Township of Union Public Schools
Administration Building

K - 5
CURRICULUM GUIDE APPROVAL REQUEST FORM

Please present the attached guide to the Board of Education for approval. The guide has been reviewed by all involved parties and is aligned with the New Jersey Core Curriculum Content Standards.

Title: Science Curriculum Guide

Department/Grade: Grade 2

Supervisor: Terri Matthews

Submission Date: May 12, 2015

Board Approval Date: ______________________________

TOWNSHIP OF UNION PUBLIC SCHOOLS

Science Grade 2
Curriculum Guide
2015 - 2016

Curriculum Guide Approved June

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Mission Statement

The Township of Union Board of Education believes that every child is entitled to an education designed to meet his or her individual needs in an environment that is conducive to learning. State standards, federal and state mandates, and local goals and objectives, along with community input, must be reviewed and evaluated on a regular basis to ensure that an atmosphere of learning is both encouraged and implemented. Furthermore, any disruption to or interference with a healthy and safe educational environment must be addressed, corrected, or when necessary, removed in order for the district to maintain the appropriate educational setting.

Philosophy Statement

The Township of Union Public School District, as a societal agency, reflects democratic ideals and concepts through its educational practices. It is the belief of the Board of Education that a primary function of the Township of Union Public School System is to formulate a learning climate conducive to the needs of all students in general, providing therein for individual differences. The school operates as a partner with the home and community.

Statement of District Goals

- Develop reading, writing, speaking, listening, and mathematical skills.
- Develop a pride in work and a feeling of self-worth, self-reliance, and self discipline.
- Acquire and use the skills and habits involved in critical and constructive thinking.
- Develop a code of behavior based on moral and ethical principals.
- Work with others cooperatively.
- Acquire a knowledge and appreciation of the historical record of human achievement and failures and current societal issues.
- Acquire a knowledge and understanding of the physical and biological sciences.
- Participate effectively and efficiently in economic life and the development of skills to enter a specific field of work.
- Appreciate and understand literature, art, music, and other cultural activities.
- Develop an understanding of the historical and cultural heritage.
- Develop a concern for the proper use and/or preservation of natural resources.
- Develop basic skills in sports and other forms of recreation.

Course Description

The second grade standards continue to focus on using a broad range of science skills in understanding the natural world. Making detailed observations, drawing conclusions, and recognizing unusual or unexpected data are skills needed to be able to use and validate information. Measurement in both standard and metric units is stressed. Through the use of hands-on investigations and cooperative learning structures the second grade will explore the following content topics with the New Jersey Core Curriculum Science Standards and the 2011 Elementary Grades Science Practices (5.1) Clarifications.

In **Life Science**, students explore the life cycle of organisms, food chains, and food webs, and the interdependence of living and non-living things in various habitats.

Earth Science focuses on the properties of materials that make up the earth's surface. Earth's history is introduced through the study of fossils. Students also investigate the Earth's resources and their importance to all life on Earth.

Astronomy and Space Science introduces students to the earth, moon, and sun system. Natural patterns such as moon phases, day and night, and the seasons are investigated.

Physical Science introduces students to energy forces through simple hands-on investigations of light, sound, and magnets.

Recommended Textbooks

Science Fusion Houghton Mifflin Harcourt

Curriculum Units

Unit 1: Earth Science

Unit 2: Astronomy and Space

Unit 3: Physical Science

Unit 4: Life Science

Pacing Guide- Course

Content	Months
Unit 1: Earth Science	September-November
Unit 2: Physical Science	December-February
Unit 3: Astronomy and Space Science	March-April
Unit 4: Life Science	May-June

Science Practices - To be integrated across the K to 4 curriculum as appropriate

Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments
How do scientists think and work? How do people learn about the physical world? How do we build and refine models that describe and explain the natural and designed world?	**5.1A** Demonstrate understanding of the interrelationships among fundamental concepts in the physical, life, and Earth systems sciences.**(5.1.4.A.1)** • Learn fundamental concepts, principles, theories, and models. • Then, build organized and meaningful understandings of the big picture (conceptual framework) that incorporate	• Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. • Determine the main idea of a text and explain how it is supported by key details; summarize the text. • Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.	Observe and record what they see when they stick part of their arm into a clear tube of water and answer the following question: Does your arm in the water appear to be aligned with the part of your arm exposed to the air? In whole class discussion, try to provide explanations. Make ray diagrams to explain what happens when light from the sun travels from air into a window and into a room of a house. Compare to diagrams where light from the sun travels from air into a clear pool. Share diagrams as a whole class.

	these concepts, principles and theories. • Then, use these relationships to interpret, understand and predict other natural phenomenon. Use outcomes of investigations to build and refine questions, models, and explanations. **(5.1.4.A.2)** • Develop models, from evidence obtained, to explain the relationships between fundamental concepts and principles. • Construct and refine explanations, arguments or models as new	• Use stated assumptions, definitions, and previously established results in constructing arguments. • Make conjectures and build a logical progression of statements to explore the truth of their conjectures. • Justify their conclusions, communicate them to others, and respond to the arguments of others. • Reason inductively about data, making plausible arguments that take into account the context from which the data arose. • Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. • Construct arguments using concrete referents such as objects, drawings, diagrams, and actions. • Listen or read the arguments of others, decide whether they	Conduct an investigation with motion and forces. Using a ramp, toy car, meter stick and stopwatch, record the time it takes for the car to travel down the ramp. Discuss the forces at work on the car and predict ways to make the car travel farther, slower and faster. Generate explanations based on evidence.

