South Brunswick School District

ELEMENTARY SCIENCE

Curriculum Guide for Parents

Date of Last Curriculum Revision: August 2012

District Mission

The South Brunswick School District will prepare students to be lifelong learners, critical thinkers, effective communicators and wise decision makers. This will be accomplished through the use of the New Jersey Core Curriculum Content Standards (NJCCCS) and/or the Common Core State Standards (CCSS) at all grade levels. The schools will maintain an environment that promotes intellectual challenge, creativity, social and emotional growth and the healthy physical development of each student.

~Adopted 8.22.11

Board Approval of Science Curriculum
August 2016

This curriculum is approved for all regular education programs as specified and for adoption or adaptation

by all Special Education Programs in accordance with Board of Education Policy.

Note to Parents

The curriculum guide you are about to enter is just that, a guide. Teachers use this document to steer their instruction and to ensure continuity between classes and across levels. It provides guidance to the teachers on what students need to know and able to do with regard to the learning of a particular content area.

The curriculum is intentionally written with some "spaces" in it so that teachers can add their own ideas and activities so that the world language classroom is personalized to the students.

How to Read the Curriculum Document

Curriculum	Area of content (e.g. Science)
Topic	Course or Unit of Study (e.g. Biology)
Grade Level	Grade Level Cluster (e.g. High School) or specific grade level (e.g. Kindergarten)
Summary	A brief overview of the course or unit of study.
Rationale	A statement as to why we are teaching this course or unit.
Interdisciplinary Connections	Which other areas of content to which there is major linkage. For example, a health education unit might link to science, language arts, social studies, art, physical education, etc.
21st Century Connections	How this course or unit is preparing students to be college and career ready. Referred to as S.A.L.T., each course or unit indicates which of the following it is building: • Skills such as critical or creative thinking, collaboration, communication, or core values • Awareness such as global, cross-cultural or career. • Literacy such as information, media, technology, etc. • Traits necessary for success in life and careers such as productivity.
Terminology	Key vocabulary and terms
Standards	Here you will find the standards that this course or unit of study is addressing. Our curriculum is standards-based. The standards are the foundation of the unit. You can get more information on state standards by going to the NJ Department of Education at **www.state.nj.us/education/cccs**
Enduring Understandings	The big ideas, concepts or life lessons that students walk away with at the end of a unit of study.
Essential Questions	Open ended questions that are considered throughout the unit of study. These are big, "worthy of wonder" questions often with multiple responses.
Objectives	The discrete skills and knowledge that students will gain during the unit of study.
Assessments	Assessments (tests, quizzes, projects, activities) that tell us if the students grasped the enduring understandings of the unit.
Lesson Plans & Pacing	Scope and sequence of lessons: how many, how long & approximately in what order.
Resources	Major resources associated with the course or unit.

Science Acknowledgments

We are appreciative of the leadership provided by our curriculum specialists and the knowledge, skills, work and effort of the teachers who served on our curriculum writing teams. In many cases, our units are "home-grown." While aligning with state and/or national standards, they are designed with the needs of the South Brunswick student population in mind.

Articulation

The Supervisors, Specialists, Curriculum Chairpersons, Technology Staff Developers, Directors and the Assistant Superintendent for Curriculum and Instruction meet for articulation at bi-monthly roundtables and ongoing content meetings throughout the year.

Among the topics of discussion are the following: curriculum review cycle, curriculum mapping, resources (ordering, budgeting, inventory), lesson plans, observation look-fors, professional development, NJ Quality Single Accountability Continuum and academic achievement, placement, acceleration, enrichment, basic skills, instructional support, technology proficienciences and content-specific technologies, formative and summative assessments, and various curriculum tasks.

Science Curriculum Development Teams comprised of teachers at every grade level along with representative special education meet together throughout the year as needed. In a time period of major revision, the teams will meet with greater frequency.

The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them.
~William Lawrence Bragg

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For every fact there is infinity of hypotheses.

~Robert M. Pirsig
Zen and the Art of Motorcycle Maintenance

Overview of Science Instruction

Mission Statement

It is the intention of South Brunswick Schools to graduate all of its students with the scientific knowledge, skills and habits of mind needed to be lifelong-learners, critical thinkers, effective communicators and wise decision-makers. Students will develop and use the skills necessary for full participation in a world shaped by science and technology.

Our vision is that all students will…

- Be curious about how the world works.
- Be scientifically honest, willing to reevaluate ideas when new data are presented.
- Respect the world around them and work to protect both the local and global environment.
- Understand that science is not a static body of knowledge but is continually evolving as new information emerges.
- Be able to evaluate scientific ideas from an historical perspective.
- Be adept in the use of electronic technology, choosing the appropriate technology for the problems and tasks with which they are confronted.
- Be able to apply knowledge, skills, and processes from science, math, and technology to solve complex, real-world problems.
- Be tenacious in solving problems.
- Be able to use reason and relevant data to support conclusions and opinions.
- Be able to effectively communicate scientific ideas and information orally, visually, and in writing using a variety of medium.
- Be able to work effectively independently and interdependently to solve problems.

Best Instructional Practices in Science

Effective classroom teachers:

1. Help students develop scientific Habits of Mind.
   An effective science experience will **foster student's natural curiosity** about the world around them, encourage students to **be open to new ideas** and promotes **appropriate skepticism**.

1. Help students to use scientific thinking skills.
   An essential element for a student to be a scientific investigator is knowing how to **find answers to questions.** The skills of scientific inquiry include questioning, hypothesizing, observing, experimenting, measuring, interpreting data, drawing conclusions, and communicating findings.

2. Make science part of everyday life in the classroom.
   Science isn't a subject that just happens once or twice a week. By making materials available, modeling scientific thinking, and responding to events that occur in the environment, **science is part of everyday life.**

3. Provide materials to encourage scientific exploration.
   Include materials that are **interesting to explore** as part of the physical environment to create a setting in which students **spontaneously ask questions and conduct both formal and informal investigations**. Displays can consist of computer programs, videos, filmstrips, books, newspaper articles, and magazines related to particular topics,

creations made by children, and objects collected by the teacher or students. A tank of fish, hermit crabs, turtles, or a frog can be a catalyst for ongoing science discussions and observations.

4. Provide tools for scientific investigations.
   An important part of science is becoming familiar with the **purposeful use of tools** and beginning to recognize the way tools relate to mathematical and scientific thinking. Some tools such as scales, measuring cups, thermometers, calculators, and rulers are for measuring. Other tools such as magnifiers, microscopes, and cameras aid observation.

5. Serve as scientific role models.
   Model scientific thinking by being observant and pointing out specific events when they happen. For example, when water forms on a glass, you might ask, "What do you think is happening here? What's causing the water to form on the glass?" The goal is to encourage children to be curious and consider cause and effect. By inviting students to talk about their experiences or discoveries and encouraging the others to ask questions, teachers help students think like investigators.

6. Select topics for long-term studies in science.
   Students learn best by having time for **extensive exploration** of a few topics during the year. It is a good idea to resist the temptation to touch briefly on many topics. Select topics that allow students to conduct first-hand research and use scientific thinking skills. Because you can only do so much, you will also want to consider which topics provide natural linkages to other subjects you will be studying.

7. Have students work in a variety of settings.
   The **choice of settings** – cooperative groups, pairs of students, individuals, and whole groups- depends on the teacher's objective and the specific content of the lesson. Students should be exposed to each kind of setting throughout the year.

8. Design, develop, implement and evaluate digital-age learning experiences and assessments.
   For example, use of classroom technologies such as interactive whiteboards, projection devices, digital hardware and software.

Program Delivery

Our Science classrooms are effective standards-based environments that foster understanding of big ideas and help students make connections between present, past and future. Below are the varied "Science paths" that students follow during their course of study in South Brunswick.

Elementary School:

- Kindergarten- The Five Senses and Our Big Backyard
- First Grade- Water; Forces/Pushes & Pulls; and Collecting and Examining Life
- Second Grade- Life Cycle of a Butterfly; Rocks & Soil; & Properties of Light
- Third Grade- Structures of Life; Water & Weather; & Earth, Sun and Moon
- Fourth Grade- Ecosystems; Matter and Energy; and Magnetism and Electricity
- Fifth Grade- Microworlds; Chemistry; Body Systems (joint science-health unit)

Middle School:

- Sixth Grade- Systems, Astronomy, Phylogenetics, and Geology
- Grades 7 and 8:
  "A" Year: Life Systems, Chemistry, and Meterology

"B" Year: Physics, Genetics, and Ecology

High School:

- Core Courses (3 years of science required for graduation):
  Physical & Earth Science; Physics I A (Alternative-Active), Physics I T (Traditional-Team based; College Prep), Physics- College H (Honors)
  Chemistry I (Community), Chemistry I (T), Chemistry (H)
  Elementsd of Biology, Biology I, Biology (H)
- Electives; Astronomy, Science and Society, Biology II, Field Ecology and Animal Behanior, Forensic Science, Human Anatomy and Physiology (H)
- Advanced Placement Courses (with prerequisites): AP Biology, AP Chemistry, AP Environmental Science, AP Physics B, AP Physics C
- Note: The following courses that extende beyond AP are now in the Mathematics Curriculum: Multivariable Calculus, Linear Algebra, Differential Equations, Cimplex Analysis, Analysis

Resources

Elementary

Kindergarten

The Five Senses – *SB District Unit*
Also uses these books: Sense-Able Science, AIMS Ed. Foundation, 1994
Sense-Abilities: Fun Ways to Explore the Senses, Michelle O'Brien-Palmer, 1998
Our Big Backyard – *SB District Unit*

First Grade

Collecting & Examining Life – *Science Companion*
Investigating Water – *DSMII kit*
Balls and Ramps – *Insights Publications*
Motion – *Science Companion*

Second Grade

Pebbles, Sand, & Silt – *FOSS kit*
Rocks – *Science Companion*
Life Cycle of Animals – *SB District Unit – STC – Life Cycle of Butterflies*
Light – *Science Companion*

