AP Biology

INTRODUCTION

Poll

A. confident

B. okay

C. unconfident

D. not sure

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Collaborate Board

What biology topics do you remember learning?

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AP Biology Curriculum Framework

- There are 4 Big Ideas:
  1. Evolution
  2. Energetics
  3. Information Storage and Transmission
  4. System Interactions

AP Biology Units

- There are 8 Units
  - Unit 1: Chemistry of Life
  - Unit 2: Cell Structure and Function
  - Unit 3: Cellular Energetics
  - Unit 4: Cell Communication and Cell Cycle
  - Unit 5: Heredity
  - Unit 6: Gene Expression and Regulation
  - Unit 7: Natural Selection
  - Unit 8: Ecology

AP Biology Curriculum Framework

- The AP biology curriculum consists of the following parts:
  - 17 Enduring Understandings (Concepts)
  - 55 Essential Knowledge
  - 149 Learning Objectives
  - 6 Science Practices

Curriculum Framework Examples

Appendix

AP Biology Concepts at a Glance

Big Idea 1: The process of evolution drives the diversity and unity of life.

Enduring understanding 1.A: Change in the genetic makeup of a population over time is evolution.	**Essential knowledge 1.A.1:** Natural selection is a major mechanism of evolution.
	Essential knowledge 1.A.2: Natural selection acts on phenotypic variations in populations.
	Essential knowledge 1.A.3: Evolutionary change is also driven by random processes.
	Essential knowledge 1.A.4: Biological evolution is supported by scientific evidence from many disciplines, including mathematics.
Enduring understanding 1.B: Organisms are linked by lines of descent from common ancestry.	**Essential knowledge 1.B.1:** Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.
	Essential knowledge 1.B.2: Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested.
Enduring understanding 1.C: Life continues to evolve within a changing environment.	**Essential knowledge 1.C.1:** Speciation and extinction have occurred throughout the Earth's history.
	Essential knowledge 1.C.2: Speciation may occur when two populations become reproductively isolated from each other.
	Essential knowledge 1.C.3: Populations of organisms continue to evolve.
Enduring understanding 1.D: The origin of living systems is explained by natural processes.	**Essential knowledge 1.D.1:** There are several hypotheses about the natural origin of life on Earth, each with supporting scientific evidence.
	Essential knowledge 1.D.2: Scientific evidence from many different disciplines supports models of the origin of life.

c. Phylogenetic trees and cladograms can be constructed from morphological similarities of living or fossil species, and from DNA and protein sequence similarities, by employing computer programs that have sophisticated ways of measuring and representing relatedness among organisms.

d. Phylogenetic trees and cladograms are dynamic (i.e., phylogenetic trees and cladograms are constantly being revised), based on the biological data used, new mathematical and computational ideas, and current and emerging knowledge.

Learning Objectives:

LO 1.17 The student is able to pose scientific questions about a group of organisms whose relatedness is described by a phylogenetic tree or cladogram in order to (1) identify shared characteristics, (2) make inferences about the evolutionary history of the group, and (3) identify character data that could extend or improve the phylogenetic tree. [See **SP 3.1**]

LO 1.18 The student is able to evaluate evidence provided by a data set in conjunction with a phylogenetic tree or a simple cladogram to determine evolutionary history and speciation. [See **SP 5.3**]

LO 1.19 The student is able create a phylogenetic tree or simple cladogram that correctly represents evolutionary history and speciation from a provided data set. [See **SP 1.1**]

Enduring understanding 1.C: Life continues to evolve within a changing environment.

Speciation and extinction have occurred throughout the Earth's history, and life continues to evolve within a changing environment. However, the rates of speciation and extinction vary. Speciation can be slow and gradual or, as described by punctuated equilibrium, can occur in "bursts" followed by relatively quiet periods. At times of ecological stress, extinction rates can be rapid, and mass extinctions are often followed by adaptive radiation, the rapid evolution of species when new habitats open. Scientific evidence, including emergent diseases, chemical resistance and genomic data, supports the idea that evolution occurs for all organisms and that evolution explains the diversity of life on the planet.

A species can be defined as a group of individuals capable of interbreeding and exchanging genetic information to produce viable, fertile offspring. New species arise when two populations diverge from a common ancestor and become reproductively isolated. Although speciation can occur by different processes, reproductive isolation must be maintained for a species to remain distinct. Evidence that speciation has occurred includes fossil records and genomic data.

