Unit 3: Earth's Systems

Driving Question: How can Earth's systems become unbalanced?
Anchor Phenomenon: The documentary "Chasing Ice"
Duration: 35-40 days

Unit Overview: In this unit, students will explore Earth as an interconnected system. They will study how matter cycles through the rock, water, and carbon cycles, and how matter changes form within Earth's systems. Students will also examine feedback systems that influence stability and change over time. Through models and investigations, students will gain an understanding of how Earth's systems interact to shape our environment.

Performance Expectations [PE]:

- HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to Earth's systems.
- HS-ESS2-3: Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
- HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- HS-ESS2-6: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
- HS-ESS2-7: Construct an argument based on evidence about the coevolution of Earth's systems and life on Earth.

	Identifying the Driving Question	Unit 4: Earth's Systems						
		Mineral Identification	Rock Cycle	Cycling of Matter	Water Cycle	Carbon Cycles	Feedbacks	
Anchor Phenomenon Activity	How can Earth's systems become unbalanced?	What properties do we use to identify minerals?	How do rocks change from one type to another?	How do convection currents drive plate tectonics?	How does water affect Earth's surface?	How does carbon move through Earth's systems?	How can a change trigger feedback in Earth's systems?	Anchor Phenomenon Activity
Documentary Chasing Ice	Driving question board	Minerals We Use in Everyday Life	Rock Types and Matching	P-wave & S-wave Spring Demo	Frost Wedging	TedEd Carbon Cycle	AppleTV The Year Earth Changed	Revisit the Driving Question
Long-form Video	Driving Question Board Activity	Quick Read	Matching Game	Demo Activity	Demo Activity	Short-form Video	Long-form Video	Anchor Chart Activity
State Investigation — Ripple Effect								

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Anchor Phenomenon Activity

How can Earth's systems become unbalanced?

Scope and Sequence of Activities

Documentary Chasing Ice	Questions and Key Points	Student Lead Question Creation	Identifying the Driving Question
			
Long-form Video	Video Activity	Driving Question Board Activity	Driving Question Board Activity

Resources and Links

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Mineral Identification

What properties do we use to identify minerals?

Key Concepts	Performance Expectations
1. Mineral Identification 2. ESRT: Mineral Identification Flowchart 3. ESRT: Mohs Hardness Scale	HS. ESS2-3: Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

Scope and Sequence of Activities

Introduction	Discovery	Notes	Revisit	Practice	Evaluate
Quick Read Minerals	Investigation Mineral Identification	Keynote w/ Class Notes	Wrap-up Mineral Identification	Question Clusters	Assessment [10 question]

Supplemental Materials

	Exploration Mineral Identification			Supplemental Mineral Identification	

Resources and Links

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Rock Cycle

How do rocks change from one type to another?

Key Concepts	Performance Expectations
1. Rock Types 2. ESRT: Rock Cycle Infographic 3. ESRT: Model of Bowen's Reaction Series 4. ESRT: Mineral Composition of Igneous Rocks	HS. ESS2-3: Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

Scope and Sequence of Activities

Introduction	Discovery	Notes	Revisit	Practice	Evaluate
Matching Game Rock Types	Investigation Rock Cycle	Keynote w/ Class Notes	Investigation Wrap-up	Question Clusters	Assessment [10 question]

Supplemental Materials

	Exploration Rock Cycle			Supplemental Rock Cycle	

Resources and Links

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Cycling of Matter

How do convection currents drive plate tectonics?

Key Concepts	Performance Expectations
1. One-dimensional model of Earth's interior [density and seismic waves] 2. Three-dimensional model of Earth's interior [plate tectonics and convection] 3. ESSRT: Model of Earth's Interior Structure 4. ESSRT: Cross Section Model of Earth's Surface and Interior 5. ESSRT: Global Tectonic Activity of the Last One Million Years	HS. ESS2-3: Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

Scope and Sequence of Activities

Introduction	Discovery	Notes	Revisit	Practice	Evaluate
					
Demo P-wave and S-wave Spring Demo	Investigation Cycling of Matter	Keynote w/ Class Notes	Investigation Wrap-up	Question Clusters	Assessment [10 question]

Supplemental Materials

	Exploration Cycling of Matter			Supplemental Cycling of Matter	

Resources and Links

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Water Cycle

How does water affect Earth's surface?

Key Concepts	Performance Expectations
1. Mechanical and Chemical Weathering 2. Hydrologic Cycle and System Interactions 3. Stream Transportation with respect to erosion and deposition 4. Infiltration, runoff, permeability, and porosity	HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Scope and Sequence of Activities

Introduction	Discovery	Notes	Revisit	Practice	Evaluate
Demo Frost Wedging	Investigation Mechanical Weathering	Keynote w/ Class Notes	Investigation Wrap-up	Question Clusters	Assessment [10 question]

Supplemental Materials

	Investigation Chemical Weathering			Supplemental Chemical Weathering	

Resources and Links

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Carbon Cycle

How does carbon move through Earth's systems?

Key Concepts	Performance Expectations
1. Modeling of Biogeochemical Cycles 2. Cycling of carbon through the ocean, atmosphere, soil, and biosphere 3. Foundation for all living organisms	HS-ESS2-6: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

Scope and Sequence of Activities

Introduction	Discovery	Notes	Revisit	Practice	Evaluate
Short-form Video TedEd Carbon Cycle	Investigation Carbon Cycle	Keynote w/ Class Notes	Investigation Wrap-up	Question Clusters	Assessment [10 question]

Supplemental Materials

	Carbon & Temperature graph for lab			Supplemental Carbon Cycle	

Resources and Links

	Look at Biointeractice website				

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Feedbacks

How can a change trigger feedback in Earth's systems?

Key Concepts	Performance Expectations
1. Increase Greenhouse Gases and Increased Temperature 2. Loss of Vegetation and Increased Runoff 3. Dammed Rivers and Ground Water Retention 4. Loss of Wetlands	HS-ESS2-2: Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to Earth's systems.

Scope and Sequence of Activities

Introduction	Discovery	Notes	Revisit	Practice	Evaluate
Long-form Video The Year Earth Changed	Investigation Virtual Greenhouse Effect	Keynote w/ Class Notes	Investigation Wrap-up	Question Clusters	Assessment [10 question]

Supplemental Materials

Resources and Links

	Biointeractive Simulating Earth's Energy budget and the Greenhouse				

Summarizing the Driving Question

How can Earth's systems become unbalanced?

Scope and Sequence of Activities

Revisit the
Driving Question

Driving Question
Board Activity

Anchor Chart
Activity

Resources and Links

Investigation: The Ripple Effect — The Work of Water Across New York State Surfaces

How can Earth's systems become unbalanced?

Performance Expectations	Resources
HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	Secure documentation provided by director.