

South Brunswick School District



Curriculum Maps K-12

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 2011



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.

K-12 Curriculum Maps:

Development of science concepts over time

Through funding provided by CONNECT-ED¹, 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 SBSB 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.

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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.

How do you collect data and what tools do you use?

Distinguish between qualitative and quantitative data
Correct selection and use of (including, but not limited to):

Microscopes, balances, laboratory glassware, stopwatches, calibrated straight edges, pipettes, dissection tools, probes, chemicals

Organizational scheme for data- ie chart, table, etc.

Use ISN (Interactive Science Notebook) to organize KWL, T-charts, Venn diagram, data tables & graphic organizers
Utilize global science norms: scientific method and metric system

Introduce tools including, but not limited to: triple-beam and electronic balanced scale, ruler, graduated cylinder, compound microscope, thermometer, glassware, stop-watch, and pipette

Participate in small group discussion & individual written observations (2-5)

Participate in student designed investigations(3-5)

Use 5 senses (k-5) to make sketches (K-5), labels (3-5), and to observe and gather data (K-5)

Engage in whole class discussion(K-5)

Fill in teacher-created charts (K-5)

Use materials responsibly and respectfully(K-5)

Use tools to collect data , including, but not limited to: magnifying lenses, rulers, scales, and thermometers (K-5)

How do you evaluate and interpret the data?

Implement correct:

Selection of visual representation of data

Best-fit line/curve & interpret trends on graphs

Interpolation and extrapolation of graphical data

Assignment of variables on axes of graph

Estimation and evaluation of error

Use consistent and appropriate scale on axes of graph

Draw conclusions

Differentiate between observation & conclusion

Implement the ISN to:

Evaluate and interpret Punnett squares, bar, line, coordinate, and pie graphs to compare data when appropriate

Identify variables (independent and dependent)

Identify qualitative and quantitative data

Distinguish between observation & inference/ interpretation

Individually interpret charts and graphs (3-5)

Create data charts and graphs (3-5)

Use teacher created charts/templates to evaluate data(k-5)

Engage in class discussion on charts and graphs(k-5)

Compare data (k-5)

How do you communicate and support your findings?

Write and/or orally present experimental findings

Implement appropriate use of technology to present data (including, but not limited, to):
Microsoft PowerPoint, Microsoft Word, Microsoft Excel

Evaluate and report findings independently with integrity

Share results/findings with peers

Use correct use of science terminology

Compare results to other groups' results

Compose lab report showcasing the use of the Scientific Method

Utilize individual thought-process written in the ISN to synthesize science concepts

Use evidence and data to support thoughts (3-5)

Complete lab sheets (3-5)

Engage in whole class and small group discussion and individual reflection(k-5)

Create sketches, journals, and models (K-5)

Use scientific terms and vocabulary (K-5)

How do you reflect on your findings to revise or support previous understandings?

Utilize peer revision to enhance understanding
Address and discuss misconceptions
Evaluate hypotheses, support or disprove

Implement pair, group and class discussion of findings

Compare data to prove/disprove hypothesis

Address and discuss misconceptions

Document a self-reflection written in ISN

Explain and support changes in thinking in discussions(K-5) and writing (2-5)

Check predictions based on collected data (K-5)

Process information using KWL charts (K-5)

Due to various forces, Earth is a part of an interconnected system with other objects in the universe that influence each other.

How do gravity and nuclear forces affect the structure, motion and evolution of celestial bodies?
What scientific tools and processes are used to determine the number of stars in our universe?
How do new technology and the evidence it generates, contribute to our current understanding of the evolution of the universe?

Is all life on Earth affected by the Sun and the moon? **(6th grade)**
Could life exist on another planet?**(6th grade)**
Why is it necessary for people to study astronomy? **(6th grade)**
Did stars enhance civilizations?
(6th grade)

To what extent are the properties of objects in our solar system predictable?
(3rd grade)
What causes patterns in the universe? **(3rd grade)**
What are some properties of the Sun, Moon, and the stars?
(3rd grade)

Earth is constantly changing as a result of its natural processes.

Earth's unique structure allows life to be possible.

How long does change take (human vs. geologic time scale)? **(6th grade)**
What can rocks tell us about the history of the Earth? **(6th grade)**
How do different types of maps help us understand the Earth? **(6th grade)**
What are the challenges in obtaining and utilizing renewable resources as opposed to non-renewable resources? **(7th and 8th grade)**
How is the world handling the demand for alternate energy? **(7th and 8th grade)**
How does the transfer of thermal radiation influence weather conditions and/or patterns?**(7th and 8th grade)**

What is the Earth made of? **(2nd grade)**
What do the rocks and soil around us look like? **(2nd grade)**
Why are rocks and minerals important resources? **(2nd grade)**
What is a fossil? **(2nd grade)**

Earth's weather and climate systems are the result of complex interactions between land, ocean, ice and atmosphere.

