

Shrewsbury Borough School District  
Science Curriculum Guide  
Grade 7  
2015

*Mission Statement:*

*The mission of the Shrewsbury Borough School District, a system built on successful cooperation among family, school and community, is to prepare all students to achieve excellence and to become responsible citizens through rigorous educational programs consistent with New Jersey Core Content State Standards and which respect individual differences and diversity. Students will be prepared to meet the challenges presented in the regional high school and the world beyond.*

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Approved by Shrewsbury Borough Board of Education:

September 2015

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Implementation: September 2015

Course Philosophy:

Students in middle school develop understanding of key concepts to help them make sense of life science. The ideas build upon students' science understanding from earlier grades and from the disciplinary core ideas, science and engineering practices, and crosscutting concepts of ideas in middle school.

Course Description:

This 7<sup>th</sup> grade life science course focuses four main areas: organisms, ecosystems, heredity, and biological evolution. The performance expectations in middle school blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge across the science disciplines. While the performance expectations in middle school life science couple particular practices with specific disciplinary core ideas, instructional decisions should include use of many science and engineering practices integrated in the performance expectations. The students will understand the following ideas during the course of the year: how cells contribute to the function of living organisms and the role cells play in body systems, the plant processes and photosynthesis, and movement of matter and energy needed for a cell; interdependent relationships in ecosystems, cycles of matter and energy transfer in ecosystems, and ecosystem dynamics; how living organisms pass traits from one generation to the next; and how organisms change over time in response to changes in the environment, natural selection, and evolution.

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Scope and Sequence	
Course Title: Life Science	Grade Level: 7

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Units:

Unit 1 Overview

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<b>Unit Title:</b> From Molecules to Organisms: Structures and Processes
<b>Grade Level:</b> 7
<b>Recommended Pacing:</b> 4 months, September to December
<b>Unit Summary:</b> Living things have certain characteristics in common. All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one cell or many different types of cells. In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. Plants, algae, and many microorganisms use the energy from light to make sugars from carbon dioxide from the atmosphere and water through the process of photosynthesis.

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**NGSS:**

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

**ISTE Standards:**

Creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making.

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**Science and Engineering Practices:**

Developing and using models; planning and carrying out investigations; constructing explanations and designing solutions; engaging in argument from evidence; obtaining, evaluating, and communicating information

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Unit Essential Questions:

What makes something alive?

What are living things made of?

What are the parts that make up a cell?

What is the cell theory?

How do we know cells exist?

What are the building blocks of organisms?

How do cells get and use energy?

How do cells move cellular materials?

How are living things organized?

How do cells grow and reproduce?

What is photosynthesis?

What characteristics do protists share?

What are the three groups of protists?



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Unit Learning Targets

*Students will know...*

- Living things are organized, respond to stimuli, use energy, grow and develop, reproduce, and achieve homeostasis.
- Living things are made of cells. The cell is the basic unit of life. Most cells are microscopic. An organism can be unicellular or multicellular. Cells can be prokaryotic or eukaryotic. A prokaryote is a single-celled organism with no nucleus or membrane-bound organelles, and is generally smaller than a eukaryote. A eukaryote is an organism made up of cells that contain DNA in a nucleus and have membrane-bound organelles. All multicellular organisms are eukaryotes. There are animal and plant cells. Plant cells have chloroplasts and cell walls and animal cells do not.
- Common cell structures are cell membrane, cytoplasm, organelles, and DNA.
- Cell theory states organisms are made up of one or more cells, cells are the basic unit of life, and cells come from other cells.
- Scientist can study living things too small to be seen with only the human eye by using microscopes.

Unit Learning Targets

*Students will do...*

- Read, take notes, and discuss material.
- Watch and participate in Brain Pop videos and quizzes.
- Listen to Flocabulary raps and YouTube science videos.
- Inquiry labs, kinesthetic activities, demonstrations.
- “Cell” –ebrate project: students make an animal cell, identify the parts and function of each.
- Plant cell shrink-dinks.
- Demonstration of diffusion: fill balloons with vinegar and vanilla. Have students identify what they smell and why.
- Place leaf in water to show leaf giving off oxygen.
- Students are given letters of elements and told to find partner/puzzle piece. When joined together they make compounds.
- Research one of the scientists (Schleiden, Schwann, Virchow) from the cell theory. Students will find out how he contributed to the cell theory, what his field of study was, and whether he collaborated with anyone.

