

OIMB GK12 CURRICULUM

5th grade

60 minutes+20 minutes/day for length of experiment

BRINE SHRIMP INQUIRY

Oregon Science Content Standards:

- 5.1L.1. Explain that organisms are composed of parts that function together to form a living system
- 5.2L.1. Explain the interdependence of plants, animals, and the environment, and how adaptation influences survival
- 5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.
- 5.3S.2 Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.
- 5.3S.3 Explain the reasons why similar investigations may have different results.

Ocean Literacy Principles:

- 5. The Ocean supports a great diversity of life and ecosystems

Goals:

- To learn about the unique adaptations of brine shrimp
- To have students design and conduct scientific experiments

Concepts:

- Brine shrimp have adaptations to survive many extreme conditions.
- The scientific method can be used to answer questions about the natural world.

Materials:

- Optional: Brine Shrimp PowerPoint
- Brine Shrimp Eggs, 1 package (available at most pet stores)
- plastic containers in which to raise shrimp, 3-5 depending on experimental design (two-liter plastic bottles with top cut off work well)
- Microscopes, one per student group or rotate (Brock scopes available from OIMB)
- non-iodized salt, 1 box
- small plastic dishes, one per student group (petri dish or other that fits under microscope lens)
- Eye dropper, one per student group or rotate

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- Optional: aerator for each container of shrimp (at pet stores or from OIMB)
- Brine Shrimp Inquiry Brainstorming Worksheet
- Brine Shrimp Inquiry Notebook, one per student (note: copy and include additional data collection and graphing pages as needed)
- Brine Shrimp Data Collection Instructions

Background:

Brine shrimp (*Artemia spp.*) are found worldwide in places where inland saltwater ponds and lakes evaporate naturally, such as in Mono Lake California and near Great Salt Lake, Utah. They do not occur in the ocean. Brine shrimp are an important food source for many organisms, including flamingoes. They are not very closely related to the shrimp we are used to eating. They are sometimes referred to as ‘sea monkeys’, although they do not live in the sea and are definitely not related to monkeys. Brine shrimp can live in evaporating salt ponds where salinity and temperature change dramatically. They can even survive for several years with no water at all. Brine shrimp eggs are cyst-like and can survive in a dormant state of animation called “diapause.” Brine shrimp eggs have adapted to a lack of water because many of the ponds where they live dry up during the summer. Dried out eggs will hatch within hours when water returns (e.g. when rains return). There are three stages in the life cycle of brine shrimp: egg, larva, and adult. The larva has a round body and two appendages by its head to help it swim. Adult brine shrimp are only about 1 cm long. The eggs are often sold in pet stores to hatch for use as aquarium food.

Lesson Plan:

1. Begin class by asking what students know about brine shrimp or ‘sea monkeys’.
2. Introduce some of the basic information about brine shrimp included in the background section above. Show PowerPoint.
3. Tell students they are going to design and perform a class experiment with brine shrimp. Hand out the Brine Shrimp Inquiry Notebooks and have the students complete the background section.
4. Optional—allow students to observe a mix of eggs and already hatched brine shrimp and record their observations.
5. Ask the students if they remember the steps of the scientific method. Review the steps:
 - Question, Hypothesis, Experiment, Analysis, Conclusions
6. Explain that their questions need to be testable, and in a relatively short amount of time.
 - For example, “does the shrimp like me” is not a testable question!
 - Testable questions must be able to be answered with an experiment.
 - The experiments must also be able to be conducted with the materials on hand.
 - You might want to limit questions to those that can be answered by changing salinity, temperature, light, oxygen, etc.

