TRUMBULL PUBLIC SCHOOLS

Trumbull, Connecticut

GRADE 2 SCIENCE
2019

(Last revision date: 2005)

Curriculum Writing Team

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Grade 2 Science
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The Trumbull Board of Education will continue to take Affirmative Action to ensure that no persons are discriminated against in its employment.

CORE VALUES AND BELIEFS

The Trumbull School Community engages in an environment conducive to learning which believes that all students will **read** and **write effectively**, therefore communicating in an articulate and coherent manner. All students will participate in activities **that present problem-solving through critical thinking**. Students will use technology as a tool applying it to decision making. We believe that by fostering self-confidence, self-directed and student-centered activities, we will promote **independent thinkers and learners**. We believe **ethical conduct** to be paramount in sustaining the welcoming school climate that we presently enjoy.

Approved 8/26/2011

INTRODUCTION & PHILOSOPHY

The Connecticut State Board of Education, based on its 2008 Position Statement on Science Education, has supported "a systematic approach to ensuring that every student in Connecticut receives a rich and coordinated PK-12 education in science. Science learning should focus simultaneously on developing an understanding of core concepts, as well as knowing how scientists work collaboratively to test ideas, analyze evidence, and solve problems. The realization of this vision is critical for our students' futures, as well as for Connecticut's place in the globally competitive economy."

The Board offers five principles to support strong elementary grades science education:

- "Ensure that the instructional focus for science is comparable to that provided for language arts and mathematics and teachers are able to integrate literacy and numeracy instruction within the context of students' science learning experiences."
- "Maintain class sizes that ensure instructional excellence and the safety of the students and the teacher."
- "Provide indoor and outdoor science learning areas, including rooms with flat, movable desks or tables and chairs, appropriate science equipment, storage space, and access to water and electricity as needed."
- "Provide students with multiple opportunities every week to experience inquiry investigations that develop students' abilities to question, explore, observe, gather simple data, create graphs, draw conclusions based on the data, and build their understanding of natural phenomena."
- "Provide science enrichment opportunities to foster student interest in science."

In 2015, the Connecticut State Board of Education adopted the Next-Generation Science Standards (NGSS), which embody the National Research Council's *Framework for K-12 Education* (2011). The TPS Grade 2 science curriculum integrates the NGSS as listed for each unit of study. The NGSS architecture uses Science and Engineering Practices along with various components of Disciplinary Core Ideas and Crosscutting Concepts to comprise the performance expectations for students. Based on the NRC *Framework*, a core idea for science education should meet at least two of the following four criteria:

- "Have broad importance across multiple sciences or engineering disciplines or be a key organizing principle of a single discipline."

- "Provide a key tool for understanding or investigating more complex ideas and solving problems."
- "Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge."
- "Be teachable and learnable over multiple grades at increasing levels of depth and sophistication."

The TPS Grade 2 science curriculum also follows the TPS guidelines for student safety in the classroom as represented in the National Science Education Standards, the Next-Generation Science Standards, the National Science Teachers Association, and OSHA. The curriculum encourages and fosters a hands-on, process and inquiry-based approach to science education, with student safety first and foremost. Lab safety guidelines are implemented through the district.

The curriculum is designed to be implemented within the parameters established by Trumbull Board of Education Policy 6112.2, "Allotment of Time for Subjects, Grades K-5."

COURSE GOALS

The course goals derive from the 2013 Next-Generation Science Standards and the 2010 Connecticut Core Standards. Goals are listed specific to each unit in this curriculum guide, and developed through unit lessons using the 5-E learning model (engage, explore, explain, elaborate, evaluate) in order to encourage student engagement and foster metacognitive learning strategies through a reflective process. See Appendix A.

COURSE ENDURING UNDERSTANDINGS

Students will understand that . . .

- Matter is everything that is made up of atoms and takes up space. Solid, liquid, and gas matter can be described and classified, including the changes of matter and its properties. Solids and liquids have distinct properties that separate them as two states of matter. Matter in a solid state holds its own shape until something changes it. Matter in a liquid state takes the shape of its own container, but has no shape of its own. Certain changes in matter occur when heating or cooling is applied.
- There are many different kinds of living things in any area, and they exist in different places on land and in water. Animals depend on their surroundings to get what they need, including food, water, shelter, and a favorable temperature to grow and survive. Plants depend on air, water, minerals in the soil, and light to grow and survive. Young animals and plants are very much, but not exactly, like their parents, and also resemble other animals and plants of the same kind as their parents, and also resemble other animals and plants of the same kind. Ecosystems where plants and animals live often change, sometimes slowly and sometimes rapidly. Living things can survive only where their needs are met.
- Events on Earth occur in cycles; some have a beginning and an end, and other occur very slowly over a time period much longer than one can observe. Water is found in the ocean, rivers, lakes, and ponds, and can exist as solid ice and in liquid form. Wind and water can change the shape of the land. Rocks, soils, and sand are present in most areas where plants and animals live.

COURSE ESSENTIAL QUESTIONS

- How can one explain the structure, properties, and interactions of matter?
- What are properties, and how can solids be described or classified?
- In what ways are all solids the same?
- How can liquids be described or classified?
- What changes in matter occur when heating or cooling is applied?
- Which forms of change are reversible, and which are not?
- How do organisms interact with the living and nonliving environments to obtain matter and energy?
- How do matter and energy move through an ecosystem?
- What happens to ecosystems when the environment changes?
- What evidence shows that different species are related?
- How does the environment influence populations of organisms over multiple generations (adaptations)?
- How can people reconstruct events in Earth's history?
- How and why is Earth constantly changing?
- How do Earth's major systems interact?
- How do the properties and movement of water shape Earth's surface and affect its systems?

COURSE KNOWLEDGE & SKILLS

Students will understand, at an age-appropriate level, . . .

- Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- Cause and effect: Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- Scale, proportion, and quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
- Systems and system models. Defining the system under study – specifying its boundaries and making explicit a model of that system – provides tools for understanding and testing ideas that are applicable throughout science and engineering.
- Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
- Structure and function. The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

- Stability and change. For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Students will be able to . . .

- ask questions (for science) and define problems (for engineering).
- develop and use models.
- plan and carry out investigations.

SCIENCE YEAR AT A GLANCE

early September – late November	Unit 1: Matter and Its Interactions Lesson 1: Solids Lesson 2: Liquids Lesson 3: Changing States of Matter
early December – mid March	Unit 2: Interdependent Relationships in Ecosystems Lesson 1: Connecticut Ecosystems and Habitats Lesson 2: River Habitats Lesson 3: Forest Habitats Lesson 4: Comparison of River and Forest Habitats Lesson 5: Seed Dispersal Lesson 6: Seed Planting
mid March – June	Unit 3: Earth's Place in the Universe / Earth's Systems Lesson 1: Soil Lesson 2: Weathering Lesson 3: Erosion Lesson 4: Events That Change the Land – Earthquakes Lesson 5: Events That Change the Land – Volcanoes Lesson 6: Human Impact

UNIT 1
Matter and Its Interactions

"Different kinds of matter exist (e.g., wood, metal, water), and many of them can be either soil or liquid, depending on temperature. Matter can be described and classified by its observable properties (e.g., visual, aural, textural), by its uses, and by whether it occurs naturally or is manufactured. Different properties are suited to different purposes. A great variety of objects can be built up from a small set of pieces (e.g., blocks, construction sets). Objects or sample of a substance can be weighed, and their size can be described and measured." (National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. 108.)

Unit Goals

At the completion of this unit, students will:

NGSS.2-PS1-1	Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
NGSS.2-PS1-2	Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
NGSS.2-PS1-3	Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
NGSS.2-PS1-4	Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.
NGSS.K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
NGSS.K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
CCS.ELA-Literacy.RI.2.1	Ask and answer such questions as *who*, *what*, *where*, *when*, *why*, and *how* to demonstrate understanding of key details in a text.
CCS.ELA-Literacy.RI.2.3	Describe the connections between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.

CCS.ELA-Literacy.RI.2.8	Describe how reasons support specific points the author makes in a text.
CCS.ELA-Literacy.W.2.1	Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., *because*, *and*, *also*) to connect opinion and reasons, and provide a concluding statement or section.
CCS.ELA-Literacy.W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
CCS.ELA-Literacy.W.2.8	Recall information from experiences or gather information from provided sources to answer a question.
CCS.MP.2	Reason abstractly and quantitatively.
CCS.MP.4	Model with mathematics.
CCS.MP.5	Use appropriate tools strategically.
CCS.2.MD.10	Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.

Science & Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Planning and Carrying Out Investigations: • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (NGSS.2-PS1-1) Analyzing and Interpreting Data: • Analyze data from tests of an object or tool to determine if it works as intended. (NGSS.2-PS1-2) Constructing Explanations and Designing Solutions:	Structure and Properties of Matter: • Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (NGSS.PS1-1) • Different properties are suited to different purposes. (NGSS.PS1-2, NGSS.PS1-3) • A great variety of objects can be built up from a small set of pieces. (NGSS.PS1-3)	Patterns: • Patterns in the natural and human designed world can be observed. (NGSS.2-PS1-1) Cause and Effect: • Events have causes that generate observable patterns. (NGSS.2-PS1-4, NGSS.2-LS2-1) • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (NGSS.2-PS1-2) Energy and Matter:

• Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena. (NGSS.2-PS1-3) Engaging in Argument from Evidence: • Construct an argument with evidence to support a claim. (NGSS.2-PS1-4)	Chemical Reactions: • Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible, and sometimes they are not. (NGSS.PS1-4) Developing Possible Solutions: • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (NGSS.ETS1.B) Optimizing the Design Solution: • Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (NGSS.ETS1.C)	• Objects may break into smaller pieces and be put together into larger pieces, or change shapes. (NGSS.2-PS1-3) Structure and Function: • The shape and stability of structures of natural and designed objects are related to their function(s). (NGSS.2-LS2-2)

Unit Essential Questions

- What are properties, and how can solids be described or classified?
- In what ways are all solids the same?
- In what ways are properties of solids used?
- In what ways can objects be assembled, disassembled, and reassembled?
- How can liquids be described or classified?
- In what ways do liquids differ from one another?
- How do liquids pour and flow? How do liquids look in various container shapes?
- In what ways are all liquids the same?
- What changes in matter occur when heating or cooling is applied? Which forms are reversible, and which are not?

Scope and Sequence

- Matter is everything that is made up of atoms and takes up space.
- Matter in a solid state holds its own shape until something changes it.
- Matter in a liquid state takes the shape of its container, but has no shape of its own.

- Certain changes in matter occur when heating or cooling is applied.
- Matter in a gas shape has no shape and spreads out into space.
- Matter can change states.

Assured Assessments
Student performance on the following assessments will be included in the Trimester 1 standards-based report card.

Formative Assessments:
- informal teacher observations during investigations
- whole-group and center check-in discussions
- monitoring during Turn & Talk
- Science Notebook entries
- diagrams, reflections, worksheets, & responses to prompts

Summative Assessments:
- Treehouse Assessment
- Solids and Liquids Assessment
- Changes in State of Matter Assessment
- Science Notebook entry

Resources
Core
- Beaty, Andrea. *Ada Twist, Scientist*. http://viewpure.com/mqbkw-GkcRI?start=0&end=0. Web.
- Beaty, Andrea. *Rosie Revere, Engineer*. http://viewpure.com/A4r8vTxeLcU?start=0&end=0. Web.
- *Building Boats*, Pearson Project STEM Module.
- Delta Science Readers. *Investigating Water*. Nashua, NH: Delta Education, 2004. Print.
- Delta Science Readers. *Solids and Liquids*. Nashua, NH: Delta Education, 2007. Print.
- *Investigating Water*, Delta Science.
- *Solids and Liquids*, FOSS Science.

