Science Learning Packet

Grade 6: Earth's Changing Climate, Lesson 11

Suggested science learning activities for SPS students during the COVID-19 school closure.

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Due to the COVID-19 closure, teachers were asked to provide packets of home activities. This is not intended to take the place of regular classroom instruction but will help supplement student learning and provide opportunities for student learning while they are absent from school. Assignments are not required or graded. Because of the unprecedented nature of this health crisis and the District’s swift closure, some home activities may not be accessible.

If you have difficulty accessing the material or have any questions, please contact your student’s teacher.
Investigation Question: What can be done to stop the carbon dioxide and methane in Earth’s atmosphere from increasing?
Lesson 11
The head climatologist is calling on you to help put together a climate change solutions blog. This blog will spread the word and inspire people to make these solutions a reality. In this lesson you will explore one solution in detail and explain this solution and its effect on the climate in your blog post.

Vocabulary you will use in this lesson:

- atmosphere
- carbon dioxide
- change
- claim
- climate
- climate change
- combustion
- energy
- evidence
- explanation
- human activities
- methane
- stability
- temperature
Lesson 11 – Part 1: Analyzing Graphs form the Earth’s Changing Climate Sim

One of these Sim tests was run with the Combustion per Person set to high; the other one was run with Combustion per Person set to medium. Which is which? Select the setting for each graph.

Explain how you knew which graph was which.
Lesson 11 – Part 2: Analyzing One Solution to Climate Change

Your assignment from Irene Lee is it be to become very familiar with one solution. You will be able to explain why the solution is needed and what the solution does to help reduce carbon dioxide or methane in the atmosphere. Over the last 2 lessons we looked at 5 different climate change solutions and modeled each in the sim.

Lesson 9:
- Producing Less Carbon Dioxide – Solar Power
- Producing Less Carbon Dioxide – Bikes and Transit

Lesson 10:
- Removing Methane – Capturing Methane from Cows
- Removing Carbon Dioxide – Capturing Carbon Dioxide at Power Plants
- Removing Carbon Dioxide – Reforestation

Choose one of these solutions to explore more. You will then write a blog post about this solution for the World’s Climate Institute’s. Reread the section of the article from Lesson 9 and 10 that explains your solution (article included in this packet, starting on the next page). Highlight helpful information as you read, and then answer the following questions:

1. Which solution did you read about? (circle one)
   a. solar power
   b. bikes and transit
   c. capturing methane from cows
   d. capturing carbon dioxide at power plants
   e. reforestation

2. What kind of solution is it? (circle one)
   a. This solution produces less carbon dioxide.
   b. This solution removes carbon dioxide from the atmosphere.
   c. This solution removes methane from the atmosphere.
3. Explain why the solution is needed.

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4. Explain how the solution works.

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5. Is this a good solution? Why or why not?

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Combustion, or burning fuel, is the process used to power most of our homes, businesses, and cars. Combustion adds carbon dioxide gas to the atmosphere.

Climate Change Solutions

The Problem: Too Much Carbon Dioxide and Methane

Most of the energy sources humans use to power our homes, businesses, and cars involve burning fuel, a process we call combustion. Combustion leads to higher temperatures on Earth—but not because fires are hot. The process of burning almost any fuel puts carbon dioxide (CO2) into the atmosphere, whether the fuel is coal, oil, natural gas, or wooden logs. It’s this increase in carbon dioxide that warms the planet.

Carbon dioxide is not the only gas that affects the Earth’s climate. Would you believe that some of the gases that warm the planet come from inside farm animals? Cows and other grass-eating animals, like sheep and goats, produce a gas called methane, which also warms the planet when it gets into the atmosphere. Methane is also produced by industrial sources such as using natural gas to produce electricity. However, of the methane put into the atmosphere by human activities, 35% comes from raising grass-eating animals.

Because they warm the planet, carbon dioxide and methane are known as greenhouse gases. How do we solve the problem of too much carbon dioxide and methane in the atmosphere? Many people have thought of possible solutions, like capturing carbon dioxide at power plants, reducing the amount of methane animals release into the air, and using more solar power. We may need to use all of these solutions together if we want to solve as huge a problem as climate change!
Part of the Solution: Removing Carbon Dioxide and Methane

Capturing Carbon Dioxide at Power Plants

We put carbon dioxide into the atmosphere by using electrical devices like lights, phones, and computers. Why is that? Phones and light bulbs don’t burn any fuel—they run on electrical energy. However, that electrical energy had to come from somewhere. It traveled through power lines from a power plant. Most power plants generate electricity by burning fossil fuels like coal, oil, or natural gas. Burning those fuels sends carbon dioxide into the atmosphere.

