The Carbon cycle & Climate Change	Grade 7 – Heat in the Environment

Lesson Plan

Safety Notes: Be careful if using scissors or knives. Ask for adult supervision.

Description

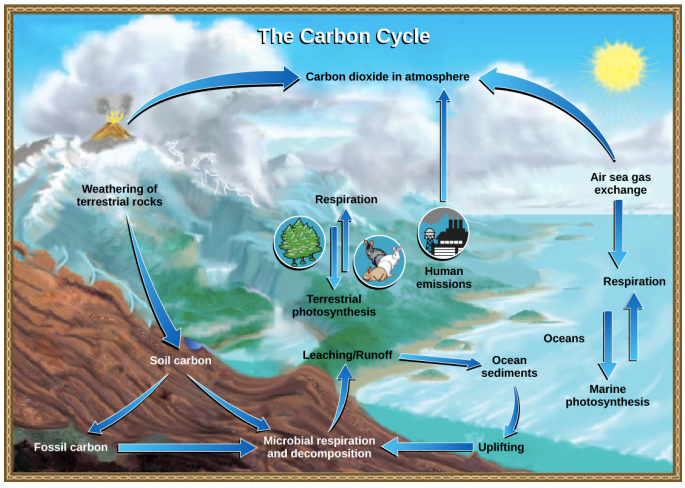
This lesson will reinforce teachings within the realm of biology, chemistry, and earth sciences, by taking a look at the carbon cycle and climate change. It will lay the foundation of how the carbon cycle influences life on Earth, and will tackle questions on climate change and how it occurs in both natural (geological / environmental events) & anthropogenic (human influence) processes.

Materials

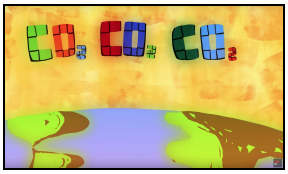
- Upcycled plastic container or plastic wrap & upcycled planting container
- Seeds of any kind or a fruit/vegetable from home
- Potting soil (preferred) or outdoor soil
- Water
- Paper Towel
- Scissors
- Knife
- cutting board

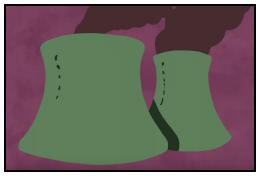
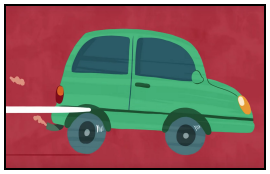
Science Background

All living things require the **carbon cycle**. The carbon cycle is a process that involves the movement of carbon from its organic state, to inorganic state, through **photosynthesis**, **respiration**, **combustion**, and **decay**.



Since the late 18th century, the **industrial revolution** began to shape the way humans used machinery. This led to an increase in the burning of **fossil fuels**, leading to an increase in **carbon dioxide (CO2)**, a **greenhouse gases (GHG)**, being released into the atmosphere. Other greenhouse gases (GHG) included: Water vapor (H2O), Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N2O), and Ozone (O3).



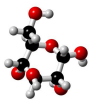
Consequently, due to the increase in GHGs' in earth atmosphere, and continued deforestation, these are contributing factors to modern **climate change**.

What is Carbon?

- One of the most important chemical elements
- Essential element in the bodies of living organisms
- Humans are 18% Carbon , Plants are 45% Carbon
- Makes up 0.025% of Earth's crust
- Combines with other elements very easily to make new compounds
- Symbol for Carbon is C

Carbon Cycle:

- The cycle of carbon in the earth's ecosystems
- Carbon dioxide is fixed by photosynthetic organisms to form organic nutrients that travel in the food chain
- Carbon restored to the inorganic state (as by respiration, protoplasmic decay, or combustion)


Glucose (Organic)


Carbon Dioxide (Inorganic)

Greenhouse Effect:

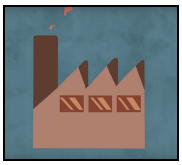
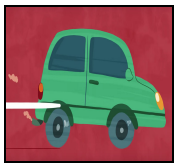
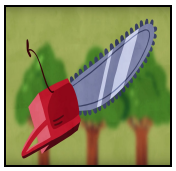
- Earth's Atmosphere has a natural greenhouse effect where gases help trap / reflect solar radiation & heat
- Carbon based compounds (CO2, Methane) play a role in creating a livable environment on the Earths' surface

Fossil Fuels:

- A fuel formed in the earth from organic materials (plant/animal remains)
- Requires Heat & Pressure over millions of years
- Burning of fossil fuels releases CO2, water, and energy

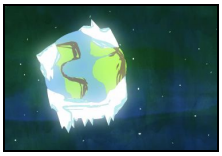
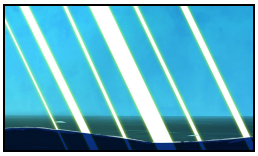
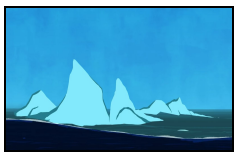
Anthropogenic (Human based) Climate Influencers:

- Industrial & Transportation emissions release carbon once stored deep in the earth's crust
- Industrial farming of certain animals produce Methane, a powerful Greenhouse Gas (GHG)
- Deforestation removes our earths' ability to capture atmospheric carbon and to store it in natural carbon sinks like trees and other plants

Natural Climate influencers

- Natural Triggers: Volcanic Activity, Asteroid strikes, Forest Fires
- Albedo effect: Fraction of radiation (light) reflected by a surface such as polar ice caps, Glaciers, & Clouds
- Solar cycles & Cosmic particles may have influence (CERN research – Switzerland)

Activity Procedure

1. Clean upcycled container of any food residue
2. Carefully, cut plastic container into working parts (Bottom and Top), if required
3. Harvest or obtain soil and fill the bottom portion of your container (at least 10cm deep)
4. Select a fruit or vegetable from home
5. Carefully cut the fruit or vegetable on a cutting board, in a way to not damage the seeds
6. Eat or put aside the flesh of the fruit or vegetable to be consumed later (No waste!)
7. Rinse off your seeds of any flesh
8. Place seeds on a paper towel and allow to dry overnight

9. Some seeds need to be cold treated by placing it in the fridge for several days/weeks. Look up what kind of treatment your seed will require.
10. Plant the seed, once treated (if needed). Look up planting depth recommended for your seed.
11. Lightly water your soil
12. Place the lid on your greenhouse allowing for some air exchange
13. Place 'greenhouse' by a window to receive sunlight
14. Watch the germination and the reaction of evaporation and condensation occur inside your greenhouse (This may take several days).

Debrief

The Carbon cycle, along with the naturally occurring greenhouse effect is what makes the world a comfortable place to live. Gases such as carbon dioxide act as glass windows insulate a garden greenhouse. Institutions such as NASA have recorded that humans have increased the amount of CO2, along with other GHGs, in the earth atmosphere, which has led to increases in average global temperatures.

In our experiment, we observed how water vapor is created through evaporation, rises in the container, and condenses when cooled. As well as, the carbon cycle in its role of providing the building blocks of life through the growing of a plant in our homemade greenhouse.

The Carbon Cycle & Climate Change — Grade 7: Heat in the environment

1. What are the two main forms of Carbon?

2. Scientists projected that fossil fuel linked CO2 concentrations in the atmosphere would reach 37.1 Billion metric tons by the end of 2018.

   What were pre-industrial levels, if the 2018 concentration are 45% higher.

3. Draw a diagram of the carbon cycle with as much detail as to where carbon may end up at any point in this cycle.

4. Make a list of both Natural Climate Influencers and human based climate influencers:

5. Provide a definition of each of the following terms:

Carbon Cycle:

Climate Change:

Greenhouse Gas (GHG):

Photosynthesis:

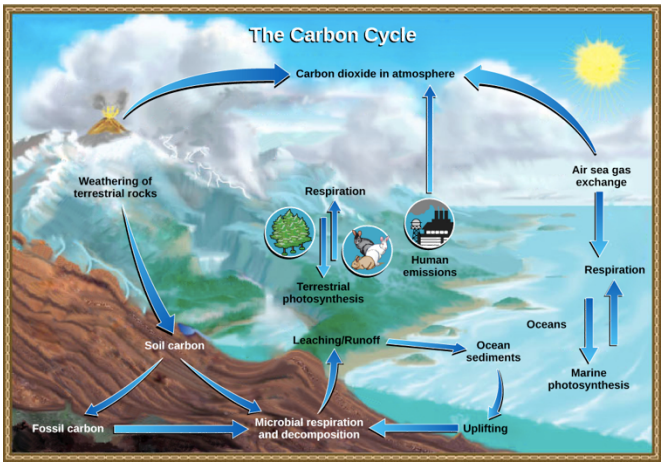
The Carbon Cycle & Climate Change — Grade 7: Heat in the environment

1. What are the two main forms of Carbon?
   Organic & Inorganic

2. Scientists projected that fossil fuel linked CO2 concentrations in the atmosphere would reach 37.1 Billion metric tons by the end of 2018.
   What were pre-industrial levels, if the 2018 concentration are 45% higher.

   25.58 Billion Metric Tons

3. Draw a diagram of the carbon cycle with as much detail as to where carbon may end up at any point in this cycle.



4. Make a list of 3 Natural and human based climate influencers:

Natural	Human Based
Forest Fires	Industry & Vehicle Emissions
Volcanoes	Deforestation
Asteroid event	Industrial Farming

5. Provide a definition of each of the following terms:

Carbon Cycle:
The Cycle of Carbon in the earth's ecosystems in which carbon dioxide is fixed by photosynthetic organisms to form organic nutrients and is ultimately restored to the inorganic state (as by respiration, protoplasmic decay, or combustion)

Climate Change:
Significant and long-lasting change in the Earth's climate and weather patterns

Greenhouse Gas (GHG):
Any of various gaseous compounds (such as carbon dioxide or methane) that absorb infrared radiation, trap heat in the atmosphere, and contribute to the greenhouse effect

Photosynthesis:
Synthesis of chemical compounds with the aid of radiant energy and especially light ; formation of carbohydrates from carbon dioxide and a source of hydrogen (such as water) in the chlorophyll-containing cells (as of green plants) exposed to light