Photosynthesis and Cellular Respiration Kit

Meet AP Biology Learning Objectives with our ThINQ!™ Investigations

The following tables list the AP Biology Learning Objectives (LOs), Essential Knowledge (EK), and Science Practices (SP) that are met by activities included in the Photosynthesis and Cellular Respiration Kit and provide specific details on how these activities align with the AP LOs.

AP Curriculum	Photosynthesis and Cellular Respiration Kit Alignment with AP LOs	Pre-lab			Investigations						Shrimp Case Study	Post Lab Q's
		1	2	3	1	2	3	4	5	6		
***Big Idea 1:** The process of evolution drives the diversity and unity of life.*		✓	✓									
LO 1.14 The student is able to pose scientific questions that correctly identify essential properties of shared, conserved core processes that provide insight into the history of life on Earth. **[EK 1.B.1 & SP 3.1]**	Based on similarities between the chloroplast and mitochondrion and between photosynthesis and cellular respiration, students pose questions about the evolutionary origins of these features and processes.	✓	✓									
LO 1.15 The student is able to describe specific examples of conserved core biological processes and features shared by all domains or within one domain of life and how these shared, conserved core processes and features support the concept of common ancestry for all organisms. **[EK 1.B.1 & SP 7.2]**	Students describe the similarities between the structure of the chloroplast and mitochondrion, and the processes of photosynthesis and cellular respiration, and use these similarities to support the argument for a common ancestry for prokaryotes and eukaryotes.	✓	✓									
LO 1.16 The student is able to justify the scientific claim that organisms share many conserved core processes and features that evolved and are widely distributed among organisms today. **[EK 1.B.1 & SP 6.1]**	Students use the similarities between the structure of the chloroplast and mitochondrion and between photosynthesis and cellular respiration to support the claim that these features and processes evolved and are present in organisms today.	✓	✓									

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AP Biology: Curriculum Alignment

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Big Idea 2: *Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.*		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
LO 2.1 The student is able to explain how biological systems use free energy based on empirical data that all organisms require constant energy input to maintain organization, to grow, and to reproduce. **[EK 2.A.1 & SP 6.2]**	Students use data collected during the investigations to describe the conversion of light energy to ATP and sugar during photosynthesis and sugar to ATP during cellular respiration.						✓	✓	✓	✓		✓
LO 2.2 The student is able to justify the scientific claim that free energy is required for living systems to maintain organization, to grow, or to reproduce, but that multiple strategies exist in different living systems. **[EK 2.A.1 & SP 6.4]**	Students compare the chemical, energy, and physical requirements for photosynthesis and cellular respiration to support the claim that organisms use one or both of these processes to maintain organization, to grow, or to reproduce.			✓	✓		✓	✓	✓	✓	✓	
LO 2.3 The student is able to predict how changes in free energy availability affect organisms, populations, and ecosystems. **[EK 2.A.1 & SP 6.4]**	Students describe the effect of nutrient/light availability on algae growth/photosynthesis and predict the effect this has on other organisms in that ecosystem.									✓	✓	✓
LO 2.4 The student is able to use representations to pose scientific questions about what mechanisms and structural features allow organisms to capture, store, and use free energy. **[EK 2.A.2 & SP 1.4, 3.1]**	Students create diagrams to describe key elements of photosynthesis and cellular respiration that allow organisms to capture, store, transfer, and transform free energy, and then use the diagrams to pose questions about how these processes can be investigated.	✓	✓	✓	✓							
LO 2.5 The student is able to construct explanations of the mechanisms and structural features of cells that allow organisms to capture, store, or use free energy. **[EK 2.A.2 & SP 6.2]**	Students create diagrams to explain how the structural features of the mitochondrion and chloroplast allow organisms to capture, store, transfer, and transform free energy necessary for cellular processes.	✓		✓	✓	✓	✓	✓	✓	✓		
LO 2.8 The student is able to justify the selection of data regarding the types of molecules that an animal, plant, or bacterium will take up as necessary building blocks and excrete as waste products. **[EK 2.A.3 & SP 4.1]**	Students explain the chemistry of using a pH indicator to monitor the production and consumption of CO_2 during photosynthesis and cellular respiration.			✓								
LO 2.9 The student is able to represent graphically or model quantitatively the exchange of molecules between an organism and its environment, and the subsequent use of these molecules to build new molecules that facilitate dynamic homeostasis, growth, and reproduction. **[EK 2.A.3 & SP 1.1, 1.4]**	Students generate graphs that represent the production and consumption of CO_2 during photosynthesis and cellular respiration.					✓	✓	✓	✓	✓		
LO 2.11 The student is able to construct models that connect the movement of molecules across membranes with membrane structure and function. **[EK 2.B.1 & SP 1.1, 7.1, 7.2]**	Students compare the structural similarities between the membranes of the chloroplast and mitochondrion and relate this to the functional similarities of the electron transport chain and ATP synthase in photosynthesis and cellular respiration.	✓	✓	✓	✓							
LO 2.13 The student is able to explain how internal membranes and organelles contribute to cell functions. **[EK 2.B.1 & SP 6.2]**	Students explain how the structure of cristae in mitochondria and thylakoids in chloroplasts contribute to increasing membrane surface area for ATP production in each organelle.	✓	✓									
LO 2.14 The student is able to use representations and models to describe differences in prokaryotic and eukaryotic cells. **[EK 2.B.1 & SP 1.4]**	Students compare and contrast the structure and function of chloroplasts and mitochondria to those of prokaryotes.	✓	✓									
LO 2.22 The student is able to refine scientific models and questions about the effect of complex biotic and abiotic interactions on all biological systems, from cells and organisms to populations, communities, and ecosystems. **[EK 2.D.1 & SP 1.3, 3.2]**	Based on data from the investigations and information from the case study, students make predictions and ask questions about the effect of complex biotic and abiotic interactions on biological systems, from the microscopic to the macroscopic, from cells and organisms to populations, communities, and ecosystems.					✓	✓	✓	✓	✓	✓	
LO 2.28 The student is able to use representations or models to analyze quantitatively and qualitatively the effects of disruptions to dynamic homeostasis in biological systems. **[EK 2.D.3 & SP 1.4]**	Based on information from the case study, students make predictions on the cause and effects of algae blooms and their effects on the surrounding ecosystem.										✓	✓

