Unit Title: Environments	**Content Area:** Life Science	**Grade Level:** 5

Unit Summary: The Environments Unit provides experience with living and nonliving environmental factors in terrestrial and aquatic systems. Organisms maintained in the classroom are used to develop the concepts of range of tolerance, and optimum conditions for survival of populations. Students observe how organisms respond to environmental conditions and how they change their environment. The Idea that all living things depend on the conditions in their environment explains that the study of the relationship between one organism and its environment builds knowledge of all organisms. The crosscutting concepts of cause and effect, scale, proportion, and quantity, stability and change, systems and system models are called out as organizing concepts of this unit. Students are expected to demonstrate proficiency in developing and using models, organizing and analyzing data from experiments and investigations with plants and animals, using mathematics and computational thinking, engaging in argument from evidence, and obtaining, evaluating, and communicating information; and to use these practices to demonstrate understanding of the core ideas.

Unit Essential Questions:

- How is matter transformed, and energy transferred/transformed in living systems?
- In what ways do organisms interact within ecosystems?
- In what ways are organisms of the same kind different from each other?
- How do changes in one part of an Earth system affect other parts of the system?
- How does this help them reproduce and survive?

Unit Enduring Understandings:

- All organisms transfer matter and convert energy from one form to another.
- All animals and most plants depend on both other organisms and their environments for their basic needs.
- Sometimes differences between organisms of the same kind give advantages in surviving and reproducing in different environments.
- How do changes in one part of an Earth system affect other parts of the system?

Possible Student Misconceptions:

- Students often think of organisms as independent of each other but dependent on people to supply them with food and shelter.
- Students may not believe food is a scarce resource in ecosystems; thinking that organisms can change their food at will according to the availability of particular sources.
- Students of all ages think that some populations of organisms are numerous in order to fulfill a demand for food by another population.
- Typically, the arrows of a food chain symbolize what each organism is eating (e.g., grass -> mouse -> snake -> hawk.)
- Students may believe that if the producers (plants) disappeared from Earth, organisms that prey on other organisms for food (carnivores) would only be slightly affected.
- Students also hold a much more restricted meaning than biologists do for the word "plant." Students often do not recognize that trees, vegetables, and grass are all plants.
- Some Students do not believe a seed is alive.
- Students may believe that plants do not need air to survive.
- Students may believe that plants do not use oxygen.
- Students may believe that the only essential constituents that plants need in order to grow are: water, light, and nutrients from the soil or medium in which they exist. Although photosynthesis is recognized as a plant function, students still maintain the idea that plants obtain their food from their environment.

NJCCCS: 5.3.4.C.1-2, 5.3.6.B.2, 5.3.6.C.1-3, 5.3.6.E.1

NGSS Performance Expectations: *Students who demonstrate understanding can…*

- 3-5-LS2-1: Develop a model to describe the movement of matter amount plants, animals, decomposers and the environment.
- 3-5-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-5-LS4-4: Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Primary CCSS ELA/Literacy Connections: RI.5.1, RI.5.9, W.5.1	**Primary CCSS Mathematics Connections:** MP.2, MP.4, MP.5, MD.A.1

Lesson Pace & Sequence

Lesson 1: Setting Up Terrariums/Recoding Changes-PART 1		**Learning Objective(s):** Students will Investigate Environmental Factors			**Lesson Duration:** 100 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core***

in conducted in sequence.					***ideas?***
Elicit: How will you access students' prior knowledge?	Ask students to think about gardens. Have class brainstorming session describing gardens that they have seen or know about. Record on newsprint "What Constitutes a Garden"				
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Teacher will provide a mini-lesson on terrariums (mini-garden)				
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Students will identify factors that make up a terrestrial environment. Using provided materials students will work in collaborative groups to set up their own terrarium. (Students will make observations for 2 weeks).	• Foss Environments Kit/ Teacher Guide	Developing and Using Models: (5-LS2-1)	LS2.A: Interdependent Relationships in Ecosystems (5-LS2-1)	Systems and System Models: A system can be described in terms of its components and their interactions. (5-LS2-1)
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Student groups will create a Terrarium Map using their own symbols to map where they put pea, corn, barley, radish, and clover seeds. - As a class students will create an Environments Word Bank	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet #3 Terrarium Map – • Vocabulary: Environment, Environmental Factor, Terrarium, Organism.			
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Every 2 to 3 days (for 2 weeks) students will record observations about the changes taking place in the Terrarium in their Terrestrial Environments Journal by recording a list of environmental factors, and describing the terrarium environment. Students should write and draw in their journals	• Foss Environments Kit Teacher Guide: • Investigation Duplication Master: Student Sheet #2 • Terrestrial Environments Journals			Stability and Change: Change is measured in terms of differences over time and may occur at different rates.
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Participation in brainstorming session - creation and completion of terrarium -				

