



Advanced Biology – Part 1

Michigan State Curriculum Content Standards

Course Description

The Advanced Biology curriculum is organized to mirror a two-semester introductory biology course for biology majors. Some colleges and universities may grant credit for an introductory course after successful completion (generally defined as a 3, 4, or 5 on the Advanced Placement Exam*) of an Advanced Biology program in high school. This credit may free the college student to register for higher-level courses in biology or to register for other courses for which biology is a prerequisite.

The course is designed to cover topics required in a college biology course and will use a textbook used by college students in a biology major. The topics are broken down by the following outline:

- I. Molecules and Cells**
 - A. Chemistry of Life
 - B. Cells
 - C. Cellular Energetics
- II. Heredity and Evolution**
 - A. Heredity
 - B. Molecular Genetics
 - C. Evolutionary Biology
- III. Organisms and Populations**
 - A. Diversity of Organisms
 - B. Structure / Function of Plants and Animals
 - C. Ecology

Course Name - Part

Michigan State Curriculum Content Standards (continued)

An in depth study of these topics aims to aid students in the development of a “conceptual framework of modern biology” built around completion of science as a process. In other words, the program is designed to generate student understanding of complex topics through exploration and discovery. The continually changing landscape of modern biology as new theories emerge makes this a daunting challenge, but the students will be well-supported in their studies.

Another aspect of the course is a laboratory requirement, the completion of which is evaluated on the AP Biology Exam. There are twelve required lab activities that supplement the class materials and required topics. The goal of these labs is to help the students make connections between the structural details of biological systems and the overall function of these systems in living organisms and populations. Together with the required reading and classroom interactions, the laboratory activities support the overall goals of the program to provide students with the factual understanding and critical thinking ability to thrive in the changing environment of modern biology.

Text Book

Biology. 7th Edition AP Student Edition plus AP Test Prep Workbook

Authors: Campbell and Reece

Publisher: Pearson

Advanced Biology Part 1 Course Guide

Unit 1 Description: Introduction and The Chemistry of Life

This unit will introduce the AP Biology students to the “study of life.” The students will explore the hierarchy of biological organization, study the emergent properties of biological systems, discover how evolution accounts for life’s unity and diversity, and observe ways in which the scientific method is applied to understand more about living systems. The students will learn that there are eleven themes that unify biology, and these major concepts will serve as a framework to structure the course. The unit then moves into the study of the important chemicals and reactions that drive the function of living things. The students will review the topics of chemical matter and bonding, as well as the importance of water as a molecule that supports life. The students will study the organic biochemicals (carbohydrates, lipids, proteins, and nucleic acids) in detail and reach a level of understanding that will support the units that follow. The students will also complete two of the required AP Biology Labs in this unit. These labs are titled Osmosis and Diffusion and Enzyme Catalysis.

Essential Content and Skills

The learner will explore and master the following topics:

Exploring Life

Course Name - Part

Michigan State Curriculum Content Standards (continued)

The Chemical Context of Life

Carbon and the Molecular Diversity of Life

The Structure and Function of Macromolecules

Unit 1 Michigan State Curriculum Content Standards

[Click here to view the Michigan DOE Curriculum Content Standards.](#)

Unit 1 Lesson 1: Exploring Life

State Standard	Description
B 2.4 A	Explain that living things can be classified based on structural, embryological, and molecular (relatedness of DNA sequence) evidence.
B 2.4 f	Recognize and describe that both living and nonliving things are composed of compounds, which are themselves made up of elements joined by energy-containing bonds, such as those in ATP.
B 1.1 A	Generate new questions that can be investigated in the laboratory or field.
B 1.1 C	Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision).
B 1.1 E	Describe a reason for a given conclusion using evidence from an investigation.
B 1.2 A	Critique whether or not specific questions can be answered through scientific investigations.
B 1.2 h	Describe the distinctions between scientific theories, laws, hypotheses, and observations.
B2.4h	Describe the structures of viruses and bacteria.

