NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut

College Prep Integrated Science

February 2020

BOE Approved June 2020

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New Milford's Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

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College Prep Integrated Science

Grade 9

The Integrated Science course involves the study of major Earth science concepts with an emphasis on the environment. Areas of study include properties of stars, the Big Bang, cycling of matter, tectonic processes and Earth's history, pollution, energy sources and resource management. Science practices outlined in the NGSS are embedded throughout the course. Students are also encouraged to consider the real-world application of Earth science concepts. Study and organizational skills are emphasized through the use of reading assignments, homework, modeling, lab reports and group discussions.

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Pacing Guide

Units	Number of Blocks
Unit 1: Big Bang and Spectroscopy	6 blocks
Unit 2: The Sun and Energy	8 blocks
Unit 3: Lives of Stars	7 blocks
Unit 4: Solar System Formation	7 blocks
Unit 5: Earth’s Formation and Early History	7 blocks
Unit 6: Earth’s Internal Energy	8 blocks
Midterm Exam	
Unit 7: Earth’s Changing Surface	8 blocks
Unit 8: Water as a Resource	8 blocks
Unit 9: Life Transforms Earth - Carbon and Carbon Resources	9 blocks
Unit 10: Solar Energy and the Atmosphere	8 blocks
Unit 11: Climate Change and the Future	8 blocks
Final Exam	

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Unit 1: The Big Bang and Spectroscopy - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS1-2 Construct an explanation of the Big Bang Theory based on astronomical evidence of light spectra,motion of distant galaxies and composition of matter in the Universe

RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST 9-10.4 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 9-10 texts and topics

RST 9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or

Transfer

Students will be able to independently use their learning to…

- SEP 4 - Analyze and interpret data
- SEP 6 - Construct explanations
- SEP 7 - Engage in argument from evidence

Meaning

UNDERSTANDINGS

Students will understand that…

- ESS1.A
  - The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth.
  - The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still

ESSENTIAL QUESTIONS

Students will keep considering…

- How can we explain our universe and how it came to be?
- What types of energy are at work in the universe around us?

<table>
<tr><td rowspan="3">mathematically (e.g., in an equation) into words.</td><td>fills that universe.
● PS4.B
○ Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities.</td><td></td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know…
● Electromagnetic radiation travels through space and carries energy and information with it.
● Electromagnetic radiation is divided into a spectrum of 7 different classifications that are organized based on the amount of energy of the wave, but all EM waves travel at the speed of light through space.
● Light spectra from distant objects can provide information about composition, temperature, and line of sight velocity (Doppler Effect).
● The Big Bang occured 13.8 billion years ago based on evidence from light from distant galaxies, abundance of elements in the universe and cosmic microwave background radiation.
● CCC (Cause and Effect): the relationship between motion of objects and wavelength change in the spectra</td><td>Students will be skilled at…
● Explaining The Big Bang Theory and supporting it by using evidence found within the universe.
● Evaluating within the visible light spectrum to determine different elements present in an object that is emitting light.
● Illustrating the movement of objects within the universe (Doppler Effect) using the visible light spectrum</td></tr>
</table>

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T,M,A	Constructed response rubric to assess for claim accuracy, appropriate evidence, and reasoning that connects to content accurately.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* The types of information that can be observed through studying the spectra of light emitting objects and how that evidence can be used to support the Big Bang Theory **Goal:** To study objects within the Universe and explain how scientists can determine composition and line of sight velocity of light emitting objects and how that information could be used to support the theory of the Big Bang. **Role:** Students will act as an astronomer and evaluate data and observations presented to them in order to describe the properties of a light emitting object. **Audience:** Visitors to the JJ McCarthy Observatory **Situation:** While using the telescope at JJMO, you come across a new light emitting object (galaxy) and analyze the spectral data to determine its composition and motion within the Universe and use that information to support the Big Bang Theory to present to fellow astronomy enthusiasts. **Products and Performance:** Constructed Response/Report **Standard for Success:** Rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* A,M Summative Assessments M,T Questioning of Students A,M,T Warm-ups and Exit Tickets A,M,T In-class Activities and Projects

Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring ● Quizzes on content ● Questions on activities and projects ● Verbal questions for comprehension ● End of unit assessment
M,A	**Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,H,R)	
T,M,A	**Expanding Balloon Activity** - Graph and analyze data related to the expansion of the Universe using a balloon as a model (H,E1,R,T)	
M,A	**Spectroscopy Activity** - Analyze given spectra to determine object composition and create unique spectra based on composition of light emitting objects (W,E1,T,O)	
T,M,A	**Doppler Effect Activity** - Analyze given spectra and explain the impact of the Doppler Effect on them. Create spectra of moving objects based the Doppler Effect (W,E1,T,O)	

Unit 2: The Sun and Energy - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation

RST 9-10.4 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 9-10 texts and topics

RST 9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Develop and use models
- SEP 4 - Analyze and interpret data
- SEP 6 - Construct explanations

Meaning

UNDERSTANDINGS

Students will understand that…

- ESS1.A
  - The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years.
- PS3.D
  - Nuclear fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation.

