection explains why the hot material in the mantle moves upward, while cooler rock sinks (the mantle is solid but so hot that it can flow very slowly over time). Students should also be able to explain that the moving mantle supports plays a major role in causing plates to interact at boundaries. Geologic features and events occur and can be seen/detected at the surface of the earth.
- Cycling of rock material continues as plates continue to move on Earth's surface.

Wrapping up the Unit

Guide students to create a chain of causation (as this will prepare them for doing a similar activity in the next unit) that leads to plate movement.

1. The interior of Earth is hot.
2. The heat moves outward.
3. Hotter material in the mantle moves upward, while cooler rock sinks (the mantle is solid but so hot that it can flow very slowly over time).
4. The moving mantle supports and carries the plates that rest on top, like a conveyor belt.
5. When plates interact at boundaries, geologic features and events occur and can be seen/detected at the surface of the earth.
6. Cycling of rock material continues as plates continue to move on Earth's surface.
7. The total amount of matter remains the same but changes form over time.

Lesson 10 Resources

IQWST

- **Lesson 10 slide deck**
- **Reading 10.1**
- **PI-Case Study Site Summary Table 1**
- **PI-Case Study Site Summary Table 2**
- **Case Study Site Summary Table Answer Key**

Geology.com: Convergent Plate Boundaries: Oceanic and Continental Plates:

Discusses how Japanese Islands and Andes Mountains were formed. Convergent plate boundaries are locations where lithospheric plates are moving towards one another. The plate collisions that occur in these areas can produce earthquakes, volcanic activity and crustal deformation.

Geology.com: Mt. St. Helens:

Mount St. Helens is a stratovolcano located in southern Washington, in the western part of the Cascade Mountain Range. It is about 100 miles south of Seattle, Washington and 50 miles northeast of Portland, Oregon. It is an eruptive volcanic cone built up of interlayered ash, pumice, lava flows, volcanic domes and other deposits. It is a young volcano. The first eruptions occurred about 40,000 years ago and it grew in a series of eruptive stages.

Geology.com: The "Yellowstone Supervolcano" produced some of Earth's largest eruptions.:

Yellowstone National Park is world-famous for its geysers and hot springs. Those thermal features are easy-to-observe evidence of an active magma system beneath the Park. This magma system has produced some of the largest volcanic eruptions in Earth's history - eruptions so large that they have been called "super volcanoes". One of these eruptions produced a caldera that is about 50 miles across.

Geology.com: Mt. Etna: Italy:

Mount Etna is Europe's highest and most active volcano. Towering above the city of Catania on the island of Sicily, it has been growing for about 500,000 years and is in the midst of a series of eruptions that began in 2001. It has experienced a variety of eruption styles, including violent explosions and voluminous lava flows. More than 25% of Sicily's population lives on Etna's slopes, and it is the main source of income for the island, both from agriculture (due to its rich volcanic soil) and tourism.

Geology.com: Transform Plate Boundaries:

Discusses San Andreas Fault: Transform Plate Boundaries are locations where two plates slide past one another. The fracture zone that forms a transform plate boundary is known as a transform fault. Most transform faults are found in the ocean basin and connect offsets in the mid-ocean ridges. A smaller number connect mid-ocean ridges and subduction zones.

Geology.com: Divergent Plate Boundary: Oceanic:

Discusses Mid-ocean Ridge and Red Sea: Divergent plate boundaries are locations where plates are moving away from one another. This occurs above rising convection currents. The rising current pushes up on the bottom of the lithosphere, lifting it and flowing laterally beneath it. This lateral flow causes the plate material above to be dragged along in the direction of flow. At the crest of the uplift, the overlying plate is stretched thin, breaks and pulls apart

East Africa's Great Rift Valley:

A Complex Rift System: Discusses Horn of Africa: The East African Rift System (EARS) is one the geologic wonders of the world, a place where the earth's tectonic forces are presently trying to create new plates by splitting apart old ones.

Discovery.com: New Japanese Island Forming in the Pacific Ocean: Photos and evidence of new island formation.

Unit 2: Life Science

Unit Plan- Why Do Organisms Look the way they do?

Stage 1 – Desired Results	
ASSESSED FOCUS STANDARDS: **LS1.A: Structure and Function** ● Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2) **LS1.B: Growth and Development of Organisms** ● Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) ● Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4) ● Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5) **LS1.D. Information Processing** ● Each sense receptor responds to	*Unit Description* Anchoring Phenomenon  Students will observe images of living organisms, discuss what traits allow them to determine whether an organism is a member of a specific species, and to develop a list of traits that differentiate humans from other organisms and one human from another. Why Do Organisms Look the Way They Do? Is a 7-week Life Science unit organized around three clusters of ideas: heredity, variation within and between species, and natural selection. These three clusters of ideas focus on different levels of organization: the individual, species, and populations. The organizing theme is focused on the similarities and differences between

different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1- 8)

LS2.A: Interdependent Relationships in Ecosystems

- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological components of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)

organisms. What makes them similar or different and how does that happen? The target science ideas and scientific practices explored in the unit are instrumental to understanding and answering the Driving Question: Why Do Organisms Look the Way They Do? Students complete investigations, conduct research and use acquired knowledge to develop understanding why all organisms are similar but different.

Meaning

ENDURING UNDERSTANDINGS

1. Offspring can get instructions for a trait from either parent.
2. Different offspring of the same two parents can inherit different traits from each parent.
3. For some traits, when parents have the same trait, the offspring always have the same trait as the parents (e.g., two non-taster parents can only have non-taster offspring).
4. For some traits, one variation is more likely to be passed on from the parents (e.g., one blue-eyed and one brown-eyed parent usually have brown-eyed children).
5. It is possible for offspring to have a trait that neither parent shows (e.g., a redheaded child of two brown-haired parents).
6. Two organisms can express the same trait but carry different genetic information.
7. Each trait is determined by two copies of instructions: one inherited from the mother and one from the father.
8. When two copies of information for a trait are not the same, one variation

ESSENTIAL QUESTIONS

- Why Do I Look the Way I Do?
- How Does the Inside Affect the Outside?
- Why Does Variation Matter?

LS3.A: Inheritance of Traits • Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1) • Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2) **LS3.B: Variation of Traits** • In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2) • In addition to variations that arise from sexual reproduction, genetic information can be altered because of	determines the expressed trait (phenotype). 9. Two parents can pass on a trait neither expresses if both parents contain one copy of each variation and the offspring happens to get both non-expressed alleles. 10. Some traits (e.g., PTC [phenylthiocarbamide] tasting, tongue rolling) have only two variations. Other traits have a continuous range of variations (e.g., height, eye color, skin color). 11. Changes in a population can occur when a population of organisms varies on an inherited trait; there is a change in the environment that affects the organism's survival; one variation of the trait has an advantage for survival; individuals with that variation are more likely to survive and reproduce; or the proportion of individuals with that variation increase in the next generations.	
	What students will know and be able to do	
	KNOWLEDGE • A trait is a characteristic of an organism that can be inherited, or acquired, or inherited and affected by the environment. • There are patterns in how traits appear to be passed from parents to offspring. • Somehow information about traits can be passed on even if it cannot be seen in parents.	**SKILLS** **NJSLS-S Performance Expectations:** ***Students who demonstrate understanding can…*** • **MS--LS1--2.** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.[Clarification Statement:

mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others are harmful,and some neutral to the organism. (MS-LS3-1) **LS4.B: Natural Selection** • Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4) • In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring. (MS-LS4-5) **LS4.C: Adaptation** • Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6) **ESS3.C: Human Impacts on Earth**	• There are similarities and differences in the human and plant pedigrees. • Each parent contributes a copy of DNA instructions (genes) to an offspring. • The offspring, therefore, has two copies (alleles) of the gene, half from each parent. • During meiosis, a number of different combinations of the gametes will be produced. • Each time a different egg from the same mother is fertilized by a sperm of the same father, different combinations of traits are likely to be in the egg and sperm. • Some alleles are dominant and some can be recessive. • If the alleles are not the same, the instructions of the dominant allele show up in the phenotype. • Individuals with one dominant and one recessive allele for a trait are called carriers. They can pass either allele on to their children. • Variations in traits can have consequences for survival of organisms and populations. • Variations matter. Variation can cause certain individuals to survive and have offspring. This can cause a population change.	Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] Cause and Effect Structure and Function Energy and Matter Scale, Proportion, Quantity Developing and Using Models. Planning and Carrying out Investigations Constructing Explanations and Designing Solutions Engaging in Argument from Evidence Obtaining, evaluating, and communicating Information • **MS--LS1--4.** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples

Systems • Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-3) **CONTENT CONNECTIONS:** **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-4), (MS-LS1-5), (MS-LS2-1), (MS-LS2-2), (MS-LS2-4), (MS-LS3-1), (MS-LS4-4), (MS-LS4-5) **RST.6-8.2** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-5) **RST.6-8.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. (MS-LS3-1), (MS-LS3-2) **RST.6-8.7** Integrate quantitative or technical information expressed in words in a text		of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] Patterns Cause and Effect Structure and Function Energy and Matter Scale, Proportion, Quantity Developing and Using Models. Planning and Carrying out Investigations Constructing Explanations and Designing Solutions Engaging in Argument from Evidence Obtaining, evaluating, and communicating Information • **MS--LS1--5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species

with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). . (MS-LS2-1), (MS-LS3-1), (MS-LS3-2) **RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-LS4-4) **RI.6.8** Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-4) **WHST.6-8.1** Write arguments focused on discipline content. (MS-LS1-4), (MS-LS2-4) **WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-5), (MS-LS4-4) **WHST.6-8.7** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ESS3-3) **WHST.6-8.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.		of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] Patterns Cause and Effect Structure and Function Energy and Matter Scale, Proportion, Quantity Developing and Using Models. Planning and Carrying out Investigations Constructing Explanations and Designing Solutions Engaging in Argument from Evidence Obtaining, evaluating, and communicating Information • **MS--LS1--8.** Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.] Patterns Cause and Effect Structure and Function Energy and Matter

(MS-LS1-8), (MS-LS4-5), (MS-ESS3-3) **WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5), (MS-LS2-2), (MS-LS2-4), (MS-LS4-4) **SL.8.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS-LS2-2), (MS-LS4-4) **SL.8.4** 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.(MS-LS2-2), (MS-LS4-4) **SL.8.5** Integrate multimedia and visual displays in presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2), (MS-LS3-1), (MS-LS3-2) **MP.4** Model with mathematics. (MS-LS3-2), (MS-LS4-6) **6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.(MS-LS4-4), (MS-LS4-6), (MS-ESS3-3) **6.EE.B.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified		Scale, Proportion, Quantity Developing and Using Models. Planning and Carrying out Investigations Constructing Explanations and Designing Solutions Engaging in Argument from Evidence Obtaining, evaluating, and communicating Information • **MS--LS2--1.** Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.] Patterns Cause and Effect Analyzing and Interpreting Data • **MS--LS2-2.** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of

set. (MS-ESS3-3) **6.EE.C.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-2) **6.SP.A.2** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. (MS-LS1-4),(MS-LS1-5) **6.SP.B.4** Summarize numerical data sets in relation to their context. (MS-LS1-4), (MS-LS1-5) **6.SP.B.5** Summarize numerical data sets in relation to their context. (MS-LS2-2), (MS-LS3-2), (MS-LS4-4), (MS-LS4-6) **7.EE.B.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-3) **7.RP.A.2** Recognize and represent proportional relationships between quantities.(MS-LS4-4), (MS-LS4-6), (MS-ESS3-3)		interactions could include competitive, predatory, and mutually beneficial.] Patterns Constructing Explanations and Designing Solutions • **MS--LS2--4.** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.] Stability and Change Engaging in Argument from Evidence • **MS--LS3--1.** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects on the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] Structure and Function • **MS--LS3--2.** Develop and use a model to describe why asexual

		reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.] Cause and Effect Constructing Explanations and Designing Solutions • **MS--LS4--4.** Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.] Constructing Explanations and Designing Solutions • **MS--LS4--5.** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of

		humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.] Obtaining, Evaluating and Communicating Information • **MS--LS4--6.** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] Using Mathematics and Computational Thinking • **MS--ESS3--3.** Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from

		streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).] Cause and Effect Constructing Explanations and Designing Solutions

Stage 2 – Evidence

SUMMATIVE ASSESSMENT(S)

The Unit Driving Question: Why do Organisms Look the way they do?

- Claim: Organisms look the way they do because…heredity, variation, natural selection.
- Evidence: focuses on the similarities and differences between organisms - heredity, variation within and between species, and natural selection - affect the individual, species, and populations.
- Reasoning: Integrates the Scientific Principles learned from analyzing and synthesizing the evidence to form a conclusion statement: the claim.

There are CERs built in throughout the unit that can be planned to build on one another to strengthen their written articulation of the standards.

CER Poster

CER Scaffold

There are CERs built in throughout the unit

Lab analysis questions/data analysis

Lesson Set 1: Lessons 1-4

CER: Why Do I Look the Way I Do?

Lesson Set 2: Lessons 5-7

CER: How Does the Inside Affect the Outside?

Lesson Set 3: Lessons 8-11

CER: Why Does Variation Matter?

STEM Gauge STEM Gauge_MS_Growth_Devel_and Repro_Item Set.pdf

124061A.pdf, 136790A.pdf, 137584A.pdf,182980A.pdf,184176A.pdf

PRE-ASSESSMENT		
Why do Organisms look the way they do? Science Probe **Page Keeley**		
Integration of 21st Century Skills	**Integration of Technology**	**Career Education**
● 9.1.4.A.1 Explain the difference between a career and a job and identify various jobs in the community and the related earnings. ● 9.1.4.A.2 Identify potential sources of income. ● 9.1.4.A.3 Explain how income affects spending and take-home pay. ● 9.2.4.A.1 Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals. ● 9.2.4.A.2 Identify various life roles and civic and work-related activities in the school, home, and community. ● 9.2.4.A.3 Investigate both traditional and nontraditional careers and relate information to personal likes and dislikes. ● 9.2.4.A.4 Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.	● Chromebooks ● IQWST Digital Portal ● Computer simulations ● Discovery Education Videos ● IQWST Projected Images ● IQWST Audio Recordings ● IQWST Activity 2.2: Flower Dissection ● Newsela articles ● Phet ● EdPuzzle Additional Resources: ● Google Classroom ● Google Jamboard ● Seesaw ● Screencastify ● Wevideo ● Padlet ● Flipgrid ● Kahoot **V-Lab Activity: Mendel's Monster Factory** **Description:** In this lab, students learn about the foundations of genetics such as inheritance, dominant and recessive genes, Punnet squares and the difference between genotypes and phenotypes. Students will also simulate the transferring of genes from parent to offspring by creating their own monster baby with Play-Doh.	**Career Connection:** Please use the above link to Login and access the Career Connection: ● Click on NJResident ● Select "Newark" and enter ZipCode ● After you login, click on the link below to access more information **Overview - Biologists** Biologists study plant and animal life ranging from single cell organisms to large animals. Their findings help solve problems, such as plant diseases or possible extinction of some animals. They also research ways to solve problems in human health. Some biologists do basic research. They study the world to gain knowledge. Other biologists do applied research. They use knowledge gained from research to create new products or processes. Biologists read articles and attend conferences to learn more about their research area. They determine research questions and design experiments to study those questions. Depending on the type of organism they study, biologists conduct experiments in a lab, forest, or other site. They may work with the organisms

	• **Teacher Resources** • **Alignment:**(MS-LS3-1, MS-LS3-2)	themselves, or have research assistants do much of the work for them. If they have assistants, scientists train them how to conduct the research and keep records. Once data is gathered, biologists analyze the data. They interpret the results and write reports. They may present their findings at conferences. Some biologists teach at colleges and universities. If they have a teaching certificate, they can also teach at high schools. There are several subfields in biology: Biochemists study the chemical makeup and processes of living things; Biophysicists study the electrical and mechanical energy properties of cells and organisms; Microbiologists study the growth, development, and characteristics of bacteria and other small organisms.
Stage 3 – Learning Plan		
UNIT VOCABULARY		
Traits Species variations Inherited Traits Acquired Traits DNA Chromosome Receptor Asexual Reproduction Sexual Reproduction Germinate	Generation Pedigree Genetic Counseling Sickle Cell Anemia Dominant Recessive Genetic Karyotype Meiosis Mitosis	Somatic Cell Allele Gene Sex cells- Gametes Phenotype Genotype Carrier Histogram Individual Population

SUMMARY OF KEY LEARNING

Lesson 1: Day 1 - Organisms and Trait

- **Learning Intention:** I am learning that traits distinguish organisms from one another.
- **Success Criteria:** I can identify the traits of an organism to draw conclusions and generate questions.
- **Brief Overview of Lesson:** Students will examine images of organisms and discuss what makes humans different from other organisms. Looking at images of fish, plants, and birds, students will identify common and differing structures and hypothesize how they get the structures they need.

Lesson 1: Day 2- Inherited or Acquired Traits?

- **Learning Intention:** I am learning that trait variations can be inherited or acquired.
- **Success Criteria:** I can gather human trait data to identify patterns in inherited and acquired trait variations.
- **Brief Overview of Lesson:** Students will survey the class, collect data of observable human traits and possible variations to distinguish between traits and their variations, and which traits are acquired vs. inherited.

Lesson 1: Day 3 - More about Traits

- **Learning Intention:** I am learning that trait variations can be inherited or acquired.
- **Success Criteria:** I can develop questions about the patterns/causes about how organisms acquired or inherited trait variations.
- **Brief Overview of Lesson:** Students will develop questions about traits based on the data they collected.

Lesson 2: Day 1 - Taste, Acquired or Inherited?

- **Learning Intention:** I am learning that there are variations of inherited traits between parents and their offspring.
- **Success Criteria:** I can obtain and evaluate information about why some traits are inherited. I can develop questions for the causes of why some traits are inherited.
- **Brief Overview of Lesson:** Students will collect and analyze data on the ability to taste PTC to determine whether what we like to eat is inherited or not. Then students collect and analyze data on tongue rolling to see if it's connected to the PTC tasting trait.

Lesson 2: Day 2-Traits and Plant Reproduction

- **Learning Intentions:** I am learning that plants reproduce in a variety of ways and have specialized features for reproduction.
- **Success Criteria:** I can use models to obtain information about plants' reproductive structure and function. Prepare seeds for exploring how different traits are passed down.
- **Brief Overview of the Lesson:** Students will cross and germinate plant seeds of the same species, but with a noted variation: purple vs.non- purple stems (seeds sprout in 2-3 days).

Lesson 2: Day 3: Traits and Plant Reproduction

- **Learning Intentions:** I am learning how to distinguish between the influence of inheritance and environment on traits.
- **Success Criteria:** I can plan an investigation to observe how traits can be passed down to offspring.
- **Brief Overview of the Lesson:** Students will discuss how they could observe traits being passed from parent to offspring, then dissect a flower to see how plant reproduction compares to human reproduction.

Lesson 3: Day 1 - Pedigrees and Traits

- **Learning Intention:** I am learning that offspring can get instructions for a trait from either parent.

- **Success Criteria:** I can examine human pedigree data to determine patterns in how traits are inherited.
- **Brief Overview of Lesson:** Students will use model pedigrees to determine if there are any patterns for how traits are inherited, then generate questions from those patterns. Ss develop claims to those questions based on evidence in their "Pattern and Evidence" chart.

Lesson 3: Day 2 - Patterns in Traits?

- **Learning Intention:** I am learning that plants reproduce in a variety of ways and have specialized features for reproduction.
- **Success Criteria:** I can determine patterns in the way plant traits are passed from one generation to the next.
- **Brief Overview of Lesson:** Students will analyze the results of their plant experiments for any patterns in how traits are inherited and compare these patterns to the human pedigree patterns. These results are added to the Pattern and Evidence Chart.

Lesson 3: Day 3 - Can Pedigrees help us to determine Patterns in Traits?

- **Learning Intention:** I am learning that traits can be inherited or acquired in plants and humans.
- **Success Criteria:** I can make predictions to what traits will appear in the second generation of plants based on observations.
- **Brief Overview of Lesson:** Students will review observations from the previous activity, where students discovered that the PTC and tongue data did not always match with the plant data and develop a scientific explanation.