Unit 1 Lesson 2: The Chemistry of Life—Matters and the Elements

State Standard	Description
B 2.2 B	Recognize the six most common elements in organic molecules (C, H, N, O, P, S).
C 3.4 A	Use the terms endothermic and exothermic correctly to describe chemical reactions in the laboratory.
C 3.4 B	Explain why chemical reactions will either release or absorb energy.
C 4.3 A	Identify the location, relative mass, and charge for electrons, protons, and neutrons.
C 4.8 B	Describe the atom as mostly empty space with an extremely small, dense nucleus consisting of the protons and neutrons and an electron cloud surrounding the nucleus.
C 4.8 C	Recognize that protons repel each other and that a strong force needs to be present to keep the nucleus intact.
C 4.10 A	List the number of protons, neutrons, and electrons for any given ion or isotope.
C 4.10 B	Recognize that an element always contains the same number of protons.
C 5.5 A	Predict if the bonding between two atoms of different elements will be primarily ionic or covalent.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 1 Lesson 3: Water—The Molecule That Supports All of Life

State Standard	Description
C 5.7 A	Recognize formulas for common inorganic acids, carboxylic acids, and bases formed from families
C 5/7 B	Predict products of an acid-base neutralization.
C 5.7 C	Describe tests that can be used to distinguish an acid from a base.
C 5.7 D	Classify various solutions as acidic or basic, given their pH.
C 5.7 E	Explain why lakes with limestone or calcium carbonate experience less adverse effects from acid rain than lakes with granite beds.

Unit 1 Lesson 4: Advanced Biology Lab #1—Osmosis and Diffusion

State Standard	Description
B 1.1 A	Generate new questions that can be investigated in the laboratory or field.
B 1.1 C	Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision).
B 1.1 E	Describe a reason for a given conclusion using evidence from an investigation.
B 1.2 A	Critique whether or not specific questions can be answered through scientific investigations.
B 1.2 h	Describe the distinctions between scientific theories, laws, hypotheses, and observations.
B 2.5h	Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).

Unit 1 Lesson 5: Carbon: The Backbone of Biological Molecules/ATP

State Standard	Description
B 2.2 A	Explain how carbon can join to other carbon atoms in chains and rings to form large and complex molecules.
B 2.2 B	Recognize the six most common elements in organic molecules (C, H, N, O, P, S).
B 2.2 D	Explain the general structure and primary functions of the major complex organic molecules that compose living organisms.
C 5.8 A	Draw structural formulas for up to ten carbon chains of simple hydrocarbons.
C 5.8 B	Draw isomers for simple hydrocarbons.
C 5.8 C	Recognize that proteins, starches, and other large biological molecules are polymers.

Unit 1 Lesson 6: The Molecules of Life—Carbohydrates and Lipids

State Standard	Description
B 2.2 C	Describe the composition of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids).
B 2.5 D	Describe how individual cells break down energy-rich molecules to provide energy for cell functions.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 1 Lesson 7: The Molecules of Life—Proteins

State Standard	Description
B 2.2 C	Describe the composition of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids). Explain the role of enzymes and other proteins in biochemical functions (e.g., the protein hemoglobin carries oxygen in some organisms, digestive enzymes, and hormones).
B 2.2 f	

Unit 1 Lesson 8: The Molecules of Life: Enzymes

State Standard	Description
B 2.2 C	Describe the composition of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids). Explain the role of enzymes and other proteins in biochemical functions (e.g., the protein hemoglobin carries oxygen in some organisms, digestive enzymes, and hormones).
B 2.2 f	

Unit 1 Lesson 9: Advanced Biology Lab #2—Enzyme Catalysis

State Standard	Description
B 1.1 A	Generate new questions that can be investigated in the laboratory or field. Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision). Describe a reason for a given conclusion using evidence from an investigation. Critique whether or not specific questions can be answered through scientific investigations. Describe the distinctions between scientific theories, laws, hypotheses, and observations.
B 1.1 C	
B 1.1 E	
B 1.2 A	
B 1.2 h	

Unit 1 Lesson 10: The Molecules of Life: Nucleic Acid

State Standard	Description
B 2.2 C	Describe the composition of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids). Explain the role of enzymes and other proteins in biochemical functions (e.g., the protein hemoglobin carries oxygen in some organisms, digestive enzymes, and hormones).
B 2.2 f	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 2 Description

This unit will detail the structure and function of the cell. The first half of the unit will focus on the cellular components, called organelles, and the membrane that surrounds the cell and separates it from its environment. The instruction will then shift to the metabolic processes performed by cells. All cells require cellular respiration, a complex set of reactions designed to release the stored energy of organic compounds and make it available for use by the cell. Only the autotrophs can perform photosynthesis, a set of chemical reactions designed to capture the sun's energy and harness it into the organic molecules of life. The connection and relationship between photosynthesis and respiration will also be examined. Finally, this unit will describe the process of asexual cell reproduction, a process called mitosis required by organisms to grow, repair damaged tissues, or even, in the case of unicellular species, propagate entire new organisms. The timing and stages of this cycle of division will be closely examined.

