



Global Warming & Climate Lesson Strand

NS 696 V: Weather and Climate for Educators

Lesson Overview/Purpose:

This lesson is designed to take place over 3-4 days in a 10th grade Biology class, although it could be adapted and lengthened for a physical or earth science course, as well as geared up or down depending on student abilities and grade level. I assume the students have a basic understanding on conservation of matter and energy, basic Earth science, basic ideas about what causes global warming. Part of my biology course includes a small amount of time spent discussing the environment and how humans affect and interact with it. Without some background knowledge about how the Earth's climate operates and the difference between climate and weather – it is impossible to learn about humankind's biggest impact on the environment: global warming.

Colorado State Science Standards (from 2007 Colorado Model Content Standards):

Standard 1: 9-12 Benchmarks – 1, 2, 3, 4, 5, 6

Standard 2: 9-12 Benchmarks – 5, 6, 7, 8, 9

Standard 4: 9-12 Benchmarks – 4, 5, 9, 10, 11

Standard 5: 9-12 Benchmarks – 3, 4, 6

Materials Required:

Laptop Computer

Smart Board (not required, but I will use one for my lecture)

LCD projector

Video: *An Inconvenient Truth* (available from Netflix)

World Map placemats or laminated color copies (x10)

Overhead transparencies (x30-60 – available from Office Depot)

Desk Lamps

Infrared Thermometers (x10 - available from Harbor Freight)

Fun Size M&Ms (x24 (4 groups, 6 blocks) – available from WalMart)

Science Overview:

There are several key scientific concepts that the instructor must firmly understand in order to effectively use this lesson:

-Energy comes from the sun in the form of visible and infrared light (among other things, like UV, X-ray, etc).

-Energy from the sun strikes the Earth and is absorbed by the ground, and remitted as thermal radiation.

-It strikes unevenly, with the energy radiating from the ground being distributed by the movement of the atmosphere

-Some of the energy radiating from the ground is absorbed by the greenhouse layer of the atmosphere; this keeps the Earth from having huge temperature swings, like the moon.

-Humans are burning fossil fuels and releasing CO₂ (a greenhouse gas) at a rate higher than is naturally able to be absorbed by photosynthetic life on Earth / dissolves into the oceans.

-CO₂ amounts in the atmosphere have risen essentially exponentially since the industrial revolution.

-Models predict that these levels of CO₂ will create an average temperature increase of 5-11F in North America, more at the poles.

Lesson Structure:

Engage:

Ask students “what is global warming?”, “do you think global warming is happening?”, “How do you know?” (in other words, try to get someone to talk about the weather locally being warmer/ colder). Possibly have student text message someone outside the school building and ask them what they think global warming is. Once a student / the teacher bring up the weather- ask for student ideas about weather vs climate. Next, group students by using SmartBoard spinners or other random generator into 4 groups. Provide each group with a Fun-Size bag of M&Ms. Bring up a table on the SmartBoard for students to record their results. Explain that each group represents a year and each bag will determine what the weather is like on March 1st. A blue M&M means a cool and cloudy day, an orange indicates warm and sunny. They should remove M&Ms from the bag until they get either an orange or a blue M&M, at which point they will record their results on the SmartBoard table. Once the results are in, the teacher should discuss how just because a day, month, or even year is “hotter than normal” or “colder than normal” it doesn’t indicate anything by itself. Explain that climate is about overall trends for the temperature of the Earth.

Explore:

Use PowerPoint or SmartBoard to briefly illustrate the idea that energy from the sun is absorbed by the ground on Earth, and that then that energy radiates away from the Earth. Explain that some of the energy leaving the Earth is trapped in and “bounces back” from the atmosphere, the “greenhouse layer.” *An Inconvenient Truth* has an excellent, simply explained cartoon of this – I would probably just show that and then go over it briefly. Hand out world maps, lamps, IR thermometers. Have students explore how different “colors” on the map absorb more or less energy and thus eventually have different temperatures. Ask what parts of the Earth might radiate more/less energy. Next, hand out transparencies and ask students to find out if they can use them to simulate the effect the atmosphere has on the Earth. The areas under more transparencies should be warmer than those without. Relate to an increase in CO₂/other greenhouse gasses, relate to Mars.

Explain:

Lecture about the following topics, using PowerPoint / Smart Notebook:

- What is global warming (review)
- Difference between weather and climate (review)
- How the atmosphere allows energy to be absorbed by the Earth and traps some of it when the ground radiates the energy as thermal radiation.
- Evidence of global warming
- What can be done to stop or reverse the buildup of greenhouse gasses in our atmosphere
- Stabilization wedges

Extend:

Watch and discuss selections from *An Inconvenient Truth*. Have students use Glogster.com to create an online poster/ad with ways to reduce their CO₂ emissions. As an alternate assignment, allow students to write a 250 word response to how they can reduce their own CO₂ emissions and publish it as a comment on a class blog. This “extend” portion will likely take 2 full days with one-hour blocks and plenty of stopping the video for discussion/explanation (critical).

Evaluate:

Student Glogsters will be graded for effort, creativity, and content. At the conclusion of each day, teacher will ask a “check for understanding” question on what was discussed. Students will respond with cell phones via TextTheMob.com.

Lesson generated by Jim Howat