Subject: Living Environment Grade: 9 Unit #: 3 Title :Energy, Matter and Organization

UNIT OVERVIEW

STAGE ONE: Identify Desired Results

Established Goals/ Standards

Key Idea 5	Organisms maintain a dynamic equilibrium that sustains life.
Perf Ind 5.1	Explain the basic biochemical processes in living organisms and their importance in maintaining dynamic equilibrium.
5.1a	The energy for life comes primarily from the Sun. Photosynthesis provides a vital connection between the Sun and the energy needs of living systems.
5.1b	Plant cells and some one-celled organisms contain chloroplasts, the site of photosynthesis. The process of photosynthesis uses solar energy to combine the inorganic molecules carbon dioxide and water into energy-rich organic

Long-Term Transfer Goal

At the end of this unit, students will use what they have learned to independently…

plan, implement, and reflect on a scientific investigation of their choosing.

Meaning

Enduring Understandings

Students will understand that…

- Human performance and physical fitness depend on diet and exercise
- The conservation and transformation of energy and matter are found in all living systems
- Organisms release energy by breaking the chemical bonds of food molecules, forming different molecules that have lower amounts of energy
- Photosynthesis transforms light energy into chemical energy, with dramatic effects on all living systems
- Energy flows through ecosystems, and matter cycles in ecosystems
- Well-designed investigations collect data, compare results to controls, draw conclusions, and report findings

Essential Questions

Students will consider such questions as…

How do you get energy? What can you do without energy? Where does energy come from? How do you get energy and what do you use it for?

What drives us? How do you do what you do? What keeps us going?

why do I need energy?

Acquisition

What knowledge will students learn as part of this unit?

- *Fitness as a function of activity level and diet*
- *Matter and energy stored in food*
- *Biologically important molecules*
- *Enzyme function*
- *Digestive system*
- *Biosynthesis*
- *Muscle structure and function*
- *Matter and energy in human*

What skills will students learn as part of this unit?

- *Controlled experimental design*
- *Comparing predicted and actual results*
- *Variables in experimental design*

		compounds (e.g., glucose) and release oxygen to the environment.	*performance* ● *Potential and kinetic energy* ● *Energy stored in matter* ● *Organization of matter* ● *Conservation and transfer of energy* ● *Cellular respiration* ● *Photosynthesis* ● *Links between energy-producing and energy-requiring reactions* ● *Metabolism and the movement of matter* ● *The accumulation of scientific knowledge* ● *The cycling of matter in ecosystems* ● *The flow of energy in ecosystems* ● *Food webs* ● *Interactions among organisms* ● *Organization in communities* ● *Decomposers and the cycling of matter* ● *Energy conversion into heat* ● *Disruption of matter and energy movement in ecosystem*	
	5.1c	In all organisms, organic compounds can be used to assemble other molecules such as proteins, DNA, starch, and fats. The chemical energy stored in bonds can be used as a source of energy for life processes.		
	5.1 d	In all organisms, the energy stored in organic molecules may be released during cellular respiration. This energy is temporarily stored in ATP molecules. In many organisms, the process of cellular respiration is concluded in mitochondria, in which ATP is produced more efficiently, oxygen is used, and carbon dioxide and water are released as wastes.		
	5.1 e	The energy from ATP is used by the organism to obtain, transform, and transport materials, and to		

	eliminate wastes.		
5.1f	Biochemical processes, both breakdown and synthesis, are made possible by a large set of biological catalysts called enzymes. Enzymes can affect the rates of chemical change. The rate at which enzymes work can be influenced by internal environmental factors such as pH and temperature.		
5.1g	Enzymes and other molecules, such as hormones, receptor molecules, and antibodies, have specific shapes that influence both how they function and how they interact with other molecules.		
6.1b	The atoms and molecules on the Earth cycle among the living and nonliving components of the biosphere. For example, carbon dioxide and water molecules used in photosynthesis to form energy-rich organic compounds are		

		returned to the environment when the energy in these compounds is eventually released by cells. Continual input of energy from sunlight keeps the process going. This concept may be illustrated with an energy pyramid.		
	6.1a	Energy flows through ecosystems in one direction, typically from the Sun, through photosynthetic organisms including green plants and algae, to herbivores to carnivores and decomposers.		
	6.1c	The chemical elements, such as carbon, hydrogen, nitrogen, and oxygen, that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in a food web, some energy is stored in newly made structures but much is dissipated into the environment		

	as heat.		