	Mapmaking and use of symbols				
Extend: How will students deepen their conceptual understanding through use in new context?	-Create an environmental - news bulletin board -Students will make home/school connection regarding living and non-living environmental factors. - Read "Amazon Rainforest Journal" and answer discussion questions.	• Foss Environments Kit Teacher Guide: • Investigation Duplication Master: Student Sheet #29 • Home/School Connection - Environments Science Stories: "Amazon Rainforest Journal"			

Lesson Pace & Sequence

Lesson 3: Making Animal Runways	**Learning Objective(s):** Students will construct an animal runway to investigate their organisms' environmental preferences.	**Lesson Duration:** 50 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Teacher will introduce the isopods and beetles and provide a brief lesson on how to care for and handle the animals.				
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Teacher will ask student groups to observe the animals with hand lenses and/or microscopes. Students will then record their observations in their journal, comparing and contrasting the microscopic structures and features of the organisms.	• Terrestrial Environments Journals			
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Students groups will use Student Sheet #5: Runway Construction to build an aluminum foil runway in order to conduct investigations of organisms'' environmental preferences.	• Foss Environments Kit/ Teacher Guide	Planning and Carrying Out Investigations. (3-5-ETS1-3) - Developing and Using Models: Develop a model to describe phenomena. (5-LS2-1)	LS2.A: Interdependent Relationships in Ecosystems (5-LS2-1)	- Systems and System Models A system can be described in terms of its components and their interactions. (5-LS2-1)
Explain: How will you help students connect their	Discuss and add new words to the class work bank: Variable,				

exploration to the concept/topic under investigation?	Environmental Factor				
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Student groups will evaluate how they might design an investigation to determine which type of environment the isopods and beetles prefer. - Students will individually read "Beetles" and answer discussion questions	• Foss Environments Science Stories: “Beetles"	Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)	LS2.A: Interdependent Relationships in Ecosystems (5-LS2-1)	
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Construction of animal runways - Observation Journal entries				
Extend: How will students deepen their conceptual understanding through use in new context?	Students can use sweep nets (terrestrial collecting nets to sample the organisms in different terrestrial environments (grassy area, weedy area, brush area) and create a chart that lists the kinds and numbers of organisms found in each environment.				

Lesson Pace & Sequence

Lesson 4: Responding to Moisture	**Learning Objective(s):** Conduct an investigation to find out how much moisture isopods and beetles prefer.	**Lesson Duration:** 50 minutes

Learning Cycle ***What lesson elements will support students’ progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students’ progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students’ application of practices and their understanding of core ideas?***

Elicit: How will you access students' prior knowledge?	Teacher will ask students groups to discuss and record the following questions: Can you think of a way to use your runways to find out how much water isopods and beetles like in their environment? Students will report out to the class after 10 min.		Asking Questions and Defining Problems. (3-5-ETS1-1)		
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Students groups will plan an investigation that tests their ideas about finding the preferred environments for the isopods and beetles. Teacher may have to introduce or review the ideas of variables in an experiment. If necessary teacher may need to review the steps of conducting a valid experiment.		Asking Questions and Defining Problems	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Student groups will prepare their runways, and conduct their investigation on the moisture preferences of isopods and beetles.	• Foss Environments Kit/ Teacher Guide	Planning and Carrying Out Investigations: (3-5-ETS1-3) - Developing and Using Models:(5-LS2-1)		
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Individual students should complete Student Sheet #7: Bugs and Beetles assessment. - Student pairs will read the science story, "The Darkling Beetle"	• Foss Environments Science Stories: "The Darkling Beetle", • Investigation Duplication Master: Student Sheet #7:Bugs and Beetles			
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Completion and accuracy of Bugs and Beetles assessment sheet - Observation notes - Participation in the planning and execution of the investigation.				

