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Name _____

Date _____

CARBON DIOXIDE: A Greenhouse Gas

Part I. Vocabulary Words: Review the given definitions. Define the remaining vocabulary words as you watch Cog's [Episode 1 - Carbon Dioxide: A Greenhouse Gas](#).

<https://youtu.be/3uMuAC09NuA>

- **Atoms** [0:25] are the smallest pieces of matter that act and react like a chemical element. We'll be talking mostly about hydrogen, carbon, and oxygen atoms.
- **Molecules** [0:25]
- **Hydrocarbons** [1:40]
- **Greenhouse gases** [3:20] are gases in our atmosphere, like water, methane, and carbon dioxide, that let high energy sunlight pass through, but trap heat.
- **Weather** [7:00]
- **Climate** [7:10]

Part II. Answer after viewing the video.

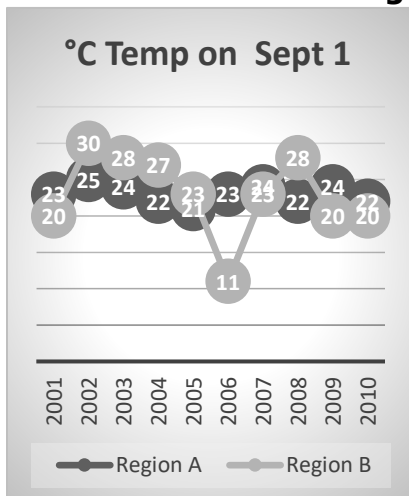
In figures 1-6, write "M" by the molecule figures and "A" by the atom figures.	What is the approximate volume of 1 lb (2.2 kg) of carbon dioxide (CO₂)?
Why do more greenhouse gases in the atmosphere trap more heat?	How does what is in your closet indicate what kind of climate you live in?

Take a deeper dive after viewing the video:

Part III. Draw icons in the boxes that capture what you already know about climate and weather. If you have access to a computer, visit <https://thenounproject.com> for icon ideas.

 Weather - Rainy	Ways people and/or animals adapt to rainy climates
Weather – Hot and Dry	  Big ears help lose heat. People carry water bottles. Ways people / animals adapt to hot and dry climates
Weather - Snowy	Ways people and/or animals adapt to cold climates
Weather today in your area	Ways people and/or animals adapt to your climate

Part IV. Think Big: Climate is the average weather on September 1, in regions A and B. The data shows the **average temp in both Region A and Region B is 23 °C.**



- How does the weather in Region A compare with the weather in Region B?
- Does it mean that Region B has a cold climate because it was cold on September 1, 2006?
- Explain the difference between climate and weather in Region B.
- If a mild region has a cold spell one year, does that mean global warming is not real? Why or why not?



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CARBON DIOXIDE: A Greenhouse Gas

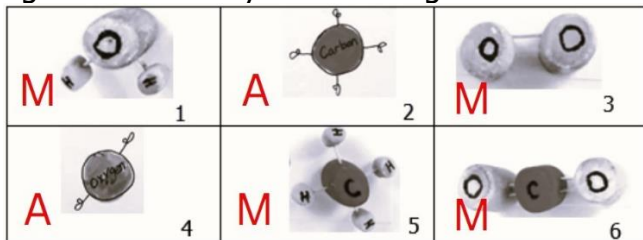
Part I. Vocabulary Words: Review the given definitions. Define the remaining vocabulary words as you watch Cog's [Episode 1 - Carbon Dioxide: A Greenhouse Gas](#).

<https://youtu.be/3uMuAC09NuA>

- **Atoms** [0:25] are the smallest pieces of matter that act and react like a chemical element. We'll be talking mostly about hydrogen, carbon, and oxygen atoms.
- **Molecules** [0:25] are made of two or more atoms bonded together.
- **Hydrocarbons** [1:40] are molecules made of only carbon and hydrogen atoms.
- **Greenhouse gases** [3:20] are gases in our atmosphere, like water, methane, and carbon dioxide, that let high energy sunlight pass through, but trap heat.
- **Weather** [7:00] is local and temporary. It's what you see when you look out the window. Weather tells you how to dress for the day.
- **Climate** [7:10] is the long-term *average* of weather over many years. It describes how cold your winters usually get and how hot your summers usually are.

