
Weather Changes



Lesson 3: The Greenhouse Effect and Global Warming

Essential Question: How is carbon dioxide important to the greenhouse effect?



TEKS Objectives:

Science

- **Identify** the significance of the water, carbon, and nitrogen cycles. (5.6B)
- **Identify** and **describe** the importance of gases of the atmosphere and classify them as renewable, nonrenewable, or inexhaustible resources. (3.11A)

Math

- **Graph** a given set of data using an appropriate graphical representation such as a picture or line graph. (5.13C)
- **Describe** the relationship between sets of data in graphic organizers such as lists, tables, charts and diagrams. (5.5A)
- **Use** addition and subtraction to solve problems involving whole numbers and decimals. (5.3A)
- **Solve** problems using elapsed time. (5.11B)
- **Solve** problems involving changes in temperature. (5.11A)



Student Outcomes

- Students will create and test a model to investigate the Greenhouse Effect.
- Students will make models demonstrating the effect of excessive carbon dioxide in the atmosphere.
- Students will investigate consequences of global warming.
- Students will investigate the importance of plants to the oxygen – carbon dioxide cycle.



Time:

3 hours, 45 minutes

Engage – 15 minutes

Explore – 45 minutes

Explain – 45 minutes

Elaborate – 60 minutes

Evaluate – 60 minutes



Background Information:

See the following websites:

Science Museum: Greenhouse Effect Animation

<http://www.sciencemuseum.org.uk/exhibitions/energy/site/EIZInfogr9.asp>

Enchanted Learning: Greenhouse Effect

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Greenhouse.shtml>

EPA Global Warming Kids Site: The Carbon Cycle

http://www.epa.gov/globalwarming/kids/carbon_cycle_version2.html



Vocabulary:

atmosphere – the layer of air that surrounds the planet

oxygen – a gas found in the air

stratosphere – the layer of the atmosphere that contains the ozone and is above the troposphere

thermosphere – the outermost layer of the atmosphere where temperatures increase with altitude

gas – a state of matter that has no definite shape and does not take up a definite amount of space.

carbon dioxide – a gas found in the air that animals exhale.

troposphere – the layer of atmosphere closest to the Earth

nitrogen – a gas found in the air

mesosphere – the layer of the atmosphere between the stratosphere and the thermosphere; characterized by temperatures that decrease with increasing altitude.

greenhouse effect – process by which the Earth atmosphere absorbs heat.

reflect – to bounce back from a surface

infrared radiation - electromagnetic radiation of a wavelength longer than that of visible light, but shorter than that of radio waves. The infrared portion of the spectrum has a number of technological uses, including target acquisition and tracking by the military; remote temperature sensing; short-ranged wireless communication; and weather forecasting

global warming – the rise in Earth’s average temperature due to excess carbon dioxide in the atmosphere.

absorb – to take in by absorption

photosynthesis – the process by which a plant makes its own food



Materials:

Explore

Janice Van Cleave’s Teaching the Fun of Science “Trapped”

2 shoeboxes per group

Ruler

Soil

2 thermometers per group

Plastic wrap

Timer

Elaborate

Digging Into TAKS: Plants and CO₂ (option)

2- 250 mL beakers

Water

Pipet

Bromothymol blue (BTB)

Straws

Elodea

Test tubes with caps

funnel

Evaluation

Carbon Cycle Record Sheet

Computers/ library reference books



Suggested Literature:

Harcourt Science p. C64; B6 – B11



Teacher Preparation

Read about the greenhouse effect and the Earth's atmosphere.