There will also be two Laboratory Exercises completed in this unit covering **Cell Respiration** and **Plant Pigments and Photosynthesis**.

Essential Content and Skills

The learner will explore and master:

- The general structure of the cellular components and the function of each.
- The design of the cell membrane and how it leads to the complex role it performs.
- The detailed reactions of cell respiration and photosynthesis.
- The process of asexual cell division and the stages of the cell cycle.

Unit 2 Michigan State Curriculum Content Standards

Unit 2 Lesson 1: A Tour of the Cell, Part 1

State Standard	Description
B 2.1 A	Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis.
B 2.5 B	Explain how major systems and processes work together in animals and plants, including relationships between organelles, cells, tissues, organs, organ systems, and organisms. Relate these to molecular functions.
B 2.5 g	Compare and contrast plant and animal cells.
B 2.5 h	Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).
B 2.5 i	Relate cell parts/organelles to their function.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 2 Lesson 2: A Tour of the Cell, Part 2

State Standard	Description
B 2.1 A	Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis. Explain how major systems and processes work together in animals and plants, including relationships between organelles, cells, tissues, organs, organ systems, and organisms. Relate these to molecular functions. Compare and contrast plant and animal cells. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport). Relate cell parts/organelles to their function.
B 2.5 B	
B 2.5 g	
B 2.5 h	
B 2.5 i	

Unit 2 Lesson 3: Membrane Structure and Function

State Standard	Description
B 2.1 A	Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis. Explain how major systems and processes work together in animals and plants, including relationships between organelles, cells, tissues, organs, organ systems, and organisms. Relate these to molecular functions. Compare and contrast plant and animal cells. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport). Relate cell parts/organelles to their function.
B 2.5 B	
B 2.5 g	
B 2.5 h	
B 2.5 i	

Unit 2 Lesson 4: An Introduction to Metabolism

State Standard	Description
B 2.1 A	Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis. Describe how energy is transferred and transformed from the Sun to energy-rich molecules during photosynthesis. Explain the interrelated nature of photosynthesis and cellular respiration in terms of ATP synthesis and degradation. Describe how organisms acquire energy directly or indirectly from sunlight.
B 2.5 C	
B 2.5 e	
B 3.1 A	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 2 Lesson 5: Cellular Respiration

State Standard	Description
B 2.1 A	Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis. Explain how cellular respiration is important for the production of ATP (build on aerobic vs. anaerobic). Describe how energy is transferred and transformed from the Sun to energy-rich molecules during photosynthesis. Explain the interrelated nature of photosynthesis and cellular respiration in terms of ATP synthesis and degradation. Describe how organisms acquire energy directly or indirectly from sunlight.
B 2.4 e	
B 2.5 C	
B 2.5 e	
B 3.1 A	

Unit 2 Lesson 6: Advanced Biology Lab #3: Cellular Respiration

State Standard	Description
B 1.1 A	Generate new questions that can be investigated in the laboratory or field. Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision). Describe a reason for a given conclusion using evidence from an investigation. Critique whether or not specific questions can be answered through scientific investigations. Describe the distinctions between scientific theories, laws, hypotheses, and observations. Explain how cellular respiration is important for the production of ATP (build on aerobic vs. anaerobic). Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).
B 1.1 C	
B 1.1 E	
B 1.2 A	
B 1.2 h	
B 2.4 e	
B 2.5h	

