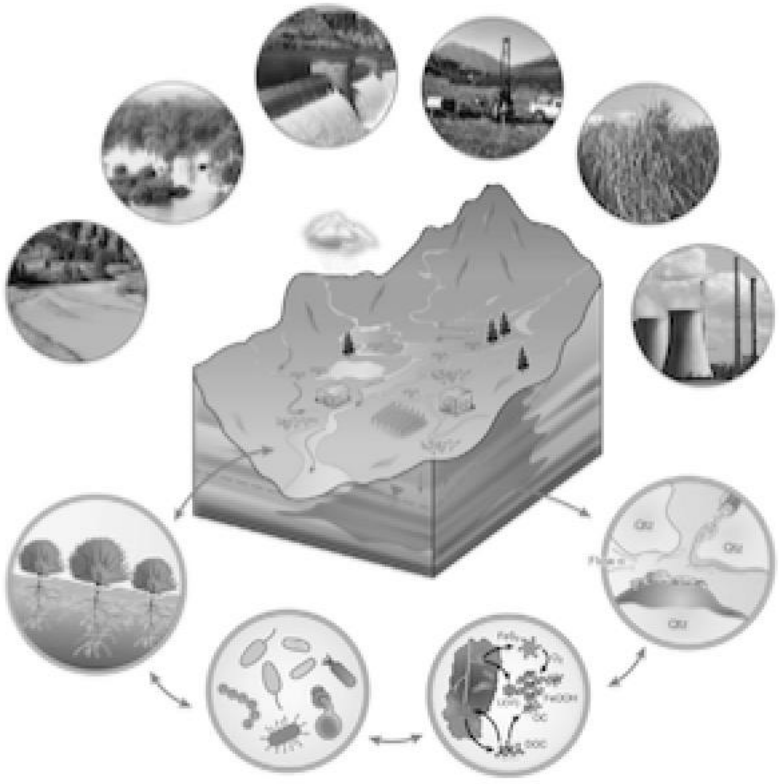
PGCPS

ANSWER KEY

Summer Enrichment Packet for Rising Biogeochemical Systems Students



PRINCE GEORGE'S COUNTY PUBLIC SCHOOLS
Division of Academics
Department of Curriculum and Instruction

Answer Key
Summer Enrichment Packet for Rising Biogeochemical Systems Students

Week	Answers
Week One: Thinking Like A Scientist	**Claim Evidence and Reasoning (C-E-R)** Answers will vary. **Controls and Variables** 1. **Shower Power** A. Brown slime in the shower B. Control Group- side sprayed with water; Independent Variable- coconut juice, Dependent Variable- appearance of brown slime C. Coconut juice did not reduce the amount of slime in the shower. 2. **Go, Go Juice** A. Control Group- Group B, Independent Variable- special juice, Dependent Variable- productivity of workers B. The special juice did not increase workers productivity C. Retest it. 3. **Itching for a Scratch** A. Control Group- Group A, Independent Variable- experimental itching powder, Dependent Variable- itchiness time B. The time was reduced by 1/3 so the claim is not supported. 4. **Diva Curls** Find a group of four people willing to be tested. Have two of them (control group) use a 'fake' hair care product and the other two individuals should use Diva Curls (independent variable). Measure hair growth (dependent variable) over four weeks for each subject. **Experimental Design** 1. While it seems Danita and Jenine made improvements, since there was no control group and no specific details as to what Danita's test for them was, further testing would be needed to determine the effectiveness of the snacks. 2. **Flower Power** A. Mendel tested more than one independent variable: location of the plant, frequency of watering, and type of water. B. He should keep everything the same in regards to the plants (number of plants, soil type, location, and frequency of watering), and only test the type of water. 3. **Microwave Mania** A. Minerva's hypothesis is that if he microwaves the fish food then the fish will be able to swim through the maze faster because microwaves make you smarter. B. The fish receiving the regular food are in the control group. C. Independent Variable- The type of food (microwave food and regular food); Dependent Variable- The time to complete the maze. D. Minerva should conclude that microwaving food does not affect intelligence. Evidence- When analyzing the average times for each group, the microwaved food group decreased by 9.625 seconds while the control group only decreased by 6.625 seconds. 4. **Blowing Bubbles** Answers will vary.

