|  |  |  |  |
| --- | --- | --- | --- |
| **Investigation/ Part** | **Focus Question** | **Writing Support** | **CCSS-ELA****NGSS** |
| Investigation 1: Terrestrial Environments Part 1: Setting Up Terrariums | What environmental factors affect the growth of seeds (and plants)?& How does the terrarium change over time?What materials do plants need to grow? | **Pre-Instruction (Classroom preparations)**:1. You will need to group students so they work and talk in pairs
2. Designate an area where students can gather as a class and you can model the creation of data tables, and other written records used in discussions.
3. Establish and display two word banks: one for the terms that are introduced during the instructional sequence Tier 2 and 3 vocabulary (see CCSS-ELA Appendix A pg. 32-33) and the other for displaying focus questions.
4. Create sentence strips of the focus questions that frame each lesson or series of lessons.

Post Instruction:* Lead a discussion on environmental factors and their impacts on the organisms in their terrariums. (group)
* Brainstorm a list of environmental factors that could affect the seeds in their terrariums (group) students copy in their science notebooks
* Ask students to identify the factors as either living or non-living.

Word Bank:Environment Environmental FactorTerrarium Organism  | 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water**.**<http://www.nextgenscience.org/5ls1-molecules-organisms-structures-processes>(note: During the course of the classroom observations students must engage in discourse (speaking) related to what materials plants need for growth (making claims and providing supportive evidence). A connection between this and the larger list of environmental factors can be established with evidence based on variables that surface during the observations over the two weeks.) The teacher must work to provide appropriate scaffolding (create public representations of evidence) and promote observations.  |
| Investigation 1: Terrestrial EnvironmentsPart 2: Recording Changes(note: this lesson repeats over the next two weeks to facilitate students making and writing about their observations of the terrariums) | “ | **Pre-instruction:*** Move students to the group gathering area and model the appropriate way to make observations.
* **Model** the creation of a classroom observation chart to model the correct way to record the observations.
* Refer to the original “focus question” to provide the purpose for gathering the data.
* **Encourage Speaking** ahead of actually making the observations by using this opportunity (to scaffold the writing process) by providing the students with a frame for their partner conversations ahead of actually observing.
	+ “When I observe my terrarium today, I predict that I will see…..
	+ “I think this because…..”
* **Model** a scientific drawing with the class, students can provide the descriptors and numbers as appropriate. Teacher models thinking aloud, systematic observations.
* **Public display:** consider creating a word list that can be referenced for descriptions that are observed as the terrarium changes.

 Post-instruction: **Shared writing mini-lesson (writing about observations):*** **Model**  aloud in front of the students the type of information that should be in the piece of writing (date, measurements, descriptors, transition words)
* **Scaffold** the student writing by providing writing frame(s) that can start student writing and a list of transition words to develop the paragraph.

Word Bank:ObservationGerminate | 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water**.**<http://www.nextgenscience.org/5ls1-molecules-organisms-structures-processes>5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.<http://www.nextgenscience.org/5ls2-ecosystems-interactions-energy-dynamics>CCSS-ELA W.5.2Write informative/explanatory texts to examine a topic and convey ideas and information clearly.<http://www.corestandards.org/ELA-Literacy/W/5/2> |
|  |  |  |  |
| Investigation 2: Bugs and BeetlesPart 1: Making Animal Runways | What type of environment do isopods and beetles prefer?  | **Pre-instruction:*** Introduce the focus question for the investigation (sentence strip) and elicit student responses. Turn and talk with partner **(speaking).**
* **Model use of the scaffold** by making observations of the two animals as a class using the Box and T chart to help with the observations. (note: the Box and T chart provides a graphical organizer to collect observations of the animals.)
	+ Enter an observation for the isopods an observation for the beetles, use the similarities and differences in chart to guide observations. (see below)

(Box and T-Chart)**Post-instruction (writing mini-lesson):** **Model** writing observations in a narrative form using the Box and T Chart graphical organizer. **Scaffold** as necessary with a writing frame to give the students a beginning space. Writing Frames:I observed…….I noticed….It reminds me of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because\_\_\_\_\_\_\_\_\_. | 4-LS1-2.Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.<http://www.nextgenscience.org/4ls1-molecules-organisms-structures-processes>CCSS-ELA W.5.3Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.<http://www.corestandards.org/ELA-Literacy/W/5/3> |
| Investigation 2: Bugs and BeetlesPart 2: Responding to Moisture  | How much moisture do isopods and beetles prefer? | **Pre-instruction (introduction of setting up the investigation (investigative question, data table, procedures) provides template and scaffolds the second part of this investigation):** * Review the observations from the previous and ongoing observation of the terrarium (what conditions do the plants seem to prefer?).
* Introduce the investigative question (**focus question)** written and displayed publically.
* **Model** the creation of the data table that the students will use to collect data from the various conditions.
	+ **Manipulated (dry, moist, wet) soil samples and responding variables (amount of animals) are identified**
	+ **Control variables (same amount of soil, same light) are identified**
* **Model** collection of class data into the data table (public representation).