Third Grade

Structures of Life – *FOSS kit*
Water – *FOSS kit,* Weather – *STC kit (Carolina)*
Earth, Sun, & Moon - *SB District Unit*

Fourth Grade

Magnetism and Electricity – *FOSS kit*
Ecosystems - *SB District Units, GEMS, Terrarium Habitats*
Matter and Energy – *FOSS kit*

Fifth Grade

Microworlds – *STC*
Chemistry & Density– *SB District Unit*
Body Systems– *SB District Unit*

Middle School

Sixth Grade

Prentice Hall Science Explorer Textbooks

Phylogenetics- *From Bacteria to Plants*
Astronomy- *Astronomy*
Geology- *Inside Earth*

FOSS Kits-

Systems- Variable, M*odels and Designs*

Seventh-Eighth Grade

Prentice Hall Science Explorer Textbooks

Chemistry- *Chemical Building Blocks and Chemical Interactions*
Life Systems- *Animals and TBD*
Meteorology- *Weather and Climate*
Ecology- *Environmental Science*
Genetics- *Heredity: Cells and Heredity*
Physics- *Motion, Forces and Ene*rgy

High School

Physical & Earth Science- *Science Spectrum,* Holt
Physics I (A/T)- *Conceptual Physics,* Addison Wesley
Honors Physics- College Physics, Thomson/Brooks/Cole
AP Physics C: Mechanics- Reese, *University Physics,* Brooks/Cole
Chemistry I (CC)- *Chemistry in the Community*, American Chemical Society
Chemistry I (T)- *Chemistry by Smoot etal,* Glencoe/McGraw Hill
Chemistry I (T)- *Chemistry by Wilbraham etal,* Prentice Hall
Chemistry (H)- *Introductory Chemistry: A foundation by Zumdahl/ Decoste/ Brroks/ Cole,* Cengage Learning
AP Chemistry- *Chemistry Principles and Reactions*, Masterton & Herley
Biology I and II- *The Web of Life*, Addison Wesley
Honors Biology- *The Web of Life*, Addison Wesley
AP Biology- *Biology by Campbell*, Reece, Mitchell, AP edition-10th edition
AP Environmental Science- *Environmental Science – Earth as a Living Planet by Botkin and Keller*
Human Anatomy & Physics- *Hole's Human Anatomy & Physiology 11th edition*
SAMCLA DECA- *Multivariable variable calculus, Stewart Linear Algebra*

Assessment

There are multiple and varied forms of assessment at each grade level. What follows is a list of the key assessment tools used at each level.

Assessments at the Elementary Level

- Teacher made tests, quizzes and projects
- Recording of observations, journal keeping, presentations
- Performance assessments
- End of Unit assessments
- 4th Grade NJASK Science

Assessments at the Middle Level:

- Teacher made tests, quizzes and projects
- Lab reports
- Embedded performance assessments
- End of unit assessments
- 8th Grade NJASK Science

Assessments at the High School Level

- State end-of-course exam: NJ Biology Competency Test (NJBCT)
- Teacher made tests, quizzes and projects
- Labs- written reports (short and long form)
- Mid Term and Final Exams
- AP Exams

Core Curriculum Content Standards for Science

The South Brunswick Science Curriculum is aligned to the New Jersey Core Curriculum Content Standards. These standards are addressed at every grade level, and are supported by research findings about how students learn science. Our program is inquiry based, and learning is viewed as an active process in which students construct their understanding of the natural world by engaging in "hands-on" and "minds-on" experiences. Technology is embedded where meaningful, and connections to the 21st Century Life and Career Education standards, to the District's core values, and to other areas of curriculum are purposely and explicitly noted.

Standard 5.1 Scientific Practices

All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

A. ***Understand Scientific Explanations***
   Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world.
B. ***Generate Scientific Evidence Through Active Investigations***
   Students master the conceptual, mathematical, physical, and computational tools that need to be applied when constructing and evaluating claims.
C. ***Reflect on Scientific Knowledge***
   Scientific knowledge builds on itself over time.
D. ***Participate Productively in Science***

The growth of scientific knowledge involves critique and communication, which are social practices that are governed by a core set of values and norms.

Standard 5.2 Physical Science

All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

- ***A. Properties of Matter***
  All objects and substances in the natural world are composed of matter. Matter has two fundamental properties: matter takes up space, and matter has inertia.
- ***B. Changes in Matter***
  Substances can undergo physical or chemical changes to form new substances. Each change involves energy.
- ***C. Forms of Energy***
  Knowing the characteristics of familiar forms of energy, including potential and kinetic energy, is useful in coming to the understanding that, for the most part, the natural world can be explained and is predictable.
- ***D. Energy Transfer and Conservation***
  The conservation of energy can be demonstrated by keeping track of familiar forms of energy as they are transferred from one object to an other.
- ***E. Forces and Motion***
  It takes energy to change the motion of objects. The energy change is understood in terms of forces.

Standard 5.3 Life Science

All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

- ***A. Organization and Development***
  Living organisms are composed of cellular units (structures) that carry out functions required for life. Cellular units are composed of molecules, which also carry out biological functions.
- ***B. Matter and Energy Transformations***
  Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.
- ***C. Interdependence***
  All animals and most plants depend on both other organisms and their environment to meet their basic needs.
- ***D. Heredity and Reproduction***
  Organisms reproduce, develop, and have predictable life cycles. Organisms contain genetic information that influences their traits, and they pass this on to their offspring during reproduction.
- ***E. Evolution and Diversity***
  Sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time.

Standard 5.4 Earth Systems Science

All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

- ***A. Objects in the Universe***
  Our universe has been expanding and evolving for 13.7 billion years under the influence of gravitational and nuclear forces. As gravity governs its expansion, organizational patterns, and the movement of celestial bodies, nuclear forces within stars govern its evolution through the processes of stellar birth and death. These same processes governed the formation of our solar system 4.6 billion years ago.
- ***B. History of Earth***
  From the time that Earth formed from a nebula 4.6 billion years ago, it has been evolving as a result of geologic, biological, physical, and chemical processes.
- ***C. Properties of Earth Materials***
  Earth's composition is unique, is related to the origin of our solar system, and provides us with the raw resources needed to sustain life.
- ***D. Tectonics***
  The theory of plate tectonics provides a framework for understanding the dynamic processes within and on Earth.
- ***E. Energy in Earth Systems***
  Internal and external sources of energy drive Earth systems.
- ***F. Climate and Weather***
  Earth's weather and climate systems are the result of complex interactions between land, ocean, ice, and atmosphere.
- ***G. Biogeochemical Cycles***
  The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity.

The curriculum is written in the Understanding by Design format and is based on enduring understandings (broad concepts) with essential questions and both formative and summative assessments.

Complete copies of the standards for science may be found at:
New Jersey Core Curriculum Standards (NJCCS)

K-12 Curriculum Maps:

Development of science concepts over time

Through funding provided by CONNECT-ED[1], curriculum developers in South Brunswick have mapped the concepts that are studied as part of the K-12 science curriculum. Their work was informed by that done by the American Association for the Advancement of Science (AAAS) in its development of the *Atlas of Science Literacy*.

To provide context, the *Atlas of Science Literacy* is a compendium of conceptual maps based on science strands. The maps show how students' understanding of the ideas and skills leads to literacy in science, mathematics, and technology— and shows how this development occurs over time, from kindergarten through 12th grade. The *Atlas* may be accessed at the AAAS homepage: www.project2061.org

Included in the SBSD Compendium of Science Maps are the South Brunswick School District maps of the science learning that takes place across the K-12 grade levels. There are four maps—each based on the New Jersey Core Curriculum Content Standards.

- Science Processes
- Earth Science
- Life Science
- Physical Science

Each map focuses on a core topic and then displays the K-12 benchmarks that are most relevant to understanding it. The map illustrates the benchmarks along the way—each building upon that which comes below and supporting that which comes after.

The compendium of maps can be found in the Science Companion Document.

[1] Established in 2003, CONNECT-ED is a Consortium of 14 central NJ districts/ independent schools, Rider and Princeton Universities, Raritan Valley Community College, Bristol-Myers Squibb Company, and the National Staff Development Council (NSDC) dedicated to providing a coherent, sustained system of professional development for K-12 teachers of science and math that **models the inquiry approach** to teaching/learning, **organizes content around the Big Ideas** in science and math, and makes concept connections across grade levels and among disciplines. South Brunswick is one of the fourteen districts involved, and has been a group member since the consortium's inception.

SCIENCE

CURRICULUM

Elementary Matrix:
NJ Core Curriculum Content Standards (NJCCCS) and Essential Questions

