NATIONAL GEOGRAPHIC

RESOURCE LIBRARY I ACTIVITY : 50 MINS

Final Carbon Cycle Model Creation

Students collaboratively finalize their carbon cycle model as a class, with a focus on educating their peers on how carbon moves through various reservoirs on Earth, where energy is stored, sourced, and released, and the impacts of carbon on the cycles.

GRADES

6, 7, 8

SUBJECTS

Earth Science

CONTENTS

1 PDF

OVERVIEW

Students collaboratively finalize their carbon cycle model as a class, with a focus on educating their peers on how carbon moves through various reservoirs on Earth, where energy is stored, sourced, and released, and the impacts of carbon on the cycles.

For the complete activity with media resources, visit:
http://www.nationalgeographic.org/activity/final-carbon-cycle-model-creation/

In collaboration with

educurious
learning that connects

DIRECTIONS

This activity is part of the Carbon Trackers unit.

1. Reorient students to the scope and focus of the *Carbon Trackers* unit as they prepare to create the final project.

- Remind students of the unit's driving question: *Where does the energy in fossil fuels come from and where does it go?*
    - Ask each student to take five minutes to write down their response to that question (using a diagram if needed).
- Follow up with a class review of the *Know & Need to Know* chart and the initial carbon cycle model from the *Tracking Down the Carbon* activity.
    - Direct students to evaluate their collective learning through this unit by asking: *Have we learned all we needed to know and resolved all of the initial questions from the model?*
- Explain that the goal for the activities in this lesson is to use all of the information and knowledge the students have gathered to prepare a presentation for the target audience. This is reflected in the lesson driving question: *How can we use our models to educate and inspire others to understand the importance of matter and energy cycling on Earth?*

2. Introduce parameters for building the final collaborative model of the carbon cycle.

- Review class notes from the end of the *Matter and Energy Cycles: Modeling* activity about how to combine all of the cycles, as well as students' ideas from the *Greenhouse Effect* activity about how the greenhouse effect should be incorporated into their model.
- Review the *Cycle Model Rubric* and explain that it will be used to assess the success of the final model and the associated presentation.
    - As the rubric states, the goal is to create a thorough, complete model of the carbon cycle with all processes labeled properly, with arrows in the correct direction(s), with all reservoirs included, and with all sub-cycles clearly integrated.
    - The model should be organized and be used to simplify a complex process for the audience. It needs to be visually appealing and effective to help others easily understand the information.

3. Break the class into groups to construct the final model.

- Split the students into four groups, each one representing one of the reservoirs: lithosphere, atmosphere, biosphere, and hydrosphere. If your class is large, you can assign the same reservoir to two groups and then have them collaborate to compare and check their work.
- Each group should spend 5-10 minutes sketching or listing the major processes and components of their assigned reservoir. Their illustration will include components and processes of one or more of the sub-cycles researched in *Matter and Energy Cycles: Research* and other processes and components from the initial carbon cycle model from *Tracking Down the Carbon*.
- Based on their sketch or list, direct each group to create their portion of the model in about 30 minutes, remaining cognizant of how their section will visually and conceptually link to the others. If you've doubled up on groups, have the groups combine about halfway through the allotted time to compare and agree on a single model.
- When students have completed their segment, assist the groups in connecting the reservoirs.

    - You may want to start with pairing two reservoirs first before connecting them all.
    - This will require some additional work, depending on the medium students use to construct their model, such as drawing arrows to connect reservoirs and adding labels.
    - Keep in mind that this part of the activity will be complex and will require thinking on your feet and adapting for your particular class size and students.

4. Prompt students to collaboratively review their final model.

- Display the final model for the whole class to: 1) critique how the ideas are visually displayed and communicated, and 2) use the *Cycle Model Rubric* to ensure that the model meets the first row of criteria.

    - This is not intended as a way to grade individual students or groups, but for the purpose of collaboratively refining and polishing the final piece to be optimally successful for the presentation.
    - If students notice any mistakes or missing pieces, provide time for the class to discuss and correct those now so that the model is complete at the end of this activity.

5. Have students respond to the questions below for homework, as an opportunity for their own reflection, to prepare and explore ideas for the final presentation, and to use as a formative assessment.

- Ask students to provide one to two ideas in response to the following questions:

    - *Describe what matter and energy cycling is, and why matter and energy cycles are important for the Earth as a system. Why are they important to living things?*
    - *What are fossil fuels? Where do they come from? How are they made?*
    - *How are they extracted and used? When used, where does the energy and matter in them go?*
    - *How does the use of fossil fuels by humans impact the normal matter and energy cycles?*
    - *How does carbon move through the large Earth system?*
    - *Why is understanding Earth's matter and energy cycles important?*
    - *The driving question for this lesson: How can we use our models to educate and inspire others to understand the importance of matter and energy cycling on Earth?*
    - *What are the limitations of our class model?*

Tip

Step 1: Depending on your local context and community, decide ahead of time if the target audience will be assigned, or, if possible, engage students in choosing who the target audience will be. This will help them to make the model specific to the audience. Examples: younger students, community members, visitors to an art or science museum, students on a field trip to a nature center, environmental groups, or fossil fuel industry executives.

Tip

Step 2: Students may need additional time to finalize their model, which can be provided now or at the beginning of the next activity. The final model could be a digital creation, a visual on paper using markers and/or pictures cut from magazines, or a clay or other 3D material model. The final format depends on what resources you have available and can easily have your students use. How you divide this final bit of work will also depend on what medium students are using. Remind your students that the goal is to create a model that helps others easily understand matter and energy cycling, with artistic representations helping to do so.

Informal Assessment

Collect the responses to the homework questions and return your feedback the following day at the start of the next activity. That will enable students to have feedback before they do the final presentation.

OBJECTIVES

Subjects & Disciplines

Earth Science

Learning Objectives

Students will:

- Collaborate to create a digital or analog model of matter and energy cycles on Earth (specifically the carbon cycle, rock cycle, water cycle, and photosynthesis and respiration)

Teaching Approach

- Project-based learning

Teaching Methods

- Cooperative learning
- Visual instruction

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Information, Media, and Technology Skills
    - Information Literacy
    - Information, Communications, and Technology Literacy
  - Learning and Innovation Skills

    - Communication and Collaboration
    - Creativity and Innovation
  - Life and Career Skills
    - Leadership and Responsibility
    - Productivity and Accountability
    - Social and Cross-Cultural Skills
- 21st Century Themes
  - Environmental Literacy
  - Global Awareness
- Critical Thinking Skills
  - Creating
- Science and Engineering Practices
  - Developing and using models
  - Obtaining, evaluating, and communicating information

National Standards, Principles, and Practices

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

• **CCSS.ELA-LITERACY.SL.7.4:**
Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
• **CCSS.ELA-LITERACY.SL.7.5:**
Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

NEXT GENERATION SCIENCE STANDARDS

• **Crosscutting Concept 4:**
Systems and system models
• **Crosscutting Concept 5:**
Energy and matter: Flows, cycles, and conservation
• **Crosscutting Concepts: Cause and Effect:**
• **ESS2.A: Earth Materials and Systems:**

All Earth processes are the result of energy flowing and matter cycling within and among the planet’s systems. This energy is derived from the sun and Earth’s hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth’s materials and living organisms.   The planet’s systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth’s history and will determine its future.

- **MS-ESS2-1:**

Develop a model to describe the cycling of Earth’s materials and the flow of energy that drives this process.

- **Science and Engineering Practice 2:**

Developing and using models

- **Science and Engineering Practice 8:**

Obtaining, evaluating, and communicating information

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Materials relevant to the type of model your students will build.

REQUIRED TECHNOLOGY

- Internet Access: Optional
- Tech Setup: Presentation software, Projector

PHYSICAL SPACE

- Classroom

SETUP

Depending on the kind of model your class will be building, it may make sense to have a large table or work space, a computer lab, or other setup.

GROUPING

- Large-group instruction
- Large-group learning

RESOURCES PROVIDED: HANDOUTS & WORKSHEETS

- Cycle Model Rubric

BACKGROUND & VOCABULARY

Background Information

Prior Knowledge

["Matter and energy cycles (including carbon cycle, water cycle, rock cycle, and photosynthesis and respiration)","Types of fossil fuel resources","Greenhouse effect"]

Recommended Prior Activities

- Greenhouse Effect
- Matter and Energy Cycles: Modeling
- Matter and Energy Cycles: Research
- Putting the "Fossil" in Fossil Fuels
- Researching Fossil Fuels
- Tracking Down the Carbon

Vocabulary

TermPart of SpeechDefinition

For Further Exploration

Articles & Profiles

- StoryboardThat: Modeling in Science with Storyboard That

- STEM Teaching Tools: What is meant by engaging youth in scientific modeling?

Interactives

- The Concord Consortium: SageModeler