

CLIMATE CHANGE LESSON PLAN - Where is the Carbon? For Grade 7

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Description of Activity: This lesson is to understand how the carbon cycle works, and why it is important for the planet's well-being as well as our own.

This lesson should be completed over 3 30 min lessons or over 1 week.

Learning Area/s: Natural Science	Learning Outcomes: NS: LO1, LO2 & LO3
<p>Assessment Standard/s: LO1 AS2 & AS3: Learner able to plan simple tests and comparisons; able to evaluate data and communicate findings</p> <p>LO2 AS3: Learner able to interpret information by identifying key ideas in text</p> <p>LO3 AS2: Learner able to show understanding of sustainable use of the earth's resources and analyse information</p>	Subject Integration: Social Science, Technology, mathematics, English Language
<p>Background knowledge required by learners: An understanding of how climate change works; factors that contribute to the increase in climatic changes</p>	<p>Materials Needed: Appendix A, B and C Beaker or narrow necked bottle, matches , baking soda , vinegar, straw, candle, funnel , round balloons</p>
<p>Activity Procedure:</p> <p>Lesson 1: Educator to ask the learners where did the carbon come from in the first place? What era in our history resulted in an increase in the release of carbon dioxide into the atmosphere? How have these activities increased over the decades and where has this left us presently?</p> <p>Discuss the carbon cycle with learners. (See Appendix A for a diagram)</p> <p>Discuss the following topics with the learners: (see Appendix B for answers)</p> <ul style="list-style-type: none"> ● try to explain the carbon cycle in words ● explain what happen in the industrial revolution ● Why has the content of carbon dioxide increased in the atmosphere since the industrial revolution? ● How can land-use change contribute to the carbon emission? ● What do you think the future looks like? Will the amount of carbon dioxide decrease, increase or stabilize? ● What is the connection of the economy in a country with the release of greenhouse gasses into the atmosphere? ● How does the excess of carbon dioxide release into the atmosphere contribute to climate change? ● What is done to prevent climate change? <p>Lesson 2: Discuss with the learners the major contributors of carbon dioxide being released into our atmosphere ie. burning of fossil fuels, cement production and land use changes such as slash and burn of indigenous forests for growing of crops etc.</p> <p>Discuss the biomass cycle, marine cycle and the fossil fuel line as these fall within the bigger carbon cycle. (See background information for teachers)</p>	

Lesson 3: Producing CO₂ - an experiment

What you will need for this activity.

- Matches
- Baking soda
- Vinegar
- Straw
- Candle
- Funnel
- Round balloons

How to do the activity.

First we will demonstrate that vinegar and baking soda, when combined, produce a gas. Pour 50 ml of vinegar in a beaker or narrow-necked bottle. Place 45 grams of baking soda in a balloon with a funnel. Tip the balloon so the baking soda falls into the vinegar. Observe the inflation of the balloon. Twist the balloon shut so that the gas will not escape.

Next, we will demonstrate how carbon dioxide gas will extinguish a flame. Tilt the gas in the inflated balloon near a burning candle and release the twist on the balloon so that the gas escapes. Ask the learners to explain why the flame went out.

Discussion.

Discuss each theory.

Some people think the levels of carbon dioxide in our atmosphere are too high. They are afraid the earth's temperature will rise making it unhealthy for life. Electric utility companies, industry, business and homes, and transportation cause carbon dioxide levels to build up in our atmosphere. (See Appendix C which indicates the rise in temperatures over the decades)

Using pictures and/or words, discuss how various human activities contribute to carbon dioxide in the atmosphere. (There will be several...perhaps burning of wood and paraffin, use of motor vehicles, burning of coal to generate electricity, etc.)

Referring to the previous lesson of the carbon cycle, discuss how we could help to take the carbon out of the atmosphere and hold it on Earth. This will be through planting more trees and other large plants.

Using pictures and/or words, explain how you could help reduce the levels of carbon dioxide in your environment.

Ask the learners to write up the experiment in their own words and to draw the stages of the experiment in their workbooks.

