Blackhawk School District

CURRICULUM

Course Title:	**Biology (Keystone Exam Course)**
Course Number:	**0420**
Grade Level(s):	**Ninth**
Periods per week:	**5**
Length of Period:	**42 minutes**
Length of Course:	**Daily**
Credits:	**1 credit**
Faculty Author(s):	**Anita Mensch, Jamie Moon, Iain Eastman, Theresa Adams**
Date:	**October 2012**

MISSION STATEMENT:
The goal of science education is to develop within students an understanding of the world around us by fostering curiosity, developing inquiry skills, and creating an excitement for learning science.

COURSE DESCRIPTION:
Biology is a course designed to introduce basic biological concepts for practical everyday use. This course covers biomolecules, cell structure and function, cell process, genetics, plant and animal systematic and ecology. This course emphasizes science process and thinking skills, manifests science interest and gives students a basis for communicating effectively using science language and reasoning. Lab experiences will be conducted within a five period per week schedule.

PA Common Core Standards for Reading and Writing in Science and Technical Subjects:
Pennsylvania Department of Education has released standards that describe what students in the science and technical subjects' classrooms should know and be able to do with the English language in reading and writing, grade 6 through 12. The standards provide the targets for instruction and student learning essentials for success in all academic areas, not just language arts classrooms. Although the standards are not a curriculum or a prescribed series of activities, Blackhawk School District has used them to develop this science curriculum.
The standards for Reading are available at:
http://static.pdesas.org/content/documents/PA_Common_Core_Standards_for_Reading_in_Science_And_Technical_Subjects_8-7-12.pdf

The standards for Writing are available at:
http://static.pdesas.org/content/documents/PA_Common_Core_Standards_for_Writing_in_Science_and_Technical_Subjects_8-7-12_rev_2.pdf

ESSENTIAL QUESTIONS:

Essential questions are the heart of the curriculum. Essential questions are conceptual commitments that teachers will use to guide instructional decision-making. In addition, they are kid friendly so that students can easily understand them. Essential questions are meant to be shared with students in either discussion or posting in the classroom. Essential questions provide the focus for teaching and learning. The following are the Essential Questions for this class:

1. How do you affect the biotic and abiotic factors in the biosphere?
2. How would your life be different if you inhabited a biome other than the temperate deciduous forest?
3. How can the resources we use cause changes to the world's biodiversity?
4. How can your actions contribute to a greener environment tomorrow?
5. Why is most of our body composed of carbon?
6. How would we digest food without enzymes?
7. How are our cells different from plant cells and bacterial cells?
8. Why can't we be made of just 1 "big" cell?
9. Why can plants make their own food but animals can't?
10. What would happen to other organisms if there were no plants on Earth?
11. How does food power our bodies once we eat?
12. How has selective breeding changed products we buy?
13. How does DNA determine our characteristics
14. What makes each organism different?
15. How do we prevent food from spoiling?
16. How do vaccines and antibiotics work?
17. Why are living things categorized into specific classification groups?
18. How do plants transport essential materials differently than animals do?
19. How is the organization of plants and animals similar?

Assessing Essential questions is key to a robust curriculum. If Essential Questions are the focal point of learning, how then do we assess students? The following is an overview of recommended assessments to the Essential Questions. In addition, Differentiated learning opportunities are embedded as well (noted by DI).

Ecology

EQ: How do you affect the biotic and abiotic factors in the biosphere?

EQ Assessment: Cause and effect graphic organizer

EQ: How would your life be different if you inhabited a biome other than the tempideiduous forest?

EQ Assessment: Biome project

EQ: How can the resources we use cause changes to the world's biodiversity?

EQ Assessment: 25 word summary

How can your actions contribute to a greener environment tomorrow?

EQ Assessment: Poster / Powerpoint

Biomolecules

EQ: Why is most of our body composed of carbon?

EQ Assessment: Quarterly Assessment

EQ: How would we digest food without enzymes?

EQ Assessment: Catalase and Lactose Lab

Cytology

EQ: How are our cells different from plant cells and bacterial cells?

EQ Assessment: Graphic organizer

EQ: Why can't we be made of just 1 "big" cell?

