# Blackhawk School District

## CURRICULUM

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| **Course Title:** | **Life Science** |
| **Grade Level(s):** | **Eighth** *(beginning in 2014-2015)* |
| **Length of Course:** | **Daily (45 minutes)** |
| **Faculty Author(s):** | **Tim Stanton; Brian Bain** |
| **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:**
Eighth grade science emphasizes the application of scientific procedures, investigations, and problem-solving to the study of living organisms.

**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

*DISCLAIMER:*
*Blackhawk School District strongly encourages all science educators to use hands-on activities that promote the education process in all science classrooms. Included in the following curriculum document are several hands-on activities that facilitate this initiative. THESE ACTIVITIES ARE NOT MANDATORY and their use is left to the discretion of individual science educators.*

**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. **Why is life science important to me?**
2. **How would science be different if scientists did not use a common measurement system?**
3. **How can the scientific method help me to think like a scientist?**
4. **How would my world be different if humans never used the scientific method?**
5. **What impact did the invention of the microscope have on life science?**
6. **How is a sports team similar to a cell?…organism?**
7. **What would happen to an organism if substances could not move into or out of its cells?**
8. **How do I get my energy to live and love from the sun?**
9. **What is cancer?**
10. **Is there any truth to the following statement, "Every human is 50% male and 50% female"?**
11. **If I ever have a child, what is the change I will a male child? …a female child?**
12. **Are all DNA mutations bad?**
13. **What is evolution?**
14. **How do I think like a taxonomist?**
15. **Why is organization in the study of classification important?**
16. **Why are animals and plants so dependent on one another?**

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)

Robust Vocabulary: data, interpret, hypothesis, theory, structure, function, energy, adapt, evolve, environment

Overarching EQ: Why is life science important to me?

Measurement:

EQ: How would science be different if scientists did not use a common measurement system?

Assessment: Students develop a measurement system in their group, apply, and share out with others.

Scientific Method:

EQ: How can the scientific method help me to think like a scientist?

How would my world be different if humans never used the scientific method?

Assessment: Students develop a research questions, testable hypothesis, and experiment to solve a problem about their world.

Cells:

EQ: What impact did the invention of the microscope have on life science?

How is a sports team similar to a cell?…organism?

Assessment: Essay

DI: Provide vocabulary and content to be included in the responses of lower level students.

Chemical Regulation:

EQ: What would happen to an organism if substances could not move into or out of its cells?

Assessment: Poster or PowerPoint presentation

Cellular Energy:

EQ: How do I get my energy to live and love from the sun?

Assessment: Graphic organizer of the carbon cycle with energy input and output

DI: Boxes and Titles provided for lower level students.

Cellular Reproduction:

EQ: What is cancer?

Is there any truth to the following statement, “Every human is 50% male and 50% female”?

Assessment: Graphic organizer of the cell cycle.

Genetics:

EQ: If I ever have a child, what is the change I will a male child? …a female child?

Are all DNA mutations bad?

Assessment: Family Pedigree or DNA model

Evolution:

EQ: What is evolution?

Assessment: Essay

DI: Give 5 sub questions and ask students to choose three to include in their response.

Classification:

EQ: How do I think like a taxonomist?

Why is organization in the study of classification important?

Assessment: Use a dichotomous key to classify tree species.

DI: Group students according to ability, guided practice with lower level students and facilitated instruction with independent learners.

Ecology:

EQ: Why are animals and plants so dependent on one another?

Assessment: Make a food web when given feeding relationships among members of an ecological community.

**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: **data, interpret, hypothesis, theory, structure, function, energy, adapt, evolve, environment**

