3-5: Search for Life Beyond Earth

Curriculum Connections

Life Sciences
- Understand how various factors can affect the life spans and life cycles of organisms.
- Observe and explain how adaptation, interdependence, and environmental change give a survival advantage to certain organisms.
- Describe how organisms and the environment are dependent on one another.

Earth and Space Sciences
- Examine, describe, investigate and measure Earth materials including water, rocks, soils, and sands.

Scientific Connections and Applications
- Develop an understanding and appreciation of the natural world.
- Understand and describe examples of the importance of scientists, science, and technology and the impact they have on our lives.

Scientific Tools and Technology
- Use technology and tools such as magnifiers, microscopes, balances, thermometers, and computers to observe and measure objects, organisms, and phenomena.

Scientific Communication
- Use information gathered from observation, experiments, print, and nonprint sources to explain phenomena.

** Based on the New York State Elementary Science Core Curriculum and the New York City New Standards™*

National Standards

Content Standard A: Science as Inquiry
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Content Standard C: Life Science
- The characteristics of organisms
- Life cycles of organisms
- Organisms and environments

Content Standard D: Earth and Space Science
- Properties of earth materials

Content Standard E: Science and Technology
- Abilities of technological design
- Understanding about science and technology
- Abilities to distinguish between natural objects and objects made by humans

Content Standard G: History of Nature and Science
- Science as a human endeavor

3-5 Exhibits List

Atacama Wall
Atacama Video
Control a Rover
Hot and Cold Worlds
Mars Meteorite

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Rock Samples
Yellowstone Wall
Yellowstone Video
Simulated Mud Pot
Observe Yellowstone Microbes
Smells of Living Things
Gold Mine Wall
Gold Mine Video
Sterile Sample Collection
Rio Tinto Wall Structure
Observe Rio Tinto Microbes
Deep Sea Vent Specimen
Submersible Simulator
Europa Surface Puzzle
Lake Vostok Wall Structure
Europa Model
Ice Flows
Life Under Ice
Searching the Night Sky
Visitor Feedback
Murchison Meteorite
How Much of Me is Water?
Water in Motion
Is this Alive Display?
Definitions of Life Video
Winogradsky Column

Guide Theme

The theme of these guides are based on popular crime and detective show investigations on TV; a mystery unfolds, questions are asked, evidence is gathered, conclusions are drawn. This process is similar to what scientists go through with the inquiry method. For more details see About the Guides.

Begin the Investigation At School

A mystery unfolds, questions are asked...

There are several ways you can introduce the topic and start the investigation. Here are some ideas that will help students start thinking about the topic and generate questions:

- Do you think there is there life on other planets?
- What defines a living creature?
- What kind of conditions would another planet need to support life?
- Scientists found life in some of the most extreme environments on earth. Why do scientists who study space and other planets think this is important?
- Demonstrate one of the Laboratory Activities with no explanation-let the questions begin
- Do one of the Laboratory Activities and facilitate a probing discussion

Prepare for Investigation at the New York Hall of Science

Once students have generated questions around the topic tell them they are going to continue the investigation at the New York Hall of Science.

At this point you may want to begin one of the Continuum Activities. These activities have the

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following features:
- Vary in length and depth
- Provide continuity and purpose for the visit
- Provide a way of assessing student understanding

Orientation and Planning: If you do nothing else, do this!
Here are five reasons to conduct student orientation and planning before going on a field trip:

1. Students focus on exploring and investigation versus the novelty of the location
2. Students don't have to worry about logistics like restrooms, schedule, eating etc.
3. Students who understand the plan and purpose of the visit are more likely to stay focused
4. Students who have clear goals for their visit are less likely to race from one exhibit to another with little understanding
5. Students who get involved in the planning of the visit, take ownership and are less likely to misbehave

Read more about the Orientation and Planning Process

Investigation at the New York Hall of Science

Evidence is gathered...
Okay. The class has arrived at the next phase of the investigation. The students have questions and seek answers. Everyone knows what exhibits they should visit and why. Everyone knows the schedule for the day. Students have materials to record findings or work on a Continuum Activity if required.

If all of the above is true, congratulations on a successful Orientation and Planning.

If you are curious about what teachers can do on site, we've put together a little piece called Teacher Role.

