



Biology – Part 1

Michigan State High School Content Expectations

Course Description

Biology will introduce the student to the diversity and complexity of living things. The student will begin his journey with the molecular basis of life followed by the study of cellular structures and functions. The student will investigate genetics and the interdependence of living things. Within each unit you will also complete various lesson activities. The lesson activities are designed to provide additional information that will be supported by each individual lesson. In addition to the lesson activities, you will also complete a water-lab. The water lab is an in-depth look at properties of water in solutions and how water reacts with other substances.

Text Book

Prentice Hall, Biology, Exploring Life

Unit 1 Description

This unit will introduce the learner to the science of life through an understanding of its scope and the processes used to make biological discoveries. The learner will investigate the chemical basis of life and discover the importance and function of chemical reactions in living things.

Essential Content and Skills

The learner will:

- Identify organizational levels of life.
- Understand the basic strategy the biologist uses in classifying organisms.
- Identify the characteristic that separates the three major domains.
- Identify ten themes of biology.
- Describe the nature of scientific discovery.
- Learn how both genes and environment affect behavior.
- Learn about the chemical nature of life.
- Gain a basic understanding of the structure of atoms, molecules, and chemical bonds.
- Realize the importance of water in living organisms.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

- Study the chemical nature of carbon and understand its importance in all organic molecules.
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Unit 1 Michigan State Curriculum Content Standards

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

Unit 1 Lesson 1: Lesson Title The Scope of Biology

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.

Unit 1 Lesson 2: Lesson Title Diverse Life Forms

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.

Unit 1 Lesson 3: Lesson Title The Study of Life

State Standard	Description
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).
B 2.4 C	Explain how different organisms accomplish the same result using different structural specializations (gills vs. lungs vs. membranes).
B 3.3 A	Use a food web to identify and distinguish producers, consumers, and decomposers and explain the transfer of energy through trophic levels.
B 5.1 A	Summarize the major concepts of natural selection (differential survival and reproduction of chance inherited variants, depending on environmental conditions).
B 5.1 B	Describe how natural selection provides a mechanism for evolution.
B 5.3 A	Explain how natural selection acts on individuals, but it is populations that evolve. Relate genetic mutations and genetic variety produced by sexual reproduction to diversity within a given population.
B 5.3 B	Describe the role of geographic isolation in speciation.
B 5.3 C	Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 1 Lesson 4: Lesson Title Scientific Inquiry and Organization

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.

Unit 1 Lesson 5: Lesson Title Hypotheses-Based Science

State Standard	Description
B 1.1 C B 1.1 h	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). Design and conduct a systematic scientific investigation that tests a hypothesis. Draw conclusions from data presented in charts or tables.

Unit 1 Lesson 6: Lesson Title Evaluating Science

State Standard	Description
B 1.1 B B 1.1 C	Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions. 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 D B 1.2 B	Identify patterns in data and relate them to theoretical models. Identify and critique arguments about personal or societal issues based on scientific evidence.
B 1.2 C	Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.
B 1.2 D B 1.2 E B 1.2 k	Evaluate scientific explanations in a peer review process or discussion format. Evaluate the future career and occupational prospects of science fields. Analyze how science and society interact from a historical, political, economic, or social perspective.

Unit 1 Lesson 7: Lesson Title Studying Behavior

State Standard	Description
B 2.6 a	Explain that the regulatory and behavioral responses of an organism to external stimuli occur in order to maintain both short- and long-term equilibrium.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 1 Lesson 8: Lesson Title Genes and the Environment's Effect on Behavior

State Standard	Description
B 2.6 a	Explain that the regulatory and behavioral responses of an organism to external stimuli occur in order to maintain both short- and long-term equilibrium.
B 5.3 B	Describe the role of geographic isolation in speciation.
B 5.3 C	Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

Unit 1 Lesson 9: Lesson Title The Behavior of Learning

State Standard	Description
B 2.6 a	Explain that the regulatory and behavioral responses of an organism to external stimuli occur in order to maintain both short- and long-term equilibrium.
B 5.3 B	Describe the role of geographic isolation in speciation.
B 5/3 C	Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