Unit 2 Lesson 7: Photosynthesis

State Standard	Description
B 2.1 A	Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis. Compare and contrast the transformation of matter and energy during photosynthesis and respiration. Illustrate and describe the energy conversions that occur during photosynthesis and respiration. Recognize the equations for photosynthesis and respiration and identify the reactants and products for both. Explain how living organisms gain and use mass through the processes of photosynthesis and respiration. Write the chemical equation for photosynthesis and cellular respiration and explain in words what they mean. Summarize the process of photosynthesis.
B 2.1 B	
B 3.1 B	
B 3.1 C	
B 3.1 D	
B 3.1 e	
B 3.1 f	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 2 Lesson 8: Advanced Biology Lab #4 - Plant Pigments and Photosynthesis

State Standard	Description
B 1.1 A B 1.1 C	Generate new questions that can be investigated in the laboratory or field. Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision).
B 1.1 E B 1.2 A	Describe a reason for a given conclusion using evidence from an investigation. Critique whether or not specific questions can be answered through scientific investigations.
B 1.2 h	Describe the distinctions between scientific theories, laws, hypotheses, and observations.
B 2.4 e	Explain how cellular respiration is important for the production of ATP (build on aerobic vs. anaerobic).
B 2.5h	Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).

Unit 2 Lesson 9: Cell Communication

State Standard	Description
B2.r6c	Recognize and explain that communication and/or interaction are required between cells to coordinate their diverse activities.

Unit 2 Lesson 10: The Cell Cycle

State Standard	Description
B 2.1 C	Explain cell division, growth, and development as a consequence of an increase in cell number, cell size, and/or cell products.
B 4.2 B B 4.3 A	Recognize that every species has its own characteristic DNA sequence. Compare and contrast the processes of cell division (mitosis and meiosis), particularly as those processes relate to production of new cells and to passing on genetic information between generations.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Description

This unit will explore the process of sexual reproduction or meiosis. The students will complete one of the required Advanced Laboratories titled **Mitosis and Meiosis**. The unit will then move on to study the biological diversity that is present on Earth. The history of Earth will be explored with an emphasis on the major branchings in the tree of life. Many of the lessons will cover the numerous classifications of living things including prokaryotes, protists, and fungi. A further detailed look at animal diversity will include an overview of the invertebrate and vertebrate phyla. The unit then moves on to the basic concept of form versus function specifically within the animal kingdom. This will include a study of the physiology behind an animals' ability to maintain homeostasis.

Essential Content and Skills

The learner will explore and master the following topics:

The process of sexual reproduction and its advantages over asexual reproduction.

The overall history of the development of life on Earth.

The phylogeny of life including prokaryotes, protists, fungi and animals.

The major differences between vertebrates and invertebrates.

The relationship between form and function in animal species.

Unit 3 Michigan State Curriculum Content Standards

Unit 3 Lesson 1: Meiosis and Sexual Life Cycles

State Standard	Description
B 4.1 B	Explain that the information passed from parents to offspring is transmitted by means of genes that are coded in DNA molecules. These genes contain the information for the production of proteins.
B 4.1.d	Explain the genetic basis for Mendel's laws of segregation and independent assortment.
B 4.2 B	Recognize that every species has its own characteristic DNA sequence.
B 4.2 C	Describe the structure and function of DNA.
B 4.3 A	Compare and contrast the processes of cell division (mitosis and meiosis), particularly as those processes relate to production of new cells and to passing on genetic information between generations.
B 4.2 f	Demonstrate how the genetic information in DNA molecules provides instructions for assembling protein molecules and that this is virtually the same mechanism for all life forms.
B 4.2 g	Describe the processes of replication, transcription, and translation and how they relate to each other in molecular biology.
B 4.2 h	Recognize that genetic engineering techniques provide great potential and responsibilities.
B4.x2i	Explain how recombinant DNA technology allows scientists to analyze the structure and function of genes.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Lesson 2: Advanced Biology Lab #5: Mitosis and Meiosis

State Standard	Description
B 1.1 A B 1.1 C	Generate new questions that can be investigated in the laboratory or field. Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision).
B 1.1 E B 1.2 A	Describe a reason for a given conclusion using evidence from an investigation. Critique whether or not specific questions can be answered through scientific investigations.
B 1.2 h	Describe the distinctions between scientific theories, laws, hypotheses, and observations.
B 4.3 A	Compare and contrast the processes of cell division (mitosis and meiosis), particularly as those processes relate to production of new cells and to passing on genetic information between generations.