Lesson 4: Day 1 - Traits over Generations/ Pedigrees

- **Learning Intention:** I am learning that there are patterns in how traits appear to be passed from parents to offspring over generations in both plants and humans.
- **Success Criteria:** I can evaluate information from human pedigrees about inherited traits from previous lessons to determine the patterns that occur over generations.
- **Brief Overview of Lesson:** Students will analyze additional generations of the PTC taster pedigrees from previous lesson to better understand how traits are passed from one generation to the next

Lesson 4: Day 2 - Traits over Generations/ Seed offsprings

- **Learning Intention:** I am learning that there are patterns in how traits appear to be passed from parents to offspring over generations in both plants and humans.
- **Success Criteria:** I can obtain and evaluate and interpret data to uncover patterns in generational growth in plants.
- **Brief Overview of Lesson:** Students will check and record the results of seed plantings set up in previous lessons to better understand how traits are passed from one generation to the next.

Lesson 4: Day 3 - Traits over Generations

- **Learning Intention:** I am learning that there are patterns in how traits appear to be passed from parents to offspring over generations in both plants and humans.
- **Success Criteria:** I can synthesize information about heredity patterns from plants and humans.
- **Brief Overview of Lesson:** Students will synthesize the information about heredity patterns from plants and humans and add to the Pattern and Evidence Chart.

Lesson 5: Day 1 - How Do I Get New Cells?

- **Learning Intention:** I am learning that each parent contributes a copy of DNA instructions (genes) to an offspring,
- **Success Criteria:** I can compare cell division in somatic cells and sex cells to understand how each serves its function.

- **Brief Overview of Lesson:** Students will compare cell division in somatic cells (i.e. mitosis) and sex cells (i.e. meiosis) to understand how organisms can appear the same on the outside, but not carry the same instructions on the inside.

Lesson 5: Day 2 - How Can Parents Produce Offspring with Different Traits?

- **Learning Intention:** I am learning that each parent contributes a copy of DNA instructions (genes) to an offspring.
- **Success Criteria:** I can model how alleles can separate to produce multiple combinations in gametes.
- **Brief Overview of Lesson:** Students will determine the amount of gamete combinations resulting during meiosis by experimenting with imaginary organisms.

Lesson 6: Day 1- Model Inheritance

- **Learning Intention:** I am learning organisms can appear the same on the outside but not carry the same instructions on the inside.
- **Success Criteria:** I can develop a model of inheritance that explains all of their observations and data about plants. I can test the model against the available evidence.

- **Brief Overview of Lesson:** Students will develop a model of inheritance that explains: How two purple plants can behave differently when producing offspring? - How can an organism pass on a trait that it does not show?

- **Lesson 6: Day 2-Model Inheritance**

- **Learning intentions:** I am learning organisms can appear the same on the outside but not carry the same instructions on the inside.
- **Success Criteria:** I can Compare both models from previously created to try to explain the plant data they have collected. I can Determine which model better fits the data.
- **Brief Overview of Lesson:** Students will test two different models against the plant data they collected - the "non-purple is stronger" model vs. the "purple is stronger" model.

Lesson 7: Day 1- Dominant or Recessive Traits

- **Learning Intention:** I am learning that some alleles are dominant and some can be recessive. I am learning that if the alleles are not the same, the instructions of the dominant allele show up in the phenotype.
- **Success Criteria:** I can determine the genotypes in human pedigrees. I can apply their model to those pedigrees.
- **Brief Overview of Lesson:** Students will apply their model of inheritance to traits in humans, specifically using the PTC tasting data and tongue-rolling data.

Lesson 7: Day 2- Dominant or Recessive Traits/ Albinism case study

- **Learning Intention:** I am learning that some alleles are dominant and some can be recessive. I am learning that if the alleles are not the same, the instructions of the dominant allele show up in the phenotype.
- **Success Criteria:** I can explain dominant and recessive traits by applying the ideas of dominant and recessive to another human example, Albinism.
- **Brief Overview of Lesson:** Students will apply inheritance model and data to case study of Albinism to provide an explanation for dominant and recessive traits.

Lesson 8: Day 1- Trait Variations/What to do with data?

- **Learning Intention:** I am learning that multiple genes can lead to variations of a trait.
- **Success Criteria:** I can identify a trait within the class population that has multiple variations (height). I can collect data and figure out how to represent them.
- **Brief Overview of the Lesson:** Students will collect, represent, and analyze data on traits with multiple variations.

Lesson 8: Day 2- Trait Variations/Collecting Data

- **Learning Intention:** I am learning that multiple genes can lead to variations of a trait.
- **Success Criteria:** I analyze data to describe the trait variation in a population
- **Brief Overview of the Lesson:** Students will use the combined height data from the previous lesson to construct a class histogram.

Lesson 8: Day 3- Trait Variations/ What does my data mean?

- **Learning Intention:** I am learning that multiple genes can lead to variations of a trait.
- **Success Criteria:** I analyze distributions of trait data to compare subgroups in a population.
- **Brief Overview of the Lesson:** Students will observe organisms; identify traits and multiple variations and analyze data from three different populations: snails, guppies, and orchids.

Lesson 8: Day 4- Trait Variations/ Explain my data

- **Learning Intention:** I am learning that multiple genes can lead to variations of a trait.
- **Success Criteria:** I explain how multiple genes can lead to variations of a trait.
- **Brief Overview of the Lesson:** Students will engage in a teacher-led thought exercise to demonstrate how multiple genes can affect one trait: height.

Lesson 9: Day 1-Peppered Moths

- **Learning Intention:** I am learning that variations in traits can have consequences for survival of organisms and populations.
- **Success Criteria:** I can identify the advantages of some traits on the survival of the Peppered Moth population.
- **Brief Overview of Lesson:** Students will engage in an experiment to find food in high places around the room without jumping or standing on a chair to demonstrate how height can be an advantage in obtaining food. Students will read about the peppered moth variations and hypothesize why the dark form of the moth is becoming more frequent and why the light form is less frequent.

Lesson 9: Day 2-What happened to the Peppered Moths?

- **Learning Intention:** I am learning that variations in traits can have consequences for survival of organisms and populations.
- **Success Criteria:** I can analyze data to explain the change in the two types of moths.
- **Brief Overview of Lesson:** Students will analyze real data from the peppered moth phenomenon to construct a chain of reasoning for why the frequencies in moth populations have changed.

Lesson 9: Day 3-Do Variations in Peppered Moths matter?

- **Learning Intention:** I am learning that variations in traits can have consequences for survival of organisms and populations.
- **Success Criteria:** I can construct an evidence-based explanation CER to account for the change in frequencies of the two types of moths.
- **Brief Overview of Lesson:** Students will use their chain of reasoning from the previous lesson to construct an evidence-based explanation for why the population of peppered moths has changed over time.

Lesson 10: Days 1-3- Darwin's Finches Investigation

- **Learning Intention:** I am learning that changes in the environment influence the survival of a population. I am learning that trait variations can account for population change and survival over time.
- **Success Criteria:** I can obtain information about the ecosystem of the Galapagos and learn about the ground finch, which will be the focus of their investigation.
- **Brief Overview of Lesson:** Students will explore the Galapagos ecosystem using simulation that introduces students to the ground finch. They brainstorm why so many finches have died and why some survived.

Lesson 10: Days 4-6-Darwin's Finches Investigation/ Collecting Data

- **Learning Intention:** I am learning that changes in the environment influence the survival of a population. I am learning that trait variations can account for population change and survival over time.
- **Success Criteria:** I obtain and evaluate information to identify the traits that changed in the Finch populations.
- **Brief Overview of Lesson:** Students will use data logging software to record data about what finches survived, what finches did not, and whether variation in the finches and other factors might affect their survival.

Lesson 10: Days 7-9-Darwin's Finches Investigation/ Solving the Mystery

- **Learning Intention:** I am learning that trait variations can account for population change and survival over time.
- **Success Criteria:** I can construct a detailed evidence-based scientific explanation to account for the change in variation of a population.
- **Brief Overview of Lesson:** Students will continue to collect data to support their claim about what happened to the finches.

Lesson 11: Day 1-Natural Selection

- **Learning Intention:** I am learning that variations can cause certain individuals to survive and have offspring, which can cause a population change. I am learning that variations can be influenced by environmental factors.
- **Success Criteria:** I can construct a model from two evidence-based explanations to explain population change.
- **Brief Overview of Lesson:** Students will construct a class consensus model from the Galapagos finches and peppered moths cases that reflects the central aspects of natural selection.

Lesson 11: Day 2- Influences in Population Change

- **Learning Intention:** I am learning that variations can cause certain individuals to survive and have offspring, which can cause a population change. I am learning that variations can be influenced by environmental factors.
- **Success Criteria:** I apply and evaluate a model of natural selection with cases of population change.
- **Brief Overview of Lesson:** Students will test the consensus model using data from two new cases of population changes: bacteria and mosquitoes.

Lesson 11: Day 3 -Why Do Organisms look the way they do?

- **Learning Intention:** I am learning that variations can cause certain individuals to survive and have offspring, which can cause a population change. I am learning that variations can be influenced by environmental factors.
- **Success Criteria:** I can analyze traits to determine which traits are influenced by heredity, environment, or population change.

- **Brief Overview of Lesson:** Students will review the main types of influences on organism population changes and get examples of those influences from organisms studied in the unit.

CULTURALLY RESPONSIVE TEACHING in PRACTICE	SOCIAL EMOTIONAL LEARNING in PRACTICE
Unit will encourage student engagement in virtual science lab investigations. Unit will connect Students to Professional partnership with participation in Students to Science Virtual Labs. Unit will *establish inclusion* as lessons are engaging and require *collaboration and cooperation.* *Positive attitudes* will be a focus of the unit as the lessons are based on *prior knowledge and experience*, are s*et with clear learning goals* and *contain fair and clear criteria for evaluation.* The unit also includes *challenging experiences t*o enhance meaning and to *encourage self assessment.*	**Set classroom norms for discussions** ● When having discussions in the classroom we open the floor to all students' perspectives. We want to make sure all of our students feel heard, and we also want to make sure all of our students feel safe enough to express their ideas within the space as well. By setting discussion norms for students that they can all contribute to set the tone that the classroom is a safe space and that all student ideas, perspective, opinions etc. are welcome while also setting guidelines for how the class will go about discussing counterpoints in a constructive manner. **Assign Group Roles** ● Whenever group work is being done all members of the group should have an assigned role. You can assign this role randomly to members in the group or let them pick their role. If groups/tables are the same every time roles can shift each time there is group work or remain the same for consistency depending on your classroom climate and preference. Having a role not only gives every student a designated task to do during that assignment/activity, it enforces a sense of self-worth to make them feel part of a larger community in that the role they are playing is essential to completion of the task as a whole group. **Acknowledge Students Ideas** ● During think-pair-share, discussions, eliciting ideas probes or any other time that you have students sharing ideas out loud you can write down key points from their ideas on the board. This shows that you are acknowledging their words and listening to what they are saying. From these key points you can use them to facilitate discussion, which makes for a much

	richer and authentic classroom discussion as you are pulling from what students have said directly. **Promoting Growth Mindset** ● Many times students will become confused or not fully understand the material right away. Often, students shut down, think that they have failed and automatically have a "fixed mindset" view. By promoting growth mindset and teaching students how to shift their thinking promotes not only students' social-emotional learning, but highlights the classroom community as a positive and safe place to cultivate learning.

Lesson 1:	**<u>The same and different, you and me</u>**	**3 days-50 minutes each**

Brief Overview of Lesson:
Day 1: Students will identify and analyze data on the traits of an organism and determine if these traits are inherited or acquired.
Day 2: Students will survey the class, collect data of observable human traits and possible variations to distinguish between traits and their variations, and which traits are acquired vs. inherited.
Day 3: Students will develop questions about traits based on the data they collected.

What students should know and be able to do to engage in this lesson:

- Observe phenomenon
- Gather and explain evidence
- Explain phenomenon
- Ask and answer questions
- Collect and record data
- Compare data

LESSON FOUNDATION

Assessed Standards for this lesson	**Important content not included in the standards**
LS1.B: Growth and Development of Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MSLS3-2)	**MS-LS1B-4** Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) **MS-LS3A-1** Genes are located in the chromosomes of cells, with

LS3.A: Inheritance of Traits Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. **LS3.B:** Variation of Traits In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.	each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1) **MS-LS3A-1** In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)
Focus Question for this Lesson	
Where do you think you get inherited traits?	
Learning Intention	**Success Criteria**
Day 1: *I am learning that traits distinguish organisms from one another* ***Day 2-3:*** *I am learning that trait variations can be inherited or acquired.*	***Day 1:*** *I can identify the traits of an organism to draw conclusions and generate questions.* ***Day 2:*** *I can gather human trait data to identify patterns in inherited and acquired trait variations.* ***Day 3:*** *I can develop questions about the patterns/causes about how organisms acquire and/or inherited trait variations.*
Assessment(s)	
Self-Assessment/Peer Assessment/Teacher Assessment I can identify human traits from traits of other organisms. Begin to generate sub questions about how we receive traits. Students will Classify human traits as inherited or acquired given a group of traits to classify in either category.	
Feedback (Peer to peer/student to teacher/teacher to student)	
Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. Scientific Discourse/Habits of Discussion	

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

- The definition of species—For sexually reproducing organisms, species comprises all organisms that can mate with one another to produce viable offspring.
- This unit does not deal with levels of taxonomy (kingdom, phylum, class, order, family, genus, and species). Although these ideas are often taught in middle-school textbooks, learning these levels of taxonomy does not help students explain any of the scientific phenomena about heredity and natural selection that form the basis of this unit, nor does it connect well to questions students have about their experiences with the natural world. However, in order to fully define *species*, students need a sense of the similarities between the organisms, which are higher levels of taxonomy.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.

- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 1 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Anchoring Phenomenon: Students (Ss) view photos of fish, plants and birds to look for patterns, noting that they have some traits in common and some that are different. Share PI: Fish and Plants and PI: Birds. Discuss human traits and variations, and the difference between inherited and acquired traits. **Discussion Prompts:** Throughout the unit, teachers should: 1) choose discussion prompts applicable to remote learning and ability to discuss with Ss, or 2) have Ss write answers to teacher-selected prompts that can be added to the slide deck, if discussion is not possible, or 3) choose questions in take-home format for Ss to discuss remotely, perhaps writing responses that are then submitted. **Questions in the SEs:** Throughout the unit, teachers should decide on the method by which the lesson will be delivered, and then have Ss ignore any questions in their SEs that do not fit the way in which the lesson needed to be enacted remotely. Teachers may provide a handout

for print-only Ss who cannot access the curriculum remotely, so that they know which questions in their SEs they should respond to.

Engage: Introducing the Lesson:

- Students begin by looking at pictures of familiar organisms and identifying the similarities and differences in their traits.
- Show students the pictures of three pairs of organisms (PI: Fish and Plants; PI: Birds). Have students observe and discuss similarities and differences using prompts.

During the Lesson

Day #1

Explore: Share and Print Projected Images (PIs) available in the slide decks for each lesson or on the Teacher Portal:

- Fish and Plants
- Desert Plant and Rainforest Plant
- Birds

Teacher will assign students to groups to observe images of various organisms and distinguish between traits

- In groups students will brainstorm a list of human traits and record everyone's ideas.
- As a whole class students will select two inherited traits from the list they generated in Activity 1.1 and two from the inherited traits previously listed.
- List the traits the class selects in the data table and tally how many people in their group have each variation of the trait and record it in the data table

Explain:

- After the brainstorm list is complete, students will discuss their group's list and decide if each item is a human trait, then cross off any that their group decides is not a trait.

- Students will then record the traits that they have agreed are human traits in the chart and then list possible variations in the individual variation column.

Lesson Closing

Evaluate: Students will use lists to determine what traits humans have in common from other organisms.

Students will complete the Making Sense question and share their ideas. Students will listen to each other's questions and make connections while adding to the Driving Question Board (DQB).

Lesson 1.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 1 Teaching Slides*
- *Teacher Resources*
- *Scholastic Study Jams-Heredity*
- *What is a trait?*
- *Inherited traits*
- *Discovery Education- Inherited traits*
- *Discovery Education- Acquired Traits*

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 1 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Day 2: **Engage:** ● Students will observe the pictures of some inherited traits on Activity Sheet 1.1. ● **Brainstorm:** Ask: "Why do you think you need to focus on inherited traits?
During the Lesson
Explore: Begin with a friendly greeting from which the class will collect data on the number of students who can do it. Students will survey those who can actually make the symbol for the greeting. Demo the Vulcan greeting or share PI: Vulcan Greeting. If possible, collect data from Ss on how many are able to do it; otherwise, use the data in Image: Vulcan Greeting Data. Either show Ss how to graph the data or instruct them to make a bar graph with the data. Or Share Graph **Share PI:** Inherited Traits. If possible, collect Ss data on two traits from this lesson and two from the previous lesson. Have Ss graph the data and answer the Making Sense questions. **Explain:** As a whole class students will combine their group data to get a number that shows how many people in their class have that trait and record the total number from the class, in the class data column. Discuss inherited trait and variation. Use the data collected to develop further understanding of the data just collected.
Lesson Closing
Elaborate: ● From the class data, students will generate graphs on each of the four traits. (Use PI: Class Data Table to tally each trait) ● Students will use the data collected to make graphing decisions **Evaluate:** Students will draw conclusions about patterns in traits based on students' observations by completing Making Sense questions and share their ideas. ● Lead students to recognize that a bar graph would be the best representation. ● What label and data should be on the x-axis? What label and data should be on the y-axis?

Extend: Students can research additional information on traits.

Lesson 1.2 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 1 Teaching Slides*
- *Teacher Resources*
- *Scholastic Study Jams-Heredity*
- *What is a trait?*
- *Inherited traits*
- *Discovery Education- Inherited traits*
- *Discovery Education- Acquired Traits*

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 1 Day 3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: ● Develop questions about traits that will drive the unit's investigations. SE Activity 1.3 Print PIs ● Human Cheek Cells ● From Cell to DNA
During the Lesson
Explore: ● Ask students if they have heard any other terms that relate to what we are studying that might help us figure out what is happening with traits. ● Review the questions from the beginning of the activity. Prompt discussion with the following questions: ● Do you have any evidence that there are instructions from somewhere in the body for traits? ● If there were instructions, where might they be found? **Explain:** Highlight patterns and propose possible reasons for why these patterns exist. ● Continue prompting students until the discussion arrives at the idea that all of the organs and systems in the body function to get the cells what they need to survive.
Lesson Closing
Elaborate: Continue the discussion: Given what we know about what cells do to keep our bodies running, what do you think about looking inside of cells for the instructions that determine our traits? Use the following prompts to get students to realize that the instructions must be made of matter in the cells ● What have you learned about the "stuff" that all things—including cells—are made of? (TE.pg. 20)

- Display PI: Human Cheek Cells. Ask the following questions.
- What is the dark structure in the cell? (TE. pg. 20)

Evaluate:

- Students now have a strong hypothesis that there are molecules in cells that may lead to traits (DNA) and develop basic scientific principles. (See Key Points.pg. 21)

Extend:

Reading 1.3: Where Did You Get Those Eyes?

- Students will look at variations among and within species. They will work like scientists who investigate genetics—the study of how traits are passed down.

Lesson 1.3 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 1 Teaching Slides*
- *Teacher Resources*
- *Scholastic Study Jams-Heredity*
- *What is a trait?*
- *Inherited traits*
- *Discovery Education- Inherited traits*
- *Discovery Education- Acquired Traits*

Unit Resources

- *Teacher Edition*
- *Student Edition*

- *Storyline*

- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Lesson 2	**What traits Get Passed On?**	**Estimated Time: 2-3 50 min sections**

Brief Overview of Lesson:
Day 1: Students will collect and analyze data on the ability to taste PTC to determine whether what we like to eat is inherited or not. Then Students collect and analyze data on tongue rolling to see if its connected to the PTC tasting trait.
Day 2: Students will discuss how they could observe traits being passed from parent to offspring, then dissect a flower to see how plant reproduction compares to human reproduction.
Day 3: Students will cross and germinate plant seeds of the same species, but with a noted variation: purple vs.non- purple stems (seeds sprout in 2-3 days).