Unit 1 Lesson 10: Lesson Title Social Behavior in Animals

State Standard	Description
B 2.6 a	Explain that the regulatory and behavioral responses of an organism to external stimuli occur in order to maintain both short- and long-term equilibrium.
B 5.3 B	Describe the role of geographic isolation in speciation.
B 5/3 C	Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 2 Description

This unit will allow the learner to study the chemical basis for life. The learner will look at the necessary elements for life and the molecules of life.

Essential Content and Skills

The learner will:

- Compare and contrast elements and compounds.
- Describe the characteristics of an atom.
- Describe the functional groups in organic molecules
- Compare and contrast various cells.

Unit 2 Michigan State Curriculum Content Standards

Unit 2 Lesson 1: Lesson Title Chemical Elements of Life

State Standard	Description
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.

Unit 2 Lesson 2: Lesson Title The Structure of Atoms

State Standard	Description
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.

Unit 2 Lesson 3: Lesson Title Chemical Bonds

State Standard	Description
C 5.4 B	Measure, plot, and interpret the graph of the temperature versus time of an ice-water mixture, under slow heating, through melting and boiling.
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 2 Lesson 4: Lesson Title Properties of Water

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

Unit 2 Lesson 5: Lesson Title Organic Molecules

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

Unit 2 Lesson 6: Lesson Title Carbohydrates

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

Unit 2 Lesson 7: Lesson Title Lipids

State Standard	Description
B 2.2 C B 2.5 A	Describe the composition of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids). Recognize and explain that macromolecules such as lipids contain high energy bonds.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 2 Lesson 8: Lesson Title 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 2 Lesson 9: Lesson Title 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 2 Lesson 10: Lesson Title Cells

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	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Description

This unit will take you through the various parts of the cell. You will look at how substances are transported through the cell as well as the individual organelles of the cell. Each organelle has a special structure and function.

Essential Content and Skills

The learner will:

- Describe the structure of cellular membranes.
- Explain how active and passive transport differ.
- Describe the functions of organelles within the cell.
- Compare and contrast autotrophs and heterotrophs.

Unit 3 Michigan State Curriculum Content Standards

Unit 3 Lesson 1: Lesson Title Cell Membrane

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 B	Describe how the maintenance of a relatively stable internal environment is required for the continuation of life.
B 2.5 h	Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).

Unit 3 Lesson 2: Lesson Title Diffusion and Equilibrium

State Standard	Description
B 2.2 D	Explain the general structure and primary functions of the major complex organic molecules that compose living organisms.
B 2.5 h	Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).
B 2.6 a	Explain that the regulatory and behavioral responses of an organism to external stimuli occur in order to maintain both short- and long-term equilibrium.

Unit 3 Lesson 3: Lesson Title The Cell At Work

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 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.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Lesson 4: Lesson Title Chloroplasts and Melochondria

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	

Unit 3 Lesson 5: Lesson Title Internal Skeleton

State Standard	Description
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).

Unit 3 Lesson 6: Lesson Title Sunlight Powers Life

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). Explain the interrelated nature of photosynthesis and cellular respiration in terms of ATP synthesis and degradation.
B 2.4 e	
B 2.5 e	

Unit 3 Lesson 7: Lesson Title Food Stores Chemical Energy

State Standard	Description
B 3.1 B	Illustrate and describe the energy conversions that occur during photosynthesis and respiration. Explain how living organisms gain and use mass through the processes of photosynthesis and respiration.
B 3.1 D	

Unit 3 Lesson 8: Lesson Title ATP Contribution to Cellular Work

State Standard	Description
B 2.3 A	Describe how cells function in a narrow range of physical conditions, such as temperature and pH (acidity), to perform life functions. Explain how cellular respiration is important for the production of ATP (build on aerobic vs. anaerobic). Explain the interrelated nature of photosynthesis and cellular respiration in terms of ATP synthesis and degradation.
B 2.4 e	
B 2.5 e	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 3 Lesson 9: Lesson Title Electrons As An Energy Source

