

The Carbon Cycle

Energy and matter flow through ecosystems during interactions that happen between biotic factors and abiotic factors. Molecules pass through organisms and the environment through biogeochemical cycles. The cycles that carry water, nitrogen, carbon and phosphorus through the biosphere are especially vital for life. In fact, life on Earth is called “carbon-based” because carbon forms the framework for life. Carbon is recycled within and between ecosystems.

Biological Processes: Carbon is the main component of biological compounds (macromolecules)

1. Primary producers remove **carbon dioxide** from the atmosphere through photosynthesis.
2. **Carbohydrates** pass from primary producers to heterotrophs.
3. **Carbon** from consumed carbohydrates in heterotrophs build proteins, lipids, and nucleic acids.
4. Consumers and producers both return **carbon dioxide** into the atmosphere through respiration.
5. Decomposers break down dead organic matter, releasing **carbon** through decomposition.
6. Over millions of years, buried remains of marine algae transformed into oil and natural gas, and buried remains of land plants transformed into coal through fossilization. These fossilized carbon deposits are also known as **fossil fuels** and act as underground reservoirs that store a great amount of carbon.

Geological Processes: Carbon is a major component of many minerals

1. Dissolved carbon dioxide in oceans combines with calcium and magnesium to form **carbonates**.
2. Carbonates accumulate on the ocean floor to form **sedimentary rocks** (limestone, dolomite) which store carbon.
3. Sedimentary rocks can then be pushed so deep into the Earth that intense heat releases **carbon dioxide** gas.
4. When volcanoes erupt, the underground **carbon dioxide** is released into the atmosphere.

Chemical and Physical Processes: Carbon exists in many forms in the atmosphere and oceans

1. **Carbon dioxide** from the atmosphere dissolves into bodies of water, like oceans.
2. **Carbon dioxide** in oceans can diffuse into the atmosphere.
3. Carbon dioxide in the atmosphere can dissolve in rainwater to form **acid rain**.

Human Activity: Carbon dioxide is a greenhouse gas, human emissions of CO₂ have significantly altered the carbon cycle which has increased the greenhouse effect, raised the average global temperature, and drives climate change

1. Extracting coal, oil, and natural gas from carbon reservoirs in the geosphere and burning them through the process of combustion, releases **carbon dioxide** back into the atmosphere.
2. Clearing and burning forests releases **carbon** in the atmosphere.

Procedures:

1. Complete the pre-activity questions
2. Use the set of pictures in the envelope, and chalk, to create a model of the carbon cycle on the lab station
 - Each picture must be connected by arrows to show the connections and interactions, make sure to include all of the pictures; forest fire, live plant, dead plant, live animal, dead animal, ocean and atmosphere, automobile, decomposers, fossil fuels
 - Each arrow must be labeled with the process that it represents, include all of the following; photosynthesis, respiration, combustion, diffusion, decomposition, death, mining /extraction, fossilization
3. Use the background information of the lab sheet, and the textbook as guidance, if necessary
4. Get the diagram checked off
5. Complete the analysis questions

The Carbon Cycle

Name: _____ Period: _____

Pre-Activity Questions:

1. Which 4 biological processes are part of the carbon cycle?
2. What is formed during geological processes that stores a great deal of carbon?
3. Which 2 chemical and physical processes are part of the carbon cycle?
4. Which human activity contributes heavily to greenhouse gases?

Analysis Questions

1. How does carbon enter the biotic factors of an ecosystem?
2. What is another process that you have learned, that is not pictured, that also brings carbon into biotic factors?
3. What role does each of the following play in the carbon cycle? Give an example of each.
 - a. Primary producers
 - b. Primary consumers
 - c. Secondary (or above) consumers
 - d. Decomposers
 - i. Give at least 2 examples of organisms that are decomposers:
4. What is a fossil fuel? Briefly describe how fossil fuels are formed.
5. What role does combustion play in the carbon cycle?
6. How does carbon end up in the oceans?
7. List 3 different places where a collection of carbon, or a carbon reserve, can be found on earth:

Decide whether each event *adds* or *removes* carbon from the atmosphere:

8. Algae makes energy-rich carbon compounds through photosynthesis. _____
9. A volcano erupts. _____
10. Carbon dioxide dissolves in rainwater. _____
11. Humans use gasoline to power their cars. _____
12. Organisms carry out cellular respiration to release energy from food molecules. _____