What students should know and be able to do to engage in this lesson:
- Observe phenomenon
- Gather and explain evidence
- Explain phenomenon
- Ask and answer questions
- Collect and Record data
- Compare data

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS1.B: Growth and Development of Organisms Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MSLS3-2) **LS3.A:** Inheritance of Traits Variations of inherited traits between parent and offspring arise from	**MS-LS3A-1** Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to

genetic differences that result from the subset of chromosomes (and therefore genes) inherited. **LS3.B:** Variation of Traits In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. **LS1.B:** Growth and Development of Organisms Animals engage in characteristic behaviors that increase the odds of reproduction. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.	proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1) **MS-LS3A-1** In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)
Focus Question for this Lesson	
Is taste an inherited or an acquired trait? Are there any ways human reproduction and plant reproduction are similar?	
Learning Intention	**Success Criteria**
Day 1-2: *I am learning that there are variations of inherited traits between parents and their offspring.* ***Day 3:*** *I am learning how to distinguish between the influence of inheritance and environment on traits.*	***Day 1:*** ● *I can obtain and evaluate information about why some traits are inherited.* ● *I can develop questions for the causes of why some traits are inherited.* ***Day 2:*** *I can use models to obtain information about plants' reproductive structure and function.* ***Day 3:*** *I can plan an investigation to observe how traits can be passed down to offspring.*
Assessment(s)	
Students will complete Making Sense questions and share their ideas and discuss their responses.	
Feedback (Peer to peer/student to teacher/teacher to student)	

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
Scientific Discourse/Habits of Discussion

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Preconceptions/Misconceptions

- In the IQWST IC1 Unit, students learn that there are receptors in the nose that detect the particles in the air so they can smell.
- In the IQWST PS1 Unit, students learn that there are sensors in the eye that detect the light that reaches them.
- In the IQWST LS2 Unit, students learn about receptors that detect pressure and send a signal to the brain that they are touching something. A person is able to taste because of receptors on the tongue, which detect certain chemicals and send signals to the brain about what is being tasted.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook

- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 2 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: Follow Up: Reading 1.3: Where Did You Get Those Eyes? • Students will revisit and discuss the following question based on Reading 1.3. Do you think that heredity could influence other things besides athletic ability and certain physical traits, like hair color or a widow's peak? • Students will predict whether there is a connection between an inherited trait and the preference for certain foods and explain their choice.
During the Lesson
Explore:

- Students will taste a sample of brussels sprouts and respond to questions (1)
- Students will taste two pieces of paper and then answer the questions. (2) and complete data table.

Explain:

- Students will analyze collected data and share out to their group data.

Lesson Closing

Elaborate:

- After students have shared their ideas, ask them how they could figure out if what they like to eat is inherited or acquired.
- Students will tally the raw data for the class.

Evaluate:

- Students will respond to the Making Sense questions using data collected and discuss their ideas.
- Students will make generalizations about traits building on the previous activities about whether or not the ability to taste PTC and disliking brussels sprouts are connected.

Extend:

- Reading 2.1: Do Traits I Inherited Affect My Senses?

Lesson 2.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 2 Teaching Slides*
- *Teacher Resources*
- NewsELA- Plant and animal reproduction
- Edpuzzle- Asexual/ Sexual Reprodution
- Flower Dissection

- Flower Parts with Amoeba Sisters
- Scholastic Study Jams- Flowers
- Discovery Education- Plant Reproduction

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 2 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: • **Reading Follow Up Ask: "**Do you think that whether or not you like a certain vegetable is inherited, acquired (learned), or both? • What information from the reading would help you decide the answer?" • **Initiate discussion leading into the activity:** What could you do in this activity to observe how traits are passed from parent to offspring? (TE. pg. 47)
During the Lesson

Explore:

- Students will dissect a flower in order to investigate how plants reproduce. Using PI: Flower Parts, guide students through a brief explanation of plant reproduction. Each student should complete his or her own activity sheet and the group will complete a composite, labeled diagram of the dissected flower.

Explain:

- Students will use a large piece of white paper that their teacher gave their group, and take the flower parts and put them together to form a flower. Label each of the flower parts. Use the image to help you with the names.

Elaborate:
Now that students have investigated flower reproduction, return to the question that began the activity: Are there any ways human reproduction and plant reproduction are similar?

Closing the lesson

Evaluate:
Students will complete Making Sense questions and share their ideas and discuss their responses.

Extend:

- Reading 2.2 What Is the Buzz About?- reinforces Activity 2.2 about how plants are pollinated and reproduce.

Lesson 2.2 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 2 Teaching Slides*
- *Teacher Resources*
- NewsELA- Plant and animal reproduction
- Edpuzzle- Asexual/ Sexual Reprodution
- Flower Dissection

- Flower Parts with Amoeba Sisters
- Scholastic Study Jams- Flowers
- Discovery Education- Plant Reproduction

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 2 Day 3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: ● **Reading Follow Up:** Ask students what they have learned about bees that make them such important insects. ● Students identified the need to know about parents and their offspring in order to decide if a trait was inherited.
During the Lesson

Explore:

- Students will observe Petri dishes of germinated seeds that were set up at the beginning of the lesson.
- **Suggested Prompts** • Based on what you learned about plant reproduction, can they be used to test ideas about heredity? (TE. pg.50)
    - Discuss the trait students will be observing **Suggested Prompts** • What are the similarities and differences you notice? (TE. pg.50)
    - Students will set up their experiment using procedural steps.

Explain:

- After students have set up their seeds, explain that it will take two or three days for the seeds to sprout. They will return to check the seeds in the next lesson. Be sure to have students check each day to make sure that there is enough water to keep the seeds moist.

Elaborate:

- Teacher will verify students follow the instructions to set up experiment:

Petri dishes and seeds. Be sure that students label their dishes with their group name or number, as well as with F1 and the type of cross they used. Explain that F1 is used to indicate the first generation of offspring (or first filial generation). This is the way scientists keep track of generations so they know the order of offspring.

Closing the lesson

Evaluate:

- Students double check to ensure all procedural steps to set up their experiment are completed accurately.

Extend:

- Students can do additional research on how traits get passed on.

Lesson 2.3 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 2 Teaching Slides*
- *Teacher Resources*
- NewsELA- Plant and animal reproduction

- Edpuzzle- Asexual/ Sexual Reprodution
- Flower Dissection
- Flower Parts with Amoeba Sisters
- Scholastic Study Jams- Flowers
- Discovery Education- Plant Reproduction

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Lesson 3:	**Can we determine patterns in Traits?**	**Estimated Time: 3 days /50 minutes each**

Brief Overview of Lesson:
Day 1: Students will use model pedigrees to determine if there are any patterns for how traits are inherited, then generate questions from those patterns. Students develop claims to those questions based on evidence in their "Pattern and Evidence" chart.
Day 2: Students will analyze the results of their plant experiments for any patterns in how traits are inherited and compare these patterns to the human pedigree patterns. These results are added to the Pattern and Evidence Chart.
Day 3: Students will review observations from the previous activity, where students discovered that the PTC and tongue data did not always match with the plant data.
What students should know and be able to do to engage in this lesson:

- Gather and explain evidence
- Ask and answer questions
- Collect and Record data
- Compare data

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS1.B: Growth and Development of Organisms Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MSLS3-2) **LS3.A:** Inheritance of Traits Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. **LS3.B:** Variation of Traits In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.	**MS-LS1B-4** Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) **MS-LS3A-1** Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1) **MS-LS3A-1** In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1) **MS-LS4C.1:** Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. *(MS-LS4-6)* **MS-LS3A.2:** Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. *(MS-LS3-2)*
Focus Question for this Lesson	
What patterns can you identify in your heredity data? Are heredity patterns in plants different from heredity patterns in humans?	
Learning Intention	**Success Criteria**
Day 1: *I am learning that offspring can get instructions for a trait from either parent.*	***Day 1:*** *I can Examine human pedigree data to determine patterns in how traits are inherited.*

Day 2: *I am learning that plants reproduce in a variety of ways and have specialized features for reproduction.* ***Day 3:*** *I am learning that traits can be inherited or acquired in plants and humans.*	***Day 2:*** *I can determine patterns in the way plant traits are passed from one generation to the next.* ***Day 3:*** *I can make predictions to what traits will appear in the second generation of plants based on observations.*

Assessment(s)
Pattern & Evidence Chart (Claims & Evidence: Use CER Rubric and remove the Reasoning)
Feedback (Peer to peer/student to teacher/teacher to student)
Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. Scientific Discourse/Habits of Discussion

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS
Anticipated Student Pre-Conceptions/Misconceptions
• In the IQWST IC1 Unit, students learn that there are receptors in the nose that detect the particles in the air so they can smell. • In the IQWST PS1 Unit, students learn that there are sensors in the eye that detect the light that reaches them. • In the IQWST LS2 Unit, students learn about receptors that detect pressure and send a signal to the brain that they are touching something. A person is able to taste because of receptors on the tongue, which detect certain chemicals and send signals to the brain about what is being tasted. • It is a common student misconception that offspring only inherit traits from the mother because she gives birth to them. It is important that students are able to identify that traits can come from either parent.
Integrated Accommodations & Modifications
English Language Learners/Socio Cultural Implications: ● Create a word wall. ● Create a Driving Question Board. ● Use partnering strategy to allow students to work in teams. ● Provide students with pictures as a visual reference when answering questions ● Utilize scaffolding strategies ● Provide prompting and support ● Provide students with sentence starters. ● Allow students to use Audio Recordings in digital format or any other reading materials ● Allow students to use Google Read&Write for speech to text to construct sentences independently. ● Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 3 Day 1

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Engage: Review with students concepts from lesson 2 what they would need to know the traits of both parents and their offspring in order to find the patterns in how traits are inherited. Teacher will explain how pedigrees keep track of family relationships and traits. Teachers will want to make sure that Ss understand the symbols used and how it is put together. Share the simple pedigree of Ralph the dog from the TE and discuss the components of a pedigree. See TE for discussion prompts.

Have Ss fill in the prediction tables for both tongue rolling and PTC tasting.

- Introducing Pedigrees, a graphic organizer or diagram that keeps track of that information. Draw a sample pedigree for Ralph the dog on the board or projector. Conduct discussion about the pedigree diagram.
- What information about a dog does a pedigree keep track of?
- How are the differences between the males and the females shown?

During the Lesson

Explore: On Activity sheet 3.1 students will predict possible variations of parent combinations of the PTC-tasting and tongue-rolling traits for the parents.

- Arrange students in groups of four.
- Distribute the pedigrees to the groups: students will complete Part 1, and Part 2, and jigsaw groups so that the new groups comprise at least four students, each representing one of the pedigree sheets (A1, A2, B1, and B2).

Explain: Students share their ideas on the prediction activity.

- **Suggested Prompts** • Does everyone agree? Disagree? • Which cases are more difficult to predict? Why?
- In the new group, students will share data and complete the charts in Part 1 of the activity sheets. As groups record data, check that they have identified the patterns correctly.

Lesson Closing

Elaborate: Begin to fill out rows of the Pattern and Evidence Chart with questions. Ask the class the question and then ask for evidence. Evidence can come from their own experience (column 3) or from human data that they have seen (column 4).

Evaluate:

- Have students complete the making sense questions using data.
- Students will share out and discuss their responses. Identify questions arising from observations.
- Remind students of the question they asked in Lesson 2: Are there patterns in the way traits are passed from parent to offspring?
- Based on the evidence they collected so far, how would they answer this question?
- What other data can you test?

Lesson 3.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 3 Teaching Slides*
- *Teacher Resources*
- Pedigree Charts
- Edpuzzle- Amoeba Sisters Pedigrees

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 3 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening

Engage:

- Use students' responses to insert additional evidence in the class Pattern and Evidence Chart based on homework responses.

During the Lesson

Explore:

- Students will observe their seedlings for evidence of inherited trait variation patterns for plants and review their prediction from Activity Sheet 2.3.
- Students will follow procedural steps to complete the Data chart. Activity 3.2.

Explain:

- After your group collects the data, each group shares the results. These are recorded on the class data table. Copy the additional data, and add it to the class data tables. Summarize the results.

Lesson Closing

Elaborate:

- Assign Questions 1–4 in the Making Sense section. Students will refer to both Activity Sheet 3.1 and Activity 2.3 in order to compare the plant data to the human data from previous activities. Have students complete Question 5, the prediction for the F2 generation.

Evaluate:

- Refer to the Pattern and Evidence Chart. Students will test each of these claims by identifying any evidence from the plant data that supports the claim. For 1–3, students will find no evidence to support the claim.

Extend:

- Have students develop a scientific principle based on the conclusion from data collected.

Lesson 3.2 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 3 Teaching Slides*

- *Teacher Resources*
- Pedigree Charts
- Edpuzzle- Amoeba Sisters Pedigrees

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard:Driving Question Board

THE LESSON IN ACTION: Lesson 3 Day 3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: • Review observations from the previous activity, where students discovered that the PTC and tongue data did not always match with the plant data.
During the Lesson
Explore: • Students will test out their ideas to germinate seeds that have been taken from a cross of plants in their F1 generations, focusing on the combinations of parent crosses that were tested to produce the F1 generation **i**n lesson 2. • Direct students to the "F2 Generation Predictions" section on the last page of Activity Sheet 3.2. Have students complete the prediction for the F2 offspring. **Explain:** • Ask students if there are any questions that they have based on their observations so far. Add those questions to the Driving Question Board and Driving Question Notes.

Lesson Closing

Elaborate:

In this lesson students observed that a cross of a purple and non-purple produced purple offspring, just like the cross of two purple plants.

- Have students predicted what they think will happen if they take an F1 generation purple plant that came from each of those crosses and crossed them?
- They will explain the possibility that these two different plants could both be purple on the outside but have different instructions inside.

Evaluate:

- Ask students if there are any questions that they have based on their observations so far. Add those questions to the Driving Question Board and Driving Question Notes. In the next lesson, they will look at human traits for multiple generations and then return to their seeds**.**

Extend:

- **Reading 3.3** Heredity Patterns – A Key to Diagnosis – Students are asked to think about in what practical ways understanding inherited trait patterns could be helpful. For example, "How could doctors use inheritance patterns?" and "What information would be important to them?"

Lesson 3.3 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 3 Teaching Slides*
- *Teacher Resources*
- Pedigree Charts
- Edpuzzle- Amoeba Sisters Pedigrees

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Lesson 4	**Do Traits show patterns over multiple generations?**	**Estimated Time: 3 days/ 50 minutes each**

Brief Overview of Lesson:
Day 1: Students will analyze additional generations of the PTC taster pedigrees from previous lessons to better understand how traits are passed from one generation to the next.
Day 2: Students will check and record the results of seed plantings set up in previous lessons to better understand how traits are passed from one generation to the next.
Day 3: Students will synthesize the information about heredity patterns from plants and humans and add to the Pattern and Evidence Chart.

What students should know and be able to do to engage in this lesson:

- Gather and explain evidence
- Ask and answer questions
- Collect and Record data
- Compare data

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS1.B: Growth and Development of Organisms Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MSLS3-2) **LS3.A:** Inheritance of Traits Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.	**MS-LS1B-4** Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) **MS-LS3A-1** Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to

LS3.B: Variation of Traits In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.	proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1) **MS-LS3A-1** In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1) **MS-LS4C.1:** Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. *(MS-LS4-6)* **MS-LS3A.2:** Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. *(MS-LS3-2)*
Focus Question for this Lesson	
How do traits get passed on?	
Learning Intention	**Success Criteria**
Day 1: *I am learning that there are patterns in how traits appear to be passed from parents to offspring over generations.* ***Day 2-3:*** *I am learning that there are patterns in how traits appear to be passed from parents to offspring over generations in both plants and humans.*	***Day 1:*** *I can evaluate information from human pedigrees about inherited traits from previous lessons to determine the patterns that occur over generations.* ***Day 2:*** *I can obtain and evaluate and interpret data to uncover patterns in generational growth in plants.* ***Day 3:*** *I can synthesize information about heredity patterns from plants and humans.*
Assessment(s)	
Self-Assessment/Peer Assessment/Teacher Assessment Pattern & Evidence Chart	

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
Scientific Discourse/Habits of Discussion

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

When reporting the data for the C and F groups in the F_2 generation, you will need to add another circle or square. Students will have gotten both non-purple and purple offspring. Make sure students add this to their Data Summary Sheets as well.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook

- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 4 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening

Engage:

- **Review the concept of "traits"** by generating discussions based on activities completed. Connect the activity in this lesson, where students will look at the ability to taste PTC across multiple generations of humans.

1. Ask how many generations they saw.
2. Ask if they think that looking at additional generations of humans may answer their questions as well. (TE.pg.106)

Share PI: Predictions of Variation in Human Traits. Have students make predictions and record their ideas if possible. They will then look at pedigrees for more than two generations.

Students work to complete the "case family observation data" table in their SE by looking carefully at the pedigrees. They should then analyze their data by answering the Making Sense questions.

Teachers may also want to share a complete Ss answer sheet after the activity and discuss. Teachers may also want to share the completed Pattern and Evidence Chart at the end of Lesson 4 at this time and discuss.

During the Lesson

Explore:

- Students will work in groups to use Activity Sheet 4.1 with the pedigrees of the three families to analyze the data to see which traits get passed on from one generation to the next. As they analyze the pedigree for each family, they should fill in the data table after the last pedigree.

Explain:

Students will start to make sense of the data. In Lesson 2, they saw that two parents who did not taste PTC always had offspring who did not taste PTC.

- Did you see a similar pattern when looking at the human pedigrees of multiple generations? If so, describe what you saw.

Lesson Closing

Elaborate:

Students will continue to analyze the data in a pedigree to see which traits get passed on from one generation to the next by responding to additional Making Sense questions: In Lesson 2, you saw that two parents who tasted PTC could have offspring that taste PTC or offspring that do not taste PTC.

- Did you see the same thing when looking at the pedigrees of multiple generations of a family? If so, describe what you saw.
- Do the data from the previous generations help you figure out how two parents who taste PTC could have offspring who do not taste PTC? Explain how.

Evaluate:

Students will draw conclusions by responding to the following question.

- Is there anything in the data from this lesson that helps figure out which tasters might be able to have offspring that do not taste?

Extend:

Students will record any questions that you have about how traits get passed on.

Lesson 4.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 4 Teaching Slides*
- *Teacher Resources*
- NewsELA- Gregor Mendel
- TEDedGregor Mendel
- Discover Education- Mendel's Contribution to Genetics

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 4 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
This activity allows students to look at data from a third generation of plants. Remind them of the new ideas from the last activity that not all PTC-tasters seem to have the same information to pass on and that sometimes traits are seen in the first generation, are not seen in the second and then seen again in the third.

Students will not have been able to do the activity of germinating the third generation, so you will need to share the data with them. Share Image of : Class Seedling Data Activity 4.2

Ss should use this data to complete the pedigrees. If possible, have a Synthesizing discussion.

Engage:

- Review what students concluded in the previous activity about the human data and the plant data they got in Lesson 3. Looking at plant data will give students more evidence about whether this pattern holds true for other traits in other organisms.

During the Lesson

Explore:

- Students will begin by filling in the key on Activity Sheet 4.2 using the data table on Activity Sheet 3.2, complete the pedigree below for your seeds.
- (If there was more than one group using the same seeds, you should combine your data. You will complete one sheet for the data collected by each of the groups.)

Explain:

- Have students discuss what they have identified about the two possible new ideas about how traits are inherited.

Lesson Closing

Elaborate:

- Have students look at the prediction they made about the F2 generation of seeds and decide based on today's data, if anyone would like to change their predictions.
- Have them place an X through the predictions they want to change in Question 5 on Activity Sheet 3.2, and ask them to write the reason for doing so. Give students time to make their changes before proceeding.