Grade	Standards & Essential Questions by Grade Level
Kindergarten	Kindergarten students study life, earth and environmental sciences based on the NJCCCS 5.1.4.A.1-A.3, 5.1.4.B.1-B.3, 5.1.4.C.1, 5.1.4.C.2, 5.1.4.D.1, 5.1.4.D.4, 5.2.2.A.1, 5.3.2.A.1, 5.3.2.B.1, 5.3.2.B.3, 5.3.2.D.2, 5.4.2.E.1, 5.4.2.F.1, 5.4.2.G.3 ➢ *The Five Senses* (life) ~ What are the five senses and what body parts are connected with each? How do the senses help us discover and interact with our environment? How do the five senses work alone and/or together? ➢ *Our Big Backyard* (earth/environment) ~ Where do we see/find nature? Why is nature important to us? What cycles and patterns do we see in nature?
First Grade	First Grade students study physical and life sciences based on the NJCCCS 5.1.4.A.1-A.3, 5.1.4.B.1-B.3, 5.1.4.C.1, 5.1.4.C.2, 5.1.4.D.1, 5.1.4.D.3, 5.1.4.D.4, 5.2.2.A.1, 5.2.2.A.2, 5.2.2.E.1-E.3, 5.2.4.E.1, 5.2.4.E.2, 5.3.2.A.1, 5.3.2.B.1-B.3, 5.4.2.E.1, 5.4.2.G.1-G.3 ➢ *Water* (physical) ~ What are the properties of water? How does water change from one form to another? Where is water found? Why is water important? ➢ *Forces* (physical) ~ How do things move? How can we change the way things move? What evidence do we have of forces that we cannot see? ➢ *Collecting and Examining Life* (life) ~ How do we know if something is alive? What are the basic needs of living things? How do living things change over time? What parts do animals have to help them move, grow, breathe, eat, and sense their environment
Second Grade	Second grade students study the life, earth and physical sciences based on the NJCCCS 5.1.4.A.2, 5.1.4.A.3, 5.1.4.B.1-B.4, 5.1.4.C.1, 5.1.4.C.3, 5.1.4.D.1-D.3, 5.2.2.B.1, 5.2.2.C.1-C.3, 5.3.2.A.1, 5.3.4.A.2, 5.3.2.B.1, 5.3.2.B.2, 5.3.2.C.1-C.3, 5.3.2.D.1, 5.3.2.D.2, 5.3.4.D.1, 5.3.2.E.1, 5.3.2.E.2, 5.4.2.G.3, 5.4.4.B.1, 5.4.2.C.1, 5.4.4.C.1, 5.4.4.C.2, ➢ *Life Cycle of Butterfly* (life) ~ What changes do living things go through during their lives? How do living things affect their environment and how do changes in the environment affect living things? ➢ *Rocks & Soil* (earth) ~What is the Earth made of? What makes up land? What do the rocks and soils around us look like? Why are rocks and minerals important resources? What is a fossil? ➢ *Properties of Light* (physical) ~ What is light? What are the sources of light? How does light travel?
Third Grade	Third Grade students study the life, earth and physical sciences based on the NJCCCS 5.1.4.A.1-A.3, 5.1.4.B.1-B.4, 5.1.4.C.1-C.3, 5.1.4.D.1-D.3, 5.2.4.E.4, 5.3.4.A.1, 5.3.4.A.2, 5.3.4.B.1, 5.3.4.D.1, 5.3.4.E.1, 5.3.4.E.2, 5.4.2.A.1, 5.4.4.A.1-A.4, 5.4.4.E.1, 5.4.2.F.1, 5.4.4.F.1, 5.4.2.G.1, 5.4.2.G.2, 5.4.4.G.1-G.4 ➢ *Structures of Life* (life) ~ What properties do all living things have that make them similar? What properties do all living things have

Grade	Standards & Essential Questions by Grade Level
	that make them different? How do different organisms meet their needs for survival? ➢ *Earth, Sun, and Moon* (earth) ~ To what extent are the properties of objects in our solar system predictable? What causes these patterns? What causes day and night? What causes the moon to appear to change shape? What are some properties of the Sun, moon and stars? ➢ *Water & Weather* (physical/earth) ~ How do changes in one part of an Earth's system affect other parts of the system? How are weather patterns observed, recorded, and interpreted? How does a drop of water travel through the water cycle? How does water affect our daily lives?
Fourth Grade	Fourth grade students study the life, earth and physical sciences based on the NJCCCS 5.1.4.A.1-A.3, 5.1.4.B.1-B.4, 5.1.4.C.1-C.3, 5.1.4.D.1-D.4, 5.2.4.A.1-A.4, 5.2.4.B.1, 5.2.4.C.1, 5.2.4.C.3, 5.2.4.C.4, 5.2.2.D.1, 5.2.4.D.1, 5.2.6.D.1, 5.2.4.E.3, 5.2.6.E.2, 5.3.2.A.1, 5.3.4.A.1, 5.3.4.A.2, 5.3.4.B.1, 5.3.2.C.1-C.3, 5.3.4.C.1, 5.3.4.C.2, 5.3.4.E.1, 5.3.4.E.2, 5.4.2.E.1, 5.4.2.G.3 ➢ *Ecosystems* (life) ~ How do living things get energy? How do living things depend on each other and on non-living parts of the environment? What happens when part of an ecosystem is altered? ➢ *Magnetism & Electricity* (physical) ~ How do magnets work? How does an electrical circuit (system) work? What happens if an element is removed from a circuit (system)? ➢ *Matter & Energy* (physical) ~ How do we know that things have energy? How can energy impact the state of matter? How does light travel and behave?
Fifth Grade	Fifth grade students study the life, earth and physical sciences based on the NJCCCS 5.1.4.A.2, 5.1.4.a.3, 5.1.4.B.1, 5.1.4.B.3, 5.1.4.B.4, 5.1.4.C.2, 5.1.4.D.2, 5.1.4.D.3, 5.1.8.A.1, 5.1.8.A.2, 5.1.8.B.2, 5.1.8.B.3, 5.1.8.C.1, 5.1.8.C.2, 5.1.8.D.1-D.3, 5.2.4.A.1, 5.2.6.A.1, 5.2.6.A.3. 5.2.6.B.1, 5.3.4.A.3, 5.3.6.A.1 ➢ *Microworlds* (life) ~ How do tools help extend our sense of sight? What are the properties of magnifiers? How do you know that something exists if you can't see it? ➢ *Chemistry & Density* (physical) ~ How do the properties of materials determine their use and identification? How might properties change after a chemical reaction? How can you change the density of an object? How do the atoms of an object effect the state of an object? What happens when two objects try to occupy the same space? ➢ *Body Systems* (life) ~ How does the human body work? What are choices that people can make to help their body and what are choices people can make to hurt their body?

KINDERGARTEN SCIENCE

Content: Kindergarten Science

Course Description or Content Overview:

Kindergarten students study the life, Earth, and physical sciences based on the following standards, enduring understandings, and essential questions.

New Jersey Core Curriculum Standards (NJCCS):

5.1 Science Practices: Science is both a body of knowledge and an evidence-based, model building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

5.2 Physical Science: Physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

5.3 Life Science: Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

5.4 Earth Systems Science: Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Enduring Understandings:

Our Big Backyard:

- The natural world is important to us and to our survival.
- Weather and seasonal changes affect the daily life of all living things.

The Five Senses:

We use our five senses together to explore our surroundings and ourselves.

Essential Questions:

Our Big Backyard:

- Where do we see/find nature?
- Why is nature important to us?
- What cycles and patterns do we see in nature?

The Five Senses:

What are the five senses and what body parts are connected with each?
How do the senses help us discover and interact with our environment?
How do the five senses work alone and/or together? What would it mean to be without them?

Knowledge and Skills:

Knowledge: Students will know…

Our Big Backyard:

- How the seasons affect their environment.
- That weather affects the decisions people make about the clothing they will wear and the outside activities they choose to do.
- The elements needed for plants to grow.

The 5 Senses:

- That the five senses help us investigate the world.
- That the sense of touch can be used to explore objects.
- That the ear is the organ used to hear things.
- That we can listen, describe, and match different sounds in and outside.
- That we can describe and match different odors with our sense of smell.
- That we can describe foods with our sense of taste.
- That we can identify objects using all our senses.

Skills: Students will be able to…

Our Big Backyard:

- Observe and classify objects from nature.
- Observe and describe the structures of a variety of living things.
- Observe living things in their surroundings.
- List the needs of living things.
- Observe and identify how pumpkins grow and the stages of the plant life cycle.
- Identify the growth patterns of pumpkins by sequencing the stages of growth in their big backyard journal.
- Make seasonal comparisons.
- Observe and record the changes that occur in a tree throughout the school year.
- Observe how the seasons affect the living things in nature.
- Describe the basic characteristics of a tree as determined by their own observations.
- Describe materials using all their senses.
- Sort and classify natural objects by self-selected attributes, such as color, shape, size, texture, and weight.
- Observe that weather changes from day to day and week to week.
- Record weather information over a period of time.
- Conduct experiments to see how changing a plant's environment affects its growth.
- Observe their seed growing into a plant.
- Record observations.
- Care for their seed/plant.
- Show respect and care for living organisms.

The Five Senses:

- Name the five senses.
- Observe and describe the properties of objects using all their senses.
- Use our sense of sight to compare and describe similar objects by color, size, shape, and pattern.

- Use a hand lens to see things better.
- Observe things indoors and outdoors.
- Name a body part used for each sense.
- Compare and classify objects using only one sense.
- Describe how the five senses work together.
- Practice safety procedures relevant to the five senses.
- Work cooperatively.
- Make predictions.
- Ask questions and share understandings and values about the world around them.
- Choose appropriate tools for explorations.
- Carefully follow oral and pictorial directions and carry out the same investigation more than once, showing similar results.
- Relate learning in mathematics and apply it in science.

Terminology:

Our Big Backyard	The 5 Senses
• Nature • Weather • Season • Environment • Cycles • Patterns • Living • Nonliving • Observe • Predict • Hypothesis • Magnifying Glass/Lens • Senses • Experiment • Seed • Plant • Physical Characteristics • Texture • Describe	• Senses • Sight • Eye/Ear • Blind • Taste • Touch • Hear • Smell • Observe • Predict • Brainstorm • Describe • Soft • Discover • Clue • Circle • Square/Triangle/Rectangle • Bigger • Biggest • Smaller • Smallest • Hypothesis • Identify • Scent • Sweet • Taste Buds • Tally • Sour • Salty • Odor • Rough

- Bitter
- Texture

Assessments:
Unit specific formative assessments
Student Observation
Class Discussion
Unit Summative Assessment

21st Century Connections:

8.1 Technology: All students will use digital tools to access, manage, evaluate, and synthesize, information in order to solve problems individually and collaboratively and to create and communicate knowledge.

8.2 Technology: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the design world, as they relate to the individual, global society, and the environment.

9.1 Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

9.3 Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Character Education:
The elementary core values of cooperation, assertion, responsibility, empathy, and self-control are addressed and stressed throughout each unit of study.

Cross Curricular / Interdisciplinary:

- Mathematics through sorting & classifying, data collection & representation, shape identification, problem solving
- Language Arts through journal writing, recording observations, and shared literature
- Art through observations and drawings

Course Resources:

Texts:
Sense-Able Science, AIMS Ed. Foundation, 1994
Sense-Abilities: Fun Ways to Explore the Senses, Michelle O'Brien-Palmer, 1998.