Extend: How will students deepen their conceptual understanding through use in new context?	Make a terrarium of local organisms: Ask students to bring in earthworms, snails, and other organisms found around the school or in the neighborhood. Plan what kinds of materials and environmental conditions will be needed to keep the animals healthy. Keep the animals for 2 weeks and then return them to their environment.		Developing and Using Models (5-LS2-1)	LS2.A: Interdependent Relationships in Ecosystems	Systems and System Models A system can be described in terms of its components and their interactions. (5-LS2-1)

Lesson Pace & Sequence

Lesson: 5: Responding to Light		**Learning Objective(s):** Students will investigate how light affects isopods and beetles.			**Lesson Duration:** 50 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Teacher will propose to students that the animal runways be used to investigate the environmental factor of light. Students groups will work collaboratively to design an experiment to test the environmental factor of light. If some students get stuck, suggest that canopies be made for the runways and allow them to choose from the materials provided in the kit.				

Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Teacher will remind students that the runways need to be set up so that all the variables are controlled except for the environmental factor of light. Have groups discuss and record how they will go about controlling their variables.				
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Using the constructed runways, student groups will conduct an investigation of how isopods and beetles respond to the environmental factor of light	• Foss Environments Kit/ Teacher Guide	-Planning and Carrying Out Investigations: (3-5-ETS1-3) - Developing and Using Models:(5-LS2-1)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Student groups will discuss the following questions: What evidence have you gathered that indicates your animals' environmental preference for light? Describe the preferred environment of isopods and beetles from evidence we have so far (remind students to use evidence collected during their investigation).		Constructing Explanations and Designing Solutions: (3-LS4-2) :	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Cause and Effect: Cause and Effect are routinely identified, tested, and used to explain change
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Have students think about the amount of light their animals might prefer. Have groups plan an investigation that would evaluate how isopods and beetles respond to different amounts of light?			LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Group participation in planning and conducting investigations - completion and accuracy of Student Sheet #6: Animal investigations	• Investigation Duplication Master: Student Sheet #6			

Extend: How will students deepen their conceptual understanding through use in new context?	Individually students will complete the Math Extension: Problem of the Week	• Foss Environments: TG (pg. 31)			
Lesson Pace & Sequence					
Lesson 6: Designing an Animal Investigation	**Learning Objective(s):** Determine the isopods and beetles environmental preferences using other environmental factors.				**Lesson Duration:** 100 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Class will brainstorm and record other environmental factors that could be investigated using the runways. (plants, heat, cold, shelter) Post the list.	Teacher may want to do this activity a day ahead in order to prepare materials			
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Student groups will choose one environmental factor from the list to investigate. Groups will plan and design their investigation and complete part 1 on their Animal Investigation sheet.			LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Student groups will conduct an investigation to explore their new environmental factor. Students should record collected data from their investigation in their notebooks and on their Animal Investigation sheet	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet #6	Planning and Carrying Out Investigations: (3-5-ETS1-3)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	

Explain: How will you help students connect their exploration to the concept/topic under investigation?	One student from each group will give a 1-minute presentation using data and evidence collected to explain to the class what environmental factor they tested in their runway investigation. Students should also report their conclusions about their investigation.		Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)		Patterns: Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena.
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	After each group has presented their findings, allow classmates the opportunity to ask questions and give feedback. To facilitate discussion the teacher can present the following questions: What do you think can happen to animals when the environment changes? Why do you think so? What factors might pose the greatest problems for the animals you studied if they were living outdoors?		Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2) :		Cause and Effect
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Students will be evaluated on the planning and design of the investigation - completion and accuracy of their Animal Investigation sheet - Participation in class discussion.	• Investigation Duplication Master: Student Sheet #6			
Extend: How will students deepen their conceptual understanding through use in new context?	Using the Home/School Connection: Investigation 2: Bugs and Beetles, Students can go on a safari in and around their home or into the neighborhood to look for insects. Students should organize the results of their safari and bring them to class.	• Foss: Environments Teachers' Guide • Student sheet # 30 • Home/School Connection for Investigation #2			
Lesson Pace & Sequence					

