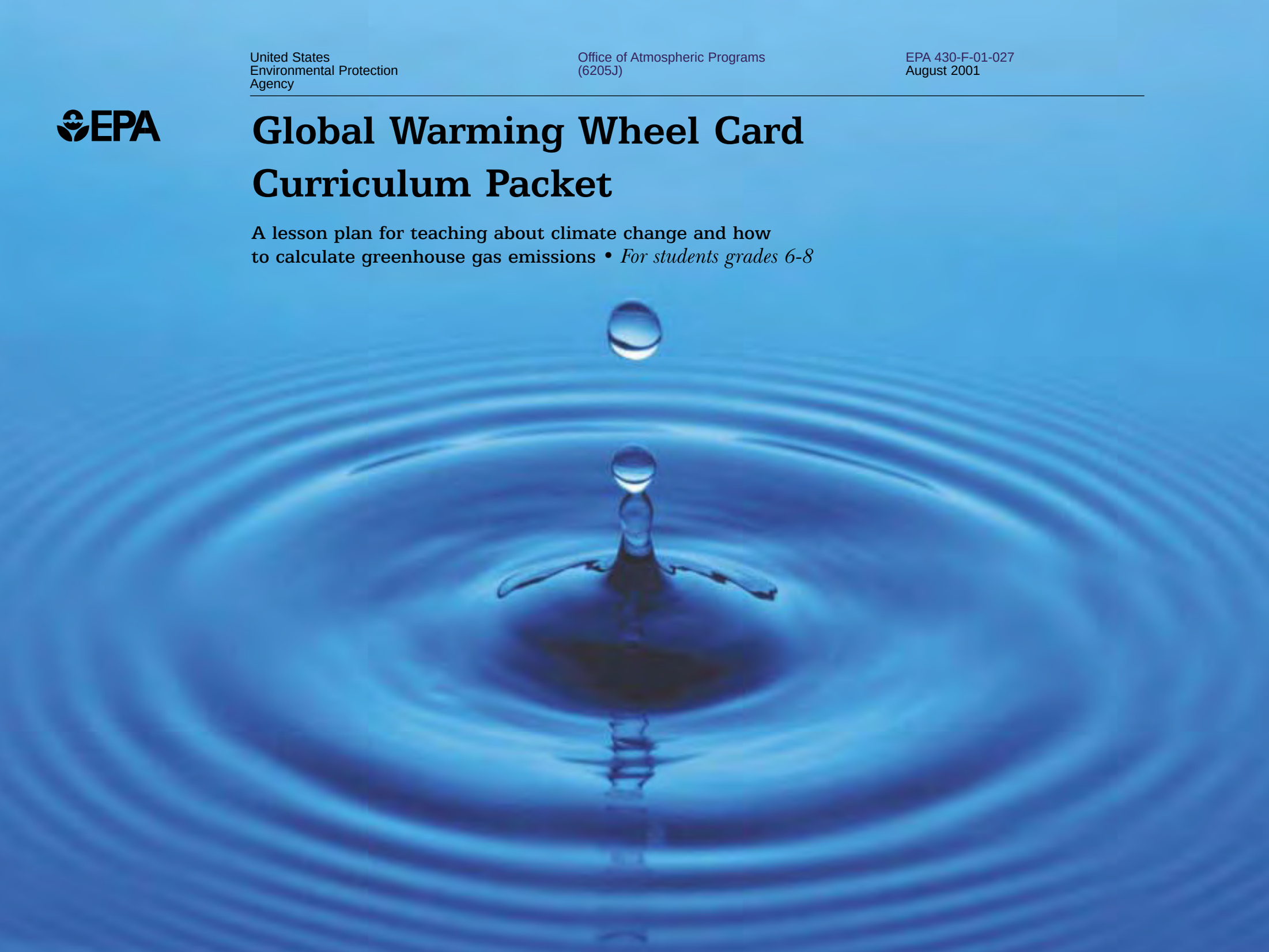
United States
Environmental Protection
Agency

Office of Atmospheric Programs
(6205J)

EPA 430-F-01-027
August 2001

Global Warming Wheel Card Curriculum Packet

A lesson plan for teaching about climate change and how to calculate greenhouse gas emissions • *For students grades 6-8*



Global Warming —

What's Your Score?

In the United States, a typical household of two people generates approximately 60,000 pounds of carbon dioxide (CO_2) emissions every year from household activities and personal transportation.

Home Heating

EPA
United States Environmental Protection Agency
Office of Air and Radiation
Office of Atmospheric
EPA-430-Y-0-007
November 2000

United States Environmental Protection Agency
Office of Atmospheric Programs (6205J)
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August 2001

Welcome to the Global Warming Wheel Card Curriculum Packet

The U.S. Environmental Protection Agency has designed this curriculum packet for teachers of grades 6 through 8 to use for teaching students about global warming, its possible effects, and the kinds of

What are the objectives of this curriculum packet?

The materials in this packet are designed to introduce students to:

- The concept of the greenhouse effect
- Carbon dioxide as a greenhouse gas
- Common sources of carbon dioxide generated by humans and the role of carbon dioxide in increasing the greenhouse effect

- A Global Warming Wheel Card that enables students to see their individual roles in generating carbon dioxide and therefore increasing the greenhouse effect
- Ways in which they might reduce their individual, family, school, and community contributions to the greenhouse effect

For more information on climate change,

see EPA's Global Warming Site at

www.epa.gov/globalwarming.

The site has up-to-date information on the climate system;

greenhouse gas emissions;

impacts of climate change; and actions that can be taken

at the national, state, local, business, and individual levels.

For more information on calculating greenhouse gas emissions, see www.epa.gov/global warming/tools/calcualtors.html.

EPA's Climate Change Education Database provides educators with a complete, searchable menu of lesson plans, videos, books, toolkits, and other educational resources on climate change. To visit the site see www.XXX.

Basic-level and advanced Fact Sheets on global warming are located at www.epa.gov/globalwarming/publications/outreach/index.html.

The U.S. Environmental Protection Agency (EPA) developed this curriculum packet for teachers of grades 6 through 8 to use for educating students about climate change. The materials are designed to:

- Introduce students to the concept of the greenhouse effect, its sources, and potential impacts
- Enable students to calculate a household's greenhouse gas emissions using a hand-held Global Warming Wheel Card
- Show students how to conduct a simple energy audit of their classrooms and identify ways in which they can help conserve energy
- Encourage students to think about ways to reduce their individual, family, school, and community contributions to the greenhouse effect

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Global Warming Wheel Card

- Cut out the two large circles and the two large rectangular pieces.
- Cut out the two little rectangular windows on each of the large rectangular pieces.
- Put glue on the backs of both circles and put them together to make the "wheel" of the wheel card, making sure that you align them so that the four labels that run along the outside of each circle (Waste Disposal, Home Heating, Electricity Use, and Transportation) line up with the corresponding labels on the other side. The Waste Disposal label on one side should line up with the Waste Disposal label on the other side, and so on.
- Lay the rectangular piece entitled "What Can You Do?" upside-down on the table with the larger of the two cutouts closer to you. If you lift up the edge of the rectangular piece and see the words "Global-Warming—What Can You Do?" right side up, you've done it correctly.
- Put the glued-together wheel on top of the rectangular piece, with the side that has all the questions (such as "On average, how much does your household spend on electricity each month?") facing up.
- Lay the other rectangular piece entitled "What's Your Score?" on top of the wheel, with the smaller of the two cutouts closer to you.
- Look for the "belly button" on the pasted-together wheel and the two large rectangular pieces. Push a paper fastener ("brad") through the "belly button" to hold all the pieces together.
- Glue the large rectangular pieces in all four corners just enough to hold the rectangles together but allowing the wheel to turn freely.
- If you wish, highlight each line inside the windows in a different color to make it easier to read. If you have access to a color printer, this step will be unnecessary.
- If you are putting the wheel together to use in a demonstration, now you're ready to calculate the greenhouse gas emissions "score" of members of your audience and what they can do to reduce it.