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7. Ask students what questions they have about brine shrimp. Discuss each suggestion and write testable suggestions (discuss why others are not testable) on the board. Students can fill out the 'brine shrimp inquiry brainstorming worksheet' to help with brainstorming.
8. Narrow the questions to ones that can be answered over a couple of weeks by keeping brine shrimp in the classroom.
9. Have the class vote on the narrowed down list to select the class experiment and write the class question in their Inquiry Notebooks.
10. Explain what a hypothesis is (an educated guess, based on what is already known). Have students come up with their hypothesis about the answer to the question and write this down in their Inquiry Notebooks.
11. Have students share ideas about how to design an experiment to test the question. Remind students to change only the variable they are testing.
 - several types of experiments can be set up by growing brine shrimp in a few different containers, changing the same variable (or condition) slightly in each
 - possibilities include: raise brine shrimp at different temperatures, raise brine shrimp in light/dark, raise brine shrimp at different salinities
12. Once the class decides on an experimental design, have the students write it down and draw the experimental setup in their Inquiry Notebooks.
13. Set up the experiment using the guidelines provided under Brine Shrimp Care.
14. Using the Brine Shrimp Data Collection Instructions, have students take turns checking on and collecting data from the different containers of brine shrimp each day. (The data sheet in the Inquiry Notebook asks students to count the eggs, hatched larva, and dead larva in each container. If the class' experimental design requires different data, create and supply the necessary data collection sheets.)
15. After a set number of days (about 1 week) combine the data for each container and compare them as a class. Have students graph the results.
16. If more brine shrimp survived in one experimental treatment (ex. light or dark) than the other, ask the students why they think this occurred.
17. Have students explain the results and write why they think this occurred. This is the conclusion—the conclusion answers the question 'why?' Explain to the students that they should give supporting reasons for their conclusion.
18. Ask the students what they would do differently if they ran this experiment again. Scientists learn from one experiment to refine and improve their experimental design.
19. What new questions do the students now have about brine shrimp?

Brine Shrimp Care:

- Brine shrimp can live at room temperature in plastic containers such as 2 liter bottles that have the top cut off
- It is best if each container has a bubbler to supply oxygen (unless the variable is oxygen).

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- To set up “hatcheries,” add one tablespoon of non-iodized salt per liter of tap water (unless the variable is salinity). Mix until the salt dissolves.
- Brine shrimp eggs can be bought at most pet stores. Less than ¼ tsp of eggs is enough for each container for these experiments.
- If algae grow on the inside of the container, the brine shrimp will eat the algae. Otherwise, the hatched brine shrimp will eat powdered yeast. They should be fed yeast 2 times/week. Add no more yeast than will disappear in the container. Keep consistent between containers, unless food is the variable.
- Keep shrimp in a warm location in the classroom, as they can die if they get too cold, such as if they are next to a window on a cold day.

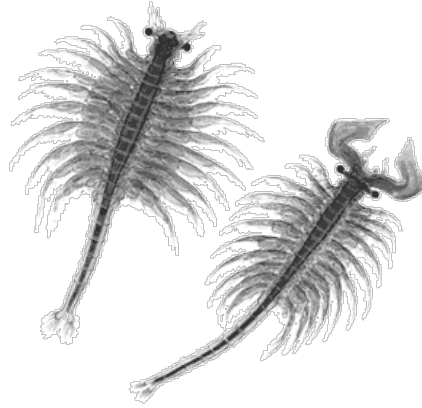
Assessment: The inquiry brainstorming worksheet and Inquiry Notebook.

GK12 Fellows: Wyatt Miller, Annie Pollard, Ryan Lenz, Alix Leferriere, Myndee McNeill, Erin Morgan

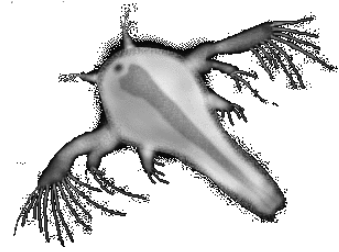
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Name:

**Brine Shrimp
Inquiry
Brainstorming**



Brine Shrimp Adult

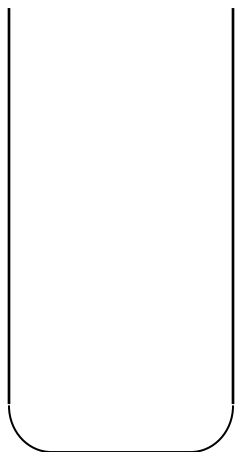


Brine Shrimp Larvae

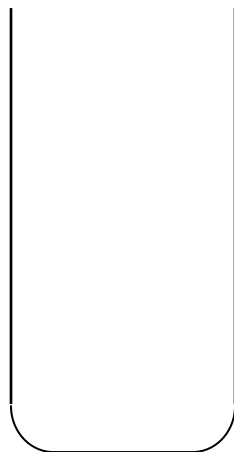
What might make brine shrimp grow really well in the water?

