Syllabus

Biology A

Course Overview

Biology is a science dedicated to studying all forms of life on Earth. You are probably familiar with life on a large scale, but do you know what makes up life? This course will teach you about the smallest building block of life—the cell. You will learn what makes a cell, how cells are built and their functions, as well as how mutations in cells can cause them to change genetically.

Course Goals

By the end of the course the student will be able to do the following:

- Describe the basic building blocks of life.
- Describe the structure and functions of a cell.
- Identify the chemicals which make up individual cells.
- Explain how gene-based inheritance in genetics works.
- Explain how mutations affect molecular genetics.
- Explain the processes of macro and micro evolution.

Math and Science Skills

Successful completion of Algebra 1 provides the mathematical skills you'll need for Biology A.

In addition, you should have a good working understanding of inquiry science methods, including:

- Experimental design, including the importance of experimental controls.
- Basic data analysis skills, including the ability to interpret mathematical patterns from data tables and graphs.
- The ability to use experimental results and/or real data sets to propose general rules.

General Skills

To participate in this course, you should be able to do the following:

- Complete basic operations with word processing software, such as Microsoft Word or Google Docs.
- Understand the basics of spreadsheet software, such as Microsoft Excel or Google Spreadsheets, but having prior computing experience is not necessary.
- Perform online research using various search engines and library databases.
- Communicate through email and participate in discussion boards.

For a complete list of general skills that are required for participation in online courses, refer to the Prerequisites section of the Plato Student Orientation document, found at the beginning of this course.

Credit Value

Biology A is a 0.5-credit course.

Course Materials

- Notebook
- Graphing calculator, recommend TI-83 or equivalent
- Computer with Internet connection and speakers or headphones
- Microsoft Word or equivalent

Course Pacing Guide

This course description and pacing guide is intended to help you keep on schedule with your work. Note that your course instructor may modify the schedule to meet the specific needs of your class.

Unit 1: Nature of Life

Summary

This unit provides a conceptual understanding the nature of life on Earth. The unit begins by explaining how scientific methods can channel human curiosity into purposeful inquiry about living things. It then explores how to conduct research in biology by safely using lab equipment and how to communicate the results of that research. The unit goes on to cover the basic concepts of chemistry that are relevant to biology. They include the structure of an atom, isotopes, ions, ionic and covalent bonds, solutions, suspensions, and colloids. The chemistry-related content also includes the properties and chemical structure of water; the role of acids, bases, and buffers in biology; and the role of the carbon atom in building organic compounds. The unit concludes by identifying the basic functional groups that build the molecules of life, such as hydroxyl, carboxyl, carbonyl, amino, sulfhydryl, and phosphate.

Day	**Activity***/Objective*	Type
1 day: 1	**Syllabus and Plato Student Orientation** *Review the Plato Student Orientation and Course Syllabus at the beginning of this course.*	Course Orientation
1 day: 2	**What Is Biology?** *Demonstrate understanding of how new knowledge is added to biology.*	Tutorial
1 day: 3	**Conducting Biology Research** *Demonstrate ability to safely and properly use lab equipment in a scientific experiment.*	Tutorial

1 day: 4	**Communicating Your Results** *Demonstrate ability to communicate results of scientific investigations to others.*	Tutorial
2 days: 5–6	**The Chemical Nature of Biology** *Demonstrate sufficient knowledge of basic chemistry to be able to understand the chemical nature of biology.*	Tutorial
2 days: 7–8	**Water: An Essential for Life** *Describe the properties of water that makes it an essential molecule of life.*	Exploration
2 days: 9–10	**Acids, Bases, and Buffers** *Explain the nature and role of acids, bases, and buffers in biology.*	Tutorial
2 days: 11–12	**Carbon: A Central Building Block** *Explain the unique chemistry of the carbon atom and why it is central to building organic compounds.*	Tutorial
2 days: 13–14	**Unit Activity and Discussion—Unit 1**	Unit Activity Discussion
1 day: 15	**Posttest—Unit 1**	Assessment

Unit 2: The Chemistry of the Cell

Summary
This unit provides a basic understanding of how natural processes work at the cell and molecular levels. It begins by explaining that most biomolecules are polymers of smaller molecules called monomers. It then goes on to describe how the major groups of biological molecules, such as carbohydrates, lipids, proteins, and nucleic acids, function in natural systems. It explains how energy transformation through metabolic pathways is the core process that defines life. This unit also discusses the structure, function, and denaturation of enzymes. It concludes by comparing prokaryotic and eukaryotic cells in terms of their size and complexity.

Day	**Activity/***Objective*	Type
2 days: 16-17	**Polymers: Combinations of Monomers** *Explain the relationship between monomers and polymers in biological chemistry.*	Tutorial
2 days: 18-19	**Carbohydrates, Lipids, Proteins, and Nucleic Acids** *Describe the structure, variations, and functions of the four major groups of biological molecules.*	Tutorial
2 days: 20-21	**Transforming Energy** *Recognize that life is a series of organized metabolic pathways that involve transforming energy.*	Tutorial
2 days: 22-23	**Enzymes** *Explain the structure, function and denaturation of enzymes.*	Tutorial
2 days: 24–25	**Cells: Prokaryotic and Eukaryotic** *Compare and contrast prokaryotic and eukaryotic cells in terms of size and complexity.*	Exploration
2 days: 26–27	**Unit Activity and Discussion—Unit 1**	Unit Activity Discussion
1 day: 28	**Posttest—Unit 1**	Assessment

Unit 3: Cell Structures and Functions

Summary
This unit introduces cell functions as the organizing structures of life. It begins with an overview of the structures and functions of cells and then explores the techniques that biologists use to study them. The unit then moves on to explain how materials are transported in and out of cells through osmosis, diffusion, and cellular transport. It also explores how cells use organic compounds and sunlight to generate their own energy. The unit concludes by addressing the concept of the cell cycle and the internal and external control systems that regulate the cell cycle.

