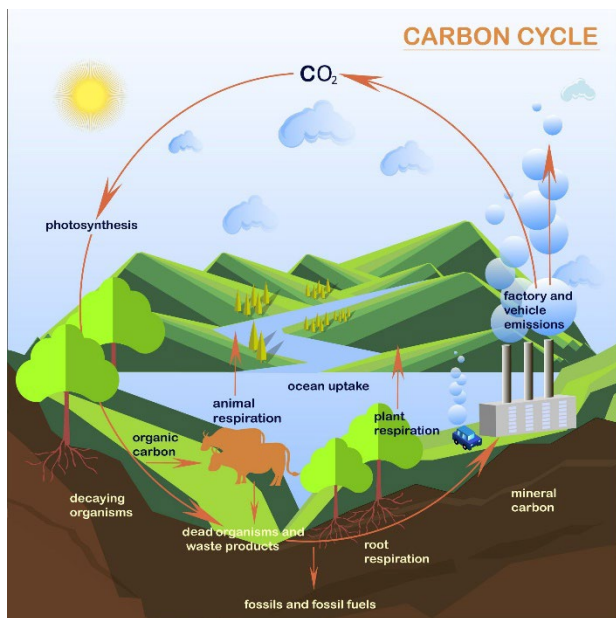


Inside the Lab: The Carbon Cycle



Background: Carbon, a chemical element, is an important part of nearly all living things. It can be found in cells and is present in all organisms. Organisms need carbon for energy, and they obtain it from their surroundings. Plants get carbon through a process called photosynthesis, while animals get carbon by eating plants or other organisms that have consumed plants.

So, what do organisms do with carbon compounds? Most organisms use a process called cellular respiration to release energy from food. This process requires oxygen. However, fungi use a different process called fermentation, which doesn't need oxygen. When food is broken down during these processes, energy is released.

Organisms then use carbon and other elements to build their own molecules. As a result, waste products are produced.

One of the waste products of respiration and fermentation is carbon dioxide. Photosynthetic organisms, like plants, absorb this carbon dioxide and use it in photosynthesis. The carbon becomes part of the plant's structure and may eventually be consumed by an animal. The continuous movement of carbon through organisms, the atmosphere, and back is called the carbon cycle.

Pre Lab-Questions:

1. Why do organisms need carbon?
2. How do plants, animals, and fungi obtain carbon? (What are the three processes?)

Procedure:

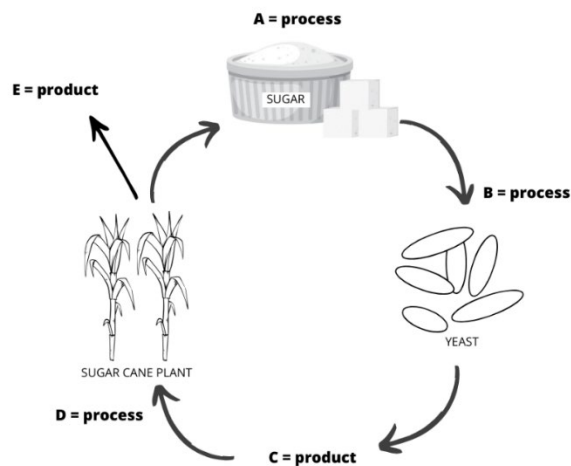
In this experiment, you will be working with yeast, which is a type of single-celled organism called a fungus. Yeast gets energy from food through a process called fermentation. By giving yeast different types of food, we will find out what it uses as its source of energy.

- a. Label the three beakers: "1", "2", and "3"
- b. Add 1 gram of yeast into each beaker
- c. Add 1 gram of sugar to beaker 2 and 1 gram of salt to beaker 3
- d. Add 100 mL of warm water to each beaker and stir gently
- e. Observe what happens in each beaker over the next 10-15 minutes and record your observations in the table. Look for bubbles rising to form a foamy layer; this is evidence of carbon dioxide production.

Reaction of Yeast to Different Food Sources	
Beaker	Observations
1 (yeast only = control)	
2 (yeast & sugar)	
3 (yeast & salt)	

Analysis:

- In which of the beakers did you observe bubbling? What does this indicate?
- Did you detect any specific odors from any of the beakers? What might be causing these smells?
- Why do you think fermentation didn't occur in all of the beakers?
- In the experiment described above, what was the source of carbon dioxide released by yeast?
- In the diagram below, fill in the blanks to explain what is occurring during each step.



