

Lesson Planning Tool for Climate Change

Title of Lesson: Greenhouse Effect and Greenhouse Gases

Grade Level: 6-8

Subject: Physical Science

Source(s) of the lesson:(

http://www.doe.virginia.gov/testing/sol/standards_docs/science/2010/lesson_plans/earth_sci/cosmology_orgins_time/sess_ES-11cd.pdf

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

Essential Question(s):

Why is the atmosphere referred to as a blanket?

Massachusetts Curriculum Frameworks Science Standards:

6 PS 4-2 Use diagrams and other models to show that both light rays and mechanical waves are reflected, absorbed, or transmitted through various materials.

7 PS 3-6 Use a model to explain how thermal energy is transferred out of hotter regions or objects and into colder ones by convection, conduction, and radiation.

Content Objectives	Practice Objectives	Language Objectives
Use diagrams and other models to show how thermal energy is transferred on Earth.	2) Modeling	I can read and follow a multi stepped procedure to understand a concept.
Identify greenhouse gases and their purpose.	3) Carrying out investigation	I can explain the greenhouse effect with visuals and examples.
	4) Analyzing and interpreting data	
	6) Using math	

Important Vocabulary:

Tier 1 sun, gas, marine, blanket, rise, open, closed **Tier 2** system, energy, greenhouse gas, greenhouse effect, atmosphere, aquarium, carbon, reflect, absorb, solar **Tier 3** CO₂, habitat, climate change, convection, conduction, radiation **Advanced** Positive Feedback Loops, Earth's albedo, infrared

Materials Needed: Plastic bottles or glass jars, thermometers, soil, cellophane wrap (greenhouse effect) or alka seltzer tabs (greenhouse gas), lamps, pre-made data table and graphs, greenhouse effect fill in the blank

Other Resources: (websites, videos, books, etc.)

Suggested HW Coloring Activity-

<https://www.cog.ca/pww/documents/greenhouseeffectfinalcolouring.pdf>

Background Information for Teacher:

A greenhouse gas (sometimes abbreviated GHG) is a gas in the atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The primary greenhouse gases in Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone. In the Solar System, the atmospheres of Venus, Mars, and Titan also contain gases that cause greenhouse effects. Greenhouse gases greatly affect the temperature of Earth; without them, Earth's surface temperature would likely be colder than present.

A commonly held misconception about greenhouse gases is that they reflect heat back to Earth. Greenhouse gases do not reflect heat. They retain or absorb heat that radiates off of Earth's surface and reradiate it back to Earth and to space. Most of the heat, in fact, returns back to space. Students may also conclude that the gases absorb heat when sunlight first penetrates the atmosphere from the Sun, but this is not the case except for some like ozone, which has some absorption in the ultraviolet and in the infrared wavelengths. Earth first absorbs the visible radiation from the Sun, which is then converted to heat, and this heat radiates out to the atmosphere, where the greenhouse gases then absorb some of the heat.

(http://www.doe.virginia.gov/testing/sol/standards_docs/science/2010/lesson_plans/earth_sci/cosmology_orgins_time/sess_ES-11cd.pdf)

Background Information the Student Needs to Access the Lesson:

Students should have some familiarity with what energy is the movement of it (heat transfer). Recommended to be done after Investigation 4, *Heat Transfer* from the Foss *Weather and Water* unit.

