Earth/Space Science

UNIT 1: EARTH'S MATERIALS

ESSENTIAL QUESTIONS	BIG IDEAS
What are the processes that create Earth's materials?	• Students understand Earth's biogeological evolution. • Students understand the complex and significant interdependencies between humans and our natural resources. • Students understand human dependencies on natural resources. • Students understand the significant environmental impact of human activities on Earth's systems.

GUIDING QUESTIONS

Content

- What are the processes that form minerals and rocks?
- How and where are minerals and rock extracted for human use?
- How do humans use mineral and rock resources?
- Can students recognize renewable and non-renewable energy sources?

Process

- Can students relate rock and mineral formation to mining locations?
- Can students identify the materials you use everyday to their place of origin?
- Can students identify hazards associated with mining? (environmental or personal)
- Can students use a dichotomous key to identify minerals and rocks?
- Can students use geologic laws to create a time-line of Earth's evolutionary past?

Reflective

- How is current legislation impacting ways mining occurs? (How are laws affecting current mining?)
- Can students create an argument for the best form of mining.
- What are the costs and benefits of the current mining practices?
- What are the costs and benefits of using renewable vs. nonrenewable energy resources?

FOCUS STANDARDS

Mastered and Assessed in this Unit:

- ESS2-7 Constructs an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
- ESS3-2: Earth and Human Activity: Evaluate competing design solutions for developing, managing and utilizing energy and mineral resources based on cost benefit ratios.
- ESS3-3 Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

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UNIT 2: SURFACE PROCESSES & NATURAL RESOURCES

ESSENTIAL QUESTIONS	BIG IDEAS
How do Earth's surface processes and human activities affect each other?	• Students develop models and explanations for the ways that feedback between different Earth systems control the appearance of Earth's surface. • Students identify mass movements and resulting consequences. • Students understand the importance of groundwater. • Students can describe how glacial erosion and deposition affect Earth's surface.

GUIDING QUESTIONS

Content

- What is the driving force between the water cycle?
- What is the relationship between the water cycle and erosional processes?
- How do human induced erosional processes cause mass movements?
- How do natural processes & human activity contribute to mass movements that change landscapes?

Process

- Can students use models/simulations to predict human impact on earth's surface?
- Can students relate glacial erosion to features that are seen in the United States?
- Can students identify areas where potential mass movements might occur?
- Can students explain the theory of plate tectonics and decipher why some rocks are older than other rocks.

Reflective

- What can people do to mitigate erosional damage and prevent run-off?
- What can people do to improve the water quality of the local watershed?
- What can people do to decrease the impacts of mass movements?

FOCUS STANDARDS

Mastered and Assessed in this Unit:

- ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- ESS3-4: Evaluate or redefine a technological solution that reduces impacts of human activities on natural systems.
- ESS1-5. E: 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.

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UNIT 3: EARTH'S INTERNAL PROCESSES

ESSENTIAL QUESTIONS	BIG IDEAS
How and why are Earth's internal processes constantly changing?	• Students relate how seismic waves and radiometric dating help scientists understand the properties of Earth's interior. • Students understand the forces responsible for Plate Tectonics. • Students use interactive models to interpret Earth's future crust. • Students describe the relationship between volcano types, plate forces, and faulting. • Students understand the dynamics of mountain building.

GUIDING QUESTIONS

Content

- How was the Theory of Plate tectonics developed?
- What mechanism drives plate movement?
- How does plate composition relate to the construction and destruction of Earth's surface?
- How are seismic waves and radiometric dating used to determine Earth's interior properties?
- How does the location of a volcano on Earth determine its general properties?

Process

- Can students create a map correlating earthquakes, volcanoes, and plate boundaries?
- Can students model the processes involved in plate tectonics (ex: friction, seismic wave movement, sea-floor spreading and convection)?

Reflective

- Based on the laws of uniformitarianism, what would the earth's crust look like in the future?
- What is the social and economic impact of earthquakes and volcanoes to the local communities?

FOCUS STANDARDS

Mastered and Assessed in this Unit:

- ESS2-1: Earth's systems 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.
- ESS2-3: Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
- 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.

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UNIT 4: WEATHER AND CLIMATE

ESSENTIAL QUESTIONS	BIG IDEAS
How does energy flow through the atmosphere?	• Students understand the system interactions that control weather and climate. • Students model the flow of energy between different components of the weather system and how this affects chemical cycles such as the carbon cycle • Students develop models and explanations for the ways that feedback between different Earth systems control global climate.

GUIDING QUESTIONS

Content

- How does the tilt of the Earth affect seasonal changes on Earth? (1.b)
- How does the Sun's rays affect Earth's energy budget?
- How has human activity increased carbon dioxide levels on Earth?
- How does the changes of global and regional climate affect weather patterns?

Process

- Can students predict the path of a frontal system or hurricane based on upper air patterns?
- Can students analyze a surface map to recognize fronts, wind patterns, moisture differences and pressure systems?
- Can students recognize the feedback loop between CO_2 in the atmosphere and ocean?

Reflective

- How will the increase in global temperatures affect life on Earth?
- How are the layers of the atmosphere important to protecting life on Earth?
- How do changes in the ocean temperatures affect weather patterns?

FOCUS STANDARDS

Mastered and Assessed in this Unit:

- 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.
- 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.
- ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere geosphere and biosphere.
- ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activities.

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UNIT 5: EARTH'S PLACE IN THE UNIVERSE

ESSENTIAL QUESTIONS	BIG IDEAS
What is the universe, and what is Earth's place in it? **What processes govern the formation, evolution & workings of the solar system & universe?**	• Students understand the formation of the universe. • Students understand the stages of stellar formation from birth to death. • Students can model the formation of our solar system. • Students can describe the formation of the planets within our solar system.. • Students can describe a variety of space exploration projects and build an argument supporting or opposing space exploration.

GUIDING QUESTIONS

Content

- What scientific tools help us learn about astronomy?
- Where is Earth's place in the solar system?
- How does Earth move in relationship to other bodies in the solar system?
- What makes a planet a planet?
- What are the characteristics of the planets?
- Where is the Solar System's place within the Universe?
- How do stars produce energy?
- What is the relationship between mass and stellar evolution?
- What is the evidence supporting the Big Bang Theory?

Process

- Can students identify and use tools that are used in astronomical observations?
- Can students compare the properties of the planets within our solar system?
- Can students describe Earth's motions in the solar system?
- Can students compare terrestrial and Jovian planets characteristics?
- Can students relate how mass will determine the evolutionary process of stars?
- Can students describe the path of energy from the core to the surface of a star?
- Can students explain the study of stars' spectra and brightness scale to identify the composition and elements of a star?

Reflective

- How did ancient astronomers contribute to our modern understanding of the universe?
- What are the pro's and con's of space exploration?
- Is space exploration worth the cost?
- Why do some stars become black holes and others do not?
- What do scientists predict for the future of the universe?

FOCUS STANDARDS

Mastered and Assessed in this Unit:

- ESS1-1: ESS1-1. Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
- 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.
- ESS1-3: Communicate scientific ideas about the way stars, over their life cycle, produce elements.
- ESS1-4: Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
- 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.