Week Two: **Science and Engineering Practices** **(Analyzing Data)**	**Analyzing Data** 1. **Hypothesis** Answers will vary. Sample response: If plants are exposed to the proper ratio of water to sunlight, then they will thrive; I predict that the ideal water level is 1 cup, and ideal exposure to sunlight is 8 hours. If the plant receives too much sunlight and not enough water, then it will dry out. If the plant receives too much water and not enough sunlight, then it will drown. 2. The two variables tested in this plant growth experiment were the effect of levels of water and sunlight exposure. 3. Answers will vary. Sample response: The sunlight exposure has a positive effect on plant growth. Regardless of amount of water, plants grew increasingly higher with more hours of sunlight. With the exception of plant #7! It had 16 hours of sunlight exposure, but showed significantly less average growth than the rest of the plants with only a ¼ cup of water. This indicates that if plants are to be exposed to an excess of sunlight, and then they need more water! This is further demonstrated by plant #8 with 16 hours of sunlight and 1 cup of water, which had the highest overall average growth. 4. Answers will vary. Sample response: The overall trend of water seemed to be the less water, the better. Plants did not require as much water to thrive; in each case, the plants with ¼ cup of water showed more overall growth. With the exception of plant #8! Because it was exposed to such a high amount of sunlight, it required more water (1 cup) to prevent it from drying out. 5. Answers will vary. Sample response: My original hypothesis stated that the plants would require an optimal level of sunlight and water to thrive; with too much sun and too little water, OR too much water and too little sun, they would not grow as tall. This aspect of my hypothesis was confirmed. However, I also predicted that 1-cup of water and 8 hours of sunlight exposure would be the ideal ratio of plant treatments. This aspect of my hypothesis was disconfirmed; the lab results indicated that the most favorable conditions for this plant were 1 cup of water and 16 hours of sunlight.
	Analyzing Data: Graphs **Answers will vary.**
Week Three: **Cell Processes**	**Photosynthesis** 1. Energy is defined in science as the ability to do work. Example: break down and build up of molecules; transport molecules across a plasma membrane. 2. Autotrophs make their own food using photosynthesis. Heterotrophs cannot make their own food. They get their food by consuming other organisms. 3. A. autotroph (plant); B. heterotroph (animal); C. autotroph (plant); D. heterotroph (fungi); E. heterotroph (animal) 4. Energy is used in a cell to carry out the processes of the cell. 5. Autotrophs are considered the basis of food chains because they produce food for themselves and for all other living things.

	Respiration 1. There are equal numbers of atoms on each side of the equation. 2. Glucose 3. Carbon Dioxide 4. Oxygen 5. Water 6. Energy 7. C. Krebs cycle 8. Answers will vary. Sample answer: The relationship between photosynthesis and cellular respiration is often described as a cycle because the products of one process are used as the reactants for the other. Photosynthesis produces carbohydrates and oxygen from carbon dioxide and water, incorporating light energy into the bonds of the carbohydrates. Cellular respiration, on the other hand, uses oxygen and releases energy from the bonds of carbohydrates, producing carbon dioxide and water.
Week Four: Modeling Matter and Energy in Ecosystems (Part I)	**Food Chains** 1. Food chains will vary. 2. Answers will vary. Sample answer: Loss of decomposers from an ecosystem would prevent nutrients from cycling back into the soil. Plants would not be able to survive without artificial fertilizer applications and would no longer be able to photosynthesize or support food chains or webs. **Food Web** **Answers will vary.**
	Tropic Levels: Introduction 1. A 2. C 3. B **Tropic Levels: Data Analysis (Population Size)** 1. Population size decreases. 2. Population size decreases significantly with each trophic level. 3. A quaternary consumer would probably not be supported and would not be able to survive.
	Tropic Levels: 10% Rule **Graphs will vary.** Analysis and Conclusion Questions 1. The amount of energy decreases as it is passed from one trophic level to the next. 2. Only 10% of the energy available to a trophic level makes it to the next trophic level. 3. The remainder of the energy is used for the everyday activities of the organism such as: movement, metabolism, etc. 4. If an organism dies and the organism in the next trophic level does not eat it, its energy will not be transferred. 5. The expression could take a number of forms. For example: energy available at a trophic level A= energy produced by flower/$10^{(A-1)}$

<table>
<tr><td rowspan="2">Week Five:
Modeling Matter and Energy in Ecosystems (Part II)</td><td>Model (Biomass and Energy)

Models will vary. Models should name specific organisms that have decreasing biomass as you continue up the pyramid. Models should show that 10% of energy moves up at each level.</td></tr>
<tr><td>Studying an Ecosystem

Answers will vary. Students might say that a pyramid of numbers would provide useful information to a scientist about the size of the population at each level, and so could indicate if a particular level is becoming too crowded or had crashed. A pyramid of energy alternately cold show if an ecosystem is in danger of running low on energy and in danger of collapsing.</td></tr>
<tr><td rowspan="2">Week Six:
Cycling of Matter and Energy in Ecosystems</td><td>The Water Cycle

Answers and Annotations will vary.</td></tr>
<tr><td>Biogeochemical Cycles

Carbon Cycle
Answers will vary. Student models should contain factual explanations of the role of photosynthesis and cellular respiration in the cycling of carbon. Equations included in student models should be correct.

Nitrogen Cycle
Answers will vary. Students should recognize that microscopic organisms, which are small in scale, have a large-scale impact on life on Earth. Plants use the nitrates releases by soil bacteria to create molecules that the plants need, such as amino acids and proteins. Other organisms in the food web also use the nitrogen compounds created by the plants to create the proteins and amino acids needed in their own bodies.

Phosphorus Cycle
Answers will vary. Sample response: Animals participate in the phosphorus cycle by eating plants that absorb phosphorus.</td></tr>
<tr><td>Week Seven:
Matter and Energy in Living Systems</td><td>Performance Task: Analyzing Water Pollution

Scoring Rubric
• Problem statement is clearly defined and identifies supporting questions to be answered. (25 points possible)

• Model clearly and accurately represents how excess nitrogen cycles through the ecosystem; any limitations of the model are identified. (25 points possible)

• Relevant images and data are included to support the solution. (25 points possible)

• Recommendation clearly explains the solution and uses evidence effectively to support the proposed solution. (25 points possible)</td></tr>
</table>