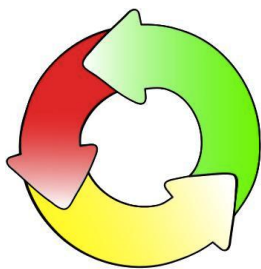


## Respiration - Teacher Notes



The carbon cycle is very important when we consider carbon dioxide and methane as forcing factors producing the enhanced Greenhouse Effect. Carbon moves throughout our global systems. It can be found in the atmosphere as carbon dioxide and methane, in the hydrosphere as soluble bicarbonate ions (hydrogen carbonate), carbonic acid and methane clathrate, in the biosphere as insoluble carbonate shells and soluble sugars and in the lithosphere as limestone and marble.

When carbon, as carbon dioxide leaves our atmosphere, it is held in sinks for varying lengths of time. The sea is the largest sink for carbon dioxide. Carbon dioxide resides in the atmosphere for between 2 and 4 years. It resides in deep oceans for up to 500 years, however. Within rocks carbon resides as carbonates and fossil fuels for many million years.

### Amount of carbon dioxide in each reservoir (gigatons)

Rocks, soil and sediment	66,000,000 to 100,000,000
Fossil fuels	4,000
Ocean	38,000 to 40,000
Terrestrial plants	540 to 610
Atmosphere	766 (CO <sub>2</sub> concentration currently increasing by about 3.2ppm per year).

The processes that cause the carbon to move through the atmosphere and hydrosphere are respiration, photosynthesis, fermentation, combustion, solution and lithification.

**Respiration** Plants and animals break up simple sugars to create energy for growth, reproduction, movement (for animals) and repair.

Where does respiration occur? [In the living cells of plants and animals](#)

Write the word equation for respiration



Why does a plant or animal respire? [To provide energy for growth, maintenance, repair, reproduction and movement \(animals\)](#)

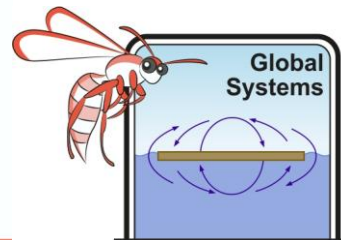
What happens initially to the carbon dioxide produced? [It is released into the atmosphere](#)

**Teacher demonstration:** To demonstrate that carbon dioxide is a product of respiration

### Materials

- Healthy plant
- Small beaker of limewater Ca(OH)<sub>2</sub>
- Bell jar or inverted large beaker sealed with plasticine to contain carbon dioxide.
- A cloth or cardboard box.





## Respiration - Teacher Notes

### Method

1. Place the plant and limewater under the bell jar.
2. Cover with cloth or inverted cardboard box to exclude light
3. Leave for two days and observe changes in limewater

### Observations

What did you observe? **The clear limewater turned milky. A white precipitate was formed.**

### Conclusion

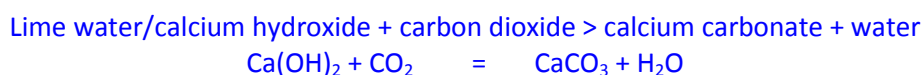
What conclusion does this observation lead you to? **The plant released carbon dioxide**

### Discussion

Which substances were the reactants? **Limewater and carbon dioxide**

Which substances were the products? **Calcium carbonate and water**

Write the word equation for this reaction



How could you tell that calcium carbonate is insoluble in water? **It precipitated out of solution to form a white solid**

***A common misconception amongst students is that plants photosynthesise and do not respire.***

**Extension respiration activities** When humans respire carbon dioxide is also produced (along with water and energy) Students may **blow gently** through a straw into limewater to demonstrate this. After a little time the limewater will turn milky. The gas we breathe out is not pure carbon dioxide as tidal air enters and leaves the lungs as well. We breathe out about 200mL of CO<sub>2</sub> every minute.

The air we breathe in contains about 0.04% carbon dioxide. The air we breathe out contains about 4% carbon dioxide (The concentration is increased one hundredfold). Water is also lost during breathing. Exhaled air has a relative humidity of 100%. Both water and carbon dioxide are greenhouse gasses.

Students might enjoy thinking of what measures could be taken to reduce personal CO<sub>2</sub> and H<sub>2</sub>O production from respiration. There is none, other than reducing population numbers, as respiration is essential for life.



When we have hiccoughs we can stop them by putting a paper bag over our face and breathing into it. The higher levels of CO<sub>2</sub> stimulate the respiratory centre in the brain and the spasms stop.