

Global Warming and Greenhouse Effects

Focus on Inquiry

The student will identify, explore and debate key questions that scientists have been investigating on global warming: the research questions, hypotheses, data collection methods, findings, and conclusions. This set of lessons may be used at the beginning of a school year as an introduction to science inquiry in earth science. Alternatively, each lesson may be used separately to focus on specific skills.

Lesson Overview

Students will explore several resources to identify the key issues and earth science concepts surrounding the debate on global warming and engage in a lab experiment on greenhouse effects.

Duration 4-5 45 minute lessons	Setting Classroom (lesson 1 & 2), computer lab (lesson 2)	Grouping Individual students, small groups, & whole class	PTI Inquiry Subskills 1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 3.5, 3.7, 3.8, 4.1, 4.2, 4.3, 4.4, 5.2, 5.3, 5.4, 5.5, 5.7, 5.8, 5.9, 6.1, 6.2, 7.2, 7.3
--	---	---	--

Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Lesson 1. <i>Is Global Warming?</i>	45 min.	1.1, 1.2, 1.3, 4.1	Internet: video clip of science news; brief scientific report	2	Students watch a news report and read a brief scientific report on global warming to identify research question, hypothesis, data collection methods, and conclusions from a new national study of research on global warming.
Lesson 2. <i>What is Greenhouse Effect?</i>	45 min.	1.1, 1.3, 2.1, 2.2, 3.1, 3.2, 3.5, 3.7, 3.8, 4.2, 4.3, 4.4, 5.4, 5.8, 5.9, 7.2, 7.3	Excel	3	Students conduct a lab experiment on greenhouse effect and complete a lab report. Use Excel to analyze the data.
Lesson 3. <i>What are the Causes of Global Warming?</i>	90 min.	4.1, 4.2, 4.3, 4.4, 5.2, 5.3, 5.5, 5.7, 6.1, 6.2, 7.2	Internet: animations and interactive simulations	3	Students explore a variety of resources and participate in a class debate on global warming, its causes and solutions.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

National Science Education Standards – Inquiry

Identify questions that can be answered through scientific investigations
 Design and conduct a scientific investigation
 Use appropriate tools and techniques to gather, analyze, and interpret data.
 Develop descriptions, explanations, predictions and models using evidence



Think critically and logically to make the relationships between evidence and explanations
 Recognize and analyze alternative explanations and predictions
 Communicate scientific procedures and explanations.
 Use mathematics in all aspect of scientific inquiry.

National Science Education Standards – Earth Science

Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.
 Water, which covers the majority of the earth’s surface, circulates through the crust, oceans, and atmosphere in what is known as the “water cycle.”
 Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate because water in the oceans holds a large amount of heat.
 The earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past.

Louisiana Grade Level Expectations – Inquiry



Gr. 8, Inquiry GLE#1 - Generate testable questions about objects, organisms, and events that can be answered through scientific investigation (SI-M-A1)
 Gr. 8, Inquiry GLE#2 - Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)
 Gr. 8, Inquiry GLE#3 - Use a variety of sources to answer questions (SI-M-A1)
 Gr. 8, Inquiry GLE#4 - Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
 Gr. 8, Inquiry GLE#5 - Identify independent variables, dependent variables, and variables that should be controlled in designing an experiment (SI-M-A2)
 Gr. 8, Inquiry GLE#6 - Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)
 Gr. 8, Inquiry GLE#7 - Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
 Gr. 8, Inquiry GLE#8 - Use consistency and precision in data collection, analysis, and reporting (SI-M-A3)
 Gr. 8, Inquiry GLE#9 - Use computers and/or calculators to analyze and interpret quantitative data (SI-M-A3)
 Gr. 8, Inquiry GLE#10 - Identify the difference between description and explanation (SI-M-A4)
 Gr. 8, Inquiry GLE#11 - Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)
 Gr. 8, Inquiry GLE#12 - Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
 Gr. 8, Inquiry GLE#13 - Identify patterns in data to explain natural events (SI-M-A4)
 Gr. 8, Inquiry GLE#14 - Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)
 Gr. 8, Inquiry GLE#15 - Identify and explain the limitations of models used to represent the natural world (SI-M-A5)
 Gr. 8, Inquiry GLE#16 - Use evidence to make inferences and predict trends (SI-M-A5)
 Gr. 8, Inquiry GLE#17 - Recognize that there may be more than one way to interpret a given set of data, which can result in alternative scientific explanations and predictions (SI-M-A6)
 Gr. 8, Inquiry GLE#a18 - Identify faulty reasoning and statements that misinterpret or are not supported by the evidence (SI-M-A6)
 Gr. 8, Inquiry GLE#19 - Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)
 Gr. 8, Inquiry GLE#22 - Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)