State Standard	Description
B 2.3 A	Describe how cells function in a narrow range of physical conditions, such as temperature and pH (acidity), to perform life functions. Illustrate and describe the energy conversions that occur during photosynthesis and respiration.
B 3.1 B	

Unit 3 Lesson 10: Lesson Title Energy With or Without Oxygen

State Standard	Description
B 3.1 B	Illustrate and describe the energy conversions that occur during photosynthesis and respiration.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Description

This unit will allow you to explore the working cell. Photosynthesis will be the key to understanding how light reactions convert light energy to chemical energy. Inside of the cell is a world of cycles. The cell cycle is a process that will be examined in the second half of the unit.

Essential Content and Skills

The learner will:

- Identify the overall reactants and products of photosynthesis.
- Identify the chemical products of the light reactions.
- Describe the path of carbon in the carbon cycle.
- Contrast the two ways that organisms reproduce.
- Describe the structure of a chromosome.
- Compare benign and malignant tumors.
- Compare and contrast mitosis and meiosis.

Unit 4 Michigan State Curriculum Content Standards

Unit 4 Lesson 1: Lesson Title 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. Recognize the equations for photosynthesis and respiration and identify the reactants and products for both. 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 C	
B 3.1 e	
B 3.1 f	

Unit 4 Lesson 2: Lesson Title Light Reactions

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. Summarize the process of photosynthesis.
B 3.1 f	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Lesson 3: Lesson Title The Calvin Cycle

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. Summarize the process of photosynthesis.
B 3.1 f	

Unit 4 Lesson 4: Lesson Title Global Impact of Photosynthesis

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 D	
B 2.3 A	Describe how cells function in a narrow range of physical conditions, such as temperature and pH (acidity), to perform life functions.
B 2.3 B	
B 3.2 A	Identify how energy is stored in an ecosystem.
B 3.2 B	
B 3.2 C	Describe energy transfer through an ecosystem, accounting for energy lost to the environment as heat.
B 3.4 D	
B 3.2 C	Draw the flow of energy through an ecosystem. Predict changes in the food web when one or more organisms are removed.
B 3.4 D	

Unit 4 Lesson 5: Lesson Title Cells From Other Cells

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.

Unit 4 Lesson 6: Lesson Title 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.

Unit 4 Lesson 7: Lesson Title Cell Division During Mitosis

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. 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 4.3 A	

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Lesson 8: Lesson Title Cancer Cells

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 2.3 A	Describe how cells function in a narrow range of physical conditions, such as temperature and pH (acidity), to perform life functions.
B 4.2 D	Predict the consequences that changes in the DNA composition of particular genes may have on an organism (e.g., sickle cell anemia, other).
B 4.2 E	Propose possible effects (on the genes) of exposing an organism to radiation and toxic chemicals.
B 4.3 C	Explain how it might be possible to identify genetic defects from just a karyotype of a few cells.
B 4.4 b	Explain that gene mutation in a cell can result in uncontrolled cell division called cancer. Also know that exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer.

Unit 4 Lesson 9: Lesson Title Meiosis

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 4.1 A	Draw and label a homologous chromosome pair with heterozygous alleles highlighting a particular gene location.
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 4.2 A	Show that when mutations occur in sex cells, they can be passed on to offspring (inherited mutations), but if they occur in other cells, they can be passed on to descendant cells only (noninherited mutations).
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.

Course Name - Part

Michigan State Curriculum Content Standards (continued)

Unit 4 Lesson 10: Lesson Title Meiosis and Genetic Variation

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 4.3 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 4.3 B	Explain why only mutations occurring in gametes (sex cells) can be passed on to offspring.
B 4.3 e	Recognize that genetic variation can occur from such processes as crossing over, jumping genes, and deletion and duplication of genes.