

STEM Sphere Lesson – Kayla Spurgeon

For this lesson, the following NGSS science standards will be addressed; in addition to a Common Core math standard.

Title: CO₂ and the Earth

Grade Level: 9th – 12th grade

Lesson duration: 1 week (block schedule)

- HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
- HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- CCSS.MATH.CONTENT.HSS.IC.B.6. Evaluate reports based on data

Throughout the lesson, the following learning targets will be addressed:

Students will be able to.....

- Determine the causes related to the increase of Carbon Dioxide (CO₂) levels seen on Earth.
- Analyze data to determine the years seen with the most spike in CO₂ levels and research life impacts that could correlate to the spike.
- Analyze data from NASA and different resources to determine how the rise in CO₂ affects all of Earth's spheres.
- Research and design solutions to decrease the amount of CO₂ being released.
- Communicate their results and present their research and design to the classroom to attempt to sell their idea.

Engage

The lesson will begin with students analyzing and brainstorming what specific images are revealing. The teacher is going to present two images from NASA and make sure that the title is not visible. One being the global temperature in 1884 and the other being the global temperature in 2019. The teacher will have students, on a sheet of paper, brainstorm what they are seeing (approximately 2-3 minutes). Students will jot down any educated guesses or questions related to the images.

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After the brainstorming time, a class discussion will be made. Pertaining to what the students believe the images are depicting. Students should be able to come up with temperature, however, if not; the teacher will scaffold some questions to shift students thinking. From this conversation, the teacher should present this question “What causes the increase in Earth’s temperatures?” From background knowledge, students should be able to come up with the idea of green house gases. When this happens the teacher should narrow down the term green house gases and ask students “What is the main gas that affects the increase in Earth’s temperature”, from background knowledge and scaffolding students should be able to come up with the term Carbon Dioxide (CO₂).

The images for the engagement can be found here: <https://climate.nasa.gov/vital-signs/global-temperature/>

Duration: 20 minutes

Explore

For the explore portion of the lesson, students will be participating in an activity using the NASA Data Literacy Cubes. Students will be working in pairs and will work through five different stations. At each station, students will answer questions related to causation of rise in CO₂ levels, Ice Sheet Data, Earth Temperature Data, Overall Increase in CO₂ levels and Sea Level Data. Stations should be separated around the room and contain a NASA Cube and a QR codes on each of the cube, for the Google Form Quiz. Students will travel with their partner around to each station and scan the QR code as they role the cube. At each station, students will be required to complete at least 3 sides of the cube (more if time allows). The teacher will time each station and allow students 20 minutes at each station before switching to the next. Students will be offered a few minutes at the end to finish any station that they have not finished. This activity will allow students to discover the causes and effects of the spikes in CO₂ levels.

The data cube templates used for this activity can be found here: <https://mydasdata.larc.nasa.gov/data-literacy-cubes-graphs-maps-and-data-tables>. This lesson uses the graph and data cubes found on the right side of the website. Forms A, B, and C are being used and assigned to students according to individual student data. Each of the cube Google forms should be downloaded to the teacher’s google drive. Once this is done, the teacher can create QR codes on <https://www.the-qr-code-generator.com/> and include with each cube and cube form. Students can scan the QR code to go straight to the Google Form connected to their specific station.

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The data used within the cubes can be found here: <https://climate.nasa.gov/vital-signs/ice-sheets/>

- Station 1 (Carbon Dioxide): Students will be given the Graph Cube (Form A,B, or C depending on their educational level). Students will use the following website to analyze the graph <https://climate.nasa.gov/vital-signs/carbon-dioxide/>
- Station 2 (Ice Sheet): Students will be given the Data Cube (Form A, B, or C depending on their educational level). Students will use the following website to analyze the data <https://climate.nasa.gov/vital-signs/ice-sheets/>
- Station 3 (Earth Temperature): Students will be given the Graph Cube (Form A, B, or C depending on their educational level). Students will use the following website to analyze the graph <https://climate.nasa.gov/vital-signs/global-temperature/>
- Station 4 (Evidence Climate Change): Students will be given the Graph Cube (Form A,B, or C depending on their educational level). Students will use the following website to analyze the graph <https://climate.nasa.gov/evidence/>
- Station 5 (Sea Levels): Students will be given the Data Cube (Form A,B, or C depending on their educational level). Students will use the following website to analyze the data <https://climate.nasa.gov/vital-signs/sea-level/>

Duration: 1 hour – 1 hour 30 minutes

Explain

For the explain portion of the lesson, students will be paired together and assigned a certain Earth Sphere to research. Students will great a Google Jamboard that justifies how the rise in CO2 levels affect their specific sphere. Students will be provided a rubric and a list of websites that may be helpful in their research process. After students are completed with the Jamboard, each student will be required to read and provide constructive feedback to three other students' Jameboards. At the end of the explain, students will be provided with a short exit slip assessment that will determine their knowledge of CO2 related to other spheres.

For the Jamboard Rubric, please see page 5.

For the website resources, please see page 5.

Duration: 1 hour – 1 hour 30 minutes

Elaborate

For the elaborate, student will be paired into partners. Students will research and design a solution to minimize the CO2 footprint seen on Earth today. With this solution, they will explain how the decrease CO2 levels would positively reflect their Earth sphere from the explain portion of the lesson. Students will create a poster of their research and design solution and communicate their ideas to the class. Their goal is to try to sell the idea to the class and students watching the

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presentation will score the presenters based on a rubric. For this activity, students will be provided with a project rubric.

For the Poster Rubric, please see page 6.

Duration: 1 hour to 1 hour and 30 minutes

Evaluate

For the final evaluate assessment, students will be asked to construct a CER scientific writing piece using the research that they have collected over the week. Students will demonstrate their knowledge of CO₂ and its affects as they develop a claim, connect evidence, and justify through reasoning. Thus, arguing their point in a scientific manner.

CER Question: What are two spheres that are affected by the increase of CO₂?

For the CER Rubric, please see page 7.

Duration 30 – 45 minutes

Citations

Carbon Dioxide. (2020, August). Retrieved from <https://climate.nasa.gov/vital-signs/carbon-dioxide/>

Climate Change: How Do We Know?. (2020, October). Retrieved from <https://climate.nasa.gov/evidence/>

Global Surface Temperature. (2020, July 16). Retrieved from <https://climate.nasa.gov/vital-signs/global-temperature/>

Ice Sheets. (2020, October). Retrieved from <https://climate.nasa.gov/vital-signs/ice-sheets/>

Sea Levels. (2020, October). Retrieved from <https://climate.nasa.gov/vital-signs/sea-level/>

Jamboard Rubric

	<u>Expectations</u>	<u>Teacher Comments</u>
Title (5 pts)	-Students include the Earth Sphere title and their names to the Jamboard	
Effects of CO2 (15 pts)	-Students will include <u>three</u> specific ways that the increase of CO2 affects their specific sphere. *Must be in complete sentences and detailed.	
Images (5 pts)	-Students will include 1 - 2 images that relate to their sphere and/or the increase of CO2.	
Citations (5 pts)	-Students will include the websites that their information / images came from. This should be located on the second page of the Jamboard.	

Total Points : _____ / 30

Website Resources

Below are some websites that could help you with your Jamboard project. You may use other websites, but they must be reliable (.edu)(.org)(.gov).

<https://earthobservatory.nasa.gov/features/CarbonCycle/page5.php>

https://www.e-education.psu.edu/earth530/content/l3_p4.html

<https://www.agci.org/earth-systems/hydrosphere>

<https://www.noaa.gov/education/resource-collections/climate/carbon-cycle>

Poster Rubric

	<u>Expectations</u>	<u>Teacher Comments</u>
Title (5 pts)	-Students will include a title that relates to their design solution and include their names to the poster.	
Design Solution (15 pts)	-Students will explain their solution to help decrease the CO2 in a specific sphere. *The explanation needs to be in complete sentences and detailed.	
Research (15 pts)	-Students will include 2 – 3 pieces of research / data that supports their idea of a design solution. *This can be data that supports there is an issue and/or research that supports a certain solution will work.	
Presentation (10 pts)	-Students poster must be neat and organized. -Students will give a brief (2 - 3 minute) sell pitch to the class, where they act professionally.	
Citations (5 pts)	-Students provide the websites where the research and data came from. This can be placed on the front or back of the poster.	

Total Points: _____ / 50

CER Rubric

Rubric Categories	Distinguished	Proficient	Apprentice	Novice	zero
Claim (out of 10 points)	-Claim is <u>correct</u> . -Claim is in a <u>complete detailed sentence</u> . 10 points	-Claim is <u>correct</u> -Claim is in a <u>complete sentence</u> (not detailed). 8 points	-Claim is <u>not correct</u> , but in a complete sentence. Or -Claim is <u>correct</u> , but not in a complete sentence. 6 points	-Claim is not correct and is not in a complete sentence. 4 points	-Claim was not stated. 0 points
Evidence (out of 15 points)	-All three pieces of evidence are supporting claim. -All three pieces of evidence come from the provided text. -All three pieces of evidence begin with a sentence starter and cite where information is from. 15 points	-Two pieces of evidence are supporting claim. Or -Two pieces of evidence come from the provided text. Or -Two pieces of evidence begin with a sentence starter and cite where information is from. 12 points	-One piece of evidence are supporting claim. Or -One piece of evidence comes from the provided text. Or -One piece of evidence begins with a sentence starter and cite where information is from. 9 points	-One piece of evidence supports claim Or - One piece of evidence comes from the provided text. And -Missing all sentence starters and evidence cites. 6 points	-Missing all three evidence pieces. 0 points
Reasoning (out of 15 points)	-All three reasonings explain the connected evidence and support claim. -All three reasonings are detailed and in the student's own words. 15 points	-All three reasonings explain the connected evidence and support claim. -All three reasonings are in the student's own words, but not detailed. 12 points	-Two reasonings explain the connected evidence and support claim. -Two reasonings are detailed and in students own words. 9 points	-One reasoning explains the connected evidence and supports claim. Or -Two reasonings are not detailed, or not in students own words. 6 points	-Missing all three reasonings. 0 points
Grammar	-Only 1-3 small	-Writing has 4 -6	- Writing has 7-10	-Writing has 10-13	-Writing has

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<p>(out of 10 points)</p>	<p>grammar mistakes (spelling, capital letter, punctuation) 10 points</p>	<p>small grammar mistakes. 8 points</p>	<p>small grammar mistakes and/or -1-2 incomplete sentences. 6 points</p>	<p>small grammar mistakes. and/or -3-5 incomplete sentences. 4 points</p>	<p>more than 13 small grammar mistakes. and/or -More than 5 incomplete sentences. 0 points</p>
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