



Greenhouse

Effect Game

Objective

Students will understand how human activities impact our how our planet functions and sustains life.

Grade Levels

4th – 8th Grade

Duration

45 Minutes

of Kids

25 students

Setting

In Class Lesson	Outdoor Classroom	Professional Development
After School	Field Trip	Career Day
Recycling Team Training	Parent Meeting	Community Event

Supplies

- Tape or chalk
- Recording sheet
- Human Action Cards

Procedure

- Before the game chalk or tape circles to decrease waiting time for students. Explain the rules of the game before taking students outside or removing them from their seat to participate.
- Set up the game space by chalking a large circle with a smaller circle inside of it. The small circle will represent the Earth that students will have to tag as they enter the large circle representing the atmosphere. Have a large paper where you can record the number of sunbeams trapped and escaped per round, also include a place to write the given card scenario.
- Explain to students that the object of the game is for those students identified as sunbeams to enter the atmosphere and tag Earth only once by touching the inner circle with a hand or foot. The sunbeams must then escape without being tagged by the students identified as carbon dioxide molecules who will stand frozen in the atmosphere. If sunbeams are tagged they must take a seat inside the atmosphere and the sunbeams that escape without being tagged will take a seat outside of the atmosphere until the round is over. It is important to explain to students that the game is recreating how the greenhouse effect works where energy from the sun is trapped as heat by the carbon dioxide in the atmosphere.
- Each round will last only thirty seconds. After each round all students will take a seat to evaluate the amount of trapped heat in the atmosphere and tally the number of carbon dioxide molecules, escaped sunbeams and trapped sunbeams; be sure to include the card scenario that was given.

Round 1: Identify two students to be carbon dioxide molecules placed in the atmosphere to show that the atmosphere has carbon dioxide existing in it. Record the data after the round then discuss the importance of carbon dioxide in the atmosphere because it allows the Earth to stay warm enough to support life. This round should have most of the sunbeams escape because of the low levels of carbon dioxide.

Round 2: Choose a card from the “What did humans do?” bag. For the second round only use the negative cards, which give scenarios that increase carbon dioxide levels in the atmosphere. After the round discuss the difference in trapped sunbeams compared to the first round and evaluate how this might affect the temperature of the Earth.

Round 3-7: Add the positive cards to the “What did humans do?” bag. These cards give scenarios, which show how humans can positively impact the levels of carbon dioxide in the atmosphere, these cards will decrease the number of carbon dioxide molecules. Continue to choose card and play out each round until there are no cards left in the bag. After each round record the data and the card scenario chosen.

- Have students examine the data table and evaluate the differences in how the levels will affect the Earth's temperature. Be sure to focus students' attention to the relationship between carbon dioxide molecules, trapped sunbeams and the Earth's temperature. Explain to students that the increase in carbon dioxide molecules in the atmosphere will also increase the number of trapped sunbeams in the atmosphere causing the Earth's temperature to rise.
- Discuss with students the human action cards and the impact the positive actions compared to the negative actions had on trapped sunbeams in the atmosphere.

Human Action Cards:

Negative:

Humans drive cars: Every gallon of gas puts 18.8 lbs of CO₂ into the atmosphere. *Add two CO₂ molecules.*

Humans cut down trees: Trees remove CO₂ from the atmosphere during photosynthesis. Fewer trees mean more CO₂. *Add four CO₂ molecules.*

Humans use incinerators: Burning waste puts CO₂ into the atmosphere along with other pollutants. *Add two CO₂ molecules.*

Humans burn coal to generate electricity: Using coal inside coal-fired power plants creates energy but also releases pollutants and CO₂ into the atmosphere. *Add three CO₂ molecules.*

Positive:

Humans ride bikes: Riding a bike is the most energy efficient form of transportation and it's fun! *Remove two CO₂ molecules.*

Humans recycle: Recycling save energy, reducing our use of fossil fuels. *Remove two CO₂ molecules.*

Modifications

Humans use renewable energies: Using technology to harness renewable energy sources like solar panels and wind turbines help reduce our use of fossil fuels. *Remove four CO₂ molecules.*

Humans drive hybrid cars: Using efficient technology that doesn't require as much gasoline reduces the amount of CO₂ released in the atmosphere. *Remove three CO₂ molecules.*

Record Sheet Example:

Round Number:	Sunbeams Trapped:	Sunbeams Escaped:	Human Action Card:

- With younger students do two examples without starting the cards to ensure all students know the flow of the game.
- Make sure to switch the roles students play to keep their interest.

<p>Humans drive cars. Burning fossil fuels increases the levels of CO2 in the atmosphere</p> <p>Add CO2 Molecules</p> <p>Discuss: Detroit connection – what public transportation is offered? What could be improved? Historically Detroit had an incredible public streetcar system in its height had 908 cars on 19 routes. https://detroit.curbed.com/2017/9/22/16322202/detroit-transit-history</p>	<p>Humans eat meat regularly. Meat production creates pollution through fossil fuel use and transportation of animals.</p> <p>Add CO2 Molecules</p> <p>Discuss: Meat production especially beef has a large carbon footprint meaning the amount of greenhouse gases produced to directly support an activity like raising a cow.</p>
<p>Humans ride bikes or use public transportation. Minimizing fossil fuel use for personal transportation allows less CO2 to enter the atmosphere.</p> <p>Less CO2 Molecules</p> <p>Discuss: what are other options? Carpool, planning ahead to do errands in a loop to decrease miles driven.</p>	<p>Humans adopt a flexitarian diet. Flexitarian is a style of eating that encourages mostly plant-based foods while allowing meat and other animal products in moderation.</p> <p>Less CO2 Molecules</p> <p>Discuss: being flexible with your diet and eating more vegetables decreases the greenhouse gases your diet contributes. To compare a 4 ounce serving of beef adds 6.61 pounds of CO2 compared to carrots that add .07 pounds of CO2. http://css.umich.edu/sites/default/files/Carbon_Footprint_Factsheet_CSS09-05_e2018_0.pdf</p>
<p>Humans eat local produce. Local produce travels far less than commercial produce which decreases the amount of fossil fuels used.</p> <p>Less CO2 Molecules</p> <p>Discuss: think about how many miles a banana has traveled to get to Michigan.</p>	<p>Humans use electricity. In Michigan 97% percent of our electricity is generated from burning petroleum, natural gas and coal.</p> <p>Add CO2 Molecules</p> <p>Discuss: Turning off electronics and unplugging when not in use can reduce CO2 emissions.</p>

Humans acquire, use and dispose goods. Americans throw away 7 pounds of trash daily, accumulating to 2,555 pounds of trash every year.

Add CO₂ Molecules

Discuss: shopping smart and purchasing items with low carbon footprint when possible. Consider packaging. Ask students what is the craziest packaging they have seen?

Humans practice the 3 Rs. Reduce, Reuse, Recycle and in that order!

Less CO₂ Molecules

Discuss: share some ways to practice 3Rs? Recycling half of household waste can save 2,400 pounds of CO₂ each year from being emitted into the atmosphere.