ESSENTIAL QUESTIONS

Students will keep considering…

- Which processes are involved in the creation, movement and transformation of matter and energy from the core of the sun to Earth?

	Acquisition	
	Students will know… ● The names and order of the six main layers of the sun. ● The type of radiation produced in the core of the sun. ● How the random walk of a photon determines the energy, wavelength, and residence time of a photon as it makes its way out of the sun. ● How long it takes a photon to reach Earth once it emerges from the surface of the sun. ● Nuclear fusion is the process which occurs in stars that is responsible for generating energy and creating elements heavier than hydrogen within their cores. ● Solar winds occur when matter is expelled from the sun and interacts with our atmosphere and environment. ● CCC (Scale, Proportion, and Quantity) understanding that a seemingly small reaction can generate relatively large amount of energy	*Students will be skilled at…* ● Illustrating the path of a photon as it is created in the sun's core and eventually reaches Earth, and evaluating the changes in properties of that photon throughout its journey. ● Describe the process of nuclear fusion and support it with criteria that allow for the process to occur. ● Explain how solar winds impact Earth's systems

Unit 2: The Sun and Energy - Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Constructed response rubric to assess for claim accuracy, appropriate evidence, and reasoning that connects to content accurately.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* The processes that generate energy in stars and the factors which affect the habitability of planets in the Kepler 62 system in regards to a potential colonization effort. **Goal:** Determine the habitability of planets in the Kepler 62 system utilizing understanding of the processes of nuclear fusion and solar winds **Role:** Planetary Scientist **Audience:** NASA's Colonization Committee **Situation:** You have been asked to evaluate a new star system for potential habitability. **Products and Performance:** CER, Diagram and written report **Standard for Success:** Rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* A, M Summative Assessments M, T Questioning of Students A, M, T Warm-up and Exit tickets A, M, T In-class Activities and Projects

Unit 2: The Sun and Energy - Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring ● Quizzes on content ● Questions on activity and projects ● Verbal questions for comprehension ● End of Unit assessment
M,A	**Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,H,R)	
T, M, A	***Random Walk Activity:*** Collect and analyze the path of a photon from its creation in the core of the sun to exiting the radiative zone and identify the relationship between residence time, energy, and wavelength changes that photon goes through (H,E1,E2,O)	
T ,M, A		

T, M, A T, M	***Nuclear Fusion:*** Model the process of nuclear fusion within the core of the sun and explain how heavier elements form (W,E1,E2,T,O) ***Model Solar Interior:*** Model energy generated in the core, exiting the sun and reaching Earth (W,E1,R,T,O) ***Solar Winds/Space Weather:*** Describing what space weather is, how it is created and the impact it has on the Earth systems (H,R,E2,O)	

Unit 3: The Lives of Stars - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS1-3 Communicate scientific ideas about the way stars, over their life cycle, produce elements.

RST 9-10.4 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 9-10 texts and topics

RST 9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Develop and use models
- SEP 4 - Analyze and interpret data
- SEP 6 - Construct explanations

Meaning

UNDERSTANDINGS

Students will understand that…

- ESS1.A
  - Other than hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode.

ESSENTIAL QUESTIONS

Students will keep considering…

- What are stars and how do their different physical properties determine how they go through their life cycles?

	Acquisition	
	Students will know… ● The various types of stars (low, high, and very high mass) and their developmental stages. ● The elements created within stars during various stages of their lives. ● What forces are in equilibrium in a stable star and what happens when those forces go out of balance. ● What apparent and absolute magnitude are and how they differ.	*Students will be skilled at…* ● Explaining how and why stars of different masses go through different developmental stages in different amounts of time. ● Describing the relationship between mass, luminosity, surface temperature,and color of a star. ● Measuring and analyzing the brightness of a light emitting object and explaining how distance affects the intensity of light received.

