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SAHRA Lesson Plan  
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### Biosphere III: Water, Energy and the Environment

#### Overview:

Students prepare contrasting “biospheres” using plastic bottles, place them in a sunny window and record temperature changes with time. The presence of water, with its high specific heat, reduces temperature fluctuations. Students prepare and compare graphs of temperature change with time. They are then asked to make and test predictions about climate in Tucson, Arizona before and during the summer rainy season.

#### Need:

This lesson will demonstrate to students how the presence of water in the environment, through its high specific heat, moderates Earth’s climate. By building and comparing models, students can make and test predictions about the affects of water’s presence on temperature. Combined with the two cloud activities, model building links several of the lessons in the module.

#### Objectives:

Students will be able to:

Describe the role of water in the environment, specifically with regards to its affect on temperature variation.

Define specific heat.

Make and test predictions about climate based on the presence of water in the environment.

#### Connections to Other Units and Disciplines:

This lesson easy links to other lessons in geography, earth sciences and chemistry. The graphing component can easily be expanded to include more mathematics.

#### Equipment List:

Thermometers (1 per group)

Plastic soda bottles (2 per group)

Sand

Water

Graphing paper

#### Introduction to Class:

Carl Sagan, a famous astronomer and philosopher, called Earth a “Pale, Blue Dot”. Dr. Sagan was referring to the fact that as far as we can tell, Earth is unique in among the planets in the Solar System in that we have abundant water. Water, with its unique properties, is essential for life on Earth, shapes the land and, in many ways, determines the climates experienced by all of Earth’s environments. In this lab, we are going to explore the affects of water on climate by building model biospheres and

recording how temperature changes are affected by the presence or absence of water. This may sound like a big idea, but I know you have some experience with how water affects temperature in the environment. (Discuss with class)

#### Instructions to Teachers:

Have the students form small groups (3-4 individuals) and pass out the Student Activity Sheet. This activity is designed to be student-directed with elements of inquiry.

#### Extensions:

Use climate data to have students apply what they've learned building models to make predictions about daily temperature fluctuations in the Sonoran Desert. During the early summer, when conditions are extremely dry, temperatures varies widely over the course of 24 hours. During the late summer Monsoon, the presence of abundant moisture reduces diurnal temperature variations dramatically. Daytime highs don't reach quite so high and nighttime lows tend to be much higher.

Student Activity Sheet  
Biosphere III: Water, Energy and the Environment

Name: \_\_\_\_\_

Period: 1 2 3 4 5 6

Objective:

We are going to make and test predictions about the affects of water on temperature in the environment using model biospheres we build.

Step 1: Making a prediction

How will the presence of water affect temperature? Will water make the environment warmer or cooler? Will the temperature change be more rapid in a wet environment or will temperature change be slower in a wet environment? Discuss this with your group and when you agree on a prediction, record it in the space below. When you are finished, check with an instructor.

Step 2: Designing a test for your prediction

Each group gets two plastic bottles, a thermometer, some sand and some water. Work together as a group to design a way to test your prediction using these materials. Remember, we are trying to better understand the affect of water on temperature in the environment. Also, remember a good design always includes a control. When you all agree, draw a picture of your experimental design below and get checked off by an instructor.

### Step 3: Collecting Data

We will record temperatures in the model biospheres every minute for 10 minutes. Record your data in degrees C and put it in a table below. Each member of the group needs to record data for themselves.

### Step 4: Data Analysis

Using the graph paper provided, prepare a line graph with time on the horizontal axis and biosphere temperature on the vertical axis. Graph both biospheres together using a solid line for your Control and a dashed line for your Treatment. Answer the Discussion Questions below.