

Biology Overview 2022 - 2023

This document is designed provide parents/guardians/community an overview of the curriculum taught in the FBISD classroom. This document supports families in understanding the learning goals for the course, and how students will demonstrate what they know and are able to do. The overview offers suggestions or possibilities to reinforce learning at home.

Included at the end of this document, you will find:

- A [glossary](#) of curriculum components
- The content area [instructional model](#)
- [Parent resources](#) for this content area

To advance to a particular grading period, click on a link below.

- [Grading Period 1](#)
- [Grading Period 2](#)
- [Grading Period 3](#)
- [Grading Period 4](#)

Process Standards

The process standards describe ways in which students are expected to engage in the content. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use knowledge learned efficiently and effectively in daily life.

B.1A Demonstrate safe practices during laboratory and field investigations

B.1B Demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials

B.2A Know the definition of science and understand that it has limitations, as specified in (b)(2) of this section

B.2B Know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence.

Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories

B.2D Distinguish between scientific hypotheses and scientific theories

B.2E Plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology

B.2F Collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as data-collecting probes, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, balances, gel electrophoresis apparatuses, micropipettes, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures

B.2G Analyze, evaluate, make inferences, and predict trends from data

B.2H Communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

B.3A Analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, so as to

encourage critical thinking by the student
B.3D Evaluate the impact of scientific research on society and the environment
B.3E Evaluate models according to their limitations in representing biological objects or events

Grading Period 1

Unit 1 – Biomolecules and Cells

Estimated Date Range: Aug. 10 – Sept. 12

Estimated Time Frame: 23 days

Unit Overview:

Students will review lab safety rules and procedures. Students will also compare the safety involved in a science classroom to the rules, guidelines and proper use of safety equipment classroom. The evaluation why safety is important in a science classroom and how it is used in everyday life will be a cornerstone of learning that will continue throughout the school year. Students will review previously learned information on how scientists identify and solve problems by planning and carrying out investigations in which hypotheses are formulated and tested. Collecting, analyzing and drawing conclusions from data are activities that will allow for students demonstrate their ability to express their understanding of scientific process in written form.

Students will review functions of four biomolecules: lipids, carbohydrates, nucleic acids, and proteins. The students will also learn cell basics such as levels of organization, prokaryote cells vs. eukaryote cells, and receive a brief review of organelle function. Homeostasis and Cellular Transport will also be discussed during this unit and cover the following: structure/function of plasma membrane, passive transport and active transport.

At home connections:

- Ask student to identify different types of scientists and state what they study and do? Have students create a digital or paper interactive science notebooks where they identify and describe common laboratory tools such as microscope, tongs, safety goggles, balance, beaker, hot plate, graduate cylinder, pipette, safety shower, fire blanket, etc...
- Have students indicate the type of biomolecules by selecting food products found in the home. The four types of biomolecules are: Lipids (fats), Carbohydrates (starches), Nucleic Acids (DNA and RNA), and Proteins (amino acids). Sample food products can include read meat, fish, onions, crackers, olive oil, potatoes, beans, pasta, and apples.

Concepts within Unit #1 Link to TEA High School Science TEKS	Success Criteria for this concept
Concept #1: Lab Safety and Nature of Science B.1A, B.2E, B.2F, B.2G, B.2H, B.3A, b.3D	<ul style="list-style-type: none"> • Follow all the safety rules of the time during laboratory/field investigations. • Identify the safety equipment in the classroom. • Explain how and when to use the safety equipment in the classroom.
Concept #2: Biomolecules B.9A, B.9C, B.10C	<ul style="list-style-type: none"> • Identify the functions of carbohydrates, lipids, proteins and nucleic acids. • Compare the functions of the four types of biomolecules. • Describe the role enzymes play in biological systems.
Concept #3: Cell Transport B.4A, B.4B, B.9C, B.10.C	<ul style="list-style-type: none"> • Describe the methods of cell transport • Explain how cell transport helps a cell maintain homeostasis. • Compare and contrast active and passive transport

Unit 2: Energy Conversion in Cells

Estimated Date Range: Sept. 13 – Sept. 30

Estimated Time Frame: 13 days

Unit Overview:

Students will be able to understand that all cells must obtain and use energy and carry out energy conversions such as photosynthesis and cellular respiration to maintain homeostasis. In addition, students will be able to explain the processes of photosynthesis and cellular respiration in cells. By the end of the unit, students will be able to understand and explain how the exchange of energy relates to how we eat and breathe.

