Earth Science 9-12	Unit 1: Scientific Methods & Experimentation		Suggested Length: 10 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
1. What is the scientific method? 2. How is a scientific procedure conducted and analyzed?	**Program of Studies** ❑ *SI-1 identify and refine questions and identify scientific concepts to guide the design of scientific investigations.* ❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve scientific investigations and communications.* ❑ *SI-4 use evidence, logic, and scientific knowledge to develop and revise scientific explanations and models.* ❑ *SI-5 communicate designs, procedures, and results of scientific investigations.* ❑ *AC-1 apply scientific inquiry and conceptual understandings to solving problems of technological design (e.g., styrofoam cups, tra*nsistors, computer chips). ❑ AC-2 examine the interaction between science and technology. **Core Content** Scientific Inquiry ❑ Formulate testable hypotheses and demonstrate the logical connections between the scientific concepts guiding a hypothesis and the design of an experiment. ❑ Use equipment, tools, techniques, technology, and mathematics to improve scientific investigations and communications. ❑ Use evidence, logic, and scientific knowledge to develop and revise scientific explanations and models.	❑ Scientific method ❑ Experimentation ❑ Problem ❑ Hypothesis ❑ Procedure ❑ Analysis ❑ Dependent variable ❑ Independent variable ❑ Constants ❑ Control	❑ Make a hypothesis about the outcome of simple experiments. DOK 2 ❑ Carry out procedures to test hypotheses. DOK 2 ❑ Analyze data and identify independent variables, dependent variables, and constants in an experiment. DOK 3 ❑ Construct line graphs of data points for two variables and utilize graphs to draw conclusions about relationships and extrapolate unknown data points. DOK

Earth Science 9-12	Unit 1: Scientific Methods & Experimentation		Suggested Length: 10 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
	❑ Design and conduct different kinds of scientific investigations. ❑ Communicate and defend the designs, procedures, observations, and results of scientific investigations. ❑ Review and analyze scientific investigations and explanations of other investigators, including peers. **Science and Technology** Students will apply scientific theory and conceptual understandings to solve problems of technological design and examine the interaction between science and technology.	❑ Conclusion ❑ Line graph	2 ❑ Evaluate the use of the scientific method in a given experiment. DOK 3 ❑ Lab Report: How does calcium chloride affect the temperature of water? ❑ Open Responses: "Experimentation-Practice (Cereals)" ❑ "Experimentation-Band Uniforms"

Earth Science 9-12	Unit 2: Minerals		Suggested Length: 7-8 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
1. What are the characteristics of minerals? 2. How can physical and chemical properties be used to identify minerals? 3. What are the uses and applications of minerals?	**Program of Studies** *Students will:* ❑ *ESS-5 recognize that the Earth contains a fixed amount of each stable chemical atom or element.* ❑ *ESS-6 analyze Earth's chemical reservoirs and recognize that each element can exist in several reservoirs (e.g., carbon in carbon dioxide reservoirs and carbonate reservoirs).* ❑ *ESS-7 investigate how Earth's internal and external sources of energy drive geochemical cycles (e.g., carbon moving from carbon dioxide reservoirs to carbonate reservoirs).* ❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve*		