Units of Study:

1. Our Big Backyard
2. The Five Senses

FIRST GRADE SCIENCE

Content: 1ST Grade Science

Course Description or Content Overview:

First Grade students study the life, Earth, and physical sciences based on the following standards, enduring understandings, and essential questions.

New Jersey Core Curriculum Standards (NJCCS):

5.1 Science Practices: Science is both a body of knowledge and an evidence-based, model building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

5.2 Physical Science: Physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

5.3 Life Science: Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

5.4 Earth Systems Science: Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Enduring Understandings:

Water:

- Water can have many shapes and forms and can change from one form to another.
- Water comes from several sources and can be used in many ways.

Forces:

- Things move in different ways.
- The way to change how something is moving is to give it a push or a pull.
- Things near the earth fall to the ground unless something holds them up.
- Magnets can be used to make some things move without being touched.

Collecting & Examining Life:

- All things in our environment are either alive, once alive, or were never alive.
- Many different kinds of living things share our environment.

Essential Questions:

Water:

- What are the properties of water?
- How does water change from one form to another?
- Where is water found?
- Why is water important?

Forces:

- How do things move?
- How can we change the way things move?
- What evidence do we have of forces that we cannot see?.

Collecting & Examining Life:

- How do we know if something is alive?
- What are the basic needs of living things?
- How do living things change over time?
- What parts do animals have to help them move, grow, breathe, eat and sense their environment?

Knowledge and Skills:

Knowledge: Students will know…

Water:

- That water has different properties, can change forms, and is found in a variety of places.
- That water is important for all living things.
- How the water cycle works to recycle the water in our environment.
- The importance of water conservation to our earth.

Forces:

- Things move in different ways.
- The way to change how something is moving is to give it a push or a pull.
- Things near the earth fall to the ground unless something holds them up.
- Magnets can be used to make some things move without being touched.

Collecting & Examining Life:

- Plants and animals may change over time.
- Living things have basic needs: air, water, food, and space to grow.
- Some living things are alike in the way they look and in the things they do, and others are very different.
- Stories sometimes give plants and animals attributes they do not have.
- Observe, identify and describe characteristics of living things.
- Leaves and seeds have specific structures and functions for a plant.

Skills: Students will be able to…

Water:

- Predict based on their observations, what will happen based on further experimentation.
- Compare their results to their predictions.
- Continue to formulate questions based on their predictions which will lead to additional investigations.
- Use their senses to explore water and describe its properties.
- Observe and draw the shape of water in different containers.

- Observe that water expands when frozen.
- Observe and record the effect of heat on the melting process.
- Define the terms evaporation, condensation, and precipitation in simple, age-appropriate language.

Forces:

- Identify everyday examples of motion in one's surroundings.
- Observe, describe, and act out various motions, including components such as distance, time, speed, change in speed, and path.
- Distinguish among the different ways that objects can move, such as: fast and slow, in a straight line, in a circular path, back and forth.
- Show that the position and motion of an object can be changed by pushing and pulling the object.

Collecting & examining life:

- Take care of living things in their classroom
- Observe and record the characteristics of living things
- Sort and classify a variety of living and non-living objects and explain why they made the choices they did.
- Think about what makes something alive.
- Identify the similarities and differences between plants and animals.
- Participate in science talk.
- Identify living objects.
- Compare plants and animals.

Terminology:

Water	Forces	Collecting & Examining Life
• Properties	• Motion	• Living
• Shape	• Distance	• Nonliving
• Expand	• Speed	• Alive/Once Alive/Never Alive
• Freeze	• Time	• Oxygen
• Ice	• Force	• Environment
• Melt	• Friction	• Gill
• Evaporation	• Gravity	• Invertebrate
• Environment	• Pushes	• Lung
• Conserve	• Pulls	• Vertebrate
• Solid		• Zoo
• Liquid		• Leafstalk
		• Vein
		• Fruit
		• Seed
		• Germination
		• Sprout

Assessments:

- Unit specific formative assessments
- Student Observation
- Class Discussion
- Science Notebooks
- Unit Summative Assessment

21st Century Connections:

8.1 Technology: All students will use digital tools to access, manage, evaluate, and synthesize, information in order to solve problems individually and collaboratively and to create and communicate knowledge.

8.2 Technology: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the design world, as they relate to the individual, global society, and the environment.

9.1 Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

9.3 Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Character Education:

The elementary core values of cooperation, assertion, responsibility, empathy, and self-control are addressed and stressed throughout each unit of study.

Cross Curricular / Interdisciplinary:

- Literacy - Unit related literature & journal writing
- Math (sorting and classifying, measurement), Venn Diagrams, over, under, and through, measuring time & distance, recording and tallying data
- Health (importance of water to health)
- Social Studies (locations of water in the world) and Gross and Fine Motor development.
- Technology – interactive websites for each unit
- Physical Education – using their bodies to study motion
- Art – illustrating science concepts

Course Resources:

Technologies:
Interactive websites to accompany units (See unit guides)

Texts:
DSM II Investigating Water unit guide & kit
Motion, Science Companion Level One Teacher Lesson Manual (or see copied lessons attached)
Pushes and Pulls (Newbridge)
Collecting & Examining Life, Science Companion

Units of Study:

1. Water
2. Forces
3. Collecting & Examining Life

SECOND GRADE SCIENCE

Content: 2ND Grade Science

Course Description or Content Overview:

Second Grade students study the life, Earth, and physical sciences based on the following standards, enduring understandings, and essential questions.

New Jersey Core Curriculum Standards (NJCCS):

5.1 Science Practices: Science is both a body of knowledge and an evidence-based, model building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

5.2 Physical Science: Physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

5.3 Life Science: Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

5.4 Earth Systems Science: Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Enduring Understandings:

Life Cycle of Animals - Butterflies:

- Most living things need water, food, and air to grow and survive.
- Some offspring look like their parents, but some go through a process called metamorphosis.
- Habitats can change in ways that can be helpful or harmful for plants and animals that live there.

Rocks & Soil:

- Rocks and soils are found all over the Earth.
- Rocks and soils can be sorted by their properties.
- The Earth forms and changes rocks.
- Rocks are made of minerals and are natural resources.
- Fossils are rocks that contain evidence of ancient life.

Properties of Light:

- Energy comes from the Sun to Earth in the form of light.
- Light travels in a straight line until it reaches an object.
- An object is seen when light traveling from the object enters the eye.
- Light can be blocked to create shadows.

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Essential Questions:

Life Cycle of Animals - Butterflies:

- What changes do living things go through during their lives?
- How do living things affect their environment and how do changes in the environment affect living things?

Rocks & Soil:

- What is the Earth made of?
- What do the rocks and soil around us look like?
- Why are rocks and minerals important resources?
- What is a fossil?

Properties of Light:

- What is light?
- What are sources of light?
- How does light travel?

Knowledge and Skills:

Knowledge: Students will know…

Life Cycle of Animals - Butterflies:

- A butterfly is an insect because it has six legs, three body parts (head, thorax, abdomen), four wings (when it has wings), two antennae, and two eyes.
- The four stages of the butterfly life cycle – egg, larva (caterpillar), pupa (chrysalis), adult (butterfly)
- The life cycle is an ongoing process.
- The monarch caterpillar habitat is the milkweed community.
- Most butterflies have a short lifespan (2-4 weeks), but butterflies that emerge in September-October migrate to certain parts of Mexico – to the oyamel trees to rest for the winter and mate. Those butterflies live about nine months and return to lay eggs in the spring.
- The difference between a life span versus a life cycle
- All living things need food, water, air, shelter, and space to survive.
- An animal's coloring can mean many things – sometimes coloring acts as camouflage, sometimes it acts as a warning to other animals.

Rocks & Soil:

- The three major groups of rocks on Earth and the process that formed them.
- That rocks are made of minerals.
- The difference between rocks and minerals.
- That hardness and streak are properties used to describe and identify minerals.
- The widespread use of minerals and mineral products.
- That a fossils is a type of rock.
- What petrified fossils are.
- That soil is a mixture of Earth materials.
- That soils vary from place to place.

- That soils have properties of color and texture.
- That soils differ in their ability to support plants.

Properties of Light:

- That light is all around us. If you can see something, then light must be present.
- That when light hits something, one or more of these three things can happen: the light can bounce off the object, go through it, or be absorbed by it.
- That the eye detects light. You see when light comes into your eye.
- That light travels in straight lines. It moves outward in all directions from a source until it hits something. When light hits something, one or more of these three things can happen: the light can bounce off it, go through it, or be absorbed by it.

Skills: Students will be able to…

Life Cycle of Animals - Butterflies:

- Identify and sequence the four stages of the life cycle.
- Describe the characteristics of the different stages of the life cycle.
    - Egg – round, small, laid under the milkweed leaf, sticky, lasts for 2-3 days, yellowish, usually one per plant
    - Larva/caterpillar – antennae, abdomen, rear tentacles, spinnerets, tentacles, spiracles, thorax - molts 5 times during this stage, eats only milkweed (20-30 milkweed leaves during the caterpillar stage), waste is called frass, caterpillars form a j shape shortly before they change to a chrysalis
    - Pupa/chrysalis – jade green color with gold dots, lasts 10-14 days, changes color in the last 1-3 days (becomes transparent and you can see the butterfly inside)
    - Adult/butterfly- the parts of a butterfly/insect – antennae, proboscis, 3 body parts – head, thorax, abdomen, 6 legs, 4 wings, 2 eyes, butterflies eat nectar from certain plants (sugary liquid), male butterflies have 2 dots on their wings, females do not.
- Draw and illustrate the stages of the life cycle.
- Make and record observations describing the shape, color, size, and movement (crawling, flying, etc.) Of each stage of the life cycle and compare the similarities between them.
- Correctly use a magnifying glass to observe.
- Describe the results of habitat loss on the survival of the monarch butterfly

Rocks & soil:

- Classify objects as rocks or non-rocks.
- Sort rocks according to different properties.
- Observe, describe, and sort according to the properties of individual rocks.
- Examine igneous, sedimentary, and metamorphic rocks.
- Examine a piece of granite and identify the minerals commonly found in it.
- Think about how the minerals in a rock affect its properties.
- Separate rocks from minerals and begin to explore mineral properties.
- Conduct streak and hardness tests on minerals.
- Play a game to set the stage for realizing that many objects are made from minerals or mineral products.
- Examine several fossils and compare them to similar present-day objects.
- Make models of petrified fossils and learn about petrifaction.