Side 1

Side 2

If you have access to a color printer and would like to download additional color Global Warming Wheel Cards, please visit the EPA Outdoor Recreation and Wildlife Toolkit homepage at www.XXX.

Global Warming Wheel Card

Side 1
[outside]

Global Warming Wheel Card

Side 1
[inside]

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Global Warming Wheel Card

Side 2
[outside]

Global Warming —
What Can You Do?

If you took all of the actions on this wheel card, you could save 22,800 pounds of carbon dioxide (CO_2) annually and $1,000 from your annual home energy bill and gasoline costs.

Actions You Can Take

Pounds of CO_2 You Can Save

Resources

U.S. Environmental Protection Agency website: www.epa.gov/globalwarming

Energy Star® website: www.energystar.gov.

Summary of assumptions used in this wheel card: www.epa.gov/globalwarming/climatelink/ and look for the greenhouse gas calculator.

Global Warming Wheel Card

Side 2
[inside]

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Welcome to the Global Warming Wheel Card Curriculum Packet

The U.S. Environmental Protection Agency has designed this curriculum packet for teachers of grades 6 through 8 to use for teaching students about global warming, its possible effects, and the kinds of activities that individuals, families, schools, and communities can take to reduce their contributions to global warming. The activities in this curriculum are focused on a Global Warming Wheel Card, which is included in this packet.

What are the objectives of this curriculum packet?

The materials in this packet are designed to introduce students to:

- The concept of the greenhouse effect
- Carbon dioxide as a greenhouse gas
- Common sources of carbon dioxide generated by humans and the role of carbon dioxide in increasing the greenhouse effect

- A Global Warming Wheel Card that enables students to see their individual roles in generating carbon dioxide and therefore increasing the greenhouse effect
- Ways in which they might reduce their individual, family, school, and community contributions to the greenhouse effect

What are the contents of this curriculum packet?

The packet contains the following items:

- Global Warming Wheel Card (assembled)
- Instructions for Making a Global Warming Wheel Card (unassembled)
- **Teacher Introduction:** Global Warming and Carbon Dioxide
- **Student Introduction:** Greenhouse Effect and Carbon Dioxide
- **Student Activity #1:** Using the Global Warming Wheel Card
- **Student Homework #1:** Electricity Use and Carbon Dioxide
- **Student Activity #2:** What You and Your Community Can Do to Reduce Carbon Dioxide
- **Student Activity #3:** A Simple Energy Audit
- Teacher Notes on Activities

www.epa.gov/globalwarming

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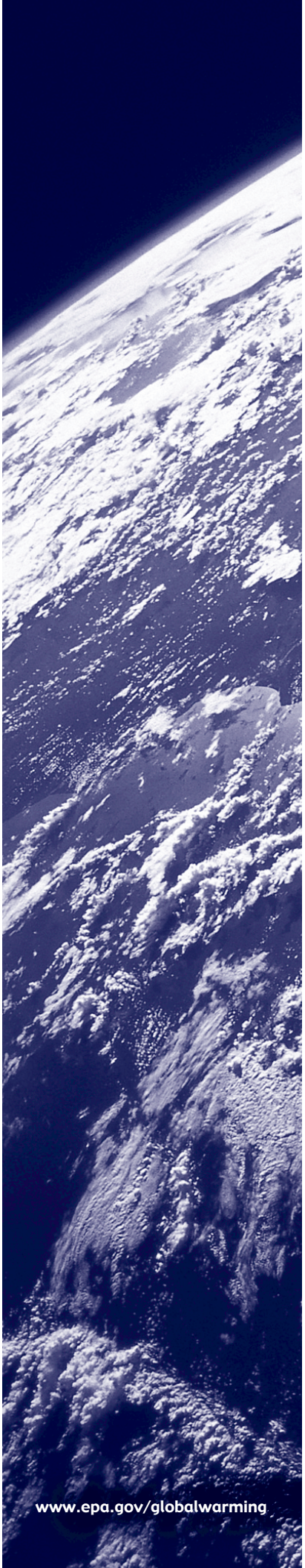

How can I use this curriculum packet?

This curriculum packet is designed to be used in two ways. The materials may be used for a single, one session activity that focuses on the construction and use of a Global Warming Wheel Card. Alternatively, the packet may be used to conduct three activities over two successive classroom sessions.

The wheel introduces students to common sources of carbon dioxide, such as manufacturing processes, power plants, and automobiles. The wheel also allows them to estimate how much carbon dioxide they and their families produce in a typical year through these sources. Once they understand how they contribute to the production of carbon dioxide, the wheel provides them with examples of activities that they can undertake to reduce the production of carbon dioxide.

Once studetns demonstrate that they understand the concepts introduced in the Global Warming Wheel Card, the second session's activities involve asking them more challenging questions and in-depth activities related to reducing the production of carbon dioxide.

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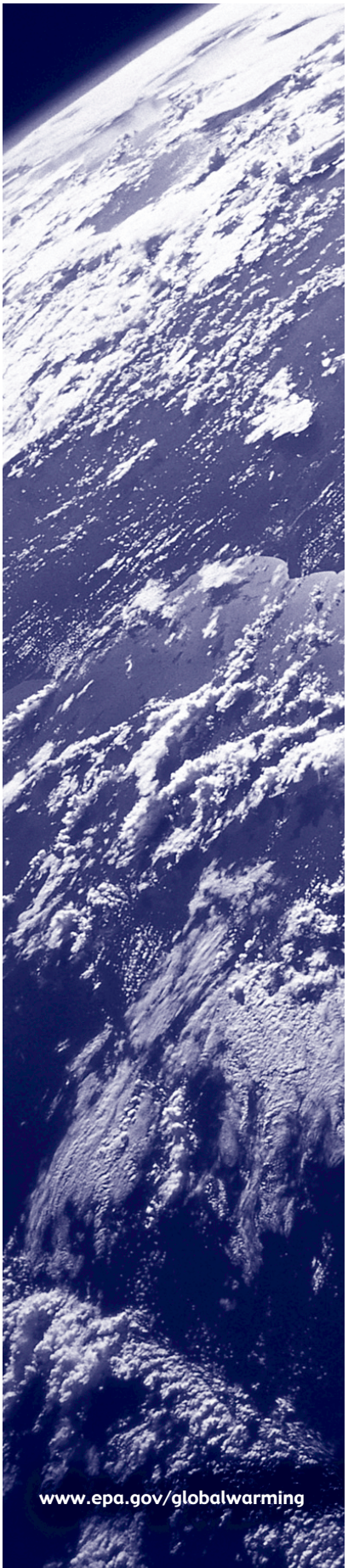


Teacher Introduction:
Global Warming and Carbon Dioxide

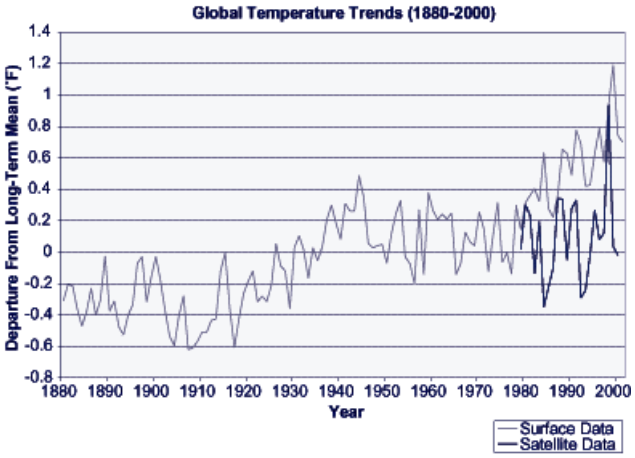
What is global warming?

