Greenhouse Gases

» Essential Question: Where do greenhouse gases come from and how do they affect the atmosphere?

» Materials: graph paper, pencils, colored pencils, rulers, Internet access

» Activity Sheet: It's Getting Hot in Here

» Time Required: 40 minutes, plus homework

» Background Resource: Learn the Basics epa.gov/climatetestudents/basics/index.html

LEARNING OUTCOMES

Students will be able to:

1. Name the type of energy provided to Earth by the sun.
2. Describe the processes by which Earth receives energy from the sun and by which greenhouse gases trap this energy to keep our planet warm.
3. Plot a graph tracking data over time.
4. List three reasons why children are vulnerable to the health effects of climate change.

INTRODUCE THE CONCEPT

Ask students to describe what happens in a closed car on a sunny day. How does the temperature differ inside and outside the car? (If circumstances allow, consider going out to the parking lot to measure the air temperature inside and outside a car.) Explain that the car’s closed windows prevent heat energy from escaping the car. This illustrates the greenhouse effect. While the air in our atmosphere goes through much more complex processes than air trapped in a car, the intense heat in the closed car demonstrates the concept of heat becoming more extreme when trapped by greenhouse gases.

EXPLORE THE SCIENCE

Have a class discussion about energy, the atmosphere, and the role of greenhouse gases:

» Earth receives energy from the sun in the form of sunlight. The energy that is not reflected back into space is absorbed by land and water. After being absorbed, some energy is released back into the atmosphere in the form of infrared radiation, or heat energy.

» Gases in Earth’s atmosphere help Earth maintain balanced temperatures by trapping some of that heat close to Earth. Those gases—called greenhouse gases—hold in the heat needed for plants and animals to survive.

» Greenhouse gases are created both as part of natural environmental cycles and as a result of human activity. Carbon dioxide (CO₂) is one of the main greenhouse gases in our atmosphere. Watch this carbon cycle video with your class to learn how carbon is balanced in our atmosphere and how it is becoming imbalanced: epa.gov/climatechange/students/basics/today/carbon-dioxide.html.

COMPLETE THE ACTIVITY

Distribute Activity Sheet A: “It’s Getting Hot in Here.” Explain that scientists use monitoring stations like Mauna Loa Observatory in Hawaii to collect data about the amount of CO₂ in the atmosphere. This data demonstrates how the levels of CO₂ are changing over time. Review the introductory information with students, then have them select a month to graph the rise in CO₂ levels over time. Ask students to describe the results and discuss their conclusions.

APPLY THE KNOWLEDGE

Ask students to discuss why climate change has a large impact on children. For background, have students consider how plants, animals, and people rely on the environment for survival.

» Print out or project “How could climate change affect children’s health?” at epa.gov/climateforaction/pdf/Section_3.pdf.

» Using page 7 of the PDF, have students explain how children are particularly affected by climate change. Make sure they factor in the impact of extreme changes in temperature, air and water quality, and weather due to climate change. Note, you will review these impacts in greater depth in Lesson 4.

» Separate students into groups to do brief research on one of the following topics to explain the impact of climate-related air quality on children’s health: smog, airborne allergens (aeroallergens), longer allergy seasons, and increased asthma attacks.

Family Connection: Direct students to investigate their county’s top industrial contributors to greenhouse gases with their families. Instruct them to visit ghgdata.epa.gov/ghgp/main.do and select their state under “View Facilities in Your State.” After selecting their county on the state map or from the menu, they should click on one of the building icons. Ask them to research what type of facility it is and to work with their families to identify what products the facility produces or what process the facility manages. After the family discussion, have students use their findings to write a profile of three facilities that contribute to their state’s greenhouse gas emissions. In their profiles, students should include additional research about how greenhouse gases are released from the facilities.

ADDITIONAL RESOURCES

» Global Climate Change: climate.nasa.gov

» Ice Cores: britannica.com/EBchecked/topic/281089/ice-core

» PPM: climatekids.nasa.gov/health-report-air

» Carbon Concentration: carbonvisuals.com/blog/400-ppm

» 400 ppm: scripps.ucsd.edu/programs/keelingcurve


» Mauna Loa Observatory: esrl.noaa.gov/gmd/obop/mlo

It’s Getting **Hot** in Here

Greenhouse gases exist naturally in Earth’s atmosphere. Without the greenhouse effect, our planet would be so deadly cold that all water on Earth would freeze and life, as we know it, would not exist. But greenhouse gases function in a delicate balance. Add too many to the atmosphere and the planet’s temperature rises higher and higher. When we burn fossil fuels for energy, we release large amounts of carbon dioxide and other greenhouse gases into the atmosphere, endangering our planet’s delicate temperature balance.

**The Path to 400 ppm**

By measuring the levels of carbon dioxide in ice cores recovered from Antarctic and mountain glaciers, scientists have determined that the natural CO₂ range in the past 800,000 years was 170 to 300 ppm (parts per million, which measures how many parts of CO₂ are in one million parts of air). Many scientists believe 350 ppm or less should be the maximum level of CO₂ in the atmosphere. Data from the Mauna Loa Observatory monitoring station in Hawaii demonstrated that in April 2014, CO₂ reached an average monthly concentration of 400 ppm for the first time in recorded history! Check out the historical data below to see just how much the CO₂ levels in the atmosphere have increased over time.

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**Graph It!** Choose one month between January and June and graph the changes in CO₂ levels from 1960 to 2015.