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

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| ***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:<br>• 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:<br>• Investigation Duplication Master: Student Sheet # 27 | | | |

## Lesson Pace & Sequence

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

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| ***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:<br>• 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 | | | | |

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| ***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

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| **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***<br><br>***What lesson elements will support students' progress towards mastery of the learning objectives(s)?***<br><br>****Elements do not have to be in conducted in sequence.*** | ***Learning Activities***<br><br>***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?*** | ***Resources/Materials***<br><br>***What curricular resources/materials are available to facilitate the implementation of the learning activities?*** | ***Science and Engineering Practices***<br><br>***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?*** | ***Disciplinary Core Ideas***<br><br>***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?*** | ***Crosscutting Concepts***<br><br>***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?*** |
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| ***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:<br>• 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:<br>• Investigation Duplication Master: Student Sheet # 9 | Planning and Carrying Out Investigations: (3-5-ETS1-3) | LS2.C: Ecosystem Dynamics, Functioning, and Resilience<br>. (secondary to 3-LS4-4) | Patterns |

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| ***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:<br>• 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:<br>• Investigation Duplication Master: Student Sheet # 28 | | | |

## Lesson Pace & Sequence

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| **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***<br><br>***What lesson elements will support students' progress towards mastery of the learning objectives(s)?***<br><br>****Elements do not have to be in conducted in sequence.*** | ***Learning Activities***<br><br>***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?*** | ***Resources/Materials***<br><br>***What curricular resources/materials are available to facilitate the implementation of the learning activities?*** | ***Science and Engineering Practices***<br><br>***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?*** | ***Disciplinary Core Ideas***<br><br>***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?*** | ***Crosscutting Concepts***<br><br>***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?*** |
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| ***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:<br>• 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<br>. (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:<br>• 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<br>. (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<br>. (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:<br>• Investigation Duplication Master: Student Sheet # 22 | | | |

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| | 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 | | | | |