Earth Science 9-12	Unit 2: Minerals		Suggested Length: 7-8 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	scientific investigations and communications. ❑ *SI-4 use evidence, logic, and scientific knowledge to develop and revise scientific explanations and models.* **<u>Core Content</u>** Scientific Inquiry: ❑ Use equipment, tools, techniques, technology, and mathematics to improve scientific investigations and communications. ❑ Use evidence, logic, and scientific knowledge to develop and revise scientific explanations and models. ❑ Design and conduct different kinds of scientific investigations. ❑ **SC-HS-2.3.7 Students will:** ❑ **explain real-life phenomena caused by the convection of the Earth's mantle;** ❑ **predict the consequences of this motion on humans and other living things on the planet.** **The outward transfer of Earth's internal heat drives convection circulation in the mantle. This causes the crustal plates to move on the face of the Earth. DOK 3** ❑ **SC-HS-4.6.4 Students will:** ❑ **describe the components and reservoirs involved in biogeochemical cycles (water, nitrogen, carbon dioxide, and oxygen);** ❑ **explain the movement of matter and energy in biogeochemical cycles and related phenomena.** **The total energy of the universe is constant. Energy can change forms and/or be**	❑ Mineral ❑ Crystal system ❑ Luster ❑ Metallic ❑ Nonmetallic ❑ Vitreous/glassy ❑ Pearly ❑ Streak ❑ Hardness ❑ Moh's Scale of Hardness ❑ Cleavage ❑ Fracture ❑ Specific gravity ❑ Ores ❑ Gems	❑ Model the six basic crystal shapes of minerals by constructing three-dimensional representations. DOK 1 ❑ Compare models of crystal shapes to photos and samples of actual crystals. DOK 2 ❑ Investigate the physical/chemical properties of mineral samples by conducting color, luster, hardness, streak, acid, magnetism, and specific gravity tests. DOK 2 ❑ Infer the identity of actual minerals from by comparing test results with known properties. DOK 3 ❑ Determine what minerals are used in everyday objects by conducting a "mineral inventory" of the classroom. DOK 1 ❑ Recognize the uses of common minerals. DOK 1 ❑ <u>Test: "Minerals"</u> ❑ <u>Lab Sheet & Report: "Mineral Identification/Properties"</u>

Earth Science 9-12	Unit 2: Minerals		Suggested Length: 7-8 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
	transferred in many ways, but it can neither be created nor destroyed. Movement of matter between reservoirs is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life. DOK 3		

Earth Science 9-12	Unit 3: Rocks/The Rock Cycle		Suggested Length: 13 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
1. How are rocks classified? 2. What processes result in rock formation? 3. What are the properties features of various rocks?	**Program of Studies** *Students will:* ❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve scientific investigations and communications* ❑ *ESS-1 examine internal and external sources of energy.* ❑ *ESS-5 recognize that the Earth contains a fixed amount of each stable chemical atom or element.* ❑ *ESS-6 analyze Earth's chemical reservoirs and recognize that each element can exist in several reservoirs (e.g., carbon in carbon dioxide reservoirs and carbonate reservoirs).* ❑ *ESS-7 investigate how Earth's internal and*		

Earth Science 9-12	Unit 3: Rocks/The Rock Cycle		Suggested Length: 13 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	external sources of energy drive geochemical cycles (e.g., carbon moving from carbon dioxide reservoirs to carbonate reservoirs). **<u>Core Content</u>** Scientific Inquiry ❑ Use equipment, tools, techniques, technology, and mathematics to improve scientific investigations and communications. ❑ Design and conduct different kinds of scientific investigations. ❑ **SC-HS-4.6.4 Students will:** ❑ **describe the components and reservoirs involved in biogeochemical cycles (water, nitrogen, carbon dioxide, and oxygen);** ❑ **explain the movement of matter and energy in biogeochemical cycles and related phenomena.** **The total energy of the universe is constant. Energy can change forms and/or be transferred in many ways, but it can neither be created nor destroyed. Movement of matter between reservoirs is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life. DOK 3** ❑ **SC-HS-4.6.8 Students will:** ❑ **describe the connections between the**	❑ Rock ❑ Igneous rock ❑ Magma ❑ Lava ❑ Intrusive (plutonic) ❑ Extrusive (volcanic) ❑ Texture ❑ Coarse crystalline (grained) ❑ Fine crystalline (grained) ❑ Glassy ❑ Mafic ❑ Felsic ❑ Sedimentary rock ❑ Metamorphic rock	❑ Relate the location, rate of cooling to crystal formation and type of igneous rocks. DOK 2 ❑ Infer the relationship between melting and freezing order of Bowen's Reaction Series by observing melting and cooling of everyday materials. DOK 3 ❑ Classify samples of igneous rocks according to texture, formation, color, and mineral composition. DOK 2 ❑ Distinguish between the three types of sedimentary rocks, the kinds of sediments they contain, and method of formation. DOK 1 ❑ Observe samples of sedimentary rocks and design a table to record data about the rocks' texture, composition, and other features. DOK 2 ❑ Use observable properties of metamorphic rock samples to infer the parent rocks from which they formed. DOK 2 ❑ Create a diagram of the rock cycle's processes, intermediate materials, and major rock types after modeling the formation of an igneous rock and its transformation to a sedimentary rock, then a metamorphic rock using modeling clay. DOK 2 ❑ Summarize and describe the processes that occur when an igneous rock is transformed into a sedimentary rock and a metamorphic rock in the rock cycle. DOK 2 ❑ Compare and contrast the properties and formation of the three major rock types. DOK 2 ❑ <u>Test: "Rocks"</u> ❑ <u>Performance Assessment: Rock Identification/Classification</u>