Unit 3: The Lives of Stars - Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Rubric focusing on content accuracy, format, and presentation of materials.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* The various types of stars, their developmental stages, and the reasoning behind the observed differences in the life cycles of stars of different masses.. **Goal:** Creating a children's book for 5th grade students showing the lives of stars. **Role:** Author of a Children's nonfiction book on the stages of star's lives. **Audience:** Students in a 5th grade class at SNIS **Situation:** You are a successful children's book author who has been asked to create a book for children explaining the lives of stars. **Product or Performance:** Children's Book **Standards for Success:** Rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* ● Quizzes and Tests ● Formative assessments ● Lab analysis and reflection on results ● Warm-ups and exit tickets ● Article readings/summaries ● Homework assignments

Unit 3: The Lives of Stars - Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring ● Quizzes on content ● Questions on activity and projects ● Verbal questions for comprehension ● End of Unit assessment
M,A	**Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,H,R)	
T,M,A	***Radiometer Lab:*** Measure and analyze the brightness of a light emitting object and explain how distance affects the intensity of light received (H,E1,R,E2)	
M,A	**Article Reading: Star Classification**	
M,A	***Life Cycles of Stars:*** Construct a timeline of developmental stages and compare/contrast the life cycle of stars of varying masses (W,E1,T,O)	
T,M,A	***H-R Diagram:*** Plot and analyze a variety of stars based on temperature and luminosity, identify trends and describe how those trends identify stars of different masses and different stages of their lives (W,E1,E2T,O)	

Unit 4: Formation of the Solar System - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS1-4 Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST 9-10.4 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 9-10 texts and topics

RST 9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

Transfer

Students will be able to independently use their learning to…

- SEP 4 - Analyze and interpret data
- SEP 5 - Use mathematics and computational thinking
- SEP 6 - Construct explanations

Meaning

UNDERSTANDINGS

Students will understand that…

- ESS1.B
  - Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects form, or collisions with, other objects in the solar systems

ESSENTIAL QUESTIONS

Students will keep considering…

- How can studying our solar system today help us understand how it, and our planet, formed?
- Why do scientists study other solar systems?

	Acquisition	
	Students will know… ● The stages of a solar system's development and the planetary objects present at each stage. ● The 8 planets within our solar system, their classification, and location within our solar system. ● The differentiation of materials within the solar system as it relates to temperature, solar wind, and planetary formation. ● Kepler's 3 laws of planetary motion and the law of universal gravitation. ● CCC (Patterns) - identify patterns within classes of planets and in orbital data	*Students will be skilled at…* ● Constructing an argument to support the nebular condensation theory utilizing observed evidence. ● drawing a model of the stages of solar system formation ● Describing the role eccentricity plays in understanding a planet's orbital velocity, orbital period, temperature ranges, and strength of the force of gravity. ● Inferring planets' features and composition based on their distance from the sun. ● Describing the role gravity plays in regards to mass and distance between two objects. ● Inferring based on Kepler's 1st and 2nd laws the relationship between different parts of a planet's orbit and the area that is covered within that period. ● Inferring within Kepler's 3rd law the relationship between distance and orbital period of a planet.

Unit 4: Formation of the Solar System - Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T,M,A	Constructed response rubric to assess for claim accuracy, appropriate evidence, and reasoning that connects to content accurately.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* How Kepler's Laws of planetary motion and Universal Gravitation allow scientists to evaluate that properties of planets that orbit other stars **Goal:** To create a model of another star system and evaluate its planets' habiltibilities in the pursuit of finding suitable places for colonization. **Role:** NASA planetary science **Audience:** International Planetary Colonization Commission **Situation:** You have been asked to create a model of another solar system and to present the potential habitability of the planets in that system **Product or Performance:** Report with planetary orbital data, evaluation of which planets are in the habitable zone and a recommendation on whether to pursue colonization of the system **Standards for Success:** Rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* ● Quizzes and Tests ● Formative assessments ● Lab analysis and reflection on results ● Warm-ups and exit tickets ● Article readings/summaries ● Homework assignments

Unit 4: Formation of the Solar System - Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring ● Quizzes on content ● Questions on activity and projects ● Verbal questions for comprehension ● End of Unit assessment
M	**Video: Introduction to the Solar System (Frank Gregorio)** (H)	
M,A	**Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,R)	
T,M,A	***Solar Stew Activity:*** - plot planetary data to identify patterns of terrestrial and jovian planets and relate these patterns to how the solar system formed (R,E2,T,O)	
T,M,A	***Kepler's 1st Law and Ellipses Activity:*** model Kepler's 1st law of Motion and calculate eccentricity of model orgits (E1, R)	
T,M,A	***Kepler's 2nd Law Activity:*** use evidence to support Kepler's 2nd Law of Motion that planets cover equal area during orbits in equal amounts of time (E1, R)	
T,M,A	***Kepler's 3rd Law Activity:*** determine the mathematical relationship between orbital period and a planet's distance from the sun (E1, R)	

Unit 5: Earth's Formation and Early History - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history

RST 9-10.4 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 9-10 texts and topics

RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

RST 9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate

Transfer

Students will be able to independently use their learning to…

- SEP 4 - Analyze and interpret data
- SEP 5 - Use mathematics and computational thinking
- SEP 6 - Construct explanations

Meaning

UNDERSTANDINGS

Students will understand that…

- ESS1.C
  - Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock records on earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history.
- PS1.C

ESSENTIAL QUESTIONS

Students will keep considering…

- What methods, objects, and features do scientists use to uncover the formation of the earth and other solar system objects?