At home connections:

- Discuss with students the purpose of photosynthesis in plants, and how it relates to cellular respiration. Cellular respiration is the process cells use to release energy from food molecules. Identify the organelle in plants that is responsible for carrying out photosynthesis in plants (chloroplast). A short activity can be done with the student where they use a plant in clear plastic cups. One cup is placed near a window or outside directly in the sun. The second plant is placed in a part of the home that does not directly receive sunlight. Observe the plant growth over a period of one week. An addition to the activity would be to place a grown plant in a small clear tube or cup and cover the opening completely. Do not cover the entire cup. Wait at least one hour and have the student observe any reactions that take place in the cup. Small bubbles should exist in the tube or clear plastic cup which represent the chemical reaction whereby plants convert carbon dioxide and water (hydrogen) into carbohydrates (food) that plants use as energy for survival.

Concepts within Unit # 2 Link to TEA High School Science TEKS	Success Criteria for this concept
Concept #1: Photosynthesis B.4B, B.9B	<ul style="list-style-type: none"> • Explain that autotrophs use the process of photosynthesis to convert radiant energy to chemical energy and can name the chemical energy as glucose (C₆H₁₂O₆). • Describe photosynthesis and in terms of matter. • Describe photosynthesis in terms of energy conversion. • Explain the role of chloroplasts and mitochondria in converting energy for organisms.
Concept #2: Cellular Respiration B.4B, B.9B	<ul style="list-style-type: none"> • Name the products and reactants of cellular respiration in terms of matter. • Describe the energy conversion that takes place in cellular respiration. • Compare photosynthesis and cellular respiration in terms of matter. • Compare photosynthesis and respiration in terms of energy conversions.

Unit 3: Nucleic Acids and Protein Synthesis

Estimated Date Range: Oct. 3 – Oct. 7

Estimated Time Frame: 5 days

Unit Overview:

Students will be able to explain that genes are segments of DNA found on chromosomes in the nucleus, and they contain information that specify our traits. Explain that the two strands of DNA are held together down the middle by hydrogen bonds between the nitrogenous base pairs. In addition, students will be able to explain that the sequence of nucleotides, specifically nitrogen bases, in the DNA specifies the structure and function of a protein, and that proteins determine our traits. Activities will also include transcribing a strand of mRNA when given a strand of DNA, using base pairing rules. Another concept in this unit is gene mutations. Students will learn that mutations occur as a result of

changes in DNA sequences. The different types of mutations (substitution, deletion, frame-shift, etc..) will also be addressed in this unit.

At home connections:

- Adults can engage in conversation with students where they ask questions about Deoxyribonucleic Acid (DNA). Questions can include: What is DNA? Where does DNA come from? Why is DNA important? Next, adults and students can work to assemble a DNA molecule (*according to base pairing rules*) with common arts and crafts products found around the home, or different colors of construction paper. The Exploratorium has compiled a variety of DNA workshop experiences for an informal science setting. Adults and students can find background information for DNA and picture templates for assembling a DNA molecule at: [Workshop #1: Introduction to DNA](#) by the [Exploratorium Teacher Institute](#) (CC BY-NC-SA 4.0).

Concepts within Unit # 3 Link to TEA High School Science TEKS	Success Criteria for this concept
Concept #1: DNA and RNA B.4B, B.6A, B.9A, B.9B, B.9C	<ul style="list-style-type: none"> • Identify and describe the three parts of a nucleotide (sugar, phosphate group, nitrogenous base). • Describe the structure of DNA as a double helix. • Explain that DNA and RNA are nucleic acids, which are polymers of nucleotides, which are the monomers. • Apply the base pairing rule of DNA and RNA. • Describe the similarities in structure between DNA and RNA.