	evidence becomes available. Use scientific facts, measurements, observations, and patterns in nature to build and critique scientific arguments. **(5.1.4.A.3)** • Use tools to observe, measure, and explain natural phenomena. • Evaluate the strengths of arguments based on the evidence presented. • Evaluate the quality of the evidence based on the logic and design of the experiment and the quality of the data collected.	make sense, and ask useful questions to clarify or improve the arguments. • Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs. • Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent	Your younger brother is convinced that a car is a living thing. He explains the evidence for his claim to you, providing evidence that it moves, eats gas, makes noise, and releases gas waste. He thinks the car's engine is the heart, the battery is the nervous system, the hoses and tubes are the circulatory system, and the gas tank is the stomach. At recess, he explained this idea to his friends in his class, and half the class agrees with him. While these ideas make some sense, you claim that a car is not a living thing. You think that more students have the same idea, so you decide to explain the essential characteristics of life. Create a presentation with visual aids to explain your thinking.

		measurement quantities using diagrams such as number line diagrams that feature a measurement scale. • Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.	
Essential Questions What	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities • Tell and write time to the nearest minute and measure time intervals in	• Create organized data tables of long-term observations of the sky to build scientific arguments for general rules for describing when the Sun and Moon are visible. Present evidence, based on collected data, for general

constitutes useful scientific evidence?	Design and follow simple plans using systematic observations to explore questions and predictions. **(5.1.4.B.1)** • Ask questions and decide what to measure in order to answer the questions. • Develop strategies for accurately measuring and collecting data. • Organize the data logically so that it may be used to answer questions or validate predictions. Measure, gather, evaluate, and share evidence using tools and	minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram. • Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).1 Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. • Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph	rules describing when the Sun and Moon are visible. • Create kinesthetic models using students to demonstrate how Earth's rotation causes day and night. • Collect data using classroom-developed weather instruments and compare the data collected from the classroom instruments to real-time weather data collected using professional instrumentation. www.weather.gov • Create and analyze graphs of the weather data in order to identify relationships among

	technologies. **(5.1.4.B.2)** • Use age-appropriate tools with accuracy and confidence. • Use mathematics in the collection, organization and analysis of data. • Use tools of data analysis to organize and represent data. Formulate explanations from evidence.**(5.1.4.B.3)** • Make claims based on the available evidence. • Cite evidence and explain the reasoning for a claim.	in which each square in the bar graph might represent 5 pets. • Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters. • Students understand and use stated assumptions, definitions, and previously established results in constructing arguments. • They make conjectures and build a logical progression of statements to explore the truth of their conjectures. • They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. • They justify their conclusions, communicate	variables such as temperature, wind speed, wind direction, precipitation, and relative humidity. • Relate local weather to published weather maps, satellite imagery, and trends in student generated data. • Share weather findings with another classroom in the school, district, state, nation or another country. Compare how the weather is similar or different depending on the location • Grow plants in the classroom from seeds. Record all of their observations, including their verbal descriptions, as well as data about the height and number of leaves of each of the plants. Vary the conditions that the plants are grown under (water, light, fertilizer, etc.), and draw conclusions about the effects of these modifications based on their evidence.

	• Use data representations to communicate findings. Communicate and justify explanations with reasonable and logical arguments.	them to others, and respond to the arguments of others. • They reason inductively about data, making plausible arguments that take into account the context from which the data arose. • Students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. • Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. • Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.	• Consider the structures of each organism from biofacts or images of a large variety of living things provided by the teacher. Select two organisms that have similar structures. Point out how the structures are similar, and how the animal uses that structure. Explain if the similar structures have similar functions, using evidence and their own scientific reasoning.

	(5.1.4.B.4) • Justify claims with connections to other fundamental concepts and principles. • Use evidence and data to support both a claim and the reasoning behind a scientific argument.		
How is scientific knowledge constructed?	Monitor and reflect on one's own knowledge regarding how ideas change over time. **(5.1.4.C.1)** • Monitor and reflect on their ideas as those ideas change over time. • Develop an understanding that "doing		

	science" extends beyond experiments and includes modeling, organizing observations, and historical reconstructions. • Develop an awareness that science is about searching for core explanations and connections between fundamental concepts and principles. Revise predictions or explanations on the basis of learning new information. **(5.1.4.C.2)** • Recognize that		

	there may be multiple interpretations for the same phenomenon. • Recognize that explanations are increasingly valuable as they account for the available evidence more completely. Present evidence to interpret and/or predict cause-and-effect outcomes of investigations. **(5.1.4.C.3)** • Use evidence to uncover cause-and-effect		• Predict, with reasoning, which would land first, a feather or a hammer, if they were dropped at the same time. • Watch as Apollo 15 astronaut Dave Scott recreates Galileo's famous gravity experiment while on the surface of the moon. Then, using their conceptual understanding of gravity, explain the results of Dave Scott's experiment. (video available at: http://www.youtube.com/watch?v=4mTsrRZEMwA)

How does scientific knowledge benefit, deepen, and broaden from scientists sharing and debating ideas and information with peers?	relationships. • Create multiple representations of the results of an investigation. • Move confidently between multiple forms of representations (e.g., graph, chart, data table).		• Look at various objects, make predictions about whether they were magnetic, and then test their predictions. • Predict, investigate and describe what happens when an object of higher temperature is placed in direct contact with an object of lower temperature. Record data and use the data to describe which way the heat energy is moving between objects.