EQ Assessment: Cell volume lab

Cell Energy

EQ: Why can plants make their own food but animals can't?

EQ Assessment: Chlorophyll separation lab

EQ: What would happen to other organisms if there were no plants on Earth?

EQ Assessment: Essay

EQ: How does food power our bodies once we eat?

EQ Assessment: 25 word summary

Genetics

EQ: How has selective breeding changed products we buy?

EQ Assessment: Discussion and exit slip

EQ: How does DNA determine our characteristics

EQ Assessment: DNA necklace

EQ: What makes each organism different?

EQ Assessment: Protein Synthesis Simulation

Viruses/Bacteria

EQ: How do we prevent food from spoiling?

EQ Assessment: Test / Essay

EQ: How do vaccines and antibiotics work?

EQ 25 word summary

Invertebrates and Vertebrates

EQ: Why are living things categorized into specific classification groups?

EQ Assessment: Classification Lab

Plants/Botany

EQ: How do plants transport essential materials differently than animals do?

EQ Assessment: Graphic Organizer

EQ: How is the organization of plants and animals similar?

EQ Assessment: Dissection Lab

ROBUST VOCABULARY:
Robust vocabulary words are Tier 2 words, meaning that they are complex, powerful, and generalizable. Robust vocabulary words support language development of both lower and high level learners. In addition, robust vocabulary instruction helps prepare students for SATs, upper level high school classes, and college. "Studies showed that robust instruction was quite effective not only for learning the meanings of words but also for affecting reading comprehension." (p. 2 *Bringing Words to Life*)

Teachers are asked to commit to teaching and students USING these words throughout the entire year. Using a variety of instructional strategies, students will learn the meaning of these words in a deep and meaningful way in this content and across other content areas.

The Robust Vocabulary for this class are: **Analyze, Illustrate, Hypothesis, Significant, Compare/Contrast, Synthesize/Synthesis, Qualitative, Benefit, Conclude, Investigate**

COURSE OUTLINE and OBJECTIVES (PA Anchors)	**RESOURCES**	**PROPOSED LABS**	**LESSON REFLECTION (for future revisions)**
Anchors Used Throughout Course S11.A.1.1.1 Compare and contrast scientific theories, scientific laws, and beliefs. S11.A.1.1.2 Analyze and explain the accuracy of scientific facts, principles, theories, and laws. S11.A.1.1.3 Evaluate the appropriateness of research questions (i.e. testable vs. non-testable). S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g. momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws). S11.A.1.1.5 Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g. behavior of atoms, functions of cells, birth of stars). S11.A.1.3.1 Use appropriate quantitative data to describe or interpret change in systems (e.g. biological indices, electrical circuit data, and automobile diagnostic systems data). S11.A.1.3.2 Describe or interpret dynamic changes to stable systems (e.g. chemical reactions, human body, food webs, tectonics, homeostasis). S11.A.2.1.1 Critique the elements of an experimental design (e.g. raising questions, formulating hypotheses, developing procedures, identifying variables, manipulating variables, interpreting data and drawing conclusions) applicable to a specific experimental design. S11.A.2.1.2 Critique the elements of the design process (e.g. identify the problem, understand criteria, create solutions, select solution, test/evaluate, communicate results) applicable to a specific technological design. S11.A.2.1.3 Use data to make inferences and predictions, or to draw conclusions, demonstrating understand of experimental limits. S11.A.2.1.4 Critique the results and conclusions of scientific inquiry for consistency and logic. S11.A.2.1.5 Communicate results of investigations using multiple representations.			

