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Name _____

Date _____

Episode 11: CLIMATE CALL TO ACTION

Part I. Vocabulary Words: Review the given definitions. Define the remaining vocabulary words as you watch Cog's [Episode 11 – A Climate Call to Action](https://youtu.be/il6NjIMeai0). <https://youtu.be/il6NjIMeai0>

- **Greenhouse Gases** [0:38] include gasses like carbon dioxide (CO_2), methane (CH_4), and water that absorb infrared radiation from Earth, creating the greenhouse effect.
- **Infrared Radiation** [1:30] is electromagnetic radiation with wavelengths longer than visible light, so we can't see it. Warm objects emit infrared that we feel it as heat.
- **Evolve** [4:35] means
- **Adapt** [4:40] means
- **Migrate** [4:45] means
- **Neanderthals** [5:02] were extinct relatives of modern human beings. Neanderthals interacted with Homo sapiens for about 100,000 years, until they disappeared about 25,000 years ago, leaving modern human beings as the only human species on Earth.
- **Homo sapiens** [5:03] is the species of all human beings that exist today.
- **Atmospheric CO_2** [5:06]
- **ppm** [6:23] means
- **Positive Feedback Loops** [10:15] are systems where the input causes increased output, which in turn increases input, which in turn increases output, and so on.

Part II. Answer after viewing the video.

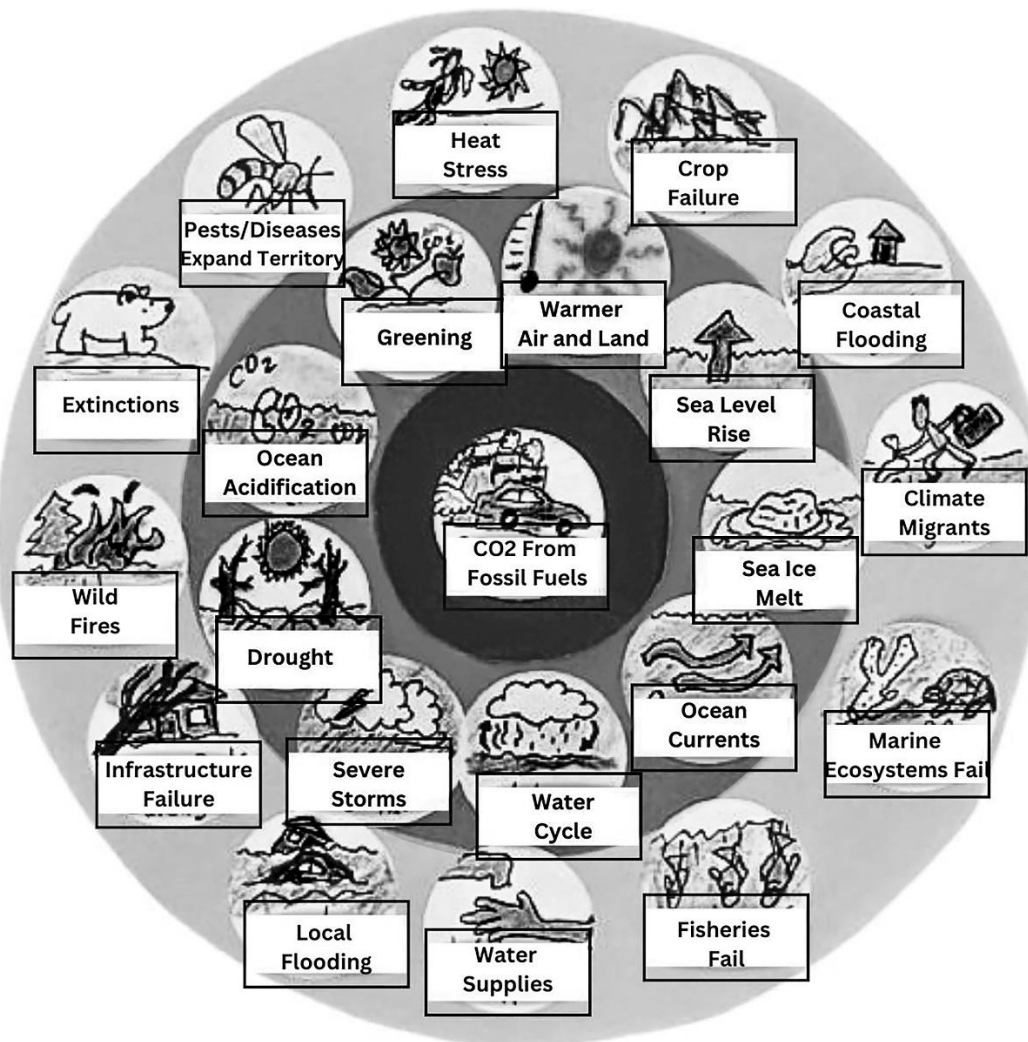
Why does increased atmospheric carbon dioxide heat Earth's surface?	What are <i>four</i> ways plants and animals can react to climate change?
What evidence from the past shows us that high CO_2 is linked to high Earth temperature?	What are four impacts we can expect from increased atmospheric CO_2 levels?