How does scientific knowledge benefit, deepen, and broaden from scientists sharing and debating ideas and information with peers?	Actively participate in discussions about student data, questions, and understandings. **(5.1.4.D.1)** • Develop increasingly productive ways of representing ideas. • Develop appropriate norms for presenting scientific arguments and evidence. • Practice productive social interactions with peers in the context of science investigations		• Use actual sky observation data, collected over a long period of time, to describe the patterns of the Moon's appearance. As a

	Work collaboratively to pose, refine, and evaluate questions, investigations, models, and theories. **(5.1.4.D.2)** • Demonstrate understanding of the difference between scientific argument, which rests on plausibility and evidence and has the goal of shared understanding, and everyday arguments. • Learn appropriate norms and language of scientific argumentation.	http://www.corestandards.org/the-standards/english-language-arts-standards/speaking-and-listening/grade-4/ Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. a. Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion. b. Follow agreed-upon rules for discussions and carry out assigned roles.	class, explore and discuss questions such as: When is the Moon visible? Is the shape predictable? How can we answer these questions using observations? • Use published lunar phase data to make predictions on what the moon will look like on subsequent nights and days. Working in a small group, develop a lunar calendar of the predictions and compare with the entire class. What do the calendars have in common? How are they different? Should they be different? Explore these questions as a class.

	• Persuade peers of the validity of one's own ideas and the ideas of others. Demonstrate how to safely use tools, instruments, and supplies. **(5.1.4.D.3)** • Evaluate risks and benefits of decision. • Minimize the probability of harm by taking appropriate precautions. • Develop an individual sense of responsibility and good habits for safety. Handle and treat organisms humanely,	c. Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others. d. Review the key ideas expressed and explain their own ideas and understanding in light of the discussion. • They justify their conclusions, communicate them to others, and respond to the arguments of others. • They reason inductively about data, making plausible arguments that take into account the context from which the data arose. • Students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—	• On a class field trip to the Jersey shore, you notice many small crabs in the rocky, intertidal habitat. You notice that they are everywhere, and they are very aggressive

	responsibly, and ethically. **(5.1.4.D.4)** • Become knowledgeable about the care of animals so that both students and the animals stay safe and healthy during all activities. • Follow local, state, and national laws, policies, and regulations when live organisms are included in the classroom. • Discuss the importance of not conducting experimental procedures if such procedures are likely to cause pain, induce	explain what it is. • Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. • Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments http://www.corestandards.org/the-standards/english-language-arts-standards/reading-informational-text/grade-4/ Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.	towards other crabs. At first, you think that they may be blue crabs, which are native to NJ. After comparing your pictures with a field guide, however, you determine that these crabs are Japanese shore crabs Hemigrapsus sanguineus. Develop questions about these crabs, including how you might determine their native habitat, their range, their diet, etc. Think about the interactions that they might have with the other species in the intertidal zone. Plan an investigation that you can conduct to determine how and why the Japanese shore crab became a dominant intertidal species in NJ. • Contact students in Japan to learn about their intertidal zone and their Japanese crab population. Are they the dominant intertidal crab species in Japan? What other species live in this habitat? Are there any species found in NJ that are found in Japan? What is the water temperature and other shore conditions? Would this impact the health or success of the crab population? Share data and draw conclusions together. • Design an investigation where a variety of solids are heated to the melting point. Collect and analyze data, and evaluate evidence. Be sure to follow appropriate

	nutritional deficiencies, or expose animals to parasites, hazardous/toxic chemicals, or radiation.	http://www.corestandards.org/the-standards/english-language-arts-standards/reading-informational-text/grade-4/ • Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. • Determine the main idea of a text and explain how it is supported by key details; summarize the text. • Explain events, procedures, ideas, or concepts in a historical, scientific, or	safety procedures. • After being presented with a number of different objects, some living, some non-living, and some once-living, engage in class discussion, building claims about the objects (This object was once living because…), and critiquing claims made by other students.

		technical text, including what happened and why, based on specific information in the text.	

