

**Maryland Science Grades 9-12
Content Standards Mapping**

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BIOLOGY	Boardworks High School Biology Presentations
1) Expectation: The student will be able to explain the correlation between the structure and function of biologically important molecules and their relationship to cell processes.	
a) The student will be able to describe the unique characteristics of chemical substances and macromolecules utilized by living systems.	
i) Water (inorganic molecule, polarity, density, and solvent properties)	Water
ii) Carbohydrates (organic molecule; monosaccharides are building blocks; supplier of energy and dietary fiber; structural component of cells: cell wall, cellulose)	Digestion Monosaccharides Polysaccharides
iii) Lipids (organic molecule; component of cell membranes; stored energy supply)	Digestion Lipids
iv) Proteins (organic molecule; amino acids are building blocks; structural and functional role, including enzymes)	Digestion Enzymes Proteins
v) Nucleic acids (organic molecule; nucleotides are building blocks - sugar, phosphate, & nitrogen bases; DNA is a double helix, RNA is a single strand; DNA replication; DNA role in storage of genetic information)	Controlling Protein Synthesis DNA DNA Replication 1 DNA Replication 2 Nucleic Acids Protein Synthesis Transcription and Translation
vi) Minerals (inorganic substances essential for cellular processes)	Digestion
vii) Vitamins (organic molecule; role in human body: C – wound healing, K – blood clotting, D – bone growth)	Digestion
b) The student will be able to discuss factors involved in the regulation of chemical activity as part of a homeostatic mechanism.	
i) Osmosis (predicting water flow across a membrane based on the cell's environment; explain role in living systems)	Osmosis Homeostasis
ii) Temperature (effect upon enzyme activity and metabolic rate; effect upon rate of diffusion and states of matter)	Body Temperature Homeostasis Thermoregulation
iii) pH (pH scale: relative values for acids and bases; effect on living systems: cellular, organismal)	–
iv) Enzyme regulation (effect of temperature, pH, and enzyme/substrate concentration on enzyme activity)	Enzymes Enzyme Shape

c) The student will be able to compare the transfer and use of matter and energy in photosynthetic and non-photosynthetic organisms.	
i) Water cycle (movement of water between living systems and the environment)	Water Cycle
ii) Carbon cycle (movement of carbon between living systems and the environment, cyclic relationship between photosynthesis and respiration)	Carbon Cycle
iii) Nitrogen cycle (roles of bacteria; human impact)	Nitrogen Cycle
iv) Photosynthesis (energy conversion: light, chemical; basic molecules involved)	Photosynthesis 1 Photosynthesis 2
v) Cellular respiration (distinctions between aerobic and anaerobic, energy released, use of oxygen; basic molecules involved in aerobic)	Aerobic Respiration Anaerobic Respiration
vi) <i>Chemosynthesis (from inorganic compounds)</i>	–
vii) ATP (energy carrier molecule)	Aerobic Respiration Cell Theory
2) Expectation: The student will demonstrate an understanding that all organisms are composed of cells which can function independently or as part of multicellular organisms.	
a) The student will explain processes and the function of related structures found in unicellular and multicellular organisms.	
i) Transportation of materials (role of cellular membranes; role of vascular tissues in plants and animals; role of circulatory systems)	Active Transport Diffusion Osmosis Specialized Plant Cells
ii) Waste disposal (role of cellular membrane; role of excretory and circulatory systems)	Digestion Eukaryotic Cells The Kidney The Respiratory System
iii) Movement (cellular – flagella, cilia, pseudopodia; interaction between skeletal and muscular systems)	Prokaryotic Cells The Skeleton
iv) Feedback (maintaining cellular and organismal homeostasis – water balance, pH, temperature, role of endocrine system)	Body Temperature Glucoregulation Homeostasis Hormones The Kidneys The Endocrine System Thermoregulation

v) Asexual (binary fission, budding, vegetative, mitosis: role in growth and repair, chromosome number remains the same) and sexual reproduction (angiosperms, mammals)	Asexual Reproduction Mitosis The Stages of Meiosis The Stages of Mitosis
vi) Control of structures (cellular organelles and human systems) and related functions (role of nucleus, role of sensory organs and nervous system)	Cells to Organisms Eukaryotic Cells Organelles Nerve Impulses The Nervous System
vii) Capture and release of energy (chloroplasts, mitochondria)	Aerobic Respiration Eukaryotic Cells Organelles
viii) Protein synthesis (ribosomes)	Controlling Protein Synthesis Protein Synthesis Organelles Transcription and Translation
b) The student will conclude that cells exist within a narrow range of environmental conditions and changes to that environment, either naturally occurring or induced, may cause changes in the metabolic activity of the cell or organism.	
<i>i) pH</i>	–
ii) Temperature	Homeostasis Thermoregulation
<i>iii) Light</i>	–
iv) Water	The Kidneys
v) Oxygen	Anaerobic Respiration
<i>vi) Carbon dioxide</i>	–
vii) Radiation (role in cancer or mutations)	Genetic Mutations Genetic Variation Inherited Diseases
<i>viii) Toxic substances (natural, synthetic)</i>	–
3) Expectation: The student will analyze how traits are inherited and passed on from one generation to another.	
a) The student will demonstrate that the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring.	
i) Meiosis (process that forms gametes; chromosome number reduced by one-half; crossing-over occurs; new gene combinations)	Meiosis The Stages of Meiosis
ii) Fertilization (combination of gametes to form zygote)	Meiosis