Unit 3 Lesson 3: The Tree of Life

State Standard	Description
B 2.4 g	Explain that some structures in the modern eukaryotic cell developed from early prokaryotes, such as mitochondria, and in plants, chloroplasts.
B 5.1 c	Summarize the relationships between present-day organisms and those that inhabited the Earth in the past (e.g., use fossil record, embryonic stages, homologous structures, chemical basis).
B 5.1 d	Explain how a new species or variety originates through the evolutionary process of natural selection.
B 5.2 a	Describe species as reproductively distinct groups of organisms that can be classified based on morphological, behavioral, and molecular similarities.
B 5.2 b	Explain that the degree of kinship between organisms or species can be estimated from the similarity of their DNA and protein sequences.
B 5.2 c	Trace the relationship between environmental changes and changes in the gene pool, such as genetic drift and isolation of subpopulations.
B 5.x2 d	Interpret a cladogram or phylogenetic tree showing evolutionary relationships among organisms.
E 5.3 A	Explain how the solar system formed from a nebula of dust and gas in a spiral arm of the Milky Way Galaxy about 4.6 Ga (billion years ago).
E.5.3 B	Describe the process of radioactive decay and explain how radioactive elements are used to date the rocks that contain them.
E 5.3 C	Relate major events in the history of the Earth to the geologic time scale, including formation of the Earth, formation of an oxygen atmosphere, rise of life, Cretaceous-Tertiary (K-T) and Permian extinctions, and Pleistocene ice age.
E 5.3 D	Describe how index fossils can be used to determine time sequence.

Unit 3 Lesson 4: Prokaryotes

State Standard	Description
B 2.4. d	Analyze the relationships among organisms based on their shared physical, biochemical, genetic, and cellular characteristics and functional processes.
B 2.4 g	Explain that some structures in the modern eukaryotic cell developed from early prokaryotes, such as mitochondria, and in plants, chloroplasts.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Lesson 5: Protists

State Standard	Description
B 2.4 d	Analyze the relationships among organisms based on their shared physical, biochemical, genetic, and cellular characteristics and functional processes.

Unit 3 Lesson 6: Fungi

State Standard	Description
B 2.4 d	Analyze the relationships among organisms based on their shared physical, biochemical, genetic, and cellular characteristics and functional processes.

Unit 3 Lesson 7: An Introduction to Animal Diversity

State Standard	Description
B 2.4 g	Explain that some structures in the modern eukaryotic cell developed from early prokaryotes, such as mitochondria, and in plants, chloroplasts.
B 5.1 c	Summarize the relationships between present-day organisms and those that inhabited the Earth in the past (e.g., use fossil record, embryonic stages, homologous structures, chemical basis).
B 5.1 d	Explain how a new species or variety originates through the evolutionary process of natural selection.
B 5.2 a	Describe species as reproductively distinct groups of organisms that can be classified based on morphological, behavioral, and molecular similarities.
B 5.2 b	Explain that the degree of kinship between organisms or species can be estimated from the similarity of their DNA and protein sequences.
B 5.2 c	Trace the relationship between environmental changes and changes in the gene pool, such as genetic drift and isolation of subpopulations.
B 5.x2 d	Interpret a cladogram or phylogenetic tree showing evolutionary relationships among organisms.

Unit 3 Lesson 8: Invertebrates

State Standard	Description
B 2.4 d	Analyze the relationships among organisms based on their shared physical, biochemical, genetic, and cellular characteristics and functional processes.

Unit 3 Lesson 9: Vertebrates

State Standard	Description
B 2.4 d	Analyze the relationships among organisms based on their shared physical, biochemical, genetic, and cellular characteristics and functional processes.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Lesson 10: Basic Principles of Animal Form and Function

