

Biology  
Period \_\_\_\_\_

Name \_\_\_\_\_  
Date \_\_\_\_\_

## THE CARBON CYCLE

Energy flows from the sun into the biosphere, but nutrients do not enter the biosphere from an outside source. Essentially, the same pool of nutrients has circulated for the billions of years that the Earth has been in existence. Some nutrients, called macronutrients, are used by organisms in large quantities, while others, micronutrients, are used only in trace quantities. Macronutrients include carbon, hydrogen, oxygen, nitrogen, and phosphorus; micronutrients include iodine, iron, zinc, and some others.

Both macronutrients and micro-nutrients are recycled; they are passed back and forth between living and nonliving components of the ecosystem in processes that we call biogeochemical cycles. This plate and the ones that follow trace the pathways of several elements through biogeochemical cycles.

**The prime focus of this plate is on the arrows that show how carbon travels among components of the biosphere. You should use darker colors for the arrows.**

Material substances are incorporated into organic compounds by primary producers. Primary producers are then consumed by secondary consumers, and decomposers are ultimately responsible for releasing the material back into the nonliving environment.

We will begin our study of the carbon cycle with the **atmosphere (A)**, which is Earth's major reservoir of carbon, in the form of carbon dioxide. Carbon enters the biotic (living) part of the ecosystem through **photosynthesis (B)**. We suggest a green color for the arrow. Plants of the **forest (C)** take the carbon in carbon dioxide and fix it in organic compounds such as glucose, starch, cellulose, and other carbohydrates. **Respiration in plants (D)** returns carbon dioxide to the atmosphere; an arrow shows this process.

**We have seen how carbon enters the cycle of living things through photosynthesis, and we will now see how it passes through various life forms. Continue reading below as you color.**

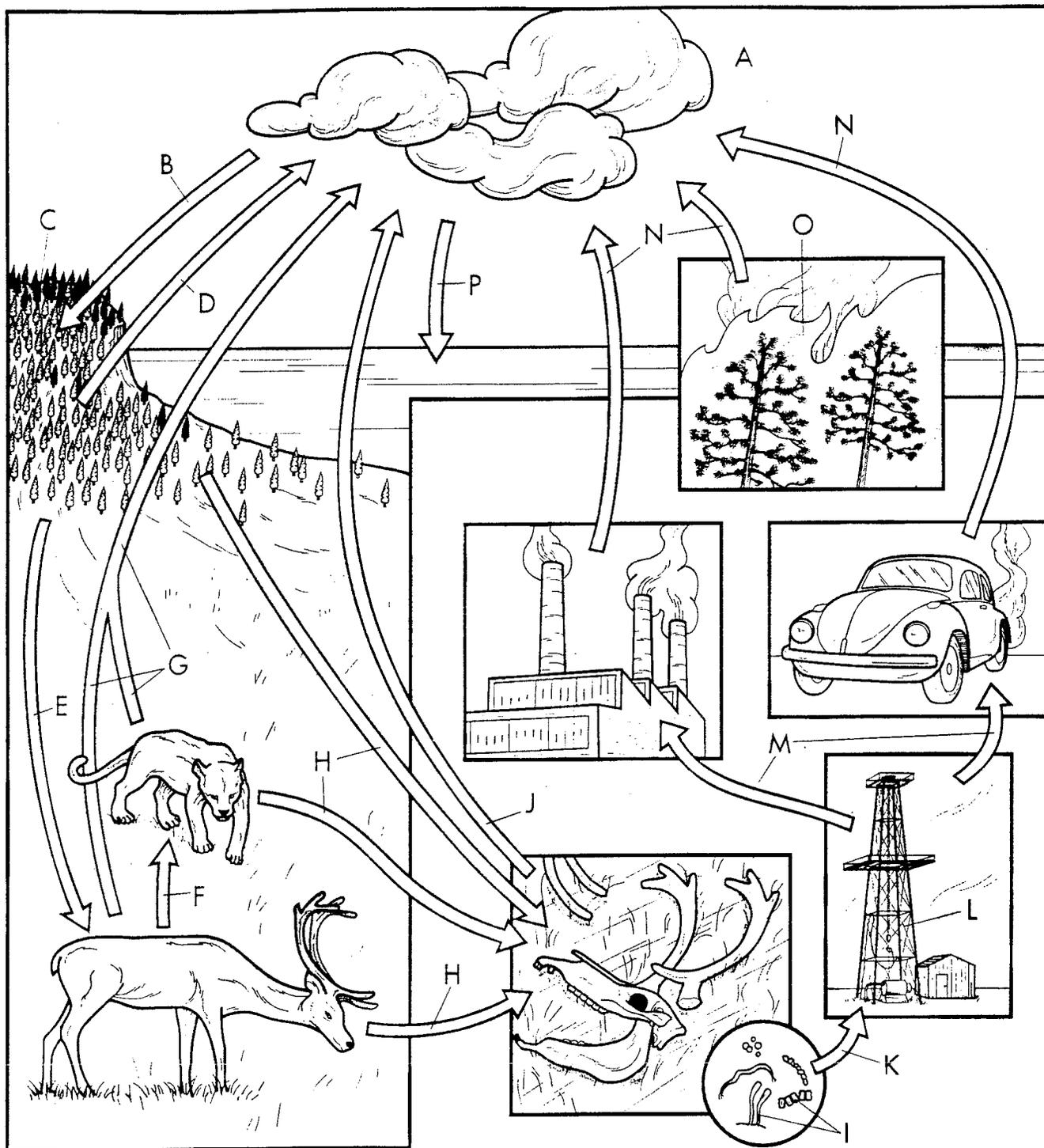
Plants are primary producers. In the course of **plant consumption (E)**, carbon passes into primary consumers, animals. When **animal consumption (F)** occurs, or when the primary consumer is eaten, carbon passes to a secondary consumer, represented by the mountain lion in the plate. **Respiration (G)** takes place in cells of the primary and secondary consumers, and carbon dioxide is released back into the environment as carbon dioxide.