Evaluate:

Discuss the Making Sense questions with the class in order to summarize as well as to lead into the next activity

Suggested Prompts: What patterns did you see in the plant data?

(Use Pattern and Evidence Chart to summarize.)

- How are the F1 and F2 generations different?
- Why do you think the group that started with purple and white stems in the P generation ended up with all purple offspring?
- Why does their F2 generation have both white and purple stems when none of their parent plants had white stems?

Extend: Students can do additional research on how traits appear to be passed from parents to offspring.

Lesson 4.2 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 4 Teaching Slides*
- *Teacher Resources*
- NewsELA- Gregor Mendel
- TEDedGregor Mendel
- Discover Education- Mendel's Contribution to Genetics

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 4 Day 3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage:

- Introduce Students to Biologist Gregor Mendel and his pea experiment

  How Mendel's pea plants helped us understand genetics - Hortensia Jiménez Díaz

- Refer to the class *pattern and evidence chart.* Ask students if there are any additional questions that they want to add based on what they have seen.

During the Lesson

Explore:

- Students will be reflecting on the patterns they observed in Lessons 2 and 3 and their new observations from Lesson 4. Go through each of the five questions on the list and add any new evidence from either the human pedigrees or the plant data that students have found in this lesson

Explain:

- After the chart is filled in, engage students in a synthesizing discussion about what they have uncovered about the patterns of inheritance.

Lesson Closing

Elaborate:

- Synthesize the questions about patterns of inheritance in both plants and humans and identify them as patterns based on the evidence collected.

Suggested Prompts • Are there any questions that have evidence from both plants and animals that support them?

Evaluate:

Remind students that in Lesson 1 they learned that they inherit instructions for traits from their parents.

- What have you learned about these instructions based on what you just reported about certain traits in plants and humans?
- How was the pattern in the non-purple plants different?
- Did you see a similar pattern in humans?

At the end of this lesson, a final list of inheritance patterns should be posted on the Driving Question Board and students should record them in their Driving Question Notes.

Extend:

Reading 4.3: Why Are Patterns Important?

- Students will read about the work of Gregor Mendel and the importance of identifying patterns that lead to determining how and why things work the way they do.

Lesson 4.3 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- How Mendel's pea plants helped us understand genetics - Hortensia Jiménez Díaz
- *Lesson 4 Teaching Slides*
- *Teacher Resources*
- NewsELA- Gregor Mendel
- TEDedGregor Mendel
- Discover Education- Mendel's Contribution to Genetics

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Lesson 5	**How do instructions from our parents get inside us?**	**Estimated Time: 2 days/50 minutes each**
Brief Overview of Lesson:		

Day 1: Students will compare cell division in somatic cells (i.e. mitosis) and sex cells (i.e. meiosis) to understand how organisms can appear the same on the outside, but not carry the same instructions on the inside.
Day 2: Students will determine the amount of gamete combinations resulting during meiosis by experimenting with imaginary organisms.

What students should know and be able to do to engage in this lesson:

- Gather and explain evidence
- Ask and answer questions
- Collect and record data
- Compare data

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS1.A: Structure and Function Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell.	**MS-LS1A.1:** All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). *(MS-LS1-1)* **MS-LS1A.4:** In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. *(MS-LS1-3)*
Focus Question for this Lesson	
How are the processes of Mitosis and Meiosis similar and different? How can an organism carry traits that are not exhibited?	
Learning Intention	**Success Criteria**
I am learning that each parent contributes a copy of DNA instructions (genes) to an offspring.	*Day 1: I can compare cell division in somatic cells and sex cells to understand how each serves its function.* *Day 2: I can model how alleles can separate to produce multiple combinations in gametes.*
Assessment(s)	
Self-Assessment/Peer Assessment/Teacher Assessment	
Feedback (Peer to peer/student to teacher/teacher to student)	

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
Scientific Discourse/Habits of Discussion

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

Students worked with the IQWST LS2 unit, they looked at different levels of organization within the human body: system, organs, tissues, and cells. Show PI: From Cell to DNA from Lesson 1. Students should notice different levels of organization here as well: cell, nucleus, chromosome, and DNA.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook

- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 5 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: **Reading Follow Up:** Link the reading to what students observed. ● Did Gregor Mendel observe the same kind of patterns that you observed in your experiments? Refer students to the Driving Question Board and the Driving Question Notes. ● Review what they know about the inheritance instructions so far. ● Ask students to think about how they can investigate where these instructions come from.

Share PI: From Cell to DNA, reviewing and pointing to the single strands of DNA in the nucleus that are called chromosomes.

- Share PI: Karyotypes to illustrate how scientists look at chromosomes to make them easier to compare and analyze. Have students find patterns like they come in pairs. Use discussion prompts for Student note taking.
- Share PI: Mitosis. Review mitosis with Ss from what they learned in Module 1. Share PI: Mitosis/meiosis. Compare mitosis with mitosis.
- Share PI: Karyotypes and point out the bands on chromosomes 1, 9 and 16. Share PI: Gene to zoom in on chromosomes. The pink section represents a gene.

Tell Students that a gene in plants carries the instructions for producing anthocyanin which produces a purple color in plants.

- Display PI: Gene for Stem Color and explain that they are looking at a representation of a chromosome. A gene for a specific trait appears at the same place on both copies of the chromosome. The band represents the gene, the color represents the allele, the variation of the trait. Relate this to the example in plants.

During the Lesson

Explore:

Show PI: From Cell to DNA from Lesson 1. Students should notice different levels of organization here as well: cell, nucleus, chromosome, and DNA.

- Students will observe and discuss the single strands of DNA in the nucleus of the cell (not just the one that is drawn-out DNA).
- Engage students in a brief brainstorm about what they think they know about chromosomes related to the plant observations they have made.
- Put the diagram on the board and have students copy it on a sheet of paper.

Explain:

- Based on observation, discuss and explain that not only human chromosomes are organized in pairs. Plants have pairs of chromosomes as well and the diagram represents the chromosomes in a plant cell from the F1 generation of Wisconsin Fast Plants® organized in pairs.

Lesson Closing

Elaborate:

- Explain that scientists studying chromosomes find it difficult to study them the way they appear in the cell. Therefore, they make charts that organize all of the chromosomes found in the cell. These charts are called karyotypes. Follow up with a description of karyotypes.
- Have students look at the images of the three pairs of chromosomes inside F1 plants. Have students copy the diagram on a piece of paper and color in the pair of two chromosomes with the instructions they think those plants would have for color.

Evaluate:
Students will discuss their coloring choices.
- What color did you make the chromosomes? Did you make them both the same? Why?
- Prompt students to think about why there are two chromosomes in plant cells for color.

Suggested Prompts: Where are the instructions for stem color located?

Extend:
Tell students that they are going to look at the process of fertilization and the egg and sperm to see if they can figure out what happens.
- Use PI: Mitosis and Meiosis and cover the meiosis side.
- Review the steps in mitosis with them. Compare the cells at the end of mitosis with the sex cells they just discussed.

Lesson 5.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 5 Teaching Slides*
- *Teacher Resources*
- NewsEla- Stages of Mitosis
- Edpuzzle- Amoeba Sisters Meiosis
- Edpuzzle- Amoeba Sisters Mitosis

- Edpuzzle- Amoeba Sisters Alleles
- Khan Academy- Meiosis and Mitosis

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 5 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: Explain that the word gamete means a sex cell, egg and sperm. • Students will do the procedure and find the additional combinations that are possible with the three chromosome pairs of a yllis. There are eight total possible combinations. • Have Students figure out how many combinations there are with 5, 6, 8 and 10 chromosome pairs and let them know that humans have 23 pairs. Ss should answer the Making Sense questions. Teachers may want to share the completed Students activity and discuss. • Remind students of the question they had leaving Lesson 4: Are all purples the same? • **Suggested Prompts:** When you observed the seedlings in the F2 generation in Lesson 4, what did the offspring look like?
During the Lesson
Explore: • Students will observe a chart that shows the traits and their variations of the chromosomes of an imaginary organism called an yllis. • Students will figure out how many possible combinations of the alleles can appear in the gametes of this adult yllis. **Explain:**

- Students will compare the number of combinations they determined with other students. If there is disagreement on the total number, students revisit to see if they can figure out whether someone missed a combination**.**

Lesson Closing

Elaborate:

Explain that the yllis only has three pairs of chromosomes but can produce many different possible gamete combinations. Students will think about humans that have 23 pairs of chromosomes and respond:

- How do you think the number of possible gamete combinations of a human compared to that of the yllis?
- When students have finished, check that they were able to find eight possible gamete combinations.

Evaluate:

Looking at the numbers, ask students again how big they think the number of possible gamete combinations for humans might be. 223 is equal to 8,388,608. Students will share their ideas.

- Students will go back to the lesson question: How can two organisms appear the same on the outside but carry different instructions on the inside?

Be sure the question "What happens if the alleles of a trait do not agree?" is placed on the Driving Question Board and in students' Driving Question Notes. In Lesson 6, students will construct models to try to figure out the answer.

Extend:

- Reading 5.2: Discovering the Source- Sometimes when patterns do not turn out the way they are expected to, it gives scientists a whole new set of questions to ask that leads them, and the scientists who follow them, to new discoveries. In this reading, a unique occurrence in the genetics of one family is giving scientists something new to think about.

Lesson 5.2 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*

- *Lesson 5 Teaching Slides*
- *Teacher Resources*
- NewsEla- Stages of Mitosis
- Edpuzzle- Amoeba Sisters Meiosis
- Edpuzzle- Amoeba Sisters Mitosis
- Edpuzzle- Amoeba Sisters Alleles
- Khan Academy- Meiosis and Mitosis

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Lesson 6	**Constructing a Model of Inheritance**	**Estimated Time: 2days/ 50 minutes each**

Brief Overview of Lesson:
Day 1: Students will develop a model of inheritance that explains:

- How do two purple plants behave differently when producing offspring?
- How an organism can pass on a trait that it does not show.

Day 2: Students will test two different models against the plant data they collected - the "non-purple is stronger" model vs. the "purple is stronger" model.

What students should know and be able to do to engage in this lesson:

- Gather and explain evidence

- Ask and answer questions
- Collect and record data
- Compare data

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS3.A: Inheritance of Traits Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. **LS3.B:** Variation of Traits In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.	**MS-LS1B.3:** Genetic factors as well as local conditions affect the growth of the adult plant. (*MS-LS1-5)* **MS-LS3A.2:** Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. *(MS-LS3-2)* **MS-LS3B.1:** In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. *(MS-LS3-2)*
Focus Question for this Lesson	
How can two organisms with the same observable variations of a trait pass on different instructions? How can two organisms appear the same on the outside but not carry the same instructions on the inside?	
Learning Intention	**Success Criteria**
I am learning that organisms can appear the same on the outside but not carry the same instructions on the inside.	*Day 1: I can develop a model of inheritance that explains all of their observations and data about plants. I can test the model against the available evidence.* *Day 2: I can compare both models from previously created to try to explain the plant data they have collected. I can determine which model better fits the data.*

Assessment(s)

Self-Assessment/Peer Assessment/Teacher Assessment
Use the Plant Pedigree Models

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
Scientific Discourse/Habits of Discussion

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

The distinction between genotype and phenotype is important as students develop their model of inheritance. Since both genotype and phenotype will be represented in their model, it is important that they understand the difference.
The creation of this model involves trial and error on the part of students. They need to take the evidence and information that they have and develop a model where all pieces of the data they have will work. This process is messy and may lead to the development of a model that is incorrect until students revise it to try to explain all of the data. It is essential that students be given the opportunity to develop this model through trial and error until they are able to account for all of the data.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions

- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 6 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: **Reading Follow-up:** • In the reading, what were scientists trying to figure out? • How does what they learned help you with what you are trying to figure out? • Review with students the results of the plant traits that they investigated.

- Using the Driving Question Board, review the following ideas about the instructions for traits from Lesson 5.

Remind Students that they are trying to understand how two plants that appear purple on the outside can have an offspring that is non-purple. Review the ideas about instructions for traits from Lesson 5 as outlined in the TE. Explain the terms genotype and phenotype.

During the Lesson

Explore:

- In this lesson, students will try to use this new idea of having a pair of instructions to see if they can explain the main question, how can two organisms with the same observable variations of a trait pass on different instructions?
- Use PI: "Gene for Stem Color" from lesson 5, which shows the two alleles for color in plants and use prompts to help students identify all the possible combinations of alleles for the trait of color.
- Students will fill in the chart on Activity Sheet 6.1 using the information from the chart filled out during the class discussion.

Explain:

- Engage students in a discussion to figure out the phenotypes for each of the genotypes in the chart. The discussion should begin with the p/p and move to the np/np.
- Students will respond to the "making sense" questions.

Lesson Closing

Elaborate:

Continue with discussion to figure out the phenotypes for each of the genotypes in the chart.

Suggested Prompts:

- How would you write the genotype of a plant if it had two copies of instructions (alleles) that were for purple?
- What do you think the phenotype would be? (Most students will guess that because the only instructions the plant had were for purple, the plant would be purple.)

Evaluate:

Conduct a discussion with students on the rule they used to create their chart/model.

- Have students identify the rules that they used for the model they have constructed.
- What rule is still a question?
- Have them share their ideas from Question 2 in "making sense".

Extend:

- Have students read up more on how traits are passed on.

Lesson 6.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 6 Teaching Slides*
- *Teacher Resources*
- Edpuzzle- Genotype and Phenotype
- Edpuzzle- Genotype and Phenotype
- Discovery Education- Inheritance patterns
- Discovery Education- Using Punnett Squares

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 6 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: Testing the models- Use images of possible models and remind Ss of the rules of the model they decided and what they still have to figure out.

During the Lesson

Explore:

- Students will fill in the following pedigrees together as a class.
- They will test Model 1 with both purple and non-purple offspring.
- Using the Data Summary from Lesson 4, fill in all of the phenotypes on the first few pages.
- Next, fill in the genotype for each generation based on Model 1. Be sure to begin at the bottom of the pedigree and work to the top.

Explain:

- In groups, students will use the pedigree to test Model 2. Remember that for the model to work, all of the rules of the model must work in all generations of the pedigree that are shown on the Data Summary.

Lesson Closing

Elaborate:

- Students will answer the "Making Sense" questions to display understanding of the lesson.

Evaluate:

Use the "Making Sense" question on the activity sheet to facilitate a brief discussion.

- Ask students how they think two plants can be the same on the outside and yet produce different offspring.
- Summarize and post Model 2 on the Driving Question Board under the title Model of Inheritance. Students should also have a copy of the model in their Driving Question Notes.

Extend:

- Reading Follow Up: Reading 6.2 Models: Using Models to Decide between Possible Explanations.

Lesson 6.2 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 6 Teaching Slides*
- *Teacher Resources*
- Edpuzzle- Genotype and Phenotype

- Edpuzzle- Genotype and Phenotype
- Discovery Education- Inheritance patterns
- Discovery Education- Using Punnett Squares

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Lesson 7	**Extending and Applying the Model of Inheritance**	**Estimated Time:2, 50 min each**

Brief Overview of Lesson:
Day 1: Students will apply their model of inheritance to traits in humans, specifically using the PTC tasting data and tongue-rolling data.

Day 2: Students will apply inheritance model and data to case study of Albinism to provide an explanation for dominant and recessive traits.

What students should know and be able to do to engage in this lesson:
- Gather and explain evidence
- Ask and answer questions
- Collect and Record data
- Compare data

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS3.A: Inheritance of Traits	**MS-LS1B.3:** Genetic factors as well as local conditions affect the growth of the adult plant. (*MS-LS1-5)*

Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. **LS3.B:** Variation of Traits In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.	**MS-LS3A.2:** Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. *(MS-LS3-2)* **MS-LS3B.1:** In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. *(MS-LS3-2)*
Focus Question for this Lesson	
What rule of the model does it not follow?	
Learning Intention	**Success Criteria**
I am learning that some alleles are dominant and some can be recessive. *I am learning that if the alleles are not the same, the instructions of the dominant allele show up in the phenotype.*	***Day 1:*** *I can determine the genotypes in human pedigrees. I can apply their model to those pedigrees.* ***Day 2:*** *I can explain dominant and recessive traits by applying the ideas of dominant and recessive to another human example, Albinism.*
Assessment(s)	
Self-Assessment/Peer Assessment/Teacher Assessment Student Models	
Feedback (Peer to peer/student to teacher/teacher to student)	
Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. Scientific Discourse/Habits of Discussion	

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

Dominant genes are more commonly visible in organisms.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort

- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 7 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: **Reading Follow Up**: • Have students share something that they learned about how scientists use models that they did not know before. This could also be used as work for students to complete at the start of class. • Using the model posted on the Driving Question Board, review the rules of the model with students.
During the Lesson
Explore: Use the following prompts to connect the model to the human data. Begin with the PTC data, but let students know that they will work on both sets of data as they complete the activity. **Suggested Prompts:** • What phenotypes of PTC tasting did you observe?

Use PI: Model Chart (from Lesson 6) and fill out the model using the PTC information. Students will work through PTC first and then go on to tongue rolling.

Explain:

- Use PI: Predictions of Variations in Human Traits from Lesson 4. In the circles and squares, it depicts instructions for tasting or not tasting. In Lesson 4, students did not know anything about what these instructions were.
- **Suggested Prompts:** What have you learned about where these instructions are?

Lesson Closing

Elaborate:

- Use the same prompts to facilitate a discussion of the Family 2 pedigree. After looking at both pedigrees, students should have the same question about what happens when the alleles are not the same.
- Use PI: Predictions of Variations in Human Traits and have students look at the taster/non taster data.
- Ask students if they think the rule applies to this data the same as it did to the plant phenotypes.

Evaluate:

- Students will respond and discuss "Making Sense" questions.

Extend:

- At this point, students have evidence to support the idea that some alleles appear to be dominant over others. Have them research why some alleles appear to be dominant over others.

Lesson 7.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 7 Teaching Slides*

- *Teacher Resources*
- NewsELA- How do Dominant genes work?
- Edpuzzle- Dominant and Recessive Traits
- Scholastic Study Jams- Heredity
- Discovery Education- Dominant and Recessive Genes

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: lesson 7 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: • Ask students, what actually happens when the alleles are not the same and one is dominant over the other? • Have students share what they found out from their research assignment.
During the Lesson
Explore: **Suggested Prompts**: What do you think will happen if a person has a genotype of t/t? • Using PI: Model Chart (from Lesson 6), fill in the table on Activity Sheet 7.2 with the possible combinations of alleles for this trait. Remind students that a capital letter indicates the dominant trait and a small letter indicates the recessive. For this example, use A and a. • **Suggested Prompts** • What are the possible combinations of alleles for a person with albinism? **Explain**:

- Show PI: Picture of brother and sister. Ask students to compare the two children. They should see that the brother has albinism. Explain that he is wearing sunglasses because of the lack of pigment in his eyes. This lack of pigment makes an albino's eyes very sensitive to all kinds of light
- **Suggested Prompts** • What do you think are the alleles of the boy in the picture?

Lesson Closing

Elaborate:

- Students will continue discussion as the teacher asks probing questions.

Evaluate:

- Have students fill out the chart at the top of Activity Sheet 7.2 with the possible genotypes and phenotypes for albinism.
- In this activity, students will answer the question "Could the boy in the picture have offspring that do not have albinism?" They will need to explain their answer and support it with evidence from their model and what they have learned about dominant and recessive traits.
- After students have completed their explanations, have a few students share their ideas and the support they used.

Extend:

- Reading 7.2 – Which Instructions Get Followed?

Lesson 7.2 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 7 Teaching Slides*
- *Teacher Resources*
- NewsELA- How do Dominant genes work?
- Edpuzzle- Dominant and Recessive Traits
- Scholastic Study Jams- Heredity

- Discovery Education- Dominant and Recessive Genes

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Lesson 8	**Variations, Variations and More Variations**	**Estimated Time: 4, 50 min each**

Brief Overview of Lesson:
Day 1: Students will collect, represent, and analyze data on traits with multiple variations.

Day 2: Students will use the combined height data from the previous lesson to construct a class histogram.