Day	**Activity/***Objective*	Type
2 days: 29–30	**Overview of Cell Structures and Functions** *Describe the general structure and ultrastructures of cells and relate these structures to their function in cells.*	Tutorial
2 days: 31–32	**Osmosis, Diffusion, and Cellular Transport** *Explain how materials are transported in and out of cells.*	Exploration
2 days: 33–34	**Energy in Cells** *Discuss in detail how cells use organic compounds as their energy source.*	Tutorial
2 days: 35–36	**Photosynthesis** *Discuss in detail how plants convert light energy into chemical energy in a stable form for all life to use.*	Exploration
2 days: 37–38	**The Cell Cycle** *Describe the cell cycle and how it is regulated.*	Exploration
2 days: 39–40	**Regulating the Cell Cycle** *Explain how the cell cycle is controlled and regulated in a cell.*	Tutorial
2 days 41–42	**Unit Activity and Discussion—Unit 3**	Unit Activity Discussion
1 day: 43	**Posttest—Unit 3**	Assessment

Unit 4: Descriptive Genetics

Summary
In this unit, you will learn how all living things inherit traits from their parents. It begins with the two types of reproduction, sexual and asexual, and the two related types of cell division, mitosis and meiosis. The unit then goes on to cover inheritance, beginning with the history of genetics as explored by Gregor Mendel, the father of genetics. The unit ends by explaining and comparing the concepts of gene-based and chromosome-based inheritance.

Day	**Activity/***Objective*	Type
2 days: 44–45	**Sexual Reproduction** *Describe how sexual reproduction contributes to genetic diversity.*	Tutorial
2 days: 46–47	**Meiosis in Life Cycles** *Explain the process and role of meiosis in sexual life cycles.*	Tutorial
2 days: 48–49	**Mendelian Genetics** *Explain and solve problems involving basic Mendelian genetics.*	Exploration
2 days: 50–51	**Gene-Based Inheritance** *Explain and solve problems involving gene based inheritance discovered since Mendel.*	Tutorial
2 days: 52–53	**Chromosomal Inheritance** *Describe experiments that led to the discovery of, and solve problems related to chromosomal inheritance.*	Tutorial
2 days 54–55	**Unit Activity and Discussion—Unit 4**	Unit Activity Discussion
1 day: 56	**Posttest—Unit 4**	Assessment

Unit 5: Molecular Genetics

Summary
This unit goes deeper into the concept of inheritance by covering DNA and genetic engineering. It begins with an overview of DNA and genes, which includes their structures and functions. This unit then goes on to explore mutation and its role in altering protein structures, as well as how genes are controlled in prokaryotic and eukaryotic cells. The unit ends by describing common methods of genetic engineering and some of their applications.

Day	**Activity/***Objective*	Type
2 days: 57–58	**Overview of DNA** *Describe the replication and repair of DNA.*	Tutorial
2 days: 59–60	**DNA and Genes** *Explain the nature and role of mutations in altering protein structure.*	Exploration
2 days: 61–62	**Mutations of Cells** *Explain the nature and role of mutations in altering protein structure.*	Tutorial
2 days: 63–64	**Genetic Control** *Describe how genetic control in prokaryotes occurs.*	Tutorial
2 days: 65–66	**Genetic Engineering** *Describe common methods of genetic engineering and some of their applications.*	Tutorial
2 days 67–68	**Unit Activity and Discussion—Unit 5**	Unit Activity Discussion
1 day: 69	**Posttest—Unit 5**	Assessment

Unit 6: Evolution

Summary
In this unit, you will study genetic concepts in evolution and how discoveries in genetics led to Darwin's concept of an evidence-based theory. This unit begins by explaining how Darwin developed his theory of natural selection. It then goes on to explore the concept of gene frequency, including the Hardy-Weinberg equilibrium and factors that change gene frequencies in a population, such as natural selection, mutation, nonrandom mating, genetic drift, and gene flow. This unit also explains the concepts of microevolution, adaptive evolution, speciation, punctuated equilibrium, and macroevolution. It delves into how biologists trace organisms' phylogeny by obtaining evidence of evolution through the study of fossils, anatomy, and embryos of organisms. This unit ends by outlining the history of the evolution of life on Earth.

Day	**Activity/***Objective*	Type
2 days: 70–71	**Darwin and Natural Selection** *Explain how Darwin developed his theory of natural selection.*	Tutorial
2 days: 72–73	**Gene Frequencies** *Show how changes in gene frequencies can lead to evolutionary changes.*	Exploration
2 days: 74–75	**Microevolution** *Discuss how microevolution results from changes in gene frequencies in a population.*	Tutorial
2 days: 76–77	**Adaptive Evolution** *Explain how genetic variation arises in a population and can result in adaptive evolution.*	Tutorial
2 days: 78–79	**Speciation** *Explain the most common mechanisms in evolution that lead to speciation.*	Tutorial
2 days: 80–81	**Macroevolution** *Describe the concept of punctuated equilibrium and how it contributes to macroevolution.*	Tutorial
2 days: 82–83	**Phylogeny** *Describe how evidence of evolution obtained by various methods allows biologists to trace organism's phylogeny.*	Tutorial

2 days: 84–85	**Evolution of Life on Earth** *Outline the history of the evolution of life on Earth.*	Exploration
2 days: 86–87	**Unit Activity and Discussion—Unit 6**	Unit Activity Discussion
1 day: 88	**Posttest—Unit 6**	Assessment
1 day: 89	**Semester Review**	
1 day: 90	**End-of-Semester Exam**	Assessment