Supplemental
- Allen, Pamela. *Who Sank the Boat?* London: Puffin, 1996. Print.
- Delta Science First Readers. *Matter*. Nashua, NH: Delta Education, 2006. Print.
- Delta Science Readers. *States of Matter*. Nashua, NH: Delta Education, 2003. Print.
- *Matter All Around Us*, KnowAtom E2 NGSS Curriculum.
- *Matter Is Everything*, Reading PowerWorks, Sundance. Print.
- Trumbauer, Lisa. *What Is Matter?* New York: Doubleday, 1997. Print.
- Zoehfeld, Kathleen Weidner. *What Is the World Made Of? All About Solids, Liquids, and Gases*. New York: HarperCollins, 2015. Print.
- Tinkertoys

Time Allotment

- Approximately twelve weeks (early September – late November)

UNIT 2
Interdependent Relationships in Ecosystems

"Animals depend on their surroundings to get what they need, including food, water, shelter, and a favorable temperature. Animals depend on plants or other animals for food. They use their senses to find food and water, and they use their body parts to gather, catch, eat, and chew the food. Plants depend on air, water, minerals (in the soil), and light to grow. Animals can move around, but plants cannot, and they often depend on animals for pollination or to move their seeds around. Different plants survive better in different settings because they have varied needs for water, minerals, and sunlight. . . . There are many different kinds of living things in any area, and they exist in different places on land and in water." (National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. 151-66.)

Unit Goals

At the completion of this unit, students will:

NGSS.2-LS2-1	Plan and conduct an investigation to determine if plants need sunlight and water to grow.
NGSS.2-LS2-2	Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
NGSS.2-LS4-1	Make observations of plants and animals to compare the diversity of life in different habitats.
NGSS.2-ESS2-1	Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
NGSS.2-ESS2-2	Develop a model to represent the shapes and kinds of land and bodies of water in an area.
NGSS.2-ESS2-3	Obtain information to identify where water is found on Earth and that it can be solid or liquid.
CCS.ELA-Literacy.W.2.2	Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.
CCS.ELA-Literacy.W.2.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.
CCS.ELA-Literacy.W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).

CCS.ELA-Literacy.SL.2.1	Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
CCS.MP.4	Model with mathematics.
CCS.MP.5	Use appropriate tools strategically.
CCS.1.MD.1	Order three objects by length; compare the lengths of two objects indirectly by using a third object.

Science & Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Developing and Using Models: • Develop a simple model based on evidence to represent a proposed object or tool. (NGSS.2-LS2-2) • Develop a model to represent patterns in the natural world. (NGSS.2-ESS2-2) Planning and Carrying Out Investigations: • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question. (NGSS.2-PS1-1, NGSS.2-LS2-1) • Make observations (firsthand or from media) to collect data which can be used to make comparisons. (NGSS.2-LS4-1) Constructing Explanations and Designing Solutions: • Compare multiple solutions to a problem. (NGSS.2-ESS2-1) Obtaining, Evaluating, and Communicating Information:	Interdependent Relationships in Ecosystems: • Plants depend on water and light to grow. (NGSS.LS2-1) • Plants depend on animals for pollination or to move their seeds around. (NGSS.LS2-2) Developing Possible Solutions: • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (NGSS.ETS1.B) Biodiversity and Humans: • There are many different kinds of living things in any area, and they exist in different places on land and in water. (NGSS.LS4.D) Earth Materials and Systems: • Wind and water can change the shape of the land. (NGSS.ESS2.A)	Patterns: • Patterns in the natural world can be observed. (NGSS.2-ESS2-2, NGSS.2-ESS2-3) Stability and Change: • Things may change slowly or rapidly. (NGSS.2-ESS1-1, NGSS.2-ESS2-1) Influence of Engineering, Technology, and Science on Society and the Natural World: • Developing and using technology has impacts on the natural world. (NGSS.2-ESS2-1) Science Addresses Questions about the Natural and Material World: • Scientists study the natural and material world. (NGSS.2-ESS2-1)

• Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question. (NGSS.2-ESS2-3)	Plate Tectonics and Large-Scale Systems Interactions: • Maps show where things are located. One can map the shapes and kinds of land and water in any area. (NGSS.ESS2.B) The Roles of Water in Earth's Surface Processes: • Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (NGSS.ESS.2.C) Optimizing the Design Solution: • Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (NGSS.ETS1.C)	

Unit Essential Questions

- How do some bodies of water in Connecticut change their states of matter throughout the year?
- How do maps help us understand our community (Connecticut)?
- What is an ecosystem?
- What is a habitat?
- How do living things meet their basic needs in a habitat within an ecosystem?
- How are river habitats and forest habitats similar, and how are they different?
- What are the predators and prey of beavers and woodchucks?
- What are adaptations animals have made to live in land habitats and water habitats?
- What are adaptations animals have made that protect them in land habitats and water habitats?
- Why and how do seeds travel?
- How do plants depend on animals?

Scope and Sequence

- Water can be found on Earth as liquid water or solid ice (e.g., a frozen pond, a liquid pond, a frozen lake).
- Geographical features of rivers and forests of Connecticut have unique ecosystems and habitats for plants and animals.

- An ecosystem is a community of living and nonliving things, and a habitat is a place where plants and animals live within an ecosystem.
- Seeds and animals (e.g., squirrels, bears, bobcats) in Connecticut contribute to seed dispersal.
- Factors in the natural environment can affect how far a seed is dispersed.
- Plants adapt to their environment by dispersing seeds in various methods.

Assured Assessments
Student performance on the following assessments will be included in the Trimester 2 standards-based report card.

