







High School - Earth Science

North Boone CUSD 200

UNITS (6/6 SELECTED)

SUGGESTED DURATION

 Unit 1: Earth, the Solar System and Universe.	<i>25 lessons</i>
 Unit 2: Dynamic Earth	<i>35 lessons</i>
 Unit 3: Earth's History / Geologic Time	<i>30 lessons</i>
 Unit 4: Weathering and Erosion	<i>25 lessons</i>
 Unit 5: The Hydrosphere	<i>20 lessons</i>
 Unit 6: Atmospheric Force and Weather	<i>25 lessons</i>

Unit 1: Earth, the Solar System and Universe.

High School - Earth Science - Last Updated on March 21, 2019

STANDARDS

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.

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 in the form of radiation.

HS-ESS2-7.: Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

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.

PRIORITY STANDARDS

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.
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 in the form of radiation.
HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

Unit 1: Earth, the Solar System and Universe.

High School - Earth Science - Last Updated on March 21, 2019

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
<p>The Big Bang is a theory of the universe's origin and holds that 12 to 14 billion years ago, the universe was a very hot, dense, tiny ball of matter that expanded very rapidly to form the universe we know today.</p> <p>The Big Bang theory is supported by observations of: distant galaxies receding from our own; the measured composition of stars and non-stellar gases; and maps of spectra of primordial radiation that still fills the universe.</p> <p>Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen and water.</p> <p>Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.</p>	<p>How do scientists construct an understanding of earth and space?</p> <p>How are scientific inquiry and engineering design interrelated in the fields of Earth Science: Geology, Oceanography, Meteorology, and Astronomy?</p> <p>How did the universe come to be?</p> <p>How does science explain the formation and history of the universe and solar system?</p> <p>What is the universe, and what is earth's place in it?</p> <p>What is the universe, and what goes on in the stars?</p> <p>What are the predictable patterns caused by Earth's movement in the solar system?</p> <p>What unique characteristics make it possible for earth to sustain life?</p>

Students will know (Knowledge):	Students will be able to (Skills):
<ul style="list-style-type: none"> • Key vocabulary and concepts associated with the earth, the solar system, and the universe, including: volatile, orbit, ellipse, focus, axis, eccentricity, gravity, force, greenhouse gas, precession, insolation, big bang theory, plasma, cosmic microwave background, crust, lithosphere, seismic wave, mantle, mesosphere, asthenosphere, core, outer core, innercore, topography • And explain the theory of the origin of the universe • The characteristics of waves and electromagnetic radiation 	<ul style="list-style-type: none"> • Use key concepts and vocabulary associated with the earth, the solar system, and the universe in discussions, investigations, and problem solving about the earth, the solar system, and the universe • Develop and use models to show how the big bang theory and its evidence are consistent with existing understanding of nuclear processes in stars • Use evidence in order to explain the origin of the universe • Use celestial maps and models to understand the universe

Unit 1: Earth, the Solar System and Universe.

High School - Earth Science - Last Updated on March 21, 2019

Students will know (Knowledge):	Students will be able to (Skills):
<ul style="list-style-type: none">• Evidence that supports the expansion of the universe• Laws governing the motion of celestial objects• Technology used to study the universe	<ul style="list-style-type: none">• Observe and measure properties of waves and electromagnetic radiation• Create the solar system to scale• Demonstrate the relationship between temperature and absolute magnitude• Compare and contrast characteristics of planets: atmosphere, rotation/revolution, terrestrial/Jovian• Use a topographic model to construct a topographic map projection• Predict occurrences of equinoxes and solstices

Unit 2: Dynamic Earth

High School - Earth Science - Last Updated on March 21, 2019

STANDARDS

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.

HS-ETS1-1.: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2.: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3.: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

PRIORITY STANDARDS

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.