Unit 1: Earth Science

Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments
How can we describe the materials that form the Earth? *How do people use Earth's resources?*	**NJCCCS:** 5.1.A 5.1.4.A.2-3 5.1.4.B.1-4 5.1.4.C.1-3 5.1.4.D.1-4 5.8.2 A 5.8.2 C 5.8.2 D All students will gain an understanding of the structure, dynamics, and geophysical systems of the Earth. The students will be able to: 1. Recognize that the Earth is made of materials that have distinct properties and provide resources that people use. (i.e., rocks, water, plants, and soil). 2. Describe rocks/soil in terms of their composition and	<u>If The Dinosaurs Came Back</u> by Bernard Most <u>Whatever Happened to the Dinosaurs</u> by Bernard Most <u>Dinosaurs Before Dark</u> by Mary Pope Osborne 1. <u>I Have, Who Has?</u> - students will be able to play a game which discusses different types of soil, dinosaurs, fossils and other things dealing with the Earth's resource	• Formative assessment • End of unit assessment: In Assessment Guide • Science Journals/Portfolios/ Writing Assignments • Class participation • Oral Presentations • Cooperative Learning Performance Assessment: Compare and contrast an ant to a mealworm. (Found in Assessment Guide pg AG11)

	physical properties. 3. Describe ways in which people use natural resources: rocks, soil, plants, water. 4. Recognize through reading, observing, and/or analyzing data, the interdependence of living things and their environment. 5. Design an experiment to find out how plants help prevent erosion.		
Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments
What is a fossil? *What can fossils teach us about earth's past?*	The students will be able to: 1. Describe what fossils are and where they are found. 2. Describe how scientists collect and reconstruct fossils. 3. Explain what scientists learn from fossils. 4. Compare and contrast living things to fossils. 5. Observe samples of fossils with hands lens. Record observations. Infer how they are formed. 6. Construct models of fossils by using clay and seashells. 7. Infer how fossils show that life on earth has changed over time.	1. Digging For Chocolate Chips - children will uses tweezers, toothpicks and paint brushes to dig out whole chocolate chips from a cookie. Then the children will use the scientific method to fill out an observation sheet. 2. Create a fossil using a penny and play dough. Children can use other objects such as a leaf, a block or small toy to make a fossil. 3. Cookie Fossil Dig –	• Formative assessment • End of unit assessment: In Assessment Guide • Science Journals/Portfolios/ Writing Assignments • Project: Dinosaur report • Class participation • Oral Presentations • Cooperative Learning Performance Assessment: Fossil Hunt (Searching for Treasure). (Found in Assessment Guide pg AG49)

		another twist on this activity is that the children must get the chips out of the cookie without moving it at all while digging. Paleontologists can't move rocks, so the children can't move the cookies. They will record their progress every 5 minutes and write down what they think about being a paleontologist.	

Unit 2: Astronomy and Space Science

Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments
What causes day and night?	**NJCCCS:** 5.1.A 5.1.4.A.2-3 5.1.4.B.1-4 5.1.4.C.1-3 5.1.4.D.1-4 5.9.2 A 5.9.2 B All students will gain an understanding of the origin, evolution and the structures of the universe. The student will be able to: 1. Infer that sunlight striking an object makes the object	Books to read: What Makes Day and Night by Dr. Franklyn Branley Sun Up, Sun Down: The Story of Day and Night by Jacqui Bailey 1. Have children role play "Earth" to learn more about day and night. Darken the room and turn on a lamp. Explain that the lamp represents the Sun. Ask a	• Formative assessment • End of unit assessment: In Assessment Guide • Science Journals/Portfolios/ Writing Assignments • Class participation • Projects: • Oral Presentations • Cooperative Learning • Homework and class work • Performance Assessment: Night and Day (found in Assessment Guide, page AG 59)

	warmer. 2. Conduct simple experiments to show how sunlight changes the temperature of land, air, water. 3. Demonstrate and describe the concept of rotation. 4. Comprehend that day and night are caused by Earth's rotation. 5. Compare and contrast day and night by characteristic changes in temperature.	student to be the Earth. Have a student rotate slowly in a counterclockwise fashion. Repeat this demonstration. Select other student volunteers so that students will get a chance to view the day and night cycle several times. Explain that it takes 24 hours for the Earth to rotate completely. 2. <u>S.T.E.M. activity</u>- Locate your state or country on a globe and place a sticker to mark the spot. Shine a flashlight on the side of the globe and turn it slowly counterclockwise. Have students watch what happens as the globe rotates. Encourage them to identify which countries are in the daylight while your hometown is experiencing nighttime. Help students make connections by going outside at various times of the day to observe the sun's apparent movement in the sky as the Earth rotates. 3. <u>S.T.E.M. activity-</u> Begin an investigation to monitor the temperature changes that	

