Biology – Unit 4: Conversion of Energy

Focus Question: How do organisms convert stored energy into usable energy?

Focus Area: ■ Math ■ Reading □ Writing

Standards:

MC.1.B.2 Describe the relationship between an enzyme and its substrate molecules.

MC.1.B.4 Explain the role of energy in chemical reactions of living systems: exergonic and endergonic reactions.

MC.3.B.2 Describe and model the conversion of stored energy in organic molecules into usable cellular energy (ATP).

MC.3.B.3 Compare and contrast aerobic and anaerobic respiration: lactic acid fermentation, alcoholic fermentation.

MC.3.B.4 Describe and model the conversion of light energy to chemical energy by photosynthetic organisms: light dependent reactions, light independent reactions.

MC.3.B.5 Compare and contrast cellular respiration and photosynthesis as energy conversion pathways.

RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Performance Task 1:

Photosynthesis and cellular respiration are both integral processes in the conversion of solar energy into usable energy within cells.

A. Using a Venn diagram or other graphic organizer, compare and contrast the reactants, products, location, process, and purpose of photosynthesis and cellular respiration.

B. Identify and explain whether photosynthesis and cellular respiration are endergonic or exergonic reactions.

C. In 2012, Representative Michele Bachmann (R-Minn.) argued that human carbon emissions couldn't pose a threat to the global climate because carbon is "natural" and that "life on planet Earth can't even exist without carbon dioxide." Write a short letter-to-the-editor describing the science of Rep. Bachmann's quote and evaluating the validity of her argument.

Standards Assessed: MC.1.B.4 / MC.3.B.5 / WHST.9-10.2

RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms. RST.9-10.6 Analyze the author's purpose in providing an explanation, describe a procedure, or discussing an experiment in a text, defining the question the author seeks to address. WHST.9-10.1 Write arguments focused on discipline-specific content. WHST.9-10.2 Write informative/explanatory texts…	**Instructional Sequence: (2 weeks)** 1. compare/contrast photosynthesis & cellular respiration 2. endergonic / exergonic reactions 3. structure and function of ATP 4. aerobic and anaerobic respiration 5. glycolysis, Kreb's cycle, ETC 6. enzymes	**Planning Considerations:**

Texts	"What Are the Differences Between Exergonic and Endergonic Reactions?"	"Enzymes Make the World Go 'Round"			
Standard(s)	MC.1.B.4 RST.9-10.5	MC.1.B.2 RST.9-10.5,6			
Quantitative	1370	880			
Qualitative	Register: Vocabulary is mostly common; any content-specific vocabulary is described in detail. Structure: Each concept is offset in an individual paragraph with a subtitle.	Register: Vocabulary is very content-specific but obliquely explained. Structure: Sentences are simple and short. Content is divided into paragraphs offset by subtitles.			

Text Dependent Questions	According to paragraph 1, what makes a reaction exergonic? Knowing the definition of exergonic and that endergonic is the opposite, what can you infer about the energy of photosynthesis? What is the purpose of activation energy in chemical reactions? Using descriptions from the text, draw an energy hill diagram for both an exergonic and an endergonic reaction.	Use evidence from the text to describe the relationships between an enzyme and a substrate. The author uses an analogy to compare enzymes to robots in an assembly line. Does this analogy make sense? Why or why not? Why must the active site maintain a specific shape? Looking at the last paragraph, use context clues to hypothesize what the word "inhibitor" means.			

Writing		
Routine	Analysis Focus	Research
3-2-1 reflections quick writes	efficiency of aerobic vs. anaerobic respiration	

Math		
Routine Skills	Grade-Level Skills	Mathematical Practices
multiplication/division		□ Problem solving with perseverance

balancing equations solving inequalities		□ Reason abstractly/quantitative □ Viable arguments and critique □ Model with mathematics □ Use tools strategically □ Attend to precision ■ Look for and use structure Express regularity in repeated reasoning
UDL Considerations		
Multiple Means of Engagement	Multiple Means of Expression	Multiple Means of Representation
endergonic/exergonic reaction labs analogy: glucose is money in bank, ATP is cash	enzyme lab enzyme demonstration – car on a ramp virtual photosynthesis lab (http://www.syngenta.com/country/uk/en/learning-zone/science-lab/experiments/Pages/photosynthesis_in_action.aspx) photosynthesis/cellular respiration lab	enzyme manipulatives Venn diagram of photosynthesis & cell. resp. graphic organizer of glycolysis ATP manipulatives