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Evidence of Learning

Formative Assessments:

- Socratic method
- Notes (student generated and teacher created)
- Homework pages from Glencoe Science workbook
- Brain Pop quizzes
- SWAT-IT review game
- Chapter 1, 2, 3, 4, 8 study guides
- Lab work

Summative Assessments:

- Written laboratory reports (see Lab activities)
- Glencoe Science chapter tests: 1, 2, 3, 4, 8
- Project Based Learning (see section on “Students will do”)

Lab Activities:

1. Elodea seen under the microscope (Glencoe Life Science text, chapter 2)
2. Diffusion lab: food color in warm and cold water (Glencoe Life Science text, chapter 3)
3. Osmosis: carrot lab (Glencoe Life Science text, chapter 3)
4. Bean lab- photosynthesis and cell division (Glencoe Life Science text, chapter 4)
5. Bacterial petri dish lab (Carolina Biological Co.)
6. Frog dissection kit (Carolina Biological Co.)

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Materials/Equipment:

Required Lab Materials:

1. Elodea plants, microscopes, tweezers, glass slides
2. Beakers, food coloring, water, hot plate
3. Beakers, string, carrots, triple beam balance, rulers, salt
4. Kidney beans, water, paper towels, sharpie markers, soil, cups
5. Petri dishes, swabs, agar
6. Frog Dissection kit including preserved frog plus instrumentation

Oven, shrinky dink paper, safety goggles, plants leaves, water, bowl, balloons, vanilla extract, vinegar

Materials/Equipment/Resources:

- Lab materials from 1-4. See above.
- Computer, smart board, laptops
- Paper, markers, glue, stickers, yarn, pompoms, pipe cleaners, art materials
- Glencoe Life Science textbook and workbook
- Fusion Science Teacher edition (Cells and Heredity)
- BrainPop, Flocabulary, “Cells, Cells” YouTube song
- How to Focus with David Hoover – YouTube video on how to use a microscope
- Elodea plant cells-how to prepare a wet microscope slide – YouTube video
- Website, Shelley’s Science Spot curriculum section

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<b>Unit 2 Overview</b> Unit Title: Heredity: Inheritance and Variation of Traits
<b>Grade Level:</b> 7
<b>Recommended Pacing:</b> 2 months, January-February
<b>Unit Summary:</b> Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. Genes are located in the chromosomes of cells. Each gene controls the production of specific proteins which affects the traits of the individual. In sexually reproducing organisms, each parent contributes half of the genes acquired by the offspring.
<b>NGSS:</b> MS-LS3-1: Develop and use a model to describe why the structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.  MS-LS3-2: Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
<b>ISTE Standards:</b> Creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making.
<b>Science and Engineering Practices:</b> Developing and using models.

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Unit Essential Questions:

What is DNA?

How was DNA discovered?

How are copies of DNA made?

When are copies of DNA made?

What are mutations?

What is genetics?

What is heredity?

What was Gregor Mendel's contribution to genetics?

How are traits inherited?

What are alleles?

What are genes?

What is the difference between genotype and phenotype?

What is the difference between heterozygous and homozygous?

What is the difference between dominant and recessive?

What are the exceptions to complete dominance?

How are Punnett squares used to predict patterns of heredity?

How can a pedigree trace a trait through generations?

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Unit Learning Targets

*Students will know...*

- DNA is the material that determines inherited characteristics in all living things. DNA is made up of compounds called nucleotides which consist of a sugar, phosphate, and a base.
- Rosalind Franklin used X-ray diffraction to image the DNA molecule and show its spiral shape. Watson and Crick created the double helix model of DNA.
- During replication, a DNA molecule separates into two strands; the bases on each side are used as a pattern for the two new strands.
- DNA replicates prior to cell division.
- A mutation is a change in the number, type, or order of bases. A mutation may have no effect, a beneficial effect, or a negative effective.
- Genetics is the study of how traits are inherited.
- Heredity is the passing of genetic material from parents to offspring.
- Gregor Mendel crossed pea plants and observed that some traits were always present from one generation to

Unit Learning Targets

*Students will do...*

- Read, take notes, and discuss material.
- Watch and participate in Brain Pop videos and quizzes.
- Listen to Flocabulary raps and YouTube science videos.
- Inquiry labs, kinesthetic activities, demonstrations.
- Make student DNA nucleotides using letters: A, T, G, C. Have students stand in two lines. Each student holds one letter to represent DNA bases. Have students in two lines move away from each other to model how a DNA molecule separates into two strands.
- Use colored stickers to represent the pairs that always go together AT and CG.
- Play telephone to model how important it is to get the DNA code correct otherwise there will be mutations.
- Build your own DNA model using pasta, pipe cleaners, and beads. Label ATCG, phosphate, and sugar.
- Punnett square practice sheets.
- Pedigree practice sheets.