Day 3: Students will observe organisms; identify traits and multiple variations and analyze data from three different populations: snails, guppies, and orchids.

Day 4: Students will engage in a teacher-led thought exercise to demonstrate how multiple genes can affect one trait: height

What students should know and be able to do to engage in this lesson:
- Gather and explain evidence
- Ask and answer questions
- Collect and record data
- Compare data

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS1.B: Growth and Development of Organisms	**3-LS3B.1:** Different organisms vary in how they look and function

Genetic factors as well as local conditions affect the growth of the adult plant. **LS2.A:** Interdependent Relationships in Ecosystems Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. **LS1.B:** Growth and Development of Organisms Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MSLS3-2) **LS3.A.2:** Inheritance of Traits Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. **LS3.A.1:** Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. **LS3.B.1:** Variation of Traits In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.	because they have different inherited information. *(3-LS3-1)* **3-LS3B.2:** The environment also affects the traits that an organism develops. (*3-LS3-2)* **3-LS2D.1:** Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. *(Note: moved from K–2)(3-LS2-1)* **MS-LS2D.1:** Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. *(secondary to MS-LS2-5)* **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)

LS3.B.2: In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism.	

Focus Question for this Lesson	
What type of data table would be best to collect this data?	
Learning Intention	**Success Criteria**
I am learning that multiple genes can lead to variations of a trait.	***Day 1:*** *I can identify a trait within the class population that has multiple variations (height). I can collect data and figure out how to represent them.* ***Day 2:*** *I analyze data to describe the trait variations in a population.* ***Day 3:*** *I analyze distributions of trait data to compare subgroups in a population.* ***Day 4:*** *I explain how multiple genes can lead to variations of a trait.*

Assessment(s)
Self-Assessment/Peer Assessment/Teacher Assessment Construct explanations: Explain why an organism with one variation of a trait would have an advantage for survival over an organism that had a different variation of the trait.
Feedback (Peer to peer/student to teacher/teacher to student)
Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. Scientific Discourse/Habits of Discussion

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS
Anticipated Student Pre-Conceptions/Misconceptions
Using a Simplified Model (Activity 8.4)

- Students may question how some people could be the heights in between those used on the chart (for example 5’9”). Remind them of the following:
    - This is a model that is simplified from the real situation just to explore the idea. Scientists are not sure how many genes contribute to height or how genes trigger growth. A model is a tool to use to help build understanding of how a process works.
    - Scientists know that the environment has a strong influence on height. That is not considered in this model.
- In this model, we are taking some liberties with what actually takes place. Height is a trait affected by multiple genes that are codominant and additive. Each dominant allele would affect height (for example, TT = 4”). Since we do not deal with codominance in this unit, we have simplified this so either one or two dominant alleles in one gene pair will have the same influence on height.
- The goal is to have students understand how multiple genes affect the range of variations for a trait.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.

- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 8 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: **Reading Follow Up:** Ask students, what does cholesterol have to do with genetics? Why do Sam's sisters not have sickle-cell anemia but Sam does? • Review how information on two-variation traits has been represented. • For individuals • For a single trait in a group. • For two traits in a group
During the Lesson
Explore:

Using PI: Line of people, facilitate a discussion about how traits allow us to identify the organisms in the picture.
Suggested Prompts • What is this?
After a list has been compiled, briefly discuss the various representations. Use a table as an example.
What would be the column headings?
Follow the same type of questioning format to go through other graphic representations suggested.

- Bar graph with one bar per person 2
- A frequency histogram with only two values—short and tall; y-axis is frequency
- A frequency histogram with multiple values; y-axis is frequency

Students will work with the teacher to create a class histogram of height in your class.

- Students will then copy the class histogram on Activity sheet 8.1.

Explain:

- Upon completion, have the groups share their representations. Have the class evaluate them as to which are the most useful in representing multiple variations of a trait in a large group.
- Students will share their data with another group so that they have a larger amount of data.

Lesson Closing

Elaborate:

- After evaluating the graphs, ask students what type of graph might be the best to organize the large amount of height data if it were combined with the rest of the class.
- **Suggested Prompts (**TE. pg. 200)
- Showing individual heights made it more difficult to see patterns.
- How could the data be more clearly displayed?

Evaluate:

- If students are not familiar with this type of graph, construct a sample one with students. Some possible subjects with multiple data are the following: test grades, age distribution in a school, and so on.

Extend:

- Assign students with data to create a graphic representation based on what was done in class.

Lesson 8.1 Resources

IQWST

- *Projected Images*
- *Recordings of Readings*
- *Lesson 8 Teaching Slides*
- *Teacher Resources*
- Khan Academy- Create a Histogram
- Khan Academy- Interpret Histogram
- Scholastic Study jams- Step by Step Histograms

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 8 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: ● Remind students that they are investigating the best ways to display trait data when there are more than two variations. In the last activity, the class discussed a histogram as a good tool to represent the multiple values in this type of data. ● Review homework activity.

During the Lesson

Explore:

- Students will use the combined height data from the first activity to construct a class histogram.
- Distribute a sticky note to each student so that girls have one color and boys have another. Have them record their height that was measured in the last activity on the note.
- On the board or wall, set up the axes for the histogram.

Prompt students to construct the graph

- What data should you plot on the y-axis? (TE.pg. 201)

Explain:

- Have students copy the class histogram onto Activity Sheet 8.2.
- Discuss each component of the histogram with students. Bring out the basic concepts. (TE.pg.201)

Lesson Closing

Elaborate:

- Look at a population like the one represented on the histogram, discuss with students the comparisons between multiple subgroups in the population.
- Have some students share the histograms they made on Activity Sheet 8.2. Use the prompts to check for understanding.

Evaluate:

- Summarize what students understand about tracking data in a population. Have students record their ideas on their Driving Question Notes and on the Driving Question Board.

Extend:

- Introducing homework 8.2 – Who uses social networks more?

Lesson 8.2 Resources

IQWST

- *Projected Images*

- *Audio Recordings of Readings*
- *Lesson 8 Teaching Slides*
- *Teacher Resources*
- Khan Academy- Create a Histogram
- Khan Academy- Interpret Histogram
- Scholastic Study jams- Step by Step Histograms

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 8 Day 3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: **Homework Follow Up:** Ask students to share their conclusions about Facebook© usage that the histograms helped them reach. ● Which age group had the most users? ● Were there more males or more females? ● Generate discussion around: Ask if students think that people are the only organisms that have traits with more than two variations.
During the Lesson
Explore: ● Display PI: Monarch Butterfly Larvae. Explain that these are all monarch butterfly larvae (a stage of growth for a young, living insect). Ask students to study it. Generate discussion:

- What trait and what variations of that trait do you see?

Explain:

- Refer students to Activity Sheet 8.3. In Part 1, students will be looking at different organisms, just as they looked at the monarch butterfly larvae.
- Display PI: Snails. Have students suggest a trait they see in the shells.
- Display PI: Guppies and PI: Orchids while students are working through the activity.

Lesson Closing

Elaborate:

- After students complete Part 1, discuss some of their responses as a class.
- Reinforce the idea that many organisms have multiple traits and multiple variations of those traits.

Evaluate:

- In Part 2, students will analyze graphs of data that represent variations of traits in populations.
- Have students share their responses to the questions from Part 2 of Activity Sheet 8.3. Ask students to compare these representations of data to each other and to the height graph that they created at the beginning of the lesson.

Extend:

- Point out that the last question on the worksheet asks students to speculate about the advantages of having certain variations of traits. Have some of the students plan to share their responses.

Lesson 8.3 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 8 Teaching Slides*
- *Teacher Resources*

- Khan Academy- Create a Histogram
- Khan Academy- Interpret Histogram
- Scholastic Study jams- Step by Step Histograms

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: lesson 8 Day 4
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: Review the model from Lesson 6 that was constructed around traits with two values—that is purple/non-purple and tasting PTC/not tasting PTC. **Suggested Prompts** ● How do these cases show a limitation of our current model? ● How could instructions in genes be different for these types of traits?
During the Lesson
Explore: ● Students will explore what happens to a trait when there are multiple variations and create a simple model to try to capture some of what they know about the height trait. ● Teacher will guide students through the activity. **Explain:** ● As students complete the data chart teacher will of the offspring genotype teacher will continue to provide guidance. **Suggested Prompts:**

- Can you find other combinations that would produce a height taller than 5’6”?
- What about a combination that would be shorter?

Lesson Closing

Elaborate:

- Teacher will continue to guide the activity as students complete the model.

Lead In: What did you see in this activity?

Evaluate:

Summarize the lesson with students. Use the following prompts to spark discussion.

- How are traits like height, weight, and skin color different?
- What influences these traits?
- What kind of representations would be most effective in showing how much of the population falls into different parts of the trait variation range?

Extend:

- Reading 8.4 – Height – Unraveling a Genetic Puzzle

Lesson 8.4 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 8 Teaching Slides*
- *Teacher Resources*
- Khan Academy- Create a Histogram
- Khan Academy- Interpret Histogram
- Scholastic Study jams- Step by Step Histograms

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Lesson 9	**Do Variations between Individuals Matter?: The Case of the Peppered Moth.**	**Estimated Time: Three Lesson: 50 min each**

Brief Overview of Lesson:
Day 1: Students will engage in an experiment to find food in high places around the room without jumping or standing on a chair to demonstrate how height can be an advantage in obtaining food. Students will read about the peppered moth variations and hypothesize why the dark form of the moth is becoming more frequent and why the light form is less frequent.

Day 2: Students will analyze real data from the peppered moth phenomenon to construct a chain of reasoning for why the frequencies in moth populations have changed.

Day 3: Students will use their chain of reasoning from the previous lesson to construct an evidence-based explanation for why the population of peppered moths has changed over time.

What students should know and be able to do to engage in this lesson:
- Gather and explain evidence
- Ask and answer questions
- Collect and record data
- Compare data

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS4.B: Natural Selection **Natural selection leads to the predominance of certain traits in a**	**LS1.B: Growth and Development of Organisms** ● Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)

population, and the suppression of others. **LS4.C: Adaptation** **Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.**	**LS2.A: Interdependent Relationships in Ecosystems** • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1) • **ESS3.C: Human Impacts on Earth Systems** • Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) • Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-3),(MS-ESS3-4)
Focus Question for this Lesson	
What might be causing the dark form of the moth to become more frequent and the light form less frequent?	
Learning Intention	**Success Criteria**
I am learning that variations in traits can have consequences for survival of organisms and populations.	***Day 1:*** *I can identify the advantages of some traits on the survival of the Peppered Moth population.* ***Day 2:*** *I can analyze data to explain the changes in the two types of moths.*

	Day 3: *I can construct an evidence-based explanation CER to account for the change in frequencies of the two types of moths.*

Assessment(s)

Self-Assessment/Peer Assessment/Teacher Assessment
Chain of Reasoning
CER

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
Scientific Discourse/Habits of Discussion

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

These moths are found in England and are called peppered moths because of the speckled color on the lighter form of the moth. These variations occur on the adult moths. The color on does not distinguish between male and female. Males and females may have either variation.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.

- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 9 Day 1
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage:

Reading Follow Up: Ask students to think back to Lesson 1, where they grouped traits based on whether they thought the trait was inherited, influenced by the environment, or both.

Suggested Prompts:

- Did you learn anything in the reading that made you change your mind about where you put the trait of height?
- Was there any evidence in the reading to support your idea about which group height belonged to?

Students will engage in a short, introductory activity in order to begin to think about why variation of a trait might matter by reaching for a candy placed at different heights.

- Have a brief discussion about the advantage of height in this situation. Refer to the class histogram of height from the previous lesson.

During the Lesson

Explore:

- Students will investigate the specific case of the peppered moth in order to begin to answer the question "Does variation in a trait matter?

Show PI: Typica Form (Visible) so that students can observe the same coloration of a moth on a different branch in order to better see what it looks like.

- Students should work in groups to read the information and answer the Making Sense questions on Activity Sheet 9.1.

Explain:

- When students have finished, conduct a brief brainstorm discussion using students' ideas in the Making Sense questions in order to get hypotheses for why the dark form of the moth is becoming more frequent and why the light form is less frequent.

Lesson Closing

Elaborate:

Continue discussion on students' responses from the Making Sense questions. **Suggested Prompts •**

- What is the change in the moth population that they found? (TE.Pg.234)

Evaluate:

- Record students' ideas on the board. Ask students what they would have to investigate to figure out what happened to the moths.

Extend:
- Students will record responses to data that could be collected to find out what happened to the moths.

Lesson 9.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 9 Teaching Slides*
- *Teacher Resources*
- NewsELA- How a Moth went to the Dark side
- NewsELA- Evolution Adaptations and Natural Selection
- Scholastic Study jams- Adaptations
- Discovery Education- What are Adaptations?
- Discovery Education- What is Natural Selection?
- Edpuzzle- Peppered Moth
- Edpuzzle- Peppered Moth GIZMO
- Edpuzzle- Peppered Moth Natural Selection Simulation

Unit Resources

- *Teacher Edition*

- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 9 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: ● Review homework activity. ● Begin by asking students why the carbonaria and typica moths change in relative frequencies.
During the Lesson
Explore: ● Students will observe several sets of data in order to gather information to figure out what caused the change in the peppered moth population. ● Activity Sheet 9.2 is divided into four sections, each addressing a different study. Each group should be assigned one of the studies to analyze. On their activity sheet, they should record the evidence they find in their study and their analysis of that evidence. **Explain:** ● After the groups finish, they should jigsaw and form new groups made up of one person from each of the four studies. In their jigsaw groups, they will fill in the information about the remaining studies on their activity sheet.
Lesson Closing
Elaborate: ● Using the" making sense section" from Activity 9.2, have students work in groups to write their evidence-based explanation. ● Each student should record his or her explanation on the activity sheet. After students are finished, bring them together and construct a class consensus explanation. **Evaluate:**

- Construct a consensus evidence-based explanation for the change in the frequency distribution of the moths.

Suggested Prompts:

- What is the trait that varies in the population?

Extend:

- Reading 9.2 – How Does Variation Matter?

Lesson 9.2 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 9 Teaching Slides*
- *Teacher Resources*
- NewsELA- How a Moth went to the Dark side
- NewsELA- Evolution Adaptations and Natural Selection
- Scholastic Study jams- Adaptations
- Discovery Education- What are Adaptations?
- Discovery Education- What is Natural Selection?
- Edpuzzle- Peppered Moth
- Edpuzzle- Peppered Moth GIZMO
- Edpuzzle- Peppered Moth Natural Selection Simulation

Unit Resources

- *Teacher Edition*
- *Student Edition*

- *Storyline*

- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 9 Day 3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: ● Review Reading 9.2, and have students explain what they have learned from the reading about variation in the plant that affected the survival of populations of the plant in different parts of the country.
During the Lesson
Explore: ● Students will use their chain of reasoning from the "making sense" question at the end of Activity Sheet 9.2, to construct an evidence-based explanation for why the population of peppered moths has changed over time. **Explain:** ● Students will write an evidence-based explanation for the change in frequencies of the two types of moths in Activity 9.3.
Lesson Closing
Elaborate: Students will meet with their group and compare their explanations with focus on evidence for each of the following points? ● variation in the population ● pollution ● lichens and trees ● predators

- offspring and inherited traits

Evaluate:

- Students will review their explanations to verify if their evidence supports the claims in the explanation. Students must go back to Activity Sheet 9.2 and check any evidence that does not make sense. Add any new evidence at this point.

Extend:

- As a class, construct a consensus evidence-based explanation for why the population of peppered moths changed over time.

Lesson 9.3 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 9 Teaching Slides*
- *Teacher Resources*
- NewsELA- How a Moth went to the Dark side
- NewsELA- Evolution Adaptations and Natural Selection
- Scholastic Study jams- Adaptations
- Discovery Education- What are Adaptations?
- Discovery Education- What is Natural Selection?
- Edpuzzle- Peppered Moth
- Edpuzzle- Peppered Moth GIZMO
- Edpuzzle- Peppered Moth Natural Selection Simulation

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Lesson 10	**The Finch Investigation**	**Estimated Time: 9 lessons/50 minutes each**

Brief Overview of Lesson:
Days 1-3: Students will explore the Galapagos ecosystem using simulation that introduces students to the ground finch. They brainstorm why so many finches have died and why some survived.

Days 4-6: Students will use data logging software to record data about what finches survived, what finches did not, and whether variation in the finches and other factors might affect their survival.

Days 7-9: Students will continue to collect data to support their claim about what happened to the finches.

What students should know and be able to do to engage in this lesson:

- Gather and explain evidence
- Ask and answer questions
- Collect and Record data
- Compare data

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS4.B: Natural Selection Natural selection leads to the predominance of certain traits in a population, and the suppression of others.	**LS2.A: Interdependent Relationships in Ecosystems** • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)

	• In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)

Focus Question for this Lesson

What factors might have affected the decline in the finch population?

Learning Intention	**Success Criteria**
I am learning that changes in the environment influence the survival of a population. *I am learning that trait variations can account for population change and survival over time.*	***Days 1-3**: I can obtain information about the ecosystem of the Galapagos and learn about the ground finch, which will be the focus of my investigation.* ***Days: 4-6:** I obtain and evaluate information to identify the traits that changed in the Finch populations.* ***Days 7-9:** I can construct a detailed evidence-based scientific explanation to account for the change in variation of a population.*

Assessment(s)

Self-Assessment/Peer Assessment/Teacher Assessment
Evidence-explanation
-What is the change in the environment? Is there a structure/function reason why individuals with one variation are more likely to survive the change than individuals with another variation?

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
Scientific Discourse/Habits of Discussion

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

Students often think that data only refers to numbers and charts or graphs. In the software, there is a great deal of data in the field notes. There are several possible strategies to get them to use the field notes:

- Make it explicit to students that you expect to see data from field notes in their data logs. On one of the days that they are using the software, check to see that every group has data from the field notes in their data logs.
- Let students know that field notes are very useful in exploring how the traits of the finches might help them, because the notes include scientists' observations of finches foraging for food, mating, evading predators, and other important behaviors.
- Let students know that in their final explanations, they need to have data from a variety of sources, and that includes the field notes.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.

- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort
- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

THE LESSON IN ACTION: Lesson 10 Days 1-3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening

Engage:

- At the end of Lesson 9, students developed a list of questions to ask about changes in any population. Return to the Driving Question Board and review these questions with students:
- What is the variation in the population?

This activity as well as 10.2-10.5 requires internet access and may not be feasible for some Students. All that is needed for these activities is an Internet browser such as Safari or Firefox. Nothing needs to be installed on the computers Students will use.

The website can be found at http://bguile.northwestern.edu

Review how the moth population changed over time.

Project the Introduction section of the BGuILE software and tell the Students what is outlined in the TE.

Students will go to "Explore Ecosystem" in the program and click on the Finch button. Have Students identify any traits they see and identify factors that might have affected the finch population. They should put those in the left column in a chart in the SE. They should then fill in the chart with information from the program. If possible, have a class discussion to share information.

Students can then choose a problem that they will investigate from those that were introduced in the software. If possible, do this in pairs, but Students could do it individually. You may want to have a list of problems for them to investigate if they have problems figuring out one on their own.

During the Lesson

Explore:

- Project the introduction section of the software. (Software can be found at http://bguile .northwestern.edu.) Ask if any students have heard of the Galapagos Islands and have them briefly share what they know. Use the map on the first page of the introduction to orient students to the location of the Galapagos and their location at the equator.
- Guide students through the steps to make a comparison of traits.

Explain:

- Have student groups go to "Explore Ecosystem". This is where they can find the information they need for their activity sheet. Have students click on the Finch button. They should see pictures of the ground finch (male and female).
- You can demonstrate one comparison that will give students some structure for using the software. Relate what they are about to do to the moth problem in Lesson 9.

Lesson Closing

Elaborate:

- Have students identify any traits they see in the picture and record their ideas on the board. Students should also record these ideas on their activity sheets.
- Students should use the buttons at the top of the Explore the Ecosystem page to find the answers to the questions on the activity sheets.
- Once groups have had time to fill in the information on their activity sheets, bring the class together to share information. Let students know that if another group mentions information that they do not have, they should add it to their activity sheet.