Technology:

- United Streaming: *The Cycle Series: The Carbon Cycle*
- Websites

BrainPop: Greenhouse Effect

Enchanted Learning: Greenhouse Effect

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Greenhouse.shtml>

Greenhouse Effect Animation

<http://earthguide.ucsd.edu/earthguide/diagrams/greenhouse/>

Planet Guide: Greenhouse Effect

http://www.planetguide.net/book/chapter_3/greenhouse_effect.html

BBC: How the Greenhouse Effect Works

http://news.bbc.co.uk/1/shared/spl/hi/sci_nat/04/climate_change/html/greenhouse.stm

Greenhouse Effect

http://www.uwsp.edu/geo/faculty/ritter/glossary/E_G/greenhouse_effect.html

Science Museum: Greenhouse Effect

<http://www.sciencemuseum.org.uk/exhibitions/energy/site/EIZInfogr9.asp>

The Greenhouse Effect

http://www.ucar.edu/learn/1_3_1.htm

The Desert Biome

<http://www.ucmp.berkeley.edu/glossary/gloss5/biome/deserts.html>

Ask a Scientist

<http://www.newton.dep.anl.gov/askasci/wea00/wea00251.htm>

Biomes: Desert

<http://www.cet.edu/ete/modules/msese/earthsysflr/desert.html>

EPA Global Warming Kids Site: The Carbon Cycle

http://www.epa.gov/globalwarming/kids/carbon_cycle_version2.html

Greenhouse Effect and Global Warming: *What's it Got to do with Me?*

http://www.worldofenergy.com.au/webquests/greenhouse/07_webquest_greenhouse.html

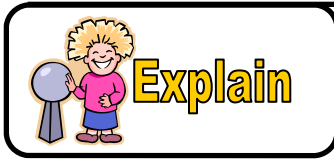


1. Ask the students to write about the following prompt: *How is the Earth like a blanket?* Students should incorporate vocabulary from yesterday's lesson.
2. Students should share and discuss their entries. Discuss possible functions of the atmosphere such as trapping in heat, weather, etc.



1. Complete the activity *Trapped*. Explain to students that they will explore how the atmosphere is important to the Earth.

2. Students should record data in their Journals or on the *Trapped* Record Sheet.



3. Discuss the students' results from *Trapped*. **Ask and discuss:**
 - **Identify the pattern of the temperatures for each box.**
 - **What conclusion can you draw based on the results**
 - **Explain how the Earth's atmosphere is like a blanket.**
3. Compare the box covered in plastic wrap to the Earth's atmosphere. Describe how the Earth absorbs some of the sun's energy like the covered box absorbed energy. Identify the term greenhouse effect.
4. Use one of the following web sites to explain the greenhouse effect and its importance to the Earth.

Enchanted Learning: Greenhouse Effect

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Greenhouse.shtml>

Greenhouse Effect Animation

<http://earthguide.ucsd.edu/earthguide/diagrams/greenhouse/>

Planet Guide: Greenhouse Effect

http://www.planetguide.net/book/chapter_3/greenhouse_effect.html

BBC: How the Greenhouse Effect Works

http://news.bbc.co.uk/1/shared/spl/hi/sci_nat/04/climate_change/html/greenhouse.stm

Greenhouse Effect

http://www.uwsp.edu/geo/faculty/ritter/glossary/E_G/greenhouse_effect.html

Science Museum: Greenhouse Effect

<http://www.sciencemuseum.org.uk/exhibitions/energy/site/EIZInfogr9.asp>

BrainPop: Greenhouse Effect

5. Students should make a diagram of the greenhouse effect in their Journals. Label vocabulary such as **carbon dioxide, oxygen, reflect, infrared, and radiation**
6. **Ask and discuss**
 - **How does the atmosphere help warm the Earth?**
 - **What is the role of carbon dioxide?**
 - **What role do plants play in the greenhouse effect?**

- **What role do humans play in the greenhouse effect?**
- **How can too much carbon dioxide be harmful?**



Part One:

1. Identify any questions the students can now answer.
2. Ask students how plants are important to the atmosphere.
3. Complete one of the following:
 - a. Conduct a simulation to demonstrate the carbon dioxide-oxygen cycle. Go outside to a flat concrete area.
 - ◇ Draw an outline of a plant on the ground.
 - ◇ Select several students to be oxygen molecules and several students to be carbon dioxide molecules. A student may also act as the sun which provides the energy for plant processes to occur.
 - ◇ Discuss with students the process by which plants take in carbon dioxide and release oxygen (respiration). The carbon dioxide is used by the plant in making food. The process of making food is called photosynthesis.
 - ◇ Instruct the carbon dioxide molecules to float outside the plant drawn on the concrete. One at a time the carbon dioxide molecules will move into the leaf of the plant.
 - ◇ As they enter the leaf, the carbon dioxide molecules will tag a student inside the leaf who will then exit as oxygen. Identify the release of oxygen as respiration.
 - ◇ The carbon dioxide molecules will stay in the leaf as part of photosynthesis.
 - ◇ The cycle will continue until there are no oxygen molecules left in the leaf.
 - ◇ **Ask and discuss:**
 - **What is important about oxygen and carbon dioxide?**
 - **What function does carbon dioxide serve inside the plant?** Carbon dioxide is used in making food for the plant
 - **What role does the sun play?**
 - **What would happen if too many trees were cut down?**
 - **What will happen as carbon dioxide levels increase?**
 - b. Complete Digging Into TAKS: Plants and CO₂.

Part Two:

1. Explain that the carbon dioxide-oxygen cycle is just one part of the carbon cycle.

2. Use the following web site to play and read the Carbon Cycle movie with the class. Students should be completing the *Carbon Cycle Record Sheet* as the class discusses the movie. Because the animation is so small, it would be beneficial to view the web site using the lap top cart or computer lab.
 - EPA Global Warming Kids Site: The Carbon Cycle
http://www.epa.gov/globalwarming/kids/carbon_cycle_version2.html
3. Students will diagram the process in their Journals. Students should label the carbon dioxide and oxygen molecules. They may even draw models learned during a previous lesson.
4. Students may also read Harcourt pp. B8-B11. If needed, view other greenhouse animations the following web sites:
 - Science Museum: Greenhouse Effect
<http://www.sciencemuseum.org.uk/exhibitions/energy/site/EIZInfo9r9.asp>
 - The Greenhouse Effect: View the animation of CO₂ in the atmosphere.
http://www.ucar.edu/learn/1_3_1.htm
 - BrainPop: Global Warming
5. Ask students about questions they may still have about the greenhouse effect. Record their questions on the board or chart paper.



Students will complete one of the following:

1. Students will read articles from the following sources.

Global Warming in Your State

<http://www.nwf.org/globalwarming/states.cfm>

Global Warming Unstoppable for 100 Years

http://news.nationalgeographic.com/news/2005/03/0317_050317_warming.html

Oceans Found to Absorb Half of all Man-Made Carbon Dioxide

http://news.nationalgeographic.com/news/2004/07/0715_040715_oceancarbon.html

Melting Away

<http://magma.nationalgeographic.com/ngexplorer/0501/articles/mainarticle.html>

No Winter by 2105

http://news.nationalgeographic.com/news/2005/10/1017_051017_warming_weather.html

- a. Students will write a letter or report to state or national representatives persuading them to confront Global Warming. The letter or report will include:
 - evidence that the greenhouse effect has been impacted by excessive amounts of carbon dioxide
 - Data that supports the Global Warming
 - sources of carbon dioxide
 - solutions to reverse the effects of global warming
 - forecast for the future if nothing is done.
2. Students will make a poster, PowerPoint presentation, or other visual aid to educate others about the effect of carbon dioxide on the Earth's atmosphere and the greenhouse effect. The poster should illustrate and explain
 - the greenhouse effect
 - sources of carbon dioxide,
 - the importance of plants and human actions on carbon dioxide levels
 - solutions to preventing global warming.
3. Students will complete *Earth's Atmosphere- Greenhouse Effect* Assessment.
4. Complete the World of Energy Webquest:
 - Greenhouse Effect and Global Warming: *What's it Got to do with Me?*
http://www.worldofenergy.com.au/webquests/greenhouse/07_webquest_greenhouse.html



Extension

1. Students may research and present information about the Greenhouse Effect on Venus.
2. Students may collect data on world temperatures over the last 100 hundred years. Students can then create a spreadsheet and graph using the data.
3. Students may research other greenhouse gases such as ozone and chlorofluorocarbons.
4. Research Atlantis.



