International Baccalaureate
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MARIETTA CITY SCHOOLS

MYP/3D Science Biology Unit Planner

Grade & Course: 10th Grade Biology	**Topic: Stability and Change in Ecosystems:** Energy and Matter in Ecosystems	**Duration:** 4 weeks
Teachers: Hunter Fisher, Heather Glazebrook, Mariah Sappington, Uswa Jadoon, Lisa Smith, Rosemary Kamau, O'Neal McRunells, Amber Carr, Zakayo Ruoro, Alvin Tremble		

Georgia Standards and Content

SB1. Obtain, evaluate, and communicate information to analyze the nature of the relationships between structures and functions in living cells.

a . Construct an explanation of how cell structures and organelles (including nucleus, cytoplasm, cell membrane, cell wall, chloroplasts, lysosome, Golgi, endoplasmic reticulum, vacuoles, ribosomes, and mitochondria) interact as a system to maintain homeostasis.

e . Ask questions to investigate and provide explanations about the roles of photosynthesis and respiration in the cycling of matter and flow of energy within the cell (e.g., single-celled alga).(Clarification statement: Instruction should focus on understanding the inputs, outputs, and functions of photosynthesis and respiration and the functions of the major sub-processes of each including glycolysis, Krebs cycle, electron transport chain, light reactions, and Calvin cycle.)

SB5. Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment.

b . Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration.

- Arranging components of a food web according to energy flow.
- Comparing the quantity of energy in the steps of an energy pyramid.
- Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).

Narrative / Background Information

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

Students have prior knowledge in prior grade levels (7th/8th) when covering standards:

S7L2. Obtain, evaluate, and communicate information to describe how cell structures, cells, tissues, organs, and organ systems interact to maintain the basic needs of organisms.

a. Develop a model and construct an explanation of how cell structures (specifically the nucleus, cytoplasm, cell membrane, cell wall, **chloroplasts**, lysosome, and **mitochondria**) contribute to the function of the cell as a system in obtaining nutrients in order to grow, reproduce, make needed materials, and process waste.

S7L4. Obtain, evaluate, and communicate information to examine the interdependence of organisms with one another and their environments.

b. Develop a model to describe the **cycling of matter and the flow of energy** among biotic and abiotic components of an ecosystem.

S8P1. Obtain, evaluate, and communicate information about the structure and properties of matter.

f. Construct an explanation based on evidence to describe **conservation of matter in a chemical**

reaction including the resulting differences between products and reactants.

Year-Long Anchoring Phenomena: (LEARNING PROCESS)
Sickle cell is a heritable genetic mutation that evolved in response to interactions in ecosystems.

Unit Phenomena (LEARNING PROCESS)

This self-sustaining EcoSphere is like having your very own tiny world. The EcoSphere Closed Aquatic Ecosystem is a completely closed, balanced, glass ecosystem. Inside this self-sustaining ecosystem are shrimp, algae, and microorganisms in salt water.
How are these organisms surviving ?

MYP Inquiry Statement:
Organisms **interact** with the natural world by **transferring** matter and **energy**.

MYP Global Context:
Scientific and Technical Innovation

Approaches to Learning Skills:

Research skills: MYP D - Human Impacts on Cycles (Artificial Photosynthesis)

Students will research and make connections between human activities and the impacts on biogeochemical cycles.

Thinking and Self-Management skills: Photosynthesis Design Lab and Cell Respiration Design Lab

Students will investigate factors that affect the process of photosynthesis and cell respiration. Students will interpret data gained from the investigation

Disciplinary Core Ideas: (KNOWLEDGE & SKILLS)

- Food Chains/Webs & Energy Transfer
- Biogeochemical Cycles
- Mitochondria/Chloroplast
- Photosynthesis & Cellular Respiration

Crosscutting Concepts: (KNOWLEDGE & SKILLS)

Energy and Matter: Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.

MYP Key and Related Concepts:

Related Concepts:

- Interactions
- Energy

and develop a laboratory report of the investigation.		**Key Concept :** Systems

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

Misconceptions:

- Energy is truly lost in many energy transformations.
- Things "use up" energy.
- Energy is associated only with movement.
- Plant cells only have a chloroplast.
- Plants get their energy from the soil through roots.
- Plants obtain their energy directly from the sun.