Finish the Investigation Back at School

Conclusions are drawn...
There are several ways you can complete the investigation. Some require less time than others. Here are some ideas:
- Student or group oral or written reports on investigation questions and answers
- Student or group illustrations of visit with answers to questions or mystery
- Do one of the Laboratory Activities
- Complete the Continuum Activity

Continuum Activities

Continuum Activities are designed to carry through the entire investigation. Some activities require less time than others.

Investigation Map

Description: Detectives will often map out related events, evidence and suspects during an investigation. This helps them get an overall picture. Students can map out their investigations with a concept map. The concept map will help you assess what students learn.

Time: (3)15-30 min. Sessions

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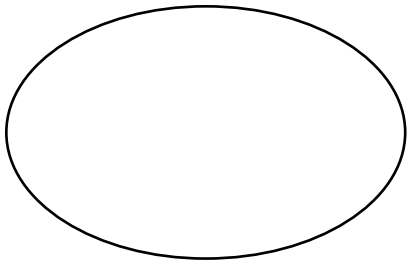
Materials Needed:

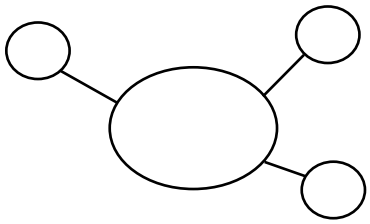
- Blank paper
- Pencils, colored markers

Procedure:

1. Begin with a center circle and write in the name of the main topic. (Students who do not write can have an adult assist or draw a representation of the main topic)



2. As students generate questions about the topic, they can add offshoot circles. They can also add circles for facts they know about prior to the visit to the New York Hall of Science.



3. When students return from their investigation at the New York Hall of Science they add additional circles of information. Their final map should reflect everything they know about the topic. Teachers can easily assess what is learned based on how the map develops.

Investigation Journals

Description: Investigation journals provide a way for students to record their questions and findings throughout the investigation.

Time: (3)15-30 min. Sessions

Materials Needed:

- Blank or lined paper
- Pencils, pens or colored markers
- On-Site Investigation Handout (print out from this web site and make copies)
- Zip-lock bags (for on-site handout only)
- Soft yarn or thick soft string (for on-site handout only)

Procedure:

1. Ask students if they have ever seen a detective take notes when trying to solve a mystery. Tell students that as "science detectives" they too will make a record of the mystery.
2. Have students begin their journal or report with questions that are generated when they Start the Investigation at School.
3. Students who do not have writing skills can make a large question mark and draw representations

of their questions. If an experiment or demonstration is done, non-writing students can sketch what they observe.

4. Older students with writing skills can list their own and other students questions in their journal.
5. We strongly advise students not bring journals to the New York Hall of Science where they can get lost. We have provided an On-Site Investigation Handout that can be copied if students want to record observations or make sketches.
6. When students return from their investigation at the New York Hall of Science have them write answers to questions or draw what they observed.

Science TV- Investigative Reporters

Description:
In this activity, students plan and produce a TV show featuring investigative reports on the topic. This is a cooperative learning activity that integrates language arts, science and technology. There is a significant amount of writing involved, however students who are not prolific writers can also contribute as camera people, script supervisors, directors and on-camera reporters. Students will video tape at school and at the New York Hall of Science so pre-planning is essential for this activity.

Time: (3) 45 minute sessions (writing)
(1) video shoot at school
(1) video shoot at the New York Hall of Science
(1) 45 minute session (writing)
(1) video shoot back at school
(1) 30 minute session for viewing final TV show

Materials Needed:

- Video camera
- (1) video tape per student group
- External wired microphone for camera (optional but suggested for good audio)
- TV
- Cables to run camera to TV for viewing
- Student internet access (optional for research)
- Lined paper and pencils
- Large plain paper and markers (cue cards)

Procedure:

First Session-Planning

1. Tell students they are going to plan and produce a TV show with investigative science news stories that are 4-5 minutes in length.
2. Divide the class into groups of four or five students.
3. Have students or the teacher chose a writer/script supervisor, camera person, director and on-camera reporter for each group.
4. Tell students about the various roles in the production team:
    - Writer-writes groups ideas for script, makes revisions
    - Cameraperson-operates camera

- Director-supervises camera person and on-camera reporter, calls for action and cuts
- Script Supervisor-makes cue cards for on-camera reporter, makes sure script is followed
- On-Camera Reporter-person who reports and appears in video

5. Tell students that everyone the group will work together to create the script.
6. Remind students of the topic of study and the trip to the New York Hall of Science.
7. Instruct students to begin to create questions around the topic for the news show. They may want to create questions for interviews with New York Hall of Science "Explainers" too.
8. Tell students to watch the local news on TV so they can observe how news reporters do their job.

