**Purpose of Science Curriculum Maps**

This map is meant to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction and our pursuit of Destination 2025.  It is a resource for organizing instruction around the TN State Standards, which define what to teach and what students need to learn at each grade level. The map is designed to reinforce the grade/course-specific standards and content—the major work of the grade (scope)—and provides *suggested* sequencing, pacing, time frames, and aligned resources. Our hope is that by curating and organizing a variety of standards-aligned resources, teachers will be able to spend less time wondering what to teach and searching for quality materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect with colleagues to continuously improve practice and best meet the needs of their students.

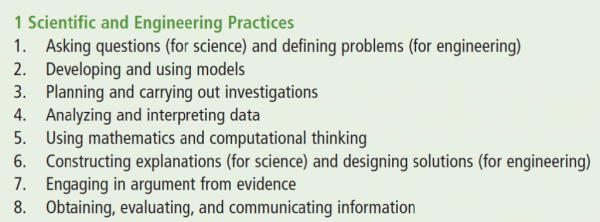
 The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice.  In fact, our goal is not to merely “cover the curriculum,” but rather to “uncover” it by developing students’ deep understanding of the content and mastery of the standards.  Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices.  However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable.  We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.

**Introduction**

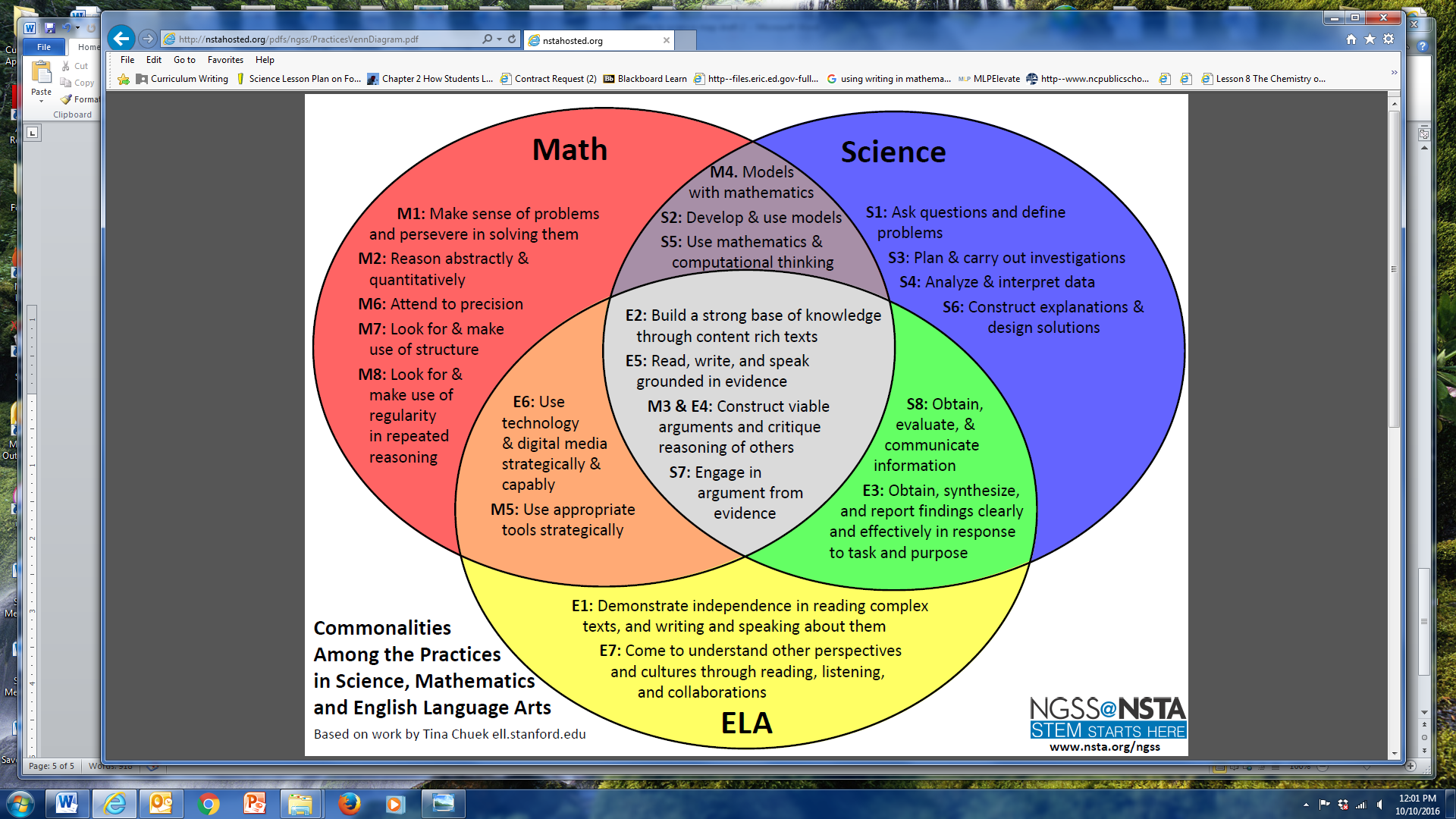
In 2014, the Shelby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committed to these goals, as further described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with high quality, College and Career Ready standards-aligned instruction. The Tennessee State Standards provide a common set of expectations for what students will know and be able to do at the end of a grade. College and Career Ready Standards are rooted in the knowledge and skills students need to succeed in post-secondary study or careers. While the academic standards establish desired learning outcomes, the curriculum provides instructional planning designed to help students reach these outcomes. **The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness.**  Educators will use this guide and the standards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order to facilitate student mastery of the standards.