- Make a mixture of earth materials to create soil.
- Use screens to separate the components in a soil mixture.
- Observe and record the results of shaking soil and water in a vial.
- Find and collect samples of soil outside the classroom.

Properties of light:

- Model or diagram how light travels in straight lines from a source.
- Draw and label a picture of their shadow.
- Identify light sources.
- Discover how the pupil of the eye reacts to light.

Terminology:

Life Cycle of Animals - Butterflies	Rocks & Soil	Properties of Light
• Life Cycle • Larvae • Grow • Frass • Plant • Chrysalis • Migrate • Metamorphosis • Animal • Pupae • Milkweed • Molt • Seed • Adult • Antennae • Camouflage • Baby • Egg • Head • Abdomen • Thorax • Proboscis • Nectar • Transparent • Proleg • Spinnerets • Mexico	• Geologist • Man-Made • Natural • Rock • Properties • Texture • Igneous Rock • Lava • Magma • Metamorphic Rock • Sediment • Sedimentary Rock • Granite • Mineral • Hardness • Streak • Luster • Renewable Resource • Nonrenewable Resource • Mine • Fossil • Fossilization • Organism • Sediment • Impression • Crystal • Mineralization • Petrified	• Light • Emit • Illuminate • Illumination • Light Source • Light Beam • Bounce • Mirror • Reflect • Scatter • Iris • Pupil • Vision • Absorb • Opaque • Translucent • Transparent

Assessments:

- Unit specific formative assessments
- Science Journals
- Science Notebook pages

- Unit summative assessment

21st Century Connections:

8.1 Technology: All students will use digital tools to access, manage, evaluate, and synthesize, information in order to solve problems individually and collaboratively and to create and communicate knowledge.

8.2 Technology: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the design world, as they relate to the individual, global society, and the environment.

9.1 Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

9.3 Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Character Education:

The elementary core values of cooperation, assertion, responsibility, empathy, and self-control are addressed and stressed throughout each unit of study.

Cross Curricular / Interdisciplinary:

- Literacy – unit related literature
- Writing – science journals
- Math – counting, measuring, sorting, classifying, collecting and analyzing data, calendar
- Social Studies – Geography, studying the migration of the Monarch butterfly
- Art – scientific drawings

Course Resources:

Technologies: Interactive websites – see unit plans
Text: Light (Teacher's guide and kit), Science Companion
Rocks (Teacher's guide and kit), Science Companion
Life Cycle of Butterflies – SB District Unit

Units of Study:

1. Life Cycle of Animals - Butterflies
2. Rocks & Soil
3. Properties of Light

THIRD GRADE SCIENCE

Content: 3rd Grade Science

Course Description or Content Overview:

Third Grade students study the life, Earth, and physical sciences based on the following standards, enduring understandings, and essential questions.

New Jersey Core Curriculum Standards (NJCCS):

5.1 Science Practices: Science is both a body of knowledge and an evidence-based, model building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

5.2 Physical Science: Physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

5.3 Life Science: Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

5.4 Earth Systems Science: Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Enduring Understandings:

Structures of Life:

- Living organisms have a variety of observable features that enable them to obtain food, dispose of waste, reproduce and survive.
- Changes in an organisms' environment sometimes affect its survival.

Sun, Moon, & Stars:

- Observable, predictable patterns in the solar system occur because of gravitational interactions and energy from the sun.
- The observable changes of the moon change day to day in a cycle that lasts about a month.
- The Sun, moon, and stars, all have properties, locations and movements that can be observed and described.

Water & Weather:

- Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth regionally and globally.
- Scientists use multiple tools and scales to observe and record the weather. This information is used to predict weather patterns over time.
- Weather is a vital, renewable resource. It is naturally replaced through the water cycle, but its use needs to be monitored so consumption does not occur faster than replacement.

- The sun causes evaporation of water. The water then condenses and forms different types of clouds. Water falls as precipitation and it gathers as groundwater, lakes, oceans, etc in the state of collection.

Essential Questions:

Structures of Life:

- What properties do all living things have that make them similar?
- What properties do all living things have that make them different?
- How do different organisms meet their needs for survival?

Sun, Moon, & Stars:

- To what extent are the properties of objects in our solar system predictable?
- What causes these patterns?
- What causes day and night?
- What causes the moon to appear to change shape?
- What are some properties of the Sun, moon and stars?
-

Water & Weather:

- How do changes in one part of an Earth system affect other parts of the system?
- How are weather patterns observed, recorded, and interpreted?
- How does a drop of water travel through the water cycle?
- How does weather affect our daily lives?

Knowledge and Skills:

Knowledge: Students will know…

Structures of Life:

- Seeds come in a variety of sizes, shapes, and colors.
- All fruits contain a seed.
- Seeds require water, light, space, and oxygen to germinate.
- Seeds are composed of multiple parts with their own functions.
- Crayfish have specific structures that allow them to survive within their environment.
- Certain crayfish behaviors allow for survival advantages.

Sun, Moon, & Stars:

- The Earth rotates on its axis, causing day and night. Day happens when a location on Earth is facing toward the Sun and night happens when a location is facing away from the Sun.
- Shadows are created when an opaque object blocks light. Shadows on Earth depend on the position of the Sun in the sky.
- Planets, stars, and moons are all objects in the sky.
- Moon orbits Earth over the course of one month and can appear in the sky both in the day and night.
- Stars are in the sky a great distance from the Earth. Some stars are in groups called constellations that appear to move together across the sky at night.

Water & Weather:

- Evaporation is the process by which liquid water changes into water vapor, a gas.
- Temperature and surface area affect the rate of evaporation.
- Condensation occurs when water vapor touches a cool surface and changes into a liquid.
- Meteorologists use tools to observe and measure cloud cover, precipitation, wind, and temperature to interpret and report weather conditions.
- There are 3 major types of clouds some of which (cumulus and stratus) produce precipitation.
- Water travels in a cycle.

Skills: Students will be able to…

Structures of Life:

- Observe and compare properties of seeds and fruits.
- Organize and communicate information about seeds and crayfish.
- Monitor and record changes in seeds over days and observations of crayfish over several days.
- Investigate the effect of changing conditions on seeds.
- Compare the mass of dry seeds and those of soaked in water.
- Use scientific method to plan an experiment to test conditions needed for seed germination.

Sun, Moon, & Stars:

- Observe and record how the Sun, Earth's star, rises in the east and sets in the west in a predictable pattern.
- Observe and record the changes and appearance of the moon over a period of at least 4 weeks.
- Notice that the phases of the moon occur in a predictable pattern
- Observe, record, and predict how a shadow will appear at certain times of the day.

Water & Weather:

- Observe, measure, and interpret four variables that meteorologists work with-cloud cover, precipitation, wind, and temperature.
- Observe, estimate, and record wind speed using Beaufort scale.
- Read and discuss thermometers as a tool that measures temperature.
- Relate the numbers on the thermometer to hotter or colder temperatures.
- Construct a rain gauge
- Measure and record amount of rainfall using a rain gauge
- Observe daily cloud patterns
- Classify types of clouds by the conditions that form precipitation
- Observe the affect that temperature and surface have on the rate of evaporation.
- Conduct an experiment to demonstrate condensation.
- Trace the path of a water droplet through the water cycle.
- Model how the properties of water can change as water moves through the water cycle.

Terminology:

Structures of Life	Sun, Moon, & Stars	Water & Weather

• Estimate • Fruit • Properties • Seed • Dormant • Mold • Embryo • Seed Coat • Cotyledon • Germination • Organism • Growth • Seedling • Root • Stem • Leaf • Nutrient • Hydroponics • Antenna • Carapace • Pincer • Swimmeret • Bristles • Egg Pore • Structures • Crustacean • Habitat • Territory • Behavior • Elodea	• Cardinal Directions • Compass • Day • Night • East • West • North • South • Predictable • Season • Shadow • Sun • Constellation • Earth • Gravity • Stars • Moon Phase • Waxing • Waning • Crescent • Gibbous • First Quarter • Third Quarter • Lunar • Gnoman • Cycle • Satellite • New Moon • Full Moon • Astronomer • Rotate • Revolve • Telescope • Magnify	• Water • Water Cycle • Water Vapor • Evaporation • Condensation • Precipitation • Renewable Resource • Thermometer • Temperature • Meteorologist • Forecast • Atmosphere • Wind Speed • Cumulus • Stratus • Cirrus • Rain Gauge • Water Conservation

Assessments:

- Unit specific formative assessments
- Student data and observations
- Science journals, Moon journals
- Posters, podcasts, iMovies
- Summative Assessments

21st Century Connections:

8.1 Technology: All students will use digital tools to access, manage, evaluate, and synthesize, information in order to solve problems individually and collaboratively and to create and communicate knowledge.

8.2 Technology: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the design world, as they relate to the individual, global society, and the environment.

9.1 Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

9.3 Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Character Education:

The elementary core values of cooperation, assertion, responsibility, empathy, and self-control are addressed and stressed throughout each unit of study.

Cross Curricular / Interdisciplinary:

- Math- measurement, classification, estimation, graphing, reading temperature
- LA- pertinent children's literature, recording observations, journals, moon journals
- Social Studies – cardinal directions
- Art – Moon drawings, scientific drawings

Course Resources:

Technologies: See units for interactive websites, FOSS teacher's instructional videos, STC Weather DVD

Text: FOSS Structures of Life – Teacher's guide and kit, FOSS Water- Teacher's guide and kit, STC Weather – Teacher's guide and kit, Sun, Moon, & Stars SB District unit

Units of Study:

1. Structures of Life
2. Sun, Moon, & Stars
3. Water & Weather

FOURTH GRADE SCIENCE

Content: 4th Grade Science

Course Description or Content Overview:

Fourth Grade students study the life, Earth, and physical sciences based on the following standards, enduring understandings, and essential questions.