S11.A.2.2.1 Evaluate appropriate methods, instruments, and scales for precise quantitative and qualitative observations (e.g. to compare properties of materials, water quality). S11.A.2.2.2 Explain how technology (e.g. GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. S11.A.3.1.3 Use appropriate quantitative data to describe or interpret a system (e.g. biological indices, electrical circuit data, and automobile diagnostic systems data). S11.A.1.2.2 Explain and apply scientific concepts to societal issues using case studies (e.g., spread of HIV, deforestation, environmental health, energy). BIO 3.3.1 Distinguish among the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.			
Biology: The Study of Life BIO A.4.2.1 Explain how organisms maintain homeostasis (e.g., thermoregulation, water regulation, oxygen regulation). BIO 3.3.1 Distinguish among the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.	Balances Rulers Consumables Graph Paper Text book General Lab Supplies	Salinity vs. Distilled Water and Seeds Metric Measurement Graphing Activity Lab Equipment Activity	
Ecology • Principles • Communities/ Biomes • Population ecology S11.A.1.3.3 Describe how changes in physical and biological indicators (e.g. soil, plants, and animals) of water systems reflect changes in these systems (e.g. changes in bloodworm populations reflect changes in pollution levels in streams). S11.A.1.3.4 Compare the rate of use of natural resources and their impact on sustainability. S11.A.3.1.1 Apply systems analysis, showing relationships (e.g. flowcharts, concept maps), input and output, and measurements to explain a system and its parts.	Textbook Consumables General Lab Supplies	Food Chain / Food Web Activity Lesson of Kaibob Environment and Eagle Population Predator / Prey Lab Biome Project Reproductive and Human Effects Research Project	

S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole. S11a.3.2.1 Compare the accuracy of predictions represented in a model to actual observations and behavior. S11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g. dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). BIO B.4.1.1 Describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome, biosphere). BIO B.4.1.2 Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. BIO B.4.2.1 Describe how energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids). BIO B.4.2.2 Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis). BIO 4.2.3 Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle, nitrogen cycle). BIO 4.2.4 Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires). BIO 4.2.5 Describe the effects of limiting factors on population dynamics and potential species extinction.			
Biomolecules S11.A.1.3.2 Describe or interpret dynamic changes to stable systems (e.g. chemical reactions, human body, food webs, tectonics, homeostasis). S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole.	Textbook Consumables Molecule Kits General Lab Supplies	Liver Enzymes Lab Periodic Tables Activity Graph Interpretation Activity	

S11.A.3.3.2 Compare stationary physical patterns (e.g. crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. BIO 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). BIO A.2.2.1 Explain how carbon is uniquely suited to form biological macromolecules. BIO A.2.2.2 Describe how biological macromolecules form from monomers. BIO A.2.2.3 Compare and contrast the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. BIO A.2.3.1 Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction. BIO A.2.3.2 Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.		Building Biomolecule Lab Lactase Lab	
Cytology • Structure of Cells • Membranes • Types of Cells • Cell Transport • Cell Cycle S11.A.1.1.4 Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g. momentum, Newton's universal law of gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, ideal gas laws). S11.A.1.1.5 Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g. behavior of atoms, functions of cells, birth of stars). S11.A.1.3.2 Describe or interpret dynamic changes to stable systems (e.g. chemical reactions, human body, food webs, tectonics, homeostasis). S11.A.2.2.2 Explain how technology (e.g. GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision.	Textbook Microscopes Slides and Cover slips Prepared Slides Dialysis Tubing Consumables General Lab Supplies	Introduction to Microscope Thread Lab Letter "e" Lab Normal and Plasmolyzed Cells Cheek Cell Lab Plant and Animal Cell Lab Osmosis Lab Mitosis Lab	

S11.A.3.1.1 Apply systems analysis, showing relationships (e.g. flowcharts, concept maps), input and output, and measurements to explain a system and its parts. S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole. BIO A.1.1.1 Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. BIO A.1.2.1 Compare and contrast cellular structures and their functions in prokaryotic and eukaryotic cells. 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). 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. BIO A.4.1.2 Compare and contrast the mechanisms that transport materials across the plasma membrane (i.e., passive transport -- diffusion, osmosis, facilitated diffusion; active transport – pumps, endocytosis, exocytosis). BIO A.4.1.3 Compare and contrast the mechanisms that transport materials across the plasma membrane (i.e., passive transport -- diffusion, osmosis, facilitated diffusion; active transport -- pumps, endocytosis, exocytosis). BIO B.1.1.1 Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis. BIO B.1.1.2 Compare and contrast the processes and outcomes of mitotic and meiotic nuclear divisions.			