Evaluate:

- Ask: “What factors might have affected the finch population?” Have students fill in the first column on their activity sheet that identifies the factors that affect survival: food, environment, and other organisms.
- Students can make these same kinds of comparisons using the software. Walk students through one example of a comparison using the following steps:

Extend:

Discussing the investigation questions In the software, students are introduced to the questions they will be investigating in this lesson.

Ask students what problem they will investigate.

- Why did the birds die?
- Why did some of them survive? Did variation matter?

Before students leave, remind them of the following:

- In their data logs, they should record anything they discovered and think is important to solving the mystery.
- They should also add notes about what they think the data show and why that idea is important to solving the mystery.

Lesson 10.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 10 Teaching Slides*
- *Teacher Resources*
- NewsELA- Charles Darwin
- Discovery Education- Who was Charles Darwin?

- Discovery Education- Darwin and the Finches
- http://bguile.northwestern.edu/
- Discovery Education- Galapagos Island

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: lesson 10 Days 4-6
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: ● Review instructions on how to save data to data logs so students can return to it later when they are looking for data to help them answer the questions. ● Students will review their comparison data about the finch, and how populations might change.
During the Lesson
Explore: ● Students will continue their investigation into the finch problem and continue to collect data. ● The first step is for each group to synthesize the ideas they have so far into an explanation. Using Part 1 of Activity Sheet 10.4, each group should complete explanations for the two questions: **Explain:** ● Students will continue their investigation into the finch problem and continue to collect data guided by the teacher.
Lesson Closing

Elaborate:

- Once groups have had time to fill in the information on their activity sheets, bring the class together to share information. Let students know that if another group mentions information that they do not have, they should add it to their activity sheet.
- Students will continue their investigation into the finch problem and continue to collect data guided by the teacher.

Evaluate:

- Students can make these same kinds of comparisons using the software. Walk students through one example of a comparison using the following steps: (TE.Pg.266)
- At the end of class, regroup briefly to assess whether students are making progress in collecting data.

Extend:

- Encourage students to write notes about their findings and why they think they are important.
- Reading 10.3 – Where Did the Data Come From?

Lesson 10.2 Resources

IQWST

- *Projected Images*
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- *Teacher Resources*
- NewsELA- Charles Darwin
- Discovery Education- Who was Charles Darwin?
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Unit Resources

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- *Student Edition*
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Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 10 Days 7-9
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: ● Ask students to share some of the unusual things that Grants had to do to collect the data about the finches. This could also be used as a bell ringer to check if students did the reading. ● Engage students in a brief discussion about why sharing information with other groups and getting their feedback is important.
During the Lesson
Explore: ● Students should now be working in their groups of four. In this activity, they can use the software to fill in any gaps in their data, resolve any disagreements uncovered in the midpoint sharing, and finalize their explanation for the finch mystery. **Explain:** ● For each question, groups should write out their claim and support it with the most important evidence they have found.
Lesson Closing
Elaborate: ● **Two pairs work together to compare their explanations** (Day 2) Have two pairs share explanations. They should begin by reading the other group's explanation and asking questions to clarify it if necessary. They should then fill out Part 2 Activity Sheet. ● Students should use the suggestions from the midpoint sharing to find additional data to use as evidence to support their explanation. They should then write their final explanation using Activity Sheet 10.5. **Evaluate:** ● Summarize the findings of the groups. ● After this discussion, have each group fill in the *follow up* question. This question asks them to list what they are going to investigate

next in order to take advantage of the feedback they received. This question is intended to focus on their final day using the software.
- Students should now be working in their groups of four. In this activity, they can use the software to fill in any gaps in their data, resolve any disagreements uncovered in the midpoint sharing, and finalize their explanation for the finch mystery.
- In Lessons 9 and 10, students saw two examples of population change and developed some ideas about how they may occur. Discuss the ideas that students might have developed.

Suggested Prompts:
- Does what we have learned about moths and finches help explain how population changes can occur?

Extend:
- Students can write a reflection about what they learned.
- Homework 10.5 – What Happens Next?

Lesson 10.3 Resources

IQWST

- *Projected Images*
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Jamboard: Driving Question Board

Lesson 11	**Constructing Models of Inheritance**	**Estimated Time: 3 lessons (50 mins each)**
Brief Overview of Lesson: Students will begin to construct a class consensus model by evaluating data from the Galapagos finches and peppered moths cases that reflects the central aspects of natural selection in creating a cause-and-effect chain. **What students should know and be able to do to engage in this lesson**: • Gather and explain evidence • Ask and answer questions • Collect and Record data • Compare data		

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
LS4.B: Natural Selection Natural selection leads to the predominance of certain traits in a population, and the suppression of others. **LS4.B:** Natural Selection In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed onto offspring.	**3-LS3B.2:** The environment also affects the traits that an organism develops. (*3-LS3-2)*
Focus Question for this Lesson	
If these two cases of the finches and moths have factors in common, do you think this type of population change can happen in other populations?	
Learning Intention	**Success Criteria**
I am learning that variations can cause certain individuals to survive and have offspring, which can cause a population change. *I am learning that variations can be influenced by environmental factors.*	*Day 1: I can construct a model from two evidence-based explanations to explain population change.* *Day 2: I can apply and evaluate a model of natural selection with cases of population change.*

	Day 3: I can analyze traits to determine which traits are influenced by heredity, environment, or population change.

Assessment(s)

Self-Assessment/Peer Assessment/Teacher Assessment
Students should identify the following critical factors to determine if natural selection is happening:- naturally occurring variation- change in environment advantage for individuals with the variation change in the population.

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
Scientific Discourse/Habits of Discussion

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

During the discussion, challenge students to focus on how the population changes happened. Was the change within the individual bacterium/insect? Students are likely to persist in the idea that mosquitoes adapted to resist the DDT. Make sure students understand the following:

- The variation had to exist prior to the environmental change.
- The change was not a response of organisms to try to survive.
- Individual insects/bacteria did not change.
- Some individuals with certain traits survived.
- Surviving individuals were able to pass the trait to their offspring.

Integrated Accommodations & Modifications

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Special Needs:

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Gifted and Talented:

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THE LESSON IN ACTION: Lesson 11 Day 1

Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.

Lesson Opening

Engage:

- Review Reading 10.5 of how well students understand the idea of how the population of finches changed and what caused that change.
- Have students compare the two cases of population change that they have seen. Solicit one or two comparisons.

During the Lesson

Explore:

Comparing the moths: Suggested Prompts:

- If these two cases, finches and moths, have facets in common, do you think this type of population change can happen in other populations?
- Guide students to the idea that they would need to examine the common factors in both cases and then generalize those factors. (TE.pg.298)
- Assign students to groups and have them work on Part 1 of the activity sheet.

Explain:

- Have students take out the explanations for the Galapagos finches and the peppered moths. They will use these to construct a table that compares the commonalities between the two cases. Go over the directions on Activity Sheet 11.1 for Part 1.
- Examine the table and make sure students understand that all steps in the table will be filled in.

Lesson Closing

Elaborate:

- When students have completed their charts, regroup the class. Ask several groups to share the steps on their charts. Look for agreements and disagreements. Through the discussion, create a class chart of the comparisons.
- Display PI: Consensus Model of Population Change. Fill in the two columns for each of the two cases that reflect the steps on which the class agreed. Develop a consensus model as a class. Remind students that the model will have to fit both explanations.

Evaluate:

- Reading 10.5:Homework Follow Up This homework is a good assessment of how well students understand the idea of how the population of finches changed and what caused that change. You may choose to review their ideas here or collect the homework and use it as an assessment.
- As you develop the consensus model, keep mapping back each step to the moth and finch stories to make sure students all agree it fits both stories. Have students record the model on Activity Sheet 11.1 as it is being developed.

Extend:

- **Reading 11.1:** Does Selection Always Occur Naturally. Students read about how selective breeding has changed the food we eat today.

Lesson 11.1 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 11 Teaching Slides*
- *Teacher Resources*
- NewsELA- Evolution Adaptations and Natural Selection
- Discovery Education- What is Natural Selection?
- Discovery Education-All about Natural Selection
- Edpuzzle-Amoeba Sisters Natural Selection

Unit Resources

- *Teacher Edition*
- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 11 Day 2
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: ● Reading Follow Up: Ask students to contrast natural selection with selective breeding.
During the Lesson
Explore: ● Group students and then give half the groups the bacteria case and the other half the insect case. ● The two cases that groups will investigate will be (1) antibiotic resistant bacteria and (2) DDT-resistant insects. **Explain:** ● Direct students to Activity Sheet 11.2. Have students write out the consensus model in the first column. ● Students will take whatever facts from the group's fact sheet that can apply to the model and place them next to the corresponding step.
Lesson Closing
Elaborate: ● After students have completed the models on the activity sheets, have groups summarize the information about their organism and the problem. Next, have the groups share their models as applied to the two cases**.** **Evaluate:** ● After the class discussion, have students complete the *making sense questions.* ● Discuss responses to the *making sense questions*. Have students summarize how the model applies across the four cases of finches, moths, mosquitoes, and bacteria. **Extend:** ● Students should be able to identify the critical factors to determine if natural selection is happening, by identifying the main scientific.

Lesson 11.2 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 11 Teaching Slides*
- *Teacher Resources*
- NewsELA- Evolution Adaptations and Natural Selection
- Discovery Education- What is Natural Selection?
- Discovery Education-All about Natural Selection
- Edpuzzle-Amoeba Sisters Natural Selection

Unit Resources

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Jamboard: Driving Question Board

THE LESSON IN ACTION: Lesson 11 Day 3
Lessons are designed to be able to transfer from IN-PERSON to HYBRID to VIRTUAL learning.
Lesson Opening
Engage: Return to the *Driving Question Board* and have students identify the main types of influences on organisms that they have investigated during the unit, and get examples of those influences from organisms studied in the unit. ● PI: Trout and Lamprey and Plants could be used to address the influences.
During the Lesson

Explain:

- Ask students if there are any questions they still have about why organisms look the way they do.

Lesson Closing

Elaborate:

- If questions are posed that can be answered in the context of the unit, allow other students to answer those questions.
- If questions are posed that require information not covered in the unit, explain that in high school, students will return to the study of biology.

Evaluate:

- Continue to respond to students' questions.

Extend:

- Students should be able to identify the critical factors to determine if natural selection is happening, by identifying the main scientific.

Lesson 11.3 Resources

IQWST

- *Projected Images*
- *Audio Recordings of Readings*
- *Lesson 11 Teaching Slides*
- *Teacher Resources*
- NewsELA- Evolution Adaptations and Natural Selection
- Discovery Education- What is Natural Selection?
- Discovery Education-All about Natural Selection
- Edpuzzle-Amoeba Sisters Natural Selection

Unit Resources

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- *Student Edition*
- *Storyline*
- *Remote Learning Lesson Overview*

Jamboard: Driving Question Board

Unit 3: PS3 How will it Move?

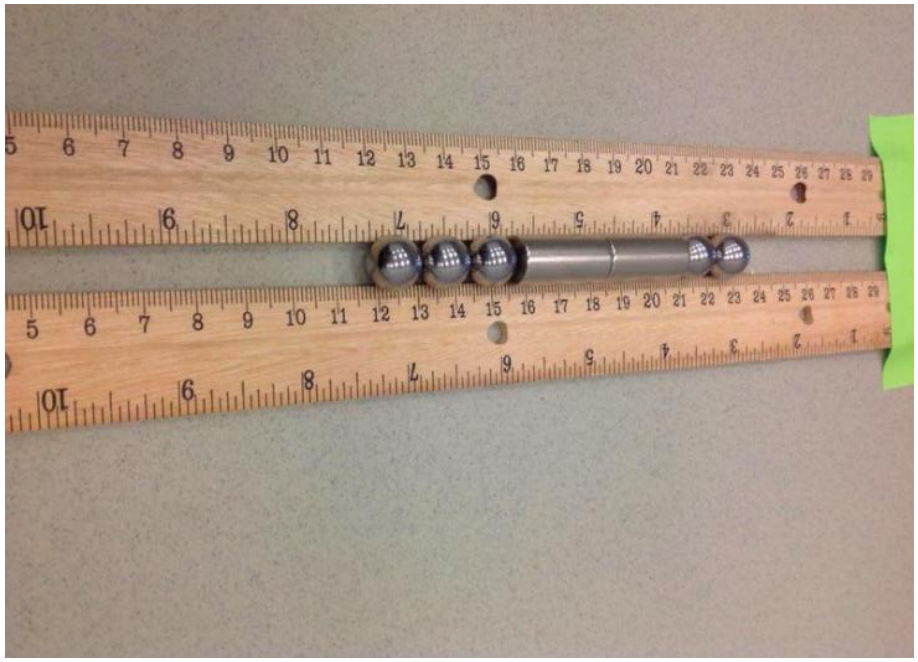
Stage 1 – Desired Results

ASSESSED FOCUS STANDARDS:

- **MS-PS2-1.** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- **MS-PS2-2.** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- **MS-PS2-3.** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- **MS-PS2-4.** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- **MS-PS2-5.** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

Unit Description

Anchoring Phenomenon:



Magnetic Cannon

The Magnetic Cannon: Students explore how this device behaves in an unpredictable manner. Students generate questions about the device and its relationship to the Driving Question, forces, motion and energy in general.

How Will It Move? Is a five-week, project-based physical science unit that contextualizes concepts dealing with forces and motion in students' real- world experiences. Four interesting devices provide a common experience for all students to begin the unit, and future lessons circle back to making sense of the anchoring phenomena. This practice of exploring, asking questions, and then continuing to revisit— each time knowing a little more of the science of

• **MS-PS3-2.** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. • **MS-PS3-5.** Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object. • **MS-ESS1-2.** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. • **MS-ESS1-3.** Analyze and interpret data to determine scale properties of objects in the solar system. **CONTENT CONNECTIONS:** • **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. (MS-PS2-1),(MS-PS2-3), (MS-PS3-5) • **RST.6-8.3** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5	what is happening— enables students to learn core ideas and crosscutting concepts about energy that can be used to explain a range of phenomena in the real world. *Meaning* **ENDURING UNDERSTANDINGS** Motion plays a fundamental role in many of our experiences. The goal of the unit is to allow students to identify the forces that are involved in many real-world situations, analyze the relationship between them, and explain and predict how objects will move due to these forces. • All forces come in pairs, in opposite directions. (Lesson 2) • The beginning of motion is always caused by forces. (Lesson 3) • Forces that are applied to an object in opposite directions counteract each other. (Lesson 3) • Forces that are applied to an object in the same direction reinforce one another. (Lesson 3) • An object's motion is influenced only by the forces that are applied to it, not by the forces it applies to others. (Lesson 3) • For every force there is an equal and opposite force. [Newton's 3rd law]. (Lesson 4) • An object will continue to remain at rest or move at a constant speed and in a straight line unless it is subjected to unbalanced forces. [Newton's 1st Law of Motion, it summarizes the	**ESSENTIAL QUESTIONS** • What makes it start and stop? • What makes it change its motion? • What is the difference?

• **WHST.6-8.1** Write arguments focused on discipline content. (MS-PS2-4), (MS-PS3-5) • **WHST.6-8.7** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5 • **SL.8.5** Integrate multimedia and visual displays in presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2), (MS-ESS1-2) • **MP.2** Reason abstractly and quantitatively. (MS-PS2-1), (MS-PS2-2), (MS-PS2-3), (MS-PS3-5) • **MP.4** Model with mathematics. (MS-ESS1-2) • **6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-5), (MS-ESS1-2) • **6.NS.C.5** Understand that positive and negative numbers are used together to describe quantities having	following four ideas]. ○ Unbalanced forces acting on an object change its speed or direction of motion, or both. (Lesson 7) ○ Unbalanced forces acting against the direction of motion cause the object to slow down. (Lesson 7) ○ Unbalanced forces acting in the direction in which they begin cause the object to speed up. (Lesson 7) ○ Balanced forces acting on an object cause it to remain at rest or to move at a constant speed in a straight line. (Lesson 7) .	
	What students will know and be able to do	
	KNOWLEDGE • Contact forces always come in pairs. • Every two objects that touch apply a contact force to each other. • All forces always come in pairs, in opposite directions. • The tennis ball began moving because a tapping force was applied to it. • The marble began moving because the rubber band applied a force to it. • Dynamic friction always acts on an object against the direction in which the object moves	**SKILLS** • **MS-PS2-1.** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.[Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] • Systems and System Models • Constructing Explanations and Designing Solutions • **MS-PS2-2.** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and

opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS2-1) • **6.EE.A.2** Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-1),(MS-PS2-2) • **7.EE.B.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-PS2-1),(MS-PS2-2) • **7.EE.B.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-PS2-1),(MS-PS2-2) • **7.RP.A.2** Recognize and represent proportional relationships between quantities. (MS-PS3-5) • **8.F.A.3** Interpret the equation y = mx	• Slowing down is caused by unbalanced forces acting against the direction of motion. • Speeding up is caused by unbalanced forces acting in the direction of motion. • Changing direction of motion is caused by unbalanced forces acting sideways.	the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] • Stability and Change • Planning and Carrying Out Investigations • **MS-PS2-3.** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.[Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] • Cause and Effect • Asking Questions and Defining Problems • **MS-PS2-4.** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.[Clarification Statement: Examples of evidence for arguments

+ b as defining a linear function whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-5)		could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] • Systems and System Models • Engaging in Argument from Evidence • **MS-PS2-5.** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] • Cause and Effect • Planning and Carrying Out Investigations • **MS-PS3-2.** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.[Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of

		objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] • Systems and System Models • Developing and Using Models • **MS-PS3-5.** Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.[Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] • Energy and Matter • Engaging in Argument from Evidence • **MS-ESS1-2.** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.[Clarification Statement: Emphasis for the model is on gravity

		as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] • Systems and System Models • Developing and Using Models • **MS-ESS1-3.** Analyze and interpret data to determine scale properties of objects in the solar system.[Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] • Scale, Proportion, and Quantity • Analyzing and Interpreting Data
Stage 2 – Evidence		
SUMMATIVE ASSESSMENT(S)		

The Unit Driving Question: How will it Move?

- Claim: Objects Move due to Forces.
- Evidence: Consider knowledge gathered from forces, energy, balanced unbalanced force to explain behavior of Magnetic Cannon.
- Reasoning: Integrates the Scientific Principles learned from analyzing and synthesizing the evidence to draw connection and formulate a conclusion statement: the claim.

There are CERs built in throughout the unit that can be planned to build on one another to strengthen their written articulation of the standards.
CER Poster
CER Scaffold

There are CERs built in throughout the unit
Lab analysis questions/data analysis

- **Learning Set 1**: What makes it start and stop?
- **Learning Set 2:** What makes it change its motion?
- **Learning Set 3:** What is the difference?

