Name _____

Date _____Phto

Episode 9: OCEANS

Directions: Define these vocabulary words as you watch Cog's Episode 9: Oceans and Climate Change.

Part I. Vocabulary Words

- **Carbon sink** [0:31]
- **pH** [1:10] The pH scale measures how acidic or basic a solution is. The range goes from 0 (VERY acidic) to 14) VERY basic. A pH of 7 is neutral, neither acidic nor basic.
- **Producers** [2:45]
- **Krill** [3:32]
- **Chlorophyl** [5:40] The green pigment that helps plants photosynthesize.
- **Limiting Factor** [5:35]
- **Ocean Currents** [6:40]

Part II. Answer after viewing the video.

Why are our oceans becoming more acidic?	How do living organisms acquire carbon and store it?
How can oceans store carbon?	How do ocean currents affect weather and climate?

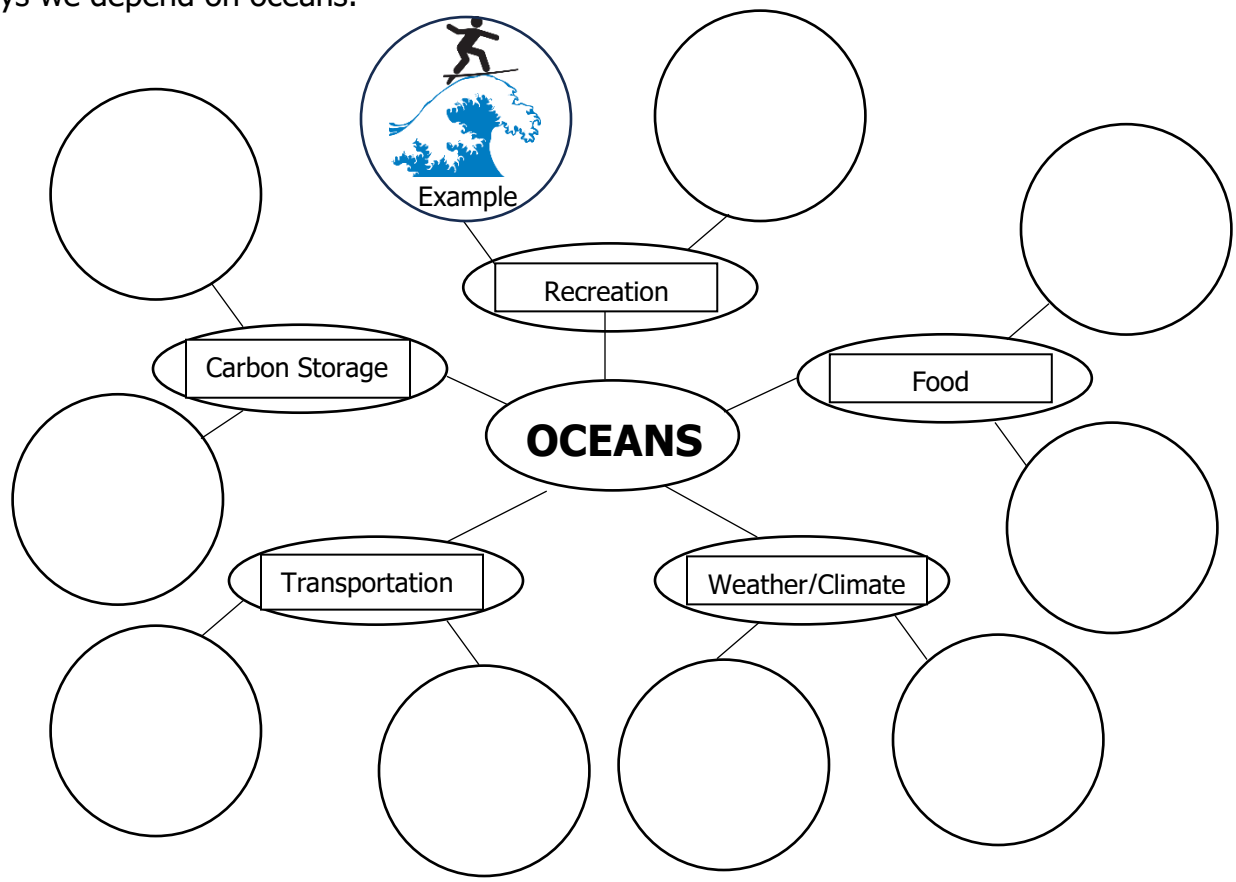
Name _____

Take a deeper dive after viewing the video:

Part III. Draw icons representing more ways that we depend upon oceans. Think about examples of food, transportation, recreation, carbon storage, global weather/weather, etc.

