

Telluride School District 10th Grade Life Science

Fertile Question: What is life?

Fertile questions	Standard/Student Outcomes	Process Skills	Activity/Lesson/Lab	Resources	Assessment
<p>How does a change in abiotic factors influence the stability or progression of an ecosystem?</p> <p>What happens when the cycling of matter in ecosystems is disrupted?</p> <p>What energy transformations occur in ecosystems?</p> <p>How does the process of burning C-rich fossil fuels compare to the oxidation of carbon biomolecules in cells?</p>	<p>1. Matter tends to be cycled within an ecosystem, while energy is transformed and eventually exits an ecosystem.</p> <p>Students can:</p> <p>a. Analyze how energy flows through trophic levels</p> <p>b. Evaluate the potential ecological impacts of a plant-based or meat based diet</p> <p>c. Analyze and interpret data from experiments where matter such as fertilizer has been added or withdrawn such as through drought.</p> <p>d. Develop, communicate, and justify an evidence-based scientific explanation showing how ecosystems follow the laws of conservation of energy, and how these are cycled or lost through life processes</p> <p>f. Describe how carbon, nitrogen, phosphorous, and water cycles work</p> <p>g. use computer simulations to analyze how energy flows through trophic levels</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p> <p>Collaboration: Students will participate in peer review; respectfully discourse; mediate opposing perspectives; understand and apply knowledge of culture; seek other's ideas</p>	<p>Students will develop and maintain a closed ecosystem within which they can simulate the cycling of matter and create a lab report communicating their findings</p> <p>Students will examine diets from families around the world showing the amount and types of food consumed in one week and draw conclusions about the ecological impacts of plant v. meat based diets. They will debate the advantages and disadvantages of both.</p> <p>Students will construct charts that show how the C, N, P and water cycles work</p> <p>Students will grow plants in different nutrient solutions to see the effects missing or excess nutrients have on plant growth and development and apply their findings to real-world agricultural situations(including eutrophication of water supplies)</p> <p>Students will experience a virtual lab to show how energy flows through trophic levels.</p>	<p>Textbook, internet, class demonstration, and exploration, virtual lab (PHET), DVD clips...</p> <p>Daily observations</p> <p>Science magazines</p> <p>Lab supplies</p>	<p>Lab reports</p> <p>Charts</p> <p>Virtual Lab questions</p> <p>Notes/Reflections</p> <p>Standardized Test prep ??s</p>

<p>How do keystone species maintain balance in ecosystems?</p> <p>How does the introduction of a non-native species influence the balance of an ecosystem?</p> <p>How is the succession of local organisms altered in an area that is disturbed or destroyed?</p>		<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p> <p>Collaboration: Students will participate in peer review; respectfully discourse; mediate opposing perspectives; understand and apply knowledge of culture; seek other's ideas</p>	<p>Students will develop and maintain a closed ecosystem within which they can simulate the cycling of matter and create a lab report communicating their findings</p> <p>Students will examine diets from families around the world showing the amount and types of food consumed in one week and draw conclusions about the ecological impacts of plant v. meat based diets. They will debate the advantages and disadvantages of both.</p> <p>Students will construct charts that show how the C, N, P and water cycles work</p> <p>Students will grow plants in different nutrient solutions to see the effects missing or excess nutrients have on plant growth and development and apply their findings to real-world agricultural situations(including eutrophication of water supplies)</p> <p>Students will experience a virtual lab to show how energy flows through trophic levels.</p>	<p>Textbook, internet, class demonstration, and exploration, virtual lab (PHET), DVD clips... Daily observations Science magazines Lab supplies</p>	<p>Lab reports Charts Virtual Lab questions Notes/Reflections Standardized Test prep ?'s</p>
	<p>2. The size and persistence of populations depend on their interactions with each other and the abiotic factors in an ecosystem</p> <p>Students can: a. Gather, analyze, and interpret data to about the</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and</p>	<p>Students will gather information to participate in a Socratic seminar about the re-introduction of wolves to the American West</p> <p>Students will use observation and field data techniques to gather and analyze data from the valley floor and mountain to evaluate local impacts of succession and</p>	<p>Textbook Videos-Living with wolves, excerpts from Planet earth and Life series Comic life DVD-Ecosystems</p>	<p>Students will be asked to revisit the ideas they expressed in their 8th grade research paper on ecological responsibilities defend or change their positions based on new information</p> <p>Students will revisit the ideas they explored in 9th grade by</p>