Louisiana Grade Level Expectations Earth Science

Gr. 8, GLE#23 - Explain the processes of evaporation, condensation, precipitation, infiltration, transpiration, and sublimation as they relate to the water cycle (ESS-M-A10)
 Gr. 8, GLE#26 - Describe and illustrate the layers of Earth’s atmosphere (ESS-M-A11)
 Gr. 8, GLE#29 - Make predictions about future weather conditions based on collected weather data (ESS-M-A12)
 Gr. 8, GLE#34 - Apply geological principles to determine the relative ages of rock layers (e.g., original horizontality, superposition, cross-cutting relationships) (ESS-M-B3)
 Gr. 8, GLE#35 - Describe how processes seen today are similar to those in the past (e.g., weathering, erosion, lithospheric plate movement) (ESS-M-B3)

Materials List

- Computers with Internet, sound card and speakers, as well as a projector for showing the video and graphics from <http://www.msnbc.msn.com/id/13474997/>

- Materials for the lab experiment: Two two-liter plastic soda bottle "experimental chambers" (instructions to follow)
- Two 14- to 16-oz. plastic containers at least 4 1/2 inches in diameter at the top (sour cream, cottage cheese, or deli containers work well)
- Knife or scissors
- Tape
- Two thermometers
- One 150-watt floodlight bulb
- Portable reflector lamp
- Stand for lamp set-up
- Graph paper

Advance Preparation

1. Print out the "Report in Brief" of the national study from <http://www.nas.edu/morenews/20060622.html>. Make copies for all students.
2. Print out the NASA article "Climate Change at the Start of 2006" from <http://www.pbs.org/now/science/climatemediaint.html>. Make copies for all students.
3. Print out lab procedures for the greenhouse effect experiment from http://www.ucar.edu/learn/1_3_2_12t.htm. Make one copy for each group.
4. Make sure the teaching station computer, the speakers, and the projector are working properly before showing the video clip.
5. Reserve a computer lab for Day 3 lesson when students explore resources to prepare for the class debate.

Other Information

Learning Objectives

The learner will:

- identify key processes of scientific procedures needed to complete an investigation.
- conduct a lab experiment on greenhouse effects.
- explore and communicate evidence and discuss alternative arguments and conclusions about global warming, its causes, and solutions.

Prior Knowledge Needed by the Students

- Formulating a hypothesis (If no prior knowledge, complete Drowning of New York City inquiry activity to develop knowledge of hypothesis and scientific inquiry: http://academic.brooklyn.cuny.edu/geology/leveson/core/topics/storm_surge/storm_surge_menu.html)

Procedures

Lesson 1. Focus Question: Is Global Warming? (45 minutes)

Engage (5 min)

1. Show a graphic image of global warming (See **Blackline Master #1**) and elicit KWL about global warming from the students.

Explore (20 min)

1. Use the teaching station computer to show the video clip (3 minutes) from <http://www.msnbc.msn.com/id/13474997/> to the whole class.
2. Have each student **read** the 4-page Report in Brief of the national study individually either online (<http://www.nas.edu/morenews/20060622.html>) or from the print out.
3. Have each student **identify** key information of the research: research question, hypothesis, data collection methods, findings, and conclusions using **Blackline Master #2**.

Explain (10 min)

Have students **share and discuss** their work:

1. Have one member of one group report their group answer about research question identification. Ask if other groups share the same answers. Ask those groups with different answers to report and explain their response. Teach or review what a good scientific question is.
2. Have one member of another group to report their identification of the hypotheses that the scientists posed prior to their investigations. Again, ask those groups with different answers to report and explain their response. Teach or review what a research hypothesis is and its role in scientific investigation.
3. Follow the same procedure to illicit and discuss answers from groups about data collection methods used. Discuss the value of these methods in earth science research and how the students may use these methods in their own investigations.
4. Follow the same procedure to illicit and discuss answers from groups about the research findings. Discuss the validity of these findings and identify alternative explanations.

Expand (10 minutes):

1. **Discuss** with the students the following questions:
 1. Are there any unresolved issues on global warming?
 2. What questions on the KWL chart remain unresolved?
 3. Are there any new questions?
 4. What are possible hypotheses related to the new questions?
 5. What methods may be used to study the questions?

Evaluate:

1. Have students turn in their Science Inquiry Reports for evaluation.

Lesson 2. Focus Question: What is Greenhouse Effect? (45 minutes)

http://www.ucar.edu/learn/1_3_2_12t.htm

Engage (5 minutes):

1. Elicit KWL about greenhouse effects from the students.

Explore (30 min):

1. Have each group **conduct** a lab experiment on greenhouse effects following the procedures at http://www.ucar.edu/learn/1_3_2_12t.htm (use print out, one for each group).

Explain (10 min)

1. Have each group complete a lab report for their experiment using the Science Inquiry Report Template (see **Blackline Master #2**). Use Excel to create a chart of the results.
2. Use Excel to create a class chart of the data. Share and discuss the groups' results in class as a whole.
3. Compare and contrast students' plastic greenhouse to the greenhouse effect on earth.

Evaluate:

1. Have students turn in their completed lab reports for evaluation.

Lesson 3: What Causes Global Warming? (2 45 minutes)**Engage** (5 minutes):

1. Tell the students that the class will read about and conduct a **debate** on whether there is global warming, what causes global warming, and what can be done.

