HAZLETON AREA SCHOOL DISTRICT
SCIENCE CURRICULUM

BIOLOGY IB

APRIL 2014

Adopted April 24, 2014

Biology IB

Unit 1: Chemical Basis for Life
(1st half of semester)

Big Idea: All organisms are made of cells and can be characterized by common aspects of their structure and functioning.

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
BIO.A.2.1 Describe how the unique properties of water support life on Earth.	BIO.A.2.1.1 Describe the unique properties of water and how these properties support life on Earth (e.g., freezing point, high specific heat, cohesion).	Why is water unique?	All students will explain how water's polarity gives it unique properties. All students will compare and contrast cohesion/adhesion, solute/solvent, and freezing point/boiling point.	All students will define water's polarity. All students will compare and contrast cohesion/adhesion, solute/solvent, and freezing point/boiling point.	CC.3.6.9-10.I PDN, tickets out the door, etc. CC.3.6.9-10.H. Create graphic organizer of the properties of water. CC.3.5.9-10.A. CC.3.6.9-10.E Research project on macromolecules CC.3.5.9-10.D. Vocabulary activities	• Freezing point • Boiling point • Cohesion • Adhesion • Hydrogen bonds
BIO.A.2.2 Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules).	BIO.A.2.2.1 Explain how carbon is uniquely suited to form biological macromolecules.	How are structure and function related on the biochemical levels of organization?	All students will explain electron configuration of a carbon atom and explain how it relates to carbon's ability to bond and form biological macromolecules. All students will construct electron configuration models using the periodic table.	All students will explain electron configuration of a carbon atom using the periodic table. All students will construct electron configuration models using the periodic table.		• Valence electrons • Covalent bonds • Macromolecules • Isotopes • Subatomic particles • Bonding • Atomic number • Atomic weight
	BIO.A.2.2.2 Describe how biological macromolecules form from monomers.		All students will describe the synthesis and hydrolysis of the biological macromolecules from their respective monomers.	All students will describe the formation of macromolecules.		• Monomer • Polymer • Carbohydrates • Monosaccharides • Polysaccharides

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
	BIO.A.2.2.3 Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.		All students will compare and contrast the structure and function of the four main macromolecules.	All students will compare and contrast the structure and function of the four main macromolecules.		• Starch • Protein • Amino acid • Lipid • Glycerol • Fatty acids • Nucleic acids • Nucleotides • Dehydration Synthesis • Hydrolysis
BIO.A.2.3 Explain how enzymes regulate biochemical reactions within a cell.	BIO.A.2.3.1 Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction.	How do environmental factors impact how enzymes regulate the rate of biochemical reactions?	All students will summarize how an enzyme catalyzes specific biochemical reactions. All students will develop and use models to illustrate and investigate how factors such as shape, pH, temperature, etc. can impact enzyme reactions.	All students will summarize how an enzyme catalyzes specific biochemical reactions. All students will develop and use models to illustrate and investigate how a factor such as shape, pH, temperature, etc. can impact enzyme reactions.		• Enzyme • Catalyst • Substrate • Reactants • Product • Activation energy • Endothermic & Exothermic reactions
	BIO.A.2.3.2 Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.		All students will investigate how various environmental conditions (pH, temperature) can affect the rate of enzymatic reactions by designing and analyzing a lab.	All students will investigate how various environmental conditions (pH, temperature) can affect the rate of enzymatic reactions.		• pH scale • Acid • Base • Neutral • Ions • Temperature • Concentration • Hydrogen • Hydroxide • Buffer

Unit 2: Cellular Structure & Function
(1st half of semester)

Big Idea: All organisms are made of cells and can be characterized by common aspects of their structure and functioning.

Anchor Descriptor	**Eligible Content**	**Essential Questions**	**Objectives**	**ELL/IEP Modified Objectives**	**PA Core***	**Vocabulary**
BIO.A.1.2 Describe relationships between structure and function at biological levels of organization.	BIO.A.1.2.1 Compare cellular structures and their functions in prokaryotic and eukaryotic cells.	How are structure and function related on each of the biological levels of organization?	All students will compare and contrast prokaryotic versus eukaryotic cell structures and functions. All students will compare and contrast the organelles of plant and animal cells. All students will analyze and infer the function of cellular structures based on microscopic investigation.	All students will compare and contrast prokaryotic versus eukaryotic cell structures and functions using a graphic organizer. All students will compare and contrast the organelles of plant and animal cells using a graphic organizer.	CC.3.6.9-10.I PDN, tickets out the door, etc. CC.3.5.9-10.D. Vocabulary activities CC.3.5.9-10.G Create a flowchart of the biological levels of organization CC.3.6.9-10.B CC.3.5.9-10.C Write an osmosis/diffusion lab report	• Prokaryote • Eukaryote • Nucleus • Cytoplasm • Cell & Plasma membrane • Ribosome • Mitochondria • Smooth & Rough endoplasmic reticulum • Golgi apparatus • Cell wall • Vesicles • Cytoskeleton • Lysosome • Nucleolus • Nuclear membrane • Chloroplast • Centrioles • Vacuole • Chromoplast • Peroxisome • Leucoplast • Cell theory