<p>How are rates of enzyme activity in cells affected by various factors such as pH or temperature?</p> <p>How does one know that enzymes speed up chemical reactions?</p>	<p>impact of removing keystone species from an ecosystem or introducing non-native species into an ecosystem b. Describe or evaluate communities in terms of primary and secondary succession as they progress over time c. Evaluate data and assumptions regarding different scenarios for future human population growth and their projected consequences d. Examine, evaluate, question, and ethically use information from a variety of sources and media to investigate ecosystem interactions</p>	<p>draw conclusions; problem solve; understand and use logic Collaboration: Students will participate in peer review; respectfully discourse; mediate opposing perspectives; understand and apply knowledge of culture; seek other's ideas Information Literacy: Students will: Evaluate information critically and competently; accessing appropriate tools to synthesize information distinguish fact/fiction/opinion/ point of view</p>	<p>compare them to Bridal Veil data. Complete Goldworthy outdoor art project</p>	<p>Valley floor/mountain Virtual population lab</p>	<p>watching Guns, Germs and Steel, summarizing the premise and main ideas and extrapolating possible future scenarios Notes/reflections Art project Standardized test prep ?s</p>
	<p>3. Cellular metabolic activities are carried out by biomolecules produced by organisms.</p> <p>Students can:</p> <p>a. Identify biomolecules and their precursors/building blocks</p> <p>b. Develop, communicate, and justify an evidence-</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p>	<p>Students will complete a lab testing for the presence of biological molecules based on their chemical structure</p> <p>Students will design a lab to test the effects of pH, salt, and temperature on the enzyme catalase</p> <p>Toothpickase activity</p> <p>Students will make models of the four major macromolecules and</p>	<p>Internet-Lab bench Textbook Lab supplies</p>	<p>Lab reports Notes/reflections Graphs Standardized test prep ?'s</p>

<p>What variables can be manipulated to change the rate of photosynthesis?</p> <p>What variables affect the rate of cell respiration?</p> <p>How does body heat relate to cellular respiration.</p>	<p>based explanation that biomolecules follow the same rules of chemistry as any other molecule</p> <p>c. Develop, communicate, and justify an evidence-based explanation regarding the optimal conditions required for enzyme activity</p> <p>d. Infer the consequences to organisms of suboptimal enzyme function - such as altered blood pH or high fever - using direct and indirect evidence</p> <p>e. Analyze and interpret data on the body's utilization of carbohydrates, lipids, and proteins</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p>	<p>of cells containing the organelles responsible for their construction</p> <p>Students will research a metabolic disorder or a disease related to impaired enzyme function</p> <p>Students will physically model the process of protein synthesis</p>	<p>Internet-Lab bench Textbook Lab supplies</p>	<p>Lab reports Notes/reflections Graphs Standardized test prep ??s</p>
	<p>4. The energy for life primarily derives from the interrelated processes of photosynthesis and cellular respiration. Photosynthesis transforms the sun's light energy into the chemical energy of molecular bonds. Cellular respiration allows</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and</p>	<p>Students will model the chemical reactions of CR and photosynthesis using marshmallows and be able to explain carbon fixation resulting in a gain of mass in plants, then make and eat rice crispy treats and understand ATP production</p>	<p>Text Demonstrations Virtual labs/internet Comic life DVD Lab supplies</p>	<p>Lab reports Notes/Reflections Graphs Diagrams Standardized Test prep ??s</p>