2. Divide the class into three groups with each group assuming the role of scientists, business people or politicians.

Explore (45 minutes):

1. Each group will read about, examine and explore the issues from a selected perspective of their interest (e.g., scientists or business people or politicians) through the following resources. While exploring the resources, use the Global Warming Debate worksheet (see **Blackline Master #3**) to take note of your position, arguments and evidence.
 - **Read** the NASA article “Climate Change at the Start of 2006” online from <http://www.pbs.org/now/science/climatemediant.html> or the print out.
 - **Watch** the video clips:
 - i. Global warming 101 (3 min) <http://video.google.com/videoplay?docid=-6876966939042596341&q=global+warming&ei=rFONSLWiOJzwrAKvxazNDQ&hl=en>
 - ii. Global warming called off (10 min) <http://video.google.com/videoplay?docid=9132823768858842624&q=global+warming&ei=rFONSLWiOJzwrAKvxazNDQ&hl=en>
 - **Explore** Global Warming facts and our Future by Science Museum of the National Academy of Science <http://www.koshlandscience.org/exhibitgcc/index.jsp>. There are informational texts and several interactive activities.
 - **Explore** Global warming kids site by EPA <http://www.koshlandscience.org/teachers/prevgw-act001.jsp> You can navigate through a series of animated explanations that break the complex processes of global warming down into simple steps.
2. Each group will prepare their group perspective for the debate using PowerPoint or other presentation tools.

Explain (30 minutes):

1. The whole class will hold a **debate** on global warming from the different perspectives.
 - a. Each group present their opening statement and evidence
 - b. Provide counter arguments and rebuttal.

Evaluate (15 minutes):

1. Each student will write and submit a **report** describing their understanding of global warming, the causes of global warning and what can be done.

Blackline Master

1. Global warming chart
2. Science inquiry report template
3. Global warming debate notes

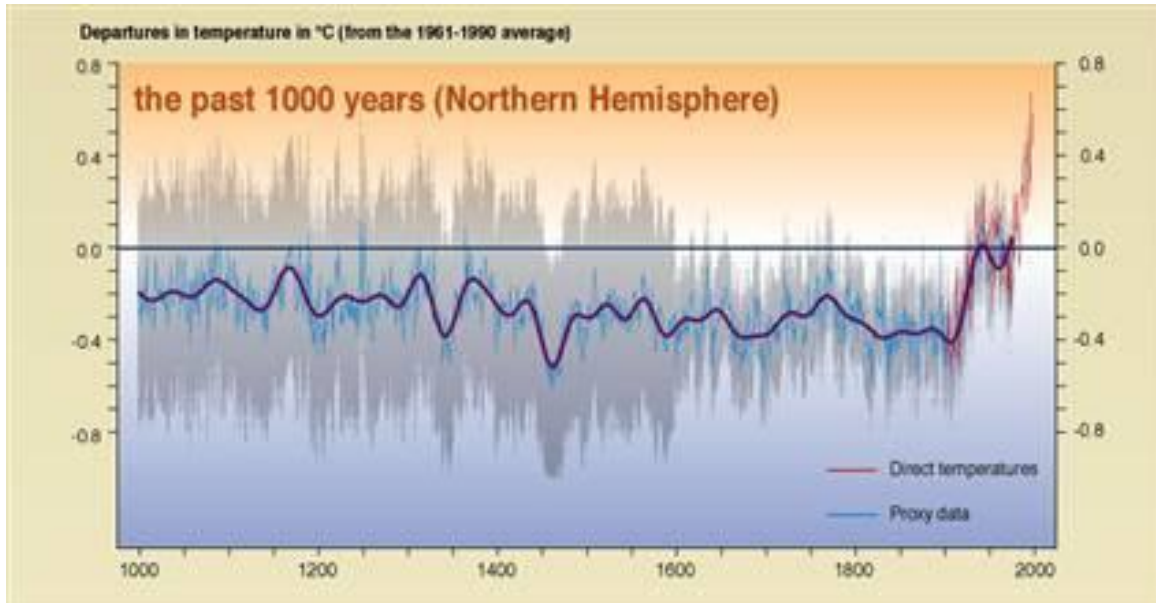
Supplementary Resources

The drowning of New York (online activity)

http://academic.brooklyn.cuny.edu/geology/leveson/core/topics/storm_surge/storm_surge_menu.html

Students investigate the evidence behind a newspaper story about sea level rise in New York City. In this activity, students learn about evaluating the evidence for the potential effects of global warming.

What do you make of this?



Source: [MSNBC.com. \(2006\)](http://www.msnbc.msn.com/id/13474997/) Earth warmest in at least 400 years, retrieved July 19, 2006,
<http://www.msnbc.msn.com/id/13474997/>



Name: _____ Date: _____ Class Hour: _____

Science Inquiry Report on _____

Research Question:

Hypothesis:

Data Collection Methods:

Findings (include a chart or table if possible):

Conclusion:



Name: _____ Date: _____ Class Hour: _____

Global Warming Debate Notes

Your role: Scientists Bush white house Oil industry Ordinary Citizen

Your position:

Your arguments:

Your supporting evidence:

1. _____

2. _____

3. _____

Your conclusion:
