St. Joseph Public Schools

Science Curriculum

Earth & Space Science

2018 - 2019

Year at a Glance

Name of Unit	Learning Goals	Michigan Science Standard	Essential Questions
Salmon in the Classroom (ongoing throughout the year, 10 days)	*Students will be able to….* -demonstrate an understanding of the life cycle of the Chinook Salmon. -explain the reasons for the introduction of the salmon to the Great Lakes. -demonstrate an understanding of the effects of invasive species on the Great Lakes. -demonstrate an understanding of the effects of the Chinook salmon to the ecosystem of the Great Lakes. -construct and defend an argument about the stocking of salmon into the Great Lakes.	MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.	How has the introduction of the Chinook salmon impacted the Great Lakes?
Unit 1 **What Causes a Storm?** (1st MP, 24 days)	*Students will be able to....* -construct and defend a model of how Earth's air is heated. -construct & defend a model of convection that includes the following: why hot air rises & cool air sinks, lift & instability, the causes of	MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. MS-ESS2-6: Develop and use a model to describe how unequal heating & rotation of the Earth cause patterns of atmospheric	What is weather? What happens to hot air? Where does the energy come from in a storm? How do the motions and interactions of air masses result in changes in weather?

	energy flow & precipitation, and air movement in storms. -analyze the differences between conduction, convection & radiation. -apply a model of convection to explain one cause of wind. -construct & defend an explanation for how the degree of temperature difference between two air masses affects air movement. -analyze weather maps to identify and track movement of high- and low pressure areas. -analyze weather maps to interpret data on cloud cover and precipitation. -apply their storm model to explain patterns in weather.	and oceanic circulation that determine regional climates. MS-ESS2-5 MI: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions in Michigan due to the Great Lakes and regional geography.	What can weather maps tell us?
Unit 2 **Why is Weather different from Place to Place?** (1st MP, 10 days)	*Students will be able to...* -analyze climate data to determine the effects of latitude on average temperature. -consider, test, and rebut the hypothesis that the average amount of daylight can explain the effects of latitude on temperature. -construct and defend a model that explains the effects of latitude on temperature.	MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. MS-ESS2-6: Develop and use a model to describe how unequal heating & rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.	Why does temperature vary in different locations? What else is affecting temperature? How do the unequal heating and rotation of the Earth determine regional climates?

	-construct, defend and apply a model that explains the cause of seasonal changes in climate.		
Unit 3 **Why is the Temperature Rising?** (2nd MP, 10 days)	*Students will be able to...* -demonstrate an understanding of the carbon cycle on Earth. -demonstrate an understanding of the causes of increasing levels of carbon dioxide in the atmosphere. -construct an argument about the factors that have caused the rise in global temperature over the last century and support my claim with evidence. -analyze the repercussions of climate change.	MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	What is the greenhouse effect? What has caused the rise in global temperatures over the past century?
Unit 4 **Investigating Energy** (2nd MP, 15 days)	*Students will be able to….* -demonstrate an understanding of the six main forms of energy. -demonstrate an understanding of global energy uses and explain trends toward future demands. -demonstrate ways to increase the efficiency of energy used in homes and at school and explain effects of our carbon footprint as a result of using energy efficiently.	MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces	What is energy? What causes an energy crisis? What would be the results if humans used only renewable and inexhaustible forms of energy?

	-use the design process to design, model, and test a wind turbine for efficiency. -calculate power and work by measuring force, distance, and time using the wind turbine model.		
Unit 5 **Sustainable Energy** (2nd MP, 20 days)	*Students will be able to…* -identify alternative forms of energy, explain why they are alternative, and identify the advantages & disadvantages of each. -identify challenges in transferring alternative energies from where they are produced to where they are consumed. -research an alternative energy solution used for a specific purpose that will reduce the national dependency on fossil fuels.	MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	How do we educate the community about the need for sustainable energy sources? What factors are challenging governments to meet energy needs in the future?
Unit 6 **How Does Water Move Through Our Parks?** (3rd MP, 13 days)	*Students will be able to:* -identify common landforms found in national parks. -identify water reservoirs located on earth's surface. -compare and contrast the sizes of Earth's global water reservoirs. -describe how water moves between reservoirs.	MS-ESS3-1: Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.	Where is water found on Earth? How does water move on Earth? What is it like to be a water molecule? How does water move in our National Parks?