Part II. Answer after viewing the video.

In figures 1-6, write "M" by the molecule figures and "A" by the atom figures.



What is the approximate volume of 1 lb (2.2 kg) of carbon dioxide (CO₂)? One pound of CO₂ would fill a beach ball about 30 inches or 76 cm diameter.

Why do more greenhouse gases in the atmosphere trap more heat?

When heat radiates out into space, it is more likely to hit a greenhouse gas molecule and bounce back if there are more molecules to hit.

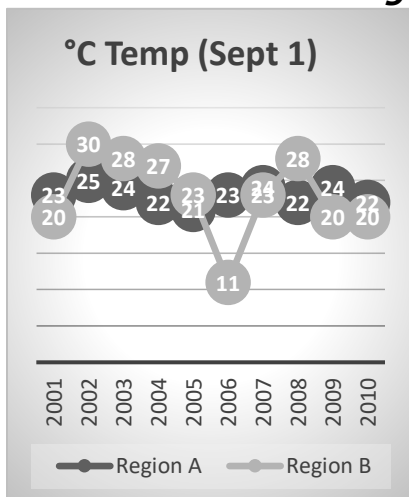
How does what is in your closet indicate what kind of climate you live in? If you live in a cold climate with cold winters, you will need sweaters, coats, and boots for the cold days. If you live in a mild climate, you may only need a hoodie for the winter. [Climate is what you expect. Weather is what you get.]

Take a deeper dive after viewing the video: Answers will vary.

Part III. Draw icons in the boxes that capture what you already know about climate and weather. If you have access to a computer, visit <https://thenounproject.com> for icon ideas.

 Weather - Rainy	You might see pictures of rain boots, raincoats, umbrellas, webbed feet, shelters, and so on. Ways people and/or animals adapt to rainy climates
You might see pictures of sun, cactus, sand, desert, no clouds in the sky, bleached bones and so on. Actually Antarctica is also a desert, so someone may draw that. Weather – Hot and Dry	  Big ears help lose heat. People carry water in bottles. Ways people / animals adapt to hot and dry climate
You might see pictures of snowflakes, clouds, mountain tops, snowmen, and so on. Weather - Snowy	You might see pictures of people skiing, or snowshoeing or in big coats and boots and mittens, fires and s'mores, hot chocolate, polar bears, penguins, and so on. Ways people and/or animals adapt to cold climates
Answers will vary Weather today in your area	Answers will vary. Ways people and/or animals adapt to your climate

Part IV. Think Big: Climate is the *average* weather on Septemmr 1, in regions A and B. The data shows the *average* temp in both **Region A and Region B is 23 °C.**



- How does the weather in Region A compare with the weather in Region B? **Region A didn't see much variation for these 10 years, but Region B had more ups and downs.**
- Does it mean that Region B has a cold climate because it was cold on September 1, 2006? **No**
- Explain the difference between climate and weather in Region B. **The climate shows a mild 23 °C temp overall in this region. However, there was a big weather event in 2006.**
- If a mild region has a cold spell one year, does that mean global warming is not real? Why or why not? **No. Global temps can rise, while temporary weather events like in 2006 happen in specific locations. [Extreme weather is actually more likely.]**

TEACHER RESOURCES

NGSS Standards:

[MS-PS1-1](#) Atomic composition of CO₂, H₂O, O₂, and CH₄.

[MS-PS1-2](#) Reactants and products of vinegar and baking soda to make CO₂ and water.

[MS-ESS3-4](#) Increased per capita use of resources impacts Earth's systems.

[MS-ESS3-5](#) Clarify factors that caused rise in global temps.