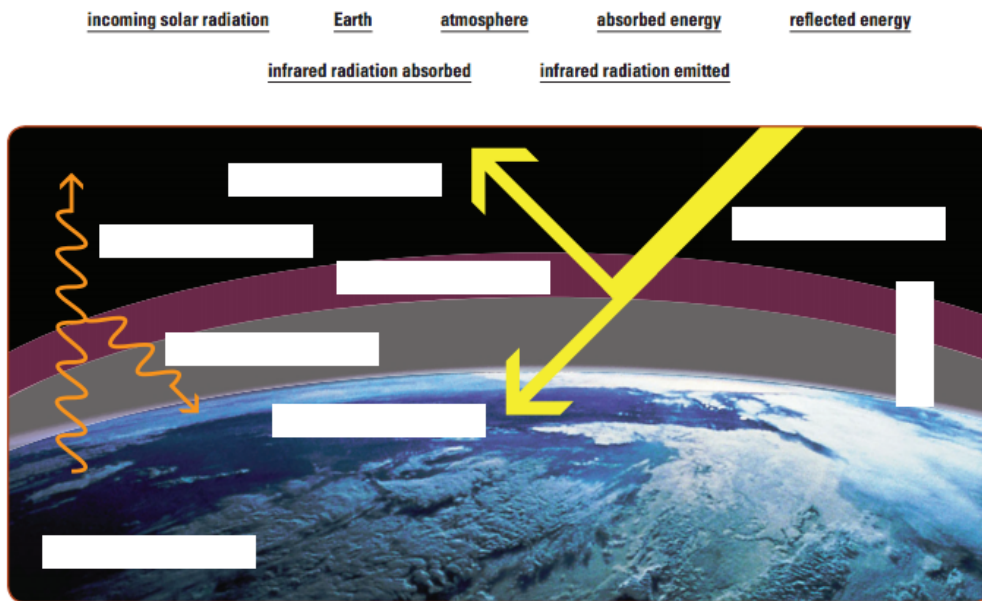
Lesson Structure

Lesson Launch (Do Now)	Brain dump on the word- Greenhouse- when have they heard it? What does it look like? How does it work? Project a picture of it.
Background Instruction (pre-activity)	Audiovisual- New England Aquarium Introduction with closed captioning (5:05 min) https://www.youtube.com/watch?v=TVr95sDQwl8&feature=youtu.be Student Sheet #1-6 http://www.neaq.org/wp-content/uploads/2016/06/LEARN_3-7_BI_intro_student.pdf Advanced- positive feedback loops, Earth's albedo Reciprocal teaching Reading- Energy in the Atmosphere http://www.ck12.org/section/Energy-in-the-Atmosphere-%3A%3Aof%3A%3A-MS-Earth%E2%80%99s-Atmosphere-%3A%3Aof%3A%3A-CK-12-Earth-Science-For-Middle-School/ Advanced video- https://www.hhmi.org/biointeractive/greenhouse-effect
Activity	Student Choice- Greenhouse effect Modeling or Carbon as a

	Greenhouse Gas Modeling
Discussion/ Debrief	- Gallery walk share out- graph and labeled picture -Questions on Greenhouse Effect/Greenhouse Gas modeling activity
Formative Assessment	<p>1) Whip-Around (Go-Around): When a brief answer can show understanding, self-assessment, or readiness for a task, teachers ask students to respond to a standard prompt one at a time, in rapid succession around the room(https://www.engageny.org/sites/default/files/resource/attachments/appendix_protocols_and_resources.pdf)</p> <p>a) List the greenhouse gases and/or how the greenhouse effect works</p> <p>b) Answer essential question</p> <p>2) Engineering Design Challenge- Provide materials for students to create their own Models of the Greenhouse Effect https://www.teachengineering.org/activities/view/cub_housing_lesson03_activity2</p>

Taken

Notes:
from:



<http://nsgl.gso.uri.edu/ohsu/ohsue12003.pdf>

Greenhouse Effect Modeling

Question: _____

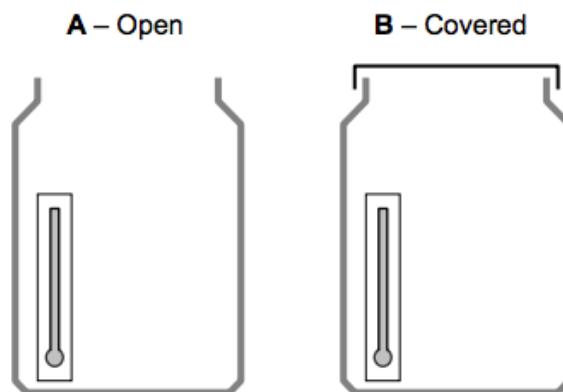
Materials (list what you use)