	-describe how water moves into the ground and where groundwater goes. -construct a model of the water cycle. -describe how water enters and leaves the atmosphere.	MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	
Unit 7 **How Does Moving Water Affect the Land?** (3rd MP, 13 days)	*Students will be able to:* -describe the results of moving water on earth materials. -identify the process that breaks apart rock. -identify the process that removes rock from earth's surface. -apply processes of weathering and erosion to change over time. -design an investigation to determine how different variables affect erosion and deposition on a stream table. -analyze data to find evidence of the processes creating landforms. -construct an evidence-based explanation about the processes that shaped a specific landform.	MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	Does water affect the land? What happens when pieces of rock collide? Where does the sediment go in a stream? How does the water shape the land in our National Parks?
Unit 8	*Students will be able to…* -describe the characteristics of sedimentary, metamorphic, and igneous rock.	MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	How does new rock form from old rock? How does rock shape landforms?

What is the Role of Rock in Creating Landforms? (3rd MP, 10 days)	-identify the processes that change sedimentary rock into other kinds of rock. -identify the processes that change rock into sedimentary rock. -identify processes that bring rock to the surface. -apply a rock cycle model to specific locations. -explain how rock and water interact to create landforms.		
Unit 9 **How is the Earth's Surface Changing?** (4th MP, 12 days?)	*Students will be able to…* -analyze patterns in seismic (earthquake) and volcanic activity data to draw conclusions about the nature of Earth's plates. -describe the theory of plate tectonics. -explain the evidence that led to the development of the theory of plate tectonics. -construct a simple model of the Earth's plates. -apply the principle of convection in air to liquids and solids. -analyze data to determine the pattern of earthquakes, volcanoes, and the location of plate boundaries. -compare the formation of mountains and volcanoes.	MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. MS-ESS2-3: Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.	Where is the Earth changing? How did the Earth look in the past? What is the composition of the Earth's surface? What makes Earth's plates move? How do plates interact with each other? What causes volcanoes?

	-use a model to explain a mechanism for volcanic chain formation.		
Unit 10 **How does Plate Tectonics Explain Earth's Features?** (4th MP, 12 days?)	*Students will be able to…* -use geologic evidence to predict and determine how plates move relative to one another. - identify subduction as a method for cycling rock material on Earth. -explain how cycling occurs at Earth's plate boundaries as a result of conservation of matter and convection. -explain how features and events are associated with plate boundary types. -build and explain physical models of Earth's plate boundary types. -use models to explain how plate tectonics affect the earth. -use models to predict how plate tectonics will affect the future of the earth.	MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. MS-ESS2-3: Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.	How are Earth's plates moving? How does new plate material form? How does the process of plate tectonics affect landforms?

Salmon in the Classroom

Unit overview:

This instrumental learning experience grants students the opportunity to raise, care for and maintain the salmon in their classroom from fall until spring. The program culminates at the end of the school year with the release of the young fish in a local watershed that feeds one of the Great Lakes. Students and teachers participate in a program to follow the life cycle of salmon from eggs, to hatchling to smolt, starting in the classroom. The program teaches students about everything from the life history of fish, to the importance of the Great Lakes and fishing to Michigan's culture. Even better, it ties directly back to their community as a great place-based educational effort. Students are connected to their local rivers and streams knowing that the smolts they released will return to the very same spot in 2-3 years to spawn. This connection encourages a long standing appreciation for Michigan's natural resources and ecosystem health. Students go on a field trip to the Wolf Lake State Fish Hatchery & the Water Treatment plant in the fall, and to Mill Creek to release the salmon in April.

Learning Goals

Students will be able to….

