Project-Based Inquiry Science: Ever-Changing Earth
Storyline

Targeted Performance Expectations:
· MS-ESS1-4 · MS-ESS2-2 · MS-ESS2-3 · MS-ESS3-1 · MS-ETS1-4

Ever-Changing Earth: What's the Big Question? What Processes Within Earth Cause Geologic Activity?

Storyline (with Disciplinary Core Ideas and Science Content)	Science and Engineering Practices	Crosscutting Concepts
In the *Introduction* to *Ever-Changing Earth*, students observe maps of geologically active areas around the world and then select one of eight regions with a specific Earth structure to learn more about. To begin thinking about the *Big Question*, *What processes within the Earth cause geologic activity?*, they read a letter from a pen pal to gather information about the geologic activity, earth structures and other information they need to begin learning about the region. They share the new information about their region and specific Earth structure with the class and locate it on the *Big Map* using longitude and latitude. Student groups compare their regions to the others and as a class prepare a *Project Board* to keep track of what they know and develop questions which will help them answer the *Big Question*.	**Obtaining, Evaluating, and Communicating Information** (observe maps and read a letter from their pen pal living in the selected region) **Asking Questions and Defining Problems** (students create the *Project Board* and add what they think they know and questions they would like to investigate)	Section Level: **Patterns**

Ever-Changing Earth: Learning Set 1 How Can My Region Be Described?

Storyline (with Disciplinary Core Ideas and Science Content)	Science and Engineering Practices	Crosscutting Concepts
Introduction to *Learning Set 1*: In *Learning Set 1*, students describe the topography of their selected Earth structure.	**Asking Questions** (record questions needed to help answer the *Big Question*) **Developing and Using Models** (create a diagram of the elevation profile for their earth structure) **Obtaining, Evaluating, and Communicating Information** (use the tools of science to obtain information about their region)	Section Level: **Scale, Proportion, and Quantity** **Systems and System Models**
Section 1.1: Students explore the tools of science to locate their selected Earth structure. They use the satellite imagery of Google Earth to determine the elevation and depth to create a vertical profile of their region. Students build their knowledge of map scale and ratios and compare what they have learned about their earth structure to the information in the letter as they describe their region. Each group creates an additional *Region Project Board* to track their learning about their Earth structure listing questions they wish to investigate.		
Section 1.2: Students develop their skill in using the tools of science to describe their local region. They use the satellite imagery of Google Earth to describe the topography of their region, vegetation and water patterns. Students use longitude and latitude to move to their desired location and create a place-mark. They use a variety of tools to visualize the features of a geographical region. In a *More to Learn,* students gain experience in creating their own topographical map from a 3D model.	**Obtaining, Evaluating, and Communicating Information** (use the tools of science to obtain information and visualize a geographical region) **Analyzing and Interpreting Data** (describe and analyze observations from satellite imagery)	Section Level: **Scale, Proportion, and Quantity**

Back to the Big Question: Students continue developing the description of their region and earth structure. Linking the vocabulary of geology and map making they begin to create a picture map of the new learning as they prepare to share their description with the class. They create cards with vocabulary on one side a descriptive diagram on the others as they begin to develop the connections between words and concepts. Students compare their region with others as they listen to the class presentations. New science learning with supporting evidence is added to the *Project Board* as well as questions for future investigation. **Disciplinary Core Ideas:** **ETS1.B: Developing Possible Solutions** · A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)	**Asking Questions** (develop more questions needed to help answer the *Big Question*) **Obtaining, Evaluating, and Communicating Information** (compare and contrast small group regions with others during oral presentations)	Section Level: **Patterns**

Ever-Changing Earth: Learning Set 2
What Is the Structure of Earth?