Lesson 7: Setting Up the Experiment	**Learning Objective(s):** Students will investigate what the optimal water conditions are for four plants: corn, radish, barley, and peas.				**Lesson Duration:** 50 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Teacher will review terrarium experience from Investigation 1, focusing on the factor of water in the terrarium environment. Pose the following questions to the class: What do you think would have happened if you had put no water in the terrarium? A lot of water? Did all of the plants get the same amount of water? Do all kinds of plants need the same amount of water? Record answers in notebooks		Asking Questions and Defining Problems: Ask questions about what would happen if a variable is changed.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Cause and Effect: Cause and Effect relationships are routinely identified, tested, and used to explain change.
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Present an experimental design to the class that they will use to find out how much water seeds need to grow - review mapping seed location from Investigation 1 - discuss what they should record - Discuss dry and moist soil - Plan the set up.	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet #'s 8-9	Asking Questions and Defining Problems: Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	- Systems and System Models A system can be described in terms of its components and their interactions. (5-LS2-1)

Explore: What hands-on/minds-on common experience(s) will you provide for students?	Student groups will isolate one factor, water, in the environment of plants, and set up an experiment to determine the range of water tolerance for the early growth of four different plants (Barley, Corn, Peas, and Radish). Each student in the group will become an expert on one of the four kinds of plants.	• Foss Environments Kit/ Teacher Guide	-Planning and Carrying Out Investigations:(3-5-ETS1-3) - Developing and Using Models: (5-LS2-1)		
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Individually students will predict what will happen in the planters, based on their experience with the seeds in the terrarium from Investigation 1		Constructing Explanations and Designing Solutions: (3-LS4-2) :		
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	-Teacher will set up a swamp environment for future observation - Individually students will evaluate the following questions: Which environments do you think will produce the tallest plants. - The plant in which environment will have the most leaves?	• Foss Environments Kit/ Teacher Guide	Asking Questions and Defining Problems	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Group participation and individual contributions to the investigation.				
Extend: How will students deepen their conceptual understanding through use in new context?	Class can create a list of words that express degrees of wetness. Once the list is compiled students should put the words in order from driest to wettest. - Individual students can research the water conditions in deserts around the world. They can find out what behavioral or structural adaptations allow the plants and animals of the desert to tolerate low-water conditions.				

Lesson Pace & Sequence

Lesson 8: Observing Plants at 5 and 8 days	**Learning Objective(s):** Students will observe changes in the plants after 5 and 8 days.	**Lesson Duration:** two 30 minute sessions

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Teacher will reintroduce the swamp planter. Have students to discuss the purpose of the swamp experiment.				
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Using the plant observation sheet, students will make observations after 5 and 8 days of growth. Students will record parts 1 and 2 of the Plant Observations sheet	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 10			
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Based on the data collected students groups will discuss the following questions: Which environment had the most plants come up? Which environment has the tallest plant? What is the height? The plant in which environment has the most leaves on one plant		Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Scale, Proportion, and Quantity
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Student groups will complete the response sheet: Water Tolerance	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 11			
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Class and group participation - Completion and accuracy of Student Sheet # 11				

Extend: How will students deepen their conceptual understanding through use in new context?	Individual students can complete the math extension: Problem of the Week	• Teacher Guide: • Investigation Duplication Master: Student Sheet # 25			
Lesson Pace & Sequence					
Lesson 9: Observing Plants At 11 Or More Days	**Learning Objective(s):** Using the Plant Profile sheet students will observe changes in the plants after 11 or more days.				**Lesson Duration:** 50 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Teacher will model the uprooting procedure. Students will uproot their plants for further observation.				
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Introduce the concept of Range of Tolerance. - Have students discuss and record the range of tolerance for their plants				
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Using the Plant Profile sheet, student groups will disassemble their planters and compare the growth of each plant in the different environments.	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 12	Planning and Carrying Out Investigations: (3-5-ETS1-3)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Patterns: Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.

Explain: How will you help students connect their exploration to the concept/topic under investigation?	In groups students will compare and record the Plant Profiles in their groups. Pose the following questions to get them started: What is the least amount of water needed to grow these plants? Is the lease amount the same for all? Can you give plants too much water? What is the range of water in which your plant can survive? What amount resulted in the best growth?	• Teacher Guide: • Investigation Duplication Master: Student Sheet # 12	Analyzing and Interpreting Data: Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Scale, Proportion, and Quantity
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Each student expert will determine the optimum amount of water for their particular plant type. Each student will make a journal entry reflecting on the optimum amount of water for the plant and what he/she thinks the range of tolerance for the plant is. Students should spend time discussing in their groups all the data they have available from their observation sheets including all the Plant Profile sheets.	• Teacher Guide: • Investigation Duplication Master: Student Sheet # 12			
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Completion of Plant Profiles - Journal entry - Group Participation				
Extend: How will students deepen their conceptual understanding through use in new context?	Students will complete the Home/School Connection Activity	• Foss: Environments: Student Sheet # 31: • Home/School Connection for Investigation 3			