Curriculum Framework Example

- **Big Idea 1: The process of evolution drives the diversity and unity of life.**
- **EU 1.A: Change in the genetic makeup of a population over time is evolution.**
- **Essential Knowledge 1.A.1: Natural selection is a major mechanism of evolution.**
- ● LO 1.1 . . .convert a data set from a table of numbers that reflect a change in the genetic makeup of a population over time and to apply mathematical methods and conceptual understandings to investigate the cause(s) and effect(s) of this change. [SP 1.5, 2.2]
- ● LO 1.2 . . .evaluate evidence provided by data to qualitatively and quantitatively investigate the role of natural selection in evolution. [SP 2.2, 5.3]
- ● LO 1.3 . . .apply mathematical methods to data from a real or simulated population to predict what will happen to the population in the future. [SP 2.2]
- **Essential Knowledge 1.A.2: Natural selection acts on phenotypic variations in populations.**
- ● LO 1.4 . . .evaluate data-based evidence that describes evolutionary changes in the genetic makeup of a population over time. [SP 5.3]
- ● LO 1.5 . . .connect evolutionary changes in a population over time to a change in the environment. [SP 7.1]
- **Essential Knowledge 1.A.3: Evolutionary change is also driven by random processes.**
- ● LO 1.6 . . .use data from mathematical models based on the Hardy-Weinberg equilibrium to analyze genetic drift and effects of selection in the evolution of specific populations. [SP 1.4, 2.1]
- ● LO 1.7 . . .justify data from mathematical models based on the Hardy-Weinberg equilibrium to analyze genetic drift and the effects of selection in the evolution of specific populations. [SP 2.1]
- ● LO 1.8 . . .make predictions about the effects of genetic drift, migration and artificial selection on the genetic makeup of a population. [SP 6.4]
- **Essential Knowledge 1.A.4: Biological evolution is supported by scientific evidence from many disciplines, including mathematics.**
- ● LO 1.9 . . .evaluate evidence provided by data from many scientific disciplines that support biological evolution. [SP 5.3]
- ● LO 1.10 . . .refine evidence based on data from many scientific disciplines that support biological evolution. [SP 5.2]
- ● LO 1.11 . . .design a plan to answer scientific questions regarding how organisms have changed over time using information from morphology, biochemistry and geology. [SP 4.2]
- ● LO 1.12 . . .connect scientific evidence from many scientific disciplines to support the modern concept of evolution. [SP 7.1]
- ● LO 1.13 . . .construct and/or justify mathematical models, diagrams or simulations that represent processes of biological evolution. [SP 1.1, 2.1]

The 6 Science Practices

1. Concept Explanation: Explain biological concepts, processes, and models presented in written format.
2. Visual Representation: Analyze visual representations of biological concepts and processes.
3. Questions and Methods: Determine scientific questions and methods.
4. Representing and Describing Data: Represent and describe data.
5. Statistical Tests and Data Analysis: Perform statistical tests and mathematical calculations to analyze and Interpret data.
6. Argumentation: Develop and justify scientific

AP Score Distribution

AP Score	Recommendation
5	Extremely well qualified
4	Well qualified
3	Qualified
2	Possibly qualified
1	No recommendation

AP Biology Exam Format

The first part of the exam is 90 minutes and it is worth 50% of the total score.

- 60 multiple-choice questions

The second part of the exam is 90 minutes and it is worth 50% of the total score.

- 2 long free response
- 4 short free response

Question 1 : Interpreting and Evaluating Experimental Results (8–10 pts)

Question 2 : Interpreting and Evaluating Experimental Results with Graphing (8–10 pts)

Question 3 : Scientific Investigation (4 pts)

Question 4 : Conceptual Analysis (4 pts) Question 5: Analyze Model or Visual Representation (4 pts)

Question 6 : Analyze Data (4 pts)

Open Ended Question

Ready? Enter your answer here.

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AP Biology Exam Format

The whole test takes 180 minutes (3 hours) to complete.

You are allowed to use the following for the exam:

a) four-function calculator, scientific calculator, and graphing calculator (no longer needed)

b) formula sheet

Multiple-Choice Section

The multiple-choice section is based on the following units and their weights:

Unit	Exam Weighting
1. Chemistry of Life	8 - 11%
2. Cell Structure and Function	10-13%
3. Cellular Energetics	12-16%
4. Cell Communication and Cell Cycle	10-15%
5. Heredity	8-11%
6. Gene Expression and Regulation	12-16%
7. Natural Selection	13-20%
8. Ecology	10-15%

Open Ended Question

Ready? Enter your answer here.

