

Ecological Cycles Part 2- The Carbon Cycle

Take a 17" X 11" sheet of paper and draw an illustrated diagram of the carbon cycle according to the following directions. Use erasable pencil at first, then color it in with crayons, colored pencils and/or pens.

This assignment is DIFFERENT from the water cycle assignment because carbon changes its chemical form as it moves through the cycle. You will need to write chemical reactions next to the arrows. Take it one step at a time! Save the coloring for the end!

Draw a landscape showing plenty of atmosphere, ocean, and land (both above and below sea level). Be sure to include a river and soil and sediments. Plenty of the land should include limestone, which geologists draw by using a "bricks" pattern.

Most of the carbon on earth takes the following forms:

In rocks:

CaCO_3 = calcium carbonate = limestone rock (the biggest reservoir of carbon)

Coal, oil, natural gas = "fossil fuels"

In the atmosphere:

CO_2 = carbon dioxide = gas in the atmosphere

H_2CO_3 = carbonic acid = dissolved in rainwater

Dissolved in seawater:

CO_2 = carbon dioxide

H_2CO_3 = carbonic acid

HCO_3^- = bicarbonate ion

CO_3^{2-} = carbonate ion

In the Biomass (mostly trees, grass, and marine plankton)

Living organic tissue

Dead organic matter

1. Draw all these types of carbon onto your diagram. Include some chemical formulas where you have room – for instance, in seawater.
2. Plants practice PHOTOSYNTHESIS, so draw an arrow labeled "photosynthesis" going from the atmosphere into plant leaves and include this chemical reaction with the arrow:
 $\text{CO}_2 + \text{H}_2\text{O} + \text{sunlight} \rightarrow \text{plant tissue} + \text{O}_2$
3. Animals eat plants and each other, and bacteria and fungi eat dead stuff, so draw arrows going from plants to animals, and from animals and plants to dead leaf litter on the ground.
4. Animals, bacteria and fungi practice RESPIRATION. (Plants are removing CO_2 from the atmosphere while animals, etc. are adding it to the atmosphere.) So, draw arrows labeled "respiration" going from the animals and dead leaf litter on the ground into the air, and include this chemical reaction alongside an arrow: $\text{plant tissue} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$

5. Dead plant matter on land gets buried and turns into coal. So draw an arrow going from living plants to some coal underground and label it "burial."
6. Dead plankton in the sea sink to the bottom, get buried and turn into oil and natural gas. So, draw an arrow going from surface seawater to the ground under the sea floor and label it "burial."
7. People remove coal, oil and natural gas from the ground and burn it adding CO_2 to the atmosphere. So, draw in an oil well and/or coal mine and show somebody burning fossil fuels (factory smokestack or car, etc.) Draw an arrow going from the coal or oil through the smokestack or car and into the air. Label it "combustion" and include this chemical reaction next to the arrow: "fossil fuels" + $\text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$.
8. In raindrops, carbon dioxide forms carbonic acid: $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$ Write this equation near the raindrops.
9. Carbonic acid in raindrops hits limestone rock and dissolves it into bicarbonate ions: These flow down the rivers and enter the ocean. So draw an arrow labeled "Dissolution" going from a limestone rock into a river and add this chemical equation: $\text{H}_2\text{CO}_3 + \text{CaCO}_3 \rightarrow 2 \text{HCO}_3^- + \text{Ca}^{2+}$
10. In the ocean, sea creatures make solid shells of calcium carbonate. The shells settle to the bottom and make more limestone! So, draw an arrow going from the seawater to the sea floor labeled "shell formation" and include the chemical reaction $\text{Ca}^{2+} + \text{CO}_3^- \rightarrow \text{CaCO}_3$.
11. Geological forces then lift the limestone onto land, so draw an arrow labeled "uplift from the sea floor to some limestone rock on land."
12. CO_2 moves freely between the atmosphere and the ocean, so draw a double-headed arrow going from the sea to the air and label it " CO_2 exchange"

Your Instructor will show you examples.