



Carbon, Carbon Everywhere

Learn how carbon moves all around us!

Activity Guide

Description: A model of the Earth's surface and atmosphere is used to explain how some energy sources such as coal emit carbon dioxide (CO_2), and how too much CO_2 contributes to climate change.

Audience: Hands-on activity for families and kids ages 5 and up

Length: 25 minutes

Learning Objective

Visitors will learn about different energy sources and the importance of conserving energy to reduce the amount of carbon dioxide (CO_2) emissions. They will be able to understand how CO_2 is released into the atmosphere when we burn carbon-based fuels and how this contributes to global climate change.

Climate Connection

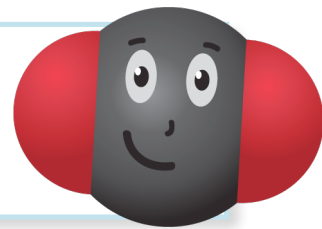
When we burn carbon-based fossil fuels such as coal and oil, large amounts of carbon are released into the atmosphere. This carbon combines (bonds) with oxygen atoms to create carbon dioxide (CO_2). In the past hundred years we have seen a significant increase in atmospheric CO_2 that scientists believe is the primary cause of an overall increase in atmospheric temperatures leading to climate change.

Our atmosphere is composed primarily of nitrogen (N) and oxygen (O), with small amounts of greenhouse gases. Greenhouse gases absorb infrared energy and trap heat within the Earth's atmosphere. Although CO_2 is the most common greenhouse gas, water vapor (H_2O) and methane (CH_4) are also important contributors to trapping heat in the Earth's atmosphere.

Most greenhouse gas molecules are comprised of three or more atoms and have the ability to absorb infrared energy. By contrast, molecules that are comprised of the same two atoms each, such as molecular oxygen (O_2) or molecular hydrogen (H_2) do not absorb infrared energy and are not greenhouse gases.

Did you know?

All living organisms are made of carbon!



Materials

- 20 oxygen magnets and 10 carbon magnets
- Landscape drawing
- Magnetic board such as whiteboard

Set up

- Set up the diagram on a magnetic surface such as a white board.
- Glue carbon and oxygen labels to magnetic sheet or magnets.
- Place a few carbon atoms paired up with oxygen atoms to represent the CO₂ molecules already present in the air around us.
- Keep the remaining carbon and oxygen magnets available to put up during the demonstration.

Program Delivery

The atmosphere is composed of gases!

One of the most important gases in our atmosphere is oxygen, which is represented here by red circles. In reality oxygen atoms are much, much smaller. Another important gas in the atmosphere is carbon dioxide, which is composed of two oxygen atoms joined with a carbon atom, which is represented by a black circle.

Carbon dioxide traps heat that helps insulate the earth—this means it is a greenhouse gas.

For thousands of years the amounts of oxygen and carbon have existed in a balance, and plants and animals have adapted to this balance.

[Have the visitors place oxygen magnets around the diagram to represent oxygen in the air around us. Pair up the oxygen magnets so they represent O₂] [Use the magnets to create a few carbon dioxide molecules in the air around us.]

There are other places where we can find carbon!

CO₂ in the air is not the only place that we find carbon. There is a massive amount of carbon stored underground in the form of coal. Coal seams are the ancient remains of plants and animals and store large amounts of energy. These carbon atoms represent the carbon that is stored under the surface of the Earth.

[Have the visitors place the majority of the carbon magnets on the picture under the Earth's surface.]

How have we been using carbon?

For the last hundred years people have been mining this carbon in the form of coal, to harvest the enormous amount of energy that is stored in coal. The first step in this process is to extract the coal from the deposits underground.

[As you are demonstrating how carbon moves, use the magnets to create CO₂ molecules from the stored fossil fuels in the ground, show visitors how we can take carbon from the ground, burn it in our factories, and release the carbon into the atmosphere.] [Repeat this process several times to show how the more coal we burn the more CO₂ is released.]

Once we have taken carbon out of the ground we have to transport it over to a factory where the energy released from the coal turns turbines that produce electricity.

Where does carbon go after it is burned?

Like many things in nature, carbon moves around in cycles. When we burn the coal, the carbon doesn't disappear but is released into the atmosphere.

Burning coal releases carbon atoms, but carbon atoms are not stable if they are alone, so instead they bond (join) together with two oxygen atoms. Each carbon atom that is released bonds with two oxygen atoms and creates a carbon dioxide (CO₂) molecule.

Carbon dioxide is increasing in our atmosphere!

Scientists have noticed a huge increase in carbon dioxide molecules over the past century. As we continue to burn carbon-based fuels such as coal, oil, or natural gas for energy, more carbon is released into the atmosphere, and more CO₂ is created. Because CO₂ is a greenhouse gas that traps heat, it leads to the warming of the atmosphere and results in a great number of changes to the climate.

[Ask the visitors create more CO₂ molecules on the diagram.] [Ask the visitors questions about what is happening to their carbon molecule as it moves through the carbon cycle.]

Discussion Questions:

How can we conserve energy and reduce our dependence on carbon based fossil fuels in our homes or at school?

What energy sources can we use that produce less or no CO₂?

Do you think the amount of CO₂ in the atmosphere has remained constant over time?

How has it been changing?

Credits

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