Second Session-Location Scout and Scriptwriting

1. Tell students they are going to do a location scout of the location they will be shooting at the New York Hall of Science. Scouting the location will help them think of more questions and give them ideas for what to shoot on location.
2. Make prints outs of the exhibits the class will visit at the New York Hall of Science OR have students access the exhibits online themselves.
3. Once students have become familiar with the exhibits, allow time for more scriptwriting. Make sure scripts have the following components:
   - Introduction to the report (name of reporter, where they are, news headline)
   - Questions the investigative report will answer
   - Conclusion (to be done after video shoot at New York Hall of Science, comment, opinion about answers, reporter sign-off)

Third Session- Rehearsals and Final Script

1. Remind students about the various roles in the production team:
   - Writer-writes groups ideas for script, makes revisions
   - Cameraperson-operates camera, responsible for video tape
   - Director-supervises camera person and on-camera reporter, calls for action and cuts
   - Script Supervisor-makes cue cards for on-camera reporter to read, makes sure script is followed
   - On-Camera Reporter-person who reports and appears in video
2. Have groups rehearse their roles using the scripts. (Camera people can use their hands to frame shots)
3. Advise groups to make script revisions if they notice problems during rehearsal.
4. Rehearsals can be done in front of whole class or in individual groups depending on your classroom space and noise level.
5. After rehearsal have groups meet and finalize the pre-New York Hall of Science script.

Homework
Have groups give script supervisor the pre-New York Hall of Science script so they can make cue cards. (Script supervisor can ask others to help make cue cards too)

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Video Shoot at School
During this session each group will shoot the introduction to their news story. Each group will have their own video tape. Make sure each group tape is labeled. If possible you may want to have groups shoot in a quiet separate location from the others or schedule group shoots during breaks in the day. If the entire class is present during shoots, make sure the others are quiet and don't distract the shooting. After shooting make sure camera people return the group tape to the teacher for safe keeping.

Video Shoot at the New York Hall of Science

1. Make the shooting schedule for the day.
2. Allow 15-20 minutes for groups to shoot in their location.
3. Choose a central location for production groups to meet the adult who will have the video camera and group tapes.
4. Make sure production groups stay together at the New York Hall of Science and Chaperones know the schedule for the day.
5. If students plan to interview a staff "Explainer", locate the Explainer in the area before shooting and ask for their assistance and cooperation for the shoot.
6. After shooting make sure camera people return the group tape to the adult for safe keeping.

Conclusion Script Back at School

1. Production groups will need to write the conclusion to their video script after their New York Hall of Science video shoot.
2. The conclusion should include a summary or opinion of the overall story as well as the reporter sign off.
3. Allow production groups to review their video footage (if necessary) so they can form opinions or summaries.
4. Have script supervisors and others in the group make up the final cue cards and conduct short rehearsals.

Video Shoot at School
During this session each group will shoot the conclusion to their news story. If possible you may want to have groups shoot in a quiet separate location from the others or schedule group shoots during breaks in the day. If the entire class is present during shoots, make sure the others are quiet and don't distract the shooting. After shooting make sure camera people return the group tape to the teacher for safe keeping.

View the Show
Hook up the camera to the TV and run the group tapes from the beginning. Enjoy the show.

Become an Explainer

Description: Students investigate one exhibit with the goal of being able to explain it when they return to the classroom. Students can choose a variety of methods to explain and make presentations.

Time: (1) 30 min. Session
(2) 45 min. Sessions (for in-class presentations)

Materials Needed:

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- Interesting objects (used for student observation)
- Print outs of On-Site Investigation Handout

(optional suggestions)

- Variety of craft materials Variety of craft materials (pipe cleaners, popsicle sticks, straws, string, paints)
- Variety of clean, household recyclables (meat trays, cardboard tubes, aluminum foil, plastic wrap)
- Any other odds and ends students can construct with
- Poster board or paper
- Markers, crayons, colored pencils

Procedure:

First Session

1. Tell students as they will be investigating exhibits at the New York Hall of Science and will choose one exhibit to explain to the class when they return. (students can work in groups or individually)
2. Help students prepare for careful observation of exhibits by distributing interesting objects.
3. Now ask students to verbally describe what they see. Encourage details.
4. After students have described the object in great detail, tell them they will need to use these same observation skills when they are investigating their chosen exhibit.
5. Lead a discussion on what students can do at the New York Hall of Science to help explain and record what they see. Ideas include:
    - Sketching
    - Writing
    - Using exhibit pictures on this web site
    - Photography
6. Distribute The On-Site Investigation Handout (if needed) for use at the New York Hall of Science.
7. Go to the New York Hall of Science.

