



Building a Biodome

David W. Rhyne
MathScience Innovation Center

Developed with funding from the American Council of Engineering Companies of Virginia and the MathScience Innovation Center. Adapted from “Biodomes Engineering Design Project: Lessons 2-6”, Integrated Teaching and Learning Program, College of Engineering, University of Colorado at Boulder, 2004.

Question

How can a biodome be designed and constructed to best meet the needs of an environment?

Standards of Learning

Physical Science, Life Science, Earth Science, Grade Six Science.
Virginia Standards of Learning: 6.1, 6.7, LS.1, LS.4, LS.10, LS.12, PS.10, ES.1, ES.13)

21st Century Curriculum

[Engineering](#): Nature of STEM(1.21, 1.23), Design and Build(2.22)

Background

In this activity students design and build a biodome to investigate ecosystems and interactions of living organisms with the environment. Engineers design and build or adapt existing designs for housing and other structures to work in specific environments. This requires an understanding of ecosystems as well as engineering design. This activity can be done over a single or multiple class periods and can be modified to be open-ended or structured.

Biomes are the result of differences in climate and geology, producing different plant and animal species that interact with one another and their environments. Different environments support not only different species, but also different densities of populations. Engineers need to know about environments and population types and densities when planning developments and structures, including parks and roads, and the impact that development will have on the environment.

How would you design your own environment if you could? What would it look like and what kinds of plants and animals would it have? What could be the population density? The goal of a biome is to have a balanced environment that will support the population. With a biodome we can study the how living things interact with their environment.

Safety

1. Observe regular classroom rules for safety.
2. Teacher should drill holes in bottle caps before class.
3. Closely supervise use of scissors when cutting bottles or plastic trays. Teacher (not students) may choose to cut using an Exacto knife.
4. Set up a hot glue station that can be closely supervised if needed.
5. Be aware of student allergies to insects, grasses.

Materials

For each group of students:

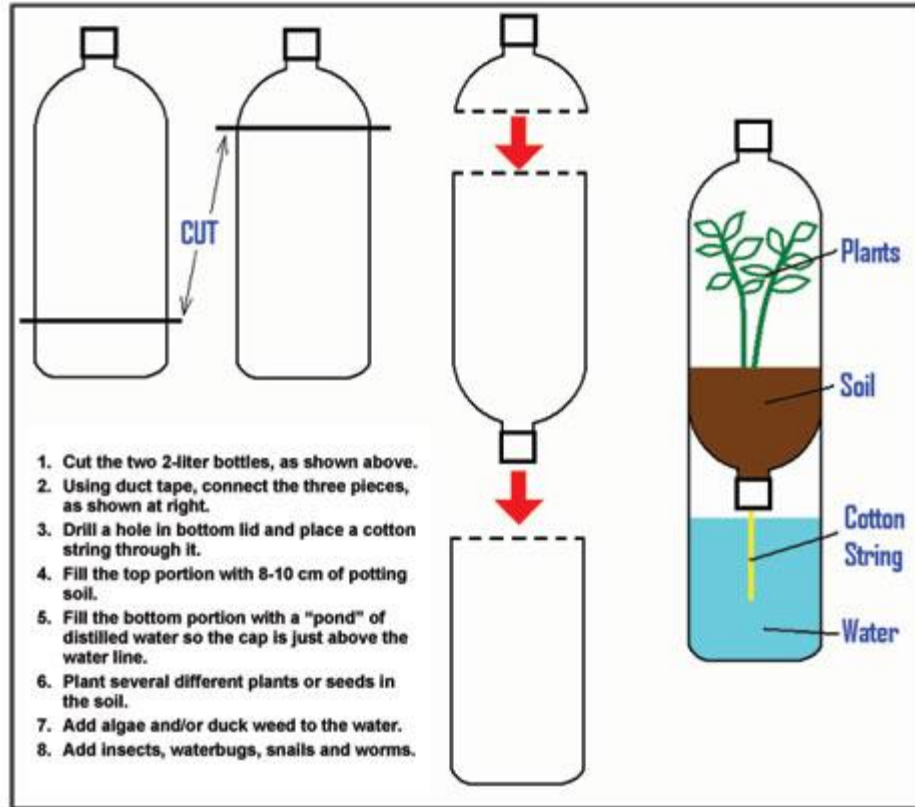
- Plastic containers (1 or 2 liter bottles w/caps, clear plastic food containers w/lids, etc.) You can have students bring materials from home if planned in advance.
- Several types of seeds
- Soil, sand, pebbles/rocks
- Small paper cups, wire, plastic wrap, string, foil, popsicle sticks
- Insects/worms (optional)