Preconceptions:

- Students should have a basic understanding of the structure and function between the mitochondria and chloroplast.
- Students understand the components of the chemical equations for photosynthesis, however, they confuse reactants and products.
- Students may think plants only require sunlight and water.
- Students should understand the general idea of homeostasis.
- Students should have a basic understanding of the biogeochemical cycles to include P, H, N, C, and H.

Key Vocabulary: (KNOWLEDGE & SKILLS)

Food Chain, Food Web, Energy, Producer, Consumer, Autotroph, Heterotroph, Carbohydrate, Light-Independent Reaction, Calvin Cycle, Products, Reactants, Electron Transport Chain, Glycolysis, Krebs Cycle, Citric Acid Cycle, Pyruvate, Mitochondria, Matrix, Cristae, Chloroplasts, Thylakoid, Stroma, Cytoplasm, Carbon, Phosphorus, Hydrogen, Oxygen, Nitrogen, Nitrifying bacteria

Inquiry Statements:

Factual:

- What are the major organelles in a cell?
- What are the 4 major classes of macromolecules, their monomers, and their functions.
- What is the chemical equation for photosynthesis and cellular respiration?
- What is the difference between a food chain and a food web?
- How do major elements such as carbon, nitrogen, phosphorus, oxygen, and hydrogen cycle in the ecosystems?

Conceptual:

- How does carbon, oxygen, and hydrogen cycle between the processes of photosynthesis and cellular respiration?
- How does energy flow between organisms by using the processes of photosynthesis and cellular respiration?

Debatable:

- Which biogeochemical cycle do humans have the greatest impact on?

MYP Objectives	Summative Assessment	
A - Function and Evidence B - Transformation/Models C - Transformation/Models D - Consequences	Task: MYP D - Human Impacts on Cycles, Artificial Photosynthesis MYP B & MYP C - Photosynthesis Design Lab MYP C - Cell Respiration Design Lab MYP A - Common Formative Assessment Common Summative Assessment	Relationship between summative assessment task(s) and statement of inquiry: The design lab demonstrates how the mitochondria perform cellular respiration. The CFAs are check-ins to determine student progress as we move through the unit. This data informs the teacher who needs to be accelerated, who is keeping up, and who needs remediation before moving forward. The summative assessments serve to test student knowledge of living systems in terms of structures of organisms and how they are classified based on their structure.

Unit Objective: Energy can neither be created nor destroyed, but it can be transformed as it flows through organisms and ecosystems.

Cells

- Photosynthesis and respiration are essential in the cycling of matter and energy within the cell. (SB1e)
- It is important to understand the inputs, outputs, and functions of photosynthesis and respiration. (SB1e)
- The functions of the major sub processes of photosynthesis and respiration include glycolysis, Krebs cycle, electron transport chain, light reactions, and Calvin cycle. (SB1e)

Classification and Phylogeny

- Energy transformation and the cycling of matter are the reasons organisms within an ecosystem depend on one another. (SB5b)

Ecology

- Food webs are useful models to represent the flow of energy. (SB5b)

- An energy pyramid is a model that can provide information about biomass and energy moving from producer to consumer and on to higher-order consumers. (SB5b)
- The carbon cycle, oxygen cycle, and hydrogen cycle model how these major biochemical elements move through ecosystems. (SB5b)

Can do :

- Describe understand the meaning of the arrows in food chains and food webs (direction of energy) and the sun is the start of all food chains/webs but may not be represented.
- Label food chains and webs with key terms (producers, autotrophs, heterotrophs, consumers, decomposers) and understand their role in the ecosystem.
- Predict what would happen if an organism was removed.
- Label the levels of the trophic pyramid (producers, levels of consumers).
- Calculate the 10% rule of energy transfer
- Recall how matter cycles through an ecosystem**:** biogeochemical cycles: Carbon, Oxygen, Nitrogen, water, phosphorus**.**
- Describe human impact on the cycles (burning of fossil fuels, deforestation, fertilization).

