**APES BIOGEOCHEMICAL CYCLES PROJECT**

**BACKGROUND INFORMATION:**

Any substance an organism needs in order to live, grow, or reproduce is called a nutrient. Some elements (such as carbon, nitrogen, sulfur, oxygen, and phosphorus), called macronutrients, are needed in fairly large amounts. These nutrient substances are continuously cycled from the abiotic environment to the biotic environment and then back again in what are called **biogeochemical cycles**. They are driven directly or indirectly by incoming solar energy and gravity. These cycles have been continually changing over the past thousands to millions of years. However, man has now interfered and changes in these cycles have taken place over only tens to hundreds of years. The following are a small list of human influenced changes:

depletion of chemicals in biogeochemical reservoirs (atmosphere, hydrosphere, and lithosphere),

buildup of other chemicals in these reservoirs (heavy metals in our water systems, toxic gases in our atmosphere), and changes in chemical cycling rates. Ecologists are working to find answers to these problems.

Because the earth is essentially a closed system, the planet’s chemical cycles are vital for all life, and they explain why without death there could be no life. The cycle of reproduction, growth, death, and decay of organisms keeps renewing the chemicals that support life. The earth’s chemical cycles also connect past, present, and future forms of life. Some of the carbon atoms in your skin may once have been part of a leaf, a dinosaur’s skin, or a layer of limestone rock. Some of the oxygen molecules you just inhaled may have been inhaled by your grandmother, by Plato, or by a hunter-gatherer who lived 25,000 years ago.

**ASSIGNMENT:**

The following activity will help you understand the process as well as the importance of each biogeochemical cycle. Read the information concerning the four biogeochemical cycles; carbon, phosphorus, sulfur, and nitrogen in your text. In addition to your textbook you may use other websites you find during your research to complete the assignment.

1. **POSTER:** After reading about the cycles you will create a poster including of one of the cycles. (Carbon, phosphorus, sulfur, and nitrogen). The poster should be completed as described below, but CANNOT include printouts or exact copies of diagrams already found in print or online:
	1. Where appropriate include chemical compounds or reactions involved in the cycle
	2. Identify inorganic and organic reservoirs for the element (where is this element stored throughout the cycle.
	3. In addition to the above content, posters should be visually pleasing including color, illustrations, and any other items you would like to use. For example, you may want to use cotton balls to represent clouds. You can color them gray to show the pollutants released when fossil fuels (carbon) are burned.
2. **ADDITIONAL INFORMATION:**
	1. On the back of your poster, answer the following questions about your assigned cycle. These must be answered using APES level writing, and complete sentences:
		1. Carbon cycle:
			1. What 4 organic compounds is carbon found in?
			2. Carbon dioxide comprises approximately what percent of tropospheric gases?
			3. How is the relative amount (%) of CO2 significant in contributing to the Earth’s “natural thermostat”?
			4. Identify the two processes which have the greatest influence on tropospheric concentrations of CO2 on a monthly or yearly basis.
			5. Name the two largest sinks (storage areas) for carbon.
			6. Discuss how oceans play a major role in regulating CO2 levels in the trophosphere
			7. Describe the two major anthropogenic interventions in the carbon cycle
		2. Nitrogen Cycle:
			1. What 2 organic compounds is nitrogen found in?
			2. Identify the two major ways that nitrogen is “fixed”
			3. Describe what takes place in each of the following processes or steps of the nitrogen cycle (include a description of the events and chemical transformations in each step):
				1. Nitrogen fixation
				2. Nitrification
				3. Ammonification
				4. Denitrification
			4. Describe two anthropogenic interventions in the nitrogen cycle
		3. Phosphorus cycle:
			1. Which organic compound is phosphorus found in?
			2. Explain why phosphorus does not circulate in the troposphere to a great extent
			3. Identify the largest sinks for phosphorus
			4. Phosphorus is typically found in what ionic form?
			5. Explain why the addition of phosphate compounds to aquatic areas typically has a dramatic effect on biological productivity
			6. Comment on how human activities have influence the phosphorus cycle regarding each of the following:
				1. Mining phosphate rock
				2. Animal waste from livestock feedlots
				3. Commercial phosphate fertilizers in agricultural areas
				4. Discharge of municipal sewage/waterwater treatment facilities
		4. Sulfur cycle
			1. Which organic compound is sulfur found in?
			2. Identify the two largest storage areas for sulfur
			3. Identify two major human activities influencing the sulfur cycle.
3. **PRESENTATION:** You will present your poster and discuss the additional information questions with the classroom. While student groups are presented each student must complete a nutrient cycles chart.

**Biogeochemical Cycle Scoring Rubric DATE DUE: 4/8/13**

Name of presenter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Name of Partner \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(you may work with at most one other person, but both partners will receive the same grade)

**General: Total\_\_\_\_\_\_/10\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1.  | Student used time wisely, project doesn’t appear rushed | 3  | 2  | 1  | 0  |
| 2.  | Student is completely prepared | 3  | 2  | 1  | 0  |
| 3.  | Project is turned in on time  | 3  | 2  | 1  | 0  |
| 4. | Student name(s) are easily found and read on poster | 1 |  |  | 0 |

**Accuracy/Thoroughness of information: Total \_\_\_\_\_/21\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1  | All stages of each cycle are apparent | 6  | 4  | 2  | 0  |
| 2. | Compounds/reactions are identified | 3  | 2  | 1  | 0  |
| 3. | Inorganic and organic reservoirs are identified | 3  | 2  | 1  | 0  |
| 4.  | Questions are correctly answered for each cycle | 6  | 4  | 2  | 0  |
| 5.  | Instructions followed | 3  | 2  | 1  | 0  |

**Poster Creativity/ Effort Score: Total\_\_\_\_\_/6\_\_\_**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1.  | Cycles are color coded and easily identifiable | 3  | 2  | 1  | 0  |
| 2. | Illustrations are included that add to each cycle | 3  | 2  | 1  | 0  |

**Nutrient Cycles Chart: Total\_\_\_\_\_/13**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1.  | Included why each cycle is important. | 3  | 2  | 1  | 0  |
| 2.  | Included the compartments, spheres, form of nutrients, locations and time frame of each cycle. | 3  | 2  | 1  | 0  |
| 3 | Included the flow and processes of each cycle. | 3 | 2 | 1 | 0 |
| 4 | Including additional/interesting notes.  | 3 | 2 | 1 | 0 |
| 3. | Student was listening to all group presentations  | 1 |   |   | 0  |

**TOTAL:** **\_\_\_\_\_/50**