Lesson Pace & Sequence

Lesson 10: Aquatic Environments: Goldfish Aquariums	**Learning Objective(s):** Students will investigate water and temperature as environmental factors for setting up a goldfish aquarium.	**Lesson Duration:** 50 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Students will brainstorm and record a list of aquatic environments they know. Student will discuss how the environments are similar to and different from each other and from terrestrial environments.				
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Teacher will introduce the aquarium and allow student groups 10-12 min. to observe the goldfish structure, movements, and behaviors.	• Foss Environments Kit/ Teacher Guide			
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Students groups will assemble freshwater aquariums and observe them over a period of time. They will observe the goldfish and monitor the environmental factors of water and temperature	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet #' 13-14	-Planning and Carrying Out Investigations: (3-5-ETS1-3) - Developing and Using Models: Develop a model to describe phenomena. (5-LS2-1)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Scale, Proportion, and Quantity: Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students will record their observations on their Aquatic Environments Journal. Students will record date and time of observation as well as goldfish structure and behavior data. Students will also list the environmental factors and label them as living or nonliving.	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 13		LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	

Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Student groups will discuss and record some of the environmental factors in the goldfish's environment. Encourage students to think of environmental factors that are missing from the goldfish environment. Each group should report out to the class. - Make word bank entries: Aquarium		Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2) :		
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Completion of accuracy of Aquarium Log - Journal entries - group participation				
Extend: How will students deepen their conceptual understanding through use in new context?	Students pairs will read and discuss "Aquatic Environments around the World" - Research and write about the factors in a variety of aquatic environments (e.g. river, creek, pond, large lake) - Research problems of acid rain, and what kinds of organisms have high and low tolerance for acid water.	• Foss: Environments: Science Stories: Aquatic Environments around the World			

Lesson Pace & Sequence

Lesson 11: Acid in Water Part 1&2	**Learning Objective(s):** Students will investigate how living organisms affect the quality of aquatic environments.	**Lesson Duration:** Two 50 minute periods

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***

Elicit: How will you access students' prior knowledge?	Day 1. Teacher will demonstrate the chemical BTB in aged (conditioned) tap water and water with vinegar added. Students will observe and note the color changes made to both liquids. Day 2. Students will plan and design an investigation to find the source of the acid test from day 1.	• Foss Environments Kit/ Teacher Guide			
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Teacher will introduce the concept of an indicator and who it will be used during this lesson: Blue indicates no acid, green indicates a little bit of acid, and yellow indicates a significant amount of acid. Ask students what they think a blue-green or aqua color indicates.	• Foss Environments Kit/ Teacher Guide			
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Day 1. Students groups will test three water samples and compare the results to determine which water sample has the most acid. Day 2. Using the Investigations with BTB sheet students will first compare their investigation plan with the suggested investigation students will then conduct an experiment to find the source of the acid in the water samples from day 1. - Lastly, students will exhale carbon dioxide into the tap water cup and observe the color change.	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 15	Planning and Carrying Out Investigations: (3-5-ETS1-3) - Developing and Using Models: (5-LS2-1)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Patterns: Patterns of change can be used to make predictions, and as evidence to support an explanation.

Explain: How will you help students connect their exploration to the concept/topic under investigation?	Day 1. Student groups will discuss what they think might cause the difference in the amounts of acid in the water samples. Groups should make a list of their ideas. Day 2. In groups students will observe the three cups for changes, and more specifically the tap water with added carbon dioxide. Students will discuss the tap water color change to determine the cause. Teacher will lead a class discussion about carbon dioxide and acid.	• Foss Environments Kit/ Teacher Guide	Constructing Explanations and Designing Solutions: (3-LS4-2)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Cause and Effect
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students will complete Response Sheet: Aquatic Environments - Make word bank entry: Indicator and Carbon Dioxide	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 16			
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Group participation - Completion and accuracy of student response sheets #'s 15-16				
Extend: How will students deepen their conceptual understanding through use in new context?	Complete Math extension: Problem of the Week	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 13			