When the primary and secondary consumers die, their organic matter enters the soil through the process of **decay (H)**. It is broken down by the decomposers, or **detritus feeders (I)**, which are small animals and microorganisms that subsist on decaying matter such as fallen leaves, dead bodies, and animal waste. Earthworms, mites, centipedes, insects, and crustaceans are detritus feeders. Thus, **respiration by detritus feeders (J)** also returns carbon to the atmosphere.

**We have seen how carbon cycles through various living things on Earth. We will now turn to a storage process for carbon in the soil. Continue reading below as you complete the plate.**

Throughout history, much carbon has been **converted to fossil fuel (K)**. High pressure and temperature transform carbon-containing organic matter into coal, oil, and natural gas. **Fossil fuel processing (L)** follows. There are many **uses for fossil fuels (M)**. Some power plants generate electricity using fossil fuels, and automobiles are powered by gasoline. The **products of combustion (N)** of fossil fuels include carbon dioxide and other carbon compounds that enter the atmosphere. Carbon also enters the environment from the burning of wood and plants that occurs during **forest fires (O)**.

A final aspect of the carbon cycle that we will examine is **exchange with oceans (P)**. Some carbon dioxide from the air dissolves in oceans and combines with calcium to form calcium carbonate, which is incorporated into the shells of mollusks and other creatures. When these shells decay, they transform into limestone, which, over time, dissolves as it is exposed to water. Carbon is released from the limestone and may return to the atmosphere.



The Carbon Cycle

- Atmosphere.....A
- Photosynthesis.....B
- Forest.....C
- Respiration in Plants....D
- Plant Consumption.....E
- Animal Consumption....F
- Respiration in Animals.....G
- Decay.....H
- Detritus Feeders.....I
- Respiration in Detritus Feeders.....J
- Conversion to Fossil Fuel.....K
- Fossil Fuel Processing.....L
- Uses for Fossil Fuel.....M
- Products of Combustion.....N
- Forest Fire.....O
- Exchange with Oceans.....P

Carbon Cycle Questions:

- 1) Where does energy come from? \_\_\_\_\_
- 2) The same pool of nutrients has circulated for the \_\_\_\_\_ that the Earth has been in existence.
- 3) What are macronutrients? \_\_\_\_\_  
Name 5 macronutrients? 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_  
4) \_\_\_\_\_ 5) \_\_\_\_\_
- 4) What is a micronutrient? \_\_\_\_\_  
Name 3 micronutrients? 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_
- 5) Explain how macronutrients and micronutrients are recycled. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 6) The carbon cycle is a \_\_\_\_\_ cycle.
- 7) Material substances are incorporated into \_\_\_\_\_ compounds by \_\_\_\_\_ producers. Primary producers are then \_\_\_\_\_ by secondary consumers, and \_\_\_\_\_ are ultimately responsible for \_\_\_\_\_ the material back into the \_\_\_\_\_ environment.
- 8) Where is the Earth's major reservoir of carbon? \_\_\_\_\_ in the form of \_\_\_\_\_
- 9) How does carbon enter the living part of the system? \_\_\_\_\_
- 10) What do plants do with the carbon dioxide? \_\_\_\_\_  
Name the 4 organic compounds: 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_  
4) \_\_\_\_\_
- 11) How do plants return carbon dioxide to the atmosphere? \_\_\_\_\_
- 12) Name a primary producer. \_\_\_\_\_
- 13) How does carbon get into primary consumer? \_\_\_\_\_
- 14) How does carbon get into a secondary consumer? \_\_\_\_\_
- 15) Where does respiration take place? \_\_\_\_\_ What is the result of respiration? \_\_\_\_\_
- 16) What are detritus feeders and what is their function? \_\_\_\_\_  
\_\_\_\_\_
- 17) Name 5 detritus feeders. 1) \_\_\_\_\_ 2) \_\_\_\_\_ 3) \_\_\_\_\_ 4) \_\_\_\_\_ 5) \_\_\_\_\_
- 18) Carbon has been converted to \_\_\_\_\_.
- 19) What transforms carbon-containing organic compounds into fossil fuels? \_\_\_\_\_  
\_\_\_\_\_
- 20) Name 3 fossil fuels: 1) \_\_\_\_\_, 2) \_\_\_\_\_, and 3) \_\_\_\_\_
- 21) Name two ways carbon gets back into the atmosphere due to combustion: 1) \_\_\_\_\_  
and 2) \_\_\_\_\_
- 22) Carbon dioxide from the air dissolves into oceans and forms \_\_\_\_\_, which can be found in the \_\_\_\_\_ of \_\_\_\_\_, and other \_\_\_\_\_.
- 23) When shells decay, they turn into \_\_\_\_\_, which \_\_\_\_\_ over time. What happens to the carbon in limestone when the limestone dissolves? \_\_\_\_\_