Earth Science 9-12	Unit 3: Rocks/The Rock Cycle		Suggested Length: 13 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
	functioning of the Earth system and its sources of energy (internal and external). ❑ **predict the consequences of changes to any component of the Earth system.** **Earth systems have sources of energy that are internal and external to the Earth. The Sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from Earth's original formation. DOK 3**		

Earth Science 9-12	Unit 4: Weathering & Erosion		Suggested Length: 6-7 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
1. How do weathering and erosion affect the earth's surface features and materials? 2. What are the factors or variables that affect weathering and erosion?	**Program of Studies** *Students will:* ❑ *ESS-7 investigate how Earth's internal and external sources of energy drive geochemical cycles (e.g., carbon moving from carbon dioxide reservoirs to carbonate reservoirs).* ❑ *ESS-10 examine and interpret ongoing changes of the Earth system (e.g., earthquakes, mountain building).* **Core Content** ❑ **SC-HS-2.3.8 Students will:** ❑ **predict consequences of both rapid (volcanoes, earthquakes)and slow (mountain building, plate movement) earth processes from evidence/data and justify reasoning.** **The Earth's surface is dynamic;**	❑ Weathering ❑ Erosion ❑ Mechanical / ❑ Physical weathering ❑ Frost/ice wedging ❑ Chemical weathering ❑ Hydrolysis ❑ Oxidation	❑ Explain how weathering and erosion relate to each other. DOK 1 ❑ Distinguish between the two types of weathering. DOK 1 ❑ Investigate how solution acidity, temperature, rock type, and surface area of rocks affects the rate and/or amount of chemical weathering through laboratory experiments. DOK 2 & 3

Earth Science 9-12	Unit 4: Weathering & Erosion		Suggested Length: 6-7 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	earthquakes and volcanic eruptions can be observed on a human time scale, but many processes, such as mountain building and plate movements, take place over hundreds of millions of years. DOK 3 ❑ **SC-HS-4.6.4 Students will:** ❑ **describe the components and reservoirs involved in biogeochemical cycles (water, nitrogen, carbon dioxide, and oxygen);** ❑ **explain the movement of matter and energy in biogeochemical cycles and related phenomena.** **The total energy of the universe is constant. Energy can change forms and/or be transferred in many ways, but it can neither be created nor destroyed. Movement of matter between reservoirs is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life. DOK 3** ❑ **SC-HS-4.6.8 Students will:** ❑ **describe the connections between the functioning of the Earth system and its sources of energy (internal and external).** ❑ **predict the consequences of changes to any component of the Earth system.**	❑ Soil ❑ Soil horizon ❑ Mass movement ❑ Creep ❑ Mudflow ❑ Landslide ❑ Slump	❑ Summarize the relationships between the investigated factors and the degree of chemical weathering. DOK 2 ❑ Understand how weathering and erosion to soil formation. DOK 2 ❑ Relate climate conditions to the type of soil found in a geographic area. DOK 2 ❑ Diagram/illustrate the different types of mass movements and use the diagrams to answer questions and summarize information about mass movements. DOK 2 ❑ <u>Test: Weathering/Erosion</u> ❑ <u>Open Response: "Mass Movements"</u> ❑ <u>Open Response: "Chemical Weathering"</u>