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Sample Exam Questions

AP BIOLOGY SAMPLE EXAM QUESTIONS

Sample Multiple-Choice Question

Two flasks with identical medium containing nutrients and glucose are inoculated with yeast cells that are capable of both anaerobic and aerobic respiration. Culture 1 is then sealed to prevent fresh air from reaching the culture; culture 2 is loosely capped to permit air to reach the culture. Both flasks are periodically shaken.

*Which of the following best **predicts** which culture will contain more yeast cells after one week, and most accurately **justifies** that prediction?*

A. Culture 1, because fresh air is toxic to yeast cells and will inhibit their growth

B. Culture 1, because fermentation is a more efficient metabolic process than cellular respiration

C. Culture 2, because fresh air provides essential nitrogen nutrients to the culture

D. Culture 2, because oxidative cellular respiration is a more efficient metabolic process than fermentation.

Correct Answer: D

Sample Grid-In Question

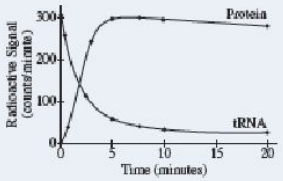
The data below demonstrate the frequency of tasters and non-tasters in an isolated population at Hardy-Weinberg equilibrium. The allele for non-tasters is recessive.

How many of the tasters in the population are heterozygous for tasting?

Tasters	Non-Tasters
8235	4328

Sample Short Free-Response Question

The role of tRNA in the process of translation was investigated by the addition of tRNA with attached radioactive leucine to an in vitro translation system that included mRNA and ribosomes. The results are shown by the graph.



*In a **short paragraph**, describe how this figure justifies the claim that the role of tRNA is to carry amino acids that are then transferred from the tRNA to growing polypeptide chains.*

AP Biology Exam Format

Section I		
Question Type	**Number of Questions**	**Timing**
Part A: Multiple Choice	60	90 minutes
Section II		
Question Type (Part B)	**Number of Questions**	**Timing**
Long Free Response	2	90 minutes
Short Free Response	4	

AP Biology Labs

There are 13 AP biology labs.

1. Artificial Selection
2. Mathematical Modeling: Hardy-Weinberg
3. Comparing DNA Sequences To Understand Evolutionary Relationships With Blast
4. Diffusion And Osmosis
5. Photosynthesis

AP Biology Labs

6. Cellular Respiration
7. Cell Division: Mitosis And Meiosis
8. Biotechnology: Bacterial Transformation
9. Biotechnology: Restriction Enzyme Analysis of DNA
10. Energy Dynamics
11. Transpiration
12. Fruit Fly Behavior
13. Enzyme Activity

AP Biology Labs

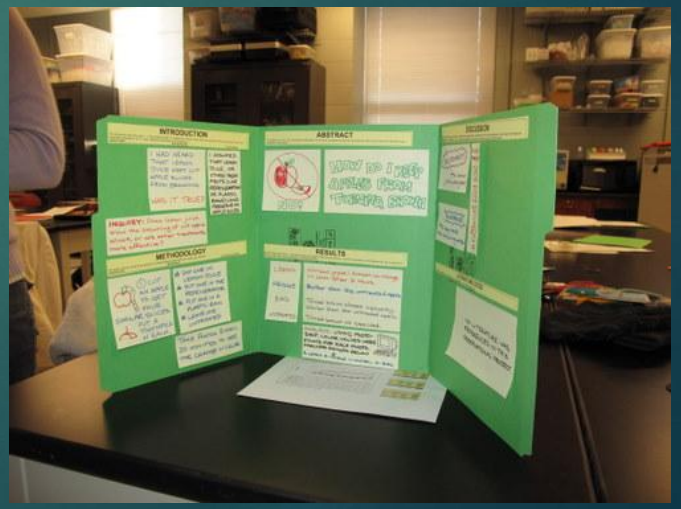
Each of the labs involve INQUIRY and the 6 science practices.

Some of the labs will be in the following format:

1. Written
2. Poster Board

Formal Lab Report Format

- A good lab report format includes six main sections:
- Title
- Introduction
- Materials and Methods
- Results
- Conclusion
- References



What is the Exam Date for AP Biology?

- Monday, May 5, 2025 at 8:00 a.m.

Quiz

A. Evolution

B. DNA and RNA

C. Energetics

D. System Interactions

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