High School

How do human activities affect climate change, ozone levels, and water pollution?
What are the effects of changes in climate, ozone levels, air and water quality on human life?
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? **(7th and 8th grade)**
How do interactions of various weather variables contribute to the formation of weather conditions in a given time and area? **(7th and 8th grade)**
What are the causes of Earth's catastrophic weather? **(7th and 8th grade)**
How can the climate of a region change over a period of time? **(7th and 8th grade)**

How do changes in one part of an Earth system affect other parts of the system? **(3rd grade)**
How are weather patterns observed, recorded, and interpreted? **(3rd grade)**
How does weather affect our daily lives? **(3rd grade)**
How does a drop of water travel through the water cycle?
Why is water important? **(3rd grade)**
How does water change from one form to another? **(3rd grade)**
What are the properties of water? **(3rd grade)**
Where is water found?**(3rd grade)**

Living organisms are all composed of cells that carry out biological functions.

High School

How do biochemical molecules define the form and function of cells?
Which biochemical molecules govern cellular processes?
How do cellular organelles govern the form and function of cells?

What is the relationship between cells, tissues, organs, and organ systems? **(7th & 8th grade)**
How are humans more complex than other organisms, with regard to specific body systems? **(7th & 8th grade)**
How do organelles work together to meet a cell's needs? **(7th & 8th grade)**
How are organisms grouped in relation to the manner by which they obtain their energy? **(6th, 7th & 8th grade)**
What are the fundamental building blocks of all living things? **(6th, 7th & 8th grade)**

What properties do all living things have that make them similar? that make them different? **(3rd & 1st grade)**
How do we know if something is alive? **(1st grade)**

To build cells, energy, which is provided by food, is required.

High School

How is solar energy by plants transformed into carbon-based energy?
How is carbon-based energy transformed into cellular energy?
Which factors affect the formation of carbon-based energy and cellular energy?
How do carbon-based energy and cellular energy contribute to the carbon cycle?

How is energy transferred among organisms in a living system? **(6th, 7th & 8th grade)**
What is the ultimate source of energy for all living things? **(6th, 7th & 8th grade)**

How do living things get energy? **(4th grade & 1st grade)**
What are basic needs of living things? **(3rd & 1st grade)**

All animals and plants depend on each other and the environment to meet their basic needs.

High School

What are the four symbiotic relationships?
How do symbiotic relationships aid organisms in meeting their basic needs?
How do environmental conditions affect population numbers within an environment?
How are nutrients and energy cycled between organisms in the environment?

What are the differences between biotic and abiotic resources and in what ways do biotic organisms identify their own niches? **(7th & 8th grade)**
How do communities, habitats, ecosystems, niches and populations relate to one another? **(7th & 8th grade)**
How is energy transferred among organisms in a living system? **(6th, 7th & 8th grade)**

How do living things depend on each other and the environment? **(4th, 3rd & 2nd grade)**
Why is nature important to us? **(Kindergarten)**

Organisms go through life cycles which includes growth, development and reproduction.

High School

What are the steps on the life cycle of a cell?
Which type of reproduction fosters biodiversity?
What are the main types of asexual reproduction?
What is the relationship between DNA, genes, chromosomes and cell division?
How can DNA-form be used to interpret the stage of cellular division?
What are four different types of mutations?
In which type of cell would mutations have the greatest effect on offspring?

How are multicellular organisms more or less suitable for survival? **(7th & 8th grade)**
How is genetic information passed from parent to offspring? **(7th & 8th grade)**
What are the differences between sexual and asexual reproduction? **(7th & 8th grade)**
How can mutations be helpful, harmful or neutral? **(7th & 8th grade)**
How do scientists use genetics to affect the quality of human life? **(7th & 8th grade)**
How can we predict the probability of a trait being inherited by an organism? **(7th & 8th grade)**

What parts do living things have to help them survive? **(3rd & 1st grade)**
What changes do living things go through during their lives? **(2nd grade)**
How do we know if something is alive? **(1st grade)**

Species adapt over time to changes in the environment.

High School

How do environmental conditions affect population numbers within an environment?
What are the key components of Darwin's theory of evolution?
What are four different types of scientific evidence that are used to show evolution?
What type of population would be significantly influenced by natural selection?
What are the differences between artificial and natural selection?
How would you estimate how closely related two organisms are?

How do adaptations enable organisms to survive in their ecosystem? **(7th & 8th grade)**
What are limiting factors in an ecosystem? **(7th & 8th grade)**
What effects do humans have on the environment? **(7th & 8th grade)**
Do humans have the right to alter the environment? **(7th & 8th grade)**
Is extinction of a species a bad thing? **(7th & 8th grade)**

How does the environment affect living things? **(4th, 3rd, 2nd & Kindergarten)**
How do living things change over time? **(2nd & 1st grade)**

In all branches of science, there exist dynamic systems; and in each, a change in one component affects the entire system.

