

Reality Space Agency: BCG Cycles

Lesson Topic

Biogeochemical Cycles / Ecology

RIEL Biology Element Collaboration

Time Required

One to two class periods

Standards Addressed

 SC.912.E.7.1 Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.

Science and Engineering Practice

 Developing and/or Using Models, Engaging in Argument from Evidence

Content Learning Objectives

 Students will develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Lesson Summary

Students will function as a team of research scientists analyzing the water, carbon, and nitrogen cycles in an attempt to establish them on a new planet/space station. Collaboration will allow students to build off of each other's ideas and hopefully create something bigger and better than they could have done individually. Students will begin by using the information they researched to argue for and establish their best course of action. Argumentation is a form of collaboration and after their evidence leads to a plan, a model is designed to highlight their vision.

Materials

- Student vocabulary packet
- Group project packet
- Introduction video Interstellar: Water Planet Scene

Before the Activity

The day before the activity, inform students we will be working on biogeochemical cycles and refresh the general topic. Then assign the intro packet as classwork or homework. Accommodation may include limiting to two cycles or providing descriptions for students and task them with the visual representations and or preferred language descriptions.





Lesson Activities

- Engage. Students watch a clip from the movie Interstellar where they first land on the "water planet" (<u>Interstellar</u>: <u>Water Planet Scene - YouTube</u>).
- 2. Explore. Students individually answer the first section on the project packet by analyzing the diagrams and making lists of cycle parts or mechanisms that help to keep humans alive. Scientists should work alone for the first two questions to help them reestablish a knowledge base and strengthen individual opinions before collaboration. Teacher circulates and if necessary, redirects students to important parts of the cycles. Accommodations: Regroup for a discussion and coach students who need additional support.
- **3. Explain**. Students are given an opportunity to share and discuss their findings with the class. Teacher will facilitate and supplement as needed. Students are then asked to form large groups based on which cycle they believe should come first. After they are separated, the teacher will form project groups. Ideally would be 3 people who each thought a different cycle should come first as this allows for discourse and argumentation. However, if this is not possible, try to create groups with as much variety as possible.
- 4. Elaborate: Students will now work with their groups to decide their cycle order and begin planning and drawing. Encouraging each student to provide the reasoning/importance for the cycle they chose first is an effective way to ensure everyone is collaborating. During this time, the teacher circulates and provides feedback such as:
 - a. What was the rationale for doing this before that?
 - b. How does this support life? How does it work on Earth?
 - c. Is there anything else you could use to do the same job?







Lesson Activities

- 5. Accommodations. For teams struggling to get started, direct them back to their individual work and ask them to compare their results. This should give them information they can compare to start the decision-making process. Additional resources such as a review video, internet article or textbook passage may be helpful if students are struggling to make connections.
- 6. Evaluate. Students will demonstrate their understanding with the results of their project. A rubric grade is given, and students participate in a gallery walk of other groups projects to provide "glows and grows."









Date:



Student Vocabulary Packet

Good Morning Recruit,

You are reading this information because you have been recommended as a Scientist to our new space organization. We cannot tell you specifics of the mission for which you are applying because they are still classified. What I can tell you is that you should brush up on some information about the BioGeoChemical Cycles. You may have heard of them in the past but just hearing about them isn't going to cut it. Included in this research are some diagrams and terms you're going to need if you're selected. As with all space missions, your ability to use and understand the information may weigh heavily on the survival of not only yourselves, but also the rest of the human race. As you complete this work, you may answer in your preferred language, but make sure to also add the term in your language to the box as well.

I've heard good things about you. Assuming the results of your physical and academic testing come back favorably, I can definitely see you making a name for yourself here. You can get started on the next page. Good Luck!