Background information for the teacher:

Our carbon cycle was formed in the Earth's formation when there was a lot of volcanic activity. Our Earth is comprised of a mantle under our layers of soil and much of the carbon was released from here during volcanic activity and the shifting of mid-ocean ridges. Carbon is stored in fossil fuels such as gas, coal and oil. It is also stored during the process of photosynthesis in plants and trees as well as being stored in our oceans. Trees, plants and oceans are referred to as carbon sinks as they are able to remove the gas from the atmosphere and store it.

There are three smaller cycles within the larger carbon cycle. They are:

- The biomass cycle
- The marine cycle
- The fossil fuel line

Understanding the biomass cycle.

- Plants absorb carbon dioxide for photosynthesis to grow
- Animals eat plants - or animals eat other animals who eat plants
- Animals and plants return carbon dioxide to the atmosphere when they breath
- They die, and carbon is returned to the soil through decomposition
- New plants grow from this carbon

Understanding the marine cycle.

- Carbon is stored in carbonate rocks
- It rains and the carbon is released through the weathering process.
- The carbon moves through the surface water, into our rivers.
- The rivers enter the sea, and the carbon is dissolved in the ocean.
- It is used for photosynthesis by marine plants
- It is also added to the sediments and laid down in layers on the sea bed. Dead sea organisms are also added to this layer.
- The carbon is released to the atmosphere through wave activity.

Understanding the fossil fuel line.

What is different about this part, when compared to the other two cycles?

It is a one-way line.

- Coal and oil are mined from the ground and burned in industry and towns and are used for fuel in our cars and for the generation of electricity
- The fossil fuel line is one-way; therefore we should be careful how we burn fossil fuels so that we do not destroy the natural balance of the natural carbon cycle.

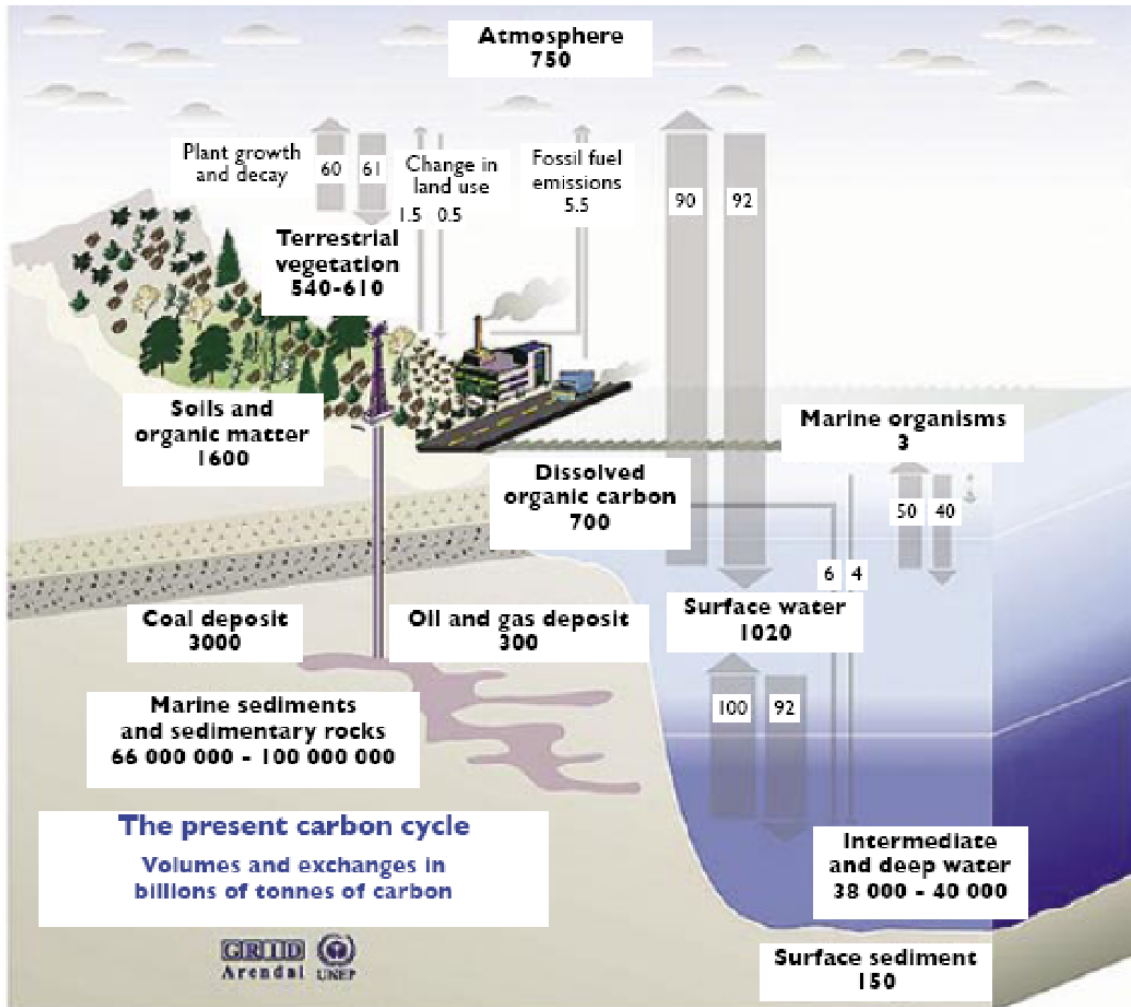
Remember: The carbon cycle is a closed cycle - the carbon must always be somewhere. If we burn too much fossil fuels then there will be too much carbon stored in the atmosphere and this may have damaging effects on our climate.

