Climate Change

By Monica Baker

What Decides the Climate?

Weather (weath-er) and climate (cli-mate) are not the same. Climate is the average weather over a long time. Earth’s water, land and atmosphere (at-mo-sphere) make up the climate system. The climate system decides what the climate will be. Earth gets its energy from the Sun. The atmosphere circles Earth and protects it from getting too hot or too cold.

Gases like carbon dioxide (car-bon di-ox-ide) can get trapped in the atmosphere. When this happens, the climate can get much hotter. It can feel like being inside of a greenhouse. It is called the "greenhouse effect."

(See picture, “Diagram: Earth’s Atmosphere and Climate System.”)

Do Our Actions Affect the Climate?

When too many gases fill the atmosphere over a long time, it can cause "global warming" (glo-bal warm-ing). Scientists have studied global warming over the last 50 years. Most scientists agree that global warming is caused by humans. Too many gases get into the atmosphere when people use too much energy. This can be from electricity, transportation or industry (in-dus-try).

Vocabulary

Choose the best word or phrase. Fill in the blank.

global warming
climate
greenhouse effect

Climate system is to ______ as clouds and water are to rain.
Carbon dioxide is to ______ as rain is to a rising river.
Greenhouse effect is to ______ as a rising river is to a flood.

BONUS: Earth's ______ is to human health as shoelaces are to shoes. (See paragraphs above.)

Weekly Lab

Adult Supervision Recommended

Main Question: Will two different systems trap heat the same way?

You need: two 12-oz mason jars with lids; two small thermometers to fit in the jars,
scotch tape, 1 cup dirt, 1 cup sand, sunny window or heat lamp, pencil, science journal

(See picture, "Activity: Trapping Heat Experiment.")

Step 1: Label the jars "1" and "2."

Step 2: Tape a thermometer on the upper inside wall of each jar. (Face the thermometers toward the inside of the jars.)

Step 3: Place the dirt into jar 1 and close the lid.

Step 4: Place the sand into jar 2 and close the lid.

Step 5: Trial 1--Read the temperatures inside each jar and fill in the chart for Fahrenheit (°F) and Celsius (°C).

Step 6: Place the jars in the sunny window. Wait 30 minutes.

Step 7: Trial 2--Read the temperatures inside each jar and fill in the chart for Fahrenheit and Celsius.

Which jar got hotter? Why do you think this happened?

Math
What happened to the temperature in each jar when exposed to heat? Which climate system appeared to absorb more heat? Fill in the temperatures from your data chart. Solve the math sentences.

(See picture, "Math Activity: Trapping Heat Data.")

Writing in Science

Look at your WEEKLY LAB results. Did the temperatures increase in both jars? Which jar increased more? Do you think it would be healthier to live surrounded by sand or dirt? Think carefully. Write three sentences and use descriptive words.

Challenge

Write a letter to a friend and ask him or her to be your "green pal!" When people use too much energy it increases global warming. What are some ways you can help each other be more careful about energy use? Write about some ways you can REDUCE, REUSE and RECYCLE.

Puzzle

You Know What To Do!--REDUCE, REUSE, AND RECYCLE!

Cut out the shapes and paste them together on a separate sheet of paper to make a happier, healthier planet Earth.

(See picture, "Puzzle: Reduce, Reuse, Recycle.")

Background

Climate is rapidly changing, and these changes are impacting human health—specifically the health of populations who have few resources to adapt to the challenges climate change brings. Humans should understand the basics of climate change and how we can slow global warming.

Earth’s atmosphere, water, land, and life interact to form our climate system, which absorbs most of its energy from sunlight. When Earth emits the same amount of energy it absorbs, it functions in an energy balance. It tilts out of balance when too many heat-trapping gases, like carbon dioxide, are emitted into Earth's natural enclosed "greenhouse environment."
When too many natural or human-induced heat-trapping gases fill the "greenhouse," Earth's temperature increases, the climate changes, and we have global warming. The latest Intergovernmental Panel on Climate Change states emphatically that the global warming observed over the last 50 years is due primarily to humans.

Humans are intensifying the "greenhouse effect" by burning excess fossil fuels—coal, oil, and natural gas—which release carbon dioxide into the atmosphere. Carbon dioxide mixes with sunlight to increase temperatures, and create smog.

Simultaneously, we are decreasing our natural "carbon sinks"—the reservoirs that absorb and remove carbon dioxide from the atmosphere. Trees, healthy oceans, and plant life are all major "sinks" that naturally reduce carbon dioxide and protect our health.

