



Park Hill School District

Building Successful Futures • Each Student • Every Day

High School Biology II Curriculum

Course Description: Biology II covers the first half of the AP Biology curriculum, aligned to the College Board's AP Biology Course and Exam Description (CED). The course includes the following units: Chemistry of Life, Cells, Cellular Energetics, and Cell Communication and the Cell Cycle. Students engage in a blend of instruction, hands-on inquiry-based laboratory investigations, and independent learning experiences designed to build conceptual understanding and scientific reasoning skills. Unit assessments and exams reflect college-level expectations and AP-style questioning. Biology II serves as the prerequisite course for students planning to enroll in AP Biology. ([AP Biology CED link](#))

Curriculum Standards: AP Biology Course Content Standards

Scope and Sequence:

Timeframe	Unit	Instructional Topics
10 Blocks	Unit 0: Introduction to Advanced Biology	0.1 Scientific Thinking 0.2 Experimental Design 0.3 Graphs 0.4 Statistics 0.5 Chi-Square Test 0.6 Properties of Life
13 Blocks	Unit 1: Chemistry of Life	1.1 Structure of Water and Hydrogen Bonding 1.2 Elements of Life 1.3 Introduction to Macromolecules 1.4 Carbohydrates 1.5 Lipids 1.6 Nucleic Acids 1.7 Proteins

19 Blocks	Unit 2: Cells	2.1 Cell Structure and Function 2.2 Cell Size 2.3 Plasma Membrane 2.4 Membrane Permeability 2.5 Membrane Transport 2.6 Facilitated Diffusion 2.7 Tonicity and Osmoregulation 2.8 Mechanisms of Transport 2.9 Cell Compartmentalization 2.10 Origins of Cell Compartmentalization
22 Blocks	Unit 3: Cellular Energetics	3.1 Enzymes 3.2 Environmental Impacts on Enzyme Function 3.3 Cellular Energy 3.4 Photosynthesis 3.5 Cellular Respiration
16 Blocks	Unit 4: Cell Communication and Cell Cycle	4.1 Cell Communication 4.2 Introduction to Signal Transduction 4.3 Signal Transduction Pathways 4.4 Feedback 4.5 Cell Cycle 4.6 Regulation of Cell Cycle

*Unit 0: Introduction to Advanced Biology is developed within the district curriculum. Units 1–4 align to the [College Board AP Biology Course and Exam Description \(CED\)](#); refer to the CED for detailed unit descriptions and learning objectives.

Curriculum Revision Tracking

Spring 2026

- The AP Biology Course and Exam Description (CED) was updated by the College Board, and the Biology 2 curriculum has been revised to reflect these changes and maintain alignment with AP Biology expectations.

Spring 2019

- Course description updated
- Timeframes for units all units adjusted
- Unit 1: Title changed from “Mechanisms of Evolution” to “Introduction to Advanced Biology”
 - Topic 1 changed from “Darwin” to “Scientific Skills and Statistics”
 - Topic 2 changed from “Evidence of Evolution” to “Animal Behavior”
 - Topic 3 changed from “Microevolution” to “Natural Selection”
 - Topic 4 eliminated
- Unit 3: Title changed from “The Cell” to “Cell Structure and Function”
 - Topic 1 added “Early Earth”
 - Cell Membrane changed to Topic 2
 - Topic 3 changed from “Cell” to “Cell and Cell Transport”
 - Topic “Cell Cycle” eliminated
- Unit 4 changed from “Mendelian Genetics” to “Cellular Energetics”
- Unit 5 changed from “Molecular Genetics” to “Cell Cycle”

Unit 0: Introduction to Advanced Biology

Subject: Biology II

Grade: 10-12

Name of Unit: Introduction to Advanced Biology

Length of Unit: 10 Blocks

Overview of Unit: Students are introduced to the foundational scientific practices that are essential for investigating biological phenomena throughout the AP Biology course. Students will use experimental design, data representation, statistical analysis, and scientific argumentation in hands-on practice.

Priority Standards for unit:

- Science Practice 3: Determine scientific questions and methods.
- Science Practice 4: Represent and describe data.
- Science Practice 5: Perform statistical tests and mathematical calculations to analyze and interpret data.
- Science Practice 6: Develop and justify scientific arguments using evidence

Learning Targets:

Priority Standard: Science Practice 3: Determine scientific questions and methods.

Learning Targets	Webb's DOK Level
	Bloom's Level
3.A: Identify or pose a testable question based on an observation, data, or a model.	2
	Applying
3.B: State the null hypothesis or predict the results of an experiment.	2
	Applying
3.C: Identify experimental procedures that align with the question, including: i. identifying dependent and independent variables ii. identifying appropriate controls iii. justifying appropriate controls	2
	Applying

Priority Standard: Science Practice 4: Represent and describe data.