<table>
<tr><td rowspan="3">information expressed visually or mathematically (e.g., in an equation) into words.</td><td>○ Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.</td><td></td></tr>
<tr><td colspan="2">Acquisition</td></tr>
<tr><td>Students will know…
the stages of Earth’s Formation
the role craters play in relative dating of solar system bodies
how radioactive elements are used in absolute dating of Earth and other solar system bodies
The mathematical trend of half lives</td><td>Students will be skilled at…
using relative dating in reference to craters size, layering, and factors that have altered their appearance to justify the age of a planetary object.
Calculating the age of a planetary object using absolute dating in reference to predictable stable half lives.</td></tr>
</table>

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T,M,A	Constructed response rubric to assess for claim accuracy, appropriate evidence, and reasoning that connects to content accurately.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* Ages of regions of different solar system object's surfaces based on various factors such as crater density, overlapping features and radiometric dating of materials. **Goal:** To estimate the ages of two different regions on the surface of Mars by using a variety of dating methods. **Role:** Astronomy Magazine Contributor **Audience:** Astronomy Magazine Readers **Situation:** You are tasked with writing a response to a question posed by a reader about how planetary scientists are able to determine the ages of surfaces of solar system objects without ever actually visiting them. **Product of Performance:** CER, Written Response, specific calculations **Standards for Success:** Rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* ● Quizzes and Tests ● Formative assessments ● Lab analysis and reflection on results ● Warm-ups and exit tickets ● Article readings/summaries ● Homework assignments

Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M,A	**Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,H,R)	● Quizzes on content ● Questions on activity and projects ● Verbal questions for comprehension ● End of Unit assessment
M,A T,M,A	***Crater Density Activity:*** Analyze the relationship between crater density and size and age of a surface. Apply this knowledge when determining the relative age of planetary objects (W,H,E1,E2)	
T,M,A	***Penny Lab:*** Model the process of radioactive decay to calculate half-lives of elements (E1,R,E2,O)	
M,A	***Radiometric Dating of ET Materials Activity:*** Use Radiometric ages of various rock material to determine the age of Earth (W,H,R,E2,O)	
	Article Reading: How Old is Earth	

Unit 6: Earth's Internal Energy - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS1-5 Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks

HS-ESS2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features

HS-ESS2-3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection

RST.9-10.4 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 9-10 texts and topics.

RST.9-10.5 Analyze the structure

Transfer

Students will be able to independently use their learning to…

- SEP 2 - Develop and use models
- SEP 6 - Construct explanations

Meaning

UNDERSTANDINGS

Students will understand that…

- ESS1.C
  - Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old.
- ESS2.A
  - Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid core, a solid

ESSENTIAL QUESTIONS

Students will keep considering…

- Can we justify our Earth's internal structure without visibly observing it?
- How can the surface of our planet give us insight into the inner processes that helped shape the continents and oceans we know today?

of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).	mantle and crust. Motions of the mantle and its plate occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. ● ESS2.B ○ Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a coherent account of its geological history. ○ Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust. ● PS4.A ○ Geologists use seismic waves and their reflection at interfaces between layers to probe structures deep in the planet	
	Acquisition	
	Students will know… ● The theory of continental drift and the evidence used to support it. ● The theory of plate tectonics and the evidence used to support it. ● The 3 different boundaries we find on the surface of the earth and the features related to them.	*Students will be skilled at…* ● Justifying the differing ages of plates by using observable features on earth. ● CCC (Cause and Effect) explaining the process of subduction as it relates to convection currents and the impact on plate boundaries ● Justifying plate motion by utilizing

	● The different waves created by earthquakes ● The layers of the earth and their features ● CCC (Energy and Matter) - explain the connection between Earth's internal energy and the movement of matter within and on the Earth's surface	evidence found within and on earth. ● Interpret data from seismic waves to justify Earth's internal structure.

