

## LESSON 2: THE GREENHOUSE EFFECT

### OVERVIEW:

*This lesson presents students with a review of the greenhouse effect and the overall energy gains by the earth due to the enhancement of this process. To illustrate the ideas presented, the class will do an investigation logging the temperatures inside and outside of an aquarium, with and without vegetation. The molecular level interactions between light energy and gases will then be presented with a PowerPoint in order for students to better understand the proposed mechanism for the greenhouse effect.*

### SUB-QUESTION:

What is the greenhouse effect?

### Ways of Knowing Urban Ecology:



*Students will...*

#### Understand

- Recognize the causes of the greenhouse effect including references to the role of atmospheric gases in capturing energy. (*ecosystem change, ecosystem state and structure*)
- Understand the positive and negative results of the greenhouse effect. (*ecosystem change, forces and drivers, ecosystem services*)

#### Talk

*No specific goals connected with talking about urban ecology in this lesson.*

#### Do

- Students will conduct an experiment investigating the greenhouse effect using a simplified model.

#### Act

*No specific goals connected with acting on urban ecology in this lesson.*

### SAFETY GUIDELINES:

None

### PREPARATION:

#### Time:

1-2 class periods

#### Materials:

#### **Activity 2.1**

Each group will need:

Two clear plastic two-liter bottles with the tops cut off

Clear plastic wrap

Two Thermometers

Small pieces of cardboard or paperboard

Clear tape

Lamp – if it is a sunny day, this may be done outside without a lamp.

Dirt, sand, or rocks

Each student will need:

Copy of the student handout

### **Activity 2.2**

PowerPoint presentation about the greenhouse effect

## **INSTRUCTIONAL SEQUENCE**

### **Activity 2.1: Greenhouse Model**

In this activity, students will be modeling the greenhouse effect that they will learn about in the PowerPoint. This can be done as a whole class or by pairs or groups of students, depending on the materials available and the teacher's preference. The sequence below is written for students in groups. These directions are also stated on the student handouts for this activity.

1. Distribute the student handouts.
2. Divide the students into small groups.
  - Have students make predictions about what they think will happen to the temperature inside each of the bottles and why they think this.
  - It may be helpful to have examples of the two bottles pre made.
3. Each group of students will need to construct their models as follows:
  - In both bottles, a small layer of dirt or gravel should be placed in the bottom to simulate the surface of the earth.
  - A piece of cardboard should be taped to the back of each thermometer, to shield it from the direct light of the lamp. The thermometers should then be taped to the inside of the bottles, facing the inside of the bottle.
  - On one of the bottles, clear plastic wrap should be used to cover the opening at the top.
  - The lamp should be positioned about 6 inches away from the tops of the bottles, centered between the two. If it is a sunny day, this may be done outside without lamps.
4. Students should then turn on the lamps and record both temperatures on their student sheet, every minute for 15 minutes.
5. After recording their data, students should complete the analysis questions on the student sheet.

### **Activity 2.2: PowerPoint**

1. The included PowerPoint will address the common misconception that global warming is caused by the hole in the ozone layer. It will also introduce students to

- the greenhouse effect and its causes. There are notes included for your use within the PowerPoint presentation slides.
2. Key concepts that should be highlighted throughout and at the end of the presentation are
    - a. Radiation from the sun enters the earth's atmosphere. Some of it hits the earth and bounces back into space, but some of the radiation energy is absorbed by molecules in the air causing them to vibrate (acquiring more kinetic energy) increasing the heat energy in the atmosphere.
    - b. The greenhouse effect is important for us to have an environment that is suitable for living. When this effect is enhanced however, the environment can get too hot and impact various ecosystems in damaging ways.
    - c. The main gases which are associated with the greenhouse effect and global climate change are:
      - i. Carbon dioxide
      - ii. Water vapor
      - iii. Methane
      - iv. Other molecules are also discussed in the narrative from lesson 1, but these are the one's that are most generally discussed.

**Concluding the Lesson:**

End class having students reflect on the following questions:

“How does the greenhouse effect on earth allow life to exist on this planet?”

Or

“Of the greenhouse gases mentioned, which do you think humans might be able to have some control over? Why?”