Vulnerable human populations who suffer from pollution now will suffer even more in the future. These people live in poor conditions, lack the resources that help them adapt to change, and are usually people of color. As temperatures rise, pollution and heat stress worsen. So do illnesses and disasters due to heat and flooding. Ironically, studies show that these same populations produce far fewer emissions than do the more affluent populations who suffer less.

At this stage, humans should know that, while we cannot reverse the effects of global warming, it can be slowed. We must decrease our emissions. Each individual must focus on ways to use less energy and reduce the amount of heat-trapping gases. At the same time, we need to learn new ways to help people adapt to climate change already happening.

Initiating Questions

1. What makes up Earth's climate system? (Earth's water, land, life, and atmosphere)

2. What is the "greenhouse effect?" (Gases trap heat in Earth's atmosphere, causing temperatures to rise, as in an enclosed greenhouse.) Is it a natural effect? (Yes)

3. What do you think happens when humans use too much energy? (We disturb the energy balance by adding too many harmful gases to the atmosphere)

4. What is global warming? (The energy balance changes, and the greenhouse effect causes temperatures to rise globally)

Follow-up Questions

5. Why do you think the Earth's energy balance is important to us? (Our life and health are affected)
6. Who do you think suffers the most from the impact of global warming in the U.S.? (vulnerable, often poor populations already at risk and without resources to combat the changes)

7. What do you think humans can do to slow global warming? (Use less energy)
How can we do that? (We can commute on foot or bike, use low energy light bulbs and appliances, and of course, "Reduce, Reuse, and Recycle!"

**Main Concept**

Students will understand the basics of climate and how it differs from weather, and how Earth's climate system affects climate. Earth gets its energy from the Sun. When Earth "gives off" the same amount of energy it absorbs, it is in "energy balance." Additionally, students learn about the "greenhouse effect" and that humans can affect the Earth's energy balance by releasing too many gases, such as carbon dioxide, into Earth's atmosphere, which leads to global warming.

**Vocabulary**

*Answers: climate, greenhouse effect, global warming*

*Bonus: energy balance*

**Weekly Lab**

Students create a model of an enclosed climate system. Students will see that heat from the Sun can be trapped inside. Discuss how gases in Earth's atmosphere can trap heat too, just like the lid of the jar. Tell them this is called the "greenhouse effect." Additionally, students will learn how different climate systems trap heat differently.

**Math**

Students will solve math sentences based on the data from their WEEKLY LAB.

**Writing in Science**

Students will write about their WEEKLY LABS, answering questions which are designed to get them thinking about Earth's various climate systems, and to form conclusions based on their data.

**Challenge**
Students are asked to write a letter to a "green pal," asking for a pledge to help each other reduce his carbon footprint.

Explain to the children the five parts of a letter: The heading includes the address and the date. The salutation is the greeting and usually starts with "Dear" and is followed by the friend's name and a comma. The body is the information the child is writing. In closing, the first word is capitalized and a comma follows the last word, like: "Yours truly," The signature goes under the closing.

Puzzle--You Know What To Do!

Children will cut out the illustrated puzzle shapes and will paste them together on a separate sheet of paper. They will learn ways to "Reduce, Reuse, and Recycle" for a healthier Earth!

Weekly Resources

Helpful Sources for Planning Your Science

Weekly Classroom Activities

Recommended Resources

Documents

*Climate* Literacy, *The Essential Principles of Climate* Sciences, A Guide for Individuals and Communities

Global *Climate Change* Impacts in the United States

Downloadable Documents

"U.S. Global Change Research Program/Climate Change* Science Program"

http://www.climatescience.gov

(Document is available at original web site.)

Internet Resources

American Public Health Association

http://www.apha.org search "Climate Change"

National Oceanographic and Atmospheric Administration

http://noaa.gov

U.S. Environmental Protection Agency

http://epa.gov/climatechange
World Wildlife Fund
http://www.worldwildlife.org/climate

Did You Know??

• The atmosphere is the protective shield around the planet and is made up of gases.

• The atmosphere is a thin layer of gases that protects life on Earth by keeping temperatures down and by blocking the most harmful rays from the Sun.

• Earth has warmed 2°F over the last 50 years. Sea levels have risen 2.5 inches.

• Earth is in energy balance when it gives off the same amount of energy as it absorbs.

• Energy use gives off carbon dioxide. The amount given off by something is called its "carbon footprint." Some things make a bigger carbon footprint than others.

• Since the beginning of the industrial revolution (about 1750), humans have intensified the greenhouse effect by increased energy use.

• A carbon footprint is a measure of how much carbon dioxide is released into the atmosphere by an activity or a device.

• Life on Earth depends on, is shaped by, and affects climate.

Citations

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