As we enter a new millennium, the findings of the international scientific community indicate that our world is becoming warmer. Abundant data demonstrate that the average global climate has taken a sharp turn upward during the past 150 years. Recent observations about trends in climate include:

- The 1980s and 1990s are the warmest decades on record
- The 10 warmest years in global meteorological history have all occurred in the past 15 years
- The 20th century has been the warmest globally in the last 600 years

Thousands of scientists around the world have concluded that the average temperature of the Earth's lower atmosphere has increased approximately 1 degree Fahrenheit since 1900 and that recent trends show that annual mean global temperatures could rise by 2.5 to 10.4 degrees Fahrenheit over the next century.

The graph on the right shows the average annual increases in temperature at the surface of the Earth since 1880. The trend is clearly upward. Are there likely to be human health or environmental effects from this warming? And if so, what can we do to reduce our contribution to this trend?



Surface Data Source: National Climatic Data Center, 2001.
Satellite Data Source: John R. Christy, University of Alabama in Huntsville, and Roy Spencer, National Aeronautics and Space Administration.

What are the effects of global warming?

Scientists have observed several recent environmental changes that they believe may be related to global warming. These changes include the rapid retreat of alpine glaciers in the northern hemisphere, melting of permafrost, and rising sea levels in the oceans. In parts of North America, lakes are freezing later in the fall and thawing earlier in the spring than they did just 50 years ago, and several cities have had numerous episodes of record heat during recent summers.

In addition to the effects on oceans and ice, there's a risk that the climate will change in other ways that will directly affect our lives. Among the potential impacts that might be expected are additional rises in sea level; more frequent and severe heat waves and droughts; more extreme weather events such as heavy rainfalls, producing floods and causing property destruction; and infectious diseases becoming more widespread.

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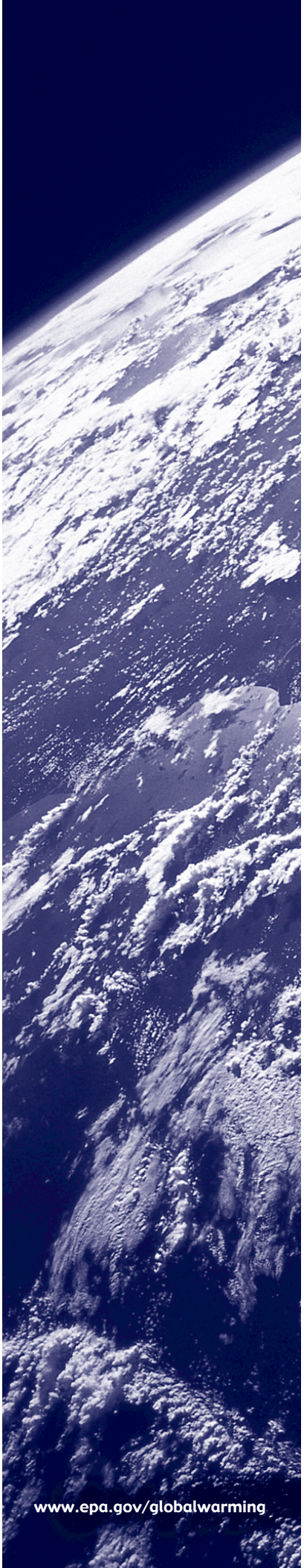

What causes global warming?

Global warming is a result of the "greenhouse effect," so-called because it is similar to the way that the glass panels of greenhouses trap heat from the sun. This causes the greenhouse to heat up, much like the inside of a car parked in a sunny spot. The trapped heat keeps the plants warm enough to live in the winter.

Gases in the atmosphere behave much like glass panes. Sunlight enters the Earth's atmosphere, passing through a blanket of greenhouse gases. As it reaches the Earth's surface, the sunlight is absorbed by land, water, and living organisms. Once absorbed, a percentage of this energy is radiated back into the atmosphere. Some of the radiated energy passes back into space, but much of it remains trapped in the atmosphere by the greenhouse gases, causing the atmosphere to heat up.

What role does carbon dioxide play?

Although several greenhouse gases (see "What Are Greenhouse Gases?") contribute to global warming, one of the greenhouse gases—carbon dioxide—is believed to play a major role in the heating of the Earth's atmosphere. Carbon dioxide is a common by-product of the burning of fossil fuels, such as coal, oil (including gasoline), and natural gas. Major sources of carbon dioxide include burning fossil fuels to produce electricity in power plants, supplying that electricity to power industrial activities and household appliances, and burning gasoline to run automobiles and other vehicles.

What Are Greenhouse Gases?

Greenhouse gases include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Greenhouse gases allow solar radiation to reach the Earth's surface and become absorbed, yet they trap thermal radiation that is leaving the Earth's surface. Outgoing thermal radiation absorbed by these gases heats the atmosphere. The atmosphere then emits thermal radiation both outward into space and downward to the Earth, further warming the surface.

It is important to note that global warming is a separate problem from ozone depletion. Ozone depletion refers to the thinning of the ozone layer in the stratosphere, which extends roughly between 9–31 miles above the Earth's surface. A diminished ozone layer allows more harmful radiation to reach the Earth's surface. Global warming, on the other hand, refers to an increase in the Earth's average temperature.

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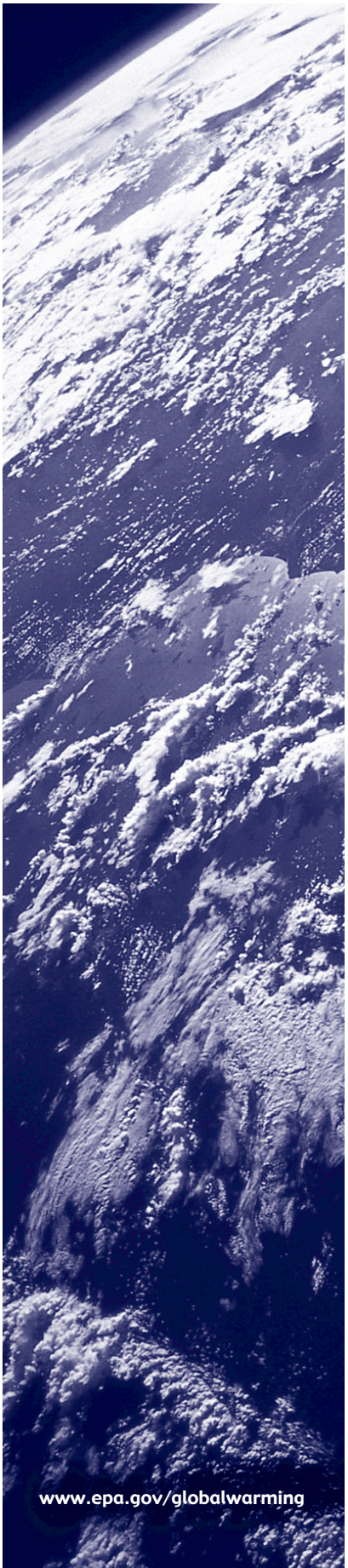

Student Introduction:

Greenhouse Effect and Carbon Dioxide

What is the greenhouse effect?

Have you ever seen a greenhouse? Most greenhouses look like a small glass house. Greenhouses are used to grow plants, especially in the winter. Greenhouses work by trapping heat from the sun. The glass panels of the greenhouse let in light but keep heat from escaping. This causes the greenhouse to heat up, much like the inside of a car parked in sunlight, and keeps the plants warm enough to live in the winter.

The Earth's atmosphere is all around us. It is the air that we breathe. "Greenhouse gases in the atmosphere," such as carbon dioxide, behave much like the glass panes in a greenhouse. Sunlight enters the Earth's atmosphere, passing through the blanket of greenhouse gases. As it reaches the Earth's surface, the land, water, and living things absorb the sunlight's energy. But some of this energy is not absorbed and instead is sent back into the atmosphere. Some of that energy passes back into space, but much of it remains trapped in the atmosphere by the greenhouse gases, causing our world to heat up. We call the heating of the Earth's atmosphere by these gases the "greenhouse effect" because it is somewhat like a greenhouse. And the more greenhouse gases there are, the more this effect occurs.