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Big Idea 4: *Biological systems interact, and these systems and their interactions possess complex properties.*		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
LO 4.4 The student is able to make a prediction about the interactions of subcellular organelles. **[EK 4.A.2 & SP 6.4]**	Students use models and drawings they have created to make predictions about how changes in the structure of either chloroplasts or mitochondria can affect photosynthesis and/or cellular respiration.	✓		✓		✓	✓	✓	✓	✓		
LO 4.5 The student is able to construct explanations based on scientific evidence as to how interactions of subcellular structures provide essential functions. **[EK 4.A.2 & SP 6.2]**	Students use diagrams of chloroplasts and mitochondria to explain the interdependence of the photosynthesis and cellular respiration that occur in these organelles in eukaryotes; that is, that the reactants for photosynthesis are the products of cellular respiration and vice versa.	✓		✓	✓	✓	✓	✓	✓	✓		
LO 4.6 The student is able to use representations and models to analyze situations qualitatively to describe how interactions of subcellular structures, which possess specialized functions, provide essential functions. **[EK 4.A.2 & SP 6.2]**	Students create a diagram to model how life on Earth today relies on the interdependence of photosynthesis and cellular respiration, which occur in the chloroplasts and mitochondria of eukaryotic cells.	✓		✓	✓							
LO 4.12 The student is able to apply mathematical routines to quantities that describe communities composed of populations of organisms that interact in complex ways. **[EK 4.A.5 & SP 2.2]**	Students mathematically analyze graphs that represent the net production/consumption of CO_2 by organisms in a mini-ecosystem.									✓		
LO 4.14 The student is able to apply mathematical routines to quantities that describe interactions among living systems and their environment, which result in the movement of matter and energy. **[EK 4.A.6 & SP 2.2]**	Students mathematically analyze graphs that represent the production and consumption of CO_2 during photosynthesis and cellular respiration.					✓	✓	✓	✓	✓		✓
LO 4.21 The student is able to predict consequences of human actions on both local and global ecosystems. **[EK 4.B.4 & SP 6.4]**	Students describe the effect of human CO_2 production on ocean acidification and the effect of agriculture on algae blooms, and then predict the consequences on local and global ecosystems.					✓					✓	✓

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