Earth Science 9-12	Unit 4: Weathering & Erosion		Suggested Length: 6-7 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
	Earth systems have sources of energy that are internal and external to the Earth. The Sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from Earth's original formation. DOK 3		

Earth Science 9-12	Unit 5: Earthquakes		Suggested Length: 8-9 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
1. What causes earthquakes and how do they affect Earth's surface? 2. How are earthquakes and the destruction they cause measured?	**Program of Studies** *Students will:* ❑ *AC-7 use science to investigate natural hazards and human-induced hazards.* ❑ *ESS-1 examine internal and external sources of energy.* ❑ *ESS-2 examine how internal sources of energy propel crustal plates across the face of the globe* ❑ *ESS-10 examine and interpret ongoing changes of the Earth system (e.g., earthquakes, mountain building).* **Core Content** *Personal and Social Perspectives* Students will explore the impact of scientific knowledge and discoveries on personal and community health; recognize how science influences human population growth, use science to analyze the use of natural resources by an increasing human population; investigate how science can be used to solve environmental quality problems, use science to investigate natural and human-induced hazards; and analyze how science and technology are necessary but not sufficient for solving local, national, and global issues.	❑ Stress ❑ Strain ❑ Fault ❑ Normal fault ❑ Reverse fault ❑ Strike-slip(transform) fault ❑ Seismologist ❑ Primary wave ❑ Secondary wave ❑ Surface wave	❑ Define stress and strain as they apply to rocks. DOK 1 ❑ Understand how the buildup of stress deforms and changes rocks. DOK 2 ❑ Compare and contrast the movement and characteristics of the three types of faults. DOK 2 ❑ Understand and demonstrate the movement of the primary and secondary earthquake waves using a slinky or other device. DOK 2 ❑ Distinguish between the focus and the epicenter of an earthquake. DOK 1 ❑ Construct a travel-time curve for the primary and

Earth Science 9-12	Unit 5: Earthquakes		Suggested Length: 8-9 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
	❑ **SC-HS-2.3.7 Students will:** ❑ **explain real-life phenomena caused by the convection of the Earth's mantle;** ❑ **predict the consequences of this motion on humans and other living things on the planet.** **The outward transfer of Earth's internal heat drives convection circulation in the mantle. This causes the crustal plates to move on the face of the Earth. DOK 3** ❑ **SC-HS-2.3.8 Students will:** ❑ **predict consequences of both rapid (volcanoes, earthquakes)and slow (mountain building, plate movement) earth processes from evidence/data and justify reasoning.** **The Earth's surface is dynamic; earthquakes and volcanic eruptions can be observed on a human time scale, but many processes, such as mountain building and plate movements, take place over hundreds of millions of years. DOK 3** ❑ **SC-HS-4.6.8 Students will:** ❑ **describe the connections between the functioning of the Earth system and its sources of energy (internal and external).** ❑ **predict the consequences of changes to any component of the Earth system.** **Earth systems have sources of energy that are internal and external to the Earth. The Sun is the major external source of energy. Two primary sources of internal energy**	❑ Focus ❑ Epicenter ❑ Magnitude ❑ Intensity ❑ Richter scale ❑ Moment magnitude scale ❑ Modified Mercalli scale ❑ Tsunami	secondary waves generated by an earthquake. DOK 2 ❑ Interpret a travel-time curve for earthquake waves. DOK 2 ❑ Describe the interior structure of the earth. DOK 2 ❑ Understand how the study of earthquake waves has helped determine the interior structure of the earth. DOK 1 ❑ Distinguish between earthquake magnitude and intensity and the scales used to measure each. DOK 1 ❑ Compare the use of intensity data and seismograph stations to locate the epicenter of an earthquake. DOK 2 ❑ Evaluate descriptions of earthquake damages to assign an intensity value to a specific city involved in an earthquake. DOK 3 ❑ Construct a seismic-intensity map using assigned intensity values and use it to locate the epicenter for a fictional earthquake occurring somewhere in the eastern United States. DOK 2 ❑ Describe damages/effects of several past earthquakes observed on a video. DOK 1 ❑ Assessment: ❑ Test: "Earthquakes" ❑ Open Response: "Travel-Time Curves of Primary and ▪ Secondary Earthquake Waves"