*The following outline provides a general overview of the course content, not a chronological timetable. The weeks denoted for each area provide an idea for the overall time spent working with a given topic throughout the school year.*

| **COURSE OUTLINE and OBJECTIVES** (PA Anchors) | **PROPOSED TIME** | **RESOURCES** | **Possible Labs/ Activities** | **LESSON REFLECTION (for future revisions)** |
|---|---|---|---|---|
| **I. <u>Measurement/ Data Collection / Instrumentation</u>**<br><br>*Concepts covered*<br>• SI system of measurement<br>• Types of Data (quantitative vs. Descriptive)<br>• Instrumentation (identifying and using science equipment)<br>• Measurement Errors<br>• Graphing and interpretation<br><br>*Standards*<br>• S8.A.2.2.1 Describe the appropriate use of instruments and scales to accurately and safely measure time, mass, distance, volume, or temperature under a variety of conditions.<br>• S8.A.2.2.2 Apply appropriate measurement systems (e.g. time, mass, distance, volume, temperature) to record and interpret observations under varying conditions. | 10 Days | <u>Cells, Heredity, and Classification</u>; Holt, Rinehart, and Winston; 2005<br><br>Scales<br>Thermometer<br>Graduated Cylinder | Measurement / Density Lab | |
| **II. <u>Scientific Methods / Inquiry / Data Analysis</u>**<br><br>*Concepts covered*<br>• Parts of the scientific method<br>• Developing testable questions and hypotheses<br>• Experimentation and data collection<br>• Data analysis and drawing conclusions<br><br>*Standards*<br>• S8.A.1.1.1 Distinguish between a scientific theory and an opinion, explaining how a theory is supported with evidence, or how new data/information may change existing theories and practices.<br>• S8.A.1.1.2 Explain how certain questions can be answered through scientific inquiry and/or technological design (such as computer, calculator, scientific instruments)<br>• S8.A.1.1.3 Use evidence, such as observations or experimental results, to support inferences about a relationship.<br>• S8.A.1.1.4 Develop descriptions, explanations, predictions, and models using evidence. | 12 Days | <u>Cells, Heredity, and Classification</u>; Holt, Rinehart, and Winston; 2005 | Scientific Method Lab<br>*Pulse Rate | |

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|---|---|---|---|---|
| • S8.A.2.1.1 Use evidence, observations, or a variety of scales (e.g. mass, distance, volume, temperature) to describe relationships.<br>• S8.A.2.1.2 Use space/time relationships, define concepts operationally, raise testable questions, or formulate hypotheses.<br>• S8.A.2.1.3 Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.<br>• S8.A.2.1.4 Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.<br>• S8.A.2.1.5 Use evidence from investigations to clearly communicate and support conclusions.<br>• S8.A.2.1.6 Identify a design flaw in a simple technological system and devise possible working solutions.<br>• S8.A.2.1.5 Use evidence from investigations to clearly communicate and support conclusions.<br>• S8.A.2.1.6 Identify a design flaw in a simple technological system and devise possible working solutions.<br>• S8.A.3.3.1 Explain how certain questions can be answered through scientific inquiry and/or technological design. | | | | |

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| **III. <u>Basic Organization of Life and Molecules</u>**<br><br>*Standards*<br>• S8.A.3.1.2 Explain the concept of order in a system (e.g., first to last–manufacturing steps; trophic levels; simple to complex–cell, tissue, organ, organ system).<br>• S8.A.3.2.1 Describe how scientists use models to explore relationships in natural systems (such as an ecosystem, river system, or the solar system).<br>• S8.A.3.3.2 Describe repeating structure patterns in nature(e.g., veins in a leaf, tree rings, , crystals, water waves) or periodic patterns (e.g., daily, monthly, annually).<br>• S8.A.2.1.1. Describe the unique properties of water and how these properties support life on earth (freezing point, high specific heat, cohesion)<br>• S8.A.2.2.1. Explain how carbon is uniquely suited to form biological macromolecules.<br>• S8.A.2.2.2. Describe how biological macromolecules form from monomers.<br>• S8.A.2.2.3. Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.<br>• S8.A.2.3.1. Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction.<br>• S8.A.2.3.2. Explain how factors such as pH, temp. and concentration levels can affect enzyme function. | | | | |

