

Carbon Sequestration Project

[\[VIDEO\]](#)

Introduction: The vast majority of scientists agree that climate change is caused by the human release of carbon dioxide. While there are many possible solutions to this crisis, one way to reduce carbon dioxide is by capturing it from the air or from industrial sources (power plants and factories). This is called *carbon sequestration*, and it could be a major industry in the future. Some companies are already paying large sums of money for *carbon credits*, which are methods to absorb carbon to compensate for carbon produced and thereby meet legal standards.

In this project, you are part of an enterprising company designing a solution to the global crisis of carbon dioxide. Due to recent climate change laws, there is a lot of money available to companies that develop cost effective and efficient methods for reducing carbon dioxide in the atmosphere. This is an *engineering* project, in which you will be designing and optimizing a process for carbon sequestration. Furthermore, you will create a small scale model of your process and communicate your findings with a research style poster board. You are in competition with the other groups to develop the most efficient, cost-effective design in order to win bids from industries that are purchasing carbon credits.

Team jobs: Each team will consist of four members that are each responsible for a set of tasks. While teams should still work together on all the tasks, the assigned person takes the lead on the assigned tasks.

Chemical engineer

- ☐ Research the chemical process of carbon sequestration and how sodium carbonate is involved in this process.
- ☐ Create the test samples (i.e. sodium carbonate mixed with varying amounts of water).
- ☐ Collect data testing different mixtures' ability to absorb carbon dioxide.
- ☐ Construct a graph from the data and use this graph to determine the optimum mixture.

Chemical researcher

- ☐ Develop a method to produce and measure carbon dioxide for laboratory study.
- ☐ Create a visual way to show how CO₂ is absorbed using pH indicators.
- ☐ Create a graph showing the correlation of pH and CO₂.
- ☐ Calculate the efficiency of the carbon sequestration device.

Thermochemistry researcher

- ☐ Explain the effect of heat and molecular structure on carbon sequestration.
- ☐ Create a graph of the effect of temperature on carbon sequestration and use the graph to identify the optimum temperature.
- ☐ Design a portable method for heating the carbon sequestration prototype by dissolving salts in water
- ☐ Use thermochemistry calculations to optimize the amount of salt needed to produce the necessary heat.

Mechanical engineer

- ☐ Explain how carbon credits work and how carbon sequestration can earn a company money.
- ☐ Determine the optimum time for the carbon sequestration process.
- ☐ Create a miniature working prototype of a carbon sequestration device.
- ☐ Use the efficiency of the carbon sequestration device to calculate how many carbon credits could be obtained from the device.

Schedule (tentative):

	Chemical engineer [VIDEO]	Chemical researcher [VIDEO]	Thermochemistry researcher [VIDEO]	Mechanical engineer [VIDEO]
Step 1 video (2 periods)	Research: works cited page & notes	Research: works cited page & notes	Research: works cited page & notes	Research: works cited page & notes
Step 2 Video (2 periods)	Write background paragraphs	Lab: producing & measuring CO ₂ (data table 2-3)	Write background paragraphs	Lab: producing & measuring CO ₂ (data table 2-3) (Help)
Step 3 (2 periods)	Lab: sodium carbonate test samples (data table 1)	Lab: producing & measuring CO ₂ (data table 2-3)	Lab: producing & measuring CO ₂ (data table 2-3) (Help)	Write background paragraphs
Step 4 (2 periods)	Lab: sodium carbonate test samples (data table 1)	Lab: pH & CO ₂ (data table 3)	Lab: determining optimum temperature (data table 4)	Develop the prototype sketch
Step 5 (2 periods)	Lab: determining optimum temperature (data table 4) (help)	Graph 2 - pH & g CO ₂	Lab: determining optimum temperature (data table 4)	Construct the prototype
Step 6 (2 periods)	Graph 1 & optimizing the hydrate	Lab: time trials (data table 6) (help)	Graph 3 - optimizing temperature	Lab: time trials (data table 6)
Step 7 (2 periods)	Lab: determining molar enthalpy (data table 5) (help)	Write procedure for lab tests	Lab: determining molar enthalpy (data table 5)	Graph 4 - optimizing time
Step 8 (1 period)	Write procedure for lab tests	Write background paragraphs	Calculate the amount of salt for optimum temperature	Write procedure for lab tests
Step 9 (1 period)	Test and refine the prototype	Measure the % by mass of CO ₂ removed	Write procedure for lab tests	Calculate carbon credits & \$\$\$
Step 10 (1 period)	Write conclusion & abstract	Write conclusion & abstract	Write conclusion & abstract	Write conclusion & abstract
Step 11	Test - 2 class periods - maximum of 10g of sodium carbonate per group			