Lesson Pace & Sequence

Lesson 12: New Organisms	**Learning Objective(s):** Students will introduce new organisms into the aquatic environment			**Lesson Duration:** 50 minutes	
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***

Elicit: How will you access students' prior knowledge?	Class will brainstorm and record ways to make the goldfish aquarium more diverse and interesting				
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Students will add snails, Elodea and Lemma to their aquariums. Students will make journal entries twice a week in their aquarium journals over the next weeks, describing the changes in the aquatic environment.	• Foss Environments Kit/ Teacher Guide • *Pre ordered plants and animals*	Developing and Using Models: (5-LS2-1)	LS2.A: Interdependent Relationships in Ecosystems (5-LS2-1)	Stability and Change: Change is measured in terms of differences over time and may occur at different rates
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Student groups should reflect on the following questions: What is a natural freshwater environment like? How is an aquarium similar to a natural freshwater environment? How is it different? Which organism (plant or animal) is your favorite one in this investigation and why? Answers should be recorded in their notebooks and reported out to the class.		Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)		
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students will use microscopes to collect and analyze additional information about the aquatic organisms, and record their observations in their journals. - Student groups will discuss what they would do differently if they set an aquarium again. Groups will create and design a plan for what their aquarium would look like.	• Foss Environments Kit/ Teacher Guide • Microscopes	Planning and Carrying Out Investigations: (3-5-ETS1-3)	LS2.A: Interdependent Relationships in Ecosystems (5-LS2-1)	
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Group participation - Responses to reflection questions - Plan and design of new aquariums				

Extend: How will students deepen their conceptual understanding through use in new context?	As a class, students can plan and develop a large class aquarium and make it a permanent part of the classroom. - Student pairs read and discuss "Shrimp Aquaculture"	• Foss: Environments: Science Stories: Shrimp Aquaculture	-Planning and Carrying Out Investigations: (3-5-ETS1-3) - Developing and Using Models: (5-LS2-1)		Systems and System Models

Lesson Pace & Sequence

Lesson 13: Brine Shrimp Hatching: Part 1: Setting up the Experiment		**Learning Objective(s):** Students will investigate the environmental factor of salinity in hatching brine shrimp eggs.			**Lesson Duration:** 50 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Teacher will review terrestrial and aquatic environments. Teacher will pose the following question for class discussion: What do you think a salt-pond is like? What might live there?				
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Teacher will pose an environmental problem to students. (See TG, pgs. 11-12) Student groups will discuss the problem to figure out possible solutions and then design an experiment to find an answer.	• Foss Environments Kit/ Teacher Guide.(see TG, pgs. 11-12)			
Explore: What hands-on/minds-on common experience(s) will you provide for students?	The class will discuss, develop and record an experimental procedure for the problem. Each group will set up and conduct the experiment according to the set procedure,	• Foss Environments Kit/ Teacher Guide.(see TG, pgs. 11-12)	Planning and Carrying Out Investigations: (3-5-ETS1-3) - Developing and Using Models:	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	

Explain: How will you help students connect their exploration to the concept/topic under investigation?	Each group will present their findings to the class for feedback and open discussion. Students should discuss similarities and differences in data and observations.		Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2) :	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Patterns: Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products. - Patterns can be used to make predictions.
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Pose the following questions to student groups for further inquiry: How can we find out if salinity affects brine shrimp hatching? - Make word bank entry: Brine Shrimp, Salinity		Asking Questions and Defining Problems		
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	- Group Participation - Plan and design of independent investigation				
Extend: How will students deepen their conceptual understanding through use in new context?	Investigate other Environmental Factors: Students can use other chemicals such as detergent or vinegar in a range of concentrations to see their effect on brine shrimp hatching.	• Chemicals with varying pH levels	Planning and Carrying Out Investigations: (3-5-ETS1-3)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	

Lesson Pace & Sequence

Lesson 14: Determining Range of Tolerance	**Learning Objective(s):** Students will monitor saltwater environment to determine which environments are conducive to hatching brine shrimp eggs.	**Lesson Duration:** 80 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	3 days after setting up hatcheries, students should make observation to note any changes.				

Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Students should complete Part 1 of their Brine Shrimp Hatching sheet in conjunction with making observations	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 17			
Explore: What hands-on/minds-on common experience(s) will you provide for students?	On day 4 students should observe and compare the hatching success in each of their four containers. They should judge the hatching success of each cup on a rough estimate of the density of larvae; none, some, or most of the eggs hatched. If available use whiteboard magnification tools (or overhead projector) to help students judge how many is "some" and how many is "most." Students should record their observations using Part 2 of Brine Shrimp Hatching sheet. Students should use their Aquatic Environments Journal to record additional observations.	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 17	Constructing Explanations and Designing Solutions: (3-LS4-2)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Patterns
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Teacher will draw a large replica of the 'Salt Conditions" chart on whiteboard or chart paper. Student groups will organize class results of hatchings by transferring their results to the replica drawing. - Student groups will discuss and record the results of the class chart to determine the best environmental conditions for brine shrimp. *Optional questions to facilitate discussion*: Do Brine shrimp eggs need sat in order to hatch? Were there cups that had conditions favorable for brine shrimp hatching? Which one(s)? Were there cups that had conditions that were unfavorable		Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2) :	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (Secondary to 3-LS4-4).	Patterns

	for brine shrimp hatching? Which one(s)? Can you give brine shrimp eggs too much salt? Can you determine the range of tolerance that brine shrimp eggs have for salt? Which salt condition(s) seemed to be optimum for brine shrimp hatching?				
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students will make a report to Dr. Bryan in their journals. Their report should address Dr. Bryan's original question: Is salinity an environmental factor that affects the hatching of Mono Lake's brine shrimp eggs? They should cite evidence from the investigation to support their conclusions. - Add new words to the class word bank. (optimum)	• Aquatic Environments Journals	Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2) :		
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Completion and accuracy of Student sheet # 17: Brine Shrimp Hatching - Journal entry report				
Extend: How will students deepen their conceptual understanding through use in new context?	Students will repeat the experiment, but this time they will try to narrow down the range of salt tolerance for brine shrimp. They should investigate 1, 3, and 5 spoons of salt. They will compare results with those for 2, 4, and 6 spoons. Is there an optimum amount of salt within the range of tolerance?	• Foss Environments Kit/ Teacher Guide	Planning and Carrying Out Investigations: (3-5-ETS1-3) - Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	

Lesson Pace & Sequence

Lesson 16: Determining Viability	**Learning Objective(s):** Students will manipulate the environment to see if they can get the dormant eggs to hatch and grow.	**Lesson Duration:** 100 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Students should observe their Hatchery trays to check for more brine shrimp larvae. Students will journal their findings.				
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Teacher will introduce the term "viable". Students groups will question the viability of their unhatched eggs: Do they think the eggs that didn't hatch are viable or dead? How could they find out if the eggs that have not hatched are still viable?				
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Student groups will plan, design and set up a viability experiment.	• Foss Environments Kit/ Teacher Guide	Planning and Carrying Out Investigations: (3-5-ETS1-3) - Developing and Using Models: (5-LS2-1)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students should write out their entire viability plan in their Aquatic Environments Journal	• Aquatic Environments Journals			

Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	After a day or two student groups will observe the results of their viability experiment. Students will be able to explore the following questions: Were the eggs in the 0-spoons and 6-spoons cups viable? Was the hatching robust or did only a few hatch? What advantage is it to the brine shrimp to postpone hatching in salt solutions that are very dilute or very concentrated? - Students will complete Student Response Sheet# 18 Brine Shrimp Hatching. - Students will make word bank entry: viable	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 18	Constructing Explanations and Designing Solutions: (3-LS4-2)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Patterns
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Completion and accuracy of Student Response Sheet # 18 - Plan, design, and set up of viability investigation.				
Extend: How will students deepen their conceptual understanding through use in new context?	Students will individually complete the Math problem of the week: Student Sheet # 27	• Foss: Teacher Guide: • Investigation Duplication Master: Student Sheet # 27			

Lesson Pace & Sequence

Lesson 17: Salt of the Earth: Setting up the Experiment		**Learning Objective(s):** Students will set up a controlled experiment to test the effect of salinity on four kinds of plants (Barley, corn, peas, and radishes.)			**Lesson Duration:** 50 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***