Grading Period 2

Unit 3 continued: Nucleic Acids and Protein Synthesis

Estimated Date Range: Oct. 11 – Oct. 24

Estimated Time Frame: 10 days

Unit Overview:

Students will be able to explain that genes are segments of DNA found on chromosomes in the nucleus, and they contain information that specify our traits. Explain that the two strands of DNA are held together down the middle by hydrogen bonds between the nitrogenous base pairs. In addition, students will be able to explain that the sequence of nucleotides, specifically nitrogen bases, in the DNA specifies the structure and function of a protein, and that proteins determine our traits. Activities will also include transcribing a strand of mRNA when given a strand of DNA, using base pairing rules. Another concept in this unit is gene mutations. Students will learn that mutations occur as a result of changes in DNA sequences. The different types of mutations (substitution, deletion, frameshift, etc..) will also be addressed in this unit.

At home connections:

- Protein synthesis is the process in which cells make proteins. Have students share information they have learned about translation and transcription as they relate to protein synthesis. Students can provide oral or written steps in the processes along engaging in the [Secret Codon](#) activity developed by the [Exploratorium Teacher Institute](#) (CC BY-NC-SA 4.0) with the supervision of an adult.

Concepts within Unit # 3 Link to TEA High School Science TEKS	Success Criteria for this concept
Concept #2: Protein Synthesis B.4A, B.4B, B.6C, B.9A, B.9B	<ul style="list-style-type: none"> • Describe the three main types of RNA involved in protein synthesis and what they do (mRNA, rRNA, tRNA). • Transcribe a strand of mRNA when given a strand of DNA, using base pairing rules. • Use a codon chart to determine a protein sequence from mRNA.
Concept #3: Mutations and Gene Expression B.4A, B.6C, B.6D, B.6E, B.9C	<ul style="list-style-type: none"> • Explain the nature of substitution, insertion, and deletion mutations. • Identify substitution, insertion, and deletion mutations in a strand of DNA by comparing the mutated DNA sequence to the original, non-mutated sequence. • Identify the effects of substitution, insertion, and deletion gene mutations in a protein by transcribing and translating the DNA sequence into an amino acid sequence. • Explain why the effects of a mutation can be harmful, helpful, or neutral. • Define the term gene expression and understand that gene expression is a regulated process.

Unit 4: Cell Cycle

Estimated Date Range: Oct. 25 – Nov. 7

Estimated Time Frame: 9 days

Unit Overview:

Students will explain the process of cell division and provide information on each phase of the cell cycle, understand how the process of mitosis is related to the growth of the organism and describe how mutations occur in cells. Students will also learn about cytokinesis as they study mitosis.

At home connections:

- Adults and students can discuss the purposes of cell division and its importance to the human body. Students may be able to relay that cells go through a division process called Mitosis and explain the phases. For instance, an adult and the student can simulate cell division by using string. Start with two 1-inch strings. Lay the two pieces of string side by side on a piece of paper. Draw a large circle around the two pieces of string to represent the cell membrane. Have the student lead the discussion about how cells divide and explain each phase of Mitosis (anaphase, interphase, telophase, and prophase). The strings should be cut to mimic the actions taken place by the cell in each phase. Cells divide in half for each phase. Therefore, the first division should result in four pieces of string, then eight pieces of string, and the cycle continues. Adults and students can refer to the HMH Biology textbook online for illustrations, search the internet for pictures.

Concepts within Unit # 4 Link to TEA High School Science TEKS	Success Criteria for this concept
Concept #1: Cell Cycle B.5A, B.5B, B.5C, B.6A, B.6B, B.6E	<ul style="list-style-type: none"> • Identify and explain what happens during the following processes of the cell cycle: Interphase, Prophase, Metaphase, and Anaphase. • Explain that cells differentiate because specific genes are activated during embryonic development which leads to cell types with specialized functions. • Explain how unregulated cell division leads to cancer. • Explain when and why DNA replication must occur, and model DNA replication through base pairing. • Compare processes of DNA replication and cell division in prokaryotes and eukaryotes.

Unit 5: Genetics

Estimated Date Range: Nov. 8 – Dec.16

Estimated Time Frame: 24 days

Unit Overview:

Students will understand that DNA holds the genetic code and traits of offspring can be determined by analyzing the genetic traits of the parents. Differentiating between Mendelian and Non-Mendelian crosses, along with using Punnett squares to predict the outcomes of genetic events will also be focus of classroom activities. The students will also describe the process of Meiosis as it relates to asexual reproduction and analyze real-world data to independently determine inheritance patterns shown in the data.