Formative Assessments:
- informal teacher observations during investigations
- whole-group and center check-in discussions
- monitoring during Turn & Talk
- Science Notebook entries
- diagrams, reflections, worksheets, & responses to prompts

Summative Assessments:
- Reading Maps Assessment
- CT River Habitat Assessment
- CT Forest Habitat Assessment
- Seed Dispersal (Traveling Seeds) Assessment

Resources
Core

- Benoit, Peter. *Temperate Forests*. Houghton, MI: Michigan Technological University, 2011. Print.
- Blackaby, Susan. *Plant Packages: A Book about Seeds*. North Mankato, MN: Picture Window, 2003. Print.
- *Discover the Wonder: Module A: Habitats*, Scott Foresman.
- Gibbons, Gail. *Beavers*. New York: Holiday House, 2013. Print.
- Johnson, Rebecca L. *A Walk in the Deciduous Forest*. Minneapolis: Lerner, 2001. Print.
- Kalman, Bobbie. *A Forest Habitat*. New York: Crabtree, 2007. Print.
- Kalman, Bobbie. *The Science of Living Things: What Is a Biome?* New York: Crabtree, 1997. Print.
- Kolpin, Molly. *American Black Bears*. North Mankato, MN: Capstone, 2012. Print.
- Jacobs, Daniel. *All from an Oak Tree*. Marlborough, MA: Discovery Links Science. Print.
- Markle, Sandra. *Build, Beaver, Build! Life at the Longest Beaver Dam*. Minneapolis: Millbrook, 2016. Print.
- Parkes, Brenda. *A River Changes*. Marlborough, MA: Discovery Links Science. Print.
- Parkes, Brenda. *Solid or Liquid*. Marlborough, MA: Discovery Links Science. Print.
- Ring, Susan. *Wind, Water, Ice*. Marlborough, MA: Discovery Links Science. Print.
- Schaefer, Lola M., and Adam Schaefer. *Because of an Acorn*. San Francisco: Chronicle, 2016. Print.

- Sheehy, Shawn. *Welcome to the Neighborhood*. Somerville, MA: Candlewick, 2015. Print.
- Trumbauer, Lisa. *Grow Seed, Grow*. London: Pearson, 2000. Print.
- Weakland, Mark. *Seeds Go, Seeds Grow*. North Mankato, MN: Capstone, 2011. Print.

Supplemental

- Gearing, Conor. "Black Bears Can Help Fruit Trees Escape Climate Change." https://www.pbs.org/wgbh/nova/article/black-bears-can-help-fruit-trees-escape-climate-change/. Web.
- "Groundhog Day Kids STEM Activity." https://www.steampoweredfamily.com/activities/groundhog-day-kids-stem-activity/. Web.
- "Habitats" anchor chart. http://2.bp.blogspot.com/-h5vg5lnHNmo/Tm_9KQZz-QI/AAAAAAAAA3w/N6obzXXnTsY/s1600/100_5002.JPG. Web.
- Kreisman, Rachelle. "What Do Plants Need?" https://www.eriesd.org/site/handlers/filedownload.ashx?moduleinstanceid=18724&dataid=22632&FileName=Gr%202%20What%20Do%20Plants%20Need%20Lexile%20440.pdf. Web.
- Martin-James, Kathleen. *Building Beavers*. Minneapolis: Lerner, 2000. Print.
- Siddals, Mary McKenna. *Compost Stew: An A to Z Recipe for the Earth*. New York: Tricycle, 2010. Print.
- State of Connecticut Department of Energy & Environmental Protection. "Find a State Park or Forest." https://www.depdata.ct.gov/maps/parksforests/parksmap.htm. Web.
- State of Connecticut Department of Energy & Environmental Protection. "What Is Habitat?" https://www.ct.gov/deep/cwp/view.asp?a=2723&q=326186. Web.
- PebbleGo articles

Time Allotment

- Approximately eleven weeks (early December – mid March)

UNIT 3
Earth's Place in the Universe / Earth's Systems

"Some events on Earth occur in cycles, like day and night, and others have a beginning and an end, like a volcanic eruption. Some events, like an earthquake, happen very quickly; others, such as the formation of the Grand Canyon, occur very slowly, over a time period much longer than one can observe. . . . Wind and water can change the shape of the land. The resulting landforms, together with the materials on the land, provide homes for living things. . . . Rocks, soils, and sand are present in most areas where plants and animals live. There may also be rivers, streams, lakes, and ponds. Maps show where things are located. One can map the shapes and kinds of land and water in any area. . . . Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. It carries soil and rocks from one place to another and determines the variety of life forms that can live in a particular location. . . . Because there is always more than one possible solution to a problem, it is useful to compare designs, test them, and discuss their strengths and weaknesses." (National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012. 178-209.)

Unit Goals

At the completion of this unit, students will:

NGSS.2-ESS1-1	Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
NGSS.2-ESS2-1	Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
NGSS.2-ESS2-2	Develop a model to represent the shapes and kinds of land and bodies of water in an area.
CCS.ELA-Literacy.RI.2.1	Ask and answer such questions as *who*, *what*, *where*, *when*, *why*, and *how* to demonstrate understanding of key details in a text.
CCS.ELA-Literacy.RI.2.3	Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
CCS.ELA-Literacy.RI.2.8	Describe how reasons support specific points the author makes in a text.
CCS.ELA-Literacy.W.2.6	With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.

CCS.ELA-Literacy.W.2.7	Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
CCS.ELA-Literacy.SL.2.2	Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.
CCS.MP.2	Reason abstractly and quantitatively.
CCS.MP.5	Use appropriate tools strategically.