Storyline (with Disciplinary Core Ideas and Science Content)	Science and Engineering Practices	Crosscutting Concepts
Introduction to *Learning Set 2*: Students explore two of the Earth's visible geologic activities: volcanoes and earthquakes. They continue to use the tools of science to learn more about these structures.	**Asking Questions** (develop more questions needed to help answer the *Big Question*) **Obtaining, Evaluating, and Communicating Information** (evaluate before and after pictures illustrating geologic change)	Unit Level: **Stability and Change**
Section 2.1: Students view a series of photographs and analyze the geologic changes that occurred over time. Multiple illustrations of geologic change provide examples of forces within the Earth.		
Section 2.2: Students assess a model of the Earth's interior sent to them by one of the pen pals. The model presents an argument with evidence to explain the observations of geologic processes. Students evaluate the model for accuracy as they add to their academic vocabulary. **Disciplinary Core Ideas:** **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. (MS-ESS2-1)	**Obtaining, Evaluating, and Communicating Information** (evaluate a model presented to explain an observable phenomenon) **Developing and Using Models** (evaluate a model to explain an observable phenomenon)	Unit Level: **Stability and Change**
Section 2.3: Students obtain additional experience with the tools of science as they examine "black boxes" used as a model for the Earth. The difference between direct observation and inference is illustrated with this exercise as they create a statement about what is inside the box. They must base their inferences and explanations on limited observations.	**Developing and Using Models** (use a model of Earth to link observations to inferences)	Section Level: **Systems and System Models**

Section 2.4: Students obtain information about what scientists know about the earth's surface and interior. Academic vocabulary is introduced and additional models illustrating the layers of the Earth's interior are explored. Students compare and contrast what they have learned about the Earth's layers and the Earth's molten core as they continue to develop the concepts of observations and inferences. In a *More to Learn*, students investigate the property of density and relate their experience to the different layers of the Earth. **Disciplinary Core Ideas:** **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. (MS-ESS2-1)	**Obtaining, Evaluating, and Communicating Information** (obtain scientific information and build academic vocabulary through expository reading) **Developing and Using Models** (examine diagrams of the earth's layers)	Section Level: **Systems and System Models**
Section 2.5: Students revisit the egg model of the Earth's structure from *Section 2.2* and evaluate it based on their new learning. They draw a model of what they now believe is the structure of the Earth's interior and develop a written description of the different layers which they can send to their pen pal pointing out the strengths and weakness of the egg model and their own. Groups share their letters with the class for review and revision. A *More to Learn* develops academic vocabulary related to the layers of the Earth's surface including the atmosphere, biosphere, hydrosphere and geosphere. **Disciplinary Core Ideas:** **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. (MS-ESS2-1) · 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) **Disciplinary Core Ideas:** **ETS1.B: Developing Possible Solutions** · A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) · Models of all kinds are important for testing solutions. (MS-ETS1-4)	**Developing and Using Models** (create a model with a description of the Earth's interior structures) **Obtaining, Evaluating, and Communicating Information** (evaluate the egg model of Earth's structure providing strengths and weaknesses)	Section Level: **Systems and System Models**
Back to the Big Question: Students build on the picture map they began in *Learning Set 1* adding new vocabulary words with descriptive illustrations. They formulate a scientific explanation with evidence to support their ideas about how the processes within the Earth's layers cause changes on the surface. The class updates the *Project Board* with their new knowledge and what they still need to investigate. **Disciplinary Core Ideas:** **ETS1.B: Developing Possible Solutions** · A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) · Models of all kinds are important for testing solutions. (MS-ETS1-4)	**Constructing Explanations** (develop an explanation about how changes on Earth's surface occur) **Engaging in Argument from Evidence** (create a claim with evidence about how the processes within Earth cause changes on the surface)	Unit Level: **Cause and Effect** **Stability and Change**

Ever-Changing Earth: Learning Set 3
What Happens at Plate Boundaries?