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| **IV. <u>Cells, Microscopes, Systems</u>**<br>*Concepts covered*<br>• Cell Theory<br>• Differentiate between prokaryotic and eukaryotic cells<br>• Eukaryotic cell structures (organelles)<br>• Microscope use and parts<br>• Levels of biological organization (cells to biosphere)<br>*Standards*<br>• S8.A.2.1.6 Identify a design flaw in a simple technological system and devise possible working solutions.<br>• S8.A.2.2.3 Describe ways technology (e.g. microscope, telescope, micrometer, hydraulics, barometer) extends and enhances human abilities for specific purposes.<br>• S8.A.3.1.1 Describe a system (e.g. watershed, circulatory system, heating system, agricultural system) as a group of related parts with specific roles that work together to achieve an observed result.<br>• S8.A.3.1.3 Distinguish among system inputs, system processes, system outputs, and feedback (e.g. physical, ecological, biological, informational).<br>• S8.A.1.2.1. Compare cellular structures and their functions in prokaryotic and eukaryotic cells.<br>• S8.A.1.2.2. Describe and interpret relationships between structure and function at various levels of biological organization (organelles, cells tissues, organs, organ systems, and multicellular organisms) | 14 Days | <u>Cells, Heredity, and Classification</u>; Holt, Rinehart, and Winston; 2005<br><br>Microscopes<br>Prepared Slides<br>Blank Slides<br>Stain | Intro to Microscopy Lab | |

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| **V. <u>Cellular Energy</u>**<br><br>*Concepts covered*<br>• Mitochondria structure and function<br>• Differentiate between aerobic and anaerobic respiration<br>• Chloroplast structure and function<br>• Chlorophyll Function<br>• Pigment, light, color<br>• Chemical Equations ( products and reactants)<br><br>*Standards*<br>• S8.A.3.2.3 Given a model showing simple cause and effect relationships in a natural system, predict results that can be used to test the assumptions in the model. (e.g., photosynthesis, water cycle, diffusion, infiltration)<br>• S8.A.3.1.1.Describe the fundamental roles of plastids (chloroplasts) and mitochondria in energy transformations.<br>• S8.A.3.2.1. Compare and contrast the basic transformation of energy during photosynthesis and cellular respiration. | 14 Days | <u>Cells, Heredity, and Classification</u>; Holt, Rinehart, and Winston; 2005<br><br>Microscopes<br>Bromothymol Blue<br>Yeast<br>Elodea | Plant Survey Lab<br><br>CO2 Lab | |

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| **VI. <u>Cellular Reproduction</u>**<br><br>*Concepts covered*<br>• 3 stages of the cell cycle<br>• 4 stages of mitosis<br>• Differentiate between DNA, chromatin, and chromosomes<br>• Differentiate between sexual and asexual reproduction<br>• Meiosis, sex cells, fertilization, and chromosome numbers.<br><br>*Standards*<br>• S8.B.1.1. Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis.<br>• S8.B.1.1.1. Describe the events that occur during the cell cycle: interphase, nuclear division (mitosis or meiosis), cytokinesis.<br>• S8.B.1.1.2. Compare the processes and outcomes of mitotic and meiotic nuclear divisions.<br>• S8.B.1.2. Explain how genetic information inherited.<br>• S8.B.1.2.1. Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.<br>• S8.B.1.2.2. Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance. | 10 days | <u>Cells, Heredity, and Classification</u>; Holt, Rinehart, and Winston; 2005<br><br>Microscopes<br><br>Prepared Animal/Plant Mitosis Slides | Mitosis Lab | |

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| **VII. <u>Genetics</u>**<br><br>*Concepts covered*<br>• Mendel's model of heredity (dominant and recessive alleles)<br>• Punnett Squares<br>• Pedigrees<br>• DNA Structure<br>• DNA Replication<br>• Protein Synthesis<br>• Genes, mutations, and alleles<br><br>*Standards*<br><br>• S8.A.1.2.1 Describe the positive and negative, intended and unintended, effects of specific scientific results or technological developments.(e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants)<br>• S8.A.1.2.2 Explain society's standard of living in terms of technological advancements and their impact on agriculture. (e.g., transportation, processing, production, storage)<br>• S8.A.1.2.3 Describe fundamental scientific or technological concepts that could solve practical problems.(e.g., Newton's Laws of motion, Mendelian genetics, mechanical advantage)<br>• S8.A.3.2.2 Describe how engineers use models to develop new and improved technologies to solve problems.<br>• S8.B.2.1. Compare Mendelian and non-Mendelian patterns of inheritance.<br>• S8.B.2.1.1. Describe and/or predict observed patterns of inheritance (dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles).<br>• 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).<br>• BIO.B.2.2 Explain the process of protein synthesis<br>• BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms.<br>• 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.<br>• BIO.B.2.3 Explain how genetic information is expressed.<br>• BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).<br>• BIO.B.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). | 20 days | <u>Cells, Heredity, and Classification</u>; Holt, Rinehart, and Winston; 2005<br><br>DNA Model | DNA Extraction Lab<br><br>DNA Modeling Activity | |