State Standard	Description
B 2.4 g	Explain that some structures in the modern eukaryotic cell developed from early prokaryotes, such as mitochondria, and in plants, chloroplasts.
B 2.5 B	Explain how major systems and processes work together in animals and plants, including relationships between organelles, cells, tissues, organs, organ systems, and organisms. Relate these to molecular functions.
B 2.5 C	Describe how energy is transferred and transformed from the Sun to energy-rich molecules during photosynthesis.
B 2.5 D	Describe how individual cells break down energy-rich molecules to provide energy for cell functions.
B 5.1 c	Summarize the relationships between present-day organisms and those that inhabited the Earth in the past (e.g., use fossil record, embryonic stages, homologous structures, chemical basis).
B 5.1 d	Explain how a new species or variety originates through the evolutionary process of natural selection.
B 5.2 a	Describe species as reproductively distinct groups of organisms that can be classified based on morphological, behavioral, and molecular similarities.
B 5.2 b	Explain that the degree of kinship between organisms or species can be estimated from the similarity of their DNA and protein sequences.
B 5.2 c	Trace the relationship between environmental changes and changes in the gene pool, such as genetic drift and isolation of subpopulations.
B 5.x2 d	Interpret a cladogram or phylogenetic tree showing evolutionary relationships among organisms.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Description

This unit will continue with the concept of homeostasis in animals. The unit will explore the various organ systems involved in maintaining this state of homeostasis in animals. The investigation will include the digestive, circulatory, lymphatic, urinary, endocrine, reproductive, skeletal, and nervous systems. The unit will highlight the physiological diversity of animals related to adaptations to the changing ecological surroundings. Disruption of homeostasis will be discussed in relation to different disorders and diseases in specific organ systems. The unit will also include a laboratory activity related to the circulatory system.

Essential Content and Skills

The learner will explore and master:

The basic anatomy and physiology of each of the main animal organ systems.

The results of a disruption in the state of homeostasis to different organ systems.

Relate form and function at the organ system level.

Unit 4 Michigan State Curriculum Content Standards

Unit 4 Lesson 1: Animal Nutrition

State Standard	Description
B 2.2 f	Explain the role of enzymes and other proteins in biochemical functions (e.g., the protein hemoglobin carries oxygen in some organisms, digestive enzymes, and hormones).
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other.
B 2.3. e	Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar).
B 2.3 f	Explain how human organ systems help maintain human health. Explain the role of enzymes and other proteins in biochemical functions (e.g., the protein hemoglobin carries oxygen in some organisms, digestive enzymes, and hormones).
B 2.4 B	Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Lesson 2: Circulation and Gas Exchange

State Standard	Description
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other. Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar). Explain how human organ systems help maintain human health. Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).
B 2..3. e	
B 2.3 f	
B 2.4 B	

Unit 4 Lesson 3: Advanced Biology Lab #6-Physiology of the Circulatory System

State Standard	Description
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other. Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar). Explain how human organ systems help maintain human health. Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).
B 2..3. e	
B 2.3 f	
B 2.4 B	

Unit 4 Lesson 4: The Immune System

State Standard	Description
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other. Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar). Explain how human organ systems help maintain human health. Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).
B 2..3. e	
B 2.3 f	
B 2.4 B	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Lesson 5: Osmoregulation and Excretion

State Standard	Description
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other. Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar). Explain how human organ systems help maintain human health. Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).
B 2.3 e	
B 2.3 f	
B 2.4 B	

Unit 4 Lesson 6: Hormones and Endocrine System

State Standard	Description
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other. Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar). Explain how human organ systems help maintain human health. Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).
B 2.3 e	
B 2.3 f	
B 2.4 B	
B 2.r.6 b	Explain that complex interactions among the different kinds of molecules in the cell cause distinct cycles of activities, such as growth and division. Note that cell behavior can also be affected by molecules from other parts of the organism, such as hormones.

Unit 4 Lesson 7: Animal Reproduction

State Standard	Description
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other. Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar). Explain how human organ systems help maintain human health. Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).
B 2.3 e	
B 2.3 f	
B 2.4 B	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Lesson 8: Animal Development

State Standard	Description
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other. Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar). Explain how human organ systems help maintain human health. Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).
B 2.3 e	
B 2.3 f	
B 2.4 B	

Unit 4 Lesson 9: Nervous System

State Standard	Description
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other. Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar). Explain how human organ systems help maintain human health. Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).
B 2.3 e	
B 2.3 f	
B 2.4 B	

Unit 4 Lesson 10: Sensory and Motor Mechanisms

State Standard	Description
B 2.3 d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other. Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar). Explain how human organ systems help maintain human health. Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).
B 2.3 e	
B 2.3 f	
B 2.4 B	