Storyline (with Disciplinary Core Ideas and Science Content)	Science and Engineering Practices	Crosscutting Concepts
Introduction to Learning Set 3: Students look for patterns across geologically active regions and make predictions about the Earth's plates.		
Section 3.1: Students simulate the movement of the Earth plates by pushing, pulling and sliding blocks of clay. They create sketches of how their observations relate to the movement of the Earth's crust, and predict what geologic events may be observed by the different interactions. Students update the *Project Board* with new learning about interactions at plate boundaries. **Disciplinary Core Ideas:** **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. (MS-ESS2-2)	**Analyzing and Interpreting Data** (record observations during a simulation and relate the data to interactions at plate boundaries) **Developing and Using Models** (create simulations to illustrate the different interactions at plate boundaries)	Unit Level: **Cause and Effect** **Stability and Change**
Section 3.2: Students obtain information about what causes earthquakes and what is occurring when they happen. Academic vocabulary is introduced and additional models illustrating the processes of earthquakes are examined including the role of energy. Students build conceptual understanding of the processes of earthquakes through demonstrations and diagrams. Seismic waves are demonstrated as a mechanism to transfer energy from one place to another in an earthquake. They update the *Project Board* by creating statements supported with evidence about how earthquakes happen. **Disciplinary Core Ideas:** **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. (MS-ESS2-1)	**Obtaining, Evaluating, and Communicating Information** (obtain information through scientific reading and evaluating diagrams) **Constructing Explanations** (develop an explanation about how earthquakes happen)	Unit Level: **Cause and Effect** **Stability and Change**
Section 3.3: Students obtain information about the tools of science and how data from earthquakes is recorded and evaluated. Academic vocabulary is introduced and additional models illustrating the results of earthquake activity are explored. Students review maps, scales and graphs used in the evaluation of historic earthquake intensity. Learners explore the theory of elastic rebound as a method to help predict future earthquake events.	**Obtaining, Evaluating, and Communicating Information** (obtain information through scientific reading and evaluating diagrams, graphs, charts and maps)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Scale, Proportion, and Quantity**
Section 3.4: Students explore earthquake data and maps to determine the epicenter of an earthquake event. They develop the skills of a scientist as they analyze, evaluate, and interpret the data and maps.	**Using Mathematical and Computational Thinking** (analyze data to determine the epicenter of an earthquake) **Analyzing and Interpreting Data** (analyze data to determine the epicenter of an earthquake)	Unit Level: **Cause and Effect** Section Level: **Patterns** **Scale, Proportion, and Quantity** **Systems and System Models**

Section 3.5: Students use real-time data to find local, regional, and worldwide patterns in earthquake activity. They revisit their region of exploration and record earthquake activity over the past week. As they compare data with others they look for patterns that might help them infer the location of plate boundaries. Students update the *Region Project Board* with ideas about geologic activity in their region based on the earthquake activity.	**Analyzing and Interpreting Data** (analyze real time data on worldwide earthquake to infer plate boundary location)	Unit Level: **Cause and Effect** Section Level: **Patterns** **Scale, Proportion and Quantity**
Section 3.6: Students evaluate regional earthquake data from maps and the internet. They develop the skills of science by looking for patterns to help establish the location of plate boundaries. They make decision about how much data are enough and what regions to look for data to support their thinking. Students revise their previous inferences about plate boundaries and describe their new confidence.	**Analyzing and Interpreting Data** (analyze real time data on worldwide earthquake to infer plate boundary location)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Patterns** **Scale, Proportion, and Quantity**
Section 3.7: Students connect the patterns in their regional map with others to form a worldwide map showing the location of plate boundaries. They evaluate their region plate boundary data for strengths and weaknesses. They use supporting evidence to make claims about the location of plates in their region and connect their knowledge with others to form the *Big Map*. Students revisit their inference from previous activities about plate boundary location and make revisions as necessary.	**Analyzing and Interpreting Data** (analyze earthquake data to infer plate boundary lines) **Constructing Explanations** (link the phenomenon of earthquake events with the location of plate boundaries) **Engaging in Argument from Evidence** (use supporting scientific data and knowledge to infer the location of plate boundaries)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Patterns** **Scale, Proportion, and Quantity**
Back to the Big Question: Students continue to build the picture map with new vocabulary terms from this *Learning Set*. They link concepts as they begin to describe the processes causing geologic activity in their region. Students develop a scientific claim with evidence to explain which plates are interacting to cause geologic activity in their region. After discussions and revisions the regional group selects the best explanation to share with the class. New knowledge about earth's processes are place on the class *Project Board* and new questions are added which will help address the *Big Question*: *What processes with in the Earth cause geologic activity?* **Disciplinary Core Ideas:** **ETS1.B: Developing Possible Solutions** · A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) · Models of all kinds are important for testing solutions. (MS-ETS1-4)	**Engaging in Argument from Evidence** (use supporting scientific data and knowledge to infer which plates are interacting to cause geologic activity in a region) **Analyzing and Interpreting Data** (analyze earthquake data to infer plate boundary lines) **Constructing Explanations** (link the phenomenon of earthquake events with the location of plate boundaries)	Unit Level: **Cause and Effect**