Name _____

Take a deeper dive after viewing the video:

Part III. With your classmates, draw in arrows you remember from the video. Now add arrows for even more connections.

HUMAN CONFLICT!!!!



Part IV. Think Big. List 3 outdoor activities that you and your friends or family enjoy participating in or watching.

- 1.
- 2.
- 3.

Part V. With a partner, circle one outdoor activity from your lists. Use it to answer questions.

4. Looking at your arrows, how might climate change affect the activity?
5. Brainstorm ways we may need to adapt the activity due to climate in your area.



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Episode 11: A CLIMATE CALL TO ACTION

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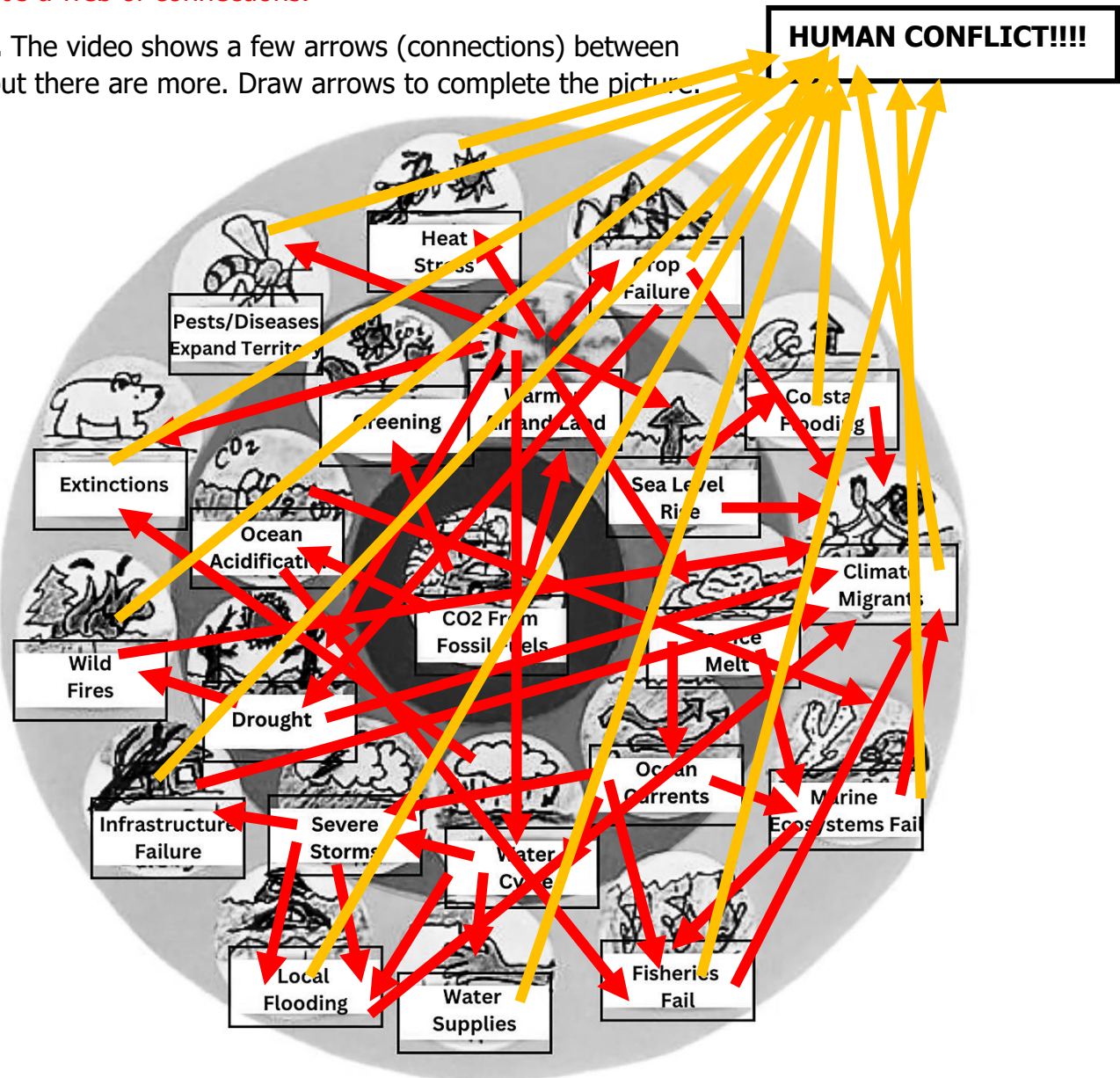
- **Greenhouse Gases** [0:38] include gases like carbon dioxide (CO₂), methane (CH₄), and water that absorb infrared radiation from Earth, creating the greenhouse effect.
- **Infrared Radiation** [1:30] is electromagnetic radiation with wavelengths longer than visible light, so we can't see it. Warm objects emit infrared that we feel it as heat.
- **Evolve** [4:35] means that a trait or traits caused by genetics becomes more or less common in a species, for example, shorter back legs in lizards.
- **Adapt** [4:40] means to change in order to be better suited to the environment. Behavior and diet are two ways an organism can adapt.
- **Migrate** [4:45] means moving from one environment to another or one location to another in order to find a suitable environment.
- **Neanderthals** [5:02] were extinct relatives of modern human beings. Neanderthals interacted with Homo sapiens for about 100,000 years, until they disappeared about 25,000 years ago, leaving modern human beings as the only human species on Earth.
- **Homo sapiens** [5:03] is the species of all human beings that exist today.
- **Atmospheric CO₂** [5:06] is a measure of how much carbon dioxide is in the atmosphere.
- **ppm** [6:23] is parts per million. In our case, we're measuring how many CO₂ molecules are included in a million molecules of atmosphere.
- **Positive Feedback Loops** [10:15] are systems where the input causes increased output, which in turn increases input, which in turn increases output, and so on.

Part II. Answer after viewing the video.

Why does increased atmospheric carbon dioxide heat Earth's surface? CO ₂ is a greenhouse gas that bounces infrared radiation back to Earth.	What are <i>four</i> ways plants and animals can react to climate change? 1. Evolve 2. Adapt 3. Migrate 4. Die or go extinct
What evidence from the past shows us that high CO ₂ levels are linked to high Earth temperature? Air bubbles in ice cores from Greenland and Antarctica show that ice sheets receded when high levels of atmospheric CO ₂ occurred. Also, alligators lived in Arctic circle and palm trees grew in Antarctica when very high CO ₂ occurred.	List at least four impacts we can expect from increased atmospheric CO ₂ levels? Drought, severe storms, sea level rise, ocean acidification, wild fires, local floods, climate migrants, coastal floods, pests migrating, crop failure, etc. And human conflict is a very important effect we are already seeing.

Take a deeper dive after viewing the video: Answers may vary. The point is that students see that it's a web of connections.

Part III. The video shows a few arrows (connections) between effects, but there are more. Draw arrows to complete the picture.



Part IV. Think Big. List 3 outdoor activities that you and your friends or family enjoy participating in or watching. Answers will vary.

1. Soccer, football, or other outdoor sports
2. Skiing on snow or water skiing
3. Fishing, hunting, hiking or other outdoor

Part V. With a partner, circle one outdoor activity from your lists and use it to answer questions.

4. Looking at your arrows, how might climate change affect the activity? Answers will vary.

We may not be able to play sports during the hot part of the day or during summer. Game animals may move away, and new animals move into your area.

5. Brainstorm ways we may need to adapt the activity due to climate in your area.

Sports may need to be played indoors or during a cooler season or not played between sunup and sundown. There may not be snow for skiing. Water skiers and hikers may need to go out at sunup or after sundown. Hunters and fishermen may have to change the game they hunt and how they hunt.

TEACHER RESOURCES

NGSS Standards:

[NGSS MS-ESS3-4](#) Increases in human population and per-capita consumption of natural resources impact Earth's systems.

[NGSS MS-ESS3-5](#) Clarify evidence of the factors that have caused the rise in global temps.

[MS-LS2-4](#) Changes to ecosystem components affect populations.

Experiment Resources:

Find the infrared thermometer experiment at:

https://www.youtube.com/watch?v=rD2jnz_0MyA

If you'd like a good explanation of how infrared radiation creates heat, you can visit,

<https://www.youtube.com/watch?v=cimZGu5GadQ>

Description: This worksheet goes along with the [Cog's Episode 11 – A Climate Call to Action](#).

[\[11:12\]](#) 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

<https://youtu.be/il6NjIMEai0>

The first page asks questions that can help students recall and 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.

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 vocabulary words can be defined as you watch the video. The timestamp next to each word indicates 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 recall information from the video in order to answer each question. It may help to refresh their memories to show them the final sketchnote on page 7 of this document or [\[10:45\]](#) in the video. If time permits, share student answers. Ask students to jot down any new information they've gathered from your discussion.

Part III. Get started as a whole group, drawing in some arrows where students remember connections from the video. If using a smart board, use the graphic on page 8. Each time an arrow is drawn, make sure students can verbalize the connection between the two events. If needed you can refer back to the video [\[7:16 – 9:15\]](#) where arrows are drawn. For example, arrows were drawn from "Warmer Air/Land" to "Heat Stress," "Crop Failure," and "Pests/Diseases Expand Territory." Ask students why heat stress is connected to these effects. [Note: Melting sea ice does not contribute to rising sea level change the same way melting ice in a full glass of ice tea does not cause the water to spill over.]

The video simplified connections in order to make a simple point - these impacts are connected. However, many more arrows could be drawn to connect these impacts. Once students are warmed up and understand the task, ask them to draw in more arrows, including those that were left out of the video. If done individually (least effective method) or in small groups, give them 5 minutes to draw arrows before coming back together as a whole group. Ask students what is the takeaway from this lesson? They should see that it's a complicated web of connections. You could show them the graphic on page 9 showing many arrows.

Part IV. Think Big Ask students to write down three outdoor activities they participate in or like to watch. Give students 2 minutes to **Think**.

Part V. Assign each student someone to work with as a pair. Ask each pair of students to agree on one of the activities on their lists and circle it. Think of that activity while answering the questions 4-5. Remind students that brainstorming is a creative process. Write down any idea whether it's a good one or not. Then circle the best idea. If time allows bring the class back together and ask who will have to act to make the change(s) you recommend.

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 and CO₂](#) (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, and releases 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](#) (Intro 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.)

The CO2 Problem

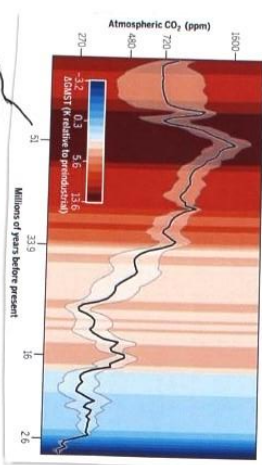
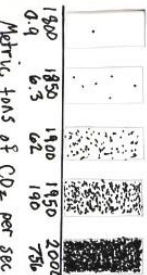
① The mug warmer sends out infrared radiation that makes he warmer.

The added CO₂ bounced back enough radiation to lower the temperature calculation 5°C.

② The infrared thermometer measures that radiation and calculates a temperature.

air	body	body	body
°C	20.4	17.8	17.3
°F	399	352	343

③ When less radiation gets to the thermometer, it calculates a lower temperature.



Timeline (for context):

- ~300,000 yrs ago - earliest homo sapiens
- ~200,000 yrs ago - earliest fire hearths
- ~130,000 yrs ago - Neanderthals
- ~120,000 yrs ago - modern homo sapiens

50 mya Earth had no polar ice caps!

Alligators lived near Greenland!

Palm trees grew in Antarctica!

Numbers



CLIMATE CALL TO ACTION

Excess CO₂ causes climate changes that impact us all.

The Ripple Effect



Evidence from Nature

Examples of Coping Strategies:

- Evolve - lizards with shorter back legs
- Adapt - polar bears looking for new food sources
- Migrate - forests moving with help of birds

(or else extinction...)