Learning Targets	Webb's DOK Level
	Bloom's Level
4.A: Construct a graph to represent the data, including: x-y graphs (bar, histogram, line, log scale, dual y), scatter plot, box and whisker plot, and pie chart. The graph should include the following components: i. type of graph appropriate for the data ii. axis labeling, including appropriate units and legend iii. scaling iv. accurately plotted data (including error bars when appropriate) v. trend line (when appropriate)	4
	Creating
4.B: Describe data from a table or graph, including: i. identifying specific data points ii. describing trends and patterns in the data iii. describing relationships between variables	3
	Analyzing

Priority Standard: Science Practice 5: Perform statistical tests and mathematical calculations to analyze and interpret data.

Learning Targets	Webb's DOK Level
	Bloom's Level
5.A: Perform mathematical calculations, including: i. mathematical equations in the curriculum ii. means iii. rates iv. ratios v. percentages and percent changes	2
	Understanding
5.B: Use confidence intervals and error bars to estimate whether sample means are statistically different.	3
	Analyzing

5.C: Perform chi-square hypothesis testing.	2
	Understanding
5.D: Use data to evaluate a hypothesis or prediction, including rejecting or failing to reject the null hypothesis.	4
	Evaluating

Priority Standard: Science Practice 6: Develop and justify scientific arguments using evidence.	
Learning Targets	Webb's DOK Level
	Bloom's Level
6.A: Make a scientific claim.	2
	Understanding
6.B: Support a claim with evidence from biological principles, concepts, processes, and data.	2
	Applying
6.C: Provide reasoning to justify a claim by connecting evidence to biological theories.	3
	Evaluating

Essential Questions:

- How do biologists turn observations into testable questions and investigations?
- How do biologists use data to identify patterns and relationships?
- How do biologists determine whether data support a hypothesis?
- How do biologists use evidence and reasoning to construct scientific arguments?

Enduring Understanding/Big Ideas:

- Biologists use testable questions and intentional experimental designs to investigate biological phenomena. Science Practice 3: Questions and Methods — 3.A, 3.B, 3.C, 3.D
- Biologists represent and interpret data to identify patterns and relationships. Science Practice 4: Representing and Describing Data — 4.A, 4.B
- Biologists use mathematical and statistical analysis to evaluate evidence and hypotheses. Science Practice 5: Statistical Tests and Data Analysis — 5.A, 5.B, 5.C, 5.D
- Biologists use evidence and reasoning to construct scientific arguments and explain biological phenomena. Science Practice 6: Argumentation — 6.A, 6.B, 6.C, 6.D, 6.E

Unit Vocabulary:

- observation
- scientific question
- testable question
- hypothesis
- prediction
- null hypothesis
- experiment
- experimental design
- independent variable
- dependent variable
- controlled variable
- control group
- experimental group
- positive control
- negative control
- sample size
- replication
- repeated trials
- experimental procedure
- qualitative data
- quantitative data
- sources of error
- data
- data set
- table
- graph
- bar graph
- histogram
- line graph
- scatter plot
- box-and-whisker plot
- pie chart
- x-axis
- y-axis
- independent variable
- dependent variable
- units
- scale
- legend
- trend
- pattern
- relationship
- correlation
- outlier
- error bars
- trend line
- mean
- median
- range
- ratio
- rate
- percentage
- percent change
- variation
- sample mean
- confidence interval
- statistical significance
- statistical test
- chi-square test
- observed value
- expected value
- null hypothesis
- reject
- fail to reject
- hypothesis
- probability
- claim
- evidence
- reasoning
- scientific argument
- conclusion
- justification

Engaging Experience 1

Title: Oreo Lab

Suggested Length of Time: 2 blocks

Standards Addressed

Priority:

- Science Practice 3: Determine scientific questions and methods.
- Science Practice 4: Represent and describe data.
- Science Practice 5: Perform statistical tests and mathematical calculations to analyze and interpret data.
- Science Practice 6: Develop and justify scientific arguments using evidence

Topics Addressed

- 0.1 Scientific Thinking
- 0.2 Experimental Design
- 0.3 Graphs
- 0.4 Statistics

Detailed Description/Instructions: Students will research the question: Is there evidence that Double Stuf Oreos and Regular Oreos have different amounts of filling? They will use this question to create hypotheses, collect data, calculate variance, standard deviation, SEM, graph, add SEM bars to the graph, and analyze the data to create a CER to answer the question.