For now, millions of people rely on power plants for electricity, and those power plants nearly always release carbon dioxide. What if we could stop that carbon dioxide from reaching the atmosphere? Some power plants use complicated processes to capture the carbon dioxide produced by burning fuel and store it deep underground. Capturing carbon dioxide keeps it out of the atmosphere, which helps stop the planet from warming as quickly. However, capturing carbon dioxide is expensive, and we don’t know what the long-term effects might be of burying huge amounts of carbon dioxide underground.
Part of the Solution: Removing Carbon Dioxide and Methane

Capturing Methane from Cows

Cows are very good at getting energy from plants, but the microorganisms that live in their digestive systems and help them eat grass also produce a lot of methane—and that methane has to get out somehow. In this case, it leaves the cows’ bodies through burps and farts! In one year, one cow puts out methane in about the same amount as one car puts out carbon dioxide.

To reduce the amount of methane cows produce, some scientists are working on inventing ways for cows to produce less gas when they digest their food. Some are trying to find out whether different diets for cows might help them put out less gas. Others are trying to change the way microorganisms in the cows’ digestive systems process food. If the microorganisms produce less methane, so will the cows.

Another solution would be to eat less beef: if humans ate less meat that comes from cows, farmers would raise fewer cows, and there would be less methane in the atmosphere.
Part of the Solution: Removing Carbon Dioxide and Methane

Capturing Methane from Landfills

While it's important to reduce, reuse, and recycle as much as you can, it's hard to avoid throwing out some trash every week. Trash that cannot be recycled or reused often ends up in landfills, where it produces methane as it decomposes.

Methane is a very powerful greenhouse gas. One pound of methane traps 25 times more heat in the atmosphere than a pound of carbon dioxide. Methane is also the main ingredient in natural gas. Because methane can be captured from landfills, it can be burned to produce electricity, heat buildings, or power garbage trucks. Capturing methane before it gets into the atmosphere also helps reduce the effects of climate change.

1. Trash decomposes (or rots) in landfills, creating methane gas.
2. Methane rises to the top of the landfill and is collected in pipes.
3. The methane is burned to produce heat or generate electricity.
Part of the Solution: Removing Carbon Dioxide and Methane

Reforestation

To reduce the amount of carbon dioxide in the atmosphere, we can use less energy and store our carbon dioxide before it reaches the atmosphere—or we can rely on a natural process to absorb carbon dioxide from the air. That natural process involves trees and other plants.

All plants take in carbon dioxide, use it to make food for themselves, and release oxygen. The more plants there are in the world, the more carbon dioxide is removed from the atmosphere. One reason there is so much carbon dioxide in the atmosphere today is that humans have cut down many of the trees on Earth and used them to build buildings and make paper and other materials. There are millions fewer trees on Earth than there once were, which means there is less carbon dioxide being taken in.

One way of solving the problem of too much carbon dioxide in the atmosphere is reforestation, or planting trees. Many tree-planting projects are located in places where people cut down forests in the past. By replacing trees that have been removed and planting new trees (even in places where they never grew before), people can cause the world’s forests to take in more carbon dioxide. Reforestation also creates forest habitat, benefiting many kinds of animals and plants that live in forests.
Lesson 11 – Part 3: Blog Post: Climate Change Solution

Dr. Lee asked you to write a blog post that describes and explains the solution you read about in "Climate Change Solutions." When you write your explanation, remember that the general public is your audience. Try to be as convincing as possible. Carefully explain the solution, how it would affect climate change, and why it is needed.

Word Bank

<table>
<thead>
<tr>
<th>absorb</th>
<th>energy</th>
<th>methane</th>
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<tbody>
<tr>
<td>atmosphere</td>
<td>enter</td>
<td>redirect</td>
</tr>
<tr>
<td>carbon dioxide</td>
<td>exit</td>
<td>surface</td>
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