New Jersey Core Curriculum Standards (NJCCS):

5.1 Science Practices: Science is both a body of knowledge and an evidence-based, model building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

5.2 Physical Science: Physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

5.3 Life Science: Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

5.4 Earth Systems Science: Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Enduring Understandings:

Matter and Energy:

- Matter and energy can be changed, and can exist in different forms.
- Energy can impact the state of matter.
- Properties of matter can be measured (mass, volume, capacity, temperature, etc.).
- Light is a form of energy that travels in straight lines from a light source.

Ecosystems:

- The sun is the source of energy on Earth
- In an ecosystem, animals and plants live and interact with each other within their environment.
- Humans can alter an ecosystem in both helpful and harmful ways.
- All parts of an ecosystem are connected. When one part is changed, it affects the rest of the system.

Magnetism and Electricity:

- Magnets and static electricity are forces that can act at a distance.
- A simple circuit is a system. In a system, when one component is missing, the system may not work..

Essential Questions:

Matter and Energy:

- How do we know that things have energy?
- How can energy impact the state of matter?
- How does light travel and behave?

Ecosystems:

- How do living things get energy?
- How do living things depend on each other and on non-living parts of the environment?
- What happens when part of an ecosystem is altered?

Magnetism & Electricity:

- How do magnets work?
- How does an electrical circuit work?
- What happens if an element is removed from a circuit?

Knowledge and Skills:

Knowledge: Students will know…

Matter and Energy:

- That light from the Sun is the source of most of the energy on Earth.
- Stored energy takes many forms.
- That energy can be converted from one form to another.
- That organisms and machines can convert stored energy to motion and heat.
- That light energy travels in straight lines from a source.

Ecosystems:

- The basic requirements for all living things to maintain their existence.
- The similarities and differences of the three roles of consumers.
- That all energy can be traced back to the sun.
- How to care for and maintain living organisms.
- That organisms are linked to each other and to their environments in a web of relationships.
- That an animal's habitat needs to provide food, shelter, moisture, light, and protection.
- That animals have structural or behavioral adaptations that make them better suited for life in their particular environment.
- That all living things leave organic remains.
- That earthworms act as "recyclers" that eat dead plants and other wastes and break them down so that the nutrients are in the soil again, ready to be absorbed by other organisms.
- The role that isopods (pillbugs and sowbugs) play in the ecology of the soil.

Magnetism & Electricity:

- That magnets display forces of attraction and repulsion.
- How simple open, closed, parallel, and series circuits work.
- The essential components of an electric circuit and understand their functions.

Skills: Students will be able to…

Matter and Energy:

- Observe energy sources doing work and learn how energy can be converted from one form to another.
- Find out how light can reflect from the surface of a mirror.
- Explore properties of the three forms of matter (solid, liquid, and gas), including change of state.
- Determine the defining characteristics of solids, liquids, and gases.
- Use metric tools to measure mass, capacity, temperature, and volume, and make multiple numerical observations to improve accuracy.
- Use a balance to determine and compare masses.
- Melt solid substances using heat.
- Observe and analyze a chemical reaction.
- Collect and analyze data to develop logical conclusions.
- Collect and use data to draw conclusions.
- Predict outcomes of investigations and compare to results.

Ecosystems:

- Define and give examples of habitats, biomes, and ecosystems.
- Identify the living and nonliving components of an ecosystem.
- Describe ways in which organisms interact with each other and their habitat in order to meet basic needs.
- Identify sources of energy.
- Describe the path of energy from the Sun to producers, then to consumers in the food chain.
- Categorize organisms within an ecosystem as producers, consumers, decomposers, or scavengers.
- Identify the different ecosystems of NJ (farms, zoos, ocean, forest, etc…).
- Identify the characteristics of a habitat that enable the habitat to support the growth of many different plants and animals.
- Evaluate populations in an ecosystem with regard to ability to thrive and grow.
- Predict and describe how a dramatic increase or decrease in population size of a single species within an ecosystem affects the entire ecosystem.
- Model an adaptation to a species that would increase its chances of survival should the environment become wetter, dryer, warmer or colder over time.
- Discover that soil contains living and non-living things, including water and nutrients necessary for life.
- Handle organisms humanely, responsibly, and ethically.
- Work cooperatively in teams to design and build a terrarium in a plastic container using soil, plants, seeds, leaves, twigs, and water to create a habitat for small animals.
- Demonstrate the safe use of tools, instruments, and supplies..

Magnetism & Electricity:

- Sort objects according to whether or not they stick to magnets.

- Explore the properties of permanent magnets.
- Measure the force of attraction between magnets.
- Investigate changes in the force of attraction between magnets as the distance between them increases.
- Investigate materials to discover which are conductors and which are insulators.
- Construct simple open and closed circuits. Construct parallel and series circuits.
- Make an electromagnet.
- Find out how the number of turns of a wire affects the strength of an electromagnet.

Terminology:

Matter and Energy	Ecosystems	Magnetism & Electricity
• Energy	• Carnivore	• Magnet
• Energy Source	• Community	• Force
• Stored Energy	• Consumer	• Properties
• Battery	• Decomposer	• Iron Filings
• Food	• Producer	• Temporary Magnet
• Fuel	• Ecosystem	• Induced Magnetism
• Convert	• Food Chain	• Attract
• Forms Of Energy	• Food Web	• Repel
• Electricity	• Habitat	• D-Cell
• Heat	• Herbivore	• Battery
• Motion	• Omnivore	• Electricity Source
• Chemical Energy	• Population	• Electricity Receiver
• Light Source	• Predator	• Circuit
• Ray	• Prey	• Filament
• Mirror	• Scavenger	• Component
• Reflect	• Biotic	• Circuit Base
• Reflection	• Abiotic	• Fahnstock Clip
• Matter	• Adaptation	• Switch
• State		• Open Circuit
• Solid		• Conductor
• Liquid		• Insulator
• Gas		• Closed Circuit
• Mass		• Closed Circuit
• Gram (G)		• Schematic Diagram
• Metric System		• Series Ciruit
• Kilogram		• Component
• Balance		• Parallel Circuit
• Volume		
• Capacity		
• Liter		
• Milliliter		
• Melting		
• Evaporation		
• Particle		
• Substance		
• Reaction		

Assessments:

- Unit-specific formative assessments, pretests
- KWL chart
- Written Science Notebook Assessments
- Performance Assessments
- End of Unit Test

21st Century Connections:

8.1 Technology: All students will use digital tools to access, manage, evaluate, and synthesize, information in order to solve problems individually and collaboratively and to create and communicate knowledge.

8.2 Technology: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the design world, as they relate to the individual, global society, and the environment.

9.1 Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

9.3 Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Character Education:

The elementary core values of cooperation, assertion, responsibility, empathy, and self-control are addressed and stressed throughout each unit of study.

Cross Curricular / Interdisciplinary:

- Math – measurement, data collection and analysis, graphing
- LA – FOSS Matter and Energy text, FOSS science stories, suggested literature list;
- Technology – www.fossweb.com interactive Web site and other suggested interactive sites
- Social Studies – compass explorations, history of electricity, development of the telegraph, geography – biomes/ecosystems around the world
- Research – ecosystem/biome research

Course Resources:

Technologies: www.fossweb.com , FOSS teacher's instructional video/dvd
Text: Matter & Energy Teacher's guide and kit, South Brunswick Ecosystem kit, Magnetism & Electricity Teacher's guide and kit

Units of Study:

1. Matter and Energy
2. Ecosystems
3. Magnetism & Electricity

FIFTH GRADE SCIENCE

Content: 5TH Grade Science

Course Description or Content Overview:
Fifth Grade students study the life, Earth, and physical sciences based on the following standards, enduring understandings, and essential questions.

New Jersey Core Curriculum Standards (NJCCS):

5.1 Science Practices: Science is both a body of knowledge and an evidence-based, model building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

5.2 Physical Science: Physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

5.3 Life Science: Life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

5.4 Earth Systems Science: Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Enduring Understandings:

Microworlds:

- There is a complexity of life that exists beyond the scope of human vision.
- Scientists use all Five senses to collect and record detailed observations.
- Tools extend the human senses. Microscopes make it possible to see that living things are made mostly of cells.

Chemistry & Density:

- The structures of materials determine their properties
- After a chemical change, color, heat formation, gas, surface change, and solid formation may occur.
- Density is the how the mass is spread out over it's volume.
- As you increase temperature the atoms spread out resulting in a gas. As the atoms cool, the matter goes from gas to liquid to solid.
- Objects can not occupy the same space. Something must move. In water it is called displacement.

Essential Questions:

Microworlds:

- What are the properties of magnifiers?
- How do you know that something exists if you can't see it?
- How do tools help extend our sense of sight?

Chemistry & Density:

- How do the properties of materials determine their use and identification?
- How might properties change after a chemical reaction?
- How can you change the density of an object?
- How do the atoms of an object effect the state of an object?
- What happens when two objects try to occupy the same space?

Knowledge and Skills:

Knowledge: Students will know…

Microworlds:

- The difference between looking and observing
- That in order to magnify, a lens must be transparent and curved
- That magnification is directly related to how much a lens is curved
- That higher magnification reveals more detail in a smaller area of a specimen being observed

Chemistry & Density:

- Pure substances have intrinsic properties
- There are two types of changes - physical and chemical
- Physical changes do not change the substance
- Mixtures and solutions are examples of physical changes. In a solution, the solute (powder) dissolves in the solvent (liquid), it does not disappear.
- The difference between a mixture/solution and a compound
- Chemical changes change the make-up of the substances. Signaled by a change in color, heat formation, gas, surface change, and solid formation may occur.
- The formation of bubbles signifies the creation of a gas
- Matter is all around us and it takes up space (volume) and has a mass
- All matter is made up of atoms and molecules
- Each state of matter has its own properties and characteristics

Skills: Students will be able to…

Microworlds:

- Use magnifiers, including hand lenses and microscopes, to observe living and nonliving specimens
- Make detailed observations and record their observations in both words and sketches
- Use appropriate equipment and techniques to prepare microscope slides for viewing
- Communicate detailed observations through writing, drawing, and discussion
- Properly handle and focus a microscope

Chemistry & Density:

- Identify a pure substance using its intrinsic properties
- Identify a change as physical or chemical and support why
- Separate a mixture using the physical properties of the individual substances
- Identify 4 white mystery powders based on physical and chemical properties and explain why
- Explain the transition for solid to liquid to gas

- Explain density as the relationship between mass and volume.