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
	BIO.A.1.2.2 Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissues, organs, organ systems, and multicellular organisms).		All students will differentiate between the various levels of biological organization from atom to organism.	All students will list the various levels of biological organization from atom to organism.		• Organelles • Cells • Tissues • Organs • Organ system • Organism • Multicellular • Unicellular
BIO.A.4.1 Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell.	BIO.A.4.1.1 Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell.	How are the structures of the cell involved in cellular transport?	All students will compare and analyze the structures for cellular transport. All students will describe the fluid mosaic model. All students will distinguish between the mechanisms of cellular transport used to maintain homeostasis in organisms.	All students will compare the structures for cellular transport. All students will describe the fluid mosaic model using a graphic.		• Lipid bi-layer • Proteins • Carbohydrates • Phospholipids

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
	BIO.A.4.1.2 Compare the mechanisms that transport materials across the plasma membrane (i.e., passive transport—diffusion, osmosis, facilitated diffusion; and active transport—pumps, endocytosis, exocytosis).		All students will compare and contrast the mechanisms of cellular transport. All students will make predictions on how a cell will behave depending upon the environment it's placed in. All students will simulate the movement of molecules across a semi-permeable membrane.	All students will compare and contrast the mechanisms of cellular transport using charts. All students will make predictions on how a cell will behave depending upon the environment it's placed in using visuals.		• Passive transport • Diffusion • Osmosis • Facilitated diffusion • Active transport • pumps (Sodium-Potassium) • Endocytosis • Exocytosis • Phagocytosis • Pinocytosis • Homeostasis • Hypotonic • Hypertonic • Isotonic • Equilibrium • Protein channels • Concentration Gradient
	BIO.A.4.1.3 Describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell.		All students will explain the role of organelles in cellular transport. All students will show how organic molecules are packaged and transported within and between cells.	All students will list the organelles in cellular transport. All students will show how organic molecules are packaged and transported within and between cells in a sequence chart.		• Endoplasmic Reticulum • Golgi apparatus • Vesicles

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
BIO.A.4.2 Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments.	BIO.A.4.2.1 Explain how organisms maintain homeostasis (e.g. thermoregulation, water regulation, oxygen regulation).	How do organisms maintain homeostasis?	All students will cite specific examples of various feedback mechanisms in a variety of organisms. All students will investigate how organisms use feedback and response mechanisms to maintain homeostasis.	All students will cite specific examples of various feedback mechanisms in a given organism. All students will explain how a given organism uses feedback and response mechanisms to maintain homeostasis.		• Thermoregulation (hyperthermia, hypothermia) • Water regulation • Oxygen regulation

Unit 3: Bioenergetics: Photosynthesis & Cellular Respiration
(1st half of semester)

Big Idea: All organisms are made of cells and can be characterized by common aspects of their structure and functioning.

Anchor Descriptor	**Eligible Content**	**Essential Questions**	**Objectives**	**ELL/IEP Modified Objectives**	**PA Core***	**Vocabulary**
BIO.A.3.1 Identify and describe the cell structures involved in processing energy.	BIO.A.3.1.1 Describe the fundamental roles of plastids (e.g. chloroplast) and mitochondria in energy transformations	How do cellular structures produce and process energy?	All students will identify and describe all of the cellular organelles involved in processing energy. All students will relate the amount of mitochondria in cells to various types of cells and tissues.	All students will identify and describe all of the cellular organelles involved in processing energy. All students will relate the amount of mitochondria in cells to various types of cells and tissues.	CC.3.6.9-10.I PDN, tickets out the door, etc. CC.3.5.9-10.D. Vocabulary Activities CC.3.5.9-10.E Venn Diagram of cell structure of plants vs. animals CC.3.5.9-10.C Fermentation lab	• Chloroplast • Mitochondria • Cristae • Pigment • Chlorophyll • Thylakoid • Stroma • Lumen • Grana • Electron transport chain • Electron Carriers • Anaerobic & Aerobic respiration • Photosynthesis • Cellular respiration