Bloom's Levels: Applying, Analyzing, Creating

Webb's DOK: 2-4

Engaging Experience 2

Title: Radish Seed Germination Lab

Suggested Length of Time: 5 Blocks

Standards Addressed

Priority:

- Science Practice 3: Determine scientific questions and methods.
- Science Practice 4: Represent and describe data.
- Science Practice 5: Perform statistical tests and mathematical calculations to analyze and interpret data.
- Science Practice 6: Develop and justify scientific arguments using evidence

Topics Addressed

- 0.1 Scientific Thinking
- 0.2 Experimental Design
- 0.3 Graphs
- 0.4 Statistics

Detailed Description/Instructions: Students are given two petri dishes, paper towels and radish seeds with the goal of investigating variables that affect the rate of germination. One dish serves as a control group and the other as an experimental group. Students grow the seeds over 5 days and collect data to write a formal lab report. Day 1 will take 20 minutes with each day after that taking about 5 minutes until the last day that will need about 45 minutes for a lab write-up.

Bloom's Levels: Applying, Analyzing, Creating

Webb's DOK: 2-4

Engaging Experience 3

Title: Chi-Square Modeling using M&Ms or Skittles

Suggested Length of Time: ½ Block

Standards Addressed

Priority:

- Science Practice 3: Determine scientific questions and methods.
- Science Practice 5: Perform statistical tests and mathematical calculations to analyze and interpret data.

Topics Addressed

- 0.4 Statistics
- 0.5 Chi-Square Test

Detailed Description/Instructions: Students get a small cup of M&Ms or skittles and count colors to test if they match the company's website percentages as expected values. Students could also predict there should be equal amounts of each color in a sample as their expected values.

Bloom's Levels: Applying, Analyzing

Webb's DOK: 2-3

Engaging Experience 4

Title: Finding Mr. Right Data Nugget

Suggested Length of Time: 1 block

Standards Addressed

Priority:

- Science Practice 3: Determine scientific questions and methods.
- Science Practice 4: Represent and describe data.
- Science Practice 5: Perform statistical tests and mathematical calculations to analyze and interpret data.
- Science Practice 6: Develop and justify scientific arguments using evidence

Topics Addressed

- 0.1 Scientific Thinking
- 0.2 Experimental Design
- 0.3 Graphs
- 0.4 Statistics
- 0.6 Properties of Life

Detailed Description/Instructions: Students will review background information for a research study on how female mate choice contributes to local adaptation in mountain chickadees.

Students will examine data, graph results, draw conclusions, and write a CER.

Bloom's Levels: Applying, Analyzing, Creating

Webb's DOK: 2-4

Engaging Experience 5

Title: Is It Alive? — The Biological Boundary Problem

Suggested Length of Time: 1 block

Standards Addressed

Priority:

- Science Practice 3: Determine scientific questions and methods.
- Science Practice 6: Develop and justify scientific arguments using evidence

Topics Addressed

- 0.1 Scientific Thinking
- 0.2 Experimental Design
- 0.3 Graphs
- 0.4 Statistics
- 0.6 Properties of Life

Detailed Description/Instructions: Students will evaluate evidence from unfamiliar biological systems and construct an evidence-based argument about whether a system should be considered alive, using the properties of life as criteria.

Students will begin by developing a working definition of life and identifying the characteristics they believe are essential to living systems. They will then analyze evidence from a variety of biological and nonbiological systems, including viruses, fire, crystals, seeds, prions, and organisms that challenge traditional definitions of life.

Working collaboratively, students will use an evidence matrix to determine which properties of life are exhibited by each system. Students must consider the limitations of using a simple checklist of characteristics and evaluate exceptions and gray areas.

Students will then analyze an unfamiliar hypothetical biological system and develop a Claim-Evidence-Reasoning (CER) argument determining whether the system should be classified as living. Their argument must incorporate multiple properties of life, use specific evidence, address a counterargument, and justify which characteristic(s) provide the strongest evidence for their conclusion.

Bloom's Levels: Understand, Apply, Analyze, Evaluate, Create

Webb's DOK: 3-4

Engaging Experience 6

Title: Bird Beaks Lab (Beaks as Tools HHMI)

Suggested Length of Time: 1 block

Standards Addressed

Priority:

- Science Practice 3: Determine scientific questions and methods.
- Science Practice 4: Represent and describe data.
- Science Practice 5: Perform statistical tests and mathematical calculations to analyze and interpret data.
- Science Practice 6: Develop and justify scientific arguments using evidence

Topics Addressed

- 0.1 Scientific Thinking
- 0.2 Experimental Design
- 0.3 Graphs
- 0.4 Statistics
- 0.6 Properties of Life

Detailed Description/Instructions: Students are “birds” and select an adaptation (skewer, fork or tweezers) and feed (collect objects from a bucket/tub/tank). Post lab includes graphing and applying properties of life to the "birds."