b) The student will illustrate and explain how expressed traits are passed from parent to offspring.	
i) Phenotypes (expression of inherited characteristics)	Environmental Variation Genetic Variation
ii) Dominant and recessive traits	Genes and Alleles Inherited Diseases
iii) <i>Sex-linked traits (X-linked only; recessive phenotypes are more often expressed in the male)</i>	–
iv) Genotypes (represented by heterozygous and homozygous pairs of alleles)	Genes and Alleles Gregor Mendel
v) Punnett square (use to predict and/or interpret the results of a genetic cross; translate genotypes into phenotypes - monohybrid only)	Gregor Mendel
vi) Pedigree (use to interpret patterns of inheritance within a family)	Patterns of Inheritance
c) The student will explain how a genetic trait is determined by the code in a DNA molecule.	
i) Definition of gene (a segment of DNA that codes for a protein or RNA)	Controlling Protein Synthesis DNA Protein Synthesis Transcription and Translation
ii) Sequence of nitrogen bases directing protein formation (role of DNA, mRNA, tRNA, rRNA)	Controlling Protein Synthesis Protein Synthesis Transcription and Translation
iii) Proteins determine traits	Controlling Protein Synthesis Protein Synthesis
d) The student will interpret how the effects of DNA alteration can be beneficial or harmful to the individual, society, and/or the environment.	
i) Mutations	DNA Replication 1 Genetic Mutations Genetic Variation
ii) Chromosome number (abnormalities)	Inherited Diseases
iii) Genetic engineering (gene splicing, recombinant DNA, cloning)	Genetic Engineering Genetic Engineering for Health Care
4) Expectation: The student will explain the mechanism of evolutionary change.	
a) The student will explain how new traits may result from new combinations of existing genes or from mutations of genes in reproductive cells within a population.	
i) Natural selection (definition; effects of environmental pressure)	Evolution The Process of Evolution

ii) Adaptations (effects on survival)	Animal Adaptation Evolution Extinction Plant Adaptation The Process of Evolution
iii) Variation (effects on survival and reproductive success)	Environmental Variation Genetic Variation The Process of Evolution
b) The student will estimate degrees of relatedness among organisms or species.	
i) Classification (recognize relationships among organisms; distinguish between prokaryotes and eukaryotes)	Classification
ii) <i>Anatomical similarities (evolutionary relationships; homologous structures)</i>	–
iii) Similarities of DNA base and/or amino acid sequence (including results from gel electrophoresis)	Understanding Genomes
5) Expectation: The student will investigate the interdependence of diverse living organisms and their interactions with the components of the biosphere.	
a) The student will analyze the relationships between biotic diversity and abiotic factors in environments and the resulting influence on ecosystems.	
i) Abiotic/ Biotic Factors: Space Soil Water Air Temperature Food Light Organisms	Ecosystems Ecosystems and Succession
ii) Relationships: Predator - prey Parasite - host Mutualism Commensalism Competition	Describing Populations Host-Parasite Relationships Predator-Prey Relationships
b) The student will analyze the interrelationships and interdependencies among different organisms and explain how these relationships contribute to the stability of the ecosystem.	
i) Diversity	Ecosystems Introduction to Biodiversity
ii) Succession	Ecosystems and Succession

iii) Trophic level (producer; consumer: herbivore, carnivore, omnivore, scavenger; decomposer)	Energy Loss in Food Chains Ecosystems Food Chains Food Webs
iv) Niche (role of organism within an ecosystem)	Animal Adaptation Ecosystems Ecosystems and Succession
v) Pyramid (energy, biomass)	Energy Transfer
c) The student will investigate how natural and man-made changes in environmental conditions will affect individual organisms and the dynamics of populations.	
i) Depletion of food	Describing Populations Loss of Diversity
ii) Destruction of habitats	Extinction Loss of Diversity
iii) Disease	Loss of Diversity
iv) Natural disasters	Loss of Diversity
v) Pollution	Air Pollution Human Impact on the Environment Water Pollution
vi) Population increase	Describing Populations Extinction Human Impact on the Environment
vii) Urbanization	Human Impact on the Environment Loss of Diversity
d) The student will illustrate how all organisms are part of and depend on two major global food webs that are positively or negatively influenced by human activity and technology	
i) Oceanic food web	Food Webs
ii) Terrestrial food web	Food Webs