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
BIO.A.3.2 Identify and describe how organisms obtain and transform energy for their life processes.	BIO.A.3.2.1 Compare the basic transformation of energy during photosynthesis and cellular respiration.	How do organisms obtain and use energy?	All students will summarize the chemical reactions of photosynthesis and cellular respiration as well as their necessary requirements. All students will compare and contrast the reactants and products of photosynthesis and cellular respiration and show their biochemical relationship. All students will explain alternative pathways for biochemical energy production (ex. fermentation) All students will compare and contrast the light-dependent and light-independent reactions of photosynthesis. All students will summarize the use of high energy electrons in the electron transport chain.	All students will summarize the chemical reactions of photosynthesis and cellular respiration as well as their necessary requirements. All students will compare and contrast the reactants and products of photosynthesis and cellular respiration and show their biochemical relationship from given equations. All students will explain alternative pathways for biochemical energy production (ex. fermentation). All students will compare and contrast the light-dependent and light-independent reactions of photosynthesis.		• Light-Dependent & Light-Independent Reactions • Photosystems • E.T.C. • ATP synthase • Calvin cycle • Chemiosmosis • Calorie • Cell respiration • Fermentation • Glycolysis • Krebs cycle
	BIO.A.3.2.2 Describe the role of ATP in biochemical reactions.		All students will define ATP and its role in biochemical reaction as it relates to life. All students will draw and/or label the structures of various energy storing molecules.	All students will define ATP. All students will draw and/or label the structures of various energy storing molecules.		• ATP • ADP • AMP • Phosphate • Heterotroph • Autotroph • High energy bonds • Adenine

Unit 4: Cellular Growth & Reproduction
(2nd half of semester)

Big Idea: Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.

Anchor Descriptor	**Eligible Content**	**Essential Questions**	**Objectives**	**ELL/IEP Modified Objectives**	**PA Core***	**Vocabulary**
BIO.B.1.1 Describe the three stages of the cell cycle: interphase, nuclear division, and cytokinesis.	BIO.B.1.1.1 Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis.	Why does each stage of the cell cycle occur?	All students will differentiate between the stages of the cell cycle. All students will investigate how cell division helps a cell efficiently organize and transfer genetic information. All students will compare and contrast cell division in various types of organisms.	All students will differentiate between the stages of the cell cycle. All students will investigate how cell division helps a cell efficiently organize and transfer genetic information. All students will compare and contrast cell division in various types of organisms.	CC.3.6.9-10.I PDN, tickets out the door, etc. CC.3.5.9-10.D. Vocabulary activities CC.3.5.9-10.A Create visual of cell cycle CC.3.6.9-10.F Create a short essay comparing and contrasting chromosomal patterns of inheritance	• Chromosome • Chromatin • Chromatid • Centromere • Cell cycle • Cytokinesis • Centriole • Interphase • Mitosis • Meiosis • Prophase • Metaphase • Anaphase • Telophase
	BIO.B.1.1.2 Compare the processes and outcomes of mitotic and meiotic nuclear divisions.		All students will compare and contrast the processes and outcomes of mitotic and meiotic divisions.	All students will compare and contrast the processes and outcomes of mitotic and meiotic divisions.		• Diploid • Haploid • Synapsis • Homologous Pairs • Gametes • Zygote • Gametogenesis • Daughter cells

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
BIO.B.1.2 Explain how genetic information is inherited.	BIO.B.1.2.2 Explain the functional relationships between DNA, Genes, Alleles, and chromosomes and their roles in inheritance.	How do chromosomes affect patterns of inheritance?	All students will investigate the function and relationship between alleles, genes, DNA, and chromosomes.	All students will investigate the function and relationship between alleles, genes, DNA, and chromosomes using visuals and graphic organizers.		• DNA • Gene • Alleles • Chromosomes • Histone

Unit 5: DNA & Protein Synthesis
(2nd half of semester)

Big Idea: Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
BIO.B.1.2 Explain how genetic information is inherited.	BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.	How does DNA replicate?	All students will identify and summarize the major events that led to the discovery of DNA. All students will construct a model of DNA structure. All students will investigate DNA replication explaining the importance of each step in the preservation of genetic information.	All students will identify the major events that led to the discovery of DNA. All students will construct a model of DNA structure. All students will investigate DNA replication explaining each step.	CC.3.6.9-10.I PDN, tickets out the door, etc. CC.3.5.9-10.D. Vocabulary activities CC.3.5.9-10.J Timeline of the discovery of DNA CC.3.6.9-10.C CC.3.6.9-10.F Short essay describing protein synthesis CC.3.5.9-10.B Genetic disorder research project	• DNA • Replication • Nucleotide • Purines • Pyrimidines • Replication Enzymes • Double helix • Base pairing