Terminology:

Micro-worlds	Chemistry & Density
• Magnification	• Substance
• Magnifier	• Physical Change
• Lens	• Chemical Change
• Microscope	• Mixture
• Observations	• Solution
• Properties	• Solute
• Inference	• Dissolve
• Opinion	• Compound
• Burlap	• Properties
• Slide	• Characteristics
• Well Slide	• Intrinsic Property
• Wet Mount Slide	• Elements
• Field Of View	• Solid
• Focus	• Liquid
• Eyepiece	• Gas
• Body	• Density
• Clip	• Mass
• Stage	• Volume
• Mirror	• Displacement
• Knob	
• Microfiche	
• Convex	
• Coverslip	

Assessments:

- Unit specific formative assessments
- Lab sheets, lab assessments
- Student notebook
- Unit tests

21st Century Connections:

8.1 Technology: All students will use digital tools to access, manage, evaluate, and synthesize, information in order to solve problems individually and collaboratively and to create and communicate knowledge.

8.2 Technology: All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the design world, as they relate to the individual, global society, and the environment.

9.1 Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

9.3 Career Awareness, Exploration, and Preparation: All students will apply knowledge about and engage in the process of career awareness, exploration, and preparation in order to navigate the globally competitive work environment of the information age.

Character Education:
The elementary core values of cooperation, assertion, responsibility, empathy, and self-control are addressed and stressed throughout each unit of study.

Cross Curricular / Interdisciplinary:

- Math - measurement
- Language Arts – integrated literature
- Social Studies – history of the microscope
- Art – scientific drawings

Course Resources:

Technologies: Interactive websites, BrainPop
Text: NSRC/STC Microworlds Kit, *Microworlds Teacher's Guide* by NSRC/STC, *Microworlds Student Activity Book*, NSRC/STC

Units of Study:

1. Microworlds
2. Chemistry & Density

MIDDLE SCHOOL SCIENCE

Overview:
After leaving the elementary program, students will continue their study of science at the middle school. The units of study covered at each grade level are listed below, and the accompanying curriculum matrix of standards and essential questions follows.

Sixth Grade	**Seventh and Eighth Grade A Year**	**Seventh and Eighth Grade B Year**
Systems	Chemistry	Ecology
Geology	Life Systems	Genetics
Astronomy	Meteorology	Physics
Phylogenetics		

Middle School Matrix:
NJ Core Curriculum Content Standards (NJCCCS) and Essential Questions

Grade	Standards & Essential Questions by Grade Level
Sixth Grade	Sixth Grade students study the life, earth and physical sciences based on the following NJCCCS: • Scientific Practices: 5.1.8.A- 5.1.8.E • Physical Science: 5.2.8.B.2, 5.2.6.C.1-3, 5.2.6.D.1, 5.2.8.D.1, 5.2.6.E.1, 5.2.6.E.3, • Life Science: 5.3.6.A.2, 5.3.8.A.1, 5.3.6.B.1, 5.3.8.C.1 • Earth Science: 5.4.6.A.1-4, 5.4.8.A.1-4, 5.4.6.B.1-4, 5.4.8.B.2, 5.4.6.C.1-3, 5.4.8.C.1-2, 5.4.6.D.1-3, 5.4.8.D.1-3, 5.4.6.E.1 The Sixth Grade units of study and the related essential questions are as follows: • *Systems* ~ Is every part of a system equally important? To what extent does science depend upon trial and error? Does an object at rest have as much energy as an object in motion? • *Geology* ~ How long does change take? What can rocks tell us about the history of the Earth? How does technology extend human senses and understanding? • *Astronomy* ~ Why is it necessary for people to study astronomy? Could life exist on another planet? Is all life on Earth affected by the Sun and Moon? Did stars enhance civilization? • *Phylogenteics* ~ What does it mean to be alive? Does every living thing have a purpose? What role does classification play in everyday life? Do all organisms need the same living conditions to survive?

Grade	Standards & Essential Questions by Grade Level
Seventh & Eighth Grade: **A Year**	Seventh and eighth grade students study the life, earth and physical sciences based on the following NJCCCS: • Scientific Practices: 5.1.8.A- 5.1.8.E • Physical Science: 5.2.6.A.1-3, 5.2.8.A.1-7, 5.2.6.B.1, 5.2.8.B.1-2 • Life Science: 5.3.6.A.1-2, 5.3.8.A.1-2, 5.3.8.B.1 • Earth Science: 5.4.6.E.1, 5.4.8.E.1, 5.4.6.F.1, 5.4.8.F.1-3, 5.4.6.G.1, 5.4.8.G.1 5.1 The seventh and eighth grade units of study and the related essential questions are as follows: A Year • *Chemistry* ~ What is matter? Why is it important to classify matter? How has the study of matter affected the quality of life on Earth? What is the difference between physical and chemical properties? How are properties of matter, such as density, mass, and volume measured? What role does heat energy play in the arrangement of matter and what causes change from one state to another? How can you use the properties of matter to distinguish one substance from another? How does the Law of Conservation of Matter apply to physical and chemical changes of matter? How does the current atomic model explain the interactions of elements and the formation of compounds? How does the atomic composition of matter influence their physical properties, chemical reactivity, and use? How are elements arranged on the Periodic Table? • *Life Systems* ~ What is the relationship between cells, tissues, organs, and organ systems? How are humans more complex than other organisms, with regard to specific body systems? How does the interdependence of body systems contribute to an organism's survival? What happens when part of an organism's internal regulation becomes faulty? How do organelles work together to meet a cell's needs? How are multicellular organisms more or less suitable for survival? • *Meteorology* ~ How does the transfer of thermal radiation influence weather conditions and/or patterns? What roles do the hydrologic cycle and ocean current patterns play in creating weather conditions? How do interactions of various weather variables contribute to the formation of weather conditions in a given time and area? What are the causes of Earth's catastrophic weather? How can the climate of a region change over a period of time?
Seventh & Eighth Grade: **B Year**	Seventh and eighth grade students study the life, earth and physical sciences based on the following NJCCCS: • Scientific Practices: 5.1.8.A- 5.1.8.E • Physical Science: 5.2.8.C.2, 5.2.8.D.1-2, 5.2.6.E.3, 5.2.8.E.1-2 • Life Science: 5.3.6.B.1-2, 5.3.8.B.2, 5.3.6.C.1-3, 5.3.8.C.1, 5.3.6.D.1-3, 5.3.8.D.1-3, 5.3.6.E.1, 5.3.8.E.1-2, • Earth Science: 5.4.8.B.1-2, 5.4.6.G.2-3, 5.4.8.G.2, The seventh and eighth grade units of study and the related essential questions are as follows: B Year • *Ecology* ~ How do the goals of science compare and contrast with the goals of technology? How and why do catastrophic events vary? How can human activity

Grade	Standards & Essential Questions by Grade Level
	improve the lives of generations to come? What are the challenges in obtaining and utilizing renewable resources as opposed to non-renewable? How is the world handling the demand for alternate energy? How is energy transferred among organisms in a living system? How do adaptations enable organisms to survive in their ecosystem? What are the differences between biotic and abiotic resources in an ecosystems? In what ways do biotic organisms identify their own niches? How do communities, habitats, ecosystems, niches and populations relate to one another? How do the major biomes represent the climate in relation of their geography? How do the major symbiotic relationships affect the organisms involved? How are organisms grouped in relation to the manner by which they obtain their energy? How do organisms adapt in order to survive? What are limiting factors in an ecosystem? How is evolution affected when two organisms share the same niche? How can human activity affect us in a food chain? How can humans affect the balance of an ecosystem? Do humans have the right to alter the course of nature? Are humans a selfish species? • *Genetics ~* How are characteristics of an organism determined? How can mutations be both helpful and harmful? What are the fundamental building blocks of all living things? How can we predict the probability of a trait being inherited by an organism? How do scientists use genetics to affect the quality of human life? How and why are we different? How can differences in the human species affect human survival on earth? What is natural selection? How do environmental changes influence natural selection? Is extinction of a species a bad thing? How do we know that present day life forms are descended from past life? • *Physics ~* What effect does the Sun's energy have on the Earth? Why is everything in the universe in motion? Why are Newton's Laws of Motion important in describing all motion in the universe and on Earth? How do mathematical equations support scientific concepts?

Curriculum

The 6th – 8th grade curriculum can be found in the South Brunswick School District Middle School Science Curriculum Guide.

HIGH SCHOOL SCIENCE

Overview:

After leaving the middle school program, students will continue their study of science at the high school. The core units of study as well as the electives are listed below, and the accompanying curriculum matrix of standards and essential questions for the required core course follows. Because prerequisites also come into play in the high school program, these are listed as well.

SCIENCE COURSES

Core Content Courses

Physical and Earth Science
Physics I (A)
Physics I (T)
Physics I (H)
Chemistry I (CC)
Chemistry (T)
Chemistry (H)
Elements of Biology
Biology I
Biology I (H)

Electives

Astronomy
Biology II
Forensic Science
Field Ecology and Animal Behavior
Human Anatomy and Physiology (Honors)
Science and Society

Advanced Placement

AP Biology
AP Chemistry
AP Environmental Science
AP Physics B (Algebra Trigonometry based)
AP Physics C (Calculus based)

High School Matrix for 9-12 Core Sequence

Science Department Philosophy

The science department is committed to helping all students develop good questioning skills to become critical & scientific thinkers, in a safe and caring environment.

