



THE CARBON CYCLE

Carbon, a chemical element, is a component of nearly all biological molecules. Carbon is found in all organisms, where it is one of the main components of cells. Organisms get energy from carbon compounds. Organisms obtain carbon from their environment. Plants get carbon through photosynthesis, while animals get carbon by eating plants or by eating organisms that ate plants. Think of the food you eat—it mostly consists of parts or products of living organisms. Consider a slice of pizza. The crust is made from wheat, which is part of a plant; the sauce is made from tomatoes, the fruit of a different plant; and the cheese is made from milk, an animal product. All of these animal and plant products supply you with the carbon compounds you need to live and grow.

So what do organisms do with carbon compounds? Through a process called *cellular respiration*, the cells of most organisms use oxygen to release the energy that is stored in food molecules. Fungi use a different process, called *fermentation*, that does not use oxygen to release energy. During both cellular respiration and fermentation, energy is released when the chemical bonds that hold the food molecules together are broken. All organisms then use elements, such as carbon, to build their own biological molecules. The molecules left after these processes are waste products.

One of the waste products is carbon dioxide, a molecule that contains carbon. As organisms conduct cellular respiration or fermentation, they release waste carbon dioxide as a gas into the atmosphere. Photosynthetic organisms, such as plants, absorb this carbon dioxide and use it in photosynthesis. The carbon gets incorporated into parts of the plant (for example, as part of the starch in a potato) and may end up being consumed by yet another animal. The constant cycling of carbon through organisms to the atmosphere and back again is called the *carbon cycle*.

THINK ABOUT IT

1. What kinds of organisms use carbon in the creation of cells?

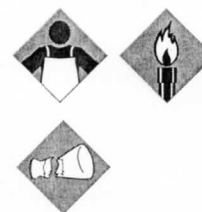
2. What happens to the carbon you eat but do not use in the creation of cells?

PROBLEM

In this experiment you will be working with yeast, a single-celled organism that is a fungus. Yeast obtains energy from food through the process of fermentation. By providing the yeast with different sources of food, we will answer the following question: What substance is used by yeast as a source of energy?

MATERIALS

- bakers yeast (check expiration date)
- 0.5 g sugar
- warm water
- 0.5 g salt
- 50 mL beakers (3)
- 100 mL beaker



INVESTIGATION 3.2, CONTINUED

PROCEDURE

3. To prepare a yeast solution, add 1 g of dry baker's yeast to 100 mL of very warm water, and stir the mixture gently.
4. Label three beakers 1, 2, and 3, and fill each half full with yeast solution.
5. Dissolve 0.5 g of sugar in beaker 2 and 0.5 g of salt in beaker 3.
6. Note what happens in each beaker, and record your observations in the data table. Be sure to look for bubbles rising to form a foamy layer. **This is evidence of carbon dioxide production.** Be sure to use your sense of smell also!

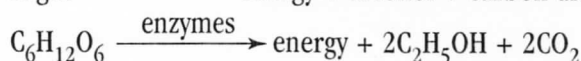
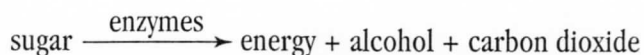
Reaction of Yeast to Different Food Sources	
Beaker	Observations
1	_____ _____
2	_____ _____
3	_____ _____

ANALYZE YOUR OBSERVATIONS

7. Which beaker served as the control in this experiment?

8. What food sources were tested in this experiment?

Below are the word and chemical equations for the fermentation carried out by yeast cells.



9. Did you notice a smell of alcohol in any beaker, and if so, which one? What does this mean?

INVESTIGATION 3.2, CONTINUED

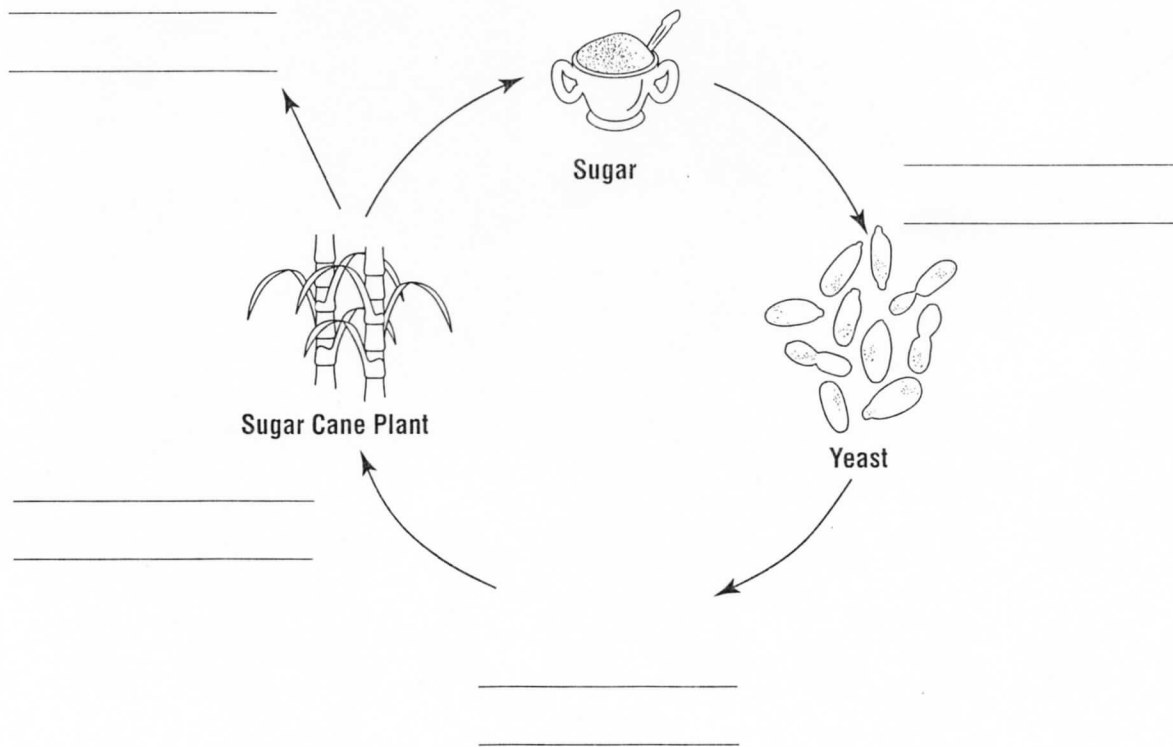
10. In which of the beakers did you notice bubbling, and what does this mean?

11. Based on the equations on the previous page and on what you observed, in which of the beakers do you think the process of fermentation occurred?

12. Why didn't fermentation happen in all of the beakers?

13. What would you conclude is the source of the carbon in the carbon dioxide produced?

14. Below is a diagram that shows the path of carbon in the carbon cycle. Fill in the blanks to describe what is happening during each of the steps.



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INVESTIGATION 3.2, CONTINUED

15. Think about a sugar-based food that you commonly eat, such as bread. When you eat it, how do you become a part of the cycle we see on the last page? In the space provided below, draw another diagram of the carbon cycle in which you are one of the organisms involved. Describe what is happening at each step.

16. How is burning gas in a car similar to digestion in living organisms?

17. Sugar acts as a fuel for living organisms. Gasoline, which comes from the remains of dead plants, provides the fuel for cars. Why is there so much stored energy in these fuels?

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