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
BIO.B.2.2 Explain the process of protein synthesis (i.e., transcription, translation, and protein modification).	BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms. BIO.B.2.2.2 Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus and the nucleus in the production of specific types of proteins.	How does a cell produce proteins?	All students will differentiate between the structures of DNA and RNA. All students will compare the structure and function of the 3 types of RNA. All students will define the processes of transcription and translation. All students will compare and contrast transcription and translation across all organisms. All students will analyze the genetic code and explain how it is read. All students will apply concepts about transcription, translation, and the genetic code to synthesize a protein. All students will identify and describe the various organelles used in protein synthesis.	All students will differentiate between the structures of DNA and RNA. All students will compare the structure and function of the 3 types of RNA. All students will define the processes of transcription and translation. All students will compare and contrast transcription and translation. All students will analyze the genetic code and explain how it is read. All students will apply concepts about transcription, translation, and the genetic code to synthesize a protein in cooperative learning groups. All students will identify and describe the various organelles used in protein synthesis.		• Transcription • Translation • RNA (mRNA, tRNA, rRNA) • Ribosome • Protein • Protein synthesis • Amino acid • Genetic code • Peptides • Codon • Anticodon

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
BIO.B.2.3 Explain how genetic information is expressed.	BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frameshift).	How are phenotypes determined?	All students will describe how mutations can impact phenotype. All students will define and describe different types of mutations. All students will apply concepts about mutations to sequencing the genetic code and predicting phenotypic outcome.	All students will define and describe different types of mutations and describe how mutations can impact phenotype. All students will apply concepts about mutations to sequencing the genetic code and predicting phenotypic outcome using graphics from previous lessons.		• Mutation • Phenotype • Point mutation • Frame-shift • Nonsense • Silent • Genetic disorders

Unit 6: Taxonomy
(2nd half of semester)

Big Idea: Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
S.11B.1.1 Explain the structure and function at multiple levels of organization.	S11.B.1.1.2 Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into classification groups, compare systems).	How has the theory of evolution changed the way organisms are classified?	All students will explain how living things are organized for study and describe Linnaeus's system of classification. All students will use a dichotomous key to identify a variety of organisms. All students will construct and interpret a cladogram and explain how it can be used to compare very dissimilar organisms. All students will identify how evolutionary relationships are important in classification. All students will compare and contrast the 6 kingdoms of life as they are now identified. All students will describe the traits, characteristics, survival needs, reproduction, energy needs, movement, and cell structure and function for each of the 6 kingdoms. All students will compare the structure of a virus and mechanisms of infection.	All students will explain how living things are organized for study and describe Linnaeus's system of classification. All students will use a dichotomous key to identify a variety of organisms. All students will interpret a cladogram and explain how it can be used to compare related organisms. All students will describe the six kingdoms. All students will describe the traits, characteristics, survival needs, reproduction, energy needs, movement, and cell structure and function for each of the 6 kingdoms from graphic. All students will create a visual structure of a virus	CC.3.5.9-10.D Vocabulary activities CC.3.5.9-10.J CC.3.6.9-10.G CC.3.6.9-10.F Bacteria/virus research project	• Taxonomy • Binomial nomenclature • Genus • Taxon • Family • Order • Class • Phylum • Kingdom • Phylogeny • Evolutionary classification • Domain • Cladogram • Dichotomous key • Bacteria • Virus

Anchor Descriptor	Eligible Content	Essential Questions	Objectives	ELL/IEP Modified Objectives	PA Core*	Vocabulary
			All students will compare and contrast uniqueness of the bacteria kingdom versus the other kingdoms. All students will cite evolutionary evidence to support the three domain system of classification.	and mechanisms of infection. All students will compare and contrast uniqueness of the bacteria kingdom versus one other kingdom.		

PA CORE STANDARDS FOR READING IN SCIENCE AND TECHNICAL SUBJECTS:

CC.3.5.9-10.A
Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

CC.3.5.9-10.B
Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.

CC.3.5.9-10.C.
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

CC.3.5.9-10.D
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 in texts and topics.

CC.3.5.9-10.E
Analyze the structure of the relationships among concepts in a text, including relationships among key terms.

CC.3.5.9-10.F
Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

CC.3.5.9-10.G
Translate quantitative or technical information expressed in words in a text into visual form and translate information expressed visually or mathematically into words.

CC.3.5.9-10.H
Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

CC.3.5.9-10.I
Compare and contrast findings presented in a text to those from other sources, noting when the findings support or contradict previous explanations or accounts.

CC.3.5.9-10.J
By the end of grade 10, read and comprehend science/technical texts in the grades 9-10 text complexity band independently and proficiently.

PA CORE STANDARDS FOR WRITING IN SCIENCE AND TECHNICAL SUBJECTS:

CC.3.6.9-10.A
Write arguments focused on discipline-specific content.

CC.3.6.9-10.B
Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

CC.3.6.9-19.C
Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CC.3.6.9-10.D
Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing, on addressing what is most significant for a specific purpose and audience.

CC.3.6.9-10.E
Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

CC.3.6.9-10.F
Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

CC.3.6.9-10.G
Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

CC.3.6.9-10.H
Draw evidence from informational texts to support analysis, reflection, and research.

CC.3.6.9-10.I.
Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.