The Greenhouse Effect Game

Lesson 2

Next Generation Climate: Grades 6-8

Climate Generation: A Will Steger Legacy

https://www.climategen.org/

2015

Activity 1: The Greenhouse Effect Game

Teacher Instructions: This activity will help students make a model of the atmosphere and will facilitate discussion. Students will illustrate a diagram of the greenhouse effect throughout the game. In the student's drawings there will need to be arrows representing where light, heat, energy, etc. are coming from. As a teacher, these are things you should not instruct your students to do, but highlight as you review their work and as they improve their diagrams after each round of game play. "How did you show movement? Heat? Light? Amount?" Encourage them, "I like how you used arrows to show direction/amount/etc." The game will work best with 15-30 students.

Setup (see Background Information)

1. Have students each make two notecards. One says HEAT and the other LIGHT.
2. Before going outside, have students draw a diagram of the greenhouse effect in their journals. Be sure they label what they draw, even if it is only a few things. They need to bring their journals outside to draw after each round of the game.
3. Take students outside to play the game. Explain that the smaller circle represents the Earth and the larger one represents Earth's atmosphere. Have students place their 'heat' cards in a pile on the Earth.
    - Misconception Alert: Explain to students that the size to atmosphere is not to scale. In real life the Earth's diameter is 7,917 miles and the atmosphere reaches about 800 miles above the Earth. A good analogy would be a peach. The flesh would represent the earth and the skin would represent the atmosphere.

Play (Take it Outside)

Round 1: Natural greenhouse effect.

a. Choose two students to be CO_2 molecules, and place them anywhere in the Earth's "atmosphere." Once they are in the atmosphere they cannot move their feet. The other students are sunlight (energy) from the sun — standing outside of the atmosphere.

b. The object of the game is for the sunlight to enter the atmosphere, tag the Earth, exchange their 'light' card for a 'heat' card, and then escape the atmosphere without getting tagged by a CO_2 molecule. Students can only be tagged once they become heat (after they tag the earth and exchange their cards). This simulation recreates the greenhouse effect: energy from the sun is trapped as heat by CO_2 and other gases in the atmosphere. Sunlight who are tagged must stay standing still in the atmosphere. Those who avoid being tagged bounce back out of the atmosphere into space. The round lasts approximately 30 seconds.

c. After the first round, have the escaped sunlight form a circle around the atmosphere to check how much heat has been trapped by greenhouse gases. During the first round, most of the energy will have escaped the atmosphere because CO_2 levels are low. Discuss how this may affect the temperature of the planet. Remind students that a certain amount of CO_2 is necessary to keep the planet consistently warm enough to support life. Before continuing the game, clear all the trapped sunlight (heat) out of the atmosphere.

d. After round one, give students several minutes to add or change their diagrams and give them time to journal about what they learned about the greenhouse effect. What would they change about their initial diagram?

Round 2: Human enhanced greenhouse effect.

a. Increase the number of CO_2 molecules in the atmosphere. Do this by reaching into the "What do humans do?" bag and pulling out an action card (for this round, include only cards that add CO_2 to the atmosphere). Follow the directions on the card and play again. Give time to journal and draw after round 2.

Round 3: Slowing down the greenhouse effect.

a. Put all of the action cards in the bag so that CO_2 levels will increase and decrease based on the actions taken. Discuss what happens with each draw (2-3 cards). Some cards will not increase or decrease CO_2 levels. Riding your bike instead of driving will not add CO_2, but it won't take away CO_2 either. (Students will learn about mitigation in Lesson 5.)
b. Give time to journal and draw after round 3. How did students' idea of the greenhouse effect change throughout the game? What conclusions can be drawn?

Activity 1: Wrap-up

Have a discussion about how energy from the sun gets trapped in the Earth's atmosphere. Discuss how human actions, particularly burning fossil fuels, can enhance the greenhouse effect by putting more CO_2 into the atmosphere. This increase in CO_2 which is increasing global temperature is referred to as climate change. The game should demonstrate that when you increase the amount of CO2, more heat gets trapped (illustrated by the students that were tagged in the atmosphere) and the Earth's temperature increases. The action cards demonstrate how even small-scale actions can affect the amount of greenhouse gas that we emit to the atmosphere. The game can be a springboard into a variety of other explorations such as researching alternative energy sources, discussing sustainable lifestyles, and examining the various solutions humans can take part in. Use the following questions for a wrap-up discussion:

a. How was this game like the atmosphere/not like the atmosphere?
b. What makes the game an accurate or inaccurate model of the atmosphere?
c. How did your diagram change throughout the game? What did you learn during the game?
d. How did you show things moving around? How did you show quantity? How did you show that light changes to heat?

Greenhouse Effect Game Action Cards

Adapted from Climate Generation's *Next Generation Climate: Grades 6-8*
Kottie Christie-Blick
www.kottiecb.com

People drive cars. **Every gallon of gas puts 18.8 pounds of CO_2 into the atmosphere.**  **Add 4 CO_2 molecules.**	**People ride bikes and walk.** **Biking and walking put no extra CO2 into the air, and it keeps you in good shape!**  **Add no CO_2 molecules.**
People cut down trees. **Trees are needed to remove CO_2 from the air during photosynthesis. Having fewer trees on Earth means more CO_2 in our air.**  **Add 4 CO_2 molecules.**	**People throw stuff away.** **All stuff breaks down over time. As it sits in the landfill, it releases carbon dioxide, methane, and other gases into the air.**  **Add 2 CO_2 molecules.**
People plant trees. **Trees remove CO_2 from the atmosphere during photosynthesis.**  **Remove 2 CO_2 molecules.**	**People waste electricity.** **People leave on lights when not needed. They use more air conditioning and heating than they really need. They leave technology turned on when not in use.**  **Add 2 CO_2 molecules.**
People recycle. **Recycling materials such as paper, glass, metal and plastic uses less energy than making brand new products.**  **Add no CO_2 molecules.**	**People reduce their energy use at home.** **People replace their regular light bulbs with LED bulbs. They turn off lights, and use less air conditioning and heating. They turn off technology.**  **Add no CO_2 molecules.**
People support climatologists. **People listen to climate scientists because they are the experts. They support their work to reduce the amount of greenhouse gases going into the air, and sequester the CO_2 that is already in the air.**  **Remove 4 CO_2 molecules.**	**People support environmental laws.** **People support laws that protect our air, land, and water from becoming poisoned, and work to remove the harmful pollutants that are already in our air, land, and water.**  **Remove 4 CO_2 molecules.**