Procedure

1. Cover the bottom of two glass jars or bottle with 2 to 3 centimeters of dark soil. (If using bottle, cut off the top)
 2. Place a temperature probe or thermometer inside each glass jar or bottle.
 3. Lightly dampen the soil
 4. Cover one glass jar or bottle with plastic wrap.
 5. Locate a lamp approximately 25 centimeters above both jars or bottles
 6. Predict which jar/bottle will get warmer faster.
 7. Record the initial temperature of the temperature probes or thermometers on the data charts.
 8. Record the temperature of each jar or bottle every minute for 15 minutes.
- Optional- Turn the light off for fifteen minutes. Record the data on your data table every minute for 15 minutes.
9. Analyze data by graphing both sets of data
 10. Interpret the data

by answering the

questions

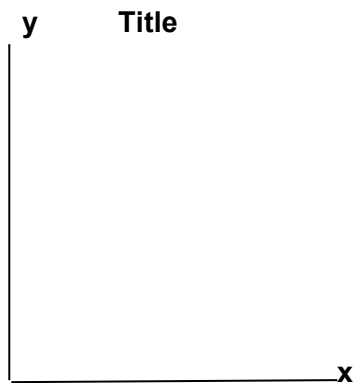


Picture from: <http://www.starhop.com/library/pdf/studyguide/elementary/glojar-7.pdf>

Data- Collect temperature reading every minute for 15 minutes

A- Open system (model without plastic wrap)		B- Closed System (model with plastic wrap)	
Minute (x)	Temperature (y)	Minute(x)	Temperature (y)
0		0	

Analyze Data- Create a graph and color code open system and closed system



Interpret Data

The models simulate a closed system (a planet with greenhouse gases) and an open system (a planet without greenhouse gases). What does each part represent (lamp light, soil, air in the container, and the plastic wrap)?

How was this a realistic model of the greenhouse effect?

How was this NOT a realistic model of the greenhouse effect?

Did one system heat more quickly?

Which system had the greatest change in temperature?

Communicate Evidence

Draw/label a picture of how CO₂ and other gases affect temperature. Explain.

Carbon as a Greenhouse Gas Modeling

Question: _____

Materials (list what you use)

Procedure

1. Place an alka seltzer tab in one of the two glass jars or bottle (If using bottle, cut off the top)
2. Place a temperature probe or thermometer inside each glass jar or bottle.
3. Locate a lamp approximately 25 centimeters above both jars or bottles
4. Add 25 ml of H₂O to each jar/bottle
5. Predict which jar/bottle will get warmer faster.
6. Record the initial temperature of the temperature probes or thermometers on the data charts.
7. Record the temperature of each jar or bottle every minute for 15 minutes.

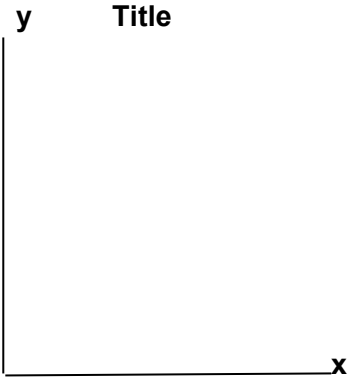
Optional- Turn the light off for fifteen minutes. Record the data on your data table every minute for 15 minutes.

8. Analyze data by graphing both sets of data
9. Interpret the data by answering the questions

Data- Collect temperature reading every minute for 15 minutes

Only Air model		Alka Seltzer Model	
Minute (x)	Temperature (y)	Minute(x)	Temperature (y)
0		0	

Analyze Data- Create a graph and color code 'only air' and 'alka seltzer' models



Interpret Data

The models simulate a planet with greenhouse gas and a planet without greenhouse gases. What does each part represent (lamp light, alka seltzer, air in the container) represent?