Earth Science 9-12	Unit 5: Earthquakes		Suggested Length: 8-9 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
	are the decay of radioactive isotopes and the gravitational energy from Earth's original formation. DOK 3		

Earth Science 9-12	Unit 6: Volcanoes/Plate Movement		Suggested Length: 13 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
1. How do volcanoes form and how can they be classified? 2. What kinds of features form as the result of igneous activity within Earth?	**Program of Studies** *Students will:* ❑ *AC-3 explore the impact of scientific knowledge and discoveries on personal and community health.* ❑ *AC-7 use science to investigate natural hazards and human-induced hazards.* ❑ *ESS-1 examine internal and external sources of energy.* ❑ *ESS-2 examine how internal sources of energy propel crustal plates across the face of the globe.* ❑ *ESS-7 investigate how Earth's internal and external sources of energy drive geochemical cycles (e.g., carbon moving from carbon dioxide reservoirs to carbonate reservoirs).* ❑ *ESS-10 examine and interpret ongoing changes of the Earth system (e.g., earthquakes, mountain building).* **Core Content** *Personal and Social Perspectives* Students will explore the impact of scientific knowledge and discoveries on personal and community health; recognize how science influences human population growth, use science to analyze the use of natural resources by an increasing human population; investigate how science can be used to solve environmental quality problems, use science to investigate natural and	❑ Viscosity ❑ Pluton ❑ Batholith ❑ Stock ❑ Laccolith ❑ Sill ❑ Dike ❑ Vent	❑ Describe factors that affect the formation of magma. DOK 1 ❑ Model the effect of trapped gases on the explosiveness of magma and the behavior of solid particles in magma using raisins, vinegar, and baking soda. DOK 2 ❑ Compare and contrast the silica content, viscosity, and explosiveness of the different types of magma. DOK 2 ❑ Describe the characteristics of each of the three types of

Earth Science 9-12	Unit 6: Volcanoes/Plate Movement		Suggested Length: 13 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	human-induced hazards; and analyze how science and technology are necessary but not sufficient for solving local, national, and global issues. ❑ **SC-HS-2.3.7 Students will:** ❑ **explain real-life phenomena caused by the convection of the Earth's mantle;** ❑ **predict the consequences of this motion on humans and other living things on the planet.** **The outward transfer of Earth's internal heat drives convection circulation in the mantle. This causes the crustal plates to move on the face of the Earth. DOK 3** ❑ **SC-HS-2.3.8 Students will:** ❑ **predict consequences of both rapid (volcanoes, earthquakes)and slow (mountain building, plate movement) earth processes from evidence/data and justify reasoning.** **The Earth's surface is dynamic; earthquakes and volcanic eruptions can be observed on a human time scale, but many processes, such as mountain building and plate movements, take place over hundreds of millions of years. DOK 3** ❑ **SC-HS-4.6.4 Students will:** ❑ **describe the components and reservoirs involved in biogeochemical cycles (water, nitrogen, carbon dioxide, and oxygen);** ❑ **explain the movement of matter and energy in biogeochemical cycles and related phenomena.**	❑ Crater ❑ Caldera ❑ Basaltic ❑ Andesitic (intermediate) ❑ Rhyolitic (granitic) ❑ Shield volcano ❑ Cinder cone volcano ❑ Composite volcano ❑ Tephra ❑ Pyroclastic flow ❑ Hot spot ❑ Convergent boundary ❑ Divergent boundary ❑ Mid-ocean ridge ❑ Oceanic trench ❑ Rifts	volcanoes and relate their characteristics to magma type. DOK 2 ❑ Identify volcanoes as shield, cinder cone, or composite based on appearance, location, etc. DOK 1 ❑ Relate the ability of magma to flow, eruptive force of a volcanic eruption, and products of a volcanic eruption to the silica and water content of magma. DOK 2 ❑ Infer the most important component of magma in determining the explosiveness of a volcanic eruption. DOK 3 ❑ Use written descriptions of igneous rock intrusions to identify specific plutons in a diagram. DOK 2 ❑ Understand effects of volcanic eruptions on people and the ecosystem. DOK 2 ❑ Explain the relationship between volcanism and hot spots. DOK 1 ❑ Explain the relationship between volcanism and tectonic plate boundaries. DOK 2 ❑ Describe the movement of the plates and the resulting features/landforms formed at each type of plate boundary. DOK 2 ❑ Identify global patterns of earthquake and volcanic activity. DOK 2 ❑ Predict whether or not a volcano and/or an earthquake will occur at a specific location, based on plate boundaries. DOK 2 ❑ ***<u>Test: "Volcanoes/Plate Tectonics"</u>*** ❑ <u>Open Responses: "Types of Volcanoes/Magmas" "Plate Boundaries, Volcanism, and Seismic Activity"</u>