(https://thenounproject.com/s can help you envision icons.)

Draw icons to fill in more ways we depend on oceans.



Part IV. Think Big:

1. What is one of your favorite things about the ocean? Why?

2. How might ocean waters becoming more acidic or warmer (therefore causing more severe storms) affect what you wrote about in question 1?

Answer Key

Name _____

Date _____

Episode 9: OCEANS

Directions: Define these vocabulary words as you watch Cog's Episode 9: Oceans and Climate Change.

Part I. Vocabulary Words

- **Carbon sink** [0:31] A carbon sink is anything that absorbs more carbon than it releases
- **pH** [1:10] The pH scale measures how acidic or basic a solution is. The range goes from 0 (VERY acidic) to 14) VERY basic. A pH of 7 is neutral, neither acidic nor basic.
- **Producers** [2:45] Producers produce sugars, food, just like land plants. In oceans this includes phytoplankton, algae, and sea grasses.
- **Krill** [3:32] Krill are tiny iron-rich, shrimp-like creatures. They are first-order consumers eating producers, in this case, phytoplankton. They are consumed by baleen whales and other second-order consumers.
- **Chlorophyl** [5:40] The green pigment that helps plants photosynthesize.
- **Limiting Factor** [5:35] Limiting factors limit how large a population can grow. For example, phytoplankton need iron, so the amount of iron in the ocean limits how many can survive and reproduce.
- **Ocean Currents** [6:40] Ocean currents are like rivers in the ocean distributing heat around the world, affecting weather and climate.

Part II. Answer after viewing the video.

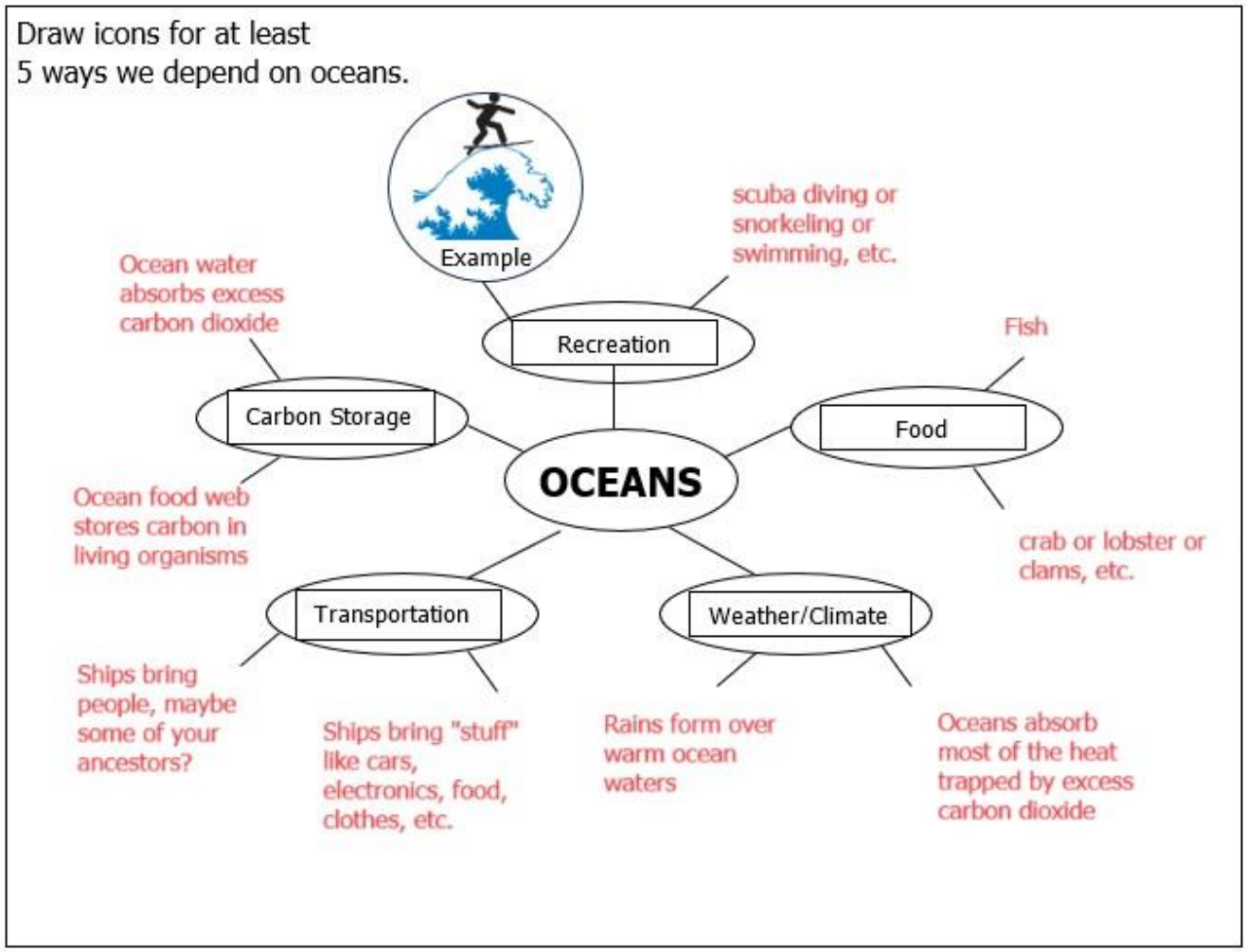
Why are our oceans becoming more acidic? Carbon dioxide is absorbed by oceans, causing carbonic acid to form.	How do living organisms get carbon and store it? Photosynthetic organisms (producers) make carbon-based sugars from CO_2. When organisms on the lower levels of the food pyramid are consumed, their carbon-based molecules are passed along.
How can oceans store carbon? Any of these are good answers. • By absorbing carbon dioxide in water. • By supporting a marine food web. • By burying dead organisms in silt and debris, causing them to take a long time to decompose.	How do oceans currents affect weather and climate? Ocean currents carry cold water from the poles to the equators where it warms. The warm water rises, evaporates, and can form rain that over land by winds.