	<p>cells to utilize chemical energy when these bonds are broken.</p> <p>Students can:</p> <p>a. Develop, communicate, and justify an evidence-based scientific explanation the optimal environment for photosynthetic activity</p> <p>b. Discuss the interdependence of autotrophic and heterotrophic life forms such as depicting the flow of a carbon atom from the atmosphere, to a leaf, through the food chain, and back to the atmosphere</p> <p>c. Explain how carbon compounds are gradually oxidized to provide energy in the form of adenosine triphosphate (ATP), which drives many chemical reactions in the cell</p>	<p>draw conclusions; problem solve; understand and use logic</p>	<p>Students will make dough, cheese and veggie pizzas to demonstrate the biological connections between P and CR</p> <p>Students will design experiments to show how manipulating variables affects the rate of both CR and P and complete virtual labs.</p> <p>Students revisit Nutrient cycle charts</p> <p>Students will understand the evolutionary significance of endosymbiotic theory</p>		
<p>What variables affect the rate of transport across a membrane?</p> <p>Why is it important that</p>	<p>5. Cells use passive and active transport of substances across membranes to maintain relatively stable intracellular environments.</p> <p>Students can:</p> <p>a. Analyze and interpret data</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate</p>	<p>Students will make and experiment with egg osmometers</p> <p>Students will complete diffusion and osmosis lab</p> <p>Students will compare and</p>	<p>Lab supplies Textbook Internet resources Virtual labs</p>	<p>Lab report Notes/Reflections Graphs Standardized Test prep ?'s</p>

<p>cell membranes are selectively permeable?</p>	<p>to determine the energy requirements and/or rates of substance transport across cell membranes</p> <p>b. Compare organisms that live in freshwater and marine environments, and identify the challenges of osmotic regulation for these organisms</p> <p>c. Diagram the cell membrane schematically, and highlight receptor proteins as targets of hormones, neurotransmitters, or drugs that serve as active links between intra and extracellular environments</p> <p>d. Use tools to gather, view, analyze, and interpret data produced during scientific investigations that involve passive and active transport</p> <p>e. Use computer simulations and models to analyze cell transport mechanisms</p>	<p>for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p>	<p>contrast structure and function of animal excretory systems</p> <p>Students will construct neuron models showing how neurotransmitters act in cells</p>	<p>Lab supplies Textbook Internet resources Virtual labs</p>	<p>Lab report Notes/Reflections Graphs Standardized Test prep ??s</p>
<p>How can an experiment be designed and conducted to test for adaptive</p>	<p>6. Cells, tissues, organs, and organ systems maintain relatively stable internal environments, even in the face of changing external environments</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process Collaboration: Students will participate in peer review; respectfully discourse; mediate</p>	<p>Students will enlarge plant and animal tissue types they observe using microscope slides and create an art project</p> <p>Students will use Comparative Mammalian dissection of heart, brain, lung and</p>	<p>Lab supplies Art supplies Internet resources Videos textbook</p>	<p>Notes/Reflections Diagrams Project Lab report Standardized Test questions</p>

<p>homeostasis during exercise and other body activities?</p> <p>Where and when are negative vs. positive feedback loops more effective in the human body?</p>	<p>Students can:</p> <p>a. Discuss how two or more body systems interact to promote health for the whole organism</p> <p>b. Analyze and interpret data on homeostatic mechanisms using direct and indirect evidence to develop and support claims about the effectiveness of feedback loops to maintain homeostasis</p> <p>c. Distinguish between causation and correlation in epidemiological data, such as examining scientifically valid evidence regarding disrupted homeostasis in particular diseases</p> <p>d. Use computer simulations and models of homeostatic mechanisms</p>	<p>opposing perspectives; understand and apply knowledge of culture; seek other's ideas</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p> <p>Information Literacy: Students will: Evaluate information critically and competently; accessing appropriate tools to synthesize information distinguish fact/fiction/opinion/ point of view</p>	<p>,kidney and elicit their interactions</p> <p>Students will choose an invertebrate and mammal and create a comparison project</p> <p>Students will complete physiology of the circulatory system lab</p> <p>Students will review the regulatory effects of the endocrine system</p> <p>Students will view videos showing the epidemiology of epidemics such as Influenza of 1918, malarial outbreaks, emerging viruses, food poisoning outbreaks and understand the structure and function of the causative organisms</p>	<p>Lab supplies Art supplies Internet resources Videos textbook</p>	<p>Notes/Reflections Diagrams Project Lab report Standardized Test questions</p>
<p>Why is it possible for a cell from one species to express genes from another species as in</p>	<p>7. Physical and behavioral characteristics of an organism are influenced to varying degrees by heritable genes, many of which encode instructions for the production of proteins</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Collaboration: Students will participate in peer review; respectfully discourse; mediate opposing perspectives; understand</p>	<p>Students will review enzymes and protein synthesis</p> <p>Students will model DNA replication</p> <p>Students will model gene expression through the bacterial <i>lac</i> operon</p>	<p>Textbook Virtual lab DVD's Lab supplies Scientific articles</p>	<p>Notes/reflections Summaries Standardized test prep ?'s</p>