High School

How does the introduction of a toxin into a dynamic ecosystem alter the health of organisms at different trophic levels?
How would eliminating or increasing a trophic level affect an ecosystem?
Which trophic level of an ecosystem would be most impacted by an interruption of nutrient cycling?
What changes in a population graph would be observed due to changes in an ecosystem?

What happens when part of an organism's internal regulation becomes faulty? **(6th, 7th, & 8th)**
How does the interdependence of body systems contribute to an organism's survival? **(7th & 8th grade)**
How are the living and non-living parts of an ecosystem interdependent? **(7th & 8th grade)**
How do changes in an ecosystem affect the remaining components of the system? **(7th & 8th grade)**

What are the functions of the specialized systems of the human body? **(4th & 5th grade)**
How do the systems of the human body interact to carry out everyday activities? **(4th & 5th grade)**
How do living things depend on each other and on non-living parts of the environment? **(4th grade)**
What happens when part of an ecosystem is altered? **(4th grade)**

Interactions among matter can be described from an energy perspective, and mass/energy, coming in many forms, is always conserved.

Why does it appear to the observer that mass/energy are NOT conserved in chemical/nuclear reactions?
When is work done?
When is mech. energy conserved? When is it not?
How can energy be transferred without a transfer of matter?
What is the nature of light?
Why is it that a cyclical process can never be 100% efficient?
What is heat?

How does the law of conservation of matter apply to the physical and chemical changes of matter? **(7th & 8th grade)**
How does the transfer of thermal radiation influence weather condition and/or patterns? **(7th & 8th grade)**
How can the law of conservation of energy be applied? **(7th & 8th grade)**
How does the law of conservation of energy explain energy transfer and changes of energy state? **(7th & 8th grade)**

What is light? **(2nd grade)**
What are the sources of light? **(2nd grade)**
How does light travel? **(2nd grade)**
How do we know that things have energy? **(4th grade)**
How does light travel and behave? **(4th grade)**

No matter the nature of the forces, we need a net force to cause a change in motion.

What accelerates?
What causes an object to accelerate?
What are the consequences of being in equilibrium? Of not being in equilibrium?
Which interaction require contact, and which do not?
How can we test the existence of a field?

Does an object at rest have as much energy as an object in motion? **(6th grade)**
Is all life on Earth affected by the Sun and moon? **(6th grade)**
Why is everything in the universe in motion? **(7th & 8th grade)**
Why are Newton's laws of motion important in describing all motion in the universe and on Earth? **(7th & 8th grade)**

What evidence do we have of forces that we cannot see? **(1st grade)**
How do things move? **(1st grade)**
How can we change the way things move? **(1st grade)**
How do magnets work? **(1st grade)**

Forces come in equal and opposite pairs.

How do we identify an action/reaction pair?

Why are Newton's laws of motion important in describing all motion in the universe and on Earth? **(7th & 8th grade)**

Atoms are the basic building blocks of matter and determine interactions among matter at the microscopic level.

How does an understanding of electrical phenomena impact and inform our everyday lives?
What is inside the atom? How are the electrons arranged?
What are some common properties of the elements?
How are molecules held together?
What causes molecular motion and how is it measured?
How do gases behave? How do various conditions change the characteristics of the gases?
How do certain factors affect the rate of a reaction and how do changes affect reversible reactions?
What are the driving forces of a reaction, and how do atoms rearrange to form new substances?
What are the physical/chemical properties associated with this change?
What role does heat energy play in the arrangement of matter?
How do acids, bases and salts behave?

What is matter? *(7th & 8th grade)*
Why is it important to classify matter? *(7th & 8th grade)*
What role does heat energy play in the arrangement of matter? *(7th & 8th grade)*
What causes change from one state of matter to another? *(7th & 8th grade)*
How can you use the properties of matter to distinguish one substance from another? *(7th & 8th grade)*
How is the current atomic model explain the interaction of elements and the formation of compounds? *(7th & 8th grade)*
How does the atomic composition of matter influence their physical properties, chemical reactivity, and use? *(7th & 8th grade)*

What are the properties of water? *(1st grade)*
How does water change from one form to another? *(1st grade)*
How does a drop of water travel through the water cycle? *(3rd grade)*
How can energy impact the state of matter? *(4th & 5th grade)*
How might physical/chemical properties change after a chemical reaction? *(5th grade)*
How do properties of materials determine their use and identification? *(5th grade)*

In all branches of science, there exist dynamic systems; and in each, a change in one component affects the entire system.

How do gases behave? How do various conditions change the characteristics of gases?
How do certain factors affect the rate of reaction?
How do changes affect reversible reactions?
How is the flow electric charge maintained?
How does one circuit component affect the function of others?
What are the connections between electricity and magnetism?

How does an electrical circuit work? *(4th grade)*
What happens if an element is removed from a circuit? *(4th grade)*