-demonstrate an understanding of the life cycle of the Chinook Salmon.
-explain the reasons for the introduction of the salmon to the Great Lakes.
-demonstrate an understanding of the effects of invasive species on the Great Lakes.
-demonstrate an understanding of the effects of the Chinook salmon to the ecosystem of the Great Lakes.
-construct and defend an argument about the stocking of salmon into the Great Lakes.

Disciplinary Core Ideas (Michigan Science Standards)

MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.
-obtain, evaluate & communicate information.

Cross Cutting Concepts

Patterns
Cause & Effect
Scale, Proportion & Quantity
Systems & System Models
Energy & Matter
Structure & Function
Stability & Change

Key Terms/Vocabulary

eyed egg	sac fry	swim up fry	smolt
parr	Michigan DNR	sustainable fishing	life cycle
watershed	point source pollution	non point source pollution	invasive species

Time Span: (Length of Unit)
1st Marking Period: 10 days

Assessment: (Methods used for formative and summative)
Salmon Field Trip student packet

Unit 1: What Causes a Storm? (IQWST)

Unit overview:

Students begin by drawing on their everyday experiences with weather to identify the conditions they need to investigate that contribute to weather events like a storm. Students first consider how air at the surface of Earth is heated. Students draw on their understanding of energy from the IQWST PS2 unit to analyze what happens to matter and energy to cause surface air to be heated. Students create a model that explains how the air at the surface is heated through a sequence of energy transfers from the sun to the Earth's surface, energy conversion from solar to thermal energy, and energy transfer (through conduction) from the ground to the air. Students then investigate what happens to the air after it is heated. Students investigate the movement of air masses at different temperatures and attempt to explain why hot air rises. They develop a model of convective currents and revise their models to show the movement of matter and energy in a storm. After investigating additional weather conditions, including pressure, humidity, and lift, students develop and revise a model of a storm that shows what happens to matter and energy before, during, and after a storm. They then use their model to explain patterns in the weather condition data from a real storm in the Midwest. At the end of this learning set, students can explain the changes that occur in local weather patterns from day to day. They are left with the question of explaining why the weather varies from one location to another on Earth

Learning Goals

Students will be able to:

-construct and defend a model of how Earth's air is heated.
-construct & defend a model of convection that includes the following: why hot air rises & cool air sinks, lift & instability, the causes of energy flow & precipitation, and air movement in storms.
-analyze the differences between conduction, convection & radiation.
-apply a model of convection to explain one cause of wind.
-construct & defend an explanation for how the degree of temperature difference between two air masses affects air movement.
-analyze weather maps to identify and track movement of high- and low pressure areas.
-analyze weather maps to interpret data on cloud cover and precipitation.
-apply their storm model to explain patterns in weather.

Disciplinary Core Ideas (Michigan Science Standards)

MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
MS-ESS2-6: Develop and use a model to describe how unequal heating & rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
MS-ESS2-5 MI: Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions in Michigan due to the Great Lakes and regional geography.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.

-obtain, evaluate & communicate information.

Cross Cutting Concepts

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Key Terms/Vocabulary

weather conditions	weather events	variables	wind	lift
temperature	precipitation	matter	thermal energy	instability
local	regional	systems	air mass	high pressure system
energy transfer	conduction	convection	radiation	low pressure system
density	air pressure	barometer	front	equilibrium
evaporation	condensation	precipitation	humidity	radar
satellite	isobars	troughs		

Time Span: (Length of Unit)

1st Marking Period: 24 days

Assessment: (Methods used for formative and summative)
What Causes a Storm? Summative Test

Unit 2: Why is Weather Different from Place to Place? (IQWST)

Unit overview:

Students begin Learning Set 2 with a question about how location affects weather. Students have constructed and tested a model that explains a storm and how the conditions affect daily weather, but students have also determined that their models cannot explain the patterns in the data that show that weather conditions vary by location on Earth. Students determine how temperature varies by latitude. To investigate this finding, students analyze the number of hours of daylight a city receives as well as its temperature. Students consider differences in hours of daylight, which their model says would lead to temperature differences, but then reject that factor as a possible explanation for the relationship between latitude and temperature. Students then collect data to analyze whether the shape of Earth affects temperature. This activity raises the question about the angle at which light hits Earth and whether that affects temperature. After discovering that the angle at which light hits an object affects the intensity, students construct an explanation about why temperature varies at different latitudes. Students use visualizations of surface temperature at two different times of the year (January/July) and observe that the warmer areas shift north in the summer and south in the winter. Their previous explanation cannot account for this, and they engage in a series of simulations to explore the idea of a tilted Earth. Students construct a model that explains seasonal variations in temperature. In the culminating activity, students use all of the evidence they have collected, as well as the scientific principles they have developed, to explain why two cities in opposite hemispheres vary in their weather patterns.

Learning Goals

Students will be able to:
-analyze climate data to determine the effects of latitude on average temperature.
-consider, test, and rebut the hypothesis that the average amount of daylight can explain the effects of latitude on temperature.
-construct and defend a model that explains the effects of latitude on temperature.
-construct, defend and apply a model that explains the cause of seasonal changes in climate.

Disciplinary Core Ideas (Michigan Science Standards)

MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
MS-ESS2-6: Develop and use a model to describe how unequal heating & rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.
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Cross Cutting Concepts

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Key Terms/Vocabulary

latitude	longitude	prime meridian	equator	rotation
revolution	sun angle	equinox	solstice	

Time Span: (Length of Unit)
1st Marking Period: 10 days

Assessment: (Methods used for formative and summative)
Why is the Weather Different from Place to Place? Unit Test

Unit 3: Why is the Temperature Rising

Unit overview:

Students explore the carbon cycle on Earth and the role that human activities place in the cycle, after making observations about the Keeling Curve. After learning about the greenhouse effect, students develop their own model and predict what Earth would be like without it. Students analyze the relationship between carbon dioxide and temperature and used evidence-based reasoning to make a claim about this relationship. Students also explore the effects of climate change on the planet.

Learning Goals

Students will be able to:
-demonstrate an understanding of the carbon cycle on Earth.
-demonstrate an understanding of the causes of increasing levels of carbon dioxide in the atmosphere.
-construct an argument about the factors that have caused the rise in global temperature over the last century and support my claim with evidence.
-analyze the repercussions of climate change.

Disciplinary Core Ideas (Michigan Science Standards)

MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.
-obtain, evaluate & communicate information.

Cross Cutting Concepts

Patterns
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Key Terms/Vocabulary

carbon cycle	carbon dioxide	greenhouse effect	greenhouse gas	methane
water vapor	climate	anomaly	Keeling's Curve	correlation
causation				

Time Span: (Length of Unit)
1st Marking Period: 10 days

Assessment: (Methods used for formative and summative)
Why is the Temperature Rising? Unit Test

Unit 4: Investigating Energy (PLTW)

Unit overview:

Students identify different forms of energy and watch the Energy Crossroads movie. After exploring energy efficiency, students calculate their energy footprint and calculate the kilowatt-hours for different household appliances. Students explore the workings of wind turbines and then work with partners to design wind turbine blades. Students use those designs to build their own model of a wind turbine. The turbines are tested for efficiency, and then students design their own Google Site to show what they've learned.

Learning Goals

Students will be able to:

-demonstrate an understanding of the six main forms of energy.
-demonstrate an understanding of global energy uses and explain trends toward future demands.
-demonstrate ways to increase the efficiency of energy used in homes and at school and explain effects of our carbon footprint as a result of using energy efficiently.
-use the design process to design, model, and test a wind turbine for efficiency.
-calculate power and work by measuring force, distance, and time using the wind turbine model.

Disciplinary Core Ideas (Michigan Science Standards)

MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.
-obtain, evaluate & communicate information.