Culminating task/project at the end of the Project-Based unit:
Students construct a complete, evidence- based explanation of the behavior of the Magnetic Cannon.
STEM GAUGE
122747A
122973A
180215A
183808A
183856A
183857A
186322A
186371A
186386A

PRE-ASSESSMENT

How will it Move?
K-W-L Jamboard Presentation

Stem Gauge 180215A.pdf

Integration of 21st Century Skills	Integration of Technology	Career Education
● 9.1.4.A.1 Explain the difference between a career and a job and identify various jobs in the community and the related earnings. ● 9.1.4.A.2 Identify potential sources of income. ● 9.1.4.A.3 Explain how income affects spending and take-home pay. ● 9.2.4.A.1 Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals. ● 9.2.4.A.2 Identify various life roles and civic and work-related activities in the school, home, and community. ● 9.2.4.A.3 Investigate both traditional and nontraditional careers and relate information to personal likes and dislikes. ● 9.2.4.A.4 Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.	● Chromebooks ● IQWST Digital Portal ● Chromebooks ● IQWST Digital Portal ● Computer simulations ● Discovery Education Videos ● IQWST Projected Images ● IQWST Audio Recordings ● IQWST Activity Videos ● Newsela articles ● Phet ● EdPuzzle Additional Resources: ● Google Classroom ● Google Jamboard ● Seesaw ● Screencastify ● Wevideo ● Padlet ● Flipgrid ● Kahoot	Please use the above link to Login and access the Career Connection: ● Click on NJResident ● Select “Newark” and enter ZipCode ● After you login, click on the link below to access more information **Overview - Electrical and Electronics Engineers** Electrical and electronics engineers design, develop, test, and maintain electrical and electronic devices. Many of these devices create power, help people talk to one another, or provide lighting for buildings. Engineers use computer-aided design (CAD) systems and engineering software to design devices and equipment. They factor in safety, environmental impact, and energy usage. They calculate costs and select materials that follow manufacturing standards. Engineers work with a team to build systems and products they have designed. They oversee and make sure workers build the product correctly. During construction, engineers identify problems and solve them. They plan the layout of equipment and lines. They make sure products meet specifications, safety standards, and codes. After construction, engineers test equipment and provide ongoing maintenance if needed. They also evaluate devices and systems

		already in use and make recommendations for repair or redesign. Electrical engineers design electrical equipment such as: Electric motors, Radar and navigation systems, Communications systems, Power generation equipment. Electronics engineers design and develop electronic equipment such as: Broadcast and communications systems, Global positioning systems (GPS), Sometimes engineers design small components for large systems, such as power inverters for solar energy systems. Some electrical and electronics engineers work for green technology companies where they may develop products that use less power. For example, in the car industry electrical engineers build efficient parts for electric cars.
Stage 3 – Learning Plan		
UNIT VOCABULARY		
Phenomenon Kinetic Energy Gravitational Energy Elastic Energy Energy Transfer Energy Conversion Energy Transformation Scientific model System Components Force Interact	Gravitational Force Electrical Force Horizontal Force Vertical Force Reinforce Counteract Net Force Free- body model Repulsive Force Balanced Force Unbalanced Force Compression	Friction Dynamic Friction Static Friction Recoil Bar chart Stationary Motion axis Time axis Vertical Motion axis Horizontal Motion axis Slope Acceleration

Interaction Contact Force Forces that act at a distant Magnetic Force	Newtons Mass Magnitude Elastic	Deceleration Velocity Planetary Motion Tides

SUMMARY OF KEY LEARNING

Lesson 1: Days 1 & 2- How will it move Phenomenon/ DQB setup

- **Learning Intention:** I am learning about energy, force and motion and how it applies to Newton's Cradle.
- **Success Criteria:** I can observe the Magnetic Cannon. I can develop and ask questions about force, motion, and energy, which will be organized to structure the unit's Driving Question Board.
- **Brief Overview of Lesson:** Students observe a device called a *Magnetic Cannon* and investigate its behavior under different conditions.

Lesson 2: Days 3-5 - Which Force Act on an Object?

- **Learning Intention:** I am learning the components that comprise a system and forces that act between pairs of objects in a system.
- **Success Criteria:** I can experiment with four devices, describe the forces involved, and explain how they think each works.
  - I can analyze scenarios to determine the components and the forces present in them.
  - I can apply what has been learned about systems and forces to the Magnetic Cannon device.
- **Brief Overview of Lesson:** Students will carry out investigations to understand the components that comprise a system and to identify the forces that act between pairs of objects in a system. This lesson builds on curiosity generated in Lesson 1 to define forces and identify those present in four phenomena. It also introduces a way to model systems and the forces that act on a system's components.

Lesson 3: Days 6-8 - Why Does an Object Start Moving?

- **Learning Intention:** I am learning that the characteristics of two forces determine whether they reinforce or counteract each other.
- **Success Criteria:** I can consider simple situations in which an object begins to move because of a single force.
  - I can analyze scenarios involving multiple forces, realizing that forces can reinforce, counteract, or cancel each other.
  - I can revisit the four devices to determine which forces made the systems begin moving.
- **Brief Overview of Lesson:** Students will analyze the characteristics of two forces to determine whether they reinforce or counteract each other. Students will analyze, construct, and use free-body diagrams to determine the forces acting on objects.

Lesson 4: Days 9-11 -How Strong Is that Force?

- **Learning Intention:** I am learning the relationship between weight and a spring's elongation, thus developing Hooke's Law.
- **Success Criteria:** I can investigate the relationship between a spring's elongation and the mass hung from it.
  - I can measure force using probes to investigate Newton's third law.
  - I can revisit Lesson 2 devices, using probes to measure some of the forces involved in these systems.

- **Brief Overview of Lesson:** Students will plan and carry out an investigation testing the relationship between weight and a spring's elongation, thus developing Hooke's Law. Students will use computational thinking, and force probe technology, to measure and analyze forces and construct Newton's third law.

Lesson 5: Days 12 &13 -Why Does an Object Stop Moving?

- **Learning Intention:** I am learning that forces come in pairs. I am learning about pairs of forces reinforcing or counteracting each other.
- **Success Criteria:** I can investigate friction by examining simple situations in which an object stops moving, either suddenly or gradually. I can analyze forces to help develop a CER Scientific explanation explaining why components of an apparatus (Magnetic Cannon) start and stop.
- **Brief Overview of Lesson:** Students will analyze pairs of forces to determine whether they reinforce or counteract each other. Students will analyze forces to provide evidence to explain that forces always come in pairs between objects. Students will construct, use, and analyze free-body diagrams as models that help explain and predict how an object will move.

Lesson 6: Days 14-16 -How Can We Describe How an Object Moves?

- **Learning Intention:** I am learning about balanced and unbalanced forces. I am learning that graphs and bar charts can be used as models to describe the motion of multiple objects along one dimension.
- **Success Criteria:** I can revisit Newton's Cradle, developing and using representations to describe when the end-ball is moving and when it is not.
    - I can develop and use a bar chart to describe whether the ball is moving or not.
    - I can develop a graph to describe the dependency of the ball's location on time, and compare this graph with the bar chart from Activity 6.1. I can apply ideas to the Magnetic Cannon, and draw conclusions regarding the slopes of the lines in motion graphs.
- **Brief Overview of Lesson:** Students will construct time-dependent graphs and bar charts to describe the motion of multiple objects along one dimension. Students will use graphs and charts as models to determine whether an object is subjected to unbalanced forces.

Lesson 7: Days 17-19 -Why Do Things Change Their Speed or Direction?

- **Learning Intention:** I am learning the laws of force and motion as they reason from specific cases to broader generalizations.
- **Success Criteria:** I can consider what happens the moment after an object begins moving or a moment before it stops moving to conclude that (1) forces are the reason why objects change their speed and (2) being at rest is like being in motion with a speed of zero.
    - I can analyze situations to conclude that forces are responsible for both changes in speed and direction.
    - I can consider a situation in which objects move at a constant speed without changing direction to conclude the forces acting on the objects must balance each other.
- **Brief Overview of Lesson:** Students will analyze a variety of scenarios in order to construct laws of force and motion as they reason from specific cases to broader generalizations

Lesson 8: Days 20&21 -Using Forces and Energy to Understand the Magnetic Cannon

- **Learning Intention:** I am learning about energy conservation and why Ball E in the Magnetic Cannon starts moving.

- **Success Criteria:** I can revisit and summarize activities from which scientific principles have been derived. I can apply scientific principles to explain the behavior of the Magnetic Cannon. I can revisit energy transformation and conservation and connect these ideas to forces, providing a CER Scientific explanation, explaining how the Magnetic Cannon works.
- **Brief Overview of Lesson:** Students will explain what is the difference between forces and energy when it comes to the magnetic cannon? Students will use scientific principles to construct an explanation of why Ball E in the Magnetic Cannon starts moving. Students will use energy conservation to construct an explanation of why Ball E shoots out from the Magnetic Cannon.

CULTURALLY RESPONSIVE TEACHING in PRACTICE	SOCIAL EMOTIONAL LEARNING in PRACTICE
Unit will encourage student engagement in virtual science lab investigations. Unit will connect Students to Professional partnership with participation in Students to Science Virtual Labs. Unit will *establish inclusion* as lessons are engaging and require *collaboration and cooperation.* *Positive attitudes* will be a focus of the unit as the lessons are based on *prior knowledge and experience*, are s*et with clear learning goals* and *contain fair and clear criteria for evaluation.* The unit also includes *challenging experiences t*o enhance meaning and to *encourage self-assessment.*	**Set classroom norms for discussions** ● When having discussions in the classroom we open the floor to all students' perspectives. We want to make sure all of our students feel heard, and we also want to make sure all of our students feel safe enough to express their ideas within the space as well. By setting discussion norms for students that they can all contribute to set the tone that the classroom is a safe space and that all student ideas, perspective, opinions etc. are welcome while also setting guidelines for how the class will go about discussing counterpoints in a constructive manner. **Assign Group Roles** ● Whenever group work is being done all members of the group should have an assigned role. You can assign this role randomly to members in the group or let them pick their role. If groups/tables are the same every time roles can shift each time there is group work or remain the same for consistency depending on your classroom climate and preference. Having a role not only gives every student a designated task to do during that assignment/activity, it enforces a sense of self-worth to make them feel part of a larger community in that the role they are playing is essential to completion of the task as a whole group. **Acknowledge Students Ideas** ● During think-pair-share, discussions, eliciting ideas probes or any other time that you have students sharing ideas out loud

	you can write down key points from their ideas on the board. This shows that you are acknowledging their words and listening to what they are saying. From these key points you can use them to facilitate discussion, which makes for a richer and authentic classroom discussion as you are pulling from what students have said directly. **Promoting Growth Mindset** ● Many times students will become confused or not fully understand the material right away. Often, students shut down, think that they have failed and automatically have a "fixed mindset" view. By promoting growth mindset and teaching students how to shift their thinking promotes not only students' social-emotional learning, but highlights the classroom community as a positive and safe place to cultivate learning.

Lesson 1:	**How will it move Phenomenon/ DQB setup**	**Estimated Time: 2 days/50 minutes each**

Brief Overview of Lesson: Students observe a device called a *Magnetic Cannon* and investigate its behavior under different conditions.

What students should know and be able to do to engage in this lesson:

- An object has energy, but it does not have a force. Instead, an object applies a force to another object.
- A force has a direction; energy has no direction.
- Forces are useful to explain motion on a moment- to- moment basis; energy is especially useful for describing beginning- to- end changes.

LESSON FOUNDATION

Assessed Standards for this lesson	**Important content not included in the standards**
MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. (A1.2, R1.2) **MS-PS2-2.** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. (A1.1, A1.2) **MS-PS3-2.** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of	**MS-PS2A-1** For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS-PS2-1) **MS-PS2A-2** The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero,its motion will change. The greater the mass of the object, the greater

potential energy are stored in the system. (A1.2, R1.2) **MS-PS3-5.** Construct, use, and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object. (A1.1, A1.2, R1.2)	the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2) **MS-PS3A-2** A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2) **MS-PS3A-2** All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MSPS2-2) **MS-PS3C-2** When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2) **MS-PS3A-5** When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)
Focus Question for this Lesson	
How did the steel balls in the Magnetic Cannon behave and why?	
Learning Intention	**Success Criteria**
I am learning about energy, force and motion and how it applies to Newton's Cradle.	*I can observe the Magnetic Cannon. I can develop and ask questions about force, motion, and energy, which will be organized to structure the unit's Driving Question Board.*
Assessment(s)	
Self-Assessment/Peer Assessment/Teacher Assessment Students will construct an explanation of why the steel ball in the Magnetic Cannon behaves the way it does- including force and energy. ● Summarize key ideas from this lesson.	
Feedback (Peer to peer/student to teacher/teacher to student)	
Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use. https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf	

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

Students commonly think the term *phenomenon* means "something outstanding or exceptional." Use this opportunity to discuss the different ways words are used in science and everyday life.

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort

- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

Groupings

- For more groups, add extra groups using pedometers with different difficulty levels of exercise.
- For fewer groups, have one group use more than one probe. The skin temperature and heart rate probes are easier to use, so one group could manage both of these probes. It is important to have at least two groups using the pedometers so that students can compare Calories used in walking versus running.
- If you modify the groups, you may have to make a new data table

Unit 4: *How Does Food Provide My Body with Energy?*

Stage 1 – Desired Results

ASSESSED FOCUS STANDARDS:

PS1.A: Structure and Properties of Matter
Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.

PS1.A: Structure and Properties of Matter
Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms.

Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals).

PS1.B: Chemical Reactions
Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different

Unit Description

Anchoring Phenomenon:

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How Does Food Provide My Body with Energy? is an eight- week, cross- disciplinary introduction to chemistry that targets ideas in the context of living systems. The unit serves to deepen understandings of the molecular aspects of how food provides organisms with energy and building blocks; the chemical reactions and energy transformations that occur during photosynthesis and cellular respiration, the biological processes that support these chemical reactions, and the interdependence of organisms in an environment for carrying out these chemical reactions; and how to design investigations and gather, organize, and analyze data in a way that yields valid results to support scientific explanation.

Meaning

ENDURING UNDERSTANDINGS	**ESSENTIAL QUESTIONS**
1. Food provides energy and building materials for the cells. (Lesson 2. Different types of food molecules, when reacting with oxygen,	● How Do Food Molecules Compare to Each Other?

molecules, and these new substances have different properties from those of the reactants. The total number of each type of atom is conserved, and thus the mass does not change. **PS3.D: Energy in Chemical Processes and Everyday Life** Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7) **PS3.D: Energy in Chemical Processes and Everyday Life** The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6)	produce different amounts of energy. (Lesson 2) 3. The difference in the amount of energy that carbohydrates, proteins, and fats have the capacity to provide is due to the differences in the arrangement and number of different types of atoms in the molecules. (Lesson 3) 4. Large food molecules are broken down through a chemical reaction. (Lesson 4) 5. Organisms build up new molecules through a chemical reaction. These molecules are used for growth and repair. When food molecules are not used immediately, organisms can store them for short or long periods of time for energy or to be used as building materials. (Lesson 5) 6. Plants need water and light to grow. (Lesson 6) 7. Plants convert light energy into chemical energy. (Lesson 6) 8. Photosynthesis is a chemical reaction that uses energy from the sun and the reactants carbon dioxide and water to form glucose and molecules of oxygen. (Lesson 7) 9. Burning food requires food molecules and oxygen and produces carbon dioxide and water. In the process, energy is released. (Lesson 8) 10. Cellular respiration is the chemical reaction that provides energy to the cells of an organism. During cellular respiration, organisms (including plants and animals) use oxygen and food molecules and produce water and carbon dioxide. (Lesson 9) 11. An ecosystem needs a constant input of light energy. As light energy enters the environment, plants use this for photosynthesis to create food molecules. These food molecules are used by plants and animals in cellular respiration to produce energy for cells. (Lesson 10) 12. Carbon in the environment can cycle from food molecules to carbon dioxide through photosynthesis and cellular respiration. (During photosynthesis, plants rearrange the carbon atoms in carbon dioxide into carbon- containing food molecules. Then during cellular respiration, plants and animals rearrange the carbon in food molecules back into carbon dioxide.) (Lesson 10)	• What Do Organisms Do with Food? • Where Does the Energy in Food Come From? • How Is Food Used for Energy?

LS1.B: Growth and Development of Organisms Genetic factors as well as local conditions affect the growth of the adult plant. **LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. **LS1.C: Organization for Matter and Energy Flow in Organisms** Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to	*What students will know and be able to do* **KNOWLEDGE** • Carbohydrates, proteins, and fats are food molecules. They are food because they provide the body with energy and building materials. • The body is constantly using energy. • In the body, a chemical reaction occurs that provides energy from food molecules and oxygen to do things. • In the chemical reaction, food reacts with oxygen and one product formed is carbon dioxide. (This is similar to burning outside the body). • The systems of the body are involved in bringing the reactants to and taking the products away from the cells, and this causes many changes in the body when energy needs increase. • Food molecules are similar in that they are all made of C, H, and O; and for proteins and carbohydrates, many of the subunits join together to form complex molecules. • Fat molecules provide the body with more energy than carbohydrates and protein molecules because of the types, number, and arrangement of their atoms. • You have to exercise longer or harder to expend the energy that can be provided by fat than for the same mass of carbohydrates and proteins. • Breaking down large food molecules like starch into glucose does not provide the body with energy. • The purpose of digestion is to make food molecules smaller so that they can get into the cells where they undergo reactions to provide the body with energy. • Both plants and animals store food for later use when they have more food than they need for energy immediately. • Plants store food molecules in their roots (like potatoes or carrots). • Animals cannot store very much in the form of carbohydrates. Instead, their bodies turn excess carbohydrates	**SKILLS** **MS-PS1-1.** Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] Patterns Cause and Effect Scale, Proportion, and Quantity Energy and Matter Structure and Function Developing and Using Models Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information **MS-PS1-2.** Analyze and interpret data on the properties

form new molecules, to support growth, or to release energy. **LS1.C: Organization for Matter and Energy Flow in Organisms** Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. **CONTENT CONNECTIONS:** **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. **RST.6-8.2** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. **RST.6-8.7** Conduct short research projects to answer a question (including a self-generated question), drawing on	and proteins into fats to be stored in fat tissue (via a chemical reaction). ● Plants need light and water for growth. ● Plants convert light energy into chemical energy of food molecules (photosynthesis). ● Photosynthesis is a chemical reaction. ● During photosynthesis, the atoms in carbon dioxide and water rearrange to produce glucose and oxygen. ● Photosynthesis only occurs in the light because plants need light energy to carry out the process of photosynthesis. ● Plants store the glucose that they produce as starch. Later, they can use the energy that this starch can provide. ● Animals can use this stored energy from plants when we eat the food molecules the plants make. ● Food reacts with oxygen to provide carbon dioxide and water. ● Burning reactions convert energy to light and thermal energy. ● During cellular respiration, food molecules react with oxygen in the cells to produce water and carbon dioxide. ● Cellular respiration provides kinetic and thermal energy. ● Cellular respiration is different from burning food in the types and amounts of energy involved. (Burning takes place in only one step, but cellular respiration takes dozens of different steps).	of substances before and after the substances interact to determine if a chemical reaction has occurred.[Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] Patterns Cause and Effect Scale, Proportion, and Quantity Energy and Matter Structure and Function Developing and Using Models Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information **MS-PS1-5.** Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms.] Patterns Cause and Effect

several sources and generating additional related, focused questions that allow for multiple avenues of exploration **SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. **WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. **WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. **MP.2** Reason abstractly and quantitatively. **MP.4** Model with mathematics. **6.SP.A.2** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.		Scale, Proportion, and Quantity Energy and Matter Structure and Function Developing and Using Models Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Obtaining, Evaluating, and Communicating Information **MS-PS1-6.** Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.[Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] Patterns Cause and Effect Scale, Proportion, and Quantity Energy and Matter Structure and Function Developing and Using Models Analyzing and Interpreting Data Constructing Explanations and Designing Solutions

6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. **6.SP.B.4** Display numerical data in plots on a number line, including dot plots, histograms, and box plots. **6.SP.B.5** Summarize numerical data sets in relation to their context. **6.EE.C.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. **8.EE.A.3** Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is		Obtaining, Evaluating, and Communicating Information **MS-PS3-4.** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] System and System Models Scale, Proportion, and Quantity Energy and Matter Developing and Using Models Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Planning and Carrying Out Investigations

than the other.		Engaging in Argument from Evidence **MS-LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] System and System Models Scale, Proportion, and Quantity Energy and Matter Cause and Effect Structure and Function Developing and Using Models Constructing Explanations and Designing Solutions Planning and Carrying Out Investigations

		Engaging in Argument from Evidence**MS-LS1-6.** Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] System and System Models Scale, Proportion, and Quantity Energy and Matter Cause and Effect Structure and Function Developing and Using Models Constructing Explanations and Designing Solutions Planning and Carrying Out Investigations Engaging in Argument from Evidence **MS-LS1-7.** Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. [Clarification Statement: Emphasis is on describing that molecules are broken apart and

		put back together and that in this process, energy is released.] System and System Models Scale, Proportion, and Quantity Energy and Matter Cause and Effect Structure and Function Developing and Using Models Constructing Explanations and Designing Solutions Planning and Carrying Out Investigations Engaging in Argument from Evidence **MS-LS2-3.** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] Patterns Stability and Change Energy and Matter Developing and Using Models Constructing Explanations and Designing Solutions Analyzing and Interpreting Data Engaging in Argument from Evidence

		MS--LS2--4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.] Patterns Stability and Change Energy and Matter Developing and Using Models Constructing Explanations and Designing Solutions Analyzing and Interpreting Data Engaging in Argument from Evidence

Stage 2 – Evidence

SUMMATIVE ASSESSMENT(S)

The Unit Driving Question: How do food molecules provide my body with energy?