Sometimes little things can turn into big things. Think about brushing your teeth. If you don't brush for one day, chances are nothing bad will happen. But if you don't brush your teeth for one month, you may develop a cavity. It's the same thing with global temperatures. If temperatures rise above normal levels for a few days, it's no big deal—the Earth will stay more or less the same. But if temperatures continue to rise over a longer period of time, then the Earth—and everything that lives on the planet, including people—may experience some problems.

This increase in average temperatures across our planet is called "global warming," and it is one way that climate changes. Scientists use the term "climate change" because warming is only one indication that climate is changing. Rainfall also can increase in some regions. At the same time, it can decrease in other areas. And, as climate changes, some places may actually become cooler. But the overall trend across the whole planet is a warming trend, and this is why most people refer to "global warming."

Average global temperature has increased by almost 1° Fahrenheit (F) in the past century. Scientists expect the average global temperature to increase an additional 2.5 to 10.4° F over the next 100 years. This may not sound like much, but it could change the Earth's climate more than it has in thousands of years. At the peak of the

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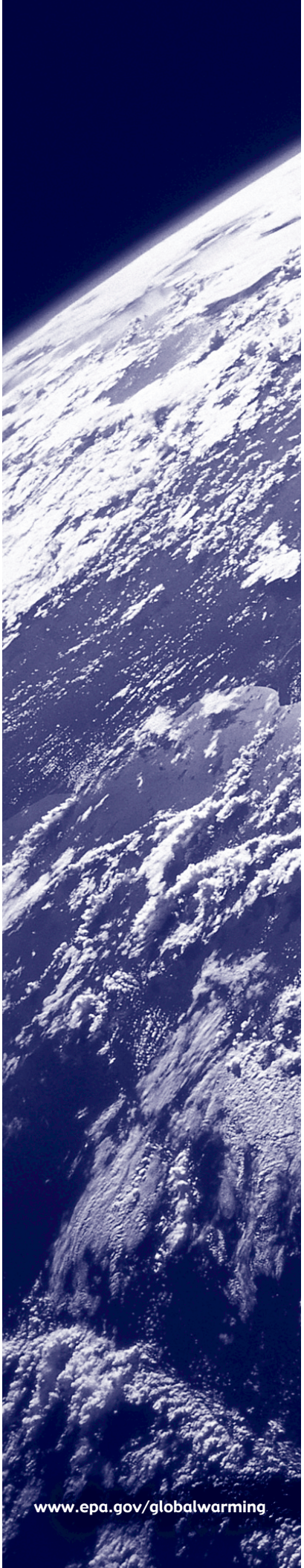


last ice age (18,000 years ago), the temperature was only 7° F colder than it is today, and glaciers covered much of North America!

Even a small increase in temperature over a long time can change the climate. When the climate changes, there may be big changes in the things that people depend on. These things include the level of the oceans and the rainfall that our crops depend on. In some places, changes could also happen to the water we drink.

Why is this happening?

In the past, all climate changes occurred naturally. However, scientists have found that once industrialization began in the 1800s, climate began changing more rapidly than it had for thousands of years. As a result of the Industrial Revolution, we began using more and more machines to make life easier. But machines need energy to operate. In the 1800s, most of that energy started coming from our burning of fossil fuels—coal, oil, natural gas, and gasoline. And burning fossil fuels releases gases into the atmosphere, including carbon dioxide. These gases help make the atmosphere warmer.

When do you send greenhouse gases into the air?

You send greenhouse gases, such as carbon dioxide, into the atmosphere whenever you...

- Watch TV
- Use an air conditioner
- Turn on a light
- Use a hair dryer
- Ride in a car
- Play a video game
- Listen to a stereo
- Wash or dry clothes
- Use a dishwasher
- Microwave a snack

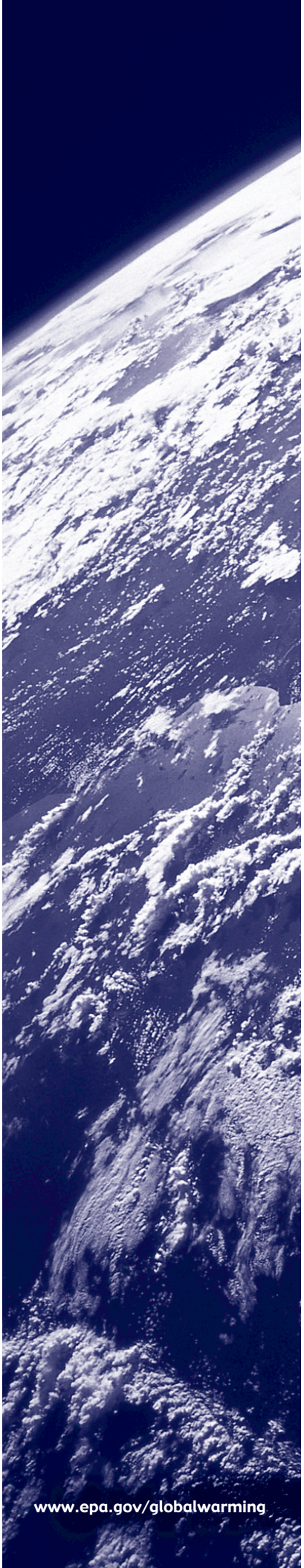
Holding place for drawing of kids watching t.v.

How is that possible? To perform many of these activities, you need to use electricity. Electricity comes from power plants. Most power plants use coal, oil, or natural gas to make electricity. Burning these fossil fuels produces greenhouse gases.

Whenever we ride in a car, we are adding greenhouse gases to the atmosphere. And when factories make the things that we buy and use everyday, they too are sending greenhouse gases into the air.

What might happen?

It is important to understand that scientists don't know for sure what global warming will bring. Some changes brought about by global warming will be good. If you live in a very cold climate, warmer temperatures in winter might be welcome. Days and nights could be more comfortable, and farmers in the area may be able to grow more crops than they could before. But it is also true that changes in some places will not be very good at all. Some farmers won't be able to grow as much or will have to grow different crops. And summers may get much warmer.



Human Health

Climate change may affect people's health both directly and indirectly. For example, very warm temperatures and high humidity can cause what is known as "heat stress"—people can faint from becoming overheated and can become very sick. Untreated, heat stress can be a very serious medical problem. Scientists suspect that, in many places, global warming will increase the number of very hot days that occur during the year. More hot days increases the possibility of heat-related health problems.

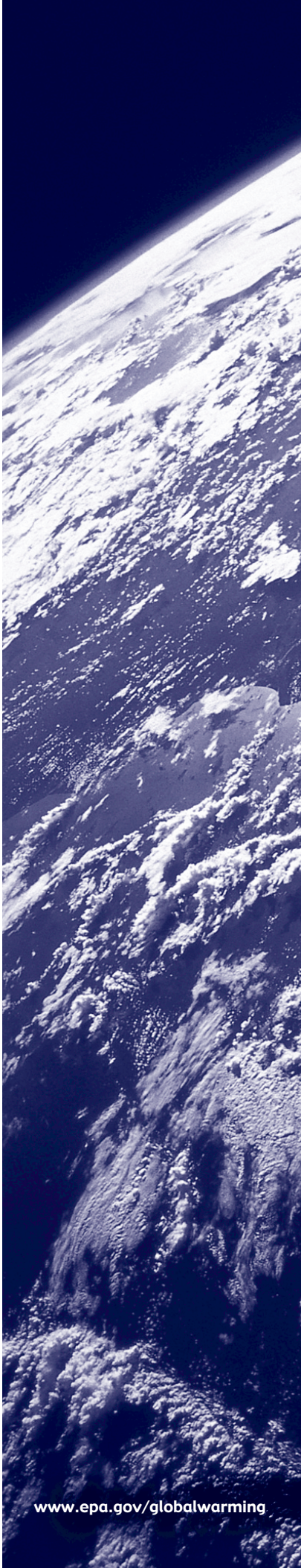
Worsening air pollution, changes in food and water supplies, and coastal flooding are all examples of possible impacts that might affect human health indirectly.

