MYP/3D Science Unit Planner

Marietta City Schools

Grade & Course: Environmental Science	**Topic:** Unit 2 - Planet Earth	**Duration:** 3 Weeks

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Georgia Standards and Content:

Summary: Investigate flow of energy and matter by using models to compare levels of biological organization, adaptations of organisms within different ecosystems, effects and changes of water properties on organisms, how ecosystems change and how humans impact environments.

Georgia Standards of Excellence Environmental Science: SEV1.a,c,e

SEV1. Obtain, evaluate, and communicate information to investigate the flow of energy and cycling of matter within an ecosystem. a. Develop and use a model to compare and analyze the levels of biological organization including organisms, populations, communities, ecosystems, and biosphere.

c. Analyze and interpret data to construct an argument of the necessity of biogeochemical cycles (hydrologic, nitrogen, phosphorus, oxygen, and carbon) to support a sustainable ecosystem.

e. Plan and carry out an investigation of how chemical and physical properties impact aquatic biomes in Georgia. (Clarification statement: Consider the diverse aquatic ecosystems across the state such as streams, ponds, coastline, estuaries, and lakes.)

https://www.georgiastandards.org/Georgia-Standards/Documents/Science-Environmental-Science-Georgia-Standards.pdf

Narrative / Background Information

Prior Student Knowledge: (REFLECTION – PRIOR TO TEACHING THE UNIT)

Summary: Understand standards from Seventh Grade Life Science analyzing interdependence of organisms with each other and their environments by explaining interactions, cycling of matter and energy, and characteristics of terrestrial biomes and aquatic ecosystems.

Georgia Standards of Excellence Seventh Grade Life Science **S7L4 a, b, c, d**

S7L4. Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments. a. Construct an explanation for the patterns of interactions observed in different ecosystems in terms of the relationships among and between organisms and abiotic components of the ecosystem. (Clarification statement: The interactions include, but are not limited to, predator-prey relationships, competition, mutualism, parasitism, and commensalism.) b. Develop a model to describe the cycling of matter and the flow of energy among biotic and abiotic components of an ecosystem. (Clarification statement: Emphasis is on tracing movement of matter and flow of energy, not the biochemical mechanisms of photosynthesis and cellular respiration.) c. Analyze and interpret data to provide evidence for how resource availability, disease, climate, and human activity affect individual organisms, populations, communities, and ecosystems. d. Ask questions to gather and synthesize information from multiple sources to differentiate between Earth's major terrestrial biomes (i.e., tropical rainforest, savanna, temperate forest, desert, grassland, taiga, and tundra) and aquatic ecosystems (i.e., freshwater, estuaries, and marine). (Clarification statement: Emphasis is on the factors that influence patterns across biomes such as the climate, availability of food and water, and location.)

Year-Long Anchoring Phenomena: (LEARNING PROCESS)
Human activities have negatively affected ecosystems, global climate, energy resources, and population.

Unit Phenomena (LEARNING PROCESS)
Climate change, driven by natural and anthropogenic activities, significantly impacts these reefs, leading to both short-term and long-term environmental changes.

MYP Inquiry Statement:
By exploring the relationships between Earth's geosphere, hydrosphere, atmosphere, and biosphere, students will investigate how natural and anthropogenic activities influence these systems, leading to both short-term and long-term environmental changes.

MYP Global Context:
- **Identities and relationships** - by exploring the interdependence between organisms and their environments, highlighting how environmental changes shape both ecological relationships and human identities, as well as the ethical responsibilities inherent in these interactions.

Science and Engineering Practices:
- Analyze and Interpreting Data
- Obtain, Evaluate and Communicate Information

ATL
- Research Skills
- Thinking Skills
- Collaboration Skills
- Communication Skills

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)
- Levels of Biological Organization
- Biogeochemical Cycles
- Earth as a Closed System
- Aquatic Biomes in Georgia

Crosscutting Concepts: (KNOWLEDGE & SKILLS)
- Scale, Proportion, and Quantity
- Systems and System Models
- Energy and Matter
- Stability and Change
- Structure and Function

MYP Key and Related Concepts:
- *Communities*
- *Connections*
- *Relationships*
- *Systems*
- *Time, Place, and Space*
- *Systems*
- *Environment*
- *Balance*

Possible Preconceptions/Misconceptions: (REFLECTION – PRIOR TO TEACHING THE UNIT)

When teaching this unit it is important to note that students come in with previous knowledge on ecology and ecosystems. Some misconceptions that they bring include:

- **Misconception of System Independence:** Students might believe that Earth's systems (geosphere, hydrosphere, atmosphere, and biosphere) operate independently rather than being interconnected and interdependent.
- **Belief in Infinite Resources:** Students may think that natural resources are infinite or easily replenished, not understanding the limits and potential for resource depletion.
- **Homogeneous View of Ecosystems:** Students might not recognize the diversity of aquatic ecosystems within Georgia, assuming all water bodies are similar in structure and function.

