EAST PENN SCHOOL DISTRICT

Geology of the National Parks

July 14, 2025

Unit 1 - Introduction to the National Parks

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

PA STEELS STANDARDS

3.3.9-12.I Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection

3.3.9-12.N Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

3.3.9-12.Q Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

Transfer

Students will be able to independently use their learning to...

- View Earth's surface with greater perspective and analyze the processes evidenced in landscapes
- Relate ongoing geological processes to still shots of today's Earth
- Engage in discussion of possible futures of landscapes by understanding cause and effect

Essential Questions
Students will keep considering...

- ☐ Where and how do humans fit in on Earth?
- ☐ What is inside the Earth?
- ☐ Why do we have national parks?
- ☐ How and why is Earth constantly changing?
- ☐ How do rocks tell the story of Earth's history?

Enduring Understandings
Students will understand that...

- ☐ The national parks have played a huge role historically in tourism and conservation in the United States.
- ☐ Human time and geological time are worlds apart.

Knowledge
Students will know...

Disciplinary Core Ideas:

- ☐ 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.

Other knowledge:

- ☐ Layers of the Earth, including inner core, outer core, mantle, crust, and lithosphere,

Skills
Students will be skilled at...

- ☐ Developing a model that represents Earth's internal structure, which includes the hot but solid inner core, the liquid outer core, and the solid mantle and crust
- ☐ Using the model to describe how thermal convection drives the cycling of matter within Earth's mantle
- ☐ Constructing a scientific argument that explains how life on Earth and Earth's nonliving systems have influenced each other over time
- ☐ Using seismic wave data to create a model/graph of Earth's interior

	and major characteristics ☐ The various aspects of the rock cycle, including the types of rocks (go into detail in later units) ☐ People and events that were helpful in establishing national parks ☐ How tourism in the United States began with our national parks and railroads ☐ How properties of Earth change as you extend closer to the core ☐ Significant geological events in Earth's history ☐ The relationship between Earth's systems and life on Earth ☐ Where/when humans appeared on Earth	☐ Constructing an argument about the simultaneous coevolution of Earth's systems and life on Earth ☐ Placing major Earth events on a timeline ☐ Converting Earth's events/timeline to a scale that makes sense to them individually ☐ Identifying the locations of national parks and regions/landforms across the United States ☐ Explaining the roles of historical figures in regards to conservation and our national park system today

Unit 2 - Cascades

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

PA STEELS STANDARDS

3.3.9-12.F *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.*

3.3.9-12.H *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.*

3.3.9-12.O *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.*

Transfer

Students will be able to independently use their learning to...

- View Earth's surface with greater perspective and analyze the processes evidenced in landscapes
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Essential Questions Students will keep considering...	Enduring Understandings Students will understand that...
☐ What would the Earth be like without plate tectonics? ☐ How do actions inside the Earth affect mountains on Earth's surface? ☐ Why is plate tectonics prolonged and also sudden? ☐ What makes mountains, like Mt. Rainier, so hazardous?	☐ What we see on Earth's surface is usually created by forces that we cannot see. ☐ Plate tectonics and associated events create natural disasters and beauty

Knowledge Students will know...	Skills Students will be skilled at...
Disciplinary Core Ideas: ☐ 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. ☐ Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. (secondary) ☐ 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. ☐ Mapping the history of natural hazards in a region, combined with an understanding of	☐ Analyzing evidence related to the ages of crustal rocks, particularly understanding that continental rocks are generally much older than oceanic rocks ☐ Applying scientific reasoning based on this evidence to explain *why* the ages of continental and oceanic crust differ ☐ Making the claim that a change occurring on Earth's surface can initiate feedback loops that lead to subsequent changes in other Earth systems ☐ Explaining how plate tectonics have influenced human life ☐ Explaining how changes inside the Earth affect Earth's surface ☐ Differentiating plate boundaries and describe the movements ☐ Differentiating types of volcanoes based on shape

	related geologic forces can help forecast the locations and likelihoods of future events. Other knowledge: ☐ Needs and an examples of mitigation strategies ☐ Where/why we can find volcanoes, and where/why we cannot ☐ The supporting evidence for Continental Drift ☐ The differences between continental drift and plate tectonics ☐ The movements, characteristics, and examples of various plate boundaries ☐ The differences between plutonic and volcanic igneous rocks ☐ How to identify igneous rocks, including crystal/grain size and texture ☐ The sequence of events that created Crater Lake ☐ The sequence of events that triggered the eruption of Mt. St. Helens ☐ How the Ring of Fire, and features of Crater Lake, Mt. Rainier, and Lassen Volcanic relate to plate tectonics ☐ Why the Cascades look the way that they do ☐ How mountains on our West Coast dictate weather patterns	and composition ☐ Analyzing seismic data to explain the relationship between plate boundaries and volcanoes/earthquakes ☐ Identifying and understanding the risk with volcanic hazards ☐ Identifying igneous rocks using crystal/grain size, texture, and composition (mafic from felsic) ☐ Using contour lines to see elevation on a topographic map