		occur outside throughout the day. Have students record the temperatures from morning, lunchtime, and afternoon in a chart.	
Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments
What causes the seasons? *Why does the moon seem to change?*	All students will gain an understanding of the origin, evolution and the structures of the universe. The student will be able to: 1. Model the rotation of Earth and its physical relationship to the sun. 2. Interpret the relationship between the sun's relative position in the morning (East), at noon, and in the late afternoon (West). 3. Model and describe how the sun's rays strike the Earth to cause the seasons. 4. Observe, chart, and illustrate phases of the moon, and describe the changing pattern of the moon as it resolves around the Earth.	Books to read: <u>The Reason For Seasons</u> By Gail Gibbons <u>I Can Read About Seasons</u> By Robyn Supraner 1.<u>S.T.E.M activity</u>- Many students have difficulties visualizing how the moon orbits the Earth and how the Earth orbits the Sun. Have small groups create models of the moon, Earth, and Sun out of balls, clay, foil, or paper. Then have the groups model the Moon's orbit around Earth and the Earth's orbit around the Sun. 2. S.T.E.M. activity- In pairs/ groups, design a trading card for each planet in the solar system. 3. S.T.E.M. activity- Design	5. Formative assessment 6. End of unit assessment: In Assessment Guide 7. Science Journals/Portfolios/ Writing Assignments 8. Class participation 9. Projects: Moon Journals 10. Oral Presentations 11. Cooperative Learning 12. Homework and class work 13. Performance Assessment: The Solar System (found in Assessment Guide, pages AG55-58)

		and create a solar system diorama. Books to Read: The Moon Seems to Change by Franklyn M. Branley Phases of the Moon by Gillia M. Olson 2.S.T.E.M. activity-Use this website to show the moon phases for each date: http://stardate.org/nightsky/moon. You can use the site to make observations and analyze patterns. 3.S.T.E.M. activity- Students can keep a moon journal drawing pictures and documenting the changes in the moon each night through one cycle. 4. Model phases of the moon on a paper plate using Oreos to create the phases (demonstrating the waxing/waning).	

Unit 3 : Physical Science

Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments
What is light?	**NJCCCS:** 5.1.A 5.1.4.A.2-3 5.1.4.B.1-4 5.1.4.C.1-3 5.1.4.D.1-4 5.7.2 A 5.7.2 B All students will gain an understanding of natural laws as they apply to motion, forces, and energy transformations. The students will be able to: 1. Identify and describe sources of light—sun, electric lights, and flashlights. 2. Distinguish between light sources and things that reflect light. 3. Observe that light travels in a straight line.	Books to read: In Touch with Science: What is Light? By Louise Spilsbury, Richard Spilsbury The Dark, Dark Night By M Christina Butler and Jane Chapman 1. Types of Light Journal – discuss the two types of light and record and draw for the next five days the light sources they see. 2. The Path of Light – students will be able to observe how light travels in a straight line using a flashlight, powder, clay and index cards.	14. Formative assessment 15. End of unit assessment: In Assessment Guide 16. Science Journals/Portfolios/ Writing Assignments 17. Class participation 18. Projects: 19. Oral Presentations 20. Cooperative Learning 21. Homework and class work 22. Performance Assessment:

Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments
How can light be changed?	All students will gain an understanding of natural laws as they apply to motion, forces,	Books to read: All the Colors of the Rainbow	23. Formative assessment 24. End of unit assessment: In Assessment Guide

	and energy transformations. The students will be able to: 1. Conduct experiments using mirrors and flashlights to change the path of a beam of light. 2. Design a model that demonstrates how shadows are created when an object blocks light. 3. Analyze how shadows change as the direction of the light source changes. 4. Explain the terms transparent, translucent, and opaque, and give examples of each. 5. Experiment with the effects of air and water on refraction. 6. Identify colors produced when light is bent as it travels through various types of matter. 7. Analyze the effects of a prism on white light. Explain why a rainbow occurs.	(Rookie Read-About Science) By Allan Fowler Light: Prisms, Rainbows, and Colors (Science @ Work) By Gina L. Hamilton Light: Shadows, Mirrors, and Rainbows (Amazing Science (Picture Window)) By Rosinsky, Natalie M, Boyd and Sheree Shadows and Reflections by Tana Hoban 1. Transparent, Translucent or Opaque? – children will be able to observe how objects in different liquid are seen in different ways. This will be done using plastic bottles and various objects. 2. Refraction Action – children will be able to observe with oil and water how colored straws look to be split in two in the cups based on the liquid. 3. Prisms – use prisms in the classroom to show the colors of the rainbow and how light splits into different colors.	25. Science Journals/Portfolios/ Writing Assignments 26. Class participation 27. Projects: 28. Oral Presentations 29. Cooperative Learning 30. Homework and class work 31. Performance Assessment:

Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments
What are forces? *How do magnets work?*	All students will gain an understanding of natural laws as they apply to motion, forces, and energy transformations. The student will be able to: 1. Explore how a magnet can make something move without touching it. Give each a group a magnet and some paper clips. Challenge them to use the magnet to make the paper clip move. Repeat this with other types of magnets. Test the pulling power of different types of magnets. Make predictions, test ideas, record data, share results, and draw conclusions to determine which magnet had the most pulling power. Measure and record the distance magnets can move a paper clip. 2. Design an investigation to describe which poles of magnets attract and repel each other. Use	Books to read: <u>Forces Make Things Move (Let's-Read-and-Find... Science 2)</u> By Kimberly Brubaker Bradley and Paul Meisel <u>Move It! :Motion, Forces and You (Primary Physical Science)</u> By Adrienne Mason and Claudia Davila <u>What Makes a Magnet? (Let's-Read-and-Find... Science 2)</u> By Franklyn M. Branley and True Kelley 1. <u>Magnetic Sort</u> - children will do an experiment using various objects to see if they are attracted to magnets and record in a journal based on whether they are magnetic or non- magnetic. 2.<u>Mr. Manny Magnet</u> – children will use a large piece of paper to make their own horseshoe magnet and will be able to write facts and label the poles to help them remember the	32. Formative assessment 33. End of unit assessment: In Assessment Guide 34. Science Journals/Portfolios/ Writing Assignments 35. Class participation 36. Projects: 37. Oral Presentations 38. Cooperative Learning 39. Homework and class work 40. Performance Assessment: Forces and Motion (found in Assessment Guide pages AG 87-90).

