

Basic Life Support System

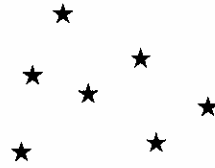
Student Procedures

1. Fill out the "Materials Used Data Sheet" with your team's choice of soil mixture, type and number of seedlings and other organisms, optimal lighting conditions, and the optimal amount of water to add to the biosphere before sealing. Remember that you are trying to create a living system that will remain balanced over a long period of time.
2. Obtain a pre-cut plastic bottle from your teacher and build your personal biosphere following the team's recommendations.
3. Seal your biosphere model with clear plastic tape. Once it is sealed, no air or other materials can go in or out. After the biosphere model is sealed it cannot be reopened.
4. Label the biosphere model with your name, the names of your team members, and the date and the time it was sealed.
5. Set your biosphere model under the lighting conditions chosen by your team.
6. Fill in the "Basic Life Support System Observation Sheet" as directed by your teacher.

Botanist

Recommendations: You should try to find a hardy plant that still may survive in less-than-perfect conditions. Also, if plant-eating animals are being placed in the biosphere, it may be helpful to provide a variety of plant species so that you can better ensure that there will be an acceptable food supply. Garden weeds may work well. Other specific types of plants may include:

- Mung bean, *Phaseolus aureus*—The mung bean grows 76-90 cm tall and has many branches with hairy bean like leaves. Flowers are yellowish-green with purple streaks and produce long, thin, hairy pods containing 9-15 small yellow seeds. Seeds are used to produce bean sprouts.
- Radish, *Raphanus sativus*—Radishes produce white, red, or black roots and stems under a rosette of lobed leaves. Radishes should be planted 1 cm deep and will sprout in 3-7 days.
- Peanut, *Arachis hypogaea*—The peanut belongs to the pea family and grows from 15-76 cm tall. Flowers are small yellow clusters that grown on stems called pegs. Pegs grow downward and push into the soil. Nuts develop from these pegs 3-8 cm underground.



Considerations: For the plants above and for any other plants, you need to consider the following questions.

- What is the best soil type for this plant?
- How much water does the plant require?
- What are the best lighting conditions?
- How tall and fast will the plant grow?
- Will the animals eat this plant?

Soil Specialist

Recommendations: Soil supplies water, nutrients, and gases, as well as structural support to plants. The ideal soil for a biosphere model should hold moisture and nutrients while letting excess water drain to make room for air. There are many types of soil. The following are some examples:

- Clay: Small particles, less than 1/250 mm, which pack closely; clay has poor drainage. However, clay often contains high levels of nutrients and can hold moisture fairly well.
- Sand: Irregular particles between 1/16 mm and 2 mm; sand drains well and is easy to manage, but has a low nutrient content.
- Loam: A mixture of both sand and clay, loam usually drains well and has a high nutrient content, although too much rain can turn it lumpy and a little difficult to handle.

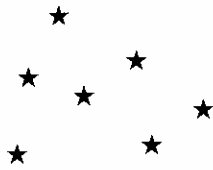
Considerations: When mixing and layering soil, you need to consider the following questions.

- How well does it hold water?
- What is the nutrient content?
- Does it provide structural support for plants?
- How well does it drain excessive water?

Science Specialist

Recommendations: A balanced biosphere model should provide soil, light, oxygen, water and food for living organisms.

- Soil provides nutrients to the plants.
- Plants provide oxygen and sometimes food for living organisms.
- Water is necessary for both plant and animal life. However, too much water can cause plants to rot.
- Light is needed for plants to grow, although different plants require different amounts of light. Too much direct light can burn plants.
- If animals are used, it is important to consider the balance between the amounts of plants and animals. For instance, if you have too many plant-eating animals, they may eat all of their food supply, thus leaving them without food and a means to recycle carbon dioxide into oxygen.



Considerations: When working with your team, you should consider the following questions.

- Are there enough nutrients in the soil for all the plants?
- Is there enough water?
- Is the lighting condition appropriate?
- Does the biosphere model include food for the animals in amounts that will be supportive, not destructive?

Entomologist (optional)

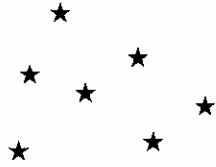
Recommendations: There are a wide variety of insects you can use in your biosphere. However, each insect has its own needs in terms of diet and environment. Here are some examples:

- Ladybugs are commonly known as beneficial insects. Ladybugs eat aphids, which are small bugs that are destructive to plants. A ladybug's life cycle depends on temperature, humidity and food supply.
- Ants eat worms, spiders, and other insects. Areas with red ants have lower infestations of pests. Ants generally burrow and live underground.
- Cockroaches like dark, moist areas with temperatures around 25° C. Cockroaches will eat nearly anything. If a cockroach is in a cardboard or plastic container and there isn't any food, it will start to eat the container.

Considerations: For the insects above, or any others you choose, you need to consider the following.

- What does the insect eat?
- Where do they live?
- What kind of climate are they used to?
- Does the insect need shade or direct sunlight?

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Materials Used Data Sheet

Name: _____

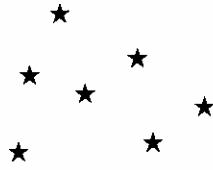
Date: _____

Soil Material	Amount Used—Explain Why
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Seedlings and Insects	Amount Used—Explain Why
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Lighting Conditions—Explain Why	Amount of Water Added—Explain Why
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Date and time it was sealed: _____



Basic Life Support System

Observation Sheet

Name: _____

Date: _____

Date	Lighting Conditions	Plants	Insects	Observations	Color Sketches

Questions & Conclusions:

On a separate sheet of paper, summarize the success or failure of your biosphere model. Be sure to address the following question:

Are some of the biosphere models doing better than others? Why or why not?