Reading Public Schools

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Science Curriculum Guide **High School Biology**

Course Description

Biology is a comprehensive full-year life science course for ninth grade students. It is built upon the Massachusetts Curriculum Frameworks for High School Biology. All ninth grade biology courses, regardless of level, address concepts from the four core areas of biology: (1) biological structures and processes from the molecular to organismal level, (2) heredity, (3) ecology and (4) evolution. Engagement in laboratory activities, online investigations and projects reinforce core concepts and present opportunities for students to further develop scientific skills and practices.

Content Standards

HS-LS1-1. Explain the roles of DNA and RNA in protein synthesis.
HS-LS1-2. Illustrate the key functions of animal body systems, including the digestive, circulatory, respiratory, excretory, and nervous systems.
HS-LS1-3. Provide evidence that homeostasis maintains internal body conditions.
HS-LS1-4. Explain why the cell cycle is necessary. Model the major events of the cell cycle.
HS-LS1-5. Illustrate the overall process of photosynthesis.
HS-LS1-6. Explain the role of elements and monomers in the construction of organic macromolecules.
HS-LS1-7. Illustrate the overall process of aerobic cellular respiration.
HS-LS2-1. Analyze data sets to support explanations that biotic and abiotic factors affect ecosystem carrying capacity.
HS-LS2-2. Use mathematical representations to support explanations that biotic and abiotic factors affect biodiversity.
HS-LS2-4. Describe energy transfer through an ecosystem.
HS-LS2-5. Explain the roles of photosynthesis, cellular respiration, decomposition and combustion in the Carbon Cycle.
HS-LS2-6. Use evidence to demonstrate that ecosystems with greater biodiversity tend to have greater resistance to change and resilience.
HS-LS2-7. Analyze effects of human activities on biodiversity and ecosystem health. Evaluate and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health.
HS-LS3-1. Model how DNA is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction.
HS-LS3-2. Demonstrate how genetic variations arise and get passed on.
HS-LS3-3. Apply concepts of probability to represent Mendelian inheritance patterns.
HS-LS3-4. Illustrate that many traits of individuals are due to interactions of genetic and environmental factors.
HS-LS4-1. Communicate scientific information indicating that common ancestry and biological evolution are supported by multiple lines of empirical evidence.
HS-LS4-2. Explain Darwin's Theory of Evolution by Natural Selection.
HS-LS4-4. Describe key features of viruses and bacteria to explain their ability to adapt and reproduce in a wide variety of environments.

Science and Engineering Practices

The high school biology standards place particular emphasis on science and engineering practices of developing and using models; constructing explanations; engaging in argumentation from evidence; and obtaining, evaluating, and communicating information. Students are expected to:

- use multiple types of models, including mathematical models, to make predictions and develop explanations, analyze and identify flaws in the model, and communicate ideas that accurately represent or simulate the biological system.
- construct and revise explanations and claims based on valid and reliable evidence and apply scientific reasoning to evaluate complex real-world problems such as the effects of human activity on biodiversity and ecosystem health.
- find and interpret scientific literature to compare, integrate, and evaluate sources and communicate phenomena related to genetics, the functioning of organisms, and interrelationships between organisms, populations, and the environment.

Subject High School Biology

Units	Essential Questions	Key Activities MAY include…
Introduction to Biology	• What constitutes useful scientific evidence? • How is scientific knowledge constructed? • How is life defined?	Animal Behavior Lab Unit Test
Biogeochemical Cycles	• How is matter transferred/transformed in living systems? • How are organisms dependent on their environment?	Microscope Lab Leaf Lab Unit Test
Structure of an Ecosystem	• How is energy transferred/transformed in living systems? • How are organisms dependent on one other?	Food Web Activity Biomagnification Activity Unit Test
Biochemistry	• What are foods made of?	Biochemistry Modelling Activity Biochemistry Online Activity Catalase Lab Unit Test
Evolution	• How does natural selection encourage diversity?	Evidence for Evolution Lab Cladogram Activity Unit Test
Heredity	• Why do you look like or not look like your parents? • How is genetic information passed through generations?	Punnett Squares Sickle Cell Lab Meiosis Modeling Activity Human Inheritance Activity Unit Test
DNA, RNA, and Protein Synthesis	• How does DNA control the growth and function of cells?	DNA Extraction Transcription-Translation Activity Unit Test
Mitosis	• How do organisms grow, repair and reproduce?	Onion Root Tip Lab Karyotype Lab Unit Test
Human Anatomy and Physiology	• How does structure relate to function in living systems from the *organismal* to the cellular level?	Fetal Pig Dissection Digestive Pathway Activity Exercise Lab Unit Test
Cells and Cell Transport	• How does structure relate to function in living systems from the organismal to the *cellular* level? • How do cells interact with their environments?	Cell Observations Lab Diffusion Lab Blood Typing Activity Unit Test

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Science Curriculum Guide Overview

Curriculum Guide	Curriculum guides are public documents aligned with the Massachusetts Department of Education Curriculum Frameworks. They focus on the set of standards that students will learn within certain disciplines at appropriate grade levels. Each area of the curriculum is divided into general strands (broad categories) under which the standards fall. When we discuss "standards-based education" we mean that students are measured against their proficiency and growth towards meeting these standards. Curriculum Guides are intended for teachers, parents, and the wider school community as an overview document of the course of study for the year.
Content Standards	The Biology curriculum at Reading Memorial High School is aligned with the 2016 Massachusetts Science and Technology/Engineering Curriculum Frameworks for High School Biology. Detailed information for the STE Framework can be found at: http://www.doe.mass.edu/frameworks/scitech/2016-04.pdf. The content standards describe what students should know and be able to do. They build from middle school and allow students to explain additional and more complex phenomena related to genetics, the functioning of organisms, and interrelationships between organisms, populations, and the environment.
Science and Engineering Practices	The integration of science and engineering practices in high school science courses gives students dynamic and relevant opportunities to refine and communicate science understandings to be well prepared for civic life, postsecondary education, and career success.
Essential Questions	Essential questions are questions that are not answerable with an easy answer or a simple instruction. The purpose of essential questions is to provide opportunities for inquiry into the learning and act as an umbrella to anchor the unit/lesson.
Key Activities	Key Activities identified in Curriculum Guides are not intended to be exhaustive, nor are they intended to be prescriptive. The activities identified may function as a menu of curriculum resources from which educators identify the most appropriate tools to utilize in their classrooms.