What might prevent the brine shrimp from hatching?

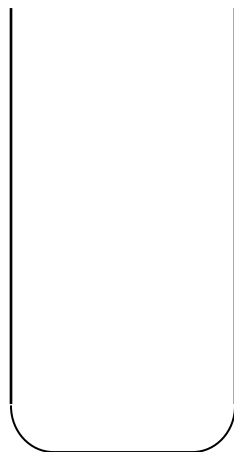
We could set up our experiment like this:



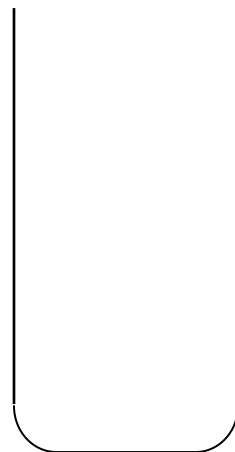
Bottle 1



Bottle 2



Bottle 3



Bottle 4

Brine Shrimp Data Collection Instructions

Using the microscopes, count the number of eggs, hatched living, and dead brine shrimp that you see. A dead animal is one that has hatched but is not moving.

Counting method

- 1.) Stir the contents of the container.
- 2.) Fill an eyedropper with the water/brine shrimp from the container (same amount each time)
- 3.) Gently squeeze the contents of the eye dropper onto a clear plastic dish.
- 4.) Place the dish under the microscope and focus.
- 5.) Look through the scope and count what you see.
- 6.) Record the number of eggs, hatched living, and dead brine shrimp in your lab notebook, under "Data". Make sure to write down the day and the container number that your sample came from.
- 7.) Draw a picture of your observations and make notes in the "Data" section of your lab notebook.
- 8.) Empty the dish back into the SAME container you took the shrimp from.
- 9.) Rinse your dropper and dish in the sink. Return all materials to the experiment area.
- 10.) Repeat steps 1-9 for the other brine shrimp containers you are collecting data from.

Lab Notebook

Brine Shrimp Inquiry Experiment

Scientist Name:

Day 1

Background: Listen to the presentation. Write some important facts about brine shrimp:

1.)

2.)

3.)

Observations: Use the microscopes to observe brine shrimp and their eggs. Draw your observations below. Make notes about anything interesting you observe.

Brine Shrimp

Eggs

Notes: _____

Question: Write the question below that we will seek to answer with our experiment.

Hypothesis: Write what you predict will happen in our experiment.

Design and Method: How should we do our experiment? What items do we need? How should we set it up and keep track of what happens?

Make a list of the items we need.

- | | |
|-----|-----|
| 1.) | 5.) |
| 2.) | 6.) |
| 3.) | 7.) |
| 4.) | 8.) |

Draw a picture of the set-up of our experiment.

Instructions:

- 1.) Set up the experiment.
- 2.) Follow the “Brine Shrimp Data Collection Instructions” when it is your turn to collect data.
- 3.) Record your data in this lab notebook.

DATA

Day _____

Container Number: _____

# Eggs	# Hatched Living	# Dead

What do the brine shrimp and eggs look like? Use the microscopes to make observations. Remember this is a scientific drawing. Label parts. Draw and note your observations below.

Notes: _____

Results/Data Table

Compile the data for all days and containers here.

Bottle 1:

Observation day	# Eggs	# Hatched Living	# Dead
1			
2			
3			
4			
5			
6			
7			
8			

Bottle 2:

Observation day	# Eggs	# Hatched Living	# Dead
1			
2			
3			
4			
5			
6			
7			
8			

Bottle 3:

Observation day	# Eggs	# Hatched Living	# Dead
1			
2			
3			
4			
5			
6			
7			
8			

Bottle 4:

Observation day	# Eggs	# Hatched Living	# Dead
1			
2			
3			
4			
5			
6			
7			
8			

Graphs (label axes and give graph a title)