Cell Energy • Photosynthesis • Cell Respiration • Fermentation S11.A.3.1.1 Apply systems analysis, showing relationships (e.g. flowcharts, concept maps), input and output, and measurements to explain a system and its parts S11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole. BIO 3.1.1 Describe the fundamental roles of plastids (e.g., chloroplasts) and mitochondria in energy transformations. BIO 3.2.1 Compare and contrast the basic transformation of energy during photosynthesis and cellular respiration. BIO 3.2.2 Describe the role of ATP in biochemical reactions.	Textbook Consumables General Lab Supplies	Chromatography Lab Virtual lab	
Genetics • Mendelian Principles • Meiosis • Genes, Chromosomes • Protein Synthesis • Human Genetics • Genetic Engineering s11.A.2.2.2 Explain how technology (e.g. GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. s11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole. s11.A.3.2.2 Describe advantages and disadvantages of using models to simulate processes and outcomes. BIO B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.	Computers Consumables Textbook General Lab Supplies PTC Paper	DNA Timeline Activity Genetics Probability Punnett Squares Human Genetics Lab Pedigree Activity	

BIO B.1.2.2 Explain the functional relationships among DNA, genes, alleles, and chromosomes and their roles in inheritance. BIO B.2.1.1 Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles). BIO B.2.1.2 Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion). BIO 2.2.1 Describe how the processes of transcription and translation are similar in all organisms. BIO 2.2.2 Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins. BIO 2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift). BIO 2.4.1 Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy).			
Evolution and Classification s11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification and chemical periodicity. BIO B.3.1.1 Explain how natural selection can impact allele frequencies of a population. BIO B.3.1.2 Describe the factors that can contribute to the development of new species (e.g., isolating mechanisms, genetic drift, founder effect, migration). BIO B.3.1.3 Explain how genetic mutations may result in genotypic and phenotypic variations within a population. BIO B.3.2.1 Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code).	Computers Consumables Textbook General Lab Supplies	Natuaral Selection Lab Inheritance Patterns Lab Comparative Anatomy Activity Introduction to Classification Dichotomous Key Lab Website: www. becominghuman.org	

Viruses / Bacteria s11.A.1.2.1 Explain and apply scientific concepts to societal issues using case studies (e.g. spread of HIV, deforestation, environmental health, energy). s11.A.2.2.2 Explain how technology (e.g. GPS, spectroscope, scanning electron microscope, pH meter, probe, interface, imaging technology, telescope) is used to extend human abilities and precision. s11.A.3.1.2 Analyze and predict the effect of making a change in one part of a system on the system as a whole. s11.A.3.1.4 Apply the universal systems model of inputs, processes, outputs, and feedback to a working system (e.g. heating, motor, food production) and identify the resources necessary for operation of the system.	Computers DVD Textbook General Lab Supplies	Virus Movie Infectious Disease Project Virtual Lab	
Invertebrates s11.A.3.1.1 Apply systems analysis, showing relationships (e.g. flowcharts, concept maps), input and output, and measurements to explain a system and its parts. s11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g. dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). s11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification and chemical periodicity. s11.A.3.3.2 Compare stationary physical patterns (e.g. crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. 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).	Computers Consumables Textbook Dissection Equipment General Lab Supplies	Live Planarian Activity Clam Dissection Crayfish Dissection Grasshopper Dissection Virtual Dissection	

Vertebrates s11.A.3.1.1 Apply systems analysis, showing relationships (e.g. flowcharts, concept maps), input and output, and measurements to explain a system and its parts. s11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g. dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). s11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification and chemical periodicity. s11.A.3.3.2 Compare stationary physical patterns (e.g. crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. 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).	Computers Consumables Textbook Dissection Equipment General Lab Supplies	Fish Dissection Frog Dissection Virtual Dissections	
Plants / Botany S11.A.3.1.1 Apply systems analysis, showing relationships (e.g. flowcharts, concept maps), input and output, and measurements to explain a system and its parts. S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g. dimensions of objects within the solar system, life spans, size of atomic particles, topographic maps). S11.A.3.3.1 Describe or interpret recurring patterns that form the basis of biological classification and chemical periodicity. S11.A.3.3.2 Compare stationary physical patterns (e.g. crystals, layers of rocks, skeletal systems, tree rings, atomic structure) to the object's properties. 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).	Consumables Microscope General Lab Supplies Prepared Slides	Comparing Plant Tissues Virtual Labs Flower Structure Activity	