Cross Cutting Concepts

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Key Terms/Vocabulary

kilowatt	kilowatt hours	turbine	wind turbine	carbon footprint
electrical energy	sound energy	chemical energy	mechanical energy	atomic energy
thermal energy				

Time Span: (Length of Unit)
1st Marking Period: 15 days

Assessment: (Methods used for formative and summative)
Wind Turbine Project (Google Sites)

Unit 5: Sustainable Energy (PLTW)

Unit overview:

Student teams research different forms of sustainable energy and present their findings to the class in an Energy Expo presentation. After further exploration of types of sustainable energy, student teams choose the best form of alternative energy to help reduce our nation's dependence on fossil fuels. After building a model of their sustainable energy source, students then prepare a short video/commercial that explains which dependency on fossil fuels their team chose to diminish through the use of an alternative energy source and why they think this is the best solution.

Learning Goals

Students will be able to:
-identify alternative forms of energy, explain why they are alternative, and identify the advantages & disadvantages of each.
-identify challenges in transferring alternative energies from where they are produced to where they are consumed.
-research an alternative energy solution used for a specific purpose that will reduce the national dependency on fossil fuels.

Disciplinary Core Ideas (Michigan Science Standards)

MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.
-obtain, evaluate & communicate information.

Cross Cutting Concepts

Patterns
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Systems & System Models
Energy & Matter
Structure & Function
Stability & Change

Key Terms/Vocabulary

voltaic cell	renewable	non renewable	sustainable	sustainability
solar cell	wind turbine	fossil fuels		

Time Span: (Length of Unit)
1st Marking Period: 20 days

Assessment: (Methods used for formative and summative)
Energy for Our Future project (video)

Unit 6: How Does Water Move Through Our Parks (IQWST)

Unit overview:

This unit consists of four lessons with a focus on water reservoirs and the ways water can move between reservoirs. Lesson 3 introduces students to where water can be found on Earth through a variety of information sources. Students apply this information to the case study on parks as well as to their own park for the visitor materials. Lesson 4 leads students to investigate the ways water moves between reservoirs in order to understand how that movement affects the landforms in parks. Students investigate evaporation, precipitation, and movement between those reservoirs. The class creates a conceptual model of the water cycle and then applies that model to their case study parks. Finally, they apply the model to their group park in order to create a local water cycle.

Learning Goals

Students will be able to:
-identify common landforms found in national parks.
-identify water reservoirs located on earth's surface.
-compare and contrast the sizes of Earth's global water reservoirs.
-describe how water moves between reservoirs.
-describe how water moves into the ground and where groundwater goes.
-construct a model of the water cycle.
-describe how water enters and leaves the atmosphere.

Disciplinary Core Ideas (Michigan Science Standards)

MS-ESS3-1: Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.

-obtain, evaluate & communicate information.

Cross Cutting Concepts

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Key Terms/Vocabulary

cliff	cave	bridge	beaches	sea stack
V-valley	U-valley	canyon	plateau	mountain
ridge	groundwater	glaciers	infiltration	precipitation
condensation	evaporation	transpiration	water cycle	consensus model
permeable	aquifer	water table	saturated zone	groundwater

Time Span: (Length of Unit)
1st Marking Period: 13 days

Assessment: (Methods used for formative and summative)
How Does Water Move Through Our Parks Summative Test

Unit 7: How Does Water Move Through Our Parks (IQWST)

Unit overview:

This unit consists of four lessons that incorporate a variety of models and hands-on activities in order to investigate weathering, erosion, and deposition. Through viewing a demonstration, students observe the effects of water on a stream table model. In this learning set, students use the stream table to manipulate variables in order to better understand the phenomena of erosion and deposition. Students construct a scientific explanation about how one of the landforms in their selected park was shaped. At this point in the unit, students have seen how to use the water cycle model and the processes of weathering, erosion, and deposition to begin to explain how the landform was shaped. Through the development of this explanation, students realize the water cycle and these processes do not fully explain all that happens. The role of rock in the process is explored in the last learning set.