At home connections:

- As students begin to learn more about DNA and its importance to inheriting traits and other characteristics, adults can elect to discuss popular genetic testing services where people are provided the historical origins of their ethnicities. In addition, adults may ask questions of students such what characteristics are similar and different between animals and their offspring, or how does one animal have brown fur and the other have black fur yet they have the same two parents? Animal examples could include horses, cows, cats, dogs, goat, or sheep.

Concepts within Unit # 5 Link to TEA High School Science TEKS	Success Criteria for this concept
Concept #1: Meiosis B.4B, B.6A, B.6B, B.6G, B.6E, B.6F	<ul style="list-style-type: none"> • Explain the purpose of meiosis. • Draw, sequence, and label the events/stages of meiosis. • Describe the significance of each stage of meiosis to sexual reproduction. • Explain why crossing over leads to genetic variation.

<p>Concept #2: Genetics B.4B, B.6A, B.6E, B.6G, B.6F</p>	<ul style="list-style-type: none">• Define allele by explaining the relationship between chromosomes, genes, alleles, and traits.• Represent alleles with capital and lowercase letters to show dominant and recessive versions of a gene.• Create monohybrid Punnett squares and predict possible outcomes.• Create dihybrid Punnett squares to predict possible outcomes.• Understand that alleles are different forms of a gene that lead to different forms of a trait.• Use the terms dominant, recessive, homozygous, and heterozygous to describe Genotypes.
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Grading Period 3

Unit 6: Evolution

Estimated Date Range: Jan. 5 – Jan. 27

Estimated Time Frame: 16 days

Unit Overview:

Students will explain the various evidences of evolution and explore the mechanisms of evolution. Students analyze and evaluate the theory of biological evolution by examining evidence of common ancestry from DNA sequences, fossil records, biogeography, and anatomical and developmental homologies. In addition, the students will explain why populations change over time and not individuals and explain the relationship between adaptations and natural selection.

At home connections:

- Adults and students can explore and research various theories of evolution, along with research on Charles Darwin’s contribution. Understanding fossils and how populations change over time is another avenue to learn more about evolution. Students can prepare an explanation for the survival of the fittest teaching where they prepare drawings and short written explanations. In addition, have students do research that support the understanding the species adapts over time rather than an individual in the species.

Concepts within Unit # 6 Link to TEA High School Science TEKS	Success Criteria for this concept
Concept #1: Evidence of Common Ancestry B.4A, B.6B, B.7A, B.7B	<ul style="list-style-type: none"> • Evaluate common ancestry using the following methodologies: Fossil Record, Biogeography, and Homologies (anatomical, developmental, and molecular). • Interpret data related to evolution including maps, visuals, data tables and graphs. • Use different homologies to show common ancestry. • Use the fossil record to show common ancestry. • Use biogeography to show common ancestry.
Concept #2: Mechanisms of Evolution B.6E, B.6G, B.7F	<ul style="list-style-type: none"> • Describe how populations can change over time through genetic drift, gene flow, mutation, and recombination. • Explain how the effects of meiosis through the recombination of genes can lead to population change over time. • Explain how random and nonrandom mechanisms cause genetic change within a population.
Concept #3: Natural Selection and Populations B.6E, B.7C, B.7D, B.7E	<ul style="list-style-type: none"> • Define and give an example of an adaption seen in a species. • State the elements of natural selection and specify how they result in differences in reproductive success. • Understand that some genes are always “on” and being expressed, and others are only “on” and being expressed some of the time. • Determine what changes have occurred in a population based on a scenario and explain why natural selection affects populations and not individuals.

Unit 7: Classification

Estimated Date Range: Jan. 30 – Feb. 21

Estimated Time Frame: 15 days

Unit Overview:

Students will learn that organisms are categorized into a hierarchical classification system based on similarities and differences. Students will learn to use a standardized taxonomic system and will identify the 6 kingdoms, their traits, compare traits of kingdoms, and place organisms within kingdoms.

