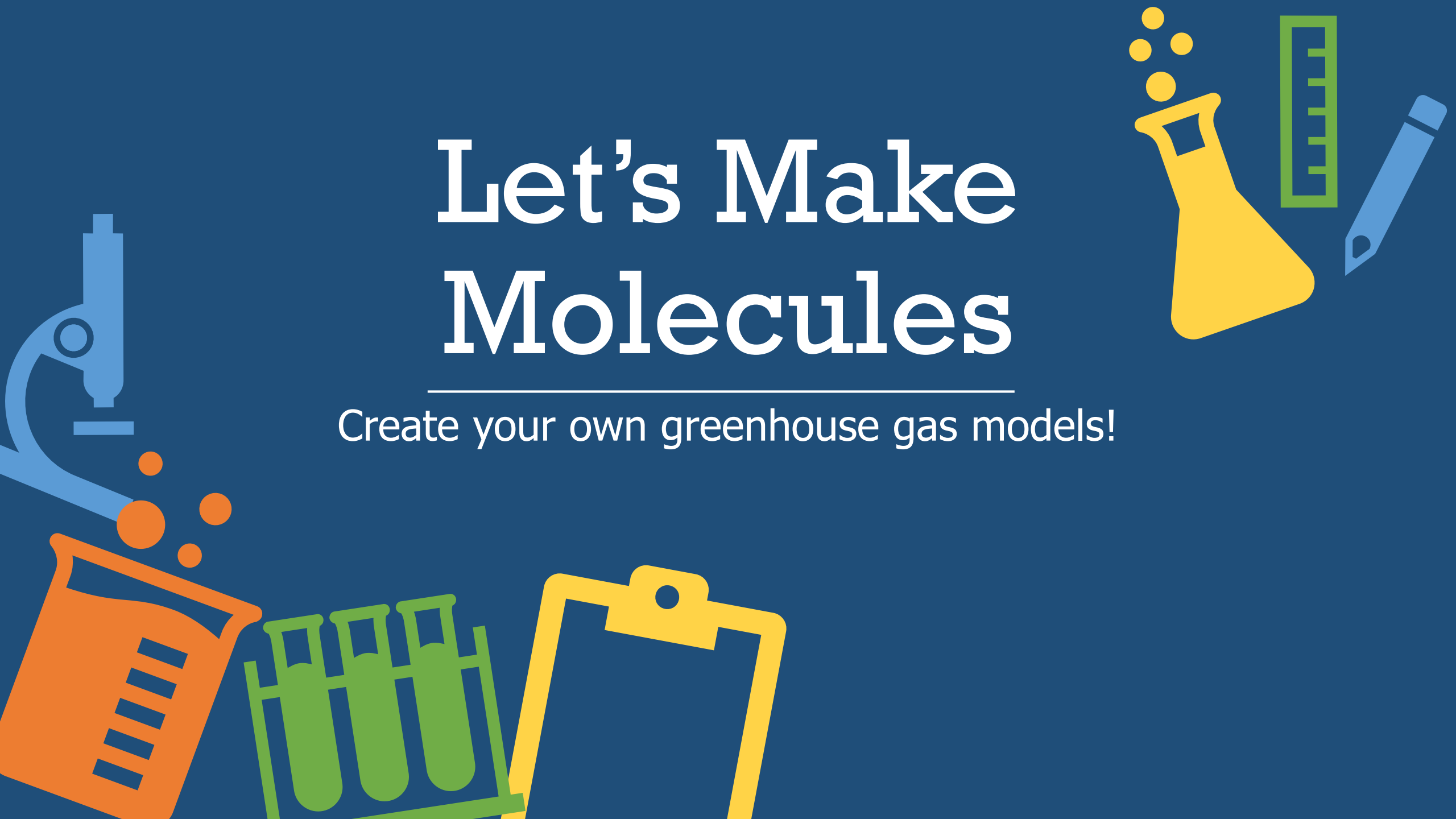


Let's Make Molecules

Create your own greenhouse gas models!



Learning Objective & Climate Connection

- Students will learn the composition and molecular structure of three greenhouse gas molecules. They will explore of how greenhouse gases are released into the atmosphere and the resulting contribution to global climate change.
- Climate Connection: Carbon dioxide (CO₂) is the by product or result of burning carbon-based fossil fuels such as coal and oil. Once we use the heat from these energy sources, large amounts of carbon are released into the atmosphere; this carbon combines or bonds with oxygen atoms to create carbon dioxide. As a result of our dependence on carbon based fossil fuels we have seen a significant increase in the amount of atmospheric carbon dioxide in the past hundred years. This increase in CO₂ is the primary cause of global warming and climate change.



Did You Know?

Greenhouse gases help regulate the temperature of the Earth; without them it would be too cold for humans! Most greenhouse gas molecules are comprised of three or more atoms and have the ability to absorb and reflect infrared (heat) energy. Carbon Dioxide is the most common greenhouse gas; water vapor and methane are also important contributors to the Earth's temperature.

Our atmosphere is composed of primarily nitrogen and oxygen with small amounts of greenhouse gases. Although carbon dioxide is the most common contributor to climate change, water vapor (H₂O) and methane (CH₄) are also important greenhouse gases. Greenhouse gases absorb and reflect back infrared energy, thus trapping heat within the Earth's atmosphere.

Infrared energy is the electromagnetic radiation of a wavelength longer than visible light. The name means "below red" (from the Latin *infra*, "below"), red being the color of visible light.



How is CO₂ Formed?

When we burn carbon-based fossil fuels such as coal and oil, large amounts of carbon are released into the atmosphere. This carbon combines or bonds with oxygen atoms to create carbon dioxide (CO₂). In the past hundred years we have seen a significant increase in the amount of atmospheric carbon dioxide, and scientists believe the increase of CO₂ is the primary reason for global warming and climate change.

What does the structure of greenhouse gases look like?

In carbon dioxide, the oxygen atoms are double bonded to the carbon atom in the center.

In water vapor, the two hydrogen atoms are bonded to the red oxygen atoms.

In methane, the four hydrogen atoms are bonded to the carbon atom.



Materials/Set Up

- Materials:
 - 3 red gumdrops (oxygen)
 - 6 green gumdrops (hydrogen)
 - 2 black or purple gumdrops (carbon)
 - 5 toothpicks broken in half
 - 2 bowls
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- Sort the gumdrops according to color and place each color in an individual bowl.
 - Cut toothpicks in half and place them in a separate bowl
 - Prepare models of each molecule
 - Carbon Dioxide CO₂
 - Water Vapor H₂O
 - Methane CH₄



What have we learned?

- How do greenhouse gases make the Earth warmer?
- What things in your home produce or contribute to producing greenhouse gases?
- What are ways of reducing greenhouse gases in our atmosphere?

- This lab will be worth 60 points. 10 points for each model and 10 points for each answer to the three questions above. In order to receive full credit for each, you must create each model and show me, and answer each question in sentence form. This lab requires at least 2 sentences for each answer.



Remember...
Safety First!