**Post-lesson investigation (writing mini-lesson):*** Have students use the date from their investigations to write a scientific explanation that answers the focus question at the beginning of the unit.
* Introduce the CER framework as model for creating scientific explanations.\* This framework should be introduced in a separate lesson identifying the various parts of the framework. Make a public display of the components of a scientific explanation so students can have a visual reminder.

CER FrameworkThis framework provides a graphical representation of the various elements of a complete scientific explanation- *claim,* *evidence, and supportive reasoning.* Support can be offered through a visual representation and explanation of the components of a complete explanation through the use of the CER framework below.* Have students self evaluate their own explanations identifying the claim (circle), supporting evidence (underline), and scientific reasoning double underline.

**\*CER Framework Explanation:**[**http://alwaysformative.blogspot.com/2012/04/claim-evidence-reasoning.html**](http://alwaysformative.blogspot.com/2012/04/claim-evidence-reasoning.html)**Word Bank:**Preferred EnvironmentManipulated variableResponding variableControl variableProcedures | CCSS-ELA W.5.2eProvide a concluding statement or section related to the information or explanation presented.<http://www.corestandards.org/ELA-Literacy/W/5/2/e>4-LS1-2.Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.<http://www.nextgenscience.org/4ls1-molecules-organisms-structures-processes> |
| Investigation 2: Bugs and BeetlesPart : 3 Responding to Light  | How do beetles and isopods respond to different amounts of light? | **Pre-instruction:*** Review the essential elements of a controlled investigation by reviewing the test and results from Investigation 2: Responding to Moisture.
* Introduce the new investigation question (focus question) and process for setting up investigation in the science notebooks.
* Based on the need of the group provide the adequate **scaffolding** for setting up the investigation:
	+ **Model** the writing of the investigative question
	+ **Mode**l the set up of the data table
* Identify, **label, and publically display** the variables in the investigation

**Post Instruction:*** Utilize the CER framework to have the students write a scientific explanation answering the investigative question. Note: depending on the group you may need to **model writing this explanation** in front of the class.
* Follow this intentional format for leading students in this writing exercise:
	+ Provide a **written “frame**” or conversation starter to engage student discourse (partner talk)
	+ **Teacher speaks** reading the investigative question and frame.
	+ **Students speak** to a partner to share your explanation using “frame”
	+ **Teacher models** writing an explanation using the frame identifying the claim, evidence, and reasoning
	+ **Students write a scientific explanation using the frame**

**“The beetles/isopods liked the \_\_\_\_\_\_\_\_\_\_\_\_environment because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.****During the investigation we had \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beetles/isopods in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ beetles/isopods in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. This suggests that beetles/isopods favor a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ environment.”** * Identify the elements of the CER framework in student responses.
 | CCSS-ELA W.5.2eProvide a concluding statement or section related to the information or explanation presented.<http://www.corestandards.org/ELA-Literacy/W/5/2/e>4-LS1-2.Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.<http://www.nextgenscience.org/4ls1-molecules-organisms-structures-processes> |
| Investigation 2: Bugs and BeetlesPart 4 Responding to Light | Investigative question chosen by students | Follow the above format for supporting students in writing investigative procedures and scientific explanations from their own animal investigations. |  |
| Investigation 3: Part 1-4 Setting and conducting the experiment | What are the optimal water conditions for each of the four plants: corn, wheat, barley, and peas? | Note: Follow the above format for supporting students in writing investigative procedures and scientific explanations from their own animal investigations.**Pre-investigation instruction:*** Review the observations from the terrariums focusing on the plants and the growth observed. Ask the students to make predictions based on their experience how the amount of water would effect the growth of the plants in their terrariums.
* Introduce the investigative question **(public display)** and explain the test.
* **Model** and then have the students record the investigative question in their science notebooks.
* Students record the manipulated (amount of water) and responding variables (growth rate of plant) from the investigation.
* Ask the students to make a **prediction** about the results of the investigation and **speak** with a science partner about their thinking.
	+ **Scaffold their speaking** with the following frame: “I think that the optimal water conditions for the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ plant will be \_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. The evidence that I gather (responding variable) will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and the things that I keep the same (controlled variable) will be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	+ Have students write their predictions using the frame
* Establish the procedures as a class and then record in the science notebooks.