Earth Science 9-12	Unit 6: Volcanoes/Plate Movement		Suggested Length: 13 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
	The total energy of the universe is constant. Energy can change forms and/or be transferred in many ways, but it can neither be created nor destroyed. Movement of matter between reservoirs is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life. DOK 3 ❑ **SC-HS-4.6.8 Students will:** ❑ **describe the connections between the functioning of the Earth system and its sources of energy (internal and external).** ❑ **predict the consequences of changes to any component of the Earth system.** **Earth systems have sources of energy that are internal and external to the Earth. The Sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from Earth's original formation. DOK 3**		

Earth Science 9-12	Unit 7: Geologic Time Scale & the Rock Record		Suggested Length: 6 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
	Program of Studies *Students will:*		

Earth Science 9-12	Unit 7: Geologic Time Scale & the Rock Record		Suggested Length: 6 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
1. How do geologists divide Earth's long history? 2. How can certain geologic principles be used to interpret relative age in layered rocks? 3. How are different techniques used to determine the absolute ages of rocks?	❑ *ESS-9 investigate how to estimate geologic time (e.g., observing rock sequences, radioactive dating).* ❑ *ESS-10 examine and interpret ongoing changes of the Earth system (e.g., earthquakes, mountain building).* **<u>Core Content</u>** ❑ SC-HS-2.3.5 Students will understand that the Sun, Earth, and the rest of the solar system formed approximately 4.6 billion years ago from a nebular cloud of dust and gas. ❑ **SC-HS-2.3.6 Students will:** ❑ **compare the limitations/benefits of various techniques (radioactive dating, observing rock sequences, and comparing fossils) for estimating geological time;** ❑ **justify deductions about age of geologic features.** **Techniques used to estimate geological time include using radioactive dating, observing rock sequences, and comparing fossils to correlate the rock sequences at various locations. DOK 3** ❑ **SC-HS-2.3.8 Students will:** ❑ **predict consequences of both rapid (volcanoes, earthquakes)and slow (mountain building, plate movement) earth processes from evidence/data and justify reasoning.** **The Earth's surface is dynamic;**	❑ Geologic time scale ❑ Eon ❑ Era ❑ Period ❑ Epoch ❑ Uniformitarianism ❑ Principle of superposition ❑ Principle of original horizontality ❑ Principle of cross-cutting relationships ❑ Unconformity ❑ Correlation ❑ Radioactive decay ❑ Half-life	❑ Describe the geologic time scale. DOK 1 ❑ Distinguish among the following geologic time scale divisions: eon, era, period, and epoch. DOK 1 ❑ Apply the geologic principles (superposition, original horizontality, cross-cutting relationships) for determining relative age to interpret rock sequences in a diagram. DOK 2, 3 ❑ Compare and contrast the several different methods used by scientists to determine absolute age. DOK 2 ❑ Model the concept of half-life using pennies or M&M's and graph the results. DOK 2 ❑ Describe how objects are dated by the use of certain radioactive elements. DOK 2 ❑ Test chapter 21. ❑ <u>Open Response: "Relative Age Dating of Rocks"</u>

Earth Science 9-12	Unit 7: Geologic Time Scale & the Rock Record		Suggested Length: 6 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	earthquakes and volcanic eruptions can be observed on a human time scale, but many processes, such as mountain building and plate movements, take place over hundreds of millions of years. DOK 3 ❑ SC-HS-4.7.4 Students will understand that evidence for one-celled forms of life, the bacteria, extends back more than 3.5 billion years. The changes in life over time caused dramatic changes in the composition of the Earth's atmosphere, which did not originally contain oxygen.		