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Evidence of Learning

Formative Assessments:

- Socratic method
- Notes (student generated and teacher created)
- Homework pages from Glencoe Life Science workbook'
- Brain Pop quizzes
- SWAT-IT review game
- Chapter 4, 5 study guide
- Lab work

Summative Assessments:

- Written laboratory reports (see Lab activities)
- Glencoe Life Science chapter test: 4, 5
- Project Based Learning (see section on “Students will do”)

Lab Activities:

1. Taste test kit (Carolina Biological Co.)
2. Exploring Mendelian Genetics (Carolina Biological Company)

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Materials/Equipment:

Required Lab Materials:

- Carolina Biological Company kit including 4 different taste test papers.
- Carolina Biological Company kit including seeds, petri dishes

Safety goggles, beakers, water, food coloring

Materials/Equipment/Resources:

- Lab materials from 1-2. See above.
- Computer, smart board, laptops
- Paper, markers, art materials, pipe cleaners, 4 -dried pasta boxes, string
- Glencoe Life Science textbook and workbook
- Fusion Science Teacher edition (Cells and Heredity)
- Brain Pop, Flocabulary, YouTube
- Website, Shelly's Science Spot curriculum section



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Unit 3 Overview

Unit Title:

Biological Evolution: Unity and Diversity

Grade Level:

7

Recommended Pacing:

2 months, March-April

Unit Summary:

The collection of fossils and their placement in chronological order is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. Anatomical similarities and differences between various organisms living today and those in the fossil record, enable the reconstruction of evolutionary history. Comparison of the embryological development of different species reveals similarities that show relationships not evident in the fully-formed anatomy. Natural selection leads to the predominance of certain traits in a population and the suppression of others. In artificial selection, people have the capacity to influence certain traits by selective breeding. Adaptation by natural selection over generations is an important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common.

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**NGSS:**

MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

MS-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

**ISTE Standards:**

Creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making.

**Science and Engineering Practices:**

Analyzing and interpreting data; using mathematics and computational thinking; constructing explanations and designing solutions; obtaining, evaluating, and communicating information.

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Unit Essential Questions:

What were early ideas about evolution?

What is evolution?

What is natural selection?

What is variation and adaptation?

What is artificial selection?

What is gradualism?

What is punctuated equilibrium?

What are clues about evolution?

What are fossils?

How do fossils form?

How can a fossil's age be determined?

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Unit Learning Targets

*Students will know...*

- In 1809, Jean Baptiste e Lamarck proposed a hypothesis to explain how species change over time. His hypothesis is called the inheritance of acquired characteristics. He suggested that traits developed during a parent organisms' lifetime are inherited by its offspring.
- In 1831, Charles Darwin was aboard the HMS *Beagle*. During the journey, he recorded observations about plants and animals he saw. He was amazed by the variety of life on Galapagos Islands. He hypothesized that all plant and animal life on the Galapagos Islands originally came from Central and South America.
- A species is a group of organisms that mate to produce fertile offspring. A population is all of the individuals of a species in an area at a given time.
- Evolution is the process by which populations gradually change over time.
- Natural selection is the process by which organisms that are better adapted to their environment survive and reproduce more than less-well-adapted organism do.
- Genetic variation refers to the differences in inherited traits of individuals in a population.

Unit Learning Targets

*Students will do...*

- Read, take notes, and discuss material.
- Watch and participate in Brain Pop videos and quizzes.
- Listen to Flocabulary raps and YouTube science videos.
- Inquiry labs, kinesthetic activities, demonstrations.
- To model adaptation, spread a piece of blue colored paper on table. Place 10 hole punched circles of blue, white, and black. Time students for 10 seconds to pick up as many circles as possible. Which paper circles were most difficult to find?
- Virtual Field trip: Take a trip with Charles Darwin.
- Darwin's Journal: Imagine you are Charles Darwin. Write 2-3 diary entries about his discoveries and ideas
- La Brea Tar Pits: Students will work in groups to research one type of fossil found in the tar pits and learn about that organism's closest living relative. Students will make models showing the similarities and differences between the extinct and living organisms.
- To introduce evolution, students demonstrate with

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**Formative Assessments:**

- Socratic method
- Notes (student generated and teacher created)
- Homework Pages from Glencoe Life Science workbook
- Brain Pop quizzes
- SWAT-IT review game
- Chapter 6 study guide
- Lab work

