

Training for Educators

Energy Transfer

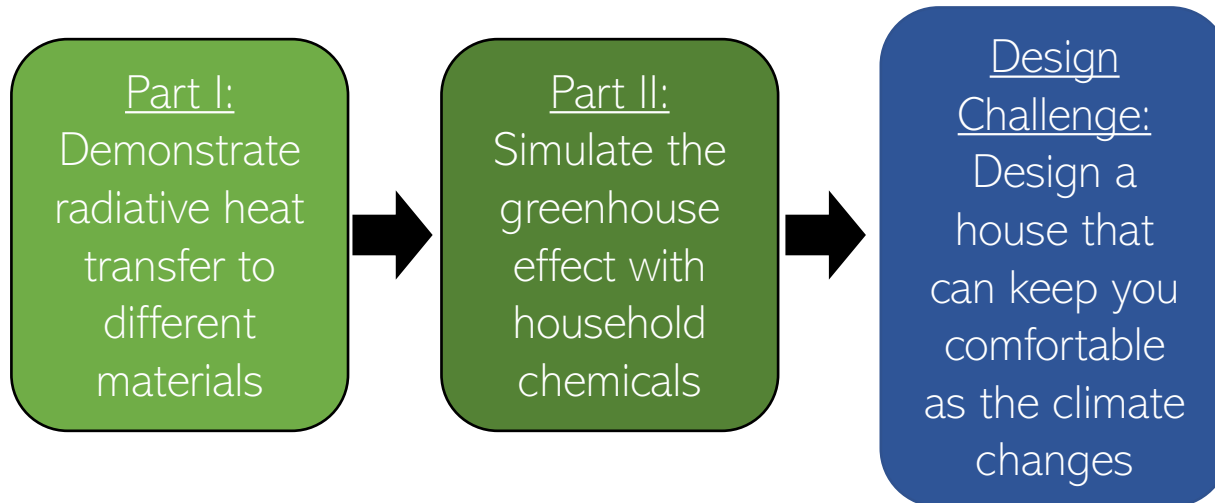
Primary Level

Ages ~6-12

Mission of the lab

- This laboratory will teach energy transfer concepts to a target audience of elementary/primary-aged students (ages ~6-12) through experiments related to energy transformation and energy absorption.
- The main takeaways are:
 - Some materials transfer heat more easily than others: metals transport heat the fastest, followed by ceramics and glasses, and plastics, which heat up the slowest.
 - Greenhouse gases are produced naturally and by activities on Earth such as burning fuels. These gases can become trapped in the Earth's atmosphere, making the Earth hotter.
 - The Sun heats up the Earth through radiation, a type of heat transfer.

Summary of experiments



There are 2 experiments and a design challenge.

Supplies list

- 1 glass object, 1 metal object, 1 plastic object
 - Optional: Fabric, ceramics, rocks, plants, whatever materials you think may be fun to try!
- 5 glass or plastic jars
 - These can be used food or drink jars
- 1 marker for writing on the jars
- Plastic covering for the jars (can be plastic wrap, a plastic bag, or any other flexible plastic material)
- Elastic band or fabric strip to secure the plastic around the jar
- 1 measuring cup
- Two chemicals (one from Chemical 1 options and choose Chemical 2 based on Chemical 1) to make the greenhouse gas reaction occur
 - Chemical 1 options:
 - Vinegar
 - Ketchup
 - Soda (any carbonated beverage)
 - Chemical 2:
 - If Chemical 1 is vinegar or ketchup:
 - Baking soda
 - If Chemical 1 is soda:
 - Salt
- Thermometer (optional)

Safety considerations

Before the students begin the laboratory, please take into consideration the following safety concerns:

- Students should be aware that objects may heat up in the sunlight and should be cautious touching objects (especially metal) that have been left in the strong sunlight for long periods of time.

Setting up your space

- Gather your supplies and separate by experiment(s) on your table.
- These are our recommendations:
 - Each student should have a pencil or pen.

Groups of 2-4 students can be given the following supplies:

- 1 glass object, 1 metal object, 1 plastic object (Part 1 can be done as a class if needed) , any other objects students would like to test
- 5 glass or plastic jars
- Plastic for covering the 5 jars
- 5 rubber bands or pieces of fabric for securing the plastic to the jars

The class can share the following supplies based on availability

- Measuring cup or cup to approximate 60 mL or ¼ cup
- Measuring spoon for 15 mL or 1 tablespoon or 1 spoonful
- Chemical 1 for the class (60 mL x number of groups)
- Chemical 2 for the class (15 mL x number of groups)
- Marker or pen for labeling jars
- A thermometer (optional)

Part I. Heat transfer

- Set-up:
 - Each group of 2-4 students gets 1 glass, 1 plastic, and 1 metal object. Any additional materials or objects may be tested as well.
- Procedure:
 - Students make predictions about how they think the objects may heat up in the Sun and then test out their predictions. Students can use thermometers or their hands to test the temperatures of the items.
- Results:
 - The metal object should heat up the most, then the glass, then the plastic.

The takeaway is that objects transfer heat differently based on what they are made from!

Part II. Make your own atmosphere!

- Set-up:
 - Each group (2-4 students) will need 5 jars made of glass or plastic with plastic coverings. The student groups can measure the appropriate amounts of chemicals 1 and 2.
- Procedure:
 - Students will prepare 5 jars filled with: nothing (only air), only chemical 1, only chemical 2, both chemicals uncovered ("open greenhouse effect" jar), and both chemicals covered ("closed greenhouse effect" jar). The students will prepare these jars and place them in the Sun and observe the temperature changes of the jars (i.e., the air in the jars) over time.
 - If your class is short on jars, students can prepare 1 jar at a time (or sets of 2 or 3) to test the temperature changes before reusing the jars.
- Results
 - The students should observe the "closed greenhouse effect" jar heats up the most! This is a simulation of what happens on Earth when we create greenhouse gasses.

This experiment simulates the greenhouse gas effect and teaches students about "control" groups in science experiments (these are the jars with nothing in it, chemical 1 only, and chemical 2 only).

Part II Results - "Closed Greenhouse Effect"



Before adding "2nd chemical" to jar



After adding "2nd chemical" to jar and securing opening with plastic. You may notice the gas ballooning the plastic slightly. Be sure to have a good seal with the elastic band to keep your gases trapped in the jar!

Design challenge

Students are asked to design a resilient house that can keep them safe and comfortable now and as the climate changes.

- Questions to ask the students
 - What weather events might you have to protect against?
 - What materials would you want your house to be made from? Are the materials different for the roof, walls, doors, and floor?
 - Do you want lots of windows and doors?
 - Do you want the Sun to shine into your house? Consider how this could be both a positive and a negative.
 - How could you make sure the stove does not heat up your house during cooking?

Troubleshooting

- Try to pick a sunny day to do these experiments, as they rely on the heat from the Sun to help students make conclusions.
- If you are having trouble heating up the objects inside, try moving the class outside if possible.