How people and nature adapt to global warming will determine how seriously it affects human health. Some people and places are likely to be affected more than others. Generally, poor people and poor countries are less likely to have the money and resources they need to cope with preventing and treating health problems. Very young children and elderly adults will run the highest risks.

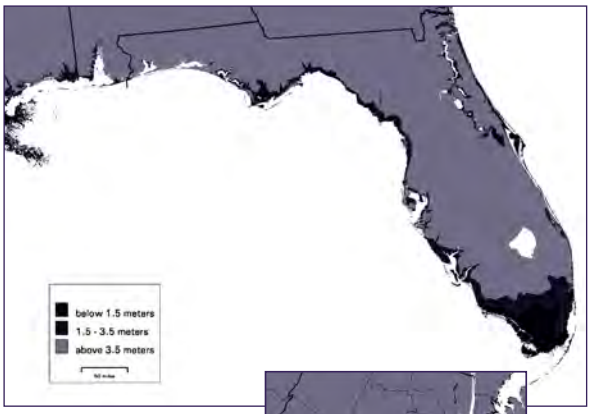
Ecological Systems

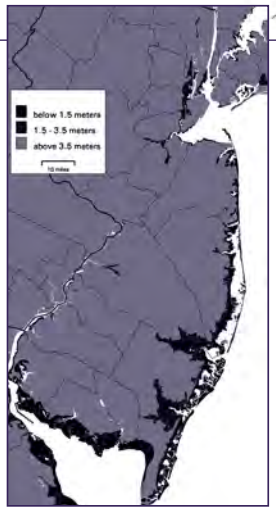
Climate change may alter the world's habitats, and all living things rely on those habitats. Together, they are the world's ecosystems. (An ecosystem is the interacting system of a biological community-plants, animals, and other living organisms—together with its non-living environmental surroundings.) Many of these places depend on a delicate balance of rainfall, temperature, and soil type. A rapid change in climate could upset this balance and seriously change the environment of many living things.

Most climate changes in the past occurred very slowly, allowing plants and animals to adapt to the new climate or move somewhere else. However, if future climate changes occur as rapidly as scientists are predicting, plants and animals may not be able to react quickly enough to survive. The ocean's ecosystems also could be affected for the same reasons.



Sea Level Rise





Global warming may make the sea level become higher. Why? Well, one reason is that warmer temperatures cause mountain glaciers to melt. A glacier is a large sheet of ice that moves very, very slowly. Melting glaciers generally add more water to the ocean.

Warmer temperatures also make water expand. When water expands in the ocean, it takes up more space and the level of the sea rises.

Some scientists believe that sea level may rise as much as 2 feet during the next century. This will affect both marine life like fish and structures along coastlines such as roads and houses. Coastal flooding could cause saltwater to flow into coastal marshes where too much salt would be harmful, threatening plants and animals in those areas. For example, an increase in the salt content of the Delaware and Chesapeake bays is thought to have decreased the number of oysters able to live in those waters.

As sea level rises, flooding during storms becomes worse. Some beaches tend to erode during storms. Oceanfront property could be affected by this higher flooding. As the sand is carried away, the houses could be even more vulnerable to being hit by waves. Whether we move our houses and other buildings back from the water or build walls in the face of a rising sea, it could cost billions of dollars to adapt to climate change. And some of the adaptations may cause problems for the ecosystems in the area.

Coastal flooding also may reduce the quality of drinking water in some regions because saltwater from the ocean could enter into drinking water supplies.

Crops and Food Supply

Global warming may make the Earth warmer in cold places. People living in these places may have a chance to grow crops in new areas. But global warming also might bring droughts to other places where we grow crops. In some parts of the world, more people may not have enough to eat because they cannot grow the food that they need.

Holding place for drawing of withered grass, plants, etc.

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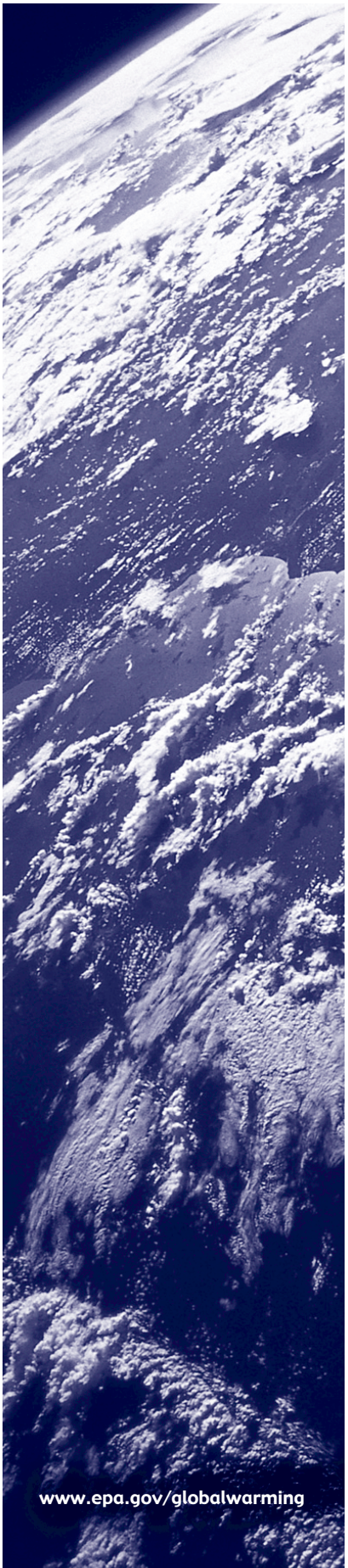

Student Activity #1:

Using the Global Warming Wheel Card

Purpose: This activity will introduce you to the Global Warming Wheel Card.

Time required: 15–20 or 30–40 minutes

Equipment:
- Four sheets of paper, from which you will need to cut out pieces, then glue them together.
- Scissors
- Glue stick or liquid glue
- Small paper fasteners or brads (the brass kind that can be pushed through paper easily and have flanges that can be bent to hold the paper)

Now that you have made your wheel, use it to answer the following questions.

1. Mr. Smith drives to work every day. He goes about 20 miles in each direction, or 40 miles round-trip. He goes to work 5 days each week. How many miles does he drive to work in a week?

   A. Figure out how many miles he travels to and from work each year.

   B. Use the Global Warming Wheel Card to calculate how much carbon dioxide his car produces just during Mr. Smith's driving to and from work.

2. Mr. Smith's family also uses the car for lots of other activities, such as shopping, going to evening football games, weekend camping trips, and other places. Mr. Smith estimates that the family travels another 400 miles per week, in addition to the miles he travels to and from work.

   A. Use the Global Warming Wheel Card to figure out how much carbon dioxide the family produces by driving during the week.

3. Use the Global Warming Wheel Card to find out what Mr. Smith could do to reduce the amount of carbon dioxide that he and his family generate by driving.

4. What other things could the Smith family could do to reduce the amount of carbon dioxide that they generate by driving?