Unit 2: Dynamic Earth

High School - Earth Science - Last Updated on March 21, 2019

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
<p>The earth is composed of multiple interacting layers.</p> <p>Continental rocks are generally much older than the rocks of the ocean floor.</p> <p>Plate tectonics explains movements of the rocks at Earth's surface and provides a framework for understanding its geologic history</p> <p>Plate movements are responsible for continental and ocean-floor features as well as the distribution of most rocks and minerals within Earth's crust</p> <p>Motions of the Earth's mantle and its plates occur primarily through the cycling of matter by thermal convection.</p>	<p>How do people reconstruct and date events in Earth's planetary history?</p> <p>Why do the continents move, and what causes earthquakes and volcanoes?</p> <p>How do Earth's major systems interact?</p>

Students will know (Knowledge):	Students will be able to (Skills):
<ul style="list-style-type: none"> • Key vocabulary and concepts associated with the dynamics of the earth, including: fault, epicenter, continental margin, tectonic plate, divergent boundary, convergent boundary, transform boundary, mid-ocean ridge, subduction, oceanic trench, mantle convection, slab pull, ridge push, sedimentary rock, sediment, igneous rock, magma, metamorphic rock, rock cycle, active margin, passive margin, isostatic equilibrium, uplift, subsidence, seismogram, subduction • The types of mountain formations at the three lithospheric plate boundaries • And explain the elastic rebound theory's role in seismic activity • And explain the advantages and disadvantages of the two major earthquake scales 	<ul style="list-style-type: none"> • Use key concepts and vocabulary associated with the dynamics of the earth in discussions, investigations, and problem solving about the dynamics of the earth • Use historical evidence and data to support the theory of continental drift • Compare and contrast geologic features at the three types of lithospheric plate boundaries • Explain the role of convection currents in the movement of lithospheric plates • Compare faulting and folding as a response to stress on rocks • Compare the role of three types of seismic waves in recording and measuring earthquakes • Describe the formation of volcanic features at the three major volcanic zones • Compare and contrast types of lava to the volcanic features that they form

Unit 2: Dynamic Earth

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Students will know (Knowledge):	Students will be able to (Skills):
	<ul style="list-style-type: none">• Summarize evidence for extraterrestrial volcanism within our solar system

Unit 3: Earth's History / Geologic Time

High School - Earth Science - Last Updated on March 21, 2019

STANDARDS

HS-ESS3-1.: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

HS-ESS3-2.: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

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

PRIORITY STANDARDS

HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural 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.

Unit 3: Earth's History / Geologic Time

High School - Earth Science - Last Updated on March 21, 2019

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
<p>Unique characteristics distinguish minerals from rocks.</p> <p>The rock cycle is an interactive system of transferring matter and energy.</p> <p>Scientists use geologic evidence to compile the rock record using absolute and relative dating techniques.</p> <p>The rock and fossil record have been used to compile a geologic time scale throughout earth's major time eras.</p> <p>Energy production and other resource extraction include economic, social, environmental, and geopolitical costs and risks and benefits.</p> <p>Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that slow or stop ecosystem deterioration</p>	<p>What characteristics distinguish minerals from rocks?</p> <p>How do the three major classifications of rock interact within the rock cycle?</p> <p>How is the rock record used to construct an account of species that lived on Earth in the past?</p> <p>What evidence is used to reconstruct earth's past?</p>

Students will know (Knowledge):	Students will be able to (Skills):
<ul style="list-style-type: none"> Key vocabulary and concepts associated with the earth's history and geologic time, including: crystal, element, mineral, compound, sedimentary rock, sediment, igneous rock, magma, metamorphic rock, rock cycle, fossil, relative age, absolute age, Precambrian, supercontinent, cyanobacteria, Paleozoic era, Mesozoic era, Cenozoic era, ice age, glacials, interglacials, nonrenewable, renewable, sustainable, fossil fuel, engineering design process, constraint, criterion, tradeoff, iterate, alloy, rare earth elements, mining, ore, recycle, reclamation, hydraulic fracturing, tar sand, oil shale, hydroelectric energy, tidal energy geothermal energy, natural resource, natural hazard, biodiversity 	<ul style="list-style-type: none"> Use key concepts and vocabulary associated with the earth's history and geologic time in discussions, investigations, and problem solving about the dynamics of the earth Classify minerals by comparing observations and information about specific minerals with various organizing schemes Analyze systems and system processes within the rock cycle Construct an explanation for how energy and matter interact through the rock cycle Model fossil formation Describe how fossils are used to interpret the history of life on Earth