Our collective goal is to ensure our students graduate ready for college and career. The standards for science practice describe varieties of expertise that science educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in science education. The Science Framework emphasizes process standards of which include planning investigations, using models, asking questions and communicating information**. The science maps contain components to ensure that instruction focuses students toward college and career readiness. The maps are centered around four basic components: the state standards and framework (Tennessee Curriculum Center), components of the 5E instructional model (performance tasks), scientific investigations (real world experiences), and informational text (specific writing activities).**

*The Science Framework for K-12 Science Education* provides the blueprint for developing the effective science practices*.* The *Framework* expresses a vision in science education that requires students to operate at the nexus of three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ideas that all students should learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for students to learn these disciplinary core ideas in the context of science and engineering practices.

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they use multiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term “practices” instead of a term such as “skills” to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 should engage in all eight practicesover each grade band**.** This guide provides specific goals for science learning in the form of grade level expectations*,* statements about what students should know and be able to do at each grade level.

Science is not taught in isolation. There are commonalities among the practices of science (science and engineering), mathematics (practices), and English Language Arts (student portraits). There is an early focus on informative writing in ELA and science. There’s a common core in all of the standards documents (ELA, Math, and Science). At the core is: reasoning with evidence; building arguments and critiquing the arguments of others; and participating in reasoning-oriented practices with others. The standards in science, math, and ELA provide opportunities for students to make sense of the content through solving problems in science and mathematics by reading, speaking, listening, and writing. Early writing in science can focus on topic specific details as well use of domain specific vocabulary. Scaffold up as students begin writing arguments using evidence during middle school. In the early grades, science and mathematics aligns as students are learning to use measurements as well as representing and gathering data. As students’ progress into middle school, their use of variables and relationships between variables will be reinforced consistently in science class. Elements of the commonalities between science, mathematics and ELA are embedded in the standards, outcomes, content, and connections sections of the curriculum maps.



An instructional model or learning cycle, such as the 5E model is a sequence of stages teachers may go through to help students develop a full understanding of a lesson concept. Instructional models are a form of scaffolding, a technique a teacher uses that enables a student to go beyond what he or she could do independently. Some instructional models are based on the constructivist approach to learning, which says that learners build or construct new ideas on top of their old ideas. Engage captures the students’ attention. Gets the students focused on a situation, event, demonstration, of problem that involves the content and abilities that are the goals of instruction. In the explore phase, students participate in activities that provide the time and an opportunity to conducts activities, predicts, and forms hypotheses or makes generalizations. The explain phase connects students’ prior knowledge and background to new discoveries. Students explain their observations and findings in their own words. Elaborate, in this phase the students are involved in learning experience that expand and enrich the concepts and abilities developed in the prior phases. Evaluate, in this phase, teachers and students receive feedback on the adequacy of their explanations and abilities. The components of instructional models are found in the content and connection columns of the curriculum maps.