**Summative Assessments:**

- Written laboratory report (see Lab activities)
- Glencoe Life Science test chapter 6
- Project Based Learning (see section on “Students will do”)

**Lab Activities:**

1. Investigating Selection (Glencoe Life Science text, chapter 6)

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Materials/Equipment:
<p><b>Required Lab Materials:</b></p> <ol style="list-style-type: none"><li>1. Paper clips, pennies, marbles, tweezers, magnets, spoons, timer</li></ol> <p>Safety goggles</p>

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**Materials/Equipment/Resources:**

- Lab materials from 1. See above.
- Computer, smart board, laptops
- Paper, markers, art materials
- Glencoe Life Science textbook and workbook
- Fusion Science Teacher edition (The Diversity of Living Things)
- Brain Pop, Flocabulary, YouTube
- Website, Shelly's Science Spot curriculum section

Unit 4 Overview

**Unit Title:**

Ecosystems: Interactions, Energy, and Dynamics

**Grade Level:**

7

**Recommended Pacing:**

2 months, May-June

**Unit Summary:**

All living and nonliving things on Earth are organized into levels, such as communities and ecosystems. Every organism has a role in the environment. Both living and nonliving parts of an environment are needed for organisms to survive. All living things use energy. Ecosystems gradually change over time. Fossil records and anatomical similarities show how organisms evolve over time.



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**NGSS:**

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-3. Develop a model to describe the cycling matter of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

**ISTE Standards:**

Creativity and innovation; communication and collaboration; research and information fluency; critical thinking, problem solving, and decision making.

**Science and Engineering Practices:**

Developing and Using Models; analyzing and interpreting data; constructing explanations and design solutions; engaging in argument from evidence.

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nit Essential Questions:

- What is ecology?
- What are ecosystems?
- What are populations?
- What are communities?
- How does the environment influence life?
- What are producers and consumers?
- How do organisms obtain energy?
- How do organisms interact?
- What are the symbiotic relationships found in nature?
- What are food webs?
- What is biodiversity?
- How are decomposers beneficial to ecosystems?

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Unit Learning Targets

*Students will know...*

- Ecology is the study of interactions that take place in the biosphere.
- All living and nonliving things on Earth are organized into levels such communities and ecosystems.
- In an ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
- Ecosystems are dynamic in nature, and their characteristics vary over time. Disruption to any physical or biological component of an ecosystem can lead to shifts in all of its populations.
- A population is made up of all organisms of the same species that live in an area at the same time. A population's size is affected by birth rate, death rate, competition, and movement of organisms in and out of a community.
- A community is all the population of all species living in an ecosystem.

Unit Learning Targets

*Students will do...*

- Read, take notes, and discuss material.
- Watch and participate in Brain Pop videos and quizzes.
- Listen to Flocabulary and YouTube science songs.
- Inquiry labs, kinesthetic activities, demonstrations.
- Students will evaluate a diagram a food web of an ecosystem to determine producers, primary consumers, secondary consumers, tertiary consumers, and quaternary consumers.
- Students will research a symbiotic relationship (mutualism, parasitism, commensalism) of one organism to another. Students will create a "Wanted" poster. Explain how relationship works in detail. Identify the ecosystem the organisms live in.
- Demonstrate heat and energy by heating a marshmallow. Energy in marshmallow is transformed into heat and energy. Some of the energy of the marshmallow is used for growth while some is used for heat.
- Students will evaluate an energy pyramid. Students will

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Evidence of Learning

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**Formative Assessments:**

- Socratic method
- Notes (student generated and teacher created)
- Homework Pages from Glencoe Life Science workbook
- Brain Pop quizzes
- SWAT-IT review game
- Chapter 24, 25, 26 study guide
- Lab work

**Summative Assessments:**

- Written laboratory report (see Lab activities)
- Glencoe Life Science test chapter 24, 25, 26
- Project Based Learning (see section on “Students will do”)

**Lab Activities:**

1. Observing seedling competition. (Glencoe Life Science text, chapter 24)

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Materials/Equipment:

Required Lab Materials:

1. Potting soil, pots, radish seeds, water, ruler

Safety goggles

Materials/Equipment/Resources:

- Lab materials from 1. See above.
- Computer, smart board, laptops
- Paper, markers, art materials
- Glencoe Life Science textbook and workbook
- Brain Pop, Flocabulary, YouTube
- Website, Shelly's Science Spot curriculum section