Elicit: How will you access students' prior knowledge?	Teacher will introduce the investigation by telling a story about Farmer Johnson.				
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Students will be asked to conduct an experiment to help Farmer Johnson decide what to do about the water. Class will discuss how the salinity of seawater and the different types of seawater salts might affect plant growth.				
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Students groups will discuss a planting procedure - Plan and design an experiment to test the effects of sodium chloride on the four crops. Class will determine how much water to use in each of their planters. - Student groups will conduct the experiment. (*note* each student in a group will become an expert on one of the four kinds of plants. The plant expert will plant that kind of seed in each of the four planters.)	• Foss Environments Kit/ Teacher Guide	-Planning and Carrying Out Investigations: (3-5-ETS1-3)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Cause and Effect
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students will complete Recording Sheet: Plant Experiment Setup	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 9			
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students will explore what the salt tolerance is for the four plants			LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Group Participation - Plan, design and set up of investigation				

Extend: How will students deepen their conceptual understanding through use in new context?	Students will investigate effects of gray water to find out what happens to plants if kitchen-sink gray-water is the water source. Students should use different concentrations of the gray-water.	• Samples of gray water from home or school.=	Planning and Carrying Out Investigations: (3-5-ETS1-3)		

Lesson Pace & Sequence

Lesson 18: Observing Plants	**Learning Objective(s):** Students will monitor growth of their plants at 5, 9, and 13 days after planting, and determine the salt tolerance of each plant.	**Lesson Duration:**100 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Teacher will review the Plant Profile Observation Sheet:	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 12			
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Using the Plant Profile Observation Sheet student groups will make Observations after days 5, 9, and 13. Remind students that they will be experts for only one kind of plant. Each student will record data for his or her plant in each of the different conditions of the environmental factor of salinity. Additionally, the expert should count, measure, and record the requested data.	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 9	Planning and Carrying Out Investigations: (3-5-ETS1-3)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Patterns

Explain: How will you help students connect their exploration to the concept/topic under investigation?	Student groups will discuss the range of salt tolerance for their plants: To facilitate discussion you can use the following questions: Did the seeds germinate the same in all salt conditions? Did the plants grow to the same height in all salt conditions? Did the same number of plants grow in all salt conditions? How does salt affect each kind of plant?		Constructing Explanations and Designing Solutions: (3-LS4-2)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Patterns
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Each student will write a letter to farmer Johnson regarding their recommendations. They should consider the concentration of salt and how the several kinds of seeds were affected. - Students will complete the Salt of the Earth Response Sheet - Class will discuss other kinds of tolerances plants might need in order to live in other environments (cold or frost tolerance, heat tolerance, drought tolerance, shade tolerance, pest tolerance, and other chemical tolerances.)	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 12	Constructing Explanations and Designing Solutions: Use evidence (e.g., observations, patterns) to construct an explanation. (3-LS4-2) :	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Evaluation of Plant Profile Sheet - Group participation - Letter to Farmer Johnson - Salt of the Earth Response Sheet				
Extend: How will students deepen their conceptual understanding through use in new context?	Students will complete the Math Extension: Problem of the Week	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 28			

Lesson Pace & Sequence

Lesson 19: End of Unit Assessment: Choosing your Own Investigation	**Learning Objective(s):** Students will select a topic from their study of environments to investigate in greater depth and prepare an investigation.	**Lesson Duration:**200 – 300 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Teacher will ask student groups to consider a problem to investigate. Students may choose their own or use the distributed Project Idea sheet.	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 20	Asking Questions and Defining Problems: Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Students will fill out the Project Proposal sheet. They will write the question they are planning to investigate and a list of materials they think they will need. Student groups will complete their investigation proposals by listing the steps they will take to complete their investigation.	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 21	Asking Questions and Defining Problems: Identify (testable) and non-scientific (non-testable) questions.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Student groups will work as independently as possible to complete their investigations. Students should keep track of the time they have to complete each step of their investigation	• Foss Environments Kit/ Teacher Guide	-Planning and Carrying Out Investigations: (3-5-ETS1-3)	LS2.C: Ecosystem Dynamics, Functioning, and Resilience . (secondary to 3-LS4-4)	Cause and Effect
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students will prepare their presentations using the Presentation Guidelines Sheet to help them prepare. Students will present their projects to the class. Student groups should evaluate each of the other groups by coming up with at least 2 questions to ask at the end of each presentation.	• Foss Environments Kit/ Teacher Guide: • Investigation Duplication Master: Student Sheet # 22			

	Teacher/students will provide feedback for each group's consideration for improvements.				
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Student should analyze teacher and student feedback and write in their journals what they did well and what they need to improve on when considering a follow-up investigation.				
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Student project and presentation				