Second Session

1. Upon return to class from the trip, tell students they will spend time preparing to explain one of the exhibits they saw.
2. Here are some suggestions for student presentations:
    - Verbal explanation (with or without picture)
    - Labeled diagram
    - Group or individual poster showing how an exhibit worked
    - Group or individual model using materials to represent exhibit (materials can be used to substitute and represent real materials from exhibit— ex. Clear plastic wrap simulates glass, cardboard tube becomes a rocket etc.)

Third Session (optional)

Use this time for students to make their class presentations if they made posters, drawings or models.

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Laboratory Activities

Laboratory Activities are designed for the classroom and generally require simple materials. These activities can be done before or after a visit to the New York Hall of Science. To help students use higher-level thinking and generate questions, facilitate discussion with these types of questions:

- What do you notice here?
- Tell me about this.
- What do you see?
- Why do you suppose this happens?
- What can you conclude from the evidence?

Fossil Preservation

Description:
Students hypothesize how different simulated environments might affect fossil development and conduct an experiment with organic materials.

Time:
(1) 30 minute session
2-3 week waiting period
(1) 45 minute session

Materials Needed:

- Access to a freezer
- 1-2 exposed light bulbs or heat lamps

(per student team)

- 3 medium-sized (8 oz) clear plastic cups
- 3 different organic items such as shells, flowers, grapes, dead insects, etc.
- an old toothbrush
- a few toothpicks
- 2 cups of sand
- water
- paper towels
- record keeping paper and pencil
- ruler
- masking tape for cup labels

Preparation:
Have students bring organic items such as shells, flowers, grapes, dead insects, etc. to class. Make sure there are three items per student team.

Procedure:

First Session

1. Tell students they are going to do an experiment to discover how different environments effect the preservation of living organisms when they die.
2. Divide class into working teams.
3. Distribute materials.
4. Tell students that the organic items will change in this experiment and it is important for them to record as much as possible about each item before any change takes place so they can compare later on.
5. Instruct student teams to complete a written description of each organic item. Include the follow-

ing:

- Item name
- Length
- Width
- Color
- Texture
- Any other descriptive data

6. Have students stick a piece of masking tape on the outside of the three cups and label with their team's name and the three environments listed below:
   - Arctic Region
   - Antarctic Region
   - Arid Desert
7. Now instruct students to do the following for each environment:
   - Antarctic Region: Put items in an empty cup and freeze.
   - Arid Desert: Bury items in sand and place under a heat lamp.

   (2-day process)
   - Arctic Region: Fill one cup half-full with water; place items inside and freeze. Next day, fill to top with water and freeze again to ensure all items are fully entombed in ice.
8. Leave items in their respective environments for at least two to three weeks.

Second Session

1. Have students recover their "fossils" and place them on a paper towel for observation.
2. Instruct students to carefully remove the sand from the remains of the buried items. (Old toothbrushes and toothpicks may be helpful. Frozen items should be thawed carefully)
3. Have students teams again measure and describe each item, recording their observations as before.
4. Facilitate a discussion of results or have students write up a report. Here are some questions you can ask:
   - How have the items changed?
   - Which items changed the most?
   - Which changed the least?
   - What were the effects of each of the simulated environments?
   - What are the differences and similarities in the preserved items?
   - Which environment seemed to preserve the items the best?
   - How might an organism appear after 1,000 or more years in each polar environment?

5. Conclude the session by telling students how the polar regions are different in real life:

   - In the Arctic, the temperature rises above freezing fairly often and items are frequently covered with silt-laden water, which then freezes into ice.
   - In Antarctica, the temperature almost never rises above freezing, exposed remains of animals are literally freeze-dried, and natural burial in snow or soil is slow.

Searching for Vents

Description:
In this simulation activity, students search for deep-sea-vents by taking temperature readings of water in a hidden environment.