	two bar magnets to demonstrate like poles repelling and opposite poles attracting. 3. Make a compass. Float a plastic plate in water. Place a bar magnet in the center of the plate. Turn the plate. Which way is north? Use a globe to introduce the concept that earth behaves as a large magnet. 4. Create a new application for using a magnet.	important parts of a magnet. 3. <u>Fun with Magnets</u> – children will sort pictures based on if they think the objects are magnetic or not and then choose one of the 10 task cards to complete another experiment with a partner and record and draw your observations to that specific task. 4. Push/Pull – based on the picture, put in columns that show either a push or pull motion.	

Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments
What is sound? *How can sound be changed?*	All students will gain an understanding of natural laws as they apply to motion, forces, and energy transformations. The student will be able to: 1. Observe that a vibrating object makes sound. 2. Determine the pitch of the sound by changing the rate of vibration (how fast). 3. Observe that sound	Books to read: <u>All about Sound (Rookie Read-About Science)</u> By Lisa Trumbauer <u>Sound: Loud, Soft, High, and Low (Amazing Science (Picture Window))</u> 1. <u>Sounds in Motion</u> – children	41. Formative assessment 42. End of unit assessment: In Assessment Guide 43. Science Journals/Portfolios/ Writing Assignments 44. Class participation 45. Projects: 46. Oral Presentations 47. Cooperative Learning 48. Homework and class work 49. Performance Assessment:

	travels through solids as well as gasses. 4. Analyze the pitch produced by changing the size and shape of a variety of instruments. 5. Make a model of a musical instrument to observe the different sounds its produces and compare variations in sounds.	will use a plastic ruler to show that all sounds are produced by vibrations of an object. 2.STEM activity – Good Vibrations – students will use cardboard boxes and rubber bands to create guitars to make different sounds. 3.STEM activity – Measure Up – students will create an instrument that can make at least three different pitches using a variety of objects. 4. STEM activity – Sound Can Really Move – students will help design a way to play music so that people in the next room can hear it. 5. STEM activity – The Better to Hear You With – students will create a device that can allow you to talk to someone in another room.	Hearing Sound (found in Assessment Guide, pages AG 93-96)

Unit 4: Life Science

Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments

How do living things grow and change? What are some animal life cycles? What are animal needs? What are some kinds of animals?	**NJCCCS:** 5.1.A 5.1.4.A.2-3 5.1.4.B.1-4 5.1.4.C.1-3 5.1.4.D.1-4 5.5.2 A 5.5.2 B 5.5.2 C All students will gain an understanding of the structure, characteristics, and the basic needs of organisms and will investigate the diversity of life. The student will be able to: 1. Describe the changes in the life cycle of a frog and a butterfly. 2. Recognize that sequential stages of life cycles are different for different animals. 3. Compare and contrast life cycles of various organisms (i.e, butterflies, frogs, mice, etc.) 4. Construct and interpret models/diagrams of animal and plant life cycles.	• Observe a frog and/or butterfly go through its life cycle by ordering a real life kit. • Books to read: <u>The Very Hungry Caterpillar</u> by Eric Carle (Life cycle of a Butterfly) <u>From Caterpillar to Butterfly</u> by Deborah Heilingman (Life cycle of a Butterfly) <u>From Tadpole to Grog</u> by Wendy Pfeffer (Life cycle of a Frog) <u>How a Seed Grows</u> by Helene Jordan (Life cycle of a Butterfly) <u>The Caterpillar and the Polliwog</u> by Jack Kent (comparing and contrasting the life cycle of a frog and butterfly) 50. Use pasta to create the life cycle of a butterfly on a plate 51. Plant a seed a damp paper towel in a plastic bag. Observe it grow. Complete a journal. 52. Think of an animal. Draw how it uses its body parts to move.	53. Formative assessment 54. End of unit assessment: In Assessment Guide 55. Science Journals/Portfolios/ Writing Assignments 56. Class participation 57. Projects: Habitat Project 58. Oral Presentations 59. Cooperative Learning 60. Performance Assessment: Compare and contrast an ant to a mealworm.
Essential Questions	Instructional Objectives/ Skills and Benchmarks *(CPIs)*	Activities	Assessments