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| **IX Ecology**<br><br>*Concepts covered*<br>• Differentiate between abiotic and biotic factors<br>• Food webs and population sizes<br>• Ecological classification of organisms (producers, consumers, and decomposers)<br>• Matter Cycles (water, carbon, nitrogen)<br>• Symbiosis<br><br>*Standards*<br>• S8.A.1.2.1 Describe the positive and negative, intended and unintended, effects of specific scientific results or technological developments.(e.g., air/space travel, genetic engineering, nuclear fission/fusion, artificial intelligence, lasers, organ transplants)<br>• S8.A.1.2.2 Explain society's standard of living in terms of technological advancements and their impact on agriculture. (e.g., transportation, processing, production, storage)<br>• S8.A.1.2.4 Identify environmental issues and explain their potential long-term health effects (e.g., pollution, pest controls, vaccinations).<br>• S8.A.1.3.2 Use evidence, observations, or explanations to make inferences about change in systems over time (e.g., carrying capacity, succession, population dynamics, loss of mass in chemical reactions, indicator fossils in geologic time scale) and the variables affecting these changes.<br>• S8.A.1.3.3 Examine systems changing over time, identifying the possible variables causing this change, and drawing inferences about how these variables affect this change.<br>• S8.A.1.3.4 Given a scenario, explain how a dynamically changing environment provides for the sustainability of living systems.<br>• S8.A.3.1.4 Distinguish between open loop (e.g., energy flow, food web, open-switch) and closed loop (e.g., materials in the nitrogen and carbon cycles, closed-switch) systems.<br>• S8.A.3.1.5 Explain how components of a natural and human-made system play different roles in a working system.<br>• S8.A.3.2.1 Describe how scientists use models to explore relationships in natural systems (such as an ecosystem, river system, or the solar system).<br>• BIO.B.4.1 Describe the ecological levels of organization in the biosphere<br>• BIO.B.4.1.1 Describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome, biosphere).<br>• BIO.B.4.1.2 Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.<br>• BIO.B.4.2 Describe interactions and relationships in an ecosystem<br>• BIO.B.4.2.1 Describe how energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids).<br>• BIO.B.4.2.2 Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis). | 20 days | Environmental Science; Holt, Rinehart, and Winston; 2005<br><br>Microscopes | Population Estimation Lab<br><br>Micro Ecosystems Lab | |

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| • BIO.B.4.2.3 Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle, nitrogen cycle).<br>• BIO.B.4.2.4 Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires).<br>• BIO.B.4.2.5 Describe the effects of limiting factors on population dynamics and potential species extinction. | | | | |

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|---|---|---|---|---|
| **X. <u>Evolution</u>**<br><br>*Concepts covered*<br>• Mutations and Natural Selection<br>• Adaptations<br>• Evidence for evolution (fossils, genetics, and comparative anatomy)<br><br>*Standards*<br>• S8.A.1.3.3 Examine systems changing over time, identifying the possible variables causing this change, and drawing inferences about how these variables affect this change.<br>• BIO.B.3.1 Explain the mechanisms of evolution<br>• BIO.B.3.1.1 Explain how natural selection can impact allele frequencies of a population.<br>• 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).<br>• BIO.B.3.1.3 Explain how genetic mutations may result in genotypic and phenotypic variations within a population.<br>• BIO.B.3.2 Analyze the sources of evidence for evolution<br>• BIO.B3.2.1 Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code).<br>• BIO.B.3.3 Apply scientific thinking, processes, tools, and technologies in the study of the theory of evolution<br>• BIO.A.3.3.1 Distinguish among the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation. | 20 days | <u>Cells, Heredity, and Classification</u>; Holt, Rinehart, and Winston; 2005 | Adaptation Lab "Human Hand"<br><br>Natural Selection Lab | |