Time:
(1) 45 minute session (not including preparation)

Materials Needed:

- Electric drill (for teacher preparation)
- Black spray paint (for teacher preparation)
- Plastic garbage bag (for teacher preparation)
- Three small buckets (for teacher preparation)

(per student group)

- Cardboard shoe box with lid
- Plastic ice cube tray
- Thermometer (that can inserted through a small hole)
- Cup with pour spout
- Container of Ice water
- Container of Room temperature water
- Container of Hot water
- 2 sheets of graph paper per student
- Pencils
- Paper towels (and clean up supplies)

Preparation:

- Using a piece of graph paper as a guide, drill 24 holes (4 by 6) through the top of the box lids. The holes should be small, but just wide enough for the thermometer to fit through
- Spray the outside of the boxes with black spray paint to help with the activity visual effect
- Cut up pieces of the plastic garbage bags and line inside of boxes to keep them water proof
- Provide students access to ice water, room temperature water and hot water by having three buckets of each available at a collecting station.

Procedure:

1. Divide students into groups.
2. Distribute materials. (except water)

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3. Tell students this short story:

> Like a closed black box, the deep ocean is full of darkness and mystery. It hasn't been until recently that scientists have had the technology to explore the deepest depths. One of the greatest finds was a 40,000 mile underwater mountain range known as the Mid-Ocean Ridge. The ridge wraps around the world like a giant zipper. When scientists looked closer at the ridge they made an amazing discovery. Cracks or vents near the ridge were emitting extremely hot water. Temperatures reached 570 degrees! An even more amazing discovery was that these deep-sea-vents contained life!

4. Tell students that they are going to do a simulation of exploring for deep-sea-vents.

5. Have student teams use the graph paper to copy the hole pattern on the box top.

6. Have students collect the three water types from the buckets at the collecting station.

7. Instruct teams to fill one section of the ice cube tray with the very hot water and the rest with room temperature tap water and ice water. The very hot water will be the deep-sea vent. Remind students that water near the vent is warm, and gets colder the further away you go.

8. Instruct students to record the location of their deep-sea-vent on their graph paper grid.

9. Tell students to place the ice cube tray inside the box and put the top on.

10. When all teams are ready, have students move to another team's black box.

11. Tell students to copy the grid pattern on a second sheet of graph paper.

12. Tell students they will now try to find the hidden deep-sea-vent.

13. Instruct students to insert the thermometer into the holes, making sure it goes all the way to the bottom.

14. Have students read and record temperatures from the entire grid.

15. When teams have explored the entire grid and recorded temperatures instruct them to examine their temperature data and make a guess or hypothesis as to where the deep-sea-vent is located in the grid.

16. Have teams compare their guesses with the teams who originally created the deep-sea-vent to verify their hypothesis.

17. Conclude the session with this short story:

> In the real world, discovering deep-sea-vents is challenging. While scientists know the vents are near the Mid-Ocean Ridge, they are looking in an area that is 40,000 miles long and 12,000 feet deep. To start their search, scientists send temperature probes into the depths. They know that the water becomes colder the deeper they go down, so if they see an unexpected rise in temperature they hypothesize that a vent may be near. Once they pin point vent locations they send a special submersible down to collect more data, photographs and video.
>
> So why were scientists so excited to find life in these hot deep-sea vents? Well to put it simply, it changed the way scientists thought about where life could exist. With temperatures at 570 degrees and absolutely no sunlight, how could life exist in these vents? The mystery is still being solved, but suddenly there are new clues to how life could exist on other planets with extreme environments.

Adapted from Source: Volcanoes of the Deep Teacher Guide http://www.volcanoesofthedeepsea.com

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Planets in a Bottle

Description:
Students measure the viability of yeast samples in different environmental conditions that simulate other planets.

Time:
(1) 45 minute session (not including preparation time)
Two hours observation and measurement time

Materials Needed:
(for specific groups-see Planet Recipes)

- boiling water
- lukewarm water
- hot orange juice
- vinegar
- UV lamp
- access to freezer
- ice chips
- Epsom salt
- sugar cubes
- Planet Recipe-printouts

(per student group)

- cup
- package of rapid rise baker's yeast
- empty half-liter plastic water bottle
- nine or ten inch party balloon
- cloth measuring tape
- small funnel (optional)
- paper and pencil

Preparation:

- Make copies of Planet Recipes printouts for student groups
- Organize materials for student groups based on Planet Recipes
- Freeze a mixture of water and Epsom salt for the Europa group (see Planet Recipes)
- Freeze the yeast in a deep freezer for the Pluto group (see Planet Recipes)
- Boil water for Mercury group (see Planet Recipes)
- Heat orange juice for Venus group (see Planet Recipes)
- Set up UV lamp for Moon and Mars group (see Planet Recipes)