Learning Goals

Students will be able to:
-describe the results of moving water on earth materials.
-identify the process that breaks apart rock.
-identify the process that removes rock from earth's surface.
-apply processes of weathering and erosion to change over time.
-design an investigation to determine how different variables affect erosion and deposition on a stream table.
-analyze data to find evidence of the processes creating landforms.
-construct an evidence-based explanation about the processes that shaped a specific landform.

Disciplinary Core Ideas (Michigan Science Standards)

MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process
MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.
-obtain, evaluate & communicate information.

Cross Cutting Concepts

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Key Terms/Vocabulary

sediment	groundwater	glaciers	infiltration	precipitation
condensation	evaporation	transpiration	water cycle	consensus model
erosion	deposition	weathering		

Time Span: (Length of Unit)
1st Marking Period: 13 days

Assessment: (Methods used for formative and summative)
How Does Moving Water Affect the Land? Summative Test

Unit 8: What is the Role of Rock in Creating Landforms? (IQWST)

Unit overview:

This unit contains three lessons in which students explore how rocks are formed, what kinds of rocks are present in the park, and how water and rock interact to create landforms. Students use first-hand experience with rocks, as well as models, to investigate the processes that form sedimentary, metamorphic, and igneous rock: deposition, solidification, melting, compression, and uplift. In the final lesson of the unit, students modify their explanation about the shaping of a landform in their park by adding the additional information they have learned in this learning set about rock types and how they interact with water-shaped landforms in their park. Students wrap-up the last three units with a culminating project, applying all concepts to a National Park.

Learning Goals

Students will be able to:
-describe the characteristics of sedimentary, metamorphic, and igneous rock.
-identify the processes that change sedimentary rock into other kinds of rock.
-identify the processes that change rock into sedimentary rock.
-identify processes that bring rock to the surface.
-apply a rock cycle model to specific locations.
-explain how rock and water interact to create landforms.

Disciplinary Core Ideas (Michigan Science Standards)

MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.
-obtain, evaluate & communicate information.

Cross Cutting Concepts

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Key Terms/Vocabulary

sedimentary rock	igneous rock	magma	lava	metamorphic rock

burial	uplift	cooling	melting	compression

Time Span: (Length of Unit)
1st Marking Period: 10 days

Assessment: (Methods used for formative and summative)
What is the Role of Rock in Creating Landforms? Summative Test
National Parks Project

Unit 9: How is Earth's Surface Changing? (IQWST)

Unit overview:

This unit has the primary learning goal to observe locations of geologic change to analyze patterns in volcano, earthquake, and elevation data on Earth and to note the apparent coincidence of particular data patterns with plate boundaries. Students explore the evidence that change has occurred in the past by investigating the phenomena that led scientists to the theory of continental drift. Students are introduced to additional phenomena concerning the ocean floor that can be used as evidence to better understand Earth changes. With a deeper understanding of what has occurred in the past and what is currently happening on Earth's surface, students build models to help make sense of the characteristics of Earth's plates, which are too large and inaccessible to explore firsthand. This allows students to apply and further refine their understanding of models and modeling (e.g., models can be used to explain phenomena). Students evaluate the components of different physical models and determine the strengths and limitations of those models for representing the real world. The last few learning sets move students from a descriptive analysis of the Earth to describing the cause of what they have observed. Students conduct simulations and experiments around convection (first in liquids, then extended to solids through the use of a malleable material). Students revisit the patterns they observed in Learning Set 1, reconsidering the locations of earthquakes and volcanic activity in relation to the boundaries of plates. Students conduct hands-on activities to help them understand the result of plates moving relative to one another and the importance of the type of plate material at the edges of plates for the development of different geological formations. Students explore the ways that volcanoes form on Earth, both at subduction zones and

at locations not aligned to plate boundaries, referred to as hotspots. This enhances students' understanding of phase changes, specifically the change from liquid to solid rock material associated with volcanic activity and with the formation of new plate material.