Earth Science 9-12	Unit 8: Earth's Atmosphere & Weather		Suggested Length: 13 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
1. What are the composition, structure, and properties that make up Earth's atmosphere? 2. How does water continually move between Earth's surface and the atmosphere? 3. How do air masses move and change and what weather	**<u>Program of Studies</u>** ❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve scientific investigations and communications* ❑ *ESS-3 examine how external sources of energy produce winds and ocean currents.* ❑ *ESS-4 examine how external sources of energy determine global climate.* ❑ *ESS-10 examine and interpret ongoing changes of the Earth system (e.g., earthquakes, mountain building).* **<u>Core Content</u>** Scientific Inquiry		

Earth Science 9-12	Unit 8: Earth's Atmosphere & Weather		Suggested Length: 13 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
conditions result from this movement? 4. How do thunderstorms, tornadoes, and hurricanes form?	Students will: ❑ Use equipment, tools, techniques, technology, and mathematics to improve scientific investigations and communications. ❑ Design and conduct different kinds of scientific investigations. ❑ **SC-HS-4.6.8 Students will:** ❑ **describe the connections between the functioning of the Earth system and its sources of energy (internal and external).** ❑ **predict the consequences of changes to any component of the Earth system.** **Earth systems have sources of energy that are internal and external to the Earth. The Sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from Earth's original formation. DOK 3** ❑ **SC-HS-4.6.9 Students will:** ❑ **explain the cause and effect relationship between global climate and weather patterns and energy transfer (cloud cover, location of mountain ranges, oceans);** ❑ **predict the consequences of changes to the global climate and weather patterns.** **Global climate is determined by energy transfer from the Sun at and near Earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the Earth's rotation and static**	❑ Ozone ❑ Troposphere ❑ Stratosphere ❑ Mesosphere ❑ Thermosphere ❑ Exosphere ❑ Radiation ❑ Conduction ❑ Convection ❑ Dew point ❑ Condensation ❑ Humidity ❑ Relative humidity ❑ Meteorology ❑ Weather ❑ Air mass ❑ Coriolis effect ❑ Jet stream ❑ Front ❑ Thermometer ❑ Barometer ❑ Thunderstorm ❑ Tornado ❑ Hurricane	❑ Hypothesize the percent composition of oxygen in the air. DOK 1 ❑ Perform an experiment to determine the percent oxygen in air and compare to the hypothesized amount. DOK 2 ❑ Compare and contrast the various layers of the atmosphere (troposphere, stratosphere, mesosphere, thermosphere, exosphere). DOK 1 ❑ Identify and give examples of three methods of transferring energy throughout the atmosphere. DOK 2 ❑ Explain relative humidity and how it relates to dew point and condensation. DOK 2 ❑ Measure the dew point in the classroom and make a line graph of temperature versus time for cooling water. DOK 2 ❑ Measure the dew point outside and compare it to the indoor dew point, and suggest reasons for possible differences. DOK 2 ❑ Identify and describe the four major cloud types: cirrus, cumulus, stratus, and nimbus. DOK 1 ❑ Describe the different air mass types and movements involved in cold fronts, warm fronts, stationary fronts, and occluded fronts, and what kind of weather conditions result along each. DOK 2 ❑ Compare and contrast thunderstorms, tornadoes, and hurricanes. DOK 2 ❑ Plot the path of actual hurricanes and recognized patterns in hurricane movement. DOK 2 ❑ Design and construct a table to list the characteristics of various weather instruments. DOK 2 ❑ Use weather maps from a local newspaper to forecast the weather for a particular day. DOK 3 ❑ Test: "Atmosphere/Weather" ❑ Open Response(s): "Weather Map", "Fronts and Weather Conditions"

