E

Earth Science Standard E.4.c.

Teacher's Masters

California Education and the Environment Initiative

The Greenhouse Effect on Natural Systems

California Education and the Environment Initiative

Approved by the California State Board of Education, 2010

The Education and the Environment Curriculum is a cooperative endeavor of the following entities:

California Environmental Protection Agency
California Natural Resources Agency
Office of the Secretary of Education
California State Board of Education
California Department of Education
California Integrated Waste Management Board

Key Leadership for the Education and Environment Initiative:

Linda Adams, Secretary, California Environmental Protection Agency
Patty Zwarts, Deputy Secretary for Policy and Legislation, California Environmental Protection Agency
Andrea Lewis, Assistant Secretary for Education and Quality Programs, California Environmental Protection Agency
Mark Leary, Executive Director, California Integrated Waste Management Board
Mindy Fox, Director, Office of Education and the Environment, California Integrated Waste Management Board

Key Partners:

Special thanks to **Heal the Bay,** sponsor of the EEI law, for their partnership and participation in reviewing portions of the EEI curriculum.

Valuable assistance with maps, photos, videos and design was provided by the **National Geographic Society** under a contract with the State of California.

Office of Education and the Environment
1001 I Street • Sacramento, California 95812 • (916) 341-6769
http://www.calepa.ca.gov/Education/EEI/

© Copyright 2010 by the State of California
All rights reserved.
This publication, or parts thereof, may not be used or reproduced without permission from the Office of Education and the Environment.

These materials may be reproduced by teachers for educational purposes.

Contents

Lesson 1 Climate, A Changing Environment

None required for this lesson.

Lesson 2 Earth's Greenhouse

None required for this lesson.

Lesson 3 Sources and Sinks of Greenhouse Gases

None required for this lesson.

Lesson 4 GHGs and Climate Change

None required for this lesson.

Lesson 5 Too Much of a Good Thing?

None required for this lesson.

Lesson 6 Deciding About the Atmosphere

None required for this lesson.

Assessments

The Greenhouse Effect on Natural Systems—
Traditional Unit Assessment Master 2

Game Board Challenge —Alternative Unit Assessment Master 6

Name: _____

Part 1

Instructions: Select the best answer and circle the correct letter. (2 points each)

1. Which of the following is a source of thermal energy that is absorbed by Earth's atmosphere?
   a. the Sun
   b. human activity
   c. Earth itself
   d. All of the above.

2. Which of the following is not a greenhouse gas?
   a. carbon dioxide
   b. nitrogen
   c. water vapor
   d. methane

3. Aerosols in the atmosphere _____.
   a. are too small to have any effect
   b. are too large to have any effect
   c. reflect energy
   d. absorb energy

4. Which best describes Earth without the greenhouse effect?
   a. Earth would be warmer.
   b. There would still be dinosaurs on Earth.
   c. There would be no atmosphere.
   d. There would be no life as we know it.

5. Which of the following is the largest natural source of carbon dioxide in the atmosphere?
   a. respiration
   b. transpiration
   c. evaporation
   b. reflection

6. Which greenhouse gas comes from decomposing plants and animal matter?
   a. nitrous oxide
   b. carbon dioxide
   c. methane
   d. All of the above.

Name: _____

7. Which best describes a greenhouse gas sink?
- a. something that absorbs and stores greenhouse gases
- b. something that removes greenhouse gases
- c. something that turns into a gas in the atmosphere
- d. something that releases greenhouse gases when it burns

8. Which is true about forests?
- a. Without them, there would be no greenhouse effect.
- b. They are both a source and sink of carbon dioxide.
- c. They absorb CFCs from the atmosphere.
- d. They were not around during the ice ages.

9. Which of the following is a result of the greenhouse effect?
- a. the climate
- b. carbon dioxide in the atmosphere
- c. global warming
- d. Both a and c.

10. All of the following are probable results of global climate change except _____.
- a. changes in average seasonal temperatures
- b. changes in the amount of snow, polar ice, and glaciers
- c. more supervolcanic eruptions
- d. extinction of some organisms

Part 2

Instructions: Complete the following tasks in the spaces provided. (5 points each)

11. What is Earth's natural greenhouse effect on the atmosphere and how does it work?

Name: _____

12. How does the greenhouse effect relate to climate?

13. Explain how scientists are studying Earth's past climate. Why are they relating past climate to greenhouse gases?

14. Describe at least two things humans do that affect greenhouse gases in the atmosphere.

Name: _____

15. What decisions have people made to deal with climate change and how do those decisions affect human practices (what people should and should not do)?

Name: _____

The producers of a popular TV game show are asking for help. The theme of an upcoming show is: "The Greenhouse Effect and Natural Systems." The producers need your help in writing questions and answers they can use with contestants during the game. The producers will decide how much each question and answer is worth—all you have to do is come up with three good questions for each category that will challenge the contestants on what they know about each category.