At home connections:

- Adults can have students organize their clothing as an example of how to classify organisms. Adults can randomly select articles of clothing worn by the students and place the items in a small pile. The student can be given directions to sort the clothes in different broad categories. Once this step is complete, the students can be given directions to further sort the items. It is possible to have the students use one more round of sorting the items. The adult can then ask the student to explain why each of the clothes were placed in certain piles for each round. Once the activity is complete, the student can be directed to explain how the process just completed compares to that of classifying living organism into kingdoms, phylum, class, order, family, genus, and species.

Concepts within Unit # 7

[Link to TEA High School Science TEKS](#)

Success Criteria for this concept

Concept #1: Classification
B.8A, B.8B. B.8C

- Organize the taxons in order of hierarchy from domain to species.
- Determine similarities and differences between species in the hierarchical classification system.
- Classify an organism into its proper kingdom, when given a list of characteristics, a picture, and/or a scenario.
- Compare characteristics of organisms in different kingdoms.

Unit 8: Ecology

Estimated Date Range: Feb. 22 – Mar. 10

Estimated Time Frame: 13 days

Unit Overview:

Students will learn that living things interact with other organisms and with their environment and understand individual organisms and populations of organisms interact with each other and the environment. Students will learn that climate and the distribution of land and water play a role in shaping ecosystems and influencing the distribution of organisms on Earth. Information in this unit will help students discover that Human population and growth threatens environmental quality and biodiversity, so conservation methods are necessary to protect Earth's natural resources.

At home connections:

- Students can examine the environment around the home to determine the type of animals live and reproduce in that area. Adults can have student create ecosystems in bottle/jar by collecting pond water sample and observing the organisms that live in the pond water along with researching any microscopic organisms that exist withing the area of the pond sample. Students can also conduct research different environments (*ex. freshwater vs. saltwater, dessert vs. tundra, etc...*) to determine living organisms within the environments and why animals survive in some ecosystems and not others.

Concepts within Unit # 8 Link to TEA High School Science TEKS	Success Criteria for this concept
Concept #1: Flow of Energy B.10C, B.12A, B.12C, B.12.D, B.12E	<ul style="list-style-type: none"> • Identify predator/prey relationships. • Describe the features of a pyramid of energy. • Create a diagram to show the flow of energy and matter through an ecosystem using food webs and energy pyramids. • Interpret interactions of organisms in terms of ecological relationships.
Concept #2: Ecological succession B.11B, B.12B, B.12E	<ul style="list-style-type: none"> • Describe ecosystem, population, community, and species diversity. • Define primary succession and secondary succession. • Identify examples of both primary succession and secondary succession. • Define pioneer species. • Define climax community.

Grading Period 4

Unit 9: Processes in Plants

Estimated Date Range: Mar. 20 – Apr. 14

Estimated Time Frame: 18 days

Unit Overview:

Students will understand how systems in plants interact to carry out the life functions of transport, reproduction, and response in plants. Know that water and minerals are transported upward from roots to shoots as xylem sap and that sugars are transported as phloem sap to roots and other parts of the plant. The students will also recognize the different tropisms that plants exhibit, and understand that through stomata, leaves take in CO₂ and expel O₂. Classroom experiences will help students understand that through the process of transpiration, the loss of water from leaves, creates a force within leaves that pulls xylem sap upward. In addition, the students will know and understand the roles and purposes of seeds, flowers, and fruits in plant reproduction.

At home connections:

- Adults can discuss the types of plants located in the home, outside of the home, or within the neighborhood. A visit to a local plant nursery can help students understand the different varieties of plants, amount of sunlight needed, and locations where plants thrive the best. Adults can help students understand that plants are living organism that reproduce just as human beings. The methods of reproduction in plants can be asexual or sexual. The difference in plant reproduction is an integral part of their survival. Students can study plants native to Texas or their local area, and why the plant exists in the environment.

Concepts within Unit # 9

[Link to TEA High School Science TEKS](#)

Success Criteria for this concept

Concept #1: Processes in Plants
B.4B, B.10B, B.10C

- Explain how systems in plants interact to carry out the life functions of transport, reproduction, and response.
- Identify structures that serve as organs in the vascular system in plants.
- Explain the importance of the vascular system in carrying out plant processes.
- Identify structures that serve as organs in the reproductive system of flowering plants.
- Describe the function of various reproductive organs in the reproductive systems of flowering plants.