- Claim:
- Evidence: Consider knowledge gathered from
- Reasoning: Integrates the Scientific Principles learned from analyzing and synthesizing the evidence to draw connection and formulate a conclusion statement: the Claim.

There are CERs built in throughout the unit that can be planned to build on one another to strengthen their written articulation of the standards.

CER Poster

CER Scaffold

Lab analysis questions/data analysis

- **Learning Set 1**: How do food molecules compare to each other? Students are expected to assess their knowledge gained about the molecular structures of carbohydrates, fats, and proteins and how their molecular nature determines the amount of energy they contain.
- **Learning Set 2:** What do organisms do with food? Students will assess their knowledge about chemical reactions within the body to break down, build up, and store large food molecules. They will tie in the connections of food molecules with cellular growth and repair.
- **Learning Set 3:** Where does the energy in food come from? Students will construct a descriptive analysis of how plants make food through photosynthesis and highlight plays as original sources of all food molecules. They will further argue that only organisms that can convert light energy into any form usable by most of the organisms on earth are plants.
- **Learning Set 4:** How is food used for energy? Students will synthesize their understanding further to consider the reactants, products and energy conversions of burning reactions in relation to the reactions that take place inside of organisms. They will construct a descriptive analysis to explain the flow of matter and energy through ecosystems.

STEM Gauge

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PRE-ASSESSMENT

Stem gauge 116955A (1).pdf

Integration of 21st Century Skills	**Integration of Technology**	**Career Education**

• Critical thinking and problem solving
• Collaboration
• Agility and adaptability
• Initiatives and entrepreneurship
	• IQWST Projected Images
	• IQWST Audio Recordings
	• IQWST Lesson Videos
	• IQWST Slide Decks
	• Discovery Education Videos
	  ○ Food, Energy, and You
	  ○ How does Food supply energy?
	  ○ Food into Fuel: Our digestive system
		Career Connection:
		
		Please use the above link to Login and access the Career Connection:
		
		• Click on NJResident

• Accessing and analyzing information • Effective oral and written communications • Curiosity and imagination 9.1.4.A.1 Explain the difference between a career and a job and identify various jobs in the community and the related earnings. 9.1.4.A.2 Identify potential sources of income. 9.1.4.A.3 Explain how income affects spending and take-home pay. 9.2.4.A.1 Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals. 9.2.4.A.2 Identify various life roles and civic and work-related	○ Turning ATP into ADP ○ Aerobic Respiration ○ Introduction to the Flow of Matter and Energy ○ The Flow of Matter ○ Biology: the Science of Life: The flow of Matter and Energy in the Living World: Photosynthesis and Cellular Respiration Bill Nye The Science Guy on the Food Web (Full Clip) PHET Simulation: Eating and Exercise: How many calories are in your favorite foods? How much exercise would you have to do to burn off these calories? What is the relationship between calories and weight? Explore these issues by choosing diet and exercise and keeping an eye on your weight.	• Select "Newark" and enter ZipCode • After you login, click on the link below to access more information **Overview - Food Scientist** Food scientists conduct research to develop and improve food products that are healthy, safe, and appealing. Food scientists work in many different industries such as: Food manufacturing companies, Colleges and universities, Federal, state, and local governments. The work of food scientists varies depending on their specialty area. Some food scientists engage in research to discover new food sources and products. They analyze food content to determine levels of vitamins, fat, sugar, or protein. Food scientists also study methods to improve the quality of foods. For example, they might look for ways to improve flavor, color, texture, or nutritional content. In addition, food scientists develop methods to process,

activities in the school, home, and community. 9.2.4.A.3 Investigate both traditional and nontraditional careers and relate information to personal likes and dislikes. 9.2.4.A.4 Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.		preserve, package, or store food. New methods must meet government rules and industry standards. Food scientists who work in product development apply the findings of food science research. For example, they test new products in test kitchens. They confer with specialists to resolve problems with products. For example, they might consult flavor experts or process engineers. In government jobs, food scientists develop food quality standards and safety and health regulations. Some food scientists enforce government regulations by inspecting food processing areas. All food scientists keep records of their research and write reports of their findings.
Stage 3 – Learning Plan		
UNIT VOCABULARY		
Energy Chemical Reaction Closed system Open system Energy Conversion Independent Variable Dependent Variable	Nutrients Proteins Carbohydrates (simple v. complex) Fats (lipids) Starch Glucose Indicator Digestion	Photosynthesis Cellular respiration Amino Acid Triglyceride Metabolism Enzyme Control Sample Size
SUMMARY OF KEY LEARNING		
Lesson 1: Days 1-3- Why do I lose Weight when I exercise?		

- **Learning Intention:** I am learning that burning food is the process in which food molecules react with oxygen to provide energy in the body.
- **Success Criteria:**
  - **Day 1&2:** I can obtain information and analyze data about what happens to the body when I exercise.
  - **Day 3:** I can construct an explanation about what happens to fat molecules when people lose weight.
- **Brief Overview of Lesson:** Students will engage in activities that will connect what they observe happening to their body when they exercise (macroscopic phenomena) to the chemical reactions and energy conversions occurring inside the cells of the body when food molecules react with oxygen to provide energy for cellular processes.

Lesson 2: Days 4& 5 - What do Plants need to Grow?

- **Learning Intention:** I am learning that plants need water and light to grow.
- **Success Criteria:** I can plan and carry out an investigation to investigate the effects of water, light and soil on plant growth.
- **Brief Overview of Lesson:** Students will be setting up their plant investigations that they will need for Learning Set 3. They will examine the characteristics of experimental design, data gathering and organization, and the importance of sample size, control groups and multiple trials.

Lesson 3: Days 6 &7 -Do different foods provide different amounts of energy?

- **Learning Intention:** I am learning that different types of food molecules release different amounts of energy when burning.
- **Success Criteria:** I can design an experiment to determine which type of food molecules, when reacting with oxygen, provides the most energy.
- **Brief Overview of Lesson:** Students will investigate the relationship between different types of food molecules and the amount of energy.

Lesson 3: Day 8- Do different foods provide different amounts of energy?/ How much do I need to exercise?

- **Learning Intention:** I am learning that fat molecules provide the body with more energy than carbohydrates and protein molecules.
- **Success Criteria:** I can calculate how many calories per minute I use up while exercising. I can argue that the difference in the amount of energy that carbohydrates, proteins, and fats have the capacity to provide is due to the differences in arrangement and type of atoms in the molecules.
- **Brief Overview of Lesson:** Students will investigate the amount of exercise needed to "use up" the energy different foods provide.

Lesson 4: Days 9 & 10 - How do food molecules provide organisms with building materials?

- **Learning Intention:** I am learning that food molecules must be broken down through a chemical reaction before they can provide energy or building materials in the cells of the body.
- **Success Criteria:** I can construct an evidence-based scientific explanation about how large food molecules are broken down into subunits through a chemical reaction.
- **Brief Overview of Lesson:** Students will use indicators to investigate the molecular breakdown of starch.

Lesson 5: Days 11 & 12 - How are food molecules built up and stored?

- **Learning Intention:** I am learning that when animals eat more food than they need to provide energy for the things they do, the excess food molecules are stored for later use.

- **Success Criteria:** I can obtain and evaluate data to argue that ingested amino acids are integrated into cells as proteins and as non-protein molecules.
- **Brief Overview of Lesson:** Students will investigate the molecular nature of using food for building materials for cells.

Lesson 6: Days 13 & 14 - What do plants need to grow?

- **Learning Intention:** I am learning that plants need light and water for growth.
- **Success Criteria:** I can obtain and evaluate data to argue that plants need water and light, but not soil, to grow.
- **Brief Overview of Lesson:** Students will use the data they have gathered from their plant experiments to begin to draw conclusions about what plants need for growth.

Lesson 7: Day 15-17 - How do plants make their own food?

- **Learning Intention:** I am learning that plants in the light consume carbon dioxide and produce oxygen and glucose.
- **Success Criteria:** I can argue from evidence that plants undergo a chemical reaction during photosynthesis. I can explain photosynthesis.
- **Brief Overview of Lesson:** Students will explore how plants make glucose and oxygen from carbon dioxide and water using energy from the sun via photosynthesis. They will conduct experiments to determine the products of photosynthesis.

Lesson 8: Days 18-20 - What can burning food teach me about food providing energy to my body?

- **Learning Intention:** I am learning that burning food requires food molecules and oxygen and produces carbon dioxide and water and releases energy.
- **Success Criteria:** I can construct evidence based explanations to argue that burning food requires oxygen and produces carbon dioxide and water.
- **Brief Overview of Lesson:** Students will observe burning in a closed system. Students will refer back to Lesson 1 to revise scientific explanations according to what they have learned about food molecules.

Lesson 9: Days 21-22- How do food molecules provide my cells with energy?/Does a reaction similar to burning happen in my cells?

- **Learning Intention:** I am learning that cellular respiration is the chemical reaction that provides energy to the cell of an organism.
- **Success Criteria:** I can use evidence to explain cellular respiration in animals to provide our body with energy.
- **Brief Overview of Lesson:** Students will analyze data already collected by scientists to determine if oxygen and glucose are used in the cells of the body to produce carbon dioxide.

Lesson 9: Day 22- How do food molecules provide my cells with energy?/ How do food molecules provide plants with energy?

- **Learning Intention:** I am learning that cellular respiration is the chemical reaction that provides energy to the cell of an organism.
- **Success Criteria:** I analyze data to construct an explanation to explain cellular respiration in plants.
- **Brief Overview of Lesson:** Students will review investigations to synthesize ideas about cellular respiration in plants.

Lesson 9: Day 24 - How do food molecules provide my cells with energy? / How do food molecules provide energy?

- **Learning Intention:** I am learning that cellular respiration is the chemical reaction that provides energy to the cell of an organism.
- **Success Criteria:** I can construct a model of cellular respiration.
- **Brief Overview of Lesson:** Students will create a model of cellular respiration.

Lesson 10: Day 25 - How do matter and energy move between organisms?/How does matter transfer between organisms?

- **Learning Intention:** I am learning that an ecosystem needs a constant input of light energy.
- **Success Criteria:** I can create an initial model of how matter cycles through an ecosystem.
- **Brief Overview of Lesson:** Students will synthesize information and evidence gathered throughout the unit to think about how carbon and energy move through organisms.

Lesson 10: Days 26 & 27 - How do matter and energy move between organisms?/How does energy move between organisms?

- **Learning Intention:** I am learning that an ecosystem needs a constant input of lights. I am learning that carbon in the environment can cycle from food molecules to carbon dioxide through photosynthesis and cellular respiration.
- **Success Criteria:** I can model carbon transfer in an ecosystem.
- **Brief Overview of Lesson:** Students will continue to study the interdependence of plants and animals.

Lesson 10: Day 28 - How do matter and energy move between organisms?/How can the flow of matter and energy change?

- **Learning Intention:** I am learning that an ecosystem needs a constant input of lights.
- **Success Criteria:** I can use a model of flow of energy through the ecosystem to describe that an ecosystem needs a constant input of light.
- **Brief Overview of Lesson:** Students will refer to their models of cycles of both photosynthesis and cellular respirations and the energy flow associated with these chemical reactions.

Lesson 10: Day 29 - How do matter and energy move between organisms?/How can the flow of matter and energy change?

- **Learning Intention:** I am learning that an ecosystem needs a constant input of lights.
- **Success Criteria:** I can use my model to predict what would happen if the system was perturbed (e.g., all the trees cut down, no sun, and so on). I can construct an argument to answer the driving question: How does food provide my body with energy?
- **Brief Overview of Lesson:** Students will work to use their model to predict and explain what would happen to the organisms on Earth if something happened to change the cycle.

CULTURALLY RESPONSIVE TEACHING in PRACTICE	SOCIAL EMOTIONAL LEARNING in PRACTICE
Unit will encourage student engagement in virtual field trips using Google Earth/Google Maps. Unit will connect Students to Professional partnership with participation in Students to Science Virtual Labs. Unit will *establish inclusion* as lessons are engaging and require *collaboration and cooperation.* *Positive attitudes* will be a focus of the unit as the lessons are based on *prior knowledge and experience*, are s*et with clear learning goals* and *contain fair and clear criteria for evaluation.*	**Set classroom norms for discussions** ● When having discussions in the classroom we open the floor to all students' perspectives. We want to make sure all of our students feel heard, and we also want to make sure all of our students feel safe enough to express their ideas within the space as well. By setting discussion norms for students that they can all contribute to set the tone that the classroom is a safe space and that all student ideas, perspective, opinions etc. are welcome while also setting guidelines for how the class will go about discussing counterpoints in a constructive manner. **Assign Group Roles**

The unit also includes *challenging experiences t*o enhance meaning and to *encourage self assessment.*	● Whenever group work is being done all members of the group should have an assigned role. You can assign this role randomly to members in the group or let them pick their role. If groups/tables are the same every time roles can shift each time there is group work or remain the same for consistency depending on your classroom climate and preference. Having a role not only gives every student a designated task to do during that assignment/activity, it enforces a sense of self-worth to make them feel part of a larger community in that the role they are playing is essential to completion of the task as a whole group. **Acknowledge Students Ideas** ● During think-pair-share, discussions, eliciting ideas probes or any other time that you have students sharing ideas out loud you can write down key points from their ideas on the board. This shows that you are acknowledging their words and listening to what they are saying. From these key points you can use them to facilitate discussion, which makes for a much richer and authentic classroom discussion as you are pulling from what students have said directly. **Promoting Growth Mindset** ● Many times students will become confused or not fully understand the material right away. Often, students shut down, think that they have failed and automatically have a "fixed mindset" view. By promoting growth mindset and teaching students how to shift their thinking promotes not only students' social-emotional learning, but highlights the classroom community as a positive and safe place to cultivate learning.

Lesson 1:	**How do I lose weight when I exercise?/What happens in my body when I run around the school?**	**Estimated Time: 2-3 days/50 minutes each**
Brief Overview of Lesson: **Lesson 1: Days 1-3- Why do I lose Weight when I exercise?**		

Brief Overview of Lesson: Students will engage in activities that will connect what they observe happening to their body when they exercise (macroscopic phenomena) to the chemical reactions and energy conversions occurring inside the cells of the body when food molecules react with oxygen to provide energy for cellular processes.

What students should know and be able to do to engage in this lesson:

- Matter is made of atoms. The arrangement and type of atoms in a substance determine its properties (IQWST IC1).
- During a chemical reaction, the atoms from the reactants rearrange to form the products. No matter is created or destroyed (IQWST IC2).
- Food provides the body with energy and building materials. Plants produce sugars and oxygen, need water and carbon dioxide, and use light energy. Organisms exist in ecosystems and their eating habits can be modeled in food webs (IQWST LS1).
- The respiratory and circulatory systems function to bring substances to and remove wastes from the cells. Enzymes digest food in the digestive system (IQWST LS2).
- Energy comes in many types and can be converted from one type to another. Energy cannot be created or destroyed (IQWST PS2).
- Collecting data from before and after exercising.

LESSON FOUNDATION	
Assessed Standards for this lesson	**Important content not included in the standards**
PS1.A: Structure and Properties of Matter Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. **PS1.B:** Chemical Reactions Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. **LS1.C:** Organization for Matter and Energy Flow in Organisms Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. **PS3.D:** Energy in Chemical Processes and Everyday Life	•**MS-PS1A.1**: Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. *(MS-PS1-1)* **MS-PS1B.1**: Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. *(MS-PS1-2), (MS-PS1-3), (MS-PS1-5)* **MS-PS1B.3•** : Some chemical reactions release energy, others store energy. *(MS-PS1-6)* **MS-PS3A.2:** A system of objects may also contain stored (potential) energy, depending on their relative positions. *(MS-PS3-2)* **MS-LS1A.1:** All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different

Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1-7)	numbers and types of cells (multicellular). *(MS-LS1-1)* **MS-LS1A.4:** In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. *(MS-LS1-3)* **5-LS1C.1:** Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. *(secondary to 5-PS3-1)* • **5-LS1C.2:** Plants acquire their material for growth chiefly from air and water. (*5-LS1-1)*

Focus Question for this Lesson

What happens in my body when I run around the school?
How do I lose weight when I exercise?

Learning Intention	**Success Criteria**
I am learning that burning food is the process in which food molecules react with oxygen to provide energy in the body.	***Day 1 &2:*** *I can obtain information and analyze data about what happens to the body when I exercise.* ***Day 3:*** *I can construct an explanation about what happens to fat molecules when people lose weight.*

Assessment(s)

Self-Assessment/Peer Assessment/Teacher Assessment
Students will construct an explanation of how burning food and the process in which food molecules react with oxygen to provide energy in the body compare.

- Summarize key ideas from this lesson.

Feedback (Peer to peer/student to teacher/teacher to student)

Students will engage in Scientific Discourse/Habits of Discussion. "I agree with what _____said. I would like to add on"; I disagree with ___because and would like to add"' I heard _____ ask/say _____ and I want to add on". This is a great resource to use.
https://d16dnhlej6sizh.cloudfront.net/assets/portal/1538743750-What%20do%20I%20say...%20Table%20tents%20v2.pdf

STUDENT CONSIDERATIONS - INTEGRATED ACCOMMODATIONS & MODIFICATIONS

Anticipated Student Pre-Conceptions/Misconceptions

- The entire body changes temperature when you exercise
- Students may preconceive that there is a relationship to diet and exercise with losing or gaining weight
- When we consume fewer calories than the body needs, the body resorts to using stored fat

Integrated Accommodations & Modifications

English Language Learners/Socio Cultural Implications:

- Create a word wall.
- Create a Driving Question Board.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters.
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard

Special Needs:

- Create a Word Wall with images.
- Create an anchor chart the class can utilize/reference throughout the module.
- Use partnering strategy to allow students to work in teams.
- Provide students with pictures to cut and paste or use as a visual reference when answering questions
- Utilize scaffolding strategies
- Provide prompting and support
- Provide students with sentence starters and word banks.
- Provide Graphic Organizers.
- Provide students with images/diagrams they can cut and paste into their notebook
- Students can provide their answers verbally and the answers can be scribed. Students can copy their scribed answers to their questions.
- For fill in the blank questions, allow the students to choose the correct answer for each question by providing only two answer choices for each fill in the blank.
- Provide students with tangible manipulatives to complete sorting tasks
- Provide students with vocabulary words on an index card - students can use the cards to assist with formulating answers or for activities which requires students to sort

- Use highlighter to guide students answering questions
- Reduce the number of questions a student answers (i.e., if there are 10 questions, some students may only answer 7 questions)
- Allow students to choose their best response/work sample for grade submission.
- Provide students with a sheet of paper to only see one question at a time to reduce distraction
- Allow students to use Audio Recordings in digital format or any other reading materials
- Allow students to use Google Read&Write for speech to text to construct sentences independently.
- Display Images/worksheet/textbook/IDE on SmartBoard
- Provide students mini-breaks when necessary

Gifted and Talented:

- Students can present what they have learned to the entire group.
- Allow students to be SME (Subject Matter Experts) to assist classmates with questions about tasks.
- Independent projects can be assigned on the basis of ability level.
- Encourage creativity and original thinking.
- Plan for tiered learning

Groupings

- For more groups, add extra groups using pedometers with different difficulty levels of exercise.
- For fewer groups, have one group use more than one probe. The skin temperature and heart rate probes are easier to use, so one group could manage both of these probes. It is important to have at least two groups using the pedometers so that students can compare Calories used in walking versus running.
- If you modify the groups, you may have to make a new data table