<p>genetic modification of organisms?</p> <p>Why are human offspring not genetic clones of their parents or siblings?</p> <p>How is it possible to distinguish learned from instinctual behaviors such as imprinting etiquette, and suckling by mammals?</p>	<p>Students can:</p> <p>a. Analyze and interpret data that genes are expressed portions of DNA.</p> <p>b. Analyze and interpret data on the processes of DNA replication, transcription, translation, and gene regulation, and show how these processes are the same in all organisms</p> <p>c. Recognize that proteins carry out most cell activities and mediate the effect of genes on physical and behavioral traits in an organism</p> <p>d. Evaluate data showing that offspring are not clones of their parents or siblings due to the meiotic processes of independent assortment of chromosomes, crossing over, and mutations</p> <p>e. Explain using examples how genetic mutations can benefit, harm, or have neutral effects on an organism</p>	<p>and apply knowledge of culture; seek other's ideas</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p> <p>Information Literacy: Students will: Evaluate information critically and competently; accessing appropriate tools to synthesize information distinguish fact/fiction/opinion/ point of view</p> <p>Nature of Science: Students will: Recognize that research on GMO's is done in university laboratories and seed companies, discuss the implications of different types of funding and the ethical traditions of science: value peer review; truthful reporting of methods and outcomes; making work public; and sharing a lens of professional skepticism when reviewing the work of others</p>	<p>Students will analyze hemoglobin DNA sequences for the sickle cell mutation</p> <p>Students will "decorate" meiosis cookies</p> <p>Students will research and present info. on a genetically modified organism</p> <p>Students will complete a bacterial transformation lab to understand the role of plasmids in genetic engineering</p> <p>Students will read and summarize articles on the evolution of dogs and animal intelligence</p> <p>Students will compare and contrast two videos on animal behavior</p>	<p>Textbook Virtual lab DVD's Lab supplies Scientific articles</p>	<p>Notes/reflections Summaries Standardized test prep ??s</p>
	<p>8. Multi-cellularity is an</p>	<p>Invention: Students will synthesize information from</p>	<p>Students will synthesize the phylogeny of vertebrates an</p>	<p>Internet resources</p>	<p>Notes/Reflections Projects</p>