Science & Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Constructing Explanations and Designing Solutions: • Make observations from several sources to construct an evidence-based account for natural phenomena (NGSS.2-ESS1-1) • Compare multiple solutions to a problem. (NGSS.2-ESS2-1) Developing and Using Models: • Develop a model to represent patterns in the natural world. (NGSS.2-ESS2-3) Obtaining, Evaluating, and Communicating Information: • Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question. (NGSS.2-ESS2-3)	The History of Planet Earth: • Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe. (NGSS.2-ESS1-1) Earth Materials and Systems: • Wind and water can change the shape of the land. (NGSS.2-ESS2-1) Plate Tectonics and Large-Scale System Interactions: • Maps show where things are located. One can map the shapes and kinds of land and water in any area. (NGSS.2-ESS2-2) The Roles of Water in Earth's Surface Processes: • Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (NGSS.2-ESS2-3) Optimizing the Design Solution: • Because there is always more than one possible solution to a problem, it is	Stability and Change: • Things may change slowly or rapidly. (NGSS.2-ESS1-1, NGSS.2-ESS2-1) Patterns: • Patterns in the natural world can be observed. (NGSS.2-ESS2-2, NGSS.2-ESS2-3) Influence of Engineering, Technology, and Science on Society and the Natural World: • Developing and using technology has impacts on the natural world. (NGSS.2-ESS2-1) Science Addresses Questions about the Natural and Material World: • Scientists study the natural and material world. (NGSS.2-ESS2-1)

	useful to compare and test designs. (NGSS.ETS1.C)	

Unit Essential Questions

- What are similarities and differences of soil and sand?
- What events cause Earth's surface to change?
- What major event changed the shape of the Connecticut River over time?
- What are different types of erosion?
- What events cause slow-occurring changes as compared to quick changes?
- What happens to Earth's surface in an earthquake?
- How do earthquakes provide evidence that Earth events can occur quickly?
- How can we use evidence from the natural world to design models?
- What happens to Earth's surface when a volcano occurs?
- What positive changes does a volcano cause?
- How is an earthquake different from a volcano?
- How can we use evidence from the natural world to design models?
- How do people cause changes to Earth's surface?
- How can people prevent some changes to Earth's surface (e.g., preventing soil erosion)?

Scope and Sequence

- Events on Earth occur in cycles; some have a beginning and an end, and others occur very slowly over a time period much longer than one can observe.
- Water is found in the ocean, rivers, lakes, and ponds.
- Wind and water can change the shape of the land.
- Rocks, soils, and sand are present in most areas where plants and animals live.
- Earthquakes are common in certain places on Earth, but can happen almost anywhere.
- An earthquake is a natural hazard created by the sudden movement of the Earth's plates that releases energy and causes powerful shaking of the ground.
- Earthquakes and volcanoes are examples of quick and/or sudden changes that the Earth experiences.

Assured Assessments

Student performance on the following assessments will be included in the Trimester 3 standards-based report card.

Formative Assessments:

- informal teacher observations during investigations
- whole-group and center check-in discussions
- monitoring during Turn & Talk
- Science Notebook entries
- diagrams, reflections, worksheets, & responses to prompts
- Soil Particle Layering Lab

- Earthquakes Facts
- Response to volcanoes article

Summative Assessments:
- Land & Soil Assessment
- Weathering & Erosion Assessment
- Weathering Makes Soil Assessment
- Quick Change Assessment