The Water Cycle



| Vocab Word | Description/Definition | A Picture or Visual Representation |
|---------------|------------------------|------------------------------------|
| Evaporation | | |
| Transpiration | | |
| Condensation | | |
| Precipitation | | |
| Runoff | | |
| Percolation | | |







The Carbon Cycle



| Vocab Word | Description/Definition | A Picture or Visual Representation |
|----------------------|------------------------|------------------------------------|
| Combustion | | |
| Fossil Fuels | | |
| Decomposition | | |
| Assimilation | | |
| Cellular Respiration | | |
| Photosynthesis | | |







The Nitrogen Cycle









Name:

Date:_



Group Project Packet

Good morning, Scientists. You are part of a team chosen to help design and establish a functional community on a new planet we've discovered. So far, our team has built a large clear dome to serve as the location for our new city. However, before we start bringing people to live there, we need to get the place working. We are trying to create an environment that will be able to sustain life into the future which means we need to get the processes that support life here on Earth established and operational. The processes we would like your team to focus on are the water cycle, carbon cycle and the nitrogen cycle. Your job will begin with some individual decisions, after which we will team you up with the rest of your crew.

Individual scientists should now finish basic training and collect some information you will find useful on your mission. Using the diagrams found in your BGC cycles Refresher document, analyze the events in each cycle and highlight things directly related to supporting human life.

What order do you believe we should use to set up the 3 cycles? Why? (Provide reasoning for the placement of each cycle.)





Teams of Scientists are now introduced and begin working on their design.

What is your team's proposed order for the cycles? Provide your reasoning for each placement.

What materials and specific organisms would you need for each cycle? Each thing should have details about why you are using it.







What problems do you think you may run into with each cycle?

Create a diagram of your Space Station highlighting major components from each cycle?







Name: _

Scoring Rubric

Biology

RIE

| | 4 | S | 2 | - | 0 |
|-----------------------------|--|--|---|---|--|
| Science Content | Understands ALL science concepts. | Understands MOST of the science concepts. | Understands SOME of the science concepts. | Understands VERY LITTLE of the science concepts. | Demonstrates no understanding of the |
| Vocabulary | Understands ALL vocabulary. | Understands MOST of the vocabulary. | Understands SOME of the vocabulary. | Understands VERY LITTLE of the vocabulary. | Demonstrates no understanding of the vocabulary. |
| Contributes to the Class | Definite leader who contributes a lot of effort. | A strong group member who tries hard. | A satisfactory group member who does what is required. | Rarely provides useful ideas when participating in class. | Often refuses to participate in class. |
| Quality of Work | Work is of the highest quality. | Provides high quality work. | Provides work that occasionally needs to be redone. | Provides work that often needs to be checked and redone. | Work is of poorest quality. |
| Time | Uses time well. | Usually uses time well. | Tends to be distracted but | Tends to be very | Cannot manage time |
| Management | | | uways gets tritigs aone by the deadline when reminded. | usingcreating of the trime. The trime of the trime. | weil al all an and deadlines are rarely met. |
| Scientific Drawings | Drawings are completely and scientifically labeled, are realistic, not artistic, and have relevant detail. | Most drawings are scientifically labeled, are realistic, not artistic, and have some relevant detail. | Drawings have incorrect labels or have missing labels, are not realistic and have little detail or extraneous details. | Drawings are not labeled or the labels are wrong. | There are no drawings. |
| Other Details | Handwriting is ALWAYS the best that can be done. When taking notes from the board, words are always copied accurately so spelling is correct. | Handwriting is USUALLY the best that can be done. When taking notes from the board, the words are usually copied accurately so the spelling is MOSTLY correct. | Handwriting is NOT THE BEST. When taking notes from the board, the words are not copied accurately so spelling is OFTEN incorrect. | Handwriting is SLOPPY. When taking notes from the board spelling is not attended to. | No notes are taken from the board. |
| Attitude | Always has a positive attitude in class. | Usually has a positive attitude in class about a project or classwork. | Occasionally has a negative attitude about a project or classwork. | Often is publicly critical of a project or classwork and openly displays a negative attitude. | Always negative about any project or assigned classwork. |
| Teamwork | Always listens to teammates and tries to make sure the team is on the right track. | Usually listens to teammates and usually tries to keep everyone on the right track. | Sometimes listens to the ideas of other teammates and sometimes tries to get everyone moving in the same direction | Rarely listens to others and tries to make sure his/her own ideas are always followed instead. | Does not get along with teammates. |





Date:_