

Why It Matters

- The [cyclical](#) exchange of certain biological chemicals allows ecosystems to sustain life without the risk of [running out](#) of resources.
- The amount of carbon present on earth right now is [greater than/less than/equal to](#) the amount that was present a million years ago.
- Human actions can [disrupt](#) different phases of exchange cycles and cause [harmful](#) effects to all parts of the ecosystem involved with that cycle.

How We Know

- Write out the equation for photosynthesis:
 - [6CO₂ + 12H₂O + Energy from Sunlight → C₆H₁₂O₆ + 6O₂ + 6H₂O](#)
- Scientists can follow the movement of oxygen throughout photosynthesis by using [radioactive](#) oxygen. From this we learned that the oxygen from water is expelled as oxygen [gas](#) and the oxygen in carbon dioxide from the air is captured in [sugar/glucose](#).
- [Melvin Calvin](#) discovered the process that uses energy from sunlight to turn the carbon in carbon dioxide into glucose.
- Oil and coal are [hydrocarbons](#). They are made from the remains of dead plants and animals buried several miles deep and under high [pressure](#) and [temperature](#) for tens of [millions](#) of years.

- Burning fossil fuels [pollutes](#) our air and water with toxic compounds. Name an energy source that can be used instead of fossil fuels:
 - [Windmills, sun energy, fuel cells](#)
- Nitrogen is essential for life. It is found in our [proteins](#) and [nucleic acids](#).
 - Nitrogen is found in the air as [nitrogen gas](#) and in soil as [nitrates](#) and [ammonia](#).
 - Nitrogen acts as a [fertilizer](#) in soil for plants.
- [Decomposition](#) enables carbon and nitrogen in dead plants and animals to be [recycled](#) back into the environment. This process can occur quickly if the right conditions are applied or slowly if it is left alone.

What We Know

- The major components of an ecosystem include:
 - [Atmosphere](#)
 - [Producers](#)
 - [Consumers](#)
 - [Decomposing organic matter](#)
 - [Soil and water](#)
- The [sun](#) either directly or indirectly provides energy for most organisms on earth.
- Through [photosynthesis](#), plants use energy from sunlight to turn carbon dioxide into energy in the form of a carbohydrate called [glucose](#).

- Most/Very few carbon molecules are stored in an organism's body and are not recycled until that organism dies.
 - Bacteria and fungi get their energy by decomposing dead organic matter which releases carbon dioxide back into the atmosphere.
- While plants need carbon dioxide from the environment, they can only use a certain amount at a time, and any extra CO₂ can trap heat in the atmosphere.
- Oxygen is a very reactive element.
- The cells in your body need oxygen to break down glucose for energy.
- When there were many plants photosynthesizing on earth and no animals undergoing respiration, atmospheric oxygen levels drastically increased/decreased.
- Oxygen exchange occurs as animals use oxygen to get energy and return it to the ecosystem as water. During photosynthesis, sunlight splits water and releases oxygen into the air for animals to breathe.
- In addition to water, glucose, and atmospheric O₂, oxygen is present in other compounds as well, including O₃ or ozone.
- Ozone is harmful in the lower atmosphere because it can harm our eyes and respiratory systems as well as plants and it is beneficial in the upper atmosphere because it protects the earth from the sun's ultraviolet radiation.
- Water is the major transportation medium for all elements.
 - Water precipitates to form clouds and falls to the ground

- Energy from the sun excites water molecules so that they escape into the atmosphere as [vapor](#).
- While nitrogen makes up about [70%](#) of the atmosphere, in order for nitrogen to be used by organisms it must be converted into [ammonia](#).
 - This conversion is done by [bacteria](#) who “fix” nitrogen.
 - Fungi and bacteria decompose nitrogen in dead organic matter and release [nitrates](#) and [ammonia](#).
 - Addition of excess nitrogen disrupts the balance of this cycle and can result in the formation of [nitric acid](#) in the atmosphere which can cause acid rain.
- Sulfur is released from [soil](#) deposits by weathering and decomposition of organic and inorganic soil and rock deposits. In the air, sulfur exists as hydrogen sulfide and sulfur dioxide. When it falls back down in rain, it becomes sulfuric acid and contributes to [acid rain](#).
- Most of the phosphorus present on earth is located in [rocks](#). Phosphorus is released into the ecosystem through [weathering](#) and [erosion](#) and is taken up by plants.
- Name two ways that anthropogenic actions affect the major exchange cycles:
 - [Excess carbon dioxide contributes to the greenhouse effect and possible global climate change](#)
 - [Nitrous oxide and sulfur dioxide produced from agriculture and industry contribute to acid rain](#)
 - [Immobilization of phosphorus by waste products in soil make it unavailable for cycling through plants and animals](#)