How do living things interact with their environment? *How do living things depend on each other for survival?* How do animal body coverings help animals? How are living things adapted to their environments? How do environments change over time? How do plants and animal need each other? How do plants and animals need one another? How does a bean plant grow?	All students will gain an understanding of structure, characteristics, and basic needs of organisms and will investigate the diversity of life. The students will be able to: 1. Classify objects as to whether they are living or nonliving. 2. Describe the nonliving components of an organism's surroundings, including water, space, and shelter. 3. Construct and interpret simple models of different kinds of habitats, including a forest and a pond. 4. Compare and contrast different ways animals use plants as homes and shelters. 5. Describe how animals are dependent on their surroundings, for example, how squirrels and other animals are affected by the loss of a forest habitat. 6. Distinguish among producers, consumers, herbivores, omnivores, carnivores, and decomposers. 7. Create and interpret a model of a food chain	• Living/Nonliving Scavenger Hunt • Food chain bulletin board: Have students continue to add to the board as the unit continues. • Habitat Scavenger Hunt (List characteristics of habitat and animals (clues) that may live there on a chart and have the students go around the room to try to find the correct habitat the clue goes with). • Books to be read: Who Eats What? by Patricia Lauber (Food Chains) • Adaptation Activity: Cut out black and red square pieces of paper. Place black and red pieces of paper on a large black piece of paper. Discuss why it's easier to see the red squares and how that relates to animals and their adaptations. • Create a diorama of a habitat • Complete a Venn diagram. Show how animal needs and plant needs are alike and different. * **STEM Activity:** Buy caterpillars from www.insectiore.com and observe the life cycle. Graph days in different ways. Use scientific notebooks or journals. * **STEM Activity:** Use graphic organizers to compare life cycles (i.e. Butterfly vs. frog)	69. Formative assessment 70. End of unit assessment: In Assessment Guide 71. Science Journals/Portfolios/ Writing Assignments 72. Class participation 73. Projects: Habitat Project 74. Oral Presentations 75. Cooperative Learning 76. Performance Assessment: Compare and contrast an ant to a mealworm. 77. Science Fusion (Houghton Mifflin Harcourt Publishing) Unit and performance assessments

	showing producers and consumers. 8. Explain how a change in one part of a food chain might affect the rest. 9. Differentiate between predators and prey. 10. Infer that most food chains begin with a green plant.	• **STEM Activity:** Take students to the zoo or nature park with scientific notebooks to make observations. • **STEM Activity:** Grow lima bean seeds in ziplocks with wet paper towels. Tape to window. Use journals. 61. **STEM Activity:** Draw a map to show different habitats for plant/ animals in your local community. 62. **STEM Activity:** Create 3-D models of plants and animals. 63. Research an animal and write a report covering all aspects of the life cycle. 64. 65. **STEM Activity:** Build a backbone to discuss vertebrates and invertebrates. 66. **STEM Activity:** Write a comparison report on it, covering life cycle. 67. **STEM Activity:** Diagram a plant and label features. 68. **STEM Activity:** Use "record and observe" method for all experiments.	

New Jersey Core Curriculum Content Standards
Science

New Jersey Core Curriculum Content Standards for Science

INTRODUCTION

Science Education in the 21st Century

"Today more than ever before, science holds the key to our survival as a planet and our security and prosperity as a nation" (Obama, 2008).

Scientific literacy assumes an increasingly important role in the context of globalization. The rapid pace of technological advances, access to an unprecedented wealth of information, and the pervasive impact of science and technology on day-to-day living require a depth of understanding that can be enhanced through quality science education. In the 21st century, science education focuses on the practices of science that lead to a greater understanding of the growing body of scientific knowledge that is required of citizens in an ever-changing world.

Mission: *Scientifically literate students possess the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity.*

Vision: A quality science education fosters a population that:

- Experiences the richness and excitement of knowing about the natural world and understanding how it functions.
- Uses appropriate scientific processes and principles in making personal decisions.
- Engages intelligently in public discourse and debate about matters of scientific and technological concern.
- Applies scientific knowledge and skills to increase economic productivity.

Intent and Spirit of the Science Standards

"Scientific proficiency encompasses understanding key concepts and their connections to other fundamental concepts and principles of science; familiarity with the natural and designed world for both its diversity and unity; and use of scientific knowledge and scientific ways of thinking for individual and social purposes" (American Association for the Advancement of Science, 1990).

All students engage in science experiences that promote the ability to ask, find, or determine answers to questions derived from natural curiosity about everyday things and occurrences. The underpinning of the revised standards lies in the premise that science is experienced as an *active* process in which inquiry is central to learning and in which students engage in observation, inference, and experimentation on an ongoing basis, rather than as an isolated a *process*. When engaging in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current scientific knowledge, and communicate their ideas to others in their community and around the world. They actively develop their understanding of science by identifying their assumptions, using critical and logical thinking, and considering alternative explanations.

Revised Standards

The revision of the science standards was driven by two key questions:

- *What are the core scientific concepts and principles that all students need to understand in the 21st century?*

What should students be able to do in order to demonstrate understanding of the concepts and principles?

In an attempt to address these questions, science taskforce members examined the scientific concepts and principles common to the National Science Education Standards, Benchmarks and Atlases for Science Literacy , and the National Assessment of Educational Progress (NAEP) Framework .This resulted in narrowing the breadth of content from 10 standards to four standards that include 17 clearly-defined key concepts and principles.