Unit 3: Earth's History / Geologic Time

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Students will know (Knowledge):	Students will be able to (Skills):
<ul style="list-style-type: none">• The principles used to evaluate relative and absolute ages from the rock record• The ways rock layers can be correlated• General principles of resource management• How earth's minerals are extracted and used in current technologies• How changes on Earth's surface can cause soil erosion• How mineral resource use has influenced human activity• How technological innovations can minimize the impacts of extracting fossil fuel resources• How the distribution of natural resources and natural hazards affects human population size and settlement patterns• How advances in engineering and technology influence relationships among natural resources, natural hazards, human population size, and human population settlement patterns	<ul style="list-style-type: none">• Describe the separation of geologic time into segments• Describe the changes to Earth's surface over its lifespan• Relate the fossil record to theories of how life on earth developed and changed over time (evolution)• Characterize Precambrian time, and the Paleozoic, Mesozoic, and Cenozoic eras based on their major events and abundant organisms• Construct explanations about changes that have occurred in Earth's past and may occur in Earth's future• Distinguish between renewable and nonrenewable energy resources• Examine the different ways fossil fuel resources are extracted• Debate the pros and cons of different renewable energy resources• Construct explanations of how human activities, including population growth, can become sustainable

Unit 4: Weathering and Erosion

High School - Earth Science - Last Updated on March 21, 2019

STANDARDS

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

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.

PRIORITY STANDARDS

HS-ESS2-5	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
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Unit 4: Weathering and Erosion

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DESIRED RESULTS

Enduring Understandings	Essential Question(s)
<p>Earth's surface is constantly being altered by the processes of weathering, erosion, and deposition of material.</p> <p>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.</p> <p>Water has exceptional capacity to: absorb, store, and release large amounts of energy; transmit sunlight; expand upon freezing; dissolve and transport materials; and lower the viscosities and melting points of rocks</p>	<p>How do the properties and movements of water shape Earth's surface and affect its systems?</p> <p>How do weathering and erosion affect the earth's surface features and materials?</p> <p>What are the factors or variables that affect weathering and erosion?</p>

Students will know (Knowledge):	Students will be able to (Skills):
<ul style="list-style-type: none"> • Key vocabulary and concepts associated with weathering and erosion of the the earth's surface, including: the water cycle, surface process, weathering, erosion, deposition, soil, horizon, drainage basin, delta, sinkhole, longshore current, glacier, moraine, plateau • How external energy and gravity drive processes at different scales of time, space, and quantity • The processes that break down rock and the scales at which they operate • The difference between an icecap and an ice sheet • How lateral, medial, and terminal moraines form • How the following glacial depositional features form: eskers, kames, and kettles • Erosional and depositional features produced by glaciers 	<ul style="list-style-type: none"> • Use key concepts and vocabulary associated with the weathering and erosion of the earth's surface in discussions, investigations, and problem solving about the dynamics of the earth • Model different ways material is moved down and across earth's surface • Compare and contrast the ways material is deposited and how soil develops and changes • 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 • Predict some erosional landforms formed by glacial ice • Observe how sediments carried from the lower part of a glacier to their sites of deposition • Plan and conduct an investigation of the properties of water and its effects on earth's materials and surface processes

Unit 5: The Hydrosphere

High School - Earth Science - Last Updated on March 21, 2019

STANDARDS

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-ETS1-1.: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2.: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3.: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

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

PRIORITY STANDARDS

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.

Unit 5: The Hydrosphere

High School - Earth Science - Last Updated on March 21, 2019

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
<p>Water is an essential resource for living things as well as an important agent of change for earth's surface.</p> <p>The Earth's hydrosphere is dynamic and interactive, and significantly contributes to changes that occur throughout the Earth's various systems.</p>	<p>How do the properties and movements of water shape Earth's surface and affect its systems?</p>

Students will know (Knowledge):	Students will be able to (Skills):
<ul style="list-style-type: none">• Key concepts and vocabulary associated with earth's water, including: hydrosphere, reservoir, universal solvent, energy, sediments, salinity, seafloor-spreading hypothesis, oceanic trench, ooze, sea-level rise,• Salt water is not potable and must undergo costly desalination processes for human consumption also that potentially causes adverse consequence• The earth's mantle contains a large amount of water, perhaps more than all of earth's oceans.• Ocean water carries sediment from land that has been deposited along the edges of continents to other parts of the ocean floor• Rock of the ocean floor does not weather as quickly as rock exposed on land.• Material from organisms such as corals and the shells of dead microscopic organisms can grow into very large structures on the ocean floor and have a large effect on it• The role of scientific data and research in providing information and proposing solutions on the sustainability of plans for using ocean resources	<ul style="list-style-type: none">• Use key concepts and vocabulary associated with the earth's water in discussions, investigations, and problem solving• Cite and explain the empirical evidence that supports the seafloor-spreading hypothesis• Cite and explain a major cause of sea-level rise and local and regional factors affecting the rate of sea-level change• Analyze the positive and negative impacts of extracting natural resources from the ocean• Model the interaction of the earth, the sun, and the moon in order to explain the difference between spring tides and neap tides

Unit 6: Atmospheric Force and Weather

High School - Earth Science - Last Updated on March 21, 2019

STANDARDS

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

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.

PRIORITY STANDARDS

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

Unit 6: Atmospheric Force and Weather

High School - Earth Science - Last Updated on March 21, 2019

DESIRED RESULTS

Enduring Understandings	Essential Question(s)
<p>The foundation for earth's global climate system is the reflection, absorption, storage, and redistribution of the sun's energy among the atmosphere, the ocean, land systems and out space.</p> <p>Changes to global and regional climate that occur on a variety of time scales can be caused by interactions among changes in: the Sun's energy output, the earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities.</p> <p>The magnitude of human impacts are great; however, so too are human abilities to model, predict, and manage current and future impacts</p>	<p>How does water continually move between Earth's surface and the atmosphere?</p> <p>What regulates weather and climate?</p> <p>How does solar energy flow from the sun to earth, within earth's spheres, and between earth's spheres?</p> <p>How have natural processes and human activities changed earth's atmosphere and climate over time?</p> <p>How do changes in earth's atmosphere, weather, and climate affect other systems on earth?</p>

Students will know (Knowledge):	Students will be able to (Skills):
<ul style="list-style-type: none"> • Key concepts and vocabulary associated with atmospheric force and weather, including: troposphere, stratosphere, mesosphere, thermosphere, weather, air temperature, precipitation, cloud cover, humidity, air pressure, wind speed and direction, weather instruments (barometer, hygrometers or psychrometers, anemometers, thermometers), Coriolis effect, air mass, fronts (cold, warm, stationary, occluded, climate, climate change • How energy from the sun is distributed on earth • Some causes for climate change, including: volcanism, orbital changes, plate tectonics, changes in atmospheric composition • How humans effect climate and the increase of carbon dioxide 	<ul style="list-style-type: none"> • Use key concepts and vocabulary associated with atmospheric force and weather in discussions, investigations, and problem solving • Describe the composition of Earth's atmosphere and explain the cycling of gases in it • Compare the characteristics of each layer of earth's atmosphere • Describe and/or create a model of various paths water might take through the water cycle as it moves between earth's surface reservoirs and the atmosphere. • Construct explanations about how interactions among earth's systems affect weather • Explore the climate component of temperature and precipitation • Distinguish between 'average' and 'range' to describe the following climate conditions: polar, dry, tropical, temperate, and continental