Vocabulary: (KNOWLEDGE & SKILLS)

Geosphere: The solid part of the Earth, including the crust, mantle, and core.

Hydrosphere: All the water on Earth's surface, including oceans, lakes, rivers, and groundwater.

Atmosphere: The layer of gasses surrounding the Earth, essential for weather and climate.

Biosphere: The regions of Earth where life exists, including land, water, and the atmosphere.

Ecosystem: A community of living organisms and their interactions with their environment.

Biodiversity: The variety of life in a particular habitat or ecosystem.

Sustainability: The practice of using resources in a way that maintains their availability for future generations.

Pollution: The introduction of harmful substances or products into the environment.

Climate Change: Long-term alterations in temperature, precipitation, wind patterns, and other aspects of the Earth's climate.

Carbon Cycle: The process by which carbon is exchanged between the atmosphere, oceans, soil, and living organisms.

Water Cycle: The continuous movement of water on, above, and below the surface of the Earth.

Inquiry Questions:

- **Factual:** What are the primary components of Earth's systems, and how do they interact?
- **Conceptual:** How do human activities influence the balance and health of Earth's systems?
- **Debatable:** To what extent can sustainable practices mitigate the impact of human activities on Earth's environment?

MYP Objectives	Summative assessment	
Sciences **B. Inquiring and designing** In order to reach the aims of sciences, students should be able to: i. explain a problem or question to be tested by a scientific investigation ii. formulate a testable hypothesis and explain it using scientific reasoning iii. explain how to manipulate the variables, and explain how data will be collected iv. design scientific investigations	MYP Assessment Task: ● **Criterion B:** Inquiring and Designing – **Formulating a Problem or Hypothesis:** ○ **SEV1.a:** Students could be assessed on their ability to formulate a research question or hypothesis related to how matter and energy cycle through ecosystems. For example, they might investigate how changes in abiotic factors (like temperature or pH) affect energy flow. ○ **SEV1.c:** Students can be assessed on their ability to formulate a hypothesis predicting the impact of specific environmental changes (such as deforestation or pollution) on a particular ecosystem. ○ **SEV1.e:** Assess students on their ability to develop a research question or hypothesis focused on the effects of human activity (e.g., urbanization, agriculture) on an ecosystem.	Relationship between summative assessment task(s) and statement of inquiry: The summative assessment is designed to align with the statement of inquiry by focusing on how students understand and evaluate the interactions among Earth's systems—geosphere, hydrosphere, atmosphere, and biosphere—and the impact of both natural and human-induced activities on these systems. 1. **Cycling of Matter and Energy in Ecosystems (SEV1.a)**: The assessment will evaluate students' ability to analyze how matter and energy cycle through various components of ecosystems. This directly relates to understanding the relationships between Earth's spheres (biosphere interacting

C: Processing and Evaluating i. Present collected and transformed data accurately and logically. ii. Interpret data and explain results using scientific reasoning. iii. Evaluate the validity of the hypothesis based on the outcomes of the investigation. iv. Identify weaknesses in the method and suggest improvements.	● **Criterion C:** Processing and Evaluating – ● **SEV1.a:** Students would be assessed on their ability to process data gathered from their models or investigations that show the cycling of matter and energy. This could involve interpreting graphs, tables, or simulation outputs that illustrate these processes. ● **SEV1.c:** Assess students on how they process data related to environmental changes, such as analyzing trends or patterns that support or refute their predictions about ecosystem impacts. ● **SEV1.e:** Students should process data from their investigations of human impact on ecosystems, potentially including statistical analysis or comparing their findings with established scientific knowledge. Formative Assessment: - A common formative assessment (quiz) designed to assess students' understanding of the Georgia Standards of Excellence SEV1.a and SEV1.c could include a variety of question types to evaluate their knowledge and application skills. **Summative Assessment:** ● The summative assessment will consist of a combination of DOK 1, 2 and 3 multiple-choice questions. The goal is to assess students' ability to analyze the cycling of matter and energy in ecosystems (SEV1.a), predict the impact of environmental changes (SEV1.c), and evaluate information about Georgia's aquatic ecosystems (SEV1.e).	with geosphere, hydrosphere, and atmosphere). By exploring these cycles, students will grasp how disruptions in one sphere can influence others, reflecting the interconnectedness emphasized in the statement of inquiry. 2. **Predicting Environmental Changes (SEV1.c)**: The assessment will include questions that require students to predict the impact of environmental changes, whether caused by natural events or human activities. This prediction process involves understanding how different spheres of Earth interact and influence one another, consistent with the inquiry into how these systems are affected by anthropogenic and natural activities. 3. **Evaluating Information about Georgia's Aquatic Ecosystems (SEV1.e)**: By assessing students' ability to evaluate information about aquatic ecosystems in Georgia, the summative assessment links local environmental changes to broader global processes. This ties into the inquiry's focus on understanding how specific environmental changes (like those in Georgia's aquatic ecosystems) can lead to broader consequences in Earth's interconnected systems.