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Procedure:

1. Tell students they will be creating simulated environments for eight planets or moons to see how friendly they are to life forms.
2. Divide the class into groups according to these eight planets and moons:
    - Earth
    - Mercury
    - Venus
    - The Moon
    - Mars
    - Europa
    - Callisto
    - Pluto
3. Distribute student group materials and Planet Recipe printouts.
4. Tell students this short story:

    The life form you will be experimenting with is a single cell organism related to mushrooms called yeast. There 600 species of yeast, but the one you will be working with is called Saccharomyces cerevisiae, which is Latin for "beer sugar". Now when you open your yeast packages you will not see organisms squirming around. That is because manufacturers discovered a way to dry the yeast so that it stays in a kind of suspended animation or becomes inactive. When you add water to yeast it becomes active. Yeast breathes, eats and reproduces. In this activity we will be able to see yeast breathe and fill a balloon...if the planet conditions are favorable.
5. Review the Planet Recipes with students so everyone in the class knows the different conditions the yeast will try to live in.
6. Ask students if they have any questions about how to use the Planet Recipes.
7. Have students to follow the Planet Recipes.
8. When they are ready, instruct student groups to cap the bottle with the balloon.
9. Instruct students to measure the circumference of the balloon with the cloth measuring tape every 15 minutes.
10. Have students record the measurements over time on a piece of paper.
11. Conclude the session by facilitating a discussion about the results. Here are some questions for your discussion:
    - What planet was the least friendly to yeast microbes?
    - What planet was most friendly to yeast microbes?
    - What ingredients from the planet recipe do you think was harmful to the yeast?
    - What ingredients from the planet recipe do you think was beneficial to the yeast?
    - Other than earth, what planet do you think is most likely to support life?

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Planet Recipes- Print Out

Earth
Earth is a very friendly planet for life.
Earth in a Bottle: Mix water and sugar in water bottle until the cubes are dissolved. Use the funnel to add yeast, the gently swirl the mixture.

Mercury
Mercury's surface is very hot.
Mercury in a Bottle: Boil the water before adding sugar and yeast. Mix water and sugar in water bottle until the cubes are dissolved. Use the funnel to add yeast, the gently swirl the mixture.

Venus
Venus is very hot, and has an acidic atmosphere.
Venus in a Bottle: Instead of water and sugar, use hot orange juice as a nutrient mix. Citric acid in the juice represents sulfuric acid in Venus's hot atmosphere. Lemon juice or vinegar can also be used to increase the acidity of the nutrient mix.

The Moon
The moon has no atmosphere, so that yeast on its surface would be exposed to a strong solar radiation.
Moon in a Bottle: Mix water and sugar in water bottle until the cubes are dissolved. Use the funnel to add yeast, the gently swirl the mixture.
Expose the yeast to a UV lamp.

Mars
Mars is cold and has a thin atmosphere which allows much solar UV radiation to penetrate to its surface.
Mars in a Bottle: Freeze the yeast, then expose the microbes to ultraviolet radiation from a UV lamp before adding yeast to the nutrient mix. Mix water and sugar in water bottle until the cubes are dissolved. Use the funnel to add yeast, the gently swirl the mixture.

Europa
Europa is a moon of Jupiter and may harbor the largest ocean in the solar system. The icy surface is a combination of pure water ice, Epsom salts, and unknown minerals.
Europa in a Bottle: Freeze a mixture of water and Epsom salt. Break the ice into chips and mix the salty ice chips with a cold nutrient solution. Mix cold water and sugar in water bottle until the cubes are dissolved. Use the funnel to add yeast, the gently swirl the mixture.

Callisto
Callisto is a moon of Jupiter and may have a salty ocean beneath its frozen crust. Callisto in a Bottle: Mix water and sugar in water bottle until the cubes are dissolved.
Add common table salt or Epsom salts to the nutrient mix to simulate a salty environment. Use the funnel to add yeast, the gently swirl the mixture.

Pluto
Pluto is the most distant planet from the sun and is very cold.
Pluto in a Bottle: Freeze the yeast in a deep freezer before adding to the nutrient mix. Mix cold water and sugar in water bottle until the cubes are dissolved. Use the funnel to add yeast, the gently swirl the mixture.

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