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Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
	conditions such as the position of mountain ranges and oceans. DOK 3 ❑ **SC-HS-4.7.3 Students will:** ❑ **predict the consequences of changes to any component (atmosphere, solid Earth, oceans, living things) of the Earth System;** ❑ **propose justifiable solutions to global problems.** **Interactions among the solid Earth, the oceans, the atmosphere, and living things have resulted in the ongoing development of a changing Earth system. DOK 3**		

Earth Science 9-12	Unit 9: Our Solar System & The Universe		Suggested Length: 8 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
1. How do you analyze the motions of the Sun, Earth, and Moon? 2. What are the characteristics of planets and interplanetary bodies? 3. What theory is used to describe the formation of the solar	**Program of Studies** ❑ *ESS-8 describe the formation of the solar system.* ❑ *ESS-11 describe theories of the formation of the universe (e.g., big bang theory).* ❑ *ESS-12 describe the formation of the stars.* ❑ *ESS-13 examine stars (e.g., energy production, formation of elements).* **Core Content** ❑ **SC-HS-2.3.2 Students will:** ❑ **describe the current scientific theory of the formation of the universe (Big Bang) and its evidence;** ❑ **explain the role of gravity in the formation of the universe and it's**	❑ Ecliptic ❑ Solstice ❑ Equinox ❑ Rotation ❑ Revolution ❑ Solar eclipse	❑ Identify the relative positions of Earth, the Sun, and the Moon. DOK 1 ❑ Describe the phases of the Moon. DOK 1 ❑ Explain eclipses of the Sun and Moon. DOK 1 ❑ Describe early models of our solar system. DOK 2 ❑ Describe the properties of the terrestrial planets and

Earth Science 9-12	Unit 9: Our Solar System & The Universe		Suggested Length: 8 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
system? 4. How do stars change during their lives?	**components.** **The big bang theory and observational measurements that support it place the origin of the universe at a time between 10 and 20 billion years ago, when the universe began in a hot dense state. According to this theory, the universe has been expanding since then. Early in the history of the universe, the first atoms to form were mainly hydrogen and helium. Over time, these elements clump together by gravitational attraction to form trillions of stars. DOK 2** ❑ **SC-HS-2.3.3 Students will explain the origin of the heavy elements in planetary objects (planets, stars).** **Some stars explode at the end of their live, and the heavy elements they have created are blasted out into space to form the next generation of stars and planets. DOK 2** ❑ SC-HS-2.3.7 Students will understand that the Sun, Earth, and the rest of the solar system formed approximately 4.6 billion years ago from a nebular cloud of dust and gas.	❑ Lunar eclipse ❑ Retrograde motion ❑ Astronomical unit ❑ Terrestrial planet ❑ Gas giant planet ❑ Asteroid ❑ Meteoroid ❑ Meteor ❑ Meteorite ❑ Comet ❑ Fusion ❑ Fission ❑ Constellation ❑ Nebula ❑ Protostar ❑ Neutron star ❑ Supernova ❑ Black hole ❑ Big Bang Theory ❑ Steady State Theory	compare them to the Earth. DOK 1 ❑ Describe the properties of the gas giant planets. DOK 1 ❑ Identify the unique nature of the planet Pluto. DOK 1 ❑ Describe how the planets formed from a disk surrounding the young Sun. ❑ Explore the structure of the Sun. ❑ Compare and contrast comets, asteroids, meteoroids, meteors, and meteorites. ❑ Describe how the Sun will change during its lifetime. ❑ Compare the evolution of stars of different masses. ❑ Describe the most commonly accepted theory about the beginning of the universe and the evidence that exists to support it. ❑ <u>Tests – Chapter 28, 29, 30, 31</u> ❑ ***<u>Open Response: "Terrestrial & Gas Giant Planets"</u>*** ❑ ***<u>Open Response: "Origin of the Universe"</u>***