Unit 10: Processes in Animals

Estimated Date Range: Apr. 19 - May 26

Estimated Time Frame: 28 days

Unit Overview:

Students will understand that certain biological functions are necessary for an organism to survive and that the body systems interact to carry out life processes. Understand importance of interdependence and interactions between biological systems to help them make connections between their own experiences and the biology of the human body. Study how organs and organ systems interact to break down food, regulate responses, keep them healthy, and respond to illness or injury.

At home connections:

- Adults can discuss life processes that are common to most living organism: nutrition, excretion movement, growth and development, respiration, response to stimuli, reproduction, and homeostasis. Adults can ask student to explain what they know or have learned in class about these life processes and identify the

responsible body systems. Body systems include muscular, respiratory, excretory, cardiovascular, digestive, integumentary, nervous, skeletal, endocrine, lymphatic, and urinary. Locating pictures or diagram online can help the student visual certain systems. Adults can identify current articles that relate to human disease or virus /bacterial infections to discuss with students how the body works to remain healthy.

Concepts within Unit # 10 Link to TEA High School Science TEKS	Success Criteria for this concept
Concept #1: Processes in Animals	<ul style="list-style-type: none"> • Place the levels of organization in order from cells to organ systems. • Describe the main functions of each body system using appropriate academic vocabulary. • Explain why it is important for animals to maintain homeostasis. • Identify the body systems that would need to interact to carry out a task in a given situation and describe what each system would do. • Describe how viruses reproduce, causing diseases in living things.

Glossary of Curriculum Components

Overview– The content in this document provides an overview of the pacing and concepts covered in a subject for the year.

TEKS – Texas Essential Knowledge and Skills (TEKS) are the state standards for what students should know and be able to do.

Unit Overview – The unit overview provides a brief description of the concepts covered in each unit.

Concept – A subtopic of the main topic of the unit.

Success Criteria—a description of what it looks like to be successful in this concept.

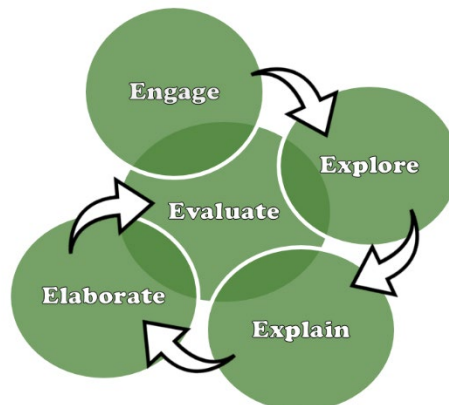
Parent Resources

The following resources provide parents with ideas to support students’ understanding. For sites that are password protected, your child will receive login information through their campus.

Resource	How it supports parent and students
https://www.fortbendisd.com/Page/92908	This is the state adopted textbook for Biology. Click on the link for directions on accessing the textbook.
Khan Academy	This resource contains practice exercises, instructional videos, and a personalized learning dashboard where students can learn and study at their own pace.
Texas Gateways	This online resource contains lessons, videos, and interactive activities for various science concepts.
NSTA – Science Resources for Parents	This online resource has science activities for high school students and their families to help support learning at home.
NOAA – National Oceanic and Atmospheric Administration	This resource is contains videos, images, interactive media, graphics and data related to the ocean and atmosphere.

Instructional Model

The structures, guidelines or model in which students engage in a particular content that ensures understanding of that content.



- It is based on the constructivist learning theory, which states that learners build or construct new ideas based on their experiences.
- It represents a recursive cycle of cognitive stages in inquiry-based learning.
- Stages are intended to be completed sequentially; however, you may revisit a stage more than once during the 5E process.

- It capitalizes on hands-on activities, students' curiosity, and academic discussion among students.
- Typically, **NOT** all five stages would be experienced in a single classroom period, but all five would certainly be embedded in a series of lessons that would develop a particular concept, lasting days or weeks.
- It should be used to develop conceptual understanding over time with each stage building on the previous stage, rather than serve as a series of activities.
- It should be used in conjunction with other instructional strategies such as writing in science, graphing, graphic organizers, collaboration, etc.