**Science Curriculum Maps Overview**

**The science maps contain components to ensure that instruction focuses students toward college and career readiness. The maps are centered around four basic components: the state standards and framework (Tennessee Curriculum Center), components of the 5E instructional model (performance tasks), scientific investigations (real world experiences), informational text (specific writing activities), and NGSS (science practices).**

At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep notebooks to record sequential observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to others. Students will carry their curiosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

At the end of the middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can identify relevant evidence and valid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make wise decision related to conservation of the natural world. They recognize that there are both negative and positive implications to new technologies.

As an SCS graduate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human enterprises with strengths and limitations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for individual and social purposes.

**How to Use the Science Curriculum Maps**

**Tennessee State Standards**

The TN State Standards are located in the first three columns. Each content standard is identified as the following: grade level expectations, embedded standards, and outcomes of the grade/subject. Embedded standards are standards that allow students to apply science practices. Therefore, you will see embedded standards that support all science content. It is the teachers' responsibility to examine the standards and skills needed in order to ensure student mastery of the indicated standard.

**Content**

The performance tasks blend content, practices, and concepts in science with mathematics and literacy. Performance tasks should be included in your plans. These can be found under the column content and/or connections. Best practices tell us that making objectives measureable increases student mastery.

**Connections**

District and web-based resources have been provided in the Instructional Support and Resources column. The additional resources provided are supplementary and should be used as needed for content support and differentiation.

(More Academic Vocabulary support can be found at the following link: <http://www.berkeleyschools.net/wp-content/uploads/2013/05/BUSD_Academic_Vocabulary.pdf>)

Following the vocabulary development work of Beck, McKeown and Kucan, the CCSS references three tiers of words that are vital to academic achievement:

* Tier One words are the words of everyday speech usually learned in the early grades… Tier Two words (what the Standards refer to as general academic words) are far more likely to appear in written texts than in speech. They appear in all sorts of texts: informational texts (words such as relative, vary, formulate, specificity, and accumulate), technical texts (calibrate, itemize, periphery), and literary texts (dignified, faltered).
* Tier Two words often represent subtle or precise ways to say relatively simple things—saunter instead of walk, for example. Because Tier Two words are found across many types of texts, they are highly generalizable.
* Tier Three words (what the Standards refer to as domain-specific words) are specific to a domain or field of study (lava, legislature, circumference, aorta) and key to understanding a new concept within a text… Recognized as new and “hard” words for most readers (particularly student readers), they are often explicitly defined by the author of a text, repeatedly used, and otherwise heavily scaffolded (e.g., made a part of a glossary).

It is important to target specific instruction on Tier 2 and Tier 3 vocabulary words to help students develop deep understanding that cannot be acquired through independent reading. Since Tier 3 words are typically targeted in content specific instruction, it's particularly important and challenging to identify and target Tier 2 words, since they appear across all disciplines.

Basic Guidelines for effective structured language practice strategies:

* Make the target language rigorous, and mandatory.
* Never use structured language practice strategies with language that hasn’t been explicitly taught first.
* Post the graphic organizers or word banks and sentence frames that you’ve taught. Require students to use them during the activity and continuously remind them to focus on their use of the language.
* Use a timer, chime, or other signal to mark the beginning, transitions, and ending of the activity. Keep it moving! Don’t adjust your pace to allow all students to finish. If you use these strategies regularly, students will increase their speed to match your snappy pace.
* Circulate to monitor for participation as well as accuracy. Provide targeted support as needed.
* Take it to writing. A brief written product (sentence(s) in a journal, language log, note sheet, poster, post-it, exit ticket…) helps hold all students accountable.

Strategies include

* Classroom Instructional Strategy - <https://drive.google.com/drive/folders/0B_iyFfHv_OU6Z1FHOWN2TFFpdDQ>
* Word Webs - <https://drive.google.com/drive/folders/0B_iyFfHv_OU6Z1FHOWN2TFFpdDQ>
* Academic Vocabulary Log - <https://drive.google.com/drive/folders/0B_iyFfHv_OU6Z1FHOWN2TFFpdDQ>

