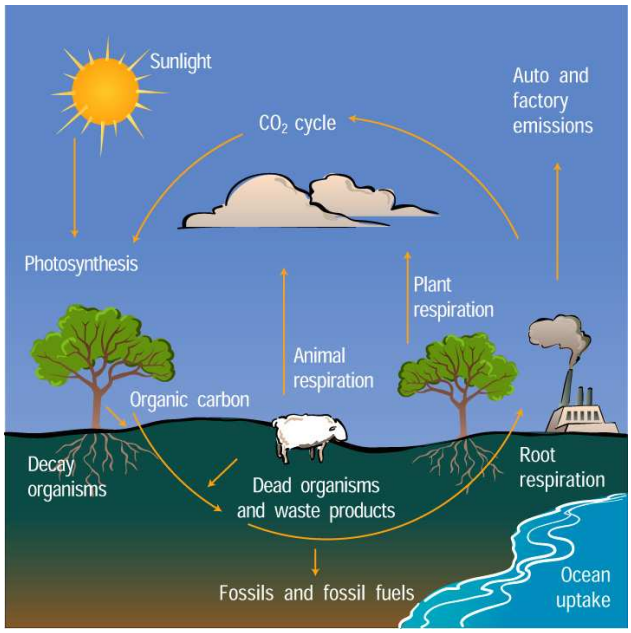
The carbon cycle through the window

How much evidence of the carbon cycle can you see through the window?

Ask the pupils to look through a window or doorway and answer the following questions:-

- where on Earth does carbon occur and where can you see evidence for it?
- where is carbon 'fixed' and where can you see evidence for it?
- where is carbon 'released' and where can you see evidence for it?



The back up:

Title: The carbon cycle through the window

Subtitle: How much evidence of the carbon cycle can you see through the window?

Topic: The carbon cycle can be introduced when teaching many topics including the atmosphere, photosynthesis, respiration, decomposition, combustion and fossil fuels, climate change . . .

Age range of pupils: 12 - 18 years

Time needed to complete activity: 15 minutes

Pupil learning outcomes: Pupils can:
- say where carbon occurs on Earth;
- say how carbon is fixed;
- say how carbon is released;
- list the major processes involved in the carbon cycle;
- list the major carbon products involved in the cycle;
- know that carbon is being moved round the cycle all the time everywhere and some part of the cycle can always be seen;
- know that any major alteration to one part of the cycle is likely to affect other parts of the cycle.

Context:
Some possible answers to the questions are shown in the table on page 2.

Following up the activity: This topic could be followed by a discussion about climate change and increasing carbon dioxide in the atmosphere**.**

Underlying principles:
- Carbon occurs in the atmosphere, biosphere, lithosphere and hydrosphere.
- Carbon is 'fixed' by certain processes.
- Carbon is 'released' by certain processes.

Thinking skill development:
- understanding the pattern (construction)
- different pieces of evidence (cognitive conflict)
- explanation of thinking (metacognition)
- relevance of the cycle to everyone (bridging)

Resource list: No resources required - apart from a window/doorway and imagination.

Useful links:
http://www.bbc.co.uk/schools/gcsebitesize/biology/livingthingsenvironment/2energyandnutrienttransferrev4.shtml
http://epa.gov/climatechange/kids/carbon_cycle_version2.html
http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/C/CarbonCycle.html
http://www.cet.edu/ete/modules/carbon/efcarbon.html

Source: Developed by Elizabeth Devon from the Earth Science Education Unit, 'Life, atmosphere and everything' workshop, E-carbon cycle activity by Paul Grant and Chris King.

Context: Table

Where can you find carbon?	**Can you see evidence for it?**
In the atmosphere	Gas - you can't see the gas but carbon is in carbon dioxide (CO_2 - 0.03% in the atmosphere) and methane (CH_4 - a trace in the atmosphere). Particles - you may be able to see a coating of soot on buildings, washing - - - Pollen, spores - you may have hay fever; sneezing may be caused by pollen and spores in the atmosphere. Rain - rainwater contains dissolved carbon dioxide.
On the land and in water	Plants, animals - carbon is in all cells, leaves, roots, skin and bone. Soils - plant and animal remains, living bugs. Water - plants and animals, dissolved gas.
In rocks	Coal - contains carbon. Oil - hydrocarbon liquids. Gas - methane (CH_4), ethane, propane. Limestone - calcium carbonate ($CaCO_3$).
Where is carbon 'fixed'	**Can you see evidence for it?**
Photosynthesis (carbon dioxide, sunlight and water used by plants to make sugar plus oxygen).	You know photosynthesis is happening if you can see green plants.
Plants are eaten by animals/birds/fish on land and in the water and so they take in carbon.	Animals/birds eating vegetation; people eating food made from plants, e.g. bread.
Decaying organisms and vegetation put carbon into the soil.	Something decaying into the ground, e.g. leaves.
Waste products from animals put carbon into the soil.	Animals defecating or urinating.
The carbon from dead organisms and waste products eventually becomes fossils and fossil fuel.	You can't see this process happening; it takes millions of years.
Phytoplankton (plants) in the ocean take up carbon dioxide from the atmosphere. The oceans also take carbon dioxide into solution from the atmosphere.	If you have a view of the ocean, you know this is happening even though you can't see it.
Where is carbon 'released'	**Can you see evidence for it?**
Animals (including humans) breathing (respiration) - carbon dioxide goes back to the atmosphere.	If the animals are alive, you know they are breathing so you know this is happening.
Plant respiration - carbon dioxide goes back to the atmosphere.	You know this is happening even though you can't see it.
Decaying organisms and vegetation release carbon into the atmosphere.	Something decaying into the ground.
Factories and vehicles which burn fossil fuels emit carbon dioxide and soot (carbon particles) into the atmosphere.	You may be able to see the smoke from a factory chimney or vehicles on a road. You may be able to see a cloud of pollution caused by vehicles and factories.
When limestone is weathered by rain, carbon dioxide is released into the atmosphere.	If the rocks outside your window are limestone, then this will be happening, if it is raining.
When volcanoes erupt, carbon dioxide is released into the atmosphere.	It is unlikely that you can see a volcano erupting through your window.