How was this a realistic model of a greenhouse gas?

How was this NOT a realistic model of greenhouse gases?

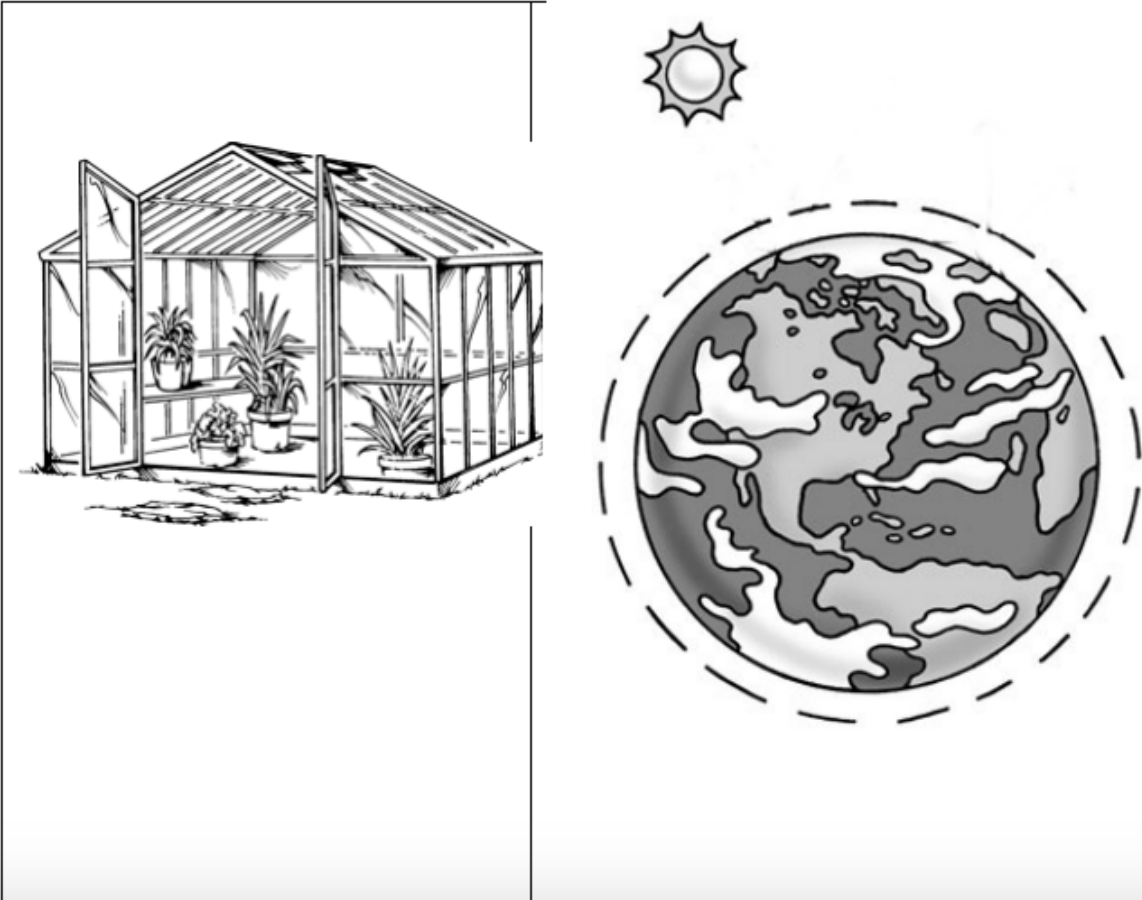
Did one bottle or jar heat up more quickly?

Which one had the greatest change in temperature?

Communicate Evidence

Draw/label a picture of how CO₂ and other gases affect temperature. Explain.

Formative Assessment- Answer Essential question- project following picture-



Picture taken from:http://www.emsb.qc.ca/laurenhill/science/STvolume5_2013CycleGlaciers.pdf