Experiment Resources:

[Click here](#) to find complete directions for using CO₂ to put out a candle.

<https://www.howitworksdaily.com/how-to-put-out-a-candle-with-co2/>

Description: This worksheet goes along with the Cog's Episode 1 video about Carbon Dioxide and Climate Change [8:32] It can be used by teachers or their substitutes (given the answer key) to guide learning, check for understanding, and interpret significance of the information in [Episode 1: Carbon Dioxide: A Greenhouse Gas](#)

<https://youtu.be/3uMuAC09NuA>

The first page asks literal questions that can help students understand the material covered in the video. The second page helps students connect the information to their own lives and evaluate or infer meaning by pondering the importance of the information. Pages can be used separately or printed front-to-back to make a 2-page worksheet.

Directions:

Before viewing the video, hand out a worksheet to each student if being done individually or a worksheet to each group of 2-4 students if they're working in groups.

Part I. Some vocabulary words have been defined and should be discussed before viewing the video. The remaining vocab words can be defined as you watch the video. The timestamp next to each word alerts you to where the word is used. Stop the video and replay as many times as needed. If students need help, give them the definitions from the answer key.

Part II. Ask students to answer each question. It may help to show them the final sketchnote, page 7 of this document or [7:50] in the video. If time permits, share student answers. Ask students to jot down any new information they've gathered from the discussion.

Part III. To warm them up, ask the class to brainstorm more examples of what icons would describe "rainy weather" or "desert climate." Now give students 3 minutes to draw icons to fill the empty boxes. The website <https://thenounproject.com> is a great place to get ideas for drawing icons if students have access to tablets or computers. It's okay for reluctant students to use words instead, but encourage them to expand their thinking by trying to draw. Stick figures are fine. When the 3 minutes are up, ask students to share their ideas, so others can add icons to their worksheet.

Part IV. Think Big: Explain that the graph has data from 2 different locations. Region A is the darker line. Region B is the lighter line. Make sure they understand that the *average* temperature for these 10 years in both locations was 23 °C (About 86 °F). Ask them to answer questions 1-4. If time allows, go over answers with students to check for understanding.

WATCH RELATED COG VIDEOS ABOUT THE CARBON CYCLE:

The fast carbon cycle:

- [Episode 2: Cellular Respiration & the Fast Carbon Cycle](#) (Food becomes CO₂ and H₂O.)
- [Episode 3: Campfires](#) (How plants burn, releasing CO₂ and water.)
- [Episode 8: Photosynthesis](#) (How plants turn CO₂ and water into food.)
- [Episode 9: Oceans](#) (How carbon moves through a food web or pyramid.)

The slow carbon cycle:

- [Episode 7: Volcanoes](#) (How volcanoes form and release CO₂.)
- [Episode 10: The Slow Carbon Cycle](#) (How CO₂ is absorbed into oceans from atmosphere, incorporated into shells, falls as sediment, lithifies into rock, which can release CO₂ when heated (volcanoes or cement production) or chemically eroded.)

Moving fossil fuels from slow carbon cycle into fast carbon cycle:

- [Episode 1: Carbon Dioxide: A Greenhouse Gas](#) (Introduction to climate change.)
- [Episode 4: Coal-Fired Power Plants](#) (How coal forms and is burned as a CO₂-generating heat source to create steam that turns a turbine and generator to produce electricity.)
- [Episode 5: Crude Oil Fuels](#) (How crude oils (petroleum) form, are refined, and burned as transportation fuels that release excess CO₂ into the atmosphere.)
- [Episode 6: Natural Gas and Methane](#) (How natural gas, which is mostly methane, forms and is burned to produce heat, also releasing excess CO₂. Includes fracking info.)