Assessment

1. *Trapped* Record Sheet
2. Journal
3. *Carbon Cycle Record Sheet*

TAKS Formatted Assessment

<u>Resources</u>	<u>Pages</u>
Kamico	247, 248; 213-216, 234, 235
Step up to the TAKS	116-118, 122-124, 128
TAKS Science Dailies	91, 92, 97, 98



Lesson 3: The Greenhouse Effect “Trapped”

Record the results of the experiment in the table below.

Temperature Data					
Container	Time (minutes)				
	Start time:	After 10 min	After 20 min	After 30 min	After 40 min
Covered box					
Uncovered box					
Difference					

1. Make a double line plot graph using the data from the table.
2. Identify the pattern of the temperatures for each box.

3. What was the range of temperatures for the covered box? _____
4. What was the range of temperatures for the uncovered box? _____
5. What was the difference between the temperatures at each interval?

Start _____

10 minutes _____

25 minutes _____

30 minutes _____

40 minutes _____

6. What conclusion can you draw based on the results?

7. If you waited for 30 more minutes, explain what you think the result would be for both boxes.

8. What time would it be after 50 more minutes? _____

9. Explain how the Earth's atmosphere is like a blanket.



Lesson 3: The Greenhouse Effect

The Carbon Cycle Record Sheet

Use the EPA Global Warming Kids Site: Carbon Cycle Movie to complete the questions.

1. Identify the places where carbon can be found.

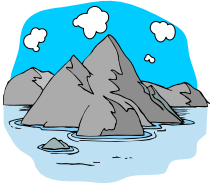
_____	_____
_____	_____
_____	_____

2. Make a diagram of the carbon cycle on land.

3. Make a diagram of the carbon cycle in the ocean.

4. Identify and explain at least two ways humans add carbon dioxide to the air.

5. Explain the consequences of having too much carbon dioxide in the air.



Lesson 3: The Greenhouse Effect *The Greenhouse Effect Assessment*

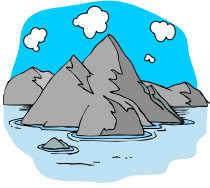
Make a labeled diagram of the Greenhouse Effect.

1. What is the role of carbon dioxide?

2. What role do plants play in the greenhouse effect?

3. What role do humans play in the greenhouse effect?

4. How can too much carbon dioxide be harmful?



Lesson 3: The Greenhouse Effect

TAKS Review

Students will identify and describe the importance of gases of the atmosphere and classify them as renewable, nonrenewable, or inexhaustible resources. (3.11A)

1. Some areas of the country have experienced wide-spread forest fires that last for many days. Which of the following may be an effect of these large forest fires?
 - A. The land will never be used again.
 - B. Plants and animals will never return to live.
 - C. The air will contain higher levels of oxygen since there will be fewer plants.
 - D. The air will contain higher levels of carbon dioxide until plant life grows back.
2. Rainforests around the Earth are shrinking in size. All of the following are benefits, or good things, the rainforests provide for the Earth, EXCEPT _____.
 - A. Rainforests provide a habitat for many plants and animals.
 - B. Rainforests add pollutants to the air.
 - C. Rainforests clean the air we breathe by taking in carbon dioxide and releasing oxygen.
 - D. Scientists are able to make new medicines using the many plants that live in rainforests.
3. Air is a _____ resource because it is used over and over again.
 - A. Renewable
 - B. Nonrenewable
 - C. Reusable
 - D. Mineral
4. During the greenhouse effect _____.
 - A. the Sun's energy is released into the atmosphere.
 - B. plants release oxygen into the atmosphere.
 - C. cold air is trapped in the atmosphere.
 - D. the Sun's energy is trapped in the atmosphere.

Students will identify the significance of the water, carbon, and nitrogen cycles. (5.6B)

1. In the carbon dioxide – oxygen cycle, _____
 - A. Plants take in oxygen and release carbon dioxide
 - B. People and animals breathe in oxygen and release carbon dioxide.
 - C. Plants take in nitrogen and release oxygen.
 - D. People and animals breathe in carbon dioxide and release oxygen.

2. All of the following release carbon dioxide into the air EXCEPT _____.
 - A. forest fires
 - B. volcanic eruptions
 - C. bicycling
 - D. driving a car