STAGE TWO: Determine Acceptable Evidence	
	Assessment Evidence
Criteria to assess understanding: *(This is used to build the scoring tool.)* **Concept--Questioning, doing inquiry, and communicating results:** Inquiry is based on an interesting testable question that can be tested with the equipment available and techniques that can be conducted in this class. Hypothesis and prediction are clearly stated and explained. **Design and execution of the inquiry:** Experiment is designed with reasonable and logical use of the concepts that are important for the chosen topic. Explanation of the design makes good use of the vocabulary important to the experiment. Experimental design uses appropriate controls. Results are recorded clearly and accurately. **Explanation for scientific design and analysis based on the question being asked**: Analysis	Performance Task focused on Transfer: Ch. 9 "Being an experimental scientist" p. 514 ● Preparation: which processes of science took place in "science all around you" p. 512? Identify 3-4 specific times when you used processes (in diagram provided); obtain rubric ● Identify and record a testable question, write down what is already known and why the question is interesting or important ● Write down the hypothesis you plan to test ● Record which of the 6 unifying principles of biology [unit titles] is most related to your hypothesis ● Gather more info using appropriate resources ● Design an experiment--rationale, hypothesis, procedure, data analysis ● Write safety plan (chemicals, equipment, biological hazards) ● Get approval and carry out experiment ● Organize data ● Formulate an explanation of data that includes a claim, evidence, and reasoning ● Describe limitations and unexpected results ● Explain what your explanation indicates about the testable question and hypothesis ● Describe how your work connects to broader questions in biology and to the unifying principle ● Assemble a presentation of your full inquiry--what you did, why you did it, what you found out ○ ID connections between your full inquiry and the unifying principles, tech, culture, history, and ethics ● Listen and participate in class discussion of the projects
	Other Assessment Evidence: Ch. 7: "Marathon" p. 391--Follow the progress of 4 people who entered a marathon, propose explanations for the roles matter and energy played in their performances ● Read, divide the 4 members amongst team members, and review discuss physiological data provided

clearly refers to the question, hypothesis, and prediction. Analysis relates 2 or more specific examples taken from the results to demonstrate a clear understanding of the phenomenon that took place. **Explanation for connections to the unifying principles of biology, technology, culture, history, and ethics:** Presentation clearly and accurately explains the inquiry's connections to the unifying principles of biology, technology, culture, history, and ethics. **Presentation:** Presentation is well organized and complete (contains a hypothesis, procedure, results, and analysis). Grammar and punctuation are used correctly, making it easy to understand what the writer meant.	● Calculate kcal burned per week during most intense training and kcal burned total during the marathon; add to data table ● Analyze training and performance on race day: ○ How did training schedule prepare them to finish, how did energy expenditure per week of training compare with amount of energy expended during marathon? ○ In weeks preceding race, did they increase or decrease intake of any class of nutrients? ○ Summarize strategy for training ○ On the day before the race, what strategies were they using ○ What strategies were they using during the race--pace, fluid intake, apparent stamina and success ○ Propose reasons why they felt the way they did at beginning, middle, and end of race ○ Propose ways your runner could have improved their race performance ● Modify conclusions based on group input ● Read "factors influencing performance p. 401 and use ch. 7 info to answer analysis questions ○ Explanation of why runners finished in the order that they did--evidence and reasoning from energy calculations plus factors that influence human performance ○ Compare training schedules and diets--recommend 2 training and 2 dietary strategies to a friend, explain physiological change(s) that you would expect as a result of each strategy; describe why such changes would be important to finishing the marathon ○ Explain how humans obtain energy from energy-yielding nutrients they ingest ○ Explain how the process of energy release from matter is more efficient in athletes ○ Write 2-3 paragraph explanation for how digestion, aerobic respiration, and biosynthesis contribute to the repair of a torn muscle in a marathon racer Ch. 8: "Tracing matter and energy" p. 467--trace the path of a radioactive carbon atom through molecules, starting with CO_2 and ending with part of a muscle protein in a human arm ● Construct a diagram or other visual aid to show a plausible set of events that could explain how a labeled carbon atom in a molecule of atmospheric CO_2 ends up in a human muscle protein--must actually occur in nature ● Label diagram with sequence of events and: ○ Type of metabolic process in each step (breakdown or

	biosynthesis) ○ Energy source for each step ○ Matter source for each step ○ Names of metabolic processes that occur in the sequence ● Class discussion/make appropriate changes

T, M, A *(Code for Transfer, Meaning Making and Acquisition)*	**STAGE THREE: Plan Learning Experiences**	
	Learning Events:	Evidence of learning: *(formative assessment)*