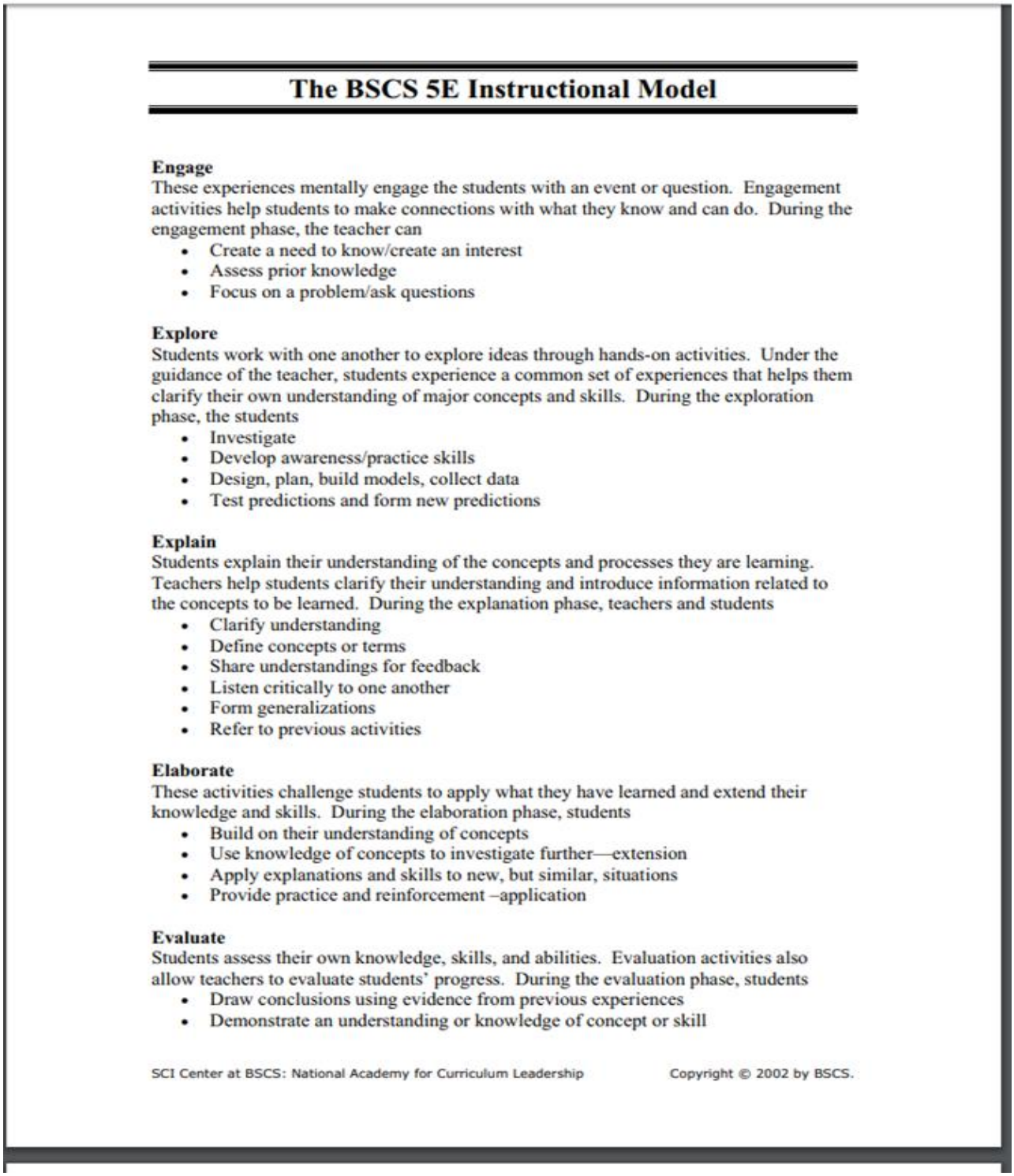
Resources

Core
- Bergman, Lincoln, and Jacqueline Barber. *What's Stronger! The Forces That Cause Erosion*. Berkeley, CA: University of California, 2007. Print.
- Delta Science Readers. *Earth Materials*. Nashua, NH: Delta Education, 2003. Print.
- Delta Science Readers. *Erosion*. Nashua, NH: Delta Education, 2004. Print.
- Delta Science Readers. *Soil Science*. Nashua, NH: Delta Education, 2004. Print.
- Prager, Ellen J. *Earthquakes*. Washington, D.C.: National Geographic, 2007. Print.
- Schreiber, Anne. *Volcanoes*. Washington, D.C.: National Geographic, 2008. Print.
- Simon, Seymour. *Earthquakes*. New York: HarperCollins, 1990. Print.
- *Soil Science*, Delta Science.
- Walker, Sally M. *Soil*. Minneapolis: Lerner, 2007. Print.
- Wong, George. *Soil*. Washington, D.C.: National Geographic, 2001. Print.

Supplemental
- *Bill Nye on Erosion*. https://app.schooltube.com/video/9522ccca25154ea897ff/Bill_Nye_Erosion. Web.
- BrainPOP Jr. *Slow Land Changes*. https://jr.brainpop.com/science/land/slowlandchanges/. Web.
- *Earthquake Technologies Challenge*, hand2mind.
- Gibbons, Gail. *Marshes & Swamps*. New York: Holiday House, 1998. Print.
- National Geographic. *Glacier Power*. http://viewpure.com/cIBFAke90SI?start+0&end=0. Web.
- PebbleGo articles

Time Allotment
- Approximately eleven weeks (mid March – June)

APPENDIX A: FRAMEWORKS FOR INQUIRY EDUCATION



The BSCS 5E Instructional Model

Engage
These experiences mentally engage the students with an event or question. Engagement activities help students to make connections with what they know and can do. During the engagement phase, the teacher can

- Create a need to know/create an interest
- Assess prior knowledge
- Focus on a problem/ask questions

Explore
Students work with one another to explore ideas through hands-on activities. Under the guidance of the teacher, students experience a common set of experiences that helps them clarify their own understanding of major concepts and skills. During the exploration phase, the students

- Investigate
- Develop awareness/practice skills
- Design, plan, build models, collect data
- Test predictions and form new predictions

Explain
Students explain their understanding of the concepts and processes they are learning. Teachers help students clarify their understanding and introduce information related to the concepts to be learned. During the explanation phase, teachers and students

- Clarify understanding
- Define concepts or terms
- Share understandings for feedback
- Listen critically to one another
- Form generalizations
- Refer to previous activities

Elaborate
These activities challenge students to apply what they have learned and extend their knowledge and skills. During the elaboration phase, students

- Build on their understanding of concepts
- Use knowledge of concepts to investigate further—extension
- Apply explanations and skills to new, but similar, situations
- Provide practice and reinforcement –application

Evaluate
Students assess their own knowledge, skills, and abilities. Evaluation activities also allow teachers to evaluate students' progress. During the evaluation phase, students

- Draw conclusions using evidence from previous experiences
- Demonstrate an understanding or knowledge of concept or skill

SCI Center at BSCS: National Academy for Curriculum Leadership

Bybee, R.W., Taylor, J.A., Gardner, A., et al. *The BSCS 5E Instructional Model: Origins and Effectiveness. A Report Prepared for the Office of Science Education, National Institutes of Health*. Colorado Springs: BSCS, 2006. Web. https://bscs.org/sites/default/files/_legacy/BSCS_5E_Instructional_Model-Full_Report.pdf.

APPENDIX B: SAMPLE ASSURED LESSON OUTLINE

Unit 1, Lesson 1 – Matter and Its Interactions

Grade: 2	**Topic:** Solids	**Lesson:** Lesson 1 of 3 - approx. 4 class sessions duration

Prior to Lesson:

- Set up students' Science Notebooks. Ensure that you have a class set of goggles, and that you know the location of your goggle sanitizer in your schools. Goggles need to be worn for each hands-on investigation.
- Read "Background for the Teacher" and "Teaching Children about Solids," *Solids and Liquids* Teacher Manual, "Investigation #1: Solids" (pp. 3-7).
- To set up baggie: Follow the *Solids and Liquids* module & Teacher Manual, "Investigation #1: Solids," Part 1, p. 8 (baggie set-up and use), & p. 21 (larger materials).
- Use Student Sheet checklist #2: "Properties of Solid Objects."

Essential Questions:

- What are properties?
- How can solids be described or classified?
- How can the same materials be used to build different structures?

Lesson Objectives:

Students will:

- Learn that matter is everything that is made up of atoms and takes up space.
- Learn that matter in a solid state holds its own shape until something changes it.