Bloom’s Levels:

Webb’s DOK:

Engaging Scenario

Engaging Scenario (An Engaging Scenario is a culminating activity that includes the following components: situation, challenge, specific roles, audience, product or performance.) Students will design an experiment, collect data, perform statistical tests, including a chi-square analysis of a data set gathered from a scientific investigation of their design.

Summary of Engaging Learning Experiences for Topics

Engaging Experience Title	Topic(s) Covered	Description	Suggested Length of Time
Oreo Lab	0.1 Scientific Thinking 0.2 Experimental Design 0.3 Graphs 0.4 Statistics	Students will research the question: Is there evidence that Double Stuf Oreos and Regular Oreos have different amounts of filling? They will use this question to create hypotheses, collect data, calculate variance, standard deviation, SEM, graph, add SEM bars to the graph, and analyze the data to create a CER to answer the question.	2 blocks
Radish Seed Germination Lab	0.1 Scientific Thinking 0.2 Experimental Design 0.3 Graphs 0.4 Statistics	Students are given two petri dishes, paper towels and radish seeds with the goal of investigating variables that affect the rate of germination. One dish serves as a control group and the other as an experimental group. Students grow the seeds over 5 days and collect data to write a formal lab report. Day 1 will take 20 minutes with each day after that taking about 5 minutes until the last day that will need about 45 minutes for a lab write-up.	2 blocks (with 5 days between)
Chi-Square Modeling using M&Ms or Skittles	0.4 Statistics 0.5 Chi-Square Test	Students get a small cup of M&Ms or skittles and count colors to test if they match the company's website percentages as expected values. Students could also predict there should be equal amounts of each color in a sample as their expected values.	½ block
Finding Mr. Right Data Nugget	0.1 Scientific Thinking 0.2 Experimental Design	Students will review background information for a research study on how female mate choice contributes to local	1 block

	0.3 Graphs 0.4 Statistics 0.6 Properties of Life	adaptation in mountain chickadees. Students will examine data, graph results, draw conclusions, and write a CER.	
Is It Alive? — The Biological Boundary Problem	0.1 Scientific Thinking 0.2 Experimental Design 0.3 Graphs 0.4 Statistics 0.6 Properties of Life	Students will evaluate evidence from unfamiliar biological systems and construct an evidence-based argument about whether a system should be considered alive, using the properties of life as criteria.	1 block
Bird Beaks Lab (Beaks as Tools HHMI)	0.1 Scientific Thinking 0.2 Experimental Design 0.3 Graphs 0.4 Statistics 0.6 Properties of Life	Students are “birds” and select an adaptation (skewer, fork or tweezers) and feed (collect objects from a bucket/tub/tank). Post lab includes graphing and applying properties of life to the “birds.”	1 block
Animal Behavior Lab	0.1 Scientific Thinking 0.2 Experimental Design 0.3 Graphs 0.4 Statistics 0.5 Chi-Square Test 0.6 Properties of Life	Students will design an experiment, collect data, perform statistical tests, including a chi-square analysis of a data set gathered from a scientific investigation of their design.	3 blocks

Unit of Study Terminology

Appendices: All Appendices and supporting material can be found in this course's shell course in the District's Learning Management System.

Assessment Leveling Guide: A tool to use when writing assessments in order to maintain the appropriate level of rigor that matches the standard.

Big Ideas/Enduring Understandings: Foundational understandings teachers want students to be able to discover and state in their own words by the end of the unit of study. These are answers to the essential questions.

Engaging Experience: Each topic is broken into a list of engaging experiences for students. These experiences are aligned to priority and supporting standards, thus stating what students should be able to do. An example of an engaging experience is provided in the description, but a teacher has the autonomy to substitute one of their own that aligns to the level of rigor stated in the standards.

Engaging Scenario: This is a culminating activity in which students are given a role, situation, challenge, audience, and a product or performance is specified. Each unit contains an example of an engaging scenario, but a teacher has the ability to substitute with the same intent in mind.

Essential Questions: Engaging, open-ended questions that teachers can use to engage students in learning.

Priority Standards: What every student should know and be able to do. These were chosen because of their necessity for success in the next course, the state assessment, and life.

Supporting Standards: Additional standards that support the learning within the unit.

Topic: These are the main teaching points for the unit. Units can have anywhere from one topic to many, depending on the depth of the unit.

Unit of Study: Series of learning experiences/related assessments based on designated priority standards and related supporting standards.

Unit Vocabulary: Words students will encounter within the unit that are essential to understanding. Academic Cross-Curricular words (also called Tier 2 words) are those that can be found in multiple content areas, not just this one. Content/Domain Specific vocabulary words are those found specifically within the content.