

Spheres and Cycles – Teacher Notes

Earth is a series of systems, which affect each other and therefore must be kept in balance.

From your knowledge of spheres and cycles please fill in the blanks and answer the questions below.

Materials and energy can cycle through four interconnected spheres:

1. The **atmosphere**, which is mostly made of gases.
2. The **lithosphere**, which is mostly made of rock.
3. The **hydrosphere**, which is mostly made of water.
4. The **biosphere**, which is mostly made of living things.

There is continual movement between all of these spheres. Materials can be temporarily stored in **sinks/reservoirs** before Earth processes move them on.

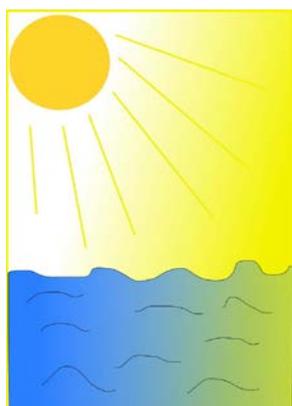
In which sphere would you find underground water in an aquifer? **In both the hydrosphere and the lithosphere as water is held between particles of rock in pore spaces.**

Part of the carbon cycle – an example

During the process of **photosynthesis** a sunflower plant took in a carbon dioxide molecule. It left the **atmosphere** and entered the **biosphere**. The carbohydrate rich starch produced was stored within the plant for six months, then was used in the process of **respiration** to make energy for the plant.



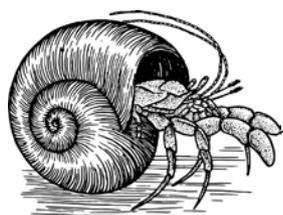
Call me a carbon sink?
Yes!



This process released carbon dioxide back into the **atmosphere** where it remained for two years being one of the essential “greenhouse gases”. Without balanced amounts of these aerosol gases in the atmosphere, our Earth would either be too cold or too hot to support most life forms.

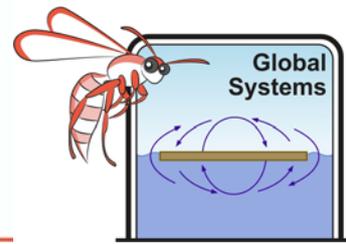
Heavy rain dissolved the gas and acidic rainwater entered the ocean. It became part of the **hydrosphere**. It only remained there, in solution, for one year.

A sea snail (gastropod) living at the bottom of the ocean used the carbon and oxygen to bond with calcium and laid down a hard protective shell of calcium carbonate. After four happy safe years the snail died and the now empty shell was taken over by a hermit crab. The young crab lived in it for two years until it had to be abandoned when its body grew too big for the shell.



Am I a sink?
No, but your borrowed shell is!

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Our shell joined others on the sea floor and after nine thousand years of sedimentation, compaction and cementation became part of a fossil rich limestone bed. Our molecule has now entered the **lithosphere**.

Am I a sink?
Yes!



Tectonic movement twenty million years later caused the limestone to be raised to be part of a high mountain chain. Acid rain falls on the limestone dissolving it and releasing carbon dioxide to begin the cycle again in the **atmosphere**.

From the information above fill in the table to describe the path this particular carbon atom took.

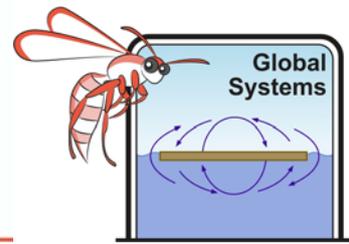
Sphere	Name of sink & length of time carbon remains in it	Process by which it enters this sink
Atmosphere	Air Unknown	Unknown
Biosphere	Sunflower Six months	Photosynthesis
Atmosphere	Air 2 years	Respiration
Hydrosphere	Sea One year	Solution
Biosphere	Shell of sea snail and crab 6 years	Precipitation
Lithosphere	Sediments (to limestone bed) 9,000 years	Sedimentation Compaction & cementation
Lithosphere	Uplift	Tectonism
Atmosphere	Air	Dissolving/solution Effervescence

A simple diagram outlining this movement of carbon is called the **carbon cycle**. Each time materials move from one location to the next, we say it has moved from **source (the original location it was found)** to a **sink (the new location)**.

Is the **“period of residence”** or time the carbon remains in every sink, the same? **No**

Is this the only path carbon atoms take? **No there are many others.**

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Coal and the carbon cycle – Extension

Most of Western Australia's coal deposits are of Permian Age. About 250 million years ago peat bogs were compressed and cemented within sedimentary piles to create the brown coals that are used to fire Muja power station and create electricity for the state grid. It has been estimated that the movement of carbon out of fossil fuels (on burning) is about 60,000 times faster than the natural movement of carbon into rock to create fossil fuels. Is this cycle balanced? Explain your answer. **No we are using it up faster than it is being replaced.**