P51™ Chlorophyll Lab

Green Glows Red!

Standards alignment

NGSS: High school life science	P. 02
AP Biology	P. 03
AP Environmental Science	P. 05
TEKS: Biology	P. 06
TEKS: Biotechnology	P. 07
BACE	P. 08
Common Core ELA	P. 09

For additional information on alignment to state standards please contact support@minipcr.com

Next Generation Science Standards: High school life science

HIGH SCHOOL LIFE SCIENCE CONCEPTS		
HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.		
SCIENCE & ENGINEERING PRACTICES	**DISCIPLINARY CORE IDEAS**	**CROSSCUTTING CONCEPTS**
• Asking Questions and Defining Problems • Planning and Carrying Out Investigations • Analyzing and Interpreting Data • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • Obtaining, Evaluating, and Communicating Information	• LS1.C: Organization for Matter and Energy Flow in Organisms	• Cause and Effect • Systems and System Models • Energy and Matter • Structure and Function • Stability and Change

Advanced Placement Biology

COURSE CONTENT	
Unit 2: Cells	
Topic 2.1: Cell Structure and Function	
Learning Objective 2.1.A: Explain how the structure and function of subcellular components and organelles contribute to the function of cells.	
2.1.A.8	Chloroplasts are specialized organelles that are found in plants and photosynthetic algae. Chloroplasts contain a double membrane and serve as the location for photosynthesis.
Unit 3: Cellular Energetics	
Topic 3.3: Cellular Energy	
Learning Objective 3.3.A: Describe the role of energy in living organisms.	
3.3.A.1	All living systems require an input of energy.
Topic 3.4: Photosynthesis	
Learning Objective 3.4.A: Describe the photosynthetic processes and structural features of the chloroplast that allow organisms to capture and store energy.	
3.4.A.1	Photosynthesis is the series of reactions that use carbon dioxide (CO_2) water (H_2O) , and light energy to make carbohydrates and oxygen (O_2). i. Photosynthetic organisms capture energy from the sun and produce sugars that can be used in biological processes or stored.
3.4.A.2	Stroma and thylakoids are found within the chloroplast.
3.4.A.3	The light reactions of photosynthesis in eukaryotes involve a series of coordinated reaction pathways that capture energy present in light to yield ATP and NADPH, which power the production of organic molecules in the Calvin cycle. This provides energy for metabolic processes.
Unit 8: Ecology	
Topic 8.2: Energy Flow Through Ecosystems	
Learning Objective 8.2.D: Explain how the activities of autotrophs and heterotrophs enable the flow of energy within an ecosystem.	
8.2.D.1	Autotrophs capture energy from physical or chemical sources in the environment. i. Photosynthetic organisms capture energy present in sunlight contributing to primary productivity.
SCIENCE PRACTICES	
1. Concept Explanation: Explain biological concepts and processes presented in written format.	
A	Describe biological concepts and processes.
B	Explain biological concepts and processes.
C	Explain biological concepts and processes in applied contexts.
6. Argumentation: Develop and justify scientific arguments using evidence.	
A	Make a scientific claim.

B	Support a claim with evidence from biological principles, concepts, processes, and data.
C	Provide reasoning to justify a claim by connecting evidence to biological theories.
D	Explain the relationship between experimental results and larger biological concepts, processes, or theories.

Advanced Placement Environmental Science

COURSE CONTENT	
Unit 1: The Living World: Ecosystems	
Topic 1.9 Trophic Levels • Enduring Understanding ENG-1: Energy can be converted from one form to another.	
Learning Objective ENG-1.B: Explain how energy flows and matter cycles through trophic levels.	
ENG-1.B.1	All ecosystems depend on a continuous inflow of high-quality energy in order to maintain their structure and function of transferring matter between the environment and organisms via biogeochemical cycles.
ENG-1.B.1	In terrestrial and near-surface marine communities, energy flows from the sun to producers in the lowest trophic levels and then upward to higher trophic levels.
SCIENCE PRACTICES	
1. Concept Explanation: Explain environmental concepts, processes, and models presented in written format.	
A	Describe environmental concepts and processes.
B	Explain environmental concepts and processes.
4. Scientific Experiments: Analyze research studies that test environmental principles.	
A	Identify a testable hypothesis or scientific question for an investigation.
B	Identify a research method, design, and/or measure used.
C	Describe an aspect of a research method, design, and/or measure used.
D	Make observations or collect data from laboratory setups (not assessed).

Texas Essential Knowledge and Skills: Biology

HIGH SCHOOL BIOLOGY SCIENCE CONCEPTS	
11. Metabolic processes and enzymes	
A	Explain how matter is conserved and energy is transferred during photosynthesis and cellular respiration using models, including the chemical equations for these processes
HIGH SCHOOL SCIENCE AND ENGINEERING PRACTICES	
SEP 1. Investigations	
A	Ask questions and define problems based on observations or information from text, phenomena, models, or investigations
B	Apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems
C	Use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards
D	Use appropriate tools such as microscopes, slides, Petri dishes, laboratory glassware, metric rulers, digital balances, pipets, filter paper, micropipettes, gel electrophoresis and polymerase chain reaction (PCR) apparatuses, microcentrifuges, water baths, incubators, thermometers, hot plates, data collection probes, test tube holders, lab notebooks or journals, hand lenses, and models, diagrams, or samples of biological specimens or structures
E	Collect quantitative data using the International System of Units (SI) and qualitative data as evidence
SEP 3. Explanations	
A	Develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories
B	Communicate explanations and solutions individually and collaboratively in a variety of settings and formats
C	Engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence
SEP 4. Scientist contributions	
A	Analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student

Texas Essential Knowledge and Skills: Biotechnology

HIGH SCHOOL BIOTECHNOLOGY CONCEPTS	
3. Scientific methods	
E	Plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting, handling, and maintaining appropriate equipment and technology
F	Collect data individually or collaboratively, make measurements with precision and accuracy, record values using appropriate units, and calculate statistically relevant quantities to describe data, including mean, median, and range
G	Demonstrate the use of course apparatus, equipment, techniques, and procedures
H	Organize, analyze, evaluate, build models, make inferences, and predict trends from data
10. Procedure performance	
A	Identify and operate laboratory equipment, including a microscope, thermocycler, hood, pH meter, hot plate stirrer, balance, mixers, autoclave, power supply, micropipette, centrifuge, and electrophoresis unit
B	Practice measuring volumes and weights to industry standards
D	Demonstrate proficiency pipetting techniques
F	Document laboratory results

Biotechnician Assistant Credentialing Exam

KNOWLEDGE PORTION OF EXAM
General topics in biotechnology
• Discuss current techniques used in biotechnology and their applications
Workplace safety and behavior
• Exercise proper laboratory safety protocols
PRACTICAL PORTION OF EXAM
Biotechnology skills
• Accurately measure liquids using micropipettes and serological pipets
Laboratory equipment: demonstrate proper and safe use of equipment
• Micropipettes & serological pipets
Research and scientific method
• Discuss good experimental design, including the proper use of controls

Common Core ELA/Literacy Standards (9-10)

RST.9-10.1	Cite specific textual evidence to support analysis of science and technical text, attending to the precise details of explanations or descriptions.
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.
RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
RST.9-10.5	Analyze the structure of the relationships among concepts in a text, including relationships among key terms (*E.g.* force, friction, reaction force, energy).
RST9-10.9	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
WHST.9-10.1	Write arguments focused on discipline-specific content.
WHST.9-10.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
WHST.9-10.9	Draw evidence from informational text to support analysis, reflection, and research.