

## Biology CR

State Standard Number	State Standard Area/Description	Unit Name	Course Topic Description
B	Biology		
B.I	Content Standards		
B.I.1.1.A	Chemical elements form organic molecules that interact to perform the basic functions of life.		
B.I.1.A.1.1	Recognize that biological organisms are composed primarily of very few elements. The six most common are C, H, N, O, P, S.	Nature of Science	Section 2, Part 13
B.I.1.A.1.2	Describe the basic molecular structures and primary functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids).	Nature of Science	Section 2, Parts 15-21
B.I.1.A.1.3	Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, which have an effect on enzymes.	Photosynthesis	Enzyme Lab, Intro
B.I.2.2.A	Cells have specific structures and functions that make them distinctive. Processes in a cell can be classified broadly as growth, maintenance, and reproduction.		
B.I.2.A.2.1	Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis,	Cell Structure	Section 1, Parts 6-9

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	facilitated diffusion, and active transport).		
B.I.2.A.2.2	Compare and contrast, at the cellular level, prokaryotes and eukaryotes (general structures and degrees of complexity).	Cell Structure	Section 1, Part 5
B.I.2.A.2.3	Use cellular evidence (such as cell structure, cell number, and cell reproduction) and modes of nutrition to describe six kingdoms (Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia).	Biological Diversity	Section 2 covers Archaeobacteria and Eubacteria, Section 3 covers Protista, Section 4 covers Plantae, Section 5 covers Fungi, and Section 6 covers Animalia
B.I.2.A.2.4	Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration. Explain the interrelated nature of photosynthesis and cellular respiration in the cells of photosynthetic organisms.	Photosynthesis	Section 3, Part 13
B.I.2.A.2.5	Explain the important role that ATP serves in metabolism.	Photosynthesis	Section 1, Part 10
B.I.2.A.2.6	Describe the cell cycle and the process of mitosis. Explain the role of mitosis in the formation of new cells, and its importance in maintaining chromosome number during asexual reproduction.	Cell Structure	Mitosis Lab
B.I.2.A.2.7	Describe how the process of meiosis results in the formation of haploid cells. Explain the importance of this process in sexual reproduction, and how gametes form diploid zygotes in the process of fertilization.	Cell Structure	Meiosis Lab
B.I.2.A.2.8	Compare and contrast a virus and a cell in terms of genetic material and reproduction.		

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B.I.3.3.A	Genes allow for the storage and transmission of genetic information. They are a set of instructions encoded in the nucleotide sequence of each organism. Genes code for the specific sequences of amino acids that comprise the proteins that are characteristic of that organism.	Genetics	Intro
B.I.3.A.3.1	Describe the basic structure (double helix, sugar/phosphate backbone, linked by complementary nucleotide pairs) of DNA, and describe its function in genetic inheritance.	Genetics	Section 4, Part 3
B.I.3.A.3.2	Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic processes of transcription and translation, and how they result in the expression of genes. Distinguish among the end products of replication, transcription, and translation.	Genetics	Section 5, Parts 3-4
B.I.3.A.3.3	Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in an organism. Explain how mutations in gametes may result in phenotypic changes in offspring.	Genetics	Section 5, Part 5
B.I.3.A.3.4	Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, incomplete dominance, codominant, sex-linked, polygenic, and multiple alleles).	Genetics	Section 2, Parts 6-8
B.I.3.A.3.5	Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance (such as dihybrid crosses).	Genetics	Section 1, Parts 6-7

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B.I.3.A.3.6	Use a Punnett Square to determine the probabilities for genotype and phenotype combinations in monohybrid crosses.	Genetics	Section 1, Part 6
B.I.4.4.A	There is a relationship between the organization of cells into tissues, and tissues into organs. The structure and function of organs determine their relationships within body systems of an organism. Homeostasis allows the body to perform its normal functions.	Animal Organization	Section 2, Parts 2-4
B.I.4.A.4.1	Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy and for repair and growth.	Animal Organization	Covered by all of Section 6
B.I.4.A.4.2	Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds from blood.	Animal Organization	Covered by all of Section 4
B.I.4.A.4.3	Explain how the respiratory system (nose, pharynx, larynx, trachea, lungs, alveoli) provides exchange of oxygen and carbon dioxide.	Animal Organization	Covered by all of Section 9

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B.I.4.A.4.4	Explain how the nervous system (brain, spinal cord, sensory neurons, motor neurons) mediates communication between different parts of the body and the body's interactions with the environment. Identify the basic unit of the nervous system, the neuron, and explain generally how it works.	Animal Organization	Covered by all of Section 7
B.I.4.A.4.5	Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscle, bones, cartilage, ligaments, tendons) works with other systems to support and allow for movement. Recognize that bones produce both red and white blood cells.	Animal Organization	Covered by all of Section 8
B.I.4.A.4.6	Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father and that sexually produced offspring resemble, but are not identical to, either of their parents.	Animal Organization	Covered by all of Section 10
B.I.4.A.4.7	Recognize that communication between cells is required for coordination of body functions. The nerves communicate with electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells.		
B.I.4.A.4.8	Recognize that the body's systems interact to maintain homeostasis. Describe the basic function of a physiological feedback loop.	Animal Organization	Section 2, Parts 2-4
B.I.5.5.A	Evolution is the result of genetic changes that occur in constantly changing environments. Over many generations, changes in the genetic make-up of populations may affect biodiversity through speciation and	Genetics	Section 2, Part 1