Ever-Changing Earth: Learning Set 4
What Causes Earth's Plates to Move?

Storyline (with Disciplinary Core Ideas and Science Content)	Science and Engineering Practices	Crosscutting Concepts
Introduction to *Learning Set 4:* Students look for explanations about the movement of the Earth's plate. *Section 4.1:* Students compare and contrast various ideas about the forces that cause the Earth's plates to move and analyze evidence to support each idea. They update the *Project Board* with question they have about these forces.	**Asking Questions** (develop questions which will help them answer the *Big Question*) **Obtaining, Evaluating, and Communicating Information** (obtain and evaluate ideas about why the Earth's plates move.) **Constructing Explanations** (link the phenomenon of plate movement to ideas of what causes them to move)	Section Level: **Patterns** **Stability and Change** Unit Level: **Cause and Effect**
Section 4.2: Students investigate the forces that cause Earth's plate to move. They build and run a simulation of material movement within Earth's mantle. Students create sketches and descriptions about what is causing the movement of liquids in the simulation. They compare other models of mantel movement to theirs as they build their conceptual knowledge of the forces within Earth. Students record what they think is causing the material and plates to move as they update the *Project Board*. They add new questions to explore which will help them answer the *Big Question*. **Disciplinary Core Ideas:** **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. (MS-ESS2-1) · 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)	**Developing and Using Models** (build and run a simulation about the movement of materials in the Earth's mantle) **Constructing Explanations** (develop an explanation for what causes the Earth's plates to move)	Unit Level: **Cause and Effect** Section Level: **Energy and Matter** **Stability and Change** **Systems and System Models**
Section 4.3: Students add to their scientific knowledge and build academic vocabulary with expository reading about convection currents and how thermal energy moves materials with the Earth's mantle. They explore how the force of plate movement results in geologic features on the Earth surface. Students write a description of the movement of a small amount of matter as it travels from the Earth's core to the surface combining their knowledge from previous activities. They revisit and evaluate earlier ideas about these forces and add evidence to support remaining ideas. **Disciplinary Core Ideas:** **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. (MS-ESS2-1) · 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)	**Obtaining, Evaluating, and Communicating Information** (obtain and evaluate ideas about the forces which move the Earth's plates.) **Developing and Using Models** (evaluate models and diagrams illustrating the forces moving the earth's plates) **Constructing Explanations** (develop an explanation for what causes the Earth's plates to move)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Energy and Matter** **Systems and System Models**

Back to the Big Question: Students add more academic vocabulary to their picture map. They link ideas and concepts as they begin to formulate an answer to the *Big Question: What processes within the Earth cause geologic activity?* They update and revise previous explanations about processes within the Earth causing changes on the surface as they add supporting evidence and new knowledge to their "best" statement. After discussions and presentations of ideas the class comes to consensus about the best explanation of how and why the Earth's plates are moving. **Disciplinary Core Ideas:** **ETS1.B: Developing Possible Solutions** · A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) · Models of all kinds are important for testing solutions. (MS-ETS1-4)	**Engaging in Argument from Evidence** (use supporting scientific data and knowledge to create a scientific claim about how and why the Earth's plates move) **Constructing Explanations** (link the phenomenon of plate movement to geologic features on the surface)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Energy and Matter** **Systems and System Models**

Ever-Changing Earth: Learning Set 5
What Can Volcanoes Tell You About Plate Interactions?