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
TMA	Rubric focused on model accuracy, content, and display.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* How different plate boundaries produce geologic hazards that present challenges to people living in that area and the processes that cause these challenges. **Goal**:To create a three-dimensional model of the geologic processes and features associated with a particular region on Earth and describe the possible effects on human settlements in that region **Role**: Geologist / Education Consultant **Audience**: Visitors to the Museum of Natural History in New York **Situation**: You have been asked to develop a three-dimensional model of a particular region on Earth which will be part of a new exhibit on geologic features and the benefits and risks associated with living in particular regions on Earth. **Product/Performance**: Three-dimensional Model/diorama with written components on Poster or Presentation/Slide Show, etc. **Standards for Success**: Rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* ● Quizzes and Tests ● Formative assessments ● Lab analysis and reflection on results ● Warm-ups and exit tickets ● Article readings/summaries ● Homework assignments

Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring ● Quizzes on content ● Questions on activity and projects ● Verbal questions for comprehension ● End of Unit assessment
M,A	**Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,H,R)	
M,A	***Wegener's Puzzling Evidence:*** Analyze fossil evidence and geologic features to recreate Pangea (W,H,E1,T,O)	
T,M,A	***Seafloor Spreading Activity:*** Calculate the rate of seafloor spreading in the Atlantic and Pacific oceans using the mid-ocean ridge and hot spots (E1,R,T,O)	
M,A	***Exploring Plate Boundaries:*** Students are given pictures of different plate boundaries and asked to identify what type of boundary is represented in the diagrams, describe the boundary, and provide an example. (E1,R,E2,T)	
M	***Mantle Convection:*** demonstration of convection currents and modeling activity for students to show Earth's interior (W,E1,R,E2,T,O)	
T,M,A	***Seismic Waves and Earth's Internal Structure:*** graph P and S wave data and use to infer the internal structure of Earth (E1,R,O)	

Unit 7: Earth's Changing Surface - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4 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 9-10 texts and topics.

Transfer

Students will be able to independently use their learning to…

- SEP 3 - Plan and carry out investigations
- SEP 4 - Analyze and interpret data
- SEP 8 - Obtain, evaluate, and communicate information

Meaning

UNDERSTANDINGS

Students will understand that…

- ESS2.A
  - Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.
- ESS2.C
  - The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit

ESSENTIAL QUESTIONS

Students will keep considering…

- How is our environment shaped by water?

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.	
	Acquisition	
	Students will know… ● The difference between Physical and Chemical weathering, examples of each, and the environments where they are most common. ● The pH scale and where acids, bases, and neutrals fall on that scale. ● Erosion is the process of moving material and has 4 agents. ● Weathering is the process of breaking down material. ● That watersheds are divided by mountains. ● Sediment size that is deposited varies based on the speed of the body of water. ● Rivers can meander or form a delta depending on their position within a watershed. ● The physical and chemical properties are central to the planet's dynamics (shaping the landscape) ● CCC (Cause and Effect) The effect of precipitation (normal vs. acidic) on different types of materials	*Students will be skilled at…* ● Using an area's climate (precipitation and temperature) to predict what type of weathering is dominant. ● Identifying how surface area plays a role in the speed of weathering. ● Identifying Acids vs Bases and how they interact with different Earth materials to cause weathering. ● Mapping out watersheds based on divides and ocean basins. ● Identifying river features (meanders, deltas, etc) and predicting their location based on the slope of the land and speed of the water.

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T,M,A	Lab Report Rubric assessing science inquiry skills.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* How the composition of a rock and the environment in which it resides determine the type and rate of weathering it will experience. **Goal:** To analyze which of 4 given rock samples will weather the slowest in an area with slightly acidic rain in order to build a statue. **Role:** Geologist **Audience:** Your local town council **Situation:** Your local town council would like to build a statue. They are aware that the rain in the area can be acidic and cause statues to break down. It is your job to test the 4 samples of rock for the statue to see which will weather the least. **Products and Performance:** Lab Report which includes: Procedural Steps, Graphs of changes in mass and pH, A letter to the town council summarizing findings and recommendations. **Standard for Success:** Rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* A,M Summative Assessments M,T Questioning of Students A,M,T Warm-ups and Exit Tickets A,M,T In-class Activities and Projects

Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M,A	**Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,H,R)	● Quizzes on content ● Questions on activities and projects ● Verbal questions for comprehension ● End of unit assessment
TMA	***Weathering and Climate Graph:*** Students will utilize a graph that displays how temperature and precipitation change the types of weathering that are dominant in that area. (E1,T,O)	
MA	***Chemical vs. Mechanical Weathering of Chalk Lab:*** Using chalk as a basic substance, model mechanical weathering	

	and then measure the varying rates of chemical weathering that occur at different ph. Exploring why pH plays a role in the weathering of many Earth materials. (W,H,E1,T,O)	
A	***Acids and Bases Activity:*** Use various materials to explore acids and bases as substances. See how neutralization reactions occur and what that "balance" causes. (H,E1,O)	
MA	***Surface Water Features Activity:*** Analyzing different features created by running water, where they occur in a river system and how slope of land and water speed determine which features form. (W,E1)	
MA	***US River Watersheds Activity:*** Exploring various rivers in the United States to see where major divides and watersheds occur. Discuss potential impacts to the watershed from human activity. (W,R,E2,T,O)	

Unit 8: Water as a Resource - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems

RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text

RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy)

Transfer

Students will be able to independently use their learning to…

- SEP 3 - Plan and carry out investigations
- SEP 4 - Analyze and interpret data
- SEP 8 - Obtain, evaluate, and communicate information

Meaning

UNDERSTANDINGS

Students will understand that…

- **ESS3.C**
  - The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
- **ETS1.B**
  - When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.