<p>Why is it possible to clone a whole organism from an undifferentiated cell?</p> <p>Why are stem cells sought by researchers as potential cures to medical problems?</p>	<p>important adaptation that makes possible a division of labor and specialization at the cellular level through the expression select genes, but not their entire genome</p> <p>Students can:</p> <p>a. Develop, communicate, and justify an evidence-based scientific explanation of how cells form specialized tissues due to the expression of some genes and not others</p> <p>b. Analyze and interpret data that show most eukaryotic deoxyribonucleic acid (DNA) does not actively code for proteins within cells</p> <p>c. Develop, communicate, and justify an evidence-based scientific explanation for how a whole organism can be cloned from a differentiated - or adult - cell</p> <p>d. Analyze and interpret data on medical problems using direct and indirect evidence in developing and supporting claims that genetic mutations and cancer are brought about</p>	<p>multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Collaboration: Students will participate in peer review; respectfully discourse; mediate opposing perspectives; understand and apply knowledge of culture; seek other's ideas</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p> <p>Information Literacy: Students will: Evaluate information critically and competently; accessing appropriate tools to synthesize information distinguish fact/fiction/opinion/ point of view</p>	<p>invertebrates by creating a children's book and game</p> <p>Students will complete a unit on Cancer using case studies and relate cancer to the cell cycle and cell process of mitosis</p> <p>Students will review protein synthesis-introns and exons</p> <p>Students will understand the scope and significance of the human genome project and cloning how they have changed many aspects of society</p> <p>Students will research the sources of stem cells, analyze current stem cell research and participate in a stem cell Socratic seminar discussing the associated political and ethical issues</p>	<p>Textbook Case studies Lab supplies</p>	<p>Graphs/diagrams Standardized Test prep ?'s</p>
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	by exposure to environmental toxins, radiation, or smoking				
<p>How do subtle differences among closely-related fossil species provide evidence of environmental change and speciation?</p> <p>How does studying extinct species contribute to our current understanding of evolution?</p> <p>How can patterns of characteristics shared among organisms be used to categorize life's diversity</p>	<p>9. Evolution occurs as the heritable characteristics of populations change across generations and can lead populations to become better adapted to their environment</p> <p>Students can:</p> <p>a. Develop, communicate, and justify an evidence-based scientific explanation for how Earth's diverse life forms today evolved from common ancestors</p> <p>b. Analyze and interpret multiple lines of evidence supporting the idea that all species are related by common ancestry such as molecular studies, comparative anatomy, biogeography, fossil record</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Collaboration: Students will participate in peer review; respectfully discourse; mediate opposing perspectives; understand and apply knowledge of culture; seek other's ideas</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p> <p>Information Literacy: Students will: Evaluate information critically and competently; accessing appropriate tools to synthesize information distinguish fact/fiction/opinion/ point of view</p>	<p>Students will learn and understand evidence supporting evolution and the links to a common ancestry by constructing phylogenetic trees and cladograms</p> <p>Students will understand the history of evolutionary thought by watching and summarizing excerpts from the PBS series Evolution</p> <p>Students will participate in a divergent evolution activity where they act out speciation of a bird population</p> <p>Students will complete activities observing natural variation in beans and understand how natural selection works on genetic variation in populations</p> <p>Students will research evidence of antibiotic resistance and the results of</p>	<p>Lab supplies Textbook Internet DVD's</p>	<p>Notes/Reflections Phylogenetic trees Standardized test prep ?'s Timeline Field data</p>

<p>according to relatedness? How does modern agriculture affect biodiversity?</p>	<p>and embryology</p> <p>c. Analyze and interpret data suggesting that over geologic time, discrete bursts of rapid genetic changes and gradual changes have resulted in speciation</p> <p>d. Analyze and interpret data on how evolution can be driven by three key components of natural selection - heritability, genetic variation, and differential survival and reproduction</p> <p>e. Generate a model - an evolutionary tree - showing how a group of organisms is most likely diverged from common ancestry</p>	<p>Invention: Students will synthesize information from multiple sources and apply new ways to solve problems for their cognitive process</p> <p>Collaboration: Students will participate in peer review; respectfully discourse; mediate opposing perspectives; understand and apply knowledge of culture; seek other's ideas</p> <p>Critical Thinking and Reasoning: Students will: argue a point; justify reasoning; evaluate for purpose; infer to predict and draw conclusions; problem solve; understand and use logic</p> <p>Information Literacy: Students will: Evaluate information critically and competently; accessing appropriate tools to synthesize information distinguish fact/fiction/opinion/ point of view</p>	<p>the overuse of pesticides</p> <p>Students will create a scale poster to understand a timeline of evolution</p> <p>Students will watch Journey of Man and summarize how genetic info can be used to trace human origins and migrations</p> <p>Students will view Walking with Dinosaurs to see the evolution of mammals and plants</p> <p>Students will use dichotomous keys to identify and then classify macro-invertebrate and plant organism in Town Park</p>	<p>Lab supplies Textbook Internet DVD's</p>	<p>Notes/Reflections Phylogenetic trees Standardized test prep ?'s Timeline Field data</p>
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