Assessment Method: Teacher assessment of the carbon cycle and carbon sinks

Teacher assessment of the cycles within the carbon cycle

Teacher and peer assessment of the writing up of the experiment and possible solutions of reducing carbon emissions.

Appendix A



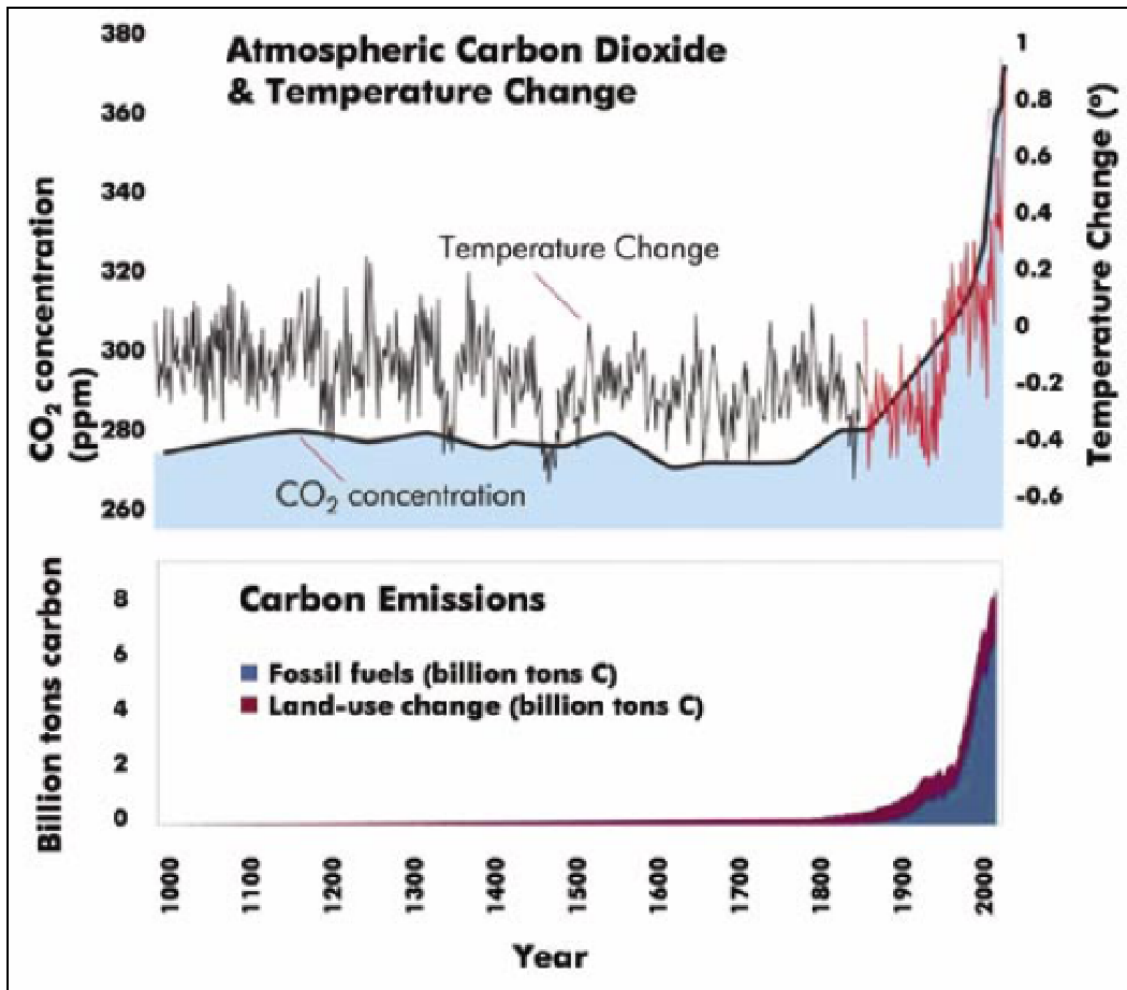
The numbers in black represent the amount stored in a carbon pool. The numbers in the grey arrows represent the amount of carbon moving from one pool to another. All the numbers in the figure is in billion tons.