| **State Standard** | **Embedded Standards** | **Outcomes** | **Content** | **Connections** |
| --- | --- | --- | --- | --- |
| **Standard 2 - Energy --- 2.0 Weeks** | | | | |
| CLE 3202.2.3 Examine the applications and effects of heat energy | CLE 3202.Math.2 Utilize appropriate mathematical equations and processes to solve basic physics problems.  CLE 3202. Inq.3 Use appropriate tools and technology to collect precise and accurate data.  CLE 3202. Inq.4 Apply qualitative and quantitative measures to analyze data and draw conclusions that are free of bias.  CLE 3202. Inq.5 Compare experimental evidence and conclusions with those drawn by others about the same testable question.  CLE 3202. Inq.6 Communicate and defend scientific findings. | Collect data to determine what happens when warm and cold objects touch each other.  Compare the ability of selected materials to absorb and/or radiate thermal energy.  Classify heat transfer as conduction, convection, or radiation.  Solve problems regarding heat, mass, specific heat capacity, and temperature change (Q=mCpΔT). | **Prentice Hall Physical Science: Concepts in Action - Thermal Energy and Heat – Chapter 16**  16.1 Thermal Energy and Matter  16.2 Heat and Thermodynamics  16.3 Using Heat  Engage/Engage – What happens When Hot and Cold Liquids Mix? – Students recognize that the final temperature of a mixture depends on the masses and temperature of the substances that are mixed. p. 473  Quick Lab – Cooling Air – students will be able to describe the effect of temperature on the volume of a gas. p. 476  Math Practice Skills  p. 477, 478  Teacher Demo – Conductors and Insulators – This activity shows the similarities and differences between types of thermal conductors and insulators. p. 480  Quick Lab – Observing Convection – students will learn to use the concept of convection to describe fluid motion. - p. 481  Quick Lab – Cooling Systems – students observe how evaporation of a liquid can cool its surroundings. – p. 490  Data Analysis – What is the Real Cost of a Washing Machine? P. 491  Design Your Own Lab- Using Specific Heat to Analyze Metals- How can you use specific heat to determine the composition of a metal can - p. 493  Measurement of Specific Heat by Vernier <http://www.chem.latech.edu/~deddy/chem104/ZZ_Vernier_Determining%20the%20Specific%20Heat_TECH.pdf>  **Glencoe Science – Thermal Energy**  6.1 Temperature and Heat  6.2 Transferring Thermal Energy  6.3 Using Heat  Launch Lab – Temperature and Kinetic Energy – p. 157  Thermal Energy Equation and Practice Problems – Solve for Thermal Energy p. 162  Mini-Lab – Observing Heat Transfer by Radiation – Students will be able to explain heat transfer by radiation – p. 168  Mini-Lab – Comparing Thermal Conductors –Students will be able to explain heat transfer by conduction p. 169  Lab – Convection in Gases and Liquids – How can convection currents be modeled and observed? p. 171  Lab – Conduction in Gases – Measure temperature changes in air near a heat source - pp. 180-181  Science Stats – Surprising Thermal Energy p.182 | **Academic Vocabulary**  Heat, temperature, absolute zero, thermal expansion, specific heat, calorimeter, conduction, thermal conductor, thermal insulator, convection, convection current, radiation, thermodynamics, heat engine, waste heat, external combustion engine, internal combustion engine, central heating system, heat pump, refrigerant  **Vocabulary Strategy**  **Science Words for Knowledge Rating-Directions:** Here are some words we will be learning in our next science unit. Please place an X in the box that best describes your understanding of this word. Teacher prepares a table and lists the words on the left and uses the following knowledge ratings.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Word** | **No clue** | **Have heard or seen it** | **Know the word** | **Know it well and can define it** |   **Performance Tasks**  **Connecting Concepts – Conservation of Energy** – Review energy conservation in Section 15.2. Describe how the first and second laws of thermodynamics are consistent with the law of conservation of energy.  C:\Users\moorerf\Desktop\Dropbox\Screenshots\Screenshot 2016-10-28 11.30.10.png  **Hot, Hot, Hot**  Students will read the article Hot, Hot, Hot and answer the following questions: What caused the heat dome in 2011? Why did it last so long? Use reasons and facts from the texts in your answer.  **Hybrid Automobile** – Students will read “How It Works” on p. 488 and make a multimedia presentation for the class explaining the hybrid automobile.  **Marketing Executive** – Imagine that you are a marketing executive in a company that sells HVAC (heating, ventilation, and air conditioning) equipment. Write a one-page flyer comparing four kinds of hearing systems. Organize the flyer so it is easy for customers to see the benefits of each system.  **Performance Assessment**  “Making a Computer Presentation” – Make a computer slideshow presentation about conductors and insulators. Start by identifying various materials around your home as either good conductors or good insulators. Plan the organization of the slideshow. Finish the show with a summary table that classifies all of the materials in your presentation. Present your show to your class. –  **Thermal Energy and Heat –** Students will make a graphic organizer to help them understand thermal energy and heat.  **Integrate Earth Science – Nature’s Heat Engine** – Hurricanes are storms that form over the ocean in regions of low pressure. Because hurricanes use heat from warm ocean water to produce strong winds, they are sometimes called nature’s heat engines. Students will research hurricanes and draw a diagram showing how they are like a heat engine.  **Air Temperature**  On a hot day a friend suggests that you can make your kitchen cooler by leaving the refrigerator door open. Explain whether leaving the refrigerator door open would cause the air temperature in the kitchen to decrease. Research this scenario and then write an argument for or against leaving the refrigerator door open. |
| **Standard 2 - Energy – 2 Weeks** | | | | |
| GCLE 3202.2.1 Investigate the properties and behaviors of mechanical and electromagnetic waves. | CLE 3202. Inq.3 Use appropriate tools and technology to collect precise and accurate data.  CLE 3202. Inq.5 Compare experimental evidence and conclusions with those drawn by others about the same testable question. | Investigate the properties of waves using a variety of wave makers, such as ropes and springs.  Investigate and distinguish between the relationship between wavelength and frequency and amplitude.  Classify waves as transverse or longitudinal.  Distinguish between mechanical and electromagnetic waves. | **Prentice Hall Physical Science: Concepts in Action, Mechanical Waves and Sound – Chapter 17**  17.1 Mechanical Waves  17.2 Properties of Mechanical Waves  17.3 Behavior of Waves  17.4 Sound and Hearing  Engage/Explore How Does a Disturbance Produce Waves? – Students will begin to understand that the height or amplitude of a wave depends on the wave’s energy. - p. 499  Teacher Demo – Wave Dance – Students will simulate transverse and longitudinal waves. p. 501  Quick Lab – Observing Waves in a Medium – Students will be able to describe a mechanical wave as a passage of energy through a medium with no net movement of the medium. p. 502  Quick Lab – Comparing Frequency and Wave Speed – Students will be able to distinguish between wave frequency and wave speed. p. 505  Math Skills and Practice Problems p. 506, 507  Exploration Lab- Investigating Sound Waves – Students will be able to define sound as a mechanical vibration whose frequency depends on the length of the vibrating object. pp. 524-525  **Glencoe Science - Waves**  10.1 The Nature of Waves  10.2 Wave Properties  10.3 The Behavior of Waves  Mini-Lab – Observing Wavelength – Students will be able to determine if the spacing of water waves is related to their wavelength - p. 297  Wave Speed Equation and Practice Problems – Solve for Wave Speed P. 299  Lab –Waves in Different Mediums Students will be able to answer the question –How is the speed of a wave affected by the type of materials it is traveling through? – p 302  Mini Lab – Experimenting with Resonance – Students will determine what happens when you hold a vibrating tuning fork near different objects- p. 311  Lab – Measuring Wave Properties – Students will measure the speed of a wave and determine the wavelength from the frequency - pp. 312-313 | **Academic Vocabulary** Mechanical wave, medium, crest, trough, transverse wave, compression, rarefaction, longitudinal wave, surface wave, periodic motion, period, frequency, hertz, wavelength, amplitude, reflection, refraction, diffraction, interference, constructive interference, destructive interference, standing wave, joule, anti-mode, sound waves, intensity, decibel, loudness, pitch, sonar, Doppler effect, resonance  **Performance Tasks**  **Explain a Sequence –** Imagine you are floating in a wave pool. The crest of one wave hits you from the left just as the crest of another hits you from the right. The two waves are otherwise identical. A friend takes a series of five photos starting when the crest hit you. Write a paragraph describing the photos.  C:\Users\moorerf\Desktop\Dropbox\Screenshots\Screenshot 2016-10-28 11.30.10.png  A Tsunami, Where? Students will read the entire article and complete the following tasks.  Look at the wave properties diagram in the Dig Deeper. Write a narrative telling what it shows. Use your own words. How does it help explain the news article that you read on page 1? Use words to explain time or sequence, as needed.  **Recording Technology -** Research one type of recording technology. Write a product’s review as if you lived at the time it was invented. Persuade people that this technology is much better than previously available technologies.  **Are Regulations Needed to Protect Whales from Noise Pollution?**  Students will read the viewpoints on p. 513 and write an argument for the viewpoint that they find is most convincing.  **Types of Waves – Graphic Organizer –** Students will make a graphic organizer to compare and contrast two types of waves.  **Integrate Social Studies – Deadly Ocean Waves –** Tsunamis can cause serious damage when they hit land. These waves can measure up to 30 m tall and can travel faster than 700km/h. Research to find which areas of the world are most vulnerable to tsunamis. Describe the effects that have occurred in these areas.  **Time-Science and History- Making Waves –** Readthe article on p. 314. Research how sonar was used by navies in World War I and World War II. Did sonar affect each war’s outcome? How did it save lives? What uses can you think of for sonar if it could be used in everyday life?  **Mechanical Waves**  Students will prepare a  PowerPoint to introduce the mechanical waves.  **Science and History – Making Waves**  Students will read p. 314 then research how sonar was used by navies in World War I and World War II. Did sonar affect each war’s outcome? How did it save lives? What uses can you think of for sonar if it could be used in everyday life? Student will prepare a brief paper to explain their answers to the questions above.  **Law of Reflection**  Students will use the Law of Reflection to explain why you see only apportion of the area behind you when you look in a mirror. Student will give a written explanation and a diagram explaining their reasoning.  **Form a Hypothesis**  In 1981, people dancing on the balconies of a Kansas City, Missouri hotel caused the balconies to collapse. Use what you have learned about wave behavior to form a hypothesis that explains why this happened. |
| CLE 3202.2.2 Explore and explain the nature of sound and light energy. | CLE 3202. Inq.2 Design and conduct scientific investigations to explore new phenomena, verify previous results, test how well a theory predicts, and compare opposing theories.  CLE 3202.T/E.1 Explore the impact of technology on social, political, and economic systems.  CLE 3202.T/E.3 Explain the relationship between the properties of a material and the use of the material in the application of a technology.  CLE 3202.T/E.4 Describe the dynamic interplay among science, technology, and engineering within living, earth-space, and physical systems. | Investigate factors that affect the speed of sound and compare and contrast sound and light waves.  Use print and electronic resources to investigate the use of active noise reduction technology.  Design and conduct an investigation of wave interactions while distinguishing among wave reflection, refraction, diffraction, and interference. | **Prentice Hall Physical Science: Concepts in Action** -**The Electromagnetic Spectrum – Chapter 18**  18.1 Electromagnetic Waves  18.2 The Electromagnetic Spectrum  18.3 Behavior of Light  18.4 Color  18.5 Sources of Light  Engage/Explore – How doe Color Filters Work? – In this activity, students begin to determine that white light contains other colors of light. - P. 531  Math Skills and Practice problems 535, 538  Teacher Demo – The Photoelectric Effect – Students will indirectly observe the photoelectric effect. - p. 536  Data Analysis – How Long Does and Antenna Need to Be? p. 542  Quick Lab – Evaluating Sunscreens - – Students will be able to use the SPF of a sunscreen to predict its effectiveness in blocking ultraviolet radiation - p. 544  Quick Lab – Comparing Fluorescent and Incandescent Light. After completing this lab, students will be able to explain the difference in spectra of incandescent and fluorescent lights- p. 559  Exploration Lab - Mixing Colored Lights – Students will be able to describe how colors of light combine by addition. - p. 563  **Glencoe Science**  **Electromagnetic Waves – Chapter 12**  12.1 What are Electromagnetic Waves  12.2 The Electromagnetic Spectrum  12.3 Radio Communication  Quick Lab – Investigating Electromagnetic Waves – p. 356  Applying Science – The Speed of Light – Identify known and unknown values. - p. 357  Applying Math pp. 359, 365, 373  Lab – The Shape of Satellite Dishes – How does the shape of a satellite dish improve reception? - p. 366  Lab – Use the Internet – Radio Frequencies – Students will be able to identify what frequencies are used by AM and FM ration stations in their area and other areas around the country. pp. 374-375 | **Academic Vocabulary**  Electromagnetic waves, electric field, magnetic field, electromagnetic radiation, photoelectric effect, photons, intensity, electromagnetic spectrum, amplitude modulation, frequency modulation, thermograms, transparent, translucent, opaque, image, regular reflection, diffuse reflection, mirage polarized light, scattering dispersion, primary colors, secondary colors, complementary colors of light, pigment, complementary colors of pigments, luminous, incandescent, fluorescence, phosphor, laser, coherent light  **Performance Tasks**  **Electromagnetic Waves**  Students will write one paragraph each about three different kinds of electromagnetic waves that they will encounter today. Use a single characteristic, such as wavelength of frequency to describe each wave. Explain how life might be different without each kind of wave.  **Connecting Concepts – Mechanical Waves –** Review the behaviors of mechanical waves discussed in the previous chapter, such as reflection and refraction. Compare them with the behavior of light.  **Explain a Concept –** Students will write a letter to a friend who is not in their class. They will explain how an object gets it color. They will give evidence and use examples to support their explanation.  **Concepts in Action – Looing Beneath the Paint Surface –**  Students will read the article on pp. 556-557, then choose one of these painting styles to research: impressionism, surrealism pointillism, or opt art. Students will prepare an oral report to share with the class, including an explanation of the painting style, how light and color ae used in the style, and three samples of the painting style  **Electromagnetic Waves – Graphic Organizers** – Students will make a graphic organizer to help them understand electromagnetic waves.  **Integrating Health CT Scans –** In certain situations, doctors will perform a CT scan on a patient instead of a traditional X ray. Research to find out more about CT scans. Compare and contrast CT scans with X rays. What are the advantages and disadvantages of a CT scan? Write a paragraph about your findings.  **Time - Science and History – Riding a Beam of Light –** Students will read the article on p. 376. They will research the life of Albert Einstein and make a timeline showing important events in his life. They will also, include on their timeline major historical events that occurred during Einstein’s lifetime. |
| **Standard 2 - Energy --- 2.0 Weeks** | | | | |
| CLE 3202.2.2 Explore and explain the nature of sound and light energy | CLE 3202. Inq.2 Design and conduct scientific investigations to explore new phenomena, verify previous results, test how well a theory predicts, and compare opposing theories.  CLE 3202.T/E.1 Explore the impact of technology on social, political, and economic systems.  CLE 3202.T/E.3 Explain the relationship between the properties of a material and the use of the material in the application of a technology.  CLE 3202.T/E.4 Describe the dynamic interplay among science, technology, and engineering within living, earth-space, and physical systems. | Investigate the characteristics of light energy and sound.  Describe the law of reflection.  Describe how a plane mirror produces and image.  Describe real and virtual images and relate them to converging and diverging light rays.  Describe the physical characteristics of plane, concave, convex, mirrors and distinguish between the types of images they form.  Define the index of refraction.  Describe the physical characteristics of concave and convex lenses and distinguish between the types of images they form.  Distinguish between how reflecting and refracting telescopes form images.  Explain how cameras regulate and focus light to form images.  Name the main parts of the eye and describe their function. | **Prentice Hall Physical *Science*: Concepts in Action**, **Chapter 19**  19.1 Mirrors  19.2 Lenses  19.3 Optical Instruments  19.4 The Eye and Vision  Engage/Explore – Inquiry Activity – How Can You Make Glass Disappear? - Students begin to recognize that the change in the path of light as it passes from one material to another depends on differences between the two materials. - p. 569  Quick Lab – Measuring the Height of your Mirror Image – Students will be able to describe how he size of a mirror limits the size of the area that is reflected, - p. 571  Teacher Demo – Flashlight Mirrors – Students will observe how a small flashlight can focus a beam. - p. 572  Data Analysis – Properties of Gemstones p. 575  **Reflections on Light**  <http://web.csulb.edu/~lhenriqu/ReflectionsOnLight.pdf>  Students will explore the general behavior of light when it is reflected and the behavior of light when it is reflected in specific angles.  Teacher Demo – Making a Telescope – Students will observe the basic requirements for a telescope. - p. 581  Quick Lab – Building a Pinhole Viewer – Students will be able to describe the formation of an inverted image by a pinhole camera. - p. 585  **Glencoe Physical Science – Light - Chapter 13** -  13.1 The Behavior of Light  13.2 Light and Color  13.3 Producing Light  13.4 Using Light  Mini Lab – Observing Refraction in Water –Student will observe a penny disappear. - p. 387  Applying Math pp. 388