Course	Standards and Enduring Understandings
Physical & Earth Science	Students study chemistry and physics based on the NJCCCS 5.1.A-D, 5.2.A-E, 5.4 (in part), 8.1 (C-F), 9.1 A, B1-2, E1, F2. Models are a way to simplify our understanding of very complex ideas and phenomena. No experiment should ever be called a "failure". All matter has some fundamental properties like mass, charge and length. Matter and energy cannot be created or destroyed. Forces play an important role in any change of motion.
Biology	Students study biology based on the NJCCCS 5.1.A-D, 5.3.A-E , 8.1 (C-F) 9.1 A, B1-2, E1, F2, F6 All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism. Organisms are grouped in taxonomy based upon similarity. The structural and functional characteristics of an organism determine their continued survival over time under changing environmental conditions.
Chemistry	Students study chemistry based on the NJCCCS 5.1.A-D, 5.2.A-E, 8.1 (C-F), 9.1 A, B1-2, E1, F2, F6. All matter is made up of atoms in definite quantities and arrangements which determine physical and chemical properties. The periodic table is arranged based upon patterns that exist in the physical and chemical properties of elements. All changes in the properties of any substance require changes in any of the following: temperature, pressure, concentration and/or the presence of a catalyst.
Physics	Students study physics based on the NJCCCS 5.1.A-D, 5.2.B-E, 8.1 (C-F), 9.1A, B1-2, E1, F2, F6 Any change in motion requires the presence of a net force. Forces play an important role in the structure and properties of matter. The total amount of mass and energy in the universe remains constant and transformations between the two can explain many natural phenomena.

Prerequisites

Based on the prerequisites met, students can take any of the sequences, including Honors courses. In the sequences below, Physics or PES, Chemistry and Biology are required while other courses are optional.

Sequencing

	SEQUENCE I	SEQUENCE II
	For students who will be taking any Algebra I course in the Ninth Grade.	**Minimum Grade of B in MS Algebra I**
9	Physical & Earth Science (PES)	Physics
10	Biology [and any Science Elective-optional]	Chemistry [and Biology if so chosen]
11	Physics &/or Chemistry/Science Elective/AP Science	Biology [and science elective/AP Science if so chosen]
12	Chemistry &/or Physics/Science Elective/AP Science	Science Elective/AP Science

Minimum Course Requirements

PES	Ninth Grade Placement, Concurrent enrollment in Algebra I (or higher).
Elements of Biology	Passing grade in PES and recommendation of science/special education teacher/case manager.
Biology I	Passing grade in PES, OR Completion of Physics I/Honors Physics/AP Physics B and co-enrollment in Chemistry.
Hon. Biology	90% (83% in Honors) in English I Academic (or higher) and one of the following: Either 90% in PES OR 83% in Chemistry (77% in Hon. Chemistry, or co-enrollment in Chemistry) and one of 80% in Physics I (77% in Honors college Physics or 77% in AP Physics B).
Chemistry I CC	73% in (80% in Elements) Algebra I (or higher math), Passing grade in PES.
Chemistry I T	83% in (93% in Elements) Algebra I OR 77% in Algebra II or 65% in Adv. Algebra II or 65% in Hon. Algebra II
Hon. Chemistry	Any student who has completed middle school Algebra I or Algebra I at the high school with: 87% or higher, and will complete one of Physics I with minimum 83% or Hon. Physics minimum 77% or AP Physics B with minimum 73% by the end of 9th grade OR 83% in Algebra II and one of either 90% in PES or 83% in Physics
Physics I A	73% in (83% in Elements) Algebra I & Geometry (or higher math)
Physics I T	85% in M.S. Algebra I and placement in Advanced Geometry or higher OR 80% in Algebra I & Geometry (87% in Elements).

Honors (College) Physics	87% in both Algebra I & Geometry (or higher math)
Astronomy	Successful completion of two science courses
Science & Society	Successful completion of two science courses
Biology II	Successful completion of Biology
Forensic Science	Successful completion of Biology and Chemistry
Field Ecology & Animal Behavior	77% in (73% in Honors) Biology I and Chemistry I
Human Anatomy & Physiology	80% in (77% in Honors) Biology I and Chemistry I
AP Biology	87% in (85% in Honors) Biology I, Chemistry I, Algebra II; 90% in (87% in Honors) Sophomore or Junior English
AP Chemistry	87% in (85% in Honors) Chemistry I and Physics I or completion of AP Physics AND 93% in Algebra II (or 90% in Advanced, 87% in Honors)
AP Environ. Science	83% in (80% in Honors) Biology I, Chemistry I, and Algebra II
AP Physics B	*Rising Ninth Graders:* 95% in both M. S. Algebra I & Geometry
AP Physics C	83% or greater in Physics IT, OR 87% or greater in Physics IA (75% in Honors) OR 75 % or greater in AP Physics B and a 73% or greater in Calculus, Hon. Pre. AP Calculus, AP Calculus AB or AP Calculus BC or co-enrollment in at least Calculus.

HS STEM Courses

Biotechnology

Course Description: Biotechnology is a semester long, lab-based course designed to introduce students to the use of biological processes or organisms to manufacture products intended to improve the quality of human life. Biotechnology is a recent term that applies to ancient techniques such as brewing and selective breeding as well as to current techniques in genetic engineering. Topics include construction of recombinant DNA, genetically modified organisms, monoclonal antibodies, genetic testing, bioremediation, careers and ethics. Concepts will be introduced and reinforced with a variety of experiments, activities and demonstrations. Students will come to understand that biotechnology not only applies to their daily lives but will be important to them in their future.

Grades will be based on activities, presentations, laboratory reports, homework quizzes and exams. There will be a comprehensive final exam at the end of the semester. Students will be required to upload some assignments to sites such as turnitin, edmodo and our class wiki.

Overview of Engineering

Description:
Overview of Engineering is a college-prep course for juniors and seniors who have an interest in majoring in engineering at a four-year college or university. This project-based learning course extends prior work in math, physics, and chemistry and applies it to engineering design problems and processes. Multiple areas will be explored including, but not limited to, the traditional disciplines of chemical, civil, electrical, and mechanical engineering. Additional design topics include cost analysis, ethics, and communications (oral and written). The course will assist students in making decisions on a prospective major as well as discussions on post-graduate opportunities in the work force and graduate education.

Curriculum

The 9^{th} - 12^{th} grade curriculum can be found in the South Brunswick School District High School Science Curriculum Guide.

South Brunswick School District

DISTRICT APPENDIX

There are the various strands that cross content.

They have relevance to every curricular area and all grade levels.

The strands are interwoven into content and integrated into instruction.
They do not stand alone.

A synopsis of each strand is included in this document.

The full SBSD K-12 District Appendix, with detailed information about each strand, can be found as a separate document.

Topics

Teaching for the 21st Century

Educational Technology Standards

21st Century Life and Career Education Skills

Character Education

Differentiation

Understanding by Design (UbD): "Reader's Digest" Version

Topic
Teaching for the 21st Century: **What does this mean and how do you do it?** Students need to gain skills that will enable them to learn on their own, think critically and creatively, and apply knowledge to new situations. An emphasis needs to be placed on problem solving, teamwork skills, global awareness, and proficiency in using technology. Students need to learn to collaborate and work on authentic problems that they will likely encounter in their future careers. This section will outline what this means and how you "teach" for the 21st century: Elementary, Middle and High.
Tools for the 21st Century: **Life, Careers, and Digital Environments** 21st Century Life and Career Education Skills and Educational Technology Skills outline the NJ Core Curriculum Content Standards for these areas that align with PK-12 learning. These standards are written into the curriculum documents for all areas of content—English Language Arts, Mathematics, Science, Social Studies, PE/Health Education, Visual Art, Music, World Language and Library-Media. They are integrated into curriculum and instruction in places where it is relevant and meaningful to do so, and in ways that enhance learning. You will see these integrations explicitly noted in the curriculum guides: Elementary, Middle and High.
Character Education: **Safe and Caring Learning Communities** South Brunswick takes an "approach" to character education that fosters the social, emotional and academic growth of each child. The intent is to create a safe and caring community while building life skills based on the five core values (CARES): C Cooperation A Assertion R Responsibility (and Respect) E Empathy S Self-Control For over ten years, the K-5 teachers have been trained in and have followed the *Responsive Classroom (RC)* approach. The middle school teachers have studied and/or been trained in the *Developmental Designs (DD)* approach to character education.

The high school approach has been named "Strive for Five" and includes an annual theme with related activities to bring Character Education to the forefront. There is always a service-learning project connected to the theme. In addition, the high school also follows the *Institute of Excellence and Ethics* (IEE) approach. The IEE approach allows for explicit teaching of Character Education through a series of multimedia lessons that are embedded into the students' schedules.

Differentiation

Differentiation of instruction is a deliberate and conscious method of planning and teaching that provides multiple avenues of learning. It means different challenges to different students. It is characterized by strategies that use an assessment of each individual student for readiness, interest and learning style to modify instruction in three ways: by content, process and product.

In this document, there is a brief description of several approaches and methods that have long been utilized in South Brunswick to meet the differentiated needs of students within the classroom.

- Bloom's Taxonomy
- Gardner's Multiple Intelligences
- Learning Styles
- Inclusion Classrooms
- Kagan Cooperative Learning
- Principles of Differentiation

It is expected that classroom instruction will be differentiated. This expectation is predicated upon the belief or disposition that "all students can learn."

Understanding by Design

For nearly two decades, the South Brunswick School District has held much value in the Understanding by Design (UbD) or Backward Design model of curriculum writing by Grant Wiggins. This model and the process of curriculum development, has been used in the district for many years. The curriculum template—which was recommended by the State of NJ and adopted/adapted by the District, includes elements of the UbD approach.)

You will note that in every curricular area, we begin with the end in mind (that is, the big idea). Enduring understandings, essential questions and performance assessments—all based on standards--- are used in the process of curriculum development.

With this being said, it is not only important to understand the process of UbD, but also how to implement curriculum designed in such a way.

A brief overview of how to use Understanding by Design in delivering curriculum is included in the Appendix.