ESSENTIAL QUESTIONS

Students will keep considering…

- What is society's impact on water resources?
- How can society minimize our impact on water resources?

	Acquisition	
	Students will know… ● Fresh water is not evenly distributed and makes up a small portion of the water on earth. An even smaller portion of this freshwater is readily available on the surface of the earth. ● Pollution, depending on its location within a watershed, will affect the rest of that watershed until it ends at an ocean ● Aquifers are underground storage of water. Aquifers contain a zone of aeration and a zone of saturation that fluctuate based on factors that affect infiltration and can be affected by human usage ● The difference and connection between porosity and permeability ● The difference between point and nonpoint source pollution and examples of each ● CCC (Cause and Effect) Eutrophication from pollution disrupts bodies of waters' natural ecosystems leading to severe environmental impacts ● Governments create legislation to help reduce the impact of human activities on the quality of water resources	*Students will be skilled at…* ● Evaluating how runoff and infiltration are affected by human interference in the makeup of watershed surfaces ● Assessing where pollution has occurred within aquifers and how slope and location of pollution affects the aquifers and around it. ● Determining what materials would work best as an aquifer by evaluating their porosity and permeability ● Identifying and comparing sources of pollution as point vs nonpoint ● Describing possible mitigation and remediation strategies for water pollution

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
TMA	Rubric focused on content accuracy, format and presentation of materials	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* How to implement a technological solution that reduces impacts of human activities on water resources. **Goal:** To implement a technological solution that limits water pollution. **Role:** Developer **Audience:** Board of Directors **Situation:** You are looking to develop homes in an area but your board of directors wants to be sure that you will minimally impact the environment to avoid any future litigation. Design systems that interact with the local watersheds and aquifers with minimal impact. **Products and Performance:** Labeled diagrams with appropriate placement, Written report to justify placement **Standard for Success:** rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* A,M Summative Assessments M,T Questioning of Students A,M,T Warm-ups and Exit Tickets A,M,T In-class Activities and Projects

Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
M,A MA	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…* **Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,H,R) **Color Me A Watershed:** Analyze how a watershed has changed over 100 years to explore the effect human interference has in regards to runoff vs infiltration of surface water. (W, E1, E2, T)	Progress Monitoring ● Quizzes on content ● Questions on activities and projects ● Verbal questions for comprehension ● End of unit assessment

TMA	**Porosity and Permeability Lab:** Compare the porosity and permeability of four types of substrate to determine the best material for an aquifer.(W, E1, R, E2)	
TMA	**Grave Mistake Activity:** Plot and analyze groundwater data to determine the source of pollution. Explain impact and possible remediation strategies. (W, H, E1, E2, T, O)	
A	**Groundwater Model Analysis:**Teacher uses a model to help students visualize parts of an aquifer, types of wells, and how those parts are affected during times of flooding, times of drought, or from point source pollution.(W, H, E1, R, T, O)	

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Unit 9: Life Transforms Earth - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

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

RST 9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in

Transfer

Students will be able to independently use their learning to…

- SEP 3 - Plan and carry out investigations
- SEP 4 - Analyze and interpret data
- SEP 5 - Use Mathematics and Computational Thinking
- SEP 8 - Obtain, evaluate, and communicate information

Meaning

UNDERSTANDINGS *Students will understand that…*	ESSENTIAL QUESTIONS *Students will keep considering…*
● **ESS2.A** ○ Earth's systems, being dynamic	● How do Earth's major systems interact? ● How do living organisms alter Earth's

a specific scientific or technical context relevant to grades 9-10 texts and topics **RST 9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	and interacting, cause feedback effects that can increase or decrease the original changes (HSESS2-2) ● **ESS2.D** ○ Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6),(HS-ESS2-7) ● Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-6) ● **ESS2.E** ○ The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual coevolution of Earth's surface and the life that exists on it. (HSESS2-7)	processes and structures?
	Acquisition	
	Students will know… ● The composition of the atmosphere has changed since the formation of Earth. ● CCC (Systems and Models) There are four spheres of Earth that are inter-connected, and changes in one can affect others. ● There are many processes that move carbon from one sphere by changing its form and keep carbon balanced at its current level	*Students will be skilled at…* ● Justifying claims using evidence. ● Describing the processes that move carbon through the different Earth system, and differentiating between short and long term processes. ● Analyzing carbon data to identify where carbon imbalances are occuring. ● Elaborating where the sinks and reservoirs of carbon on the planet are and how they shaped our planet from its

	● CCC (Cause and Effect) The changes of gases have an effect on the atmosphere through the development of feedback mechanisms that can alter other systems. (Ozone and life formation on land) ● There are many cycles, but the carbon cycle can affect weather, climate and other systems (such as acidification of the hydrosphere).	formation to present time.