Lesson Plan – 5 E Model:

ENGAGE: Opening activity – access prior learning / stimulate interest / generate questions

Session 1

- Prepare SMARTBoard and computer.
- Phenomenon: All things on earth are made up of matter! Watch video of Andrea Beaty's *Ada Twist, Scientist*: http://viewpure.com/mqbkw-GkcRI?start=0&end=0 (approx. 7 minutes). Have students discuss lessons from what they have seen. What question "words" did Ada use?
- Provide students with Thinking Activity Sheet to reflect on Ada's thinking plan (focusing on matter).
- Regroup class, and read and discuss the next two book selections:
  - *States of Matter Reader* pp. 2-4.
  - *What Is the World Made Of?* by Kathleen Weidner Zoehfeld, pp. 4-16.
- Have students divide a Science Notebook page into three sections.
  - In one section, students should write what they know about solids, using words and/or pictures.
  - In the second section, students should write what they know about liquids, using words and/or pictures.
  - In the third section, students should list the differences between a solid and a liquid.
- Students can Turn & Talk or share with the whole class.

EXPLORE: Description – Materials needed / probing or clarifying questions / resources	
Scope & Sequence	**Materials**
Session 2 • Prepare student baggies of solid materials as directed in *Solids and Liquids*. • Introduce "Investigation #1: Solids," Part 1 (pp. 9-12). • Read *What Is the World Made Of?* pp. 9-12. Define "matter" and explain that there are three states that differ from each other. • Read *States of Matter* pp. 2-4. Begin word bank on p. 16 on chart paper or in Science Notebooks. • Follow "Investigation #1: Solids," Part 1 (pp. 13-16). • Organize students into small groups and hand out baggies of materials. Have students explore solids and note how they look, feel, smell, and sound. Students should share their findings with their groups, then take each object separately and complete the student checklist, marking each property.	Session 2 • "Properties of Solids" checklist • "I Spy a Solid" homework sheet p. 39
Session 3 • Define "engineer" ("someone who uses his/her knowledge of science, math, and creativity to design objects, systems, or processes to solve problems") and "engineering" • Return to phenomenon, viewing Andrea Beaty's *Rosie Revere, Engineer*: http://viewpure.com/A4r8vTxeLcU?start=0&end=0. Discuss with class, prior to Tinkertoy explorations, what an engineer is! • Students will construct an object with a set amount of pieces. Students with then disassemble the object and make a new structure using the same amount of pieces. • Split students into small groups. Each group will get half a container of Tinkertoys. Students should count out the amount of pieces in their baggies and split them equally among those in their group. The group must use all of the pieces to create a structure. Once that is complete, students need to draw a diagram of the structure in their Science Notebooks. Students should record the amount of pieces they used. After students have illustrated their object, they will need to disassemble it, then use the same amount of pieces to build a different structure. Students	Session 3 • Tinkertoys put into labeled bags • Supplemental text on engineer • Note: "Solid objects have definite shape and the shape does not change when the object is moved from one place to another. When solids are moved from one container to another [or used in different ways], they maintain the same shape they had before they were moved" (*Solids and Liquids* Teacher Manual, p. 3).

need to illustrate a diagram of the second object as well, then compare the two objects to discuss that different objects can be built from the same set of pieces.	
EXPLAIN: Concepts explained and vocabulary defined	
Scope & Sequence	**Concepts & Vocabulary**
Session 4 • Use "Treehouse Assessment" worksheet. Include the vocabulary on visible charts or Word Walls.	Session 4 • properties • texture • shape • flexible • rigid • smooth • rough • pointed • flat • transparent • opaque • solid • matter • density • structure
ELABORATE: Applications and extensions	
• In writing, students can further explain their thinking.	
EVALUATE: Assured assessments	
Formative Assessments	**Summative Assessment**
Sessions 1-4 • Class discussion • Science Notebook entries ○ Observations and reflections • Drawings	Session 4 • "Treehouse Assessment"
ELABORATE FURTHER: Reflection / enrichment (optional)	
• See pp. 26-27 of *Solid Materials* for extension activities. • Use any of the *Quick Common Notebook Entries* for continued student monitoring.	

APPENDIX C: INTERACTIVE SCIENCE NOTEBOOKS RESOURCES

Setting up Interactive Science Notebooks

(Beginning of School – before starting science units.
Guidelines below are also available on the G drive.)

1. Student Rubric: Glued inside of front cover. Be sure to review it carefully with students so that they can refer to it at any time.
2. Teacher Note Page: A note from you to students stating your expectations for science. You can also include what you will cover at your grade level and how Science Notebooks will be used for recording what students learn.
3. Classroom Rules: These are your regular classroom rules so that students understand that Science is part of their curriculum in school and the same rules pertain. They are not taking time to "do science," but instead they are *learning* science!
4. Author's Page: All about the student – what type of a scientist would the student be? This is the student's choice. Use of color enhances their work!
5. Science Safety Rules: Cut and paste into notebooks. Read with the students and have them sign that they have read the rules with the class.
6. Why Interactive Science Notebooks? This will help you and your students understand ISNs.
7. Observation Helper / Examples of How to Show What You Know About What You Learned! These two sheets help students with ideas. They should be glued into the back two pages of the Science Notebook so students can peek at them when they need ideas to help them demonstrate their understanding.

GRADE 2 Science Notebook Student Rubric

- Did I follow all the directions?
- Are my diagrams neat, complete, and labeled?
- Did I answer each question as accurately as I can?
- Did I add evidence to support my claim?
- Did I write neatly and check my spelling?