Storyline (with Disciplinary Core Ideas and Science Content)	Science and Engineering Practices	Crosscutting Concepts
Introduction to *Learning Set 5*: Students explore what the location and type of volcano can tell scientists about plate interactions.	**Obtaining, Evaluating, and Communicating Information** (obtain information about the location of regional volcanoes) **Constructing Explanations** (link the location of regional volcanoes, the presence of earthquakes iand plate boundaries)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Patterns** **Systems and System Models**
Section 5.1: Students use real time data sets to find patterns of volcanic activity in their region. They analyze their findings to build a relationship between volcanoes and earthquakes and plate boundaries. Students share their findings with the class adding new evidence to support their understanding of the location of plate boundaries as well as the forces causing changes on the Earth's surface. **Disciplinary Core Ideas:** **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. (MS-ESS2-2)		
Section 5.2: Students compare volcanoes in their region with ones around the world. They observe maps and photos to compare and contrast different types of volcanoes. They return to the letters from their pen pal and update the description of volcanic activity in their region. Each group adds the volcano from their region to the *Big Map* and updates the *Project Board* with what new knowledge about different types of volcanoes and how they erupt.	**Obtaining, Evaluating, and Communicating Information** (obtain information about the location of regional volcanoes)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Patterns**

Section 5.3: Students build their scientific knowledge and academic vocabulary about the worldwide location and causes of volcanic activity. They observe maps charts and diagrams to link the movement of the Earth's mantel material to changes on the earth surface including the movement of thermal energy. Students deepen their knowledge of forces and processes within the Earth through a scientific reading about underground volcanic activity. **Disciplinary Core Ideas:** **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. (MS-ESS2-2)	**Obtaining, Evaluating, and Communicating Information** (obtain information about the location and causes of volcanoes worldwide) **Constructing Explanations** (explain the location of volcanoes with the interaction of Earth' plates)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Patterns**
Section 5.4: The location and type of regional volcanic activity help students develop their knowledge of how the plates move. Student identify the type(s) of volcano(es) in their region and use information in a table to infer the direction of plate movement. They share their ideas with other groups and then the class to make inferences about the direction of plate movements in all regions. Discussions and disagreements are recorded if inferences are not consistent. The *Project Board* is updated with new knowledge, supporting evidence, and more questions that will help address the *Big Question*. **Disciplinary Core Ideas:** **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. (MS-ESS2-2)	**Obtaining, Evaluating, and Communicating Information** (obtain information about the location and types of volcanoes in a region) **Analyzing and Interpreting Data** (use data to determine the direction of plate movement) **Constructing Explanations** (use the type and location of volcanoes to infer the direction of plate movement)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Energy and Matter** **Patterns**
Back to the Big Question: Students build on their scientific knowledge in *Learning Set 5* to increase the picture map of academic vocabulary. They revise and add connections from their previous maps and discuss their connections with others. The revisit and review their previous explanation about geologic activity in their region, revise and update the supporting evidence as the prepare their best statement about the processes beneath the Earth's surface that cause changes on the surface. Groups meet to come to consensus about the best explanation about the causes of geologic activity and they share their thoughts with the class. Students build their academic vocabulary and deepen their knowledge of the rock cycle through a *More To Learn* expository reading. **Disciplinary Core Ideas:** **ETS1.B: Developing Possible Solutions** · A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) · Models of all kinds are important for testing solutions. (MS-ETS1-4)	**Constructing Explanations** (explain the connection between vocabulary words linked to the forces within Earth and surface features) **Engaging in Argument from Evidence** (use supporting scientific data and knowledge to create a scientific claim about the processes beneath Earth's surface that are causing geologic are in a region)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Energy and Matter** **Patterns**