**During investigation collecting observations:*** Teacher **models** making observations using details expected on the observations of the plants on a class control set up. Note: An optional observation sheet is provided in the kit.
* Teacher **models** the sentence **frames** that will provide **scaffolding** for writing about observations in science notebooks (emphasis on collecting good qualitative and quantitative data- color, measurements, etc)
* Teacher **models** use of the words in the word bank measured/responding/control variables.
	+ I observed \_\_\_\_\_\_\_\_\_\_\_\_ on the \_\_\_\_\_\_\_\_\_\_\_\_\_ plants but \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ plants.

Post Investigation:* Teacher leads students in a class discussion about the results of the investigation.
* Teacher scaffolds as appropriate the use of the claims-evidence- and reasoning framework with students.
* Students write their own scientific explanation or conclusion to answer the experimental question following the claim-evidence-reasoning framework.

**Word Bank:**Range of ToleranceOptimum | 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water**.**<http://www.nextgenscience.org/5ls1-molecules-organisms-structures-processes>(note: During the course of the classroom observations students must engage in discourse (speaking) related to what materials plants need for growth encouraging them to make claims and providing supportive evidence. A connection between this and the larger list of environmental factors can be established with evidence based on the variables that surface during the observations of their terrariums over the two weeks. The teacher must work to provide appropriate scaffolding (create public representations of evidence) and promote observations to support reasoning related to plants needs for water and sun to support growth. |
| Investigation 5: Brine Shrimp HatchingPart 1: Setting up the Experiment- | Does the salinity change in Mono Lake, CA have an effect on brine shrimp hatching? | **Pre-instruction writing:**This lesson provides an opportunity to allow the students to own the design of the investigation to determine the effect that salinity has on an organism such as the brine shrimp. * Introduce the problem about the historical issue concerning brine shrimp habitat in Mono Lake and the use of fresh water with the city of Los Angeles. You can read the passage in the FOSS teachers guide and also look through the information on the website below to provide more context.
* <http://www.monolake.org/today/2013/07/08/will-dwp-choose-wisely-two-paths-ahead-lead-to-restoration-for-monos-tributaries/>
* <http://en.wikipedia.org/wiki/Mono_Lake>
* <http://www.naturestudy.org/projects/mono-lake/>
* Present the challenge:

Students have to determine the actual **optimum** levels of salinity or the **range of tolerance** for the brine shrimp in order to establish some safe lake levels to keep the population of brine shrimp alive and protect the fragile ecosystem of Mono Lake.Students must determine the **range of tolerance** and then create a scientific explanation (claim, evidence, and reasoning) which answers the investigative question. * Conduct a controlled investigation to answer the experimental question.
* Collect data (evidence) to construct a scientific explanation which answers the experimental question
* Write an *opinion piece* to the Los Angeles Department of Water and Power (DWP) on the topic of brine shrimp in Mono Lake, CA. In the piece you should *make a claim and back it with supporting evidence and scientific reasoning t*o state whether or not brine shrimp population in Mono Lake are threatened by increases in the salinity due to fresh water diversion from the lake.

**Word Bank:**Brine shrimpSalinity **Investigation set-up:*** Students should write up investigation using their science notebooks.
* Teacher **models** the set-up of the investigation as appropriate based on needs of the class.
	+ Data table developed
	+ Procedure list articulated
	+ Variables identified –manipulated (salinity), controlled (amount of water in cups), responding (amount of brine shrimp hatching)

**Word Bank:**Manipulated VariableControlled VariableResponding Variable**Post-Investigation:*** Lead a writing lesson to support students writing the opinion piece to the City of LA (DWP).
* Remind students of the CER framework and if necessary go through **modeling** a class scientific explanation to answer the investigative question.
* Identify the claim, use supporting evidence from the investigation, and provide some reasoning in support of the data.
 | * [CCSS.ELA-Literacy.W.5.1a](http://www.corestandards.org/ELA-Literacy/W/5/1/a/) Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped to support the writer’s purpose.
 |

Resources cited:

Krajcik, J., & McNeil, K. (2012). *Supporting grade 5-8 students in constructing explanations in science: The claim, evidence, and reasoning framework for talk and writing*. (1st ed.). New York: Pearson. Retrieved from <http://www.amazon.com/Supporting-Students-Constructing-Explanations-Science/dp/0137043457>

Rupp-Fulwiler, B. (2011). *Science in writing in action*. (1 ed., Vol. 1). Portsmouth: Heinemann. Retrieved from <http://www.heinemann.com/products/E04211.aspx>