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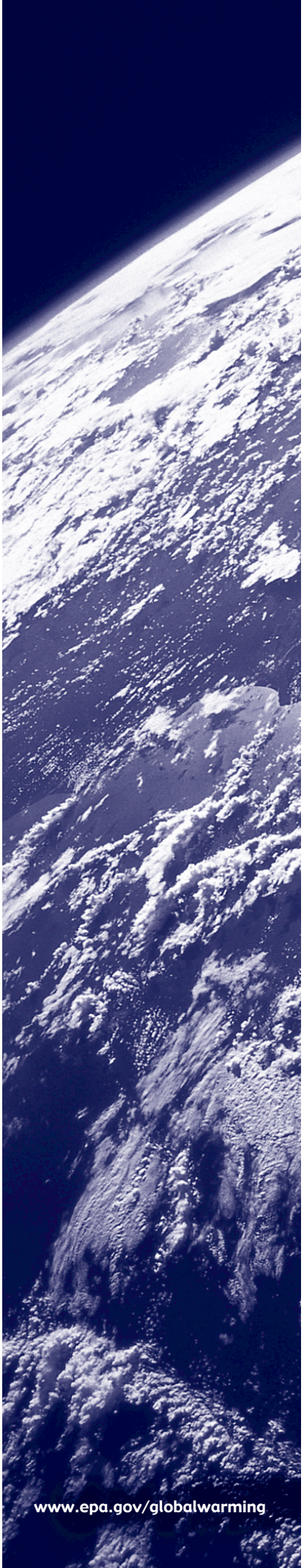

5. The Jones family lives next door to the Smith family. Although the Smiths recycle all of their trash, the Jones family thinks it is too much trouble to recycle, so they throw every piece of paper, every plastic container, glass bottle, and aluminum can into the trash, which gets picked up and taken to the local landfill ("garbage dump").
   A. Use the Global Warming Wheel Card to find out the estimated level of carbon dioxide the Smith family produces every year from their waste disposal (throwing away trash).
   B. How much carbon dioxide does the Jones family generate every year by throwing away their trash instead of recycling?
6. Use the Global Warming Wheel Card to find out what the Jones family could do to reduce the carbon dioxide that the family produces every year.

_____

_____

_____

_____

_____

7. What other things could the Jones family do to reduce the amount of carbon dioxide that the family generates with their waste disposal habits?

_____

_____

_____

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Holding place for
drawing of Recycling Box

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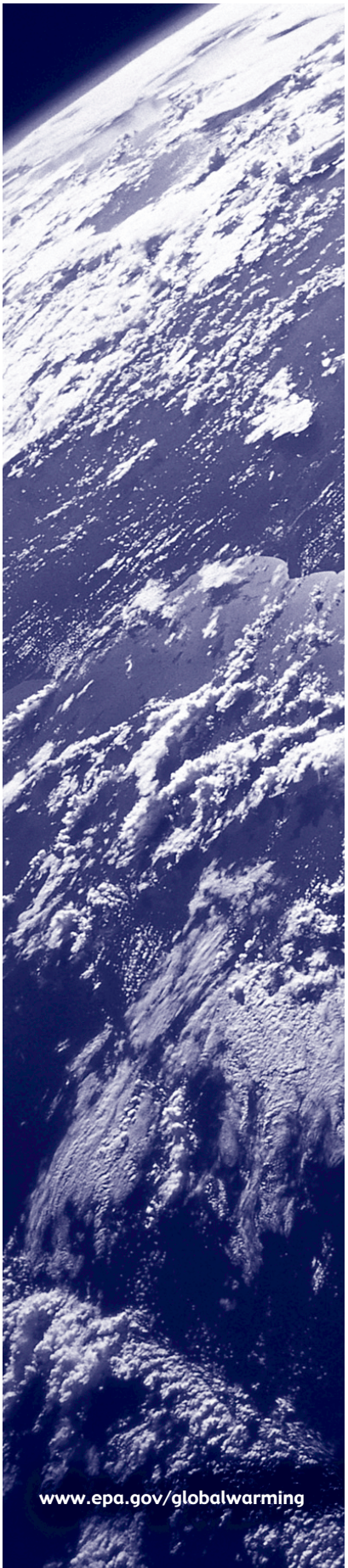

Student Homework #1:

Electricity Use and Carbon Dioxide

This homework requires that you take your Global Warming Wheel Card home with you and ask your parents or other adult to share their electricity and home heating bills with you.

1. Look around your house for items that need electricity to operate. List the first 10 items that you find.

1 _____
2 _____
3 _____
4 _____
5 _____
6 _____
7 _____
8 _____
9 _____
10 _____

2. Of those 10 items, which ones do you use every day?

_____
_____
_____

3. How much did your family spend each month for electricity in the past six months?

Total amount: _____

Now divide that number by 6. This will give you an average monthly bill.

Average monthly bill: _____

4. Using your Global Warming Wheel Card, pick the amount that is closest to the "average for six months" that you just calculated. How much carbon dioxide does your household produce every year? _____

5. Use your Global Warming Wheel Card to find what your household can do to reduce the amount of carbon dioxide that you generate.

_____
_____
_____

6. Can you think of other things that you can do to reduce the amount of electricity that you use in your home? You may want to go back to #2 for some ideas.

_____
_____
_____

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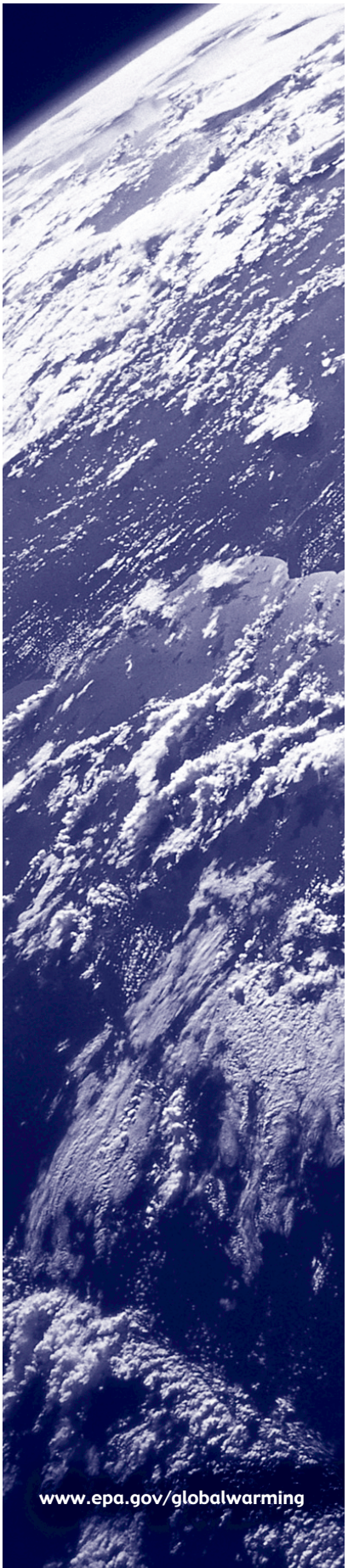

Student Activity #2:

What You and Your Community Can Do to Reduce Carbon Dioxide

Purpose: This activity will allow you to think about what you can do to help reduce the release of carbon dioxide into the air and perhaps limit the greenhouse effect in the future.

Time: 40 minutes

Equipment: Pencils and paper
Materials provided in this packet, including responses to Activity #1, fact sheets, and Global Warming Wheel Card

1. Find three other students with whom you would like to work. You will need pencils and paper, and you might want to have these things with you:
   A. Your Global Warming Wheel Card
   B. Your "Introduction to the Greenhouse Effect and Carbon Dioxide"
   C. Your answers from Activity #1
2. Take the next 20 minutes to discuss the following:
   A. The four of you work for your town's Department of Environmental Protection. You have learned a great deal about global warming in the past several months, and you are becoming concerned about the possible effects it will have on your local community if it continues to get worse. You are now aware of some of the causes and effects of global warming, and you would like to do everything you can to make sure that your community does not contribute more carbon dioxide than is absolutely necessary. However, you also realize that people in your community enjoy the way their lives are now, and you do not want to make too many changes that will upset their lives. Your department has been asked to come up with some new programs for reducing the amount of carbon dioxide generated by your community. What three programs would you propose to encourage your community's citizens, businesses, and institutions (such as schools) to change their behavior so they produce less carbon dioxide?