Ever-Changing Earth: Learning Set 6 What Geologic Activity Happens at Plate Boundaries?		
Storyline (with Disciplinary Core Ideas and Science Content)	**Science and Engineering Practices**	**Crosscutting Concepts**
Introduction to *Learning Set 6*: Students explore how plate interactions cause geologic activity and the effects of those interactions.		
Section 6.1: Students observe simulation about four different interactions of plate boundaries, comparing and contrasting each one looking for differences in the movement of magma and activity at the edges, They prepare a flip book to model these interactions and describe the geologic activity that results from these interactions. Students link their new learning with what they know about the relationship between earthquakes and volcanoes. **Disciplinary Core Ideas:** **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. (MS-ESS2-2)	**Obtaining, Evaluating, and Communicating Information** (obtain information about interaction at plate boundaries) **Constructing Explanations** (explain the relationship between earthquakes, volcanoes and plate interaction)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Energy and Matter** **Systems and System Models**
Section 6.2: Students explore what scientists know about plate interactions and build academic language about these interactions as they read and model the four interactions. They observe diagrams and photos to compare and contrast the various events and organize their learning about the patterns of geologic activity associated with each one. The concept of density is revisited as a force involved in the interactions. They revise their previous prediction about how the plates in their region move using new knowledge supported by scientific evidence and present their idea to the class. Students deepen their understanding of the nature of magma in a *More To Read*. **Disciplinary Core Ideas:** **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. (MS-ESS2-1) · 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)	**Obtaining, Evaluating, and Communicating Information** (obtain information about the four types of interaction at plate boundaries) **Constructing Explanations** (explain how the plates move in a region based on geologic structures found in the region)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Energy and Matter** **Systems and System Models**
Section 6.3: Students use earth-viewing software to examine the plate boundary of their region. They collect the data needed to come to an agreement about the direction of their plate movement, the type of boundary and the evidence to support their ideas. Combining the data from other groups, the class describes what happens at the intersections of the plates for all the groups. They move toward addressing the *Big Question* as they identify what information they are now sure of and what they are still unsure of.	**Obtaining, Evaluating, and Communicating Information** (obtain information about interaction at plate boundaries in their region) **Constructing Explanations** (explain how the plates in their region move and interact)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Patterns**

Back to the Big Question: Students complete the picture map by putting the last of new vocabulary onto cards with a descriptive diagram and linking the word to other concepts found in the Unit. They review their statement about geologic activity in their region from *Learning Set 5*, revise and rewrite it adding more supportive evidence for the final explanation. They share their explanation with the class providing a description of their region, patterns of geologic activity, evidence and scientific knowledge to support their claim. They pull together everything they have learned to update the *Project Board,* adding evidence to support each statement and how the information will help them address the *Big Question.* **Disciplinary Core Ideas:** **ETS1.B: Developing Possible Solutions** · A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) · Models of all kinds are important for testing solutions. (MS-ETS1-4)	**Constructing Explanations** (explain how the plates move in a region based on geologic structures found in the region) **Engaging in Argument from Evidence** (use supporting scientific data and knowledge to create a scientific claim about the processes beneath the Earth surface that are causing geologic activity in a region)	Unit Level: **Cause and Effect** **Stability and Change**

Ever-Changing Earth: Answer the Big Question
What Processes Within Earth Cause Geologic Activity?

Storyline (with Disciplinary Core Ideas and Science Content)	Science and Engineering Practices	Crosscutting Concepts
Students draw on their reading, data collection, experiences and sketches to describe the thermal nature of Earth materials, the movement of plates and their interactions at the boundaries and the resulting changes in the Earth's surface and creating of earth structures. They use this knowledge to make a claim with evidence to support their statement about the processes beneath the Earth that cause geologic activity. They share and compare the claims of others and discuss differences. After discussion and revision, the class comes to consensus with a single statement that best answers the *Big Question* and has the best supporting evidence. Students compare their explanation about the processes within the Earth's crust with the explanation of scientists by reading the *More to Learn*. They build on their knowledge from this Unit with information about plate tectonics, continental drift, the fossil record, and geologic time scales. **Disciplinary Core Ideas:** **ETS1.B: Developing Possible Solutions** · A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) **ESS1.C: The History of Planet Earth** · Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor 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 that 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 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)	**Engaging in Argument from Evidence** (use supporting scientific data and knowledge to create a scientific claim about the processes beneath the Earth surface that are causing geologic activity in a region)	Unit Level: **Cause and Effect** **Stability and Change** Section Level: **Patterns**