A molecule made of atoms

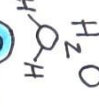
carbon dioxide
 CO_2



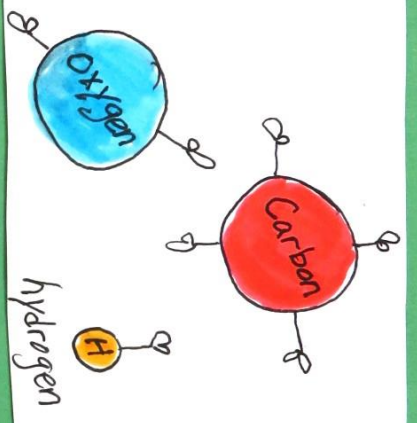
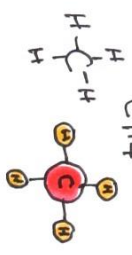
oxygen
 O_2



water
 H_2O



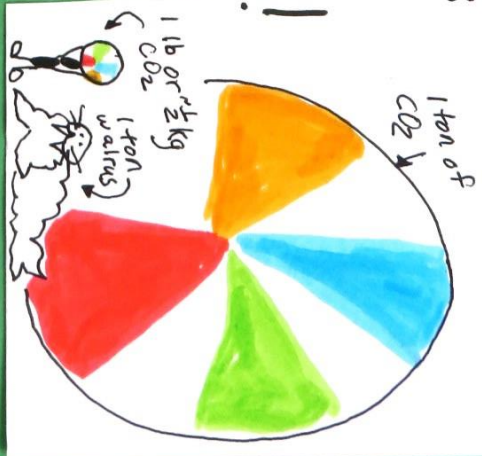
methane
 CH_4



What is CO_2 ?

An invisible, odorless gas

Gas is NOT Nothing!



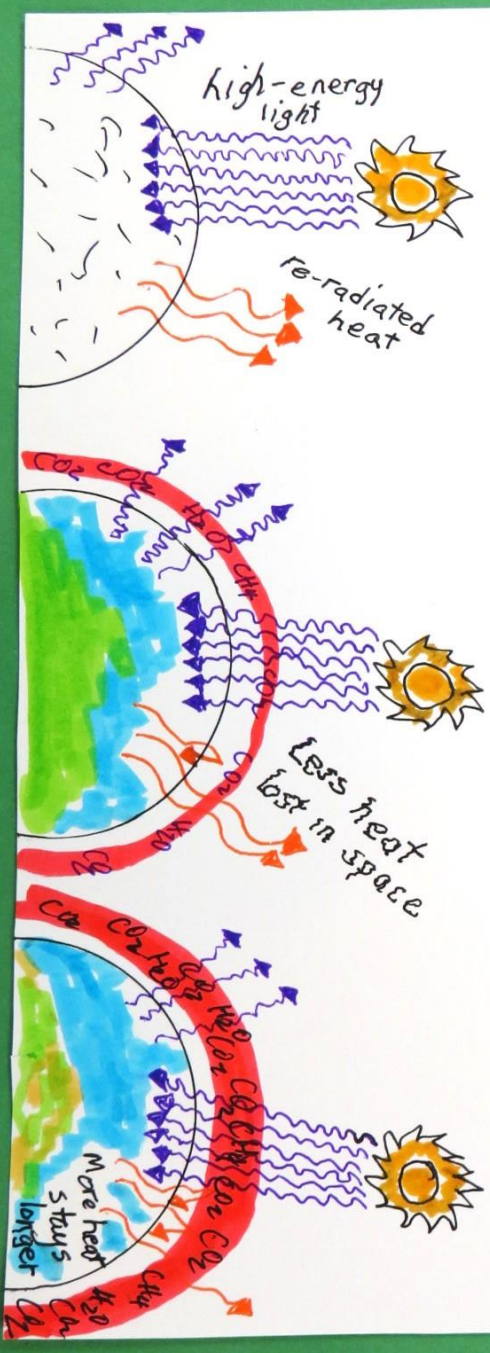
A greenhouse gas

doesn't accumulate

H_2O watercycle

CH_4 methane is powerful

CO_2 carbon dioxide stops longer more of it



Note:

Weather is local and is temporary

vs

Climate is the average over many years