   _____
   _____
   _____
   _____
   _____

   B. What would your community probably like about these programs?

   _____
   _____
   _____
   _____
   _____

   C. What would your community probably NOT like about these programs?

   _____
   _____
   _____
   _____
   _____

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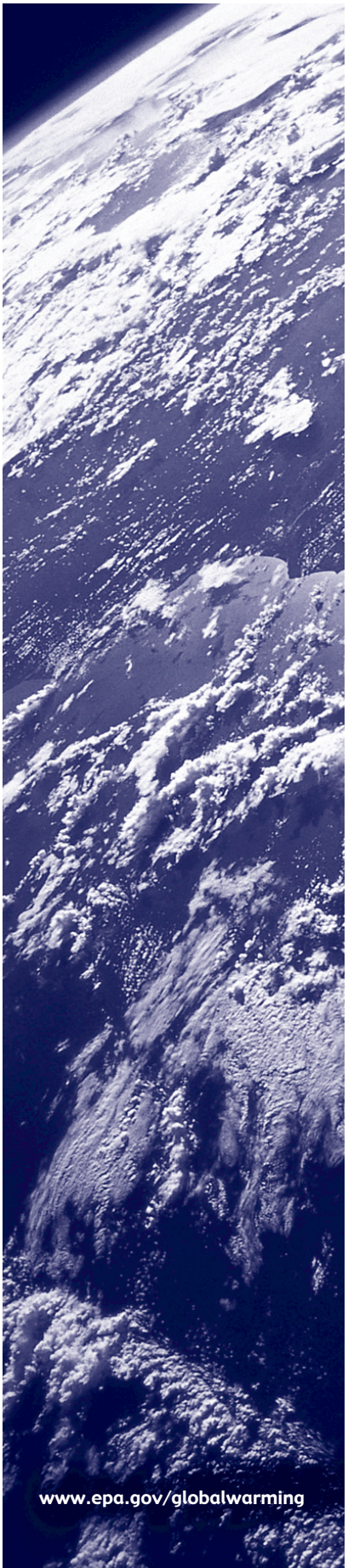


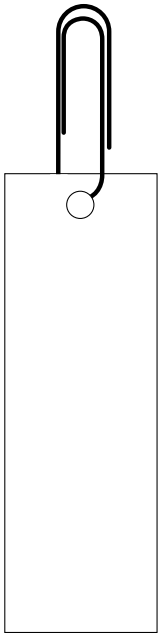
Student Activity #3:
A Simple Energy Audit

Purpose: To encourage students to examine their classrooms and identify ways in which they can help conserve energy.

Time required: 20–45 minutes

Equipment: For each student: This worksheet, a pencil, and a small piece of lightweight paper (such as tissue paper), approximately 1″ across and 3″ long, that hangs on a paper clip (see drawing)

Introduction: We spend much of our day in school. But few of us notice details about buildings, such as windows and thermostats. We also pay little attention to the small actions that each of us does-such as turning lights on and off-that affect energy use. These actions are important not only because they contribute to our comfort, but also because the use of energy in heating, cooling, and lighting school buildings increases the cost of operating our schools.



An energy-efficient school is more comfortable than one that is not energy-efficient, and it needs less oil, natural gas, coal, or electricity for heating or cooling. A building that is badly designed or poorly maintained is expensive to operate because it is trying to heat or air-condition the outdoors as well as the indoors.

The following activity will teach you to conduct a simple energy audit. By conducting this exercise, you will point out areas that could be improved and save energy, which means saving money and making you more comfortable. You will learn about things that you and your classmates can do to save energy.

You will conduct an audit inside your classroom.

Audit: Inside Your Classroom

1. Where is the thermostat located?
   A. It should be located on inside walls, away from a bright light source (such as sunlight) or a heating or air conditioning vent. Is it? _____yes _____no

2. What setting is the thermostat reading?
   A. It should be set at 68 degrees Fahrenheit in winter or 78 degrees Fahrenheit in summer. Is it? _____yes _____no

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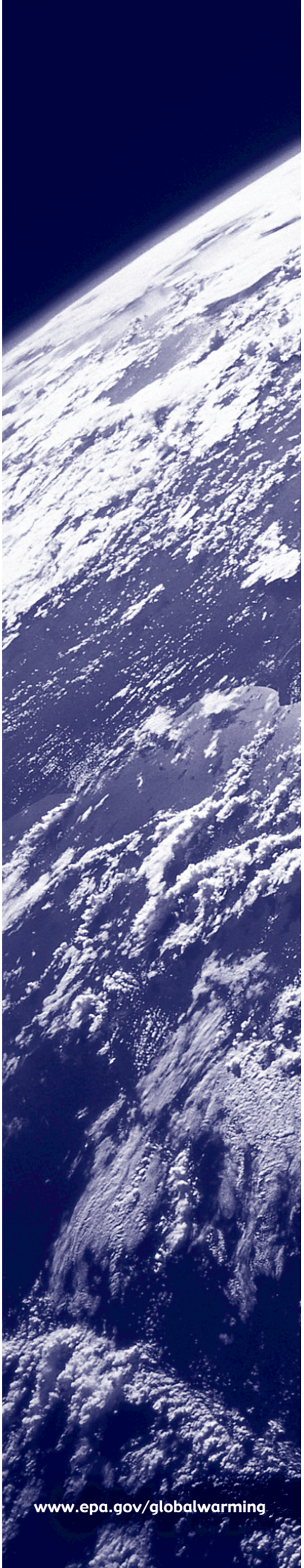


3. Do you have windows in your classroom? Answer these questions, if you have windows.
   A. Does your classroom have window coverings that allow you to block out intense sunlight during hot days? _____yes _____no
   B. Take the small piece of paper and paper clip you made. This is a "draft detector." Walk up to the window, and hang the piece of paper at four different spots along the edge of the window, where the window meets the wall. Hold it still for about 30 seconds in each spot. Be sure to get really close to the window, if you can do it safely, and make sure that the heating vents aren't blowing the paper.
   C. Does the paper move? Can you feel warm or cold air coming in through the window? If you can feel air move, the windows are not energy-efficient. Are your windows energy-efficient? _____yes _____no

Holding place for drawing papers at window

4. Now take your draft detector to your classroom door. (If you have a door to a hallway and a door to the outside, do this activity with both doors.)
   A. Place the detector along the sides of the inside of the door, where it meets the walls, and along the floor. Do you detect any air moving through the cracks between the door and the wall or the floor? If you can feel any air moving, your door is not energy-efficient. Is your door energy-efficient? _____yes _____no
   B. Place the detector along the sides of the outside of the door, where it meets the walls, and along the floor. Do you detect any air moving through the cracks between the door and the wall or the floor? If you can feel any air moving, your door is not energy-efficient. Is your door energy-efficient? _____yes _____no

5. Does your classroom have a floor covering, such as carpeting? _____yes _____no

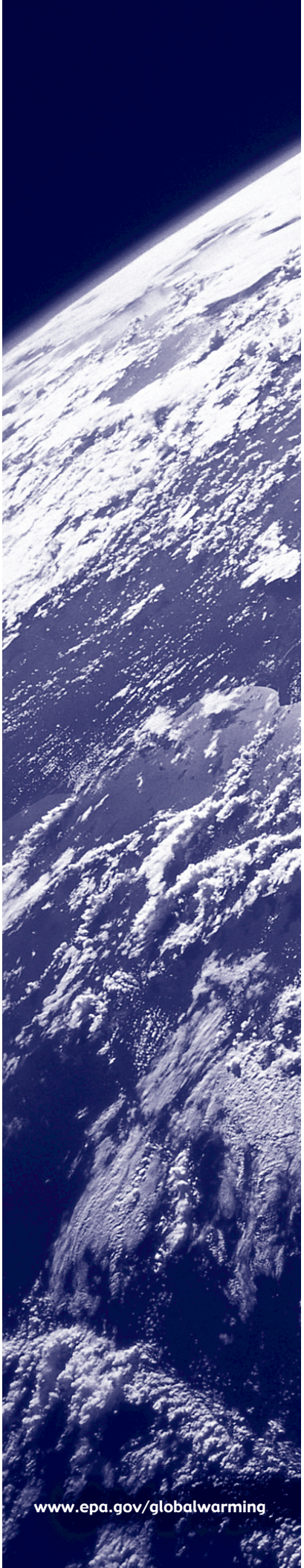
6. How high is your ceiling? (Use caution when trying to determine this.) Is it 8 feet or less? _____yes _____no