Appendix B

Suggestions to answers on the questions (notice that the answers not are exhaustive and some of the questions are topics to discussion and perspectives and do not have a complete answer)

- The industrial revolution started in the 18. Century (around 1750) and refers to a shift in energy use from muscle power from humans and animals and heat from plants to use of fossils fuel. The use of fossil fuels and the development of the steam engine entailed an increase in the production and many factories was build
- The use of fossil fuels since the industrial revolution has induced an increase of greenhouse gasses in the atmosphere since the carbon that was stored in reservoirs (as coal, oil or gas) in the earth now is released to the atmosphere
- Changes in land-use influence the uptake of carbon since trees are a carbon sink the amount of trees has an impact on the uptake of carbon from the atmosphere. Big amounts of the forest in the world is been cut down, which have a big impact on the carbon uptake. In the northern hemisphere the melting of the permafrost means that the frozen areas becomes swamps or moors and releases methane when the organic matter decompose under anaerobe conditions
- The amount of greenhouse gasses in the atmosphere will increase, it looks like some countries for example China and India will still have an increase in the release in greenhouse gasses because of an increase in production. It is important to remember that it is still the developed countries in the Western Europe and US that have the biggest release in green house gas per citizen
- The economy and the release in greenhouse gasses in a country seem to have a strong connection. It is the strong or the upcoming economies in the world there have the biggest amount in release in greenhouse gasses. It seems as the release of greenhouse gasses and the GDP per citizen have a strong connection. In counties with high GDP the population has more money to consume - and that entails release of greenhouse gasses.
- Many of the countries in the world have signed the Kyoto protocol that sets quotes on the countries release on greenhouse gasses. Through Kyoto the countries can sell and buy carbon quotes and the developed countries can implement clean development mechanism in developing countries. Apart from the Kyoto protocol many countries are also trying to find alternative sources of energy instead of fossils fuels.

Appendix C



The graph shows the atmospheric CO₂ concentration and the temperature change from year 1000 up until 2000.

As the graphs shows the concentration of Carbon Dioxide has increased since the industrial revolution. Since year 1900 the biggest contributor to carbon emissions is the burning of fossils fuels, but also Land-use change is a big contributor to carbon emissions. To understand these things it is very useful to look at the global carbon cycle.