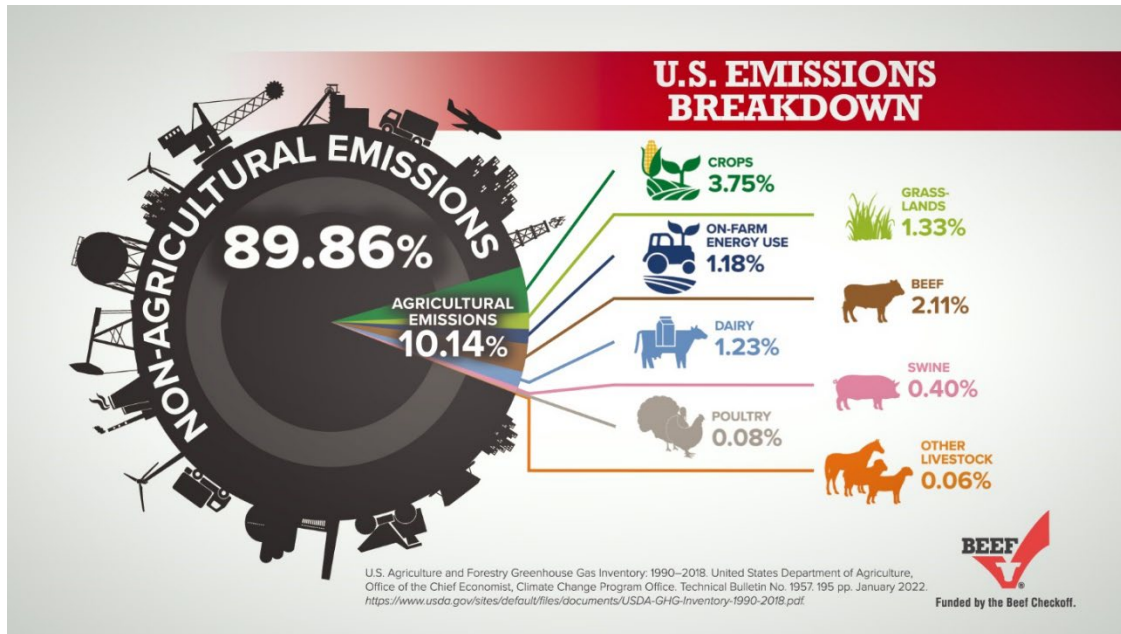
- A - _____
- B - _____
- C - _____
- D - _____
- E - _____

- Where do humans fit into the cycle depicted above?
- How is burning gas in a car similar to the digestion process in living organisms?
- Sugar acts as a fuel for living organisms, while gasoline, derived from the remains of deceased organisms, serves as fuel for cars. Why is there so much stored energy in these fuels?

Name: _____

ACTIVITY: Cattle Carbon Cycling C.E.R and Debate

Please review the figure below and answer the questions that follow:

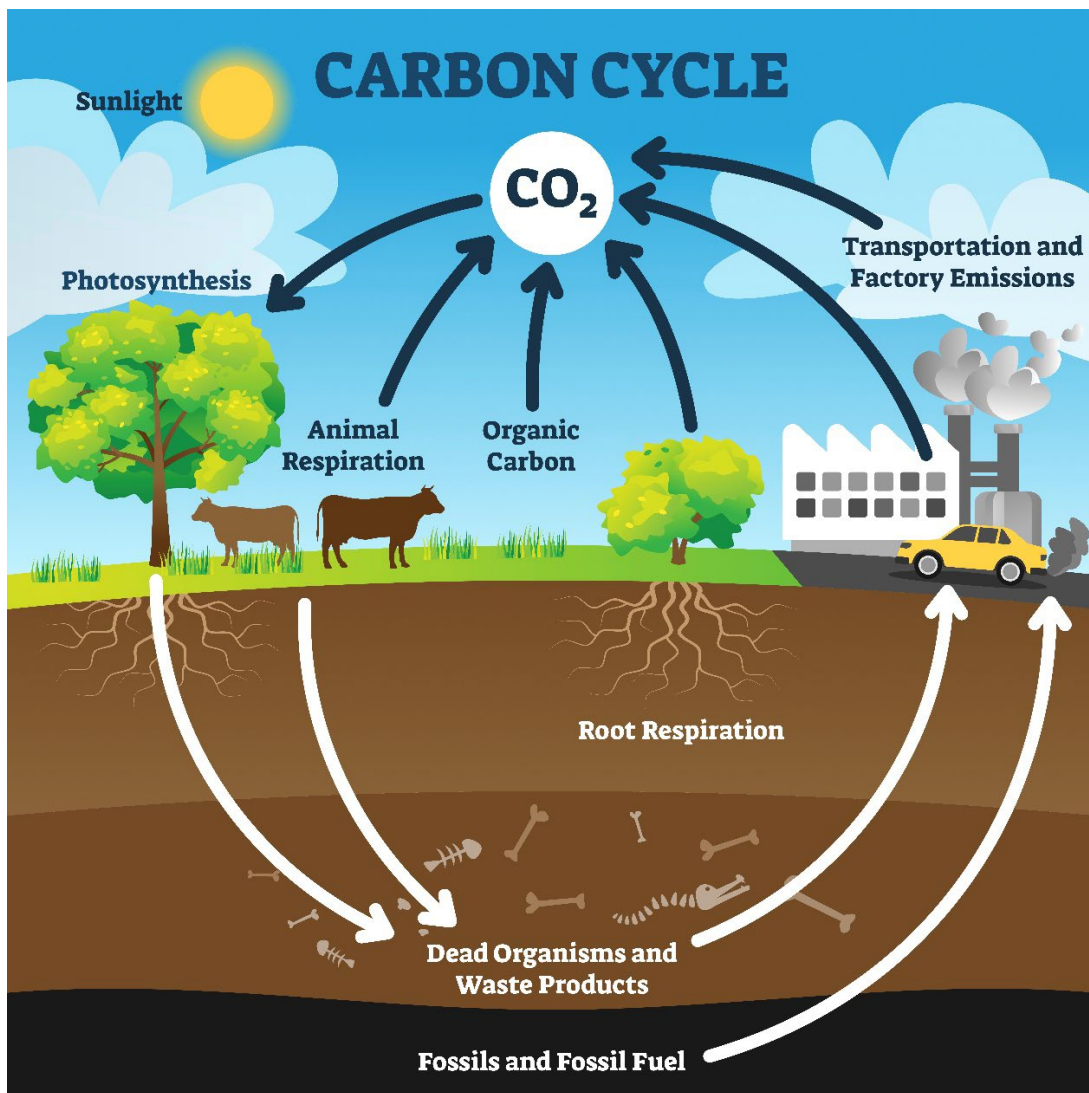


1. What do all the images circling the pie chart have in common?
2. Name three things, not related to farming, that produce greenhouse gas emissions.
3. What is the total percentage of the agriculture-related emissions?
4. What percentage of the agricultural emissions is labeled as “beef”?
5. If people stop eating beef, would it significantly slow down climate change?
6. Are cows the main contributors to climate change?
7. What are some other factors that contribute to climate change?
8. How can people help reduce carbon emissions?

Research Question: “Does the data about cattle and greenhouse gas emissions contradict what you may have previously heard?”

As you conduct research on the effects of cattle, methane, and carbon cycling, remember to take detailed notes to support your point of view. After gathering information, write a Claim, Evidence, and Reasoning (C.E.R.) based on your research. Use your position to engage in a classroom debate, ensuring that both sides of the argument are well-prepared with claims, data, research, and a clear stance. When forming debate groups, assign individuals that argue both the pros AND cons of the topic.

This document provides graphics and resources that can be helpful. However, you **WILL NEED** to conduct additional research.



Additional Resources:

- Beef. It's What's For Dinner.: bit.ly/3rbJxzl
- Beef Research – Carbon Footprint: bit.ly/45SGY4o
- Beef Research – Carbon Sequestration: bit.ly/3PD5LDN
- Carbon Cowboys - <https://carboncowboys.org/>
- Colorado State University – Ruminants as Part of a Sustainable Agriculture System: bit.ly/48aFiER

Fill out the following table stating your claim and indicate the evidence you have collected to justify your claim.

The Research Question: Does the data about cattle and greenhouse gas emissions conflict with what you may have heard before?	
Your Claim:	
Your Evidence:	Your Justification of the Evidence:

Write down the arguments presented by the other teams and develop your counter-arguments in response to them. Record your responses in the Rebuttal Column.

Group Name:	Group Name:
Argument #1	Rebuttal
Rebuttal	Argument #1
Argument #2	Rebuttal
Rebuttal	Argument #2