Learning Goals

Students will be able to:
-analyze patterns in seismic and volcanic activity data to draw conclusions about the nature of Earth's plates.
-describe the theory of plate tectonics.
-explain the evidence that led to the development of the theory of plate tectonics.
-construct a simple model of the Earth's plates.
-apply the principle of convection in air to liquids and solids.
-analyze data to determine the pattern of earthquakes, volcanoes, and the location of plate boundaries.
-compare the formation of mountains and volcanoes.
-use a model to explain a mechanism for volcanic chain formation.

Disciplinary Core Ideas (Michigan Science Standards)

MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-2: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
MS-ESS2-3: Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.

-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.
-obtain, evaluate & communicate information.

Cross Cutting Concepts

Patterns
Cause & Effect
Scale, Proportion & Quantity
Systems & System Models
Energy & Matter
Structure & Function
Stability & Change

Key Terms/Vocabulary

seismic	volcano	earthquake	tectonic plates	Pangaea
Theory of Continental Drift	Alfred Wegener	seafloor spreading	mid ocean ridge	ocean trench
convection	convection current	mantle	asthenosphere	lithosphere
hotspot	transform boundary	divergent boundary	convergent boundary	subduction
oceanic plate	continental plate			

Time Span: (Length of Unit)
1st Marking Period: 12 days

Assessment: (Methods used for formative and summative)
How is Earth's Surface Changing? Summative Test

Unit 10: How does Plate Tectonics Explain Earth's Features? (IQWST)

Unit overview:

This unit furthers students' understanding about how plates move and from where new plate material comes, related to the conservation of matter. Students explore data they have accumulated on the Driving Question Board, containing a detailed map of the world, and they infer the direction of the movement of plates on Earth's surface. This is based on various geological phenomena, such as the formation of volcanoes and mountains and the occurrence of earthquakes. Students synthesize what they have discovered using the phenomena as evidence and apply logic and reasoning to determine how plates must move on the surface of the earth. Students write scientific explanations discussing how plate material is recycled through the earth system as a result of plate tectonic processes (plate movement). This process conserves the total amount of matter on Earth, and these activities extend and apply information about conservation to a new situation. Students synthesize and summarize understandings and knowledge of plate movement on Earth in several ways, each building on one another. First, students label a detailed cross section of the Earth, which includes possible results of relative plate movement. Next, they complete a chart to organize the concepts and processes associated with each of the plate boundary types and locations. They follow this by planning and building physical models to represent and illustrate their understanding for the plate movement mechanism and the phenomena that result from movement. During the final lesson, students return to the case study sites on Earth to describe the tectonic processes that explain that location (e.g., why it looks the way it does, how the site is still changing today as a result of plate movement). This description should take into account the scientific principles of conservation of matter and convection, which contribute to our understanding of the mechanisms by which plates move on Earth's surface.

Learning Goals

Students will be able to:
-use geologic evidence to predict and determine how plates move relative to one another.
- identify subduction as a method for cycling rock material on Earth.
-explain how cycling occurs at Earth's plate boundaries as a result of conservation of matter and convection.
-explain how features and events are associated with plate boundary types.
-build and explain physical models of Earth's plate boundary types.
-use models to explain how plate tectonics affect the earth.
-use models to predict how plate tectonics will affect the future of the earth.

Disciplinary Core Ideas (Michigan Science Standards)

MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
MS-ESS2-3: Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Science & Engineering Practices

Students will be able to:
-ask questions & define problems.
-develop & use models.
-plan & carry out investigations.
-analyze & interpret data.
-use mathematics & computational thinking
-construct explanations & design solutions.
-engage in argument from evidence.
-obtain, evaluate & communicate information.

Cross Cutting Concepts

Patterns
Cause & Effect
Scale, Proportion & Quantity
Systems & System Models
Energy & Matter
Structure & Function
Stability & Change

Key Terms/Vocabulary

San Andreas Fault	island chain	Mt St Helens	Mt Vesuvius	epicenter

Time Span: (Length of Unit)
1st Marking Period: 12 days

Assessment: (Methods used for formative and summative)
How does Plate Tectonics Explain Earth's Features? Summative Test