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
A, M, T	Writing Rubric to assess content accuracy, use of evidence as support, and writing skills.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Goal**: To evaluate several energy sources in terms of risks and benefits. **Role**: Energy Consultant (Green and traditional) **Audience**: Companies interested in switching to alternative energy sources as a way to reduce their carbon emissions.. **Situation**: Several companies within the state are interested in switching to alternative energy sources as a way to reduce their carbon emissions. Students will evaluate their options and present the best possible alternatives. **Product**: Cost-Benefit Analysis Presentation **Standard**: Rubric
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* A,M Summative Assessments M,T Questioning of Students A,M,T Warm-ups and Exit Tickets A,M,T In-class Activities and Projects

Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M,A	**Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,H,R)	● Quizzes on content ● Questions on activity and projects ● Verbal questions for comprehension ● End of Unit assessment
A, T	***Atmosphere and Living Things Graph:*** Students will construct a graph that shows how the composition of the atmosphere has changed over Earth's history and how life on Earth has affected Earth's systems (W, H, E2)	
A	**Article: Plants role in Making Earth Unique**	
T, M, A	***Carbon Footprint Activity:*** Students analyze a carbon footprint for a various family scenarios and discuss ways the families could reduce their carbon footprint (W,H,E1,R,E2,T,O)	
M, A	**Fossil Fuel Comparison Graphic Organizer** (E1,R,E2,T)	

Unit 10: The Atmosphere and Energy - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS2-2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that causes changes to other Earth systems.

HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate

RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text

RST 9-10.4 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 9-10 texts and topics

Transfer

Students will be able to independently use their learning to…

SEP 3: Plan and Carry Out Investigations
SEP 4: Analyze and Interpret Data
SEP 5: Use Mathematics and Computational Thinking
SEP 7: Engage in Argument from Evidence

Meaning

UNDERSTANDINGS
Students will understand that…

- **ESS2.D**
  - The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (HS-ESS2-2)

- **ESS2.D**
  - Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect

ESSENTIAL QUESTIONS
Students will keep considering…

- What regulates Earth's weather and climate?
- What are the impacts of greenhouse gases on our planet's temperature and how does changing the balance have negative consequences on our planet?
- Why can locations at the same latitude have drastically different weather and climate?

RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy) **RST 9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	climate. (HS-ESS2-4)	
	Acquisition	
	Students will know… ● There is a relationship between angle of insolation, latitude and temperature. ● How albedo can impact atmospheric temperature and create a feedback loop. ● There is a difference in specific heat of water and land which can cause unequal heating of the air. ● CCC (Energy and Matter) The series of steps it takes for energy to be transformed from sunlight (electromagnetic) to heat in the atmosphere (thermal). ● CCC (Cause and Effect) Carbon dioxide, and other greenhouse gasses, are affecting the heat balance in the atmosphere and causing a change in weather and climate.	*Students will be skilled at…* ● Explaining the relationship between angle of insolation and the amount of heat that the surface can generate and transfer to the air. ● Conducting an experiment about the differences between land and water in terms of heat available for transfering to the air. ● Elaborating about the effects of albedo and air temperature. ● Model different atmospheric energy feedback loops, such as: albedo and increase greenhouse gasses. ● Interpreting monthly insolation values for different latitudes.

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T, M, A	Rubric to assess graphing skills, claim accuracy, appropriate use of evidence, and reasoning that connects claim to content.	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* **Goal:** A group of scientists have been collecting data to try and determine why a penguin population has been decreasing over the past 2 decades. **Role:** Each student will specialize in specific scientific study collecting data about their topic. **Audience:** The group will be a key presenter at a Climate Change Conference to present their findings to the audience. **Situation:** A group of scientists have collected a variety of data and are analyzing why the population of penguins has been on a rapid decline.They combine the different data sets to present their claim for the population crash. (with evidence and reasoning) **Product:** Poster board of all data sets, descriptions of their data, and Claim-Evidence-Reasoning section. **Standards:** Rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* A,M Summative Assessments M,T Questioning of Students A,M,T Warm-ups and Exit Tickets A,M,T In-class Activities and Projects

Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A, M	● ***Lab: Angle of Insolation*** - Students will calculate how much energy each unit of area is absorbing based on different angles of light striking the surface. We will use a flat piece of paper (for daily angle changes of energy) and a globe (for latitude changes of energy). A flashlight will represent the sun. (W, H, E1, E2, T)	● Quizzes on content ● Questions on activity and projects ● Verbal questions for comprehension ● End of Unit assessment
A, M, T	● ***Lab: Albedo*** - Students will collect and analyze temperature data of various colors (black/silver cans, or various color paper sleeves). (W, H, E1, E2, T)	

A, M, T	● ***Greenhouse Effect: (PhET Simulation)*** - Students run a simulation demonstrating the impact of various greenhouse gasses and the impact it has on temperature. (H, E1, E2, T, O)	

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Unit 11: Climate Change and the Future - Stage 1 Desired Results

ESTABLISHED GOALS

HS-ESS3-5 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

HS-ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity

RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in

Transfer

Students will be able to independently use their learning to…

SEP 2 - Develop and Use Models
SEP 4 - Analyze and Interpret Data
SEP 8 - Obtain, Evaluate and Communicate Information

Meaning

UNDERSTANDINGS
Students will understand that…

- **ESS2.D**
  - Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to

ESSENTIAL QUESTIONS
Students will keep considering…

- How do we know what the climate was like in the past?
- What human activities have an impact on Earth's climate and what can be done to minimize those impacts?
- What information is included in climate

a specific scientific or technical context relevant to grades 9-10 texts and topics **RST.9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words **RST.9-10.8** Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem	rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere ● **ESS3.D** ○ Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict and manage current and future impacts ● **ESS3.D** ○ Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities	models and how can they be used to help make predictions about the future?
	Acquisition	
	Students will know… ● The foundation for Earth's global climate system is the electromagnetic radiation from the sun as well as its reflections, absorption, storage and redistribution among the Earth's various spheres	*Students will be skilled at…* ● Evaluate historical climate data to describe how Earth's climate has changed ● Analyze and interpret current climate models to show how Earth's global temperature has been increasing and will

	● CCC (Patterns) Climate change can occur when certain parts of Earth's systems are altered as evidenced by the geological record ● Changes in the atmosphere due to human activity have increased greenhouse gas concentrations and have an effect on climate ● Global climate models incorporate scientists' best knowledge of physical and chemical processes and the interactions of relevant systems ● Current climate models predict that although future regional climate changes will be complex and varied, average global temperatures will continue to rise ● When the source of an environmental problem is understood, new technologies and regulations can be utilized to regulate human activities in order to mitigate global impacts	continue to increase into the future ● Ask questions about what factors should be included in a climate model and how climate models are created and used ● Discuss the impact of climate change on future populations ● Evaluate technological improvements, legislative acts and best management practices which may improve the conditions caused by global climate change

Stage 2 – Evidence		
Code	**Evaluative Criteria**	**Assessment Evidence**
T,M,A	Rubric to assess claim accuracy, appropriate use of evidence, reasoning that connects claim to content, and oral presentation skills	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…* Use a climate model to make a prediction about future impacts climate change will have on a community and then make a set of recommendations to mitigate or prevent those impacts **Goal**: Use several climate models and data sets (sea levels, wildfire frequency, storm intensity, etc.) to predict the potential future impact on a U.S. city and make recommendations for mitigation **Role**: City Planner **Audience**: City Development Committee **Situation**: You've been asked to develop a plan for a major U.S. city's response to consequences of future climate change **Product/Performance**: Presentation to the City Development Committee that includes future impacts of climate change, mitigation strategies and potential technological solutions that can be implemented. **Standards**: Rubric

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* ● Quizzes and Tests ● Formative assessments ● Lab analysis and reflection on results ● Warm-ups and exit tickets ● Article readings/summaries ● Homework assignments

Stage 3 – Learning Plan		
Code	***Pre-Assessment*** ● Brainstorming at the start of the unit ● Informal assessment of prior knowledge ● Formal pre-assessments to match the post assessment (optional)	
	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
M,A	**Teacher prepares notes and leads class discussions** - to introduce unit, provide content, provide opportunity formative assessment, and address misconceptions (W,H,R)	● Quizzes on content ● Questions on activity and projects ● Verbal questions for comprehension ● End of Unit assessment
T,M,A	***Analyzing Past Climates Using Ice Core Data:*** Analyze temperature graphs generated by analysis of ice core data in order to explore past climates. Look at other climate proxy data to reconstruct past climates (H,E1,O)	
T,M,A	***Climate Model Comparisons:*** Compare various climate models and evaluate which models are best at predicting future climates based on the quality and quantity of data included in the model (W,E1,R,E2,T,O)	