This is what the game board will look like. Your questions will fill in the rows under each category when the game begins.

GHGs and the GHE	Sources and Sinks of GHGs	Human Influence on GHGs and Sources/Sinks	GHGs and Climate Change	Climate Science, Law, and Policy

Name: _____

Instructions: Using your 15 index cards, write three questions for each of the five categories. (Place each question and its answer on one card.) Write the question on the front of the card and the answer on the back. Make sure you identify to which category each of your cards belongs (see sample below). The more complete the questions and answers, the higher the points received.

Front

Category: GHGs and the GHE

Your question here

Back

Answer goes on back

Name: _____

You may use all of your work from this unit's lessons on the greenhouse effect and natural systems to help you create good questions and answers to challenge the contestants. Use the **Game Board Challenge Scoring Tool** on the following two pages to guide your writing.

Your game cards are due at the end of class. Good luck!

For Teacher Use

Score/grade on this assignment: _____

Comments:

Name: _____

Game Board Challenge Scoring Tool

Your questions for the game should:

Component	4 Points	3 Points	2 Points	1 Point
Identify the different atmospheric gases involved in the functioning of the greenhouse effect and the role of the GHE in the functioning of natural systems, human life, and communities.	Questions and answers identify all of the GHGs, how the GHE works, and the importance of the GHE to life on Earth.	Questions and answers identify most of the GHGs, how the GHE works, and the importance of the GHE to life on Earth.	Questions and answers identify some of the GHGs, how the GHE works, and/or the importance of the GHE to life on Earth.	Questions and answers identify at least one of the GHGs, how the GHE works, or the importance of the GHE to life on Earth.
Identify the roles of natural systems and human communities or activities on the production and absorption of atmospheric gases (sources and sinks).	Questions and answers identify natural sources and sinks of GHGs, that humans are the source of several significant GHGs that do not occur in nature, and how humans alter sources and sinks. Students should mention these GHGs by name.	Questions and answers identify the natural sources and sinks of most GHGs and that humans are the source of several significant GHGs that do not occur in nature. Students do not mention these GHGs by name.	Questions and answers identify the natural sources and sinks of some GHGs and that humans are the source of several significant GHGs. Students do not mention these GHGs by name.	Questions and answers identify the natural sources and sinks of some GHGs or that humans are the source of several significant GHGs. Students do not mention these GHGs by name.
Describe the possible effects of human activities on the accumulation and dissipation of greenhouse gases.	Questions and answers describe how humans affect the sources and sinks of all known GHGs.	Questions and answers describe how humans affect the sources and sinks of most known GHGs.	Questions and answers describe how humans affect the sources and sinks of some known GHGs.	Questions and answers describe how humans affect a source or sink of GHGs.

Name: _____

Game Board Challenge Scoring Tool (continued)

Component	4 Points	3 Points	2 Points	1 Point
Provide examples of the influences of the greenhouse effect on global climate change.	Questions and answers show how global temperatures and GHG levels in the atmosphere are determined and how they connect to climate and climate change.	Questions and answers show how global temperatures and GHG levels in the atmosphere are determined, but not how they connect to climate and climate change.	Questions and answers show how global temperatures and GHG levels in the atmosphere are determined, or discuss how scientists know about climate and climate change in Earth's past.	Questions and answers show that global temperatures and GHG levels in the atmosphere have changed over time, but do not discuss climate and climate change in Earth's past.
Identify and describe the factors that limit knowledge about the scope and potential environmental effects of global climate change.	Questions and answers identify and describe four factors that limit knowledge about the scope and potential environmental effects of global climate change.	Questions and answers identify and describe three factors that limit knowledge about the scope and potential environmental effects of global climate change.	Questions and answers identify and describe two factors that limit knowledge about the scope and potential environmental effects of global climate change.	Questions and answers identify or describe one factor that limits knowledge about the scope and potential environmental effects of global climate change.
Describe the role of scientific knowledge on policy and management decisions related to global climate change. Provide examples of what has been done locally, nationally, and internationally to address policy and decision making concerning climate change.	Questions and answers describe the theory that human contribution of carbon-based GHGs (CO_2 and methane) is changing the climate, and that scientific discoveries in this area have led to state, national, and international policies related to limiting GHG emissions from human activity.	Questions and answers describe the theory that human activities that emit GHGs (without stating which ones) are changing the climate, and that scientific discoveries in this area have led to state, national, and international policies related to limiting GHG emissions from human activity.	Questions and answers state that human activities are changing the climate, but do not clarify how or what activities are doing so. Questions and answers state that scientific discoveries in this area have led to state, national, and international policies related to limiting GHG emissions from human activity.	Questions and answers state that human activities are changing the climate, but do not clarify how or what activities are doing so or address the fact that scientific discoveries in this area have led to state, national, and international policies related to limiting GHG emissions from human activity.

California Education and the Environment Initiative

Printed on post-consumer recycled paper