Name _____

Take a deeper dive after viewing the video:

Part III. Draw icons that represent at least 5 ways that we depend upon oceans. Think about examples of food, transportation, recreation, carbon storage, global weather, etc.

(https://thenounproject.com/s can help you envision icons.) Here are some possible answers.



Part IV. Think Big:

3. What is one of your favorite things about the ocean? Why? Answers will vary.

4. How might ocean waters becoming more acidic or warmer (therefore causing more severe storms) affect what you wrote about in question 1? If it won't affect you, how might it affect others? Answers will vary.

TEACHER RESOURCES

NGSS Standards:
MS-PS1-2 Chemical reactions
MS-LS2-1 Resource availability and populations
MS-LS1-6 Role of photosynthesis in cycling matter
MS-LS2-3 Cycling of matter and flow of energy
MS-LS2-4 Changes to physical or biological components affect populations
MS-ESS2-5 Interactions of air masses result in weather
MS-ESS3-4 Increased human consumption impacts Earth's systems

Experiment resources:
Find the experiment at:
https://www.exploratorium.edu/snacks/ocean-acidification-in-cup

Description: This worksheet goes along with the Cog's Episode 9 video about Oceans and Climate Change [9:16] 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 *STEM with Cog's Episode 9: Oceans.*
https://youtu.be/OBpoHWwm8qs
The first page of this worksheet 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 by using higher level thinking skills. Pages can be used separately or print front-to-back to make a 2-page worksheet.

Directions:

Before viewing the video, handout 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 timestep 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 the questions. It may help to show them final sketchnote (page 7 of this document or [8:10] in the video). If time permits, share student answers. Ask students to jot down any new information they've gathered from others.

Part III. To warm up, ask students to brainstorm ways we use the ocean for recreation. An example, surfing, is given with a simple icon. Ask students what other ways we recreate in oceans as you write on the board. Ask students to draw an icon for one of these in the second circle for "recreation." https://thenounproject.com/s 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 (as shown in the Answer Key), but encourage them to expand their learning by trying to draw some. Stick figures are fine. After 5 minutes, ask students to share what they chose to draw for each subcategory. Students can fill in any empty circles.

Part IV. Think Big: (Think-Pair-Share) Give students 1-2 minutes to **Think** and write their answers to the 2 questions. Then assign each student to a **Pair**. Ask the pair to **Share** their work. Remind students to listen respectfully and ask questions if they have any. If time allows bring the class back together and ask then what kind of problems they foresee for our oceans.

WATCH RELATED COG VIDEOS ABOUT THE CARBON CYCLE:

The fast carbon cycle:

- Episode 2: Gas Exchange (How food is broken down, releasing CO_2 and water.)
- Episode 3: Campfires (How plants burn, releasing CO_2 and water.)
- Episode 8: Photosynthesis (How plants turn CO_2 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 CO_2)
- Episode 10: The Slow Carbon Cycle (How CO_2 absorbed into oceans from atmosphere is incorporated into shells, falls as sediment, lithifies into rock, and releases CO_2 as it is heated (volcanoes or cement production) or chemically eroded.

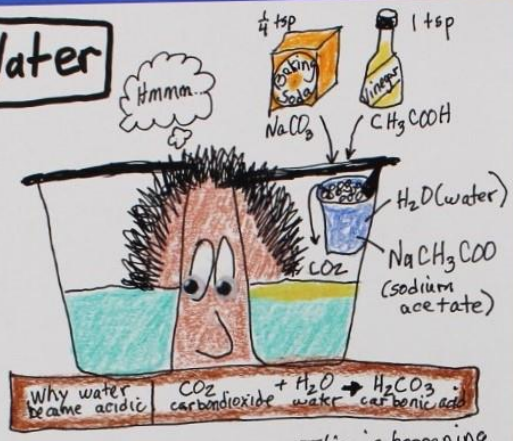
Moving fossil fuels from slow carbon cycle into fast carbon cycle:

- Episode 4: Coal-fired Power Plants (How coal forms and is burned as a CO_2-generating heat source to create steam that turns a turbine and generator to produce electricity.)
- Episode 5: Crude Oil Fuels (How petroleum or crude oils form, are refined, and burned as a CO_2-generating fuel for cars and jets.)
- Episode 6: Natural Gas and Methane (How natural gas, which is mostly methane, forms and is burned as a CO_2-producing heat source. Includes fracking explanation.)

CO_2 in Ocean Water

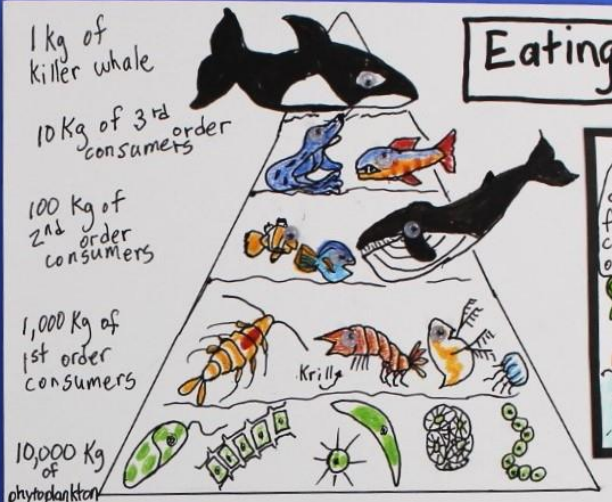
Bromothymol blue is blueish in neutral tap water - pH ≈ 7

In a carbon dioxide rich environment, some CO_2 reacts with water to make Carbonic Acid

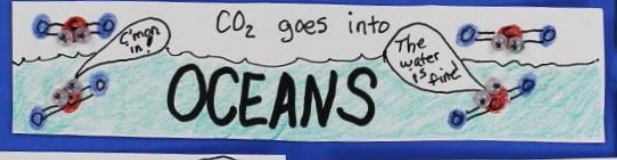


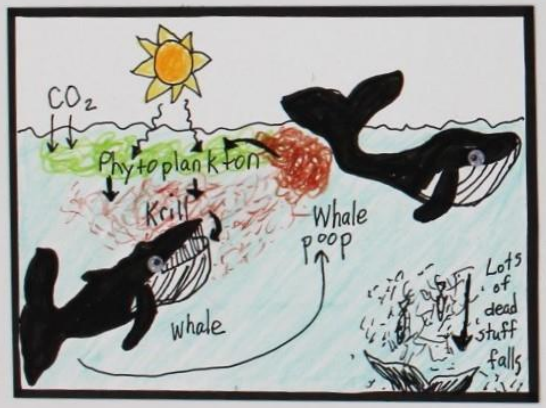
This is happening in our oceans.

Eating Carbon

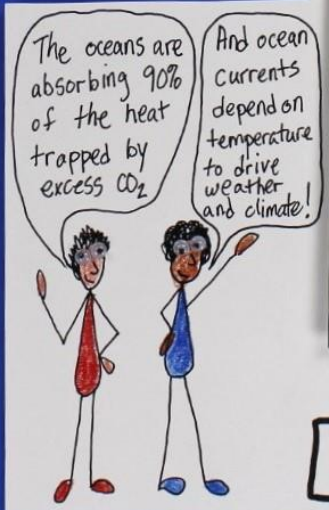


In sunlight, phytoplankton make food using CO_2 and water during photosynthesis.





Carbon Capture in Oceans



Oceans and Climate