For the entire class to share:

- Masking tape
- Duct tape
- Glue (hot glue sticks and glue guns work best)
- Scissors (teacher can use Exacto knife if needed).
- Nets/jars to capture and hold insects (optional)
- water

Procedures

1. Prior to class collect materials and drill holes in bottle caps.
2. Review biomes with students. Biodomes are models of biomes. Tell them they are being asked to design a small scale biodome that will compete with other models. The winning design could be used by engineers to build a large scale biodome.
3. Organize students into groups. Provide them with a list of the materials available. Have them brainstorm ideas on what a biodome should contain, then design their biodome on paper.
4. Get students started by showing them a simple biodome that can be constructed from two soda bottles. Cut the top off one bottle (2-3cm) and the bottom off another bottle (2-3cm). Invert the second bottle and place it into the first bottle and tape the cut-off top onto the second bottle (so it has two tops). Add water into the bottom bottle and soil into the top bottle. Poke a hole in the cap of the bottle that was inverted and put a string into it. The string extends into the water, so that water can “climb” into the soil of the top bottle.



Copyright © Geoff Hill, ITL Program, College of Engineering, University of Colorado at Boulder.

4. Once they have completed their design, provide students with materials and have them build the biodome. Remind them that it needs to be a completely contained (sealed) mini-environment. Use tape and/or hot glue to seal the biodome, leaving the ability to open and close it as needed.

5. As an optional extension take the class outside and let them collect insects/worms to populate their biodome. Point out they do not want animals that feed on other animals in the biodome. Once the food source runs out other animals will die. Discuss the roll of worms (decomposers) in the environment. [If insects/worms are not available due to weather or other factors, you can purchase crickets or snails from a local pet store.] Biodomes can be observed periodically to note changes over time.

Data Analysis/ Results

Once completed, have groups present their biodomes and explain the environment contained in it. Have them address the kinds of plants and animals in their biodome and what plants and animals could be included on a full scale biodome of the same environment. Have them discuss food webs that could be supported in the biodome and energy flow. Where does energy for the biodome come from initially (sunlight)? What are air and water sources and how do they balance?

Conclusion / Questions

1. What challenges did you have building your biodome?
2. How could you improve the structure?
3. Describe the environment in your biodome. Include plants and animals as appropriate.
4. What food webs exist in the biodome?
5. How does the environment in the biodome balance resources (food, water, air)?

References

Teach Engineering

Lesson adapted from “Curricular Unit: Biodomes” at <http://teachengineering.org/index.php>

MathScience Innovation Center

Information on educational programs available to students, teachers and school divisions and procedures for registering for programs. <http://msinnovation.info>

Biodome Challenge

Engle, Patty. A Science, Geography, Language Arts and Technology Webquest for Upper Elementary Grades.

<http://www.todaysteacher.com/BiodomeWebQuest/biodome.htm#Introduction>

PBS Kids, ZOOM.

Activities for kids, by kids.

<http://pbskids.org/zoom/activities/sci/biodome.html>

Wikieducator

A web site devoted to the development of free content.

<http://www.wikieducator.org/Biodome>

Biosphere2

University of Arizona research facility.

<http://www.b2science.org>

The World’s Biomes

University of California Museum of Paleontology

<http://www.ucmp.berkeley.edu/exhibits/biomes/index.php>