7. If you can safely open the air conditioning or heating unit in the classroom, do so, and look at the filters. Are they clean (little dust or dirt, not clogged)? _____yes _____no

8. Are the light bulbs used in your classroom energy-saving bulbs? (You might need to ask your facilities manager this question.) _____yes _____no

9. Are all the desks and chairs away from heating or cooling vents? _____yes _____no

10. Now we will look at some of your personal activities in your classroom that affect energy use.
    A. Do you wear clothing that is appropriate for the season, such as sweaters in the winter and lightweight clothes in the summer? _____yes _____no
    B. Do you turn off the lights if you are the last one out of the room? _____yes ____no
    C. Do you avoid putting your textbooks, notebooks, etc. on top of heating or cooling vents? _____yes _____no



If you answered "yes" to most of these questions, your classroom is doing well. But if you said "no" to three or more, you need to work with your teacher, facilities manager, or other adult to improve these areas.

Here's why your answers matter:

1. If your thermostat is located too close to a strong light or heat source, it will not properly measure the room temperature, which means that energy will be wasted because the heater or air conditioner runs more than it needs to. It also could mean that you are uncomfortable in your classroom, because if the thermostat is near a source of heat or air-conditioning, it will turn off well before the entire room is heated or cooled.

2. If your thermostat is set too high in winter or too low in summer, you are wasting energy. Ask the person responsible for energy management in your school to check your thermostats and make sure that they are working properly.

3. If your windows do not have the ability to block out intense sun, your air-conditioning costs are too high, or your comfort level is lowered (because the room cannot cool down). If you see or feel air moving through the edge of the window, this means you are losing energy from your classroom, and the windows need to be caulked, sealed, or covered by a storm window system.

4. Your draft detector has helped you to determine whether your door is energy-efficient.

5. Carpeting helps keep rooms more comfortable and conserves heat.

6. Clean filters conserve energy. Dirty filters waste energy.

7. Ceilings higher than 8 feet waste energy, because warm air moves to the top of the room instead of remaining near the floor where we are.

8. Energy-saving bulbs are more expensive to buy but save lots of money on electricity in the long term.

9. If furniture blocks heating or cooling vents, the furnace or air conditioner will insufficiently heat or cool the room.

Holding place for drawing of CFL

10. When you wear clothes that are appropriate for the weather, you require less energy to keep warm or cool.

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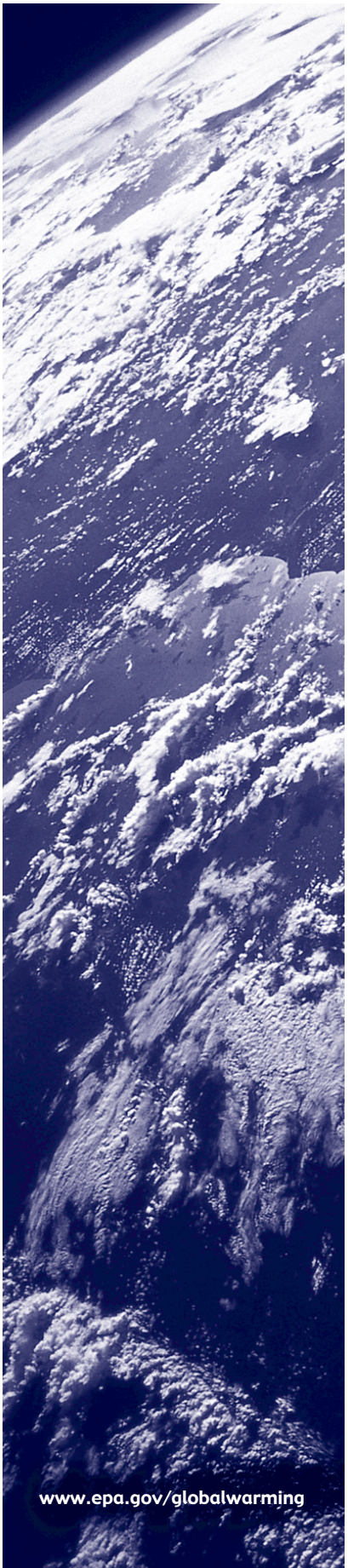
Teacher Notes on Activities



Student Activity #1:

- Classroom Time Needed:
  - Without classroom introduction to greenhouse effect and carbon dioxide: 15–20 minutes
  - With introduction and discussion: 30–40 minutes

- You may want to send students home with the "Introduction" fact sheet the night before you do this exercise, so that they are familiar with all the terms and the issues of global warming.

- We have provided a "homework" activity that follows up on the classroom exercise. This homework activity asks students to ask their parents about their electricity bills and their heating bills. Because some families live in housing in which they do not pay utilities, you might want to prepare some "sample" heating or electric bills that students can use to complete the exercise.

- This exercise is very good for reinforcing students' abilities to follow written directions. However, if your students find reading the instructions too difficult, demonstrate how to put together the wheel. You may need to do this twice for all students to comprehend the process.

- This exercise is also very good for practicing fine motor skills. However, if you have students with impaired mobility or limited fine motor skills, you may want to cut the pieces out in advance and provide them with partially prepared wheels.

Student Activity #2:

- Classroom time needed: 40 minutes (20 minutes for group discussion, 20 minutes to discuss responses)

- You may want to reinforce some of the key concepts from all four areas of the Global Warming Wheel Card, because Activity #1 focuses on transportation and waste disposal. If the students have not completed the homework activity, you may want to walk them through the "Electricity Use" and "Home Heating" portions of the Global Warming Wheel Card to remind students that those are also controllable sources of carbon dioxide.

- This is a group exercise. Be sure to point out that all four members of the group are equals-each person gets to contribute his or her fair share to the process.

- Require that all students write down the answers to the questions. This will reinforce writing and organizational skills.

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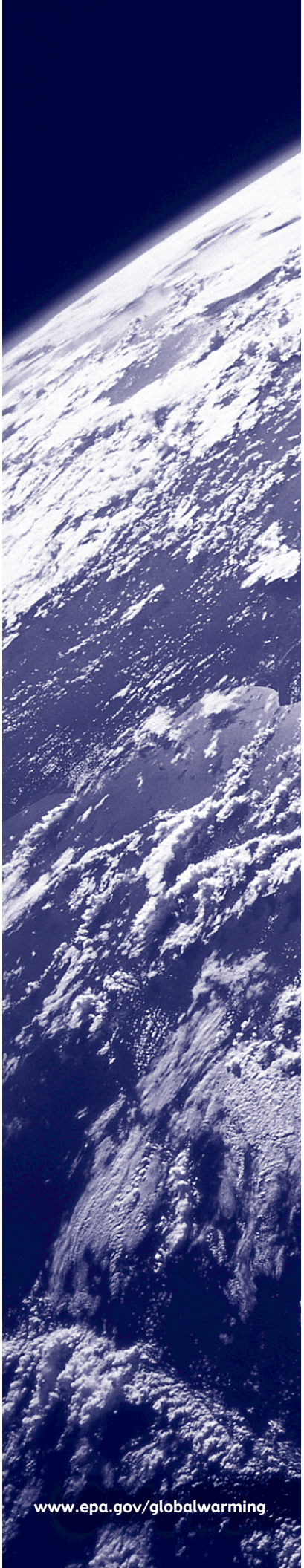

Student Activity #3:

- Without introduction to global warming: 20–30 minutes
- With introduction: 30–45 minutes
- Another possible activity would involve having the students perform an audit on other rooms in the building, such as the cafeteria, gymnasium, or even another classroom.