	(3) Wow! (Meets Grade-Level Standards) 	(2) Almost (Progressing towards Standards) 	(1) Not Yet (Making limited progress towards meeting the Standards) 
<u>Content Accuracy</u> Indicator #1 on Report Card: Demonstrates understanding of current science concepts and key vocabulary.	My explanation shows that I understand the science ideas we learned in class. • I provided a correct response. • I explained my thinking clearly. • I used the scientific vocabulary words we learned in class.	My explanation shows that I have a partial understanding of the science ideas we learned in class. • I provided a partially correct response. • I used some scientific vocabulary in my sentences, but not enough to support my response.	My explanation shows that I do not understand the science ideas we learned in class. • I did not explain my thinking. • I did not give evidence to support my answers. • I did not use the scientific vocabulary we learned in class. • My response was inaccurate.
<u>Illustrations and Diagrams</u> Indicator #2 on Report Card: Makes observations and presents information in words and drawings.	My illustrations and diagrams/sketches are clear, accurate, and labeled showing what I know about what I learned.	My illustrations and diagrams are partially accurate and/or labeled with some missing key scientific vocabulary words.	My illustrations or diagrams/sketches are missing or unclear.

Dear Second-Graders,

Welcome to Second-Grade Science!!! This year we will be learning how to think like scientists and engineers as we study properties of matter, the river and forest area ecosystems of Connecticut, two native seed dispersers of Connecticut, and the needs of two native animals in each of the two ecosystems! As scientists we will go through each exciting unit and explore! We will make observations, conduct experiments, learn new science concepts, and reflect on all of this right here in our Science Notebooks!

To think like a scientist we expect you to:

- use your senses when making observations (your observations are not opinions, but actual happenings).
- record your observations accurately in your science notebook.
- ask realistic questions and ones that we can investigate.
- be respectful with partners whom you work with so we can all enjoy our learning.

Your science notebook is a great way to collect all the information you will learn throughout this year. We know you will be great scientists/engineers and cannot wait to get started!!!

Sincerely,
Your Second-Grade Teacher

Classroom Rules

Work Hard.

Be Kind.

Be Respectful.

Follow your classroom rules!

ME as the Scientist

Name _____

Draw yourself as a scientist:

One science concept I hope to learn about this year is

_____

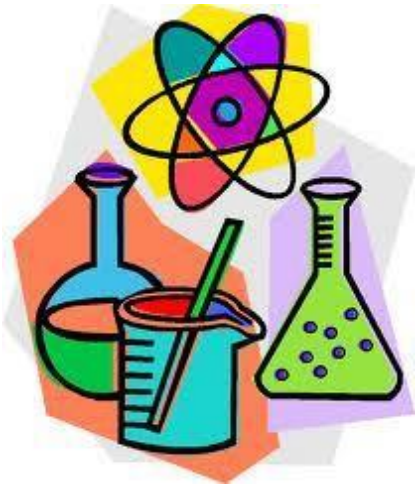
_____

_____

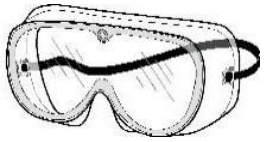
_____

Science Safety Rules

1. Always follow the safety rules given by your teacher.
2. Ask questions if you are not sure about what to do.
3. Tell your teacher about accidents, even small ones.
4. Clean up spills as quickly and carefully as you can.

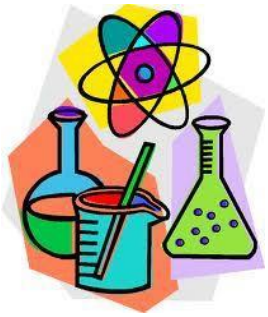


5. Be careful using science tools (especially when they are sharp or pointy).
6. Protect your eyes always and wear safety goggles when necessary!



7. Never put anything into your mouth. DO NOT smell or taste anything unless your teacher tells you to do so.
8. DO NOT touch your face, mouth, ears, or eyes when working with plants, animals, or chemicals.
9. Always wash your hands when you are done with an experiment.

10. Always clean up!



I have read these rules with my class and I promise to follow them:

_____ _____

(name) (date)

Why Interactive Science Notebooks?

An Interactive Science Notebook is . . .

- A student's own personalized record of learning.
- A place for teacher input of testable and other important information.
- A place for student output demonstrating the student's understanding.

It also . . .

- Promotes metacognitive learning strategies and use of both sides of the brain to make learning easier.
- Encourages information processing through the use of both words and visuals.

AND . . . An Interactive Science Notebook . . .

- Provides a place to apply critical and creative thinking skills.
- Builds organizational skills while promoting creative thought and reflection.
- Becomes a working portfolio demonstrating student understanding for formative and summative assessments.

Observation Helper

Ways to help me start my writing . . .

Think of properties you can see such as size, shape, color, lines, texture, pattern, behavior . . .	I observed . . . 
Think of the other senses of smell, sound, touch, and perhaps taste!	I noticed . . . 
Connect it with something that you already know.	It (or this) reminds me of . . .
Add more detail as needed. Support what you say or claim with evidence.	This is so because . . . 
Be curious and ask questions you could investigate.	I am curious about . . . It surprised me that . . . or I wonder what would happen if. . .

Examples of how to show what you know about what you learned!

- Make a drawing or a diagram – be sure to label it carefully!
- Write a reflection:
  - Explain the steps you took for your experiment
  - Write a prediction and explain why
  - Make a connection to something you may have already learned
  - Write how you would change your investigation if you had a chance to do it over
  - Begin your sentences with
    - I noticed that . . .
    - I wonder if . . .
    - That is how I . . .

- Draw a chart or a graph to show how you collected information
- Record your observations – use your sense to write or draw
  - What do you see, hear, feel, and smell?
- Teach a friend about what you know by reading your written explanation or sharing your illustration
- Be sure to:
  - Always number the page in the upper outer corner
  - Always put the date on a new entry page
  - Use at least 3 colors in your diagrams or drawings
  - Organize your information – it helps your brain to learn!
  - Use color pencils and crayons – stay away from markers and highlighters because they leak through the paper