Learning Activities and Experiences	Inquiry & Obtain:	Evaluate:	Communicate:
Week 1 Food Webs/Food Chains	**Phenomenon** - Ecosystems are linked together by energy and matter flows. **Gathering** **Untangle Food Web Activity** Students will explore how energy moves within food chains and food webs. https://www.cpalms.org/PreviewResourceStudentTutorial/Preview/113119	Students will **model** the flow of **energy** between trophic levels in all of the following: food chain, food web, energy pyramid, and biomass pyramid. Food webs are models that demonstrate how matter and energy is transferred between producers, consumers and decomposers as the three groups interact — primarily for food — within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal	**Untangle Food Webs Questions**: Students will complete the tutorial and answer the questions on schoology. https://marietta.schoology.com/template/4658005004/resource-assessment?&f=181130072#/template/4658005004/resource-assessment?&f=181130072 YellowStone Food Web Students will **model** the flow of **energy** between trophic levels in all of the following: food chain, food web, energy pyramid, and biomass pyramid. **Differentiated Activities**

		matter back to the soil in terrestrial environments or to the water in aquatic environments.	- Alternative lessons/activities to address the needs of students with limited english proficiency and/or students with disabilities. Food Chain and Food Web Vocabulary Food Chain and Food Web ESL
Week 2 Photosynthesis	**Phenomenon** - Where does a tree get its mass? https://youtu.be/2KZb2_vcNTg Trees start as a tiny seed, then grow into a sapling, and then finally into large beautifully trees Humans get larger by taking in nutrients through food. Think about what trees take in through photosynthesis and tell me what makes them bigger? Class Discussion - is it carbon dioxide? Is it water? Is it light? Is it nutrients from the soil? Is it something else?	MYP B & MYP C - Photosynthesis Design Lab - The Photosynthesis Inquiry Lab is a hands-on activity that is differentiated for advanced, and on-level students. Students will **investigate** the factors that affect the rate of photosynthesis.	MYP B & MYP C - Photosynthesis Design Lab Leaf Disk Lab Leaf Disk Lab ESL Photosynthesis Inquiry Lab Lab Exploration: Photosynthesis and Cellular Respiration
Week 3 Cell Respiration	**Phenomenon** - Muscle soreness occurs in humans after a long run. Class Discussion: What causes this soreness?	MYP C - Cell Respiration Design Lab : Students will **investigate** and **model** how cellular respiration is a chemical process whereby the bonds of	MYP C - Cell Respiration Design Lab Exercise Lab Yeast Fermentation Lab Fermentation in Yeast Online Lab

		food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.	Compare and Contrast: Cell Respiration and Photosynthesis Lab Exploration: Cell Respiration and Photosynthesis In Schoology
Week 4 Biogeochemical Cycles	**Phenomenon** Microorganisms found during the decomposition process can provide useful information for criminal investigators. https://www.biointeractive.org/classroom-resources/solving-crimes-necrobiome	Students will develop a **model** to show how carbon, oxygen, hydrogen, nitrogen, and phosphorus move through ecosystems.	Students develop a model to describe a phenomenon that includes the movement of matter within an ecosystem Cycles Foldable Cycle Color Water Cycle in a Bag Experiment Biogeochemical Cycles Assignment Carbon Cycle Game Carbon Cycle Game for Distance Learning

Resources are hyperlinked in Common Learning Experiences above.	
Differentiation: Video will have closed captions to aid students (either in English or their native language) Images will be present in powerpoints and handouts to help support reading and ELL's. Foldables are found to support academic language. Many activities have an extended section to allow students to go further with their understanding of the topics at hand.	

Reflection: Considering the planning, process and impact of the inquiry		
Prior to teaching the unit	During teaching	After teaching the unit
Informally assess student retention of content from 7th grade standards.		

Students struggle understanding factors that impact the rate of photosynthesis. We will address this by implementing more graphing practice. Students struggle with the inputs and outputs related to photosynthesis. We will address by including differentiated questions and repetition with warm ups/closers. Students struggle identifying connections between terrestrial and aquatic food webs. We will include more examples of aquatic food webs.		