- **Science Practices** (standard 5.1) embody the idea of "knowledge in use" and include understanding scientific explanations, generating scientific evidence, reflecting on scientific knowledge, and participating productively in science. Science practices are integrated into the Cumulative Progress Indicators within each science domain in recognition that science content and processes are inextricably linked; science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge.
- Science content is presented in **Physical Science** (standard 5.2), **Life Science** (standard 5.3), and **Earth Systems** (standard 5.4). The most current research on how science is learned informed the development of learning progressions for each strand, which increase in depth of understanding as students' progress through the grades.

Laboratory Science in the 21st Century

Laboratory science is a *practice* not a *place.* It is important to emphasize that standards-driven lab science courses do *not* include student manipulation or analysis of data created by a teacher as a replacement or substitute for direct interaction with the natural or designed world.

The revised standards and course descriptions emphasize the importance of students independently creating scientific arguments and explanations for observations made during investigations. Science education thereby becomes a sense-making enterprise for students in which they are systematically provided with ongoing opportunities to:

- Interact directly with the natural and designed world using tools, data-collection techniques, models, and theories of science.
- Actively participate in scientific investigations and use cognitive and manipulative skills associated with the formulation of scientific explanations.
- Use evidence, apply logic, and construct arguments for their proposed explanations.

The 2009 Science Standards implicitly and explicitly point to a more student-centered approach to instructional design that engages learners in inquiry. Inquiry, as defined in the revised standards, envisions learners who:

- Are engaged by scientifically-oriented questions.
- Prioritize evidence that addresses scientifically-oriented questions.
- Formulate explanations from that evidence to address those scientifically-oriented questions.
- Evaluate their explanations in light of alternative explanations, particularly those reflecting scientific understanding.
- Communicate and justify their proposed explanations.

Fundamental principles of instructional design assist students in achieving their intended learning goals through lab-science experiences that:

- Are designed with clear learning outcomes in mind.
- Are sequenced thoughtfully into the flow of classroom science instruction.
- Integrate learning of science content with learning about science practices.
- Incorporate ongoing student reflection and discussion (National Research Council, 2007).

Students K-12 lab-science experiences should include the following:

- **Physical manipulation of authentic substances or systems:** This may include such activities as chemistry experiments, plant and animal observations, and investigations of force and motion.
- **Interaction with simulations:** In 21st-century laboratory science courses, students can work with computerized models, or simulations, that represent aspects of natural phenomena that cannot be observed directly because they are very large, very small, very slow, very fast, or very complex. Students may also model the interaction of molecules in chemistry or manipulate models of cells, animal or plant systems, wave motion, weather patterns, or geological formations using simulations.
- **Interaction with authentic data:** Students may interact with authentic data that are obtained and represented in a variety of forms. For example, they may study photographs to examine characteristics of the Moon or other heavenly bodies or analyze emission and absorption spectra in the light from stars. Data may be incorporated in films, DVDs, computer programs, or other formats.
- **Access to large databases:** In many fields of science, researchers have arranged for empirical data to be normalized and aggregated - for example, genome databases, astronomy image collections, databases of climatic events over long time periods, biological field observations. Some students may be able to access authentic and timely scientific data using the Internet and can also manipulate and analyze authentic data in new forms of laboratory experiences (Bell, 2005).
- **Remote access to scientific instruments and observations:** When available, laboratory experiences enabled by the Internet can link students to remote instruments, such as the environmental scanning electron microscope (Thakkar et al., 2000), or allow them to control automated telescopes (Gould, 2004).

New Jersey Scoring Rubric

SCIENCE RUBRIC

Exceeds – must receive no more than one 3 and the rest 4s in the other areas of the rubric.
Meets – may receive no more than one 2 and a combination of 3s and 4s in the other areas of the rubric.
Approaches – may receive no more than one 1 and a combination of 2s, 3s, or 4s, in the other areas of the rubric.
Begins – must receive at least a 1 in all 3 areas of the rubric.

	KNOWLEDGE Knows and understands scientific terms, facts, concepts, principles, theories and methods	APPLICATION Applies scientific knowledge , skills and methods to manipulate, analyze, synthesize, create and evaluate	COMMUNICATION Communicates scientific knowledge and applications through writing, speech, and visual displays.
4	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are complete and correct.	• Applications are thorough, appropriate, and accurate.	• Written, oral and/or visual communication is well-organized and effective.
3	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are mostly complete and correct.	• Applications are mostly thorough, appropriate, and accurate.	• Most of the written, oral and/or visual communication is well-organized and effective.
2	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are somewhat complete and correct.	• Applications are somewhat appropriate and accurate.	• Some of the written, oral and/or visual communication is organized and effective.
1	• Descriptions of scientific terms, facts, concepts, principles, theories and methods are minimally present or correct.	• Applications are minimally, appropriate and accurate.	• Little of the written, oral and/or visual communication is organized and effective.
0	• All descriptions of scientific terms, facts, concepts, principles, theories and methods are missing and/or incorrect.	• All applications are missing and/or incorrect.	• All of the written, oral or visual communication is missing and/or lacks organization.
Score			