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	extinction.		
B.I.5.A.5.1	Explain how evolution is demonstrated by evidence from the fossil record, comparative anatomy, genetics, molecular biology, and examples of natural selection.	Evolution	Section 1, Parts 5-7
B.I.5.A.5.2	Describe species as reproductively distinct groups of organisms. Recognize that species are further classified into a hierarchical taxonomic system (kingdom, phylum, class, order, family, genus, species) based on morphological, behavioral, and molecular similarities. Describe the role that geographic isolation can play in speciation.	Evolution Biological Diversity	Section 2, Part 3 Intro
B.I.5.A.5.3	Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity from a population.	Evolution	Section 2, Part 4
B.I.6.6.A	Ecology is the interaction among organisms and between organisms and their environment.	Ecology	Intro
B.I.6.A.6.1	Explain how birth, death, immigration, and emigration influence population size.	Ecology	Section 1, Part 1

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B.I.6.A.6.2	Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human activity, and the introduction of invasive, non-native species.		
B.I.6.A.6.3	Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels. Describe how relationships among organisms (predation, parasitism, competition, commensalism, and mutualism) add to the complexity of biological communities.		
B.I.6.A.6.4	Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an ecosystem and how oxygen cycles through photosynthesis and respiration.		
B.II	Scientific Inquiry Skills Standards		
B.II.SIS1	Make observations, raise questions, and formulate hypotheses.	Nature of Science	Scientific Method Lab
B.II.SIS1.1	Observe the world around them from a scientific perspective.	Nature of Science	Scientific Method Lab

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B.II.SIS1.2	Pose questions and form hypotheses based on personal observations, scientific articles, experiments, and knowledge.		
B.II.SIS1.3	Read, interpret, and examine the credibility and validity of scientific claims in different sources of information, such as scientific articles, advertisements, or media stories.		
B.II.SIS2	Design and conduct scientific investigations.		
B.II.SIS2.1	Articulate and explain the major concepts being investigated and the purpose of an investigation.		
B.II.SIS2.2	Select required materials, equipment, and conditions for conducting an experiment.		
B.II.SIS2.3	Identify independent and dependent variables.	Nature of Science	Scientific Method Lab
B.II.SIS2.4	Write procedures that are clear and replicable.		

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B.II.SIS2.5	Employ appropriate methods for accurately and consistently	Nature of Science	Scientific Method Lab
B.II.SIS2.5.	making observations;	Nature of Science	Scientific Method Lab
B.II.SIS2.5.	making and recording measurements at an appropriate level of precision and;	Nature of Science	Scientific Method Lab
B.II.SIS2.5.	collecting data or evidence in an organized way.	Nature of Science	Scientific Method Lab
B.II.SIS2.6	Properly use instruments, equipment, and materials (such as scales, probeware, meter sticks, microscopes, computers, etc.) including: set-up, calibration (if required), technique, maintenance, and storage.		
B.II.SIS2.7	Follow safety guidelines.	Nature of Science	Scientific Method Lab
B.II.SIS3	Analyze and interpret results of scientific investigations.	Nature of Science	Scientific Method Lab

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B.II.SIS3.1	Present relationships between variables in appropriate forms.		
B.II.SIS3.1.	Represent data and relationships between variables in charts and graphs.		
B.II.SIS3.1.	Use appropriate technology (such as graphing software, etc.) and other tools.		
B.II.SIS3.2	Use mathematical operations to analyze and interpret data results.		
B.II.SIS3.3	Identify reasons for inconsistent results, such as sources of error or uncontrolled conditions, and assess the reliability of data.		
B.II.SIS3.4	Use results of an experiment to develop a conclusion to an investigation that addresses the initial questions and supports or refutes the stated hypothesis.	Nature of Science	Scientific Method Lab
B.II.SIS3.5	State questions raised by an experiment that may require further investigation.		

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B.II.SIS4	Communicate and apply the results of scientific investigations.		
B.II.SIS4.1	Develop descriptions and explanations of scientific concepts that an investigation focused on.		
B.II.SIS4.2	Review information, explain statistical analysis, and summarize data collected and analyzed from an investigation.		
B.II.SIS4.3	Explain diagrams and charts that represent relationships of variables.		
B.II.SIS4.4	Construct a reasoned argument and respond appropriately to critical comments and questions.		
B.II.SIS4.5	Use language and vocabulary appropriately, speak clearly and logically, and use appropriate technology (such as presentation software, etc.) and other tools to present findings.		
B.II.SIS4.6	Use and refine scientific models that simulate physical processes or phenomena.		

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B.III	Mathematical Skills		
0	Students are expected to know the content of the Massachusetts Mathematics Curriculum Framework, through grade 8. Below are some specific skills from the Mathematics Framework that students in this course should have the opportunity to apply:		
B.III.1	Construct and use tables and graphs to interpret data sets.		
B.III.2	Solve simple algebraic expressions.		
B.III.3	Perform basic statistical procedures to analyze the center and spread of data.		
B.III.4	Measure with accuracy and precision (length, volume, mass, temperature, time, etc.)		
B.III.5	Convert within a unit (such as, centimeters to meters).		

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B.III.6	Use common prefixes such as milli-, centi-, and kilo-.		
B.III.7	Use scientific notation, where appropriate.		
B.III.8	Use ratio and proportion in the solution of problems.		
B.III.9	The following skills are not detailed in the Mathematics Framework, but are necessary for a solid understanding in this course:		
B.III.9.1	Determine the correct number of significant figures.		
B.III.9.2	Determine percent error from experimental and accepted values.		
B.III.9.3	Use appropriate metric/standard international (SI) units of measurement for mass (kg); length (m); and time (s).		



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B.III.9.4	Use Celsius the scale.		
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