

# Earth in a Jar

## Subject

Earth and Human Activity

## Objectives

The students will:

- Understand the meaning and components of climate change
- Be able to demonstrate how greenhouse gasses cause heat trapping

## Materials

You will need outdoor space and a sunny day for the following activity:

- Open White Board Space
- 2 small thermometers (per group, depending on class)
- 2 ice cubes (per groups, depending on size)
- 1 large glass jar (per group, depending on class)
- Heat Trapping Work Sheet

## Size/Setting/Duration

Entire class/classroom and outdoor space/~1 hour

## Background

**Climate change** is a term used to define global or regional climate patterns, in particular a change largely attributed to the increase in atmospheric **carbon dioxide** produced by the use of fossil fuels (oil, natural gas, coal, etc.). **Fossil fuels** are **nonrenewable resources**, or resources that cannot be replaced once they are used, and is the most common energy resources used by people to power phones, cars, buildings, etc. **Renewable** resources also exist and are often “cleaner” than nonrenewable resources. These include wind, solar, and hydro power. Renewable resources tend to be “clean” because they are reusable, whereas nonrenewable resources are utilized vis the burning of fossil fuels that cannot be re-burned to create more energy.

Sunlight reaching the Earth can heat the land, ocean, and atmosphere. Some of that sunlight is reflected back to space by the surface, clouds, or ice. Much of the sunlight that reaches Earth is absorbed and warms the planet. Burning fossil fuels emits carbon dioxide in the air. Carbon dioxide is important for the Earth because it traps the sun's warmth and allows life on Earth to flourish.

However, as our population grows, we are burning more fossil fuels and producing more carbon

dioxide, which acts as a heat trapping blanket, causing warmer temperatures than ever recorded and odd weather patterns.

### Procedure

1. Begin the lesson by flipping off the light in your classroom. Explain that in a world without energy, many things we depend on every day, including lights, cars, washing machines, and phones, would not exist. Ask your students where we get the majority of the energy we use (i.e. How do we power cars? How do we warm our homes?). Ask the class what the word energy means. After some discussion, explain that energy refers to the power created by the use of resources.
2. Introduce students to the words renewable and nonrenewable resources. Write their ideas about each word and what resources they think fit under each category on the board. Once some ideas have been suggested, provide the students with the definitions of renewable and nonrenewable resources.
3. Tell your students that humans get most of their energy from burning nonrenewable resources called fossil fuels (coal, oil, gasoline, and natural gas). Burning releases carbon dioxide into the air. The carbon dioxide builds up in the atmosphere where it acts like a heat-trapping blanket. Show students this 2 minute [video on climate change](#) to familiarize students with the effects of burning fossil fuels.
4. Tell the student that they are going to carry out an experiment to show how this heat trapping blanket works.
  - a. Show students that you will be going outside with two identical thermometers and two identical cubes of ice, one set of each will be put in a glass jar while the other set will remain outside of the jar. Explain that the glass will act like carbon dioxide in the atmosphere that is released from the burning of fossil fuels.
  - b. Ask learners to use their existing knowledge and experiences to predict what will happen to the temperature and the ice over time. Use the Heat Trapping Work Sheet to write out a hypothesis.
    - i. Do you think the temperature will always be the same on both thermometers at any given time?
    - ii. What do you predict will happen to each ice cube?
    - iii. Why do you think this is?
  - c. Explain that learners are going to try this experiment (alternatively, you could do this as a whole class). Organize learners in groups of three. Explain that each group will need to place the thermometer and ice sets on the same type of surface (i.e. concrete, grass, etc.) side-by-side. They will then enclose one pair of thermometer and ice cube in a large glass jar – explain that this is like the heat trapping blanket caused by burning fossil fuels.

- d. They should take and record the readings from each thermometer and write observations of the ice cube straight away; again after 20 minutes, and again after 40 minutes.  
*Safety Note: Ensure learners take care when handling glass jars to minimize the risk of breakage and possible injury.*
- e. Ask students to record their results using a table and line graph.
- f. Ask learners to compare the temperature changes for each thermometer and the sizes of each ice cube.
  - i. What did you find?
  - ii. Why do you think this happened?
  - iii. Where your predictions correct?
- g. Recap on what the students learned about climate change – gases such as carbon dioxide have a similar effect on the Earth's temperature as the glass jar had on the thermometer and ice cube. Carbon dioxide is important for us as it has made the Earth warm enough to support life. However, human activity (such as burning fossil fuels – a nonrenewable resource) is causing great carbon dioxide emissions, which makes the “heat trapping blanket” around the Earth warmer. Scientists predict many negative effects as a result of these changes in temperature and people are already being affected.
  - i. What do these results tell us about glaciers, snow pack, and ice caps?
  - ii. Write ideas as a class that can help reduce the emission of carbon dioxide (i.e. reduce energy use by turning off lights when you leave a room). Encourage students to go home and talk to their family about these opportunities.

### Extension

Have student groups put their samples on different types of surfaces (i.e. concrete, glass, soil, etc.) and compare how the effect is different on each type of surface – what does this mean for climate change as we build more roads and fewer green spaces are available?

Next Generation Science Standards**Performance Expectation**

**4-ESS3-1:** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Scientific and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<ul style="list-style-type: none"> <li>▪ Constructing Explanations and Designing Solutions</li> <li>▪ Obtaining, Evaluating, and Communicating Information</li> </ul>	<ul style="list-style-type: none"> <li>▪ ESS3.A: Natural Resources</li> <li>▪ ESS3.B: Natural Hazards</li> </ul>	<ul style="list-style-type: none"> <li>▪ Cause and Effect</li> <li>▪ System and system models</li> </ul>

## Heat Trapping Work Sheet

1. Write a hypothesis about how you think the glass jar will affect the temperature and ice and how this will differ from the temperature and ice outside of the glass jar.

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2. Use the table and graph below to record your results.

Time	No Jar		Jar	
	Temperature	Ice Observation	Temperature	Ice Observation

3. Write complete sentences about your conclusion of the experiment. Was your hypothesis correct?

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