Unit 3 - Yellowstone & Grand Teton

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

PA STEELS STANDARDS

3.3.9-12.H *Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that causes change to other Earth systems.*

3.3.9-12.O *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.*

3.3.9-12.G *Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide*

Transfer

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Essential Questions
Students will keep considering...

- ☐ Why should we protect predators?
- ☐ How do actions inside the Earth affect water features on Earth's surface?
- ☐ What should tourists know about Yellowstone?

Enduring Understandings
Students will understand that...

- ☐ Animals and fear can change landscapes.
- ☐ Not all volcanoes look the same.

Knowledge
Students will know...

Disciplinary Core Ideas:

- ☐ 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.
- ☐ 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.
- ☐ Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.

Other knowledge:

- ☐ What previous Yellowstone eruptions did so that predictions can be made about future eruption impacts

Skills
Students will be skilled at...

- ☐ Making the claim that a change, like a Yellowstone eruption, can initiate feedback loops that lead to subsequent changes in other Earth systems
- ☐ Construct an argument supported by evidence and scientific reasoning to support the formation of various geological landforms in the Yellowstone/Teton region
- ☐ Model the cause and effect of geothermal features in Yellowstone (geysers, mudpots, fumaroles, and hot springs)
- ☐ Analyze data to claim that changes to Earth's surface can change other Earth systems
- ☐ Using the VEI scale to classify volcanoes
- ☐ Identifying different types of volcanic rocks seen in Yellowstone
- ☐ Recognizing the different type of fault-block systems

	☐ Yellowstone, and other volcanoes, have climatic effects ☐ How hot spots are different than other volcanoes ☐ Not all mountains are volcanoes ☐ Yellowstone's snowfall impacts the geothermal features ☐ Yellowstone's hot spot shows itself through geothermal features at the surface ☐ Wolves change the behavior of rivers ☐ Why Yellowstone and its features look the way they do ☐ How the Grand Tetons formed ☐ The differences between erosional and depositional landforms ☐ The different type of fault-block systems	

Unit 4 - Southwest

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

PA STEELS STANDARDS

3.3.9-12.K *Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.*

3.3.9-12.O *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.*

3.3.9-12.H *Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems*

Transfer

Students will be able to independently use their learning to...

- View Earth's surface with greater perspective and analyze the processes evidenced in landscapes
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Essential Questions
Students will keep considering...

- ☐ How does the interaction of Earth, air, and water shape the Southwest?
- ☐ What do rocks tell us?
- ☐ How do rocks change?

Enduring Understandings
Students will understand that...

- ☐ Current rock formations reveal relative age.
- ☐ Water is the most important force in the arid Southwest

Knowledge
Students will know...

Disciplinary Core Ideas:

- ☐ Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.
- ☐ Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
- ☐ The differences between weathering and erosion
- ☐ The factors affecting rate of weathering
- ☐ Processes such as cross bedding,

Skills
Students will be skilled at...

- ☐ Applying scientific reasoning to link evidence from ancient Earth materials to construct explanations about the formation of the Grand Canyon
- ☐ Construct an argument supported by evidence and scientific reasoning to support the formation of various geological landforms in the southwest (arches, slot canyons, etc...)
- ☐ Planning and conducting an investigation to show the effect that water has on weather and erosion
- ☐ Identifying various types of sedimentary processes, weathering, and erosion
- ☐ Using the principle of superposition to relatively date rocks
- ☐ Identifying minerals by using a variety of tests
- ☐ Identifying sedimentary rocks
- ☐ Explaining why weathering occurs

	mudcracks, ripple marks, frost wedging, exfoliation, graded bedding ☐ The 3 different processes in which sedimentary rocks are formed ☐ Previous environments that formed today's sedimentary rocks, including transgression and regression of ancient seas ☐ Why the Grand Canyon is so "grand" ☐ How the color of rocks can change ☐ The power of flash flooding ☐ How Zion Canyon and its features formed ☐ How hoodoos formed ☐ How arches, fins, and balanced rocks formed ☐ Chemical weathering attacks chemical ingredients in rocks and is active in humid climates (carbonation, hydration, solution, oxidation). ☐ Physical/mechanical weathering destroys rock but leaves chemicals unchanged and is active in cold/dry climates (exfoliation, granular disintegration, frost wedging, pressure release).	☐ Describing the ways that water breaks and transports rock

Unit 5 - Alaska

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

PA STEELS STANDARDS

3.3.9-12.O *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.*

3.3.9-12.L *Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.*

3.3.9-12.P Evaluate completing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

3.3.9-12.M Use a computational representation to illustrate relationships among earth systems and how those relationships are being modified due to human activity.

3.3.9-12.R Evaluate or refine a technological solution that reduces the impact of human activities on natural systems.

Transfer

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Essential Questions
Students will keep considering...

- ☐ How does the use of resources affect humans and our environment?
- ☐ How do landscapes change over time?
- ☐ How does the Earth and its features move?

Enduring Understandings
Students will understand that...

- ☐ Glaciers have their own life cycle and it is critical to the lives of all living things on Earth.
- ☐ Climate change can be seen in landscape changes.

Knowledge
Students will know...

Disciplinary Core Ideas:

- ☐ Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities
- ☐ Tectonic processes continually generate new ocean seafloor at ridges and destroy old seafloor at trenches. (secondary)
- ☐ 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.
- ☐ The complex patterns of the changes and the movement of water in the atmosphere,

Skills
Students will be skilled at...

- ☐ Construct an argument supported by evidence and scientific reasoning to support wildlife populations being connected to geological processes
- ☐ Developing and using models to illustrate how Earth's internal processes, such as plate tectonics, and surface processes create Alaska's landscapes
- ☐ Using repeat photography to investigate changes in landscapes
- ☐ Calculate glacial movement (loss by using recessional moraine deposits, rates of advancing, and overall glacier budget)
- ☐ Recognizing the difference between glacial and river valleys
- ☐ Differentiating the different types of moraines left by glaciers
- ☐ Identifying and labeling erosional and depositional landforms
- ☐ Identifying the different animals of Alaska's national parks and explaining how they affect or

	determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns ☐ Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. ☐ Why gold exists, where and how it can be found, and how it has impacted human history ☐ Renewable and nonrenewable resources in Alaska ☐ Formation of Alaska's Aleutian, Alaska, and Chugach Ranges ☐ The relationship between mountains and weather (orographic effect) ☐ The formation of glacial ice and the different types of glaciers and ice sheets that can form ☐ Erosional and depositional landforms created by glaciers ☐ Warning signs and impacts of climate change	are affected by the geology

Unit 6 - Yosemite, Olympic, Glacier

STAGE 1 | DESIRED RESULTS

Context and relevance for student learning

Standards

PA STEELS STANDARDS

3.3.9-12.P *Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*

3.3.9-12.K *Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.*

3.3.9-12.R *Evaluate or refine a technological solution that reduces impacts on human activities on natural systems.*

3.3.9-12.O *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.*

Transfer

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Essential Questions
Students will keep considering...

- ❏ How has geology become recreational?
- ❏ Why does water quality matter?
- ❏ How has water affected humans throughout history?
- ❏ How has water shaped our planet?

Enduring Understandings
Students will understand that...

- ❏ Water forces human response and new challenges will continue to occur on Earth.

Knowledge
Students will know...

Disciplinary Core Ideas:

- ☐ The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns
- ☐ The distribution and quantity of freshwater on Earth
- ☐ The parts of the hydrosphere and movements within the water cycle
- ☐ Porosity and permeability and factors controlling each
- ☐ The different ground regions that are part of the water table
- ☐ The erosional and depositional landforms created at a coastline

Skills
Students will be skilled at...

- ☐ Developing and using models to illustrate how Earth's internal and surfacial processes, such as plate tectonics and glaciation, create landscapes such as Half Dome, Yosemite Valley
- ☐ Analyzing data (rainfall, river flow) over time (e.g., discharge rates, sediment load, erosion patterns) to determine how weather and rivers shape the land and affect ecosystems
- ☐ Design a solution to reduce runoff pollution in a local river and explain how it helps maintain ecosystem balance
- ☐ Identifying conditions that lead to groundwater changes
- ☐ Explaining in detail how landforms affect weather
- ☐ Explaining the relationship between stream speed, discharge, and size/shape of the stream
- ☐ Identifying different parts of a floodplain
- ☐ Describing conditions that lead to flooding
- ☐ Describing measures taken to prevent flooding