Unit Objectives:

1. **Develop and use a model to compare and analyze the levels of Biological Organization.**
2. **Analyze and interpret data to construct an argument of the necessity of biogeochemical cycles to support a sustainable ecosystem. *(Hydrologic, nitrogen, phosphorus, oxygen, and carbon)***
3. **Plan and carry out an investigation of how the chemical and physical properties impact aquatic biomes in Georgia.**

Learning Activities and Experiences	Inquiry & Obtain: (LEARNING PROCESS)	Evaluate: (LEARNING PROCESS)	Communicate: (LEARNING PROCESS)
Week 1: Biological Organization and Biogeochemical Cycles (Hydrologic)	**Concept Mapping:** ● **Objective:** Visualize the hierarchical levels of biological organization. ● **Activity:** Have students create concept maps individually or in groups to illustrate the levels of biological organization (organisms, populations, communities, ecosystems, and biosphere). **Case Study Analysis:** ● **Objective:** Apply concepts of the hydrologic cycle to real-world scenarios. ● **Activity:** Provide students with case studies related to water distribution, usage, and its impact on ecosystems. Students analyze the case studies and present their findings, focusing on the biological and environmental implications.	**Concept Map Assessment:** ● **Accuracy of Content:** The educator will check that the students correctly represent the hierarchical levels of biological organization—organisms, populations, communities, ecosystems, and biosphere—and accurately depict the relationships and flow between these levels. ● **Clarity and Organization:** The educator will assess how clearly the concept map presents information. This includes the logical arrangement of levels, the use of connecting lines or arrows to show relationships, and the overall readability of the map. The concept map should be easy to follow, with clear labels and organized structure. ● **Understanding of Relationships:** The educator will evaluate the students' ability to illustrate and explain how different levels of biological organization are interconnected. This includes assessing whether students effectively demonstrate how individual organisms contribute to populations, how populations form communities, and so on. **Case Study Assessment:** **Understanding of the Hydrologic Cycle:** ● The educator will assess how well students apply their knowledge of the hydrologic cycle to the case studies. This includes accurately identifying and explaining the processes involved (e.g., evaporation, condensation, precipitation, infiltration) and how these processes impact water distribution and usage in the given scenarios.	**Concept Mapping Discussions:** ● Students could engage in peer review sessions where they explain their concept maps to classmates and receive feedback. This promotes collaborative learning and allows students to refine their understanding based on input from others. **Science Posters:** ● **Objective:** Allow students to visually communicate scientific information. ● **Activity:** Students create posters that explain biological organization or illustrate the hydrologic cycle. Display the posters in the classroom and have a gallery walk where students explain their work to peers.

		Analysis of Biological and Environmental Implications: ● Students will be evaluated on their ability to analyze the effects of water distribution and usage on ecosystems. This includes understanding the ecological consequences, such as changes in habitats, effects on biodiversity, and potential impacts on human communities. The educator will look for depth in the analysis, showing that students can connect hydrologic processes with broader biological and environmental outcomes. **Use of Evidence:** ● The educator will assess the extent to which students support their analysis and conclusions with evidence from the case study or relevant scientific principles. This includes the accurate interpretation of data, references to hydrologic concepts, and the ability to draw reasonable conclusions based on the information provided.	
Week 2: Biogeochemical Cycles (C, O, N, P)	**Cycle Diagrams and Graphic Organizers:** ● **Objective:** Visualize and understand the processes and components of each cycle. ● **Activity:** Have students create detailed diagrams or graphic organizers of each biogeochemical cycle. Encourage them to include key processes (e.g., photosynthesis, respiration, nitrogen fixation) and components (e.g., reservoirs, fluxes). **Group Projects and Collaboration:** ● **Objective:** Encourage collaborative learning and deeper exploration of the cycles. ● **Activity:** Assign group projects where students work together to create a comprehensive presentation or model of a biogeochemical cycle. They can use materials	**Cycle Diagrams and Graphic Organizers:** ● **Assessment Focus:** Evaluate whether students correctly depict the key processes (e.g., photosynthesis, respiration, nitrogen fixation) and components (e.g., reservoirs, fluxes) of each biogeochemical cycle. The educator will check for accurate representation of these elements and their correct placement within the cycle. ● **Completeness:** Ensure that students include all the necessary components of the biogeochemical cycles in their diagrams or graphic organizers. This includes evaluating whether the major processes and components are represented without significant omissions.	**Infographics:** ***Poster Sessions*** ● Students can display their diagrams as part of a classroom "poster session" where other students and teachers can walk around, view the work, and ask questions. This format mimics a scientific conference and encourages students to explain their findings concisely and effectively. ***Peer Review and Feedback:*** ● Students might exchange their diagrams with peers for review, providing and receiving feedback. This exchange allows students to communicate their findings to someone else and to reflect on their work based on peer input.

	like posters, PowerPoint, or 3D models to illustrate their understanding.	**Understanding of Interconnections:** ● **Assessment Focus:** Evaluate how well students illustrate and explain the interconnections within the cycle, such as how different processes influence each other or how components are linked. This includes assessing their ability to show the flow of matter and energy through the cycle and the relationships between different parts of the cycle.	
Week 3: Biogeochemical Cycles (N, P) and Aquatic Ecosystems	**Research Projects:** ● **Objective:** Investigate specific aspects of Georgia's aquatic ecosystems in depth. ● **Activity:** Assign research projects where students choose a specific aquatic ecosystem in Georgia to investigate further. They can explore topics like the biodiversity, ecological significance, human impact, and conservation efforts related to their chosen ecosystem. Students present their findings through reports or presentations. **Water Quality Testing:** ● **Objective:** Conduct experiments to understand water quality and its impact on ecosystems. ● **Activity:** Perform water quality testing using kits to measure parameters like pH, temperature, turbidity, dissolved oxygen, and nitrate levels in local water samples. Students analyze the results and discuss how these factors affect aquatic ecosystems.	**Depth and Accuracy of Research:** ● **Understanding of Chemical and Physical Properties:** Assess whether students correctly identify and measure the relevant chemical (e.g., pH, salinity) and physical (e.g., clarity, temperature) properties of water and understand their impacts on aquatic biomes. This can be evaluated through the accuracy of their data collection and their explanations of how these properties influence biodiversity. ● **Execution of the Investigation:** Evaluate students on their ability to plan and carry out an investigation, including the design of their experiments, the use of control and experimental groups, and the collection of data. The educator can review students' procedures and their adherence to scientific methods, as well as their ability to run tests multiple times and average results, as outlined in the lab instructions. ● **Data Analysis and Interpretation:** Assess how well students analyze the collected data, particularly their ability to recognize trends, identify errors, and determine correlations between water properties and biodiversity. Their written summaries and graphical representations (e.g., charts) will provide insight into their analytical skills. ● **Scientific Reasoning and Communication:** Evaluate the	**Written Reports:** ● Students may also communicate their research through detailed written reports. These reports would include a comprehensive discussion of their chosen ecosystem, supported by research data, analysis, and references. The written format allows for a deeper exploration of the topic and the inclusion of more detailed information than might be possible in an oral presentation. **Group Discussions and Collaboration:** ● If students are working in groups, they will communicate with each other throughout the research process. This includes discussing their findings, dividing responsibilities, and making collaborative decisions on how to present their work. Effective communication within the group is essential for producing a cohesive and comprehensive final project. **Peer Review and Feedback:**

		students' ability to construct well-reasoned claims based on their data, supported by evidence and sound scientific principles. This includes their responses to the class data analysis questions and their final CER (Claim, Evidence, Reasoning) related to Georgia aquatic biomes. ● **Application to Real-World Contexts:** Lastly, assess how students connect their findings to broader ecological and conservation issues, such as the impacts on Georgia's aquatic ecosystems. Their ability to compare class data with real-world data (e.g., from the Georgia Adopt-a-Stream program) and suggest improvements to their investigations further demonstrates mastery.	● Students might exchange drafts of their reports or practice presentations with peers for review. This process allows them to communicate their ideas in a less formal setting, receive constructive feedback, and refine their work based on peer input. Peer review encourages collaboration and the development of communication skills by giving and receiving feedback.

Resources (hyperlink to model lessons and/or resources):
Greenhouse Gas Concentration Virtual Lab
Properties of Gasses Virtual Lab
Molecules and Light Interactions Virtual Lab
pH Scale Virtual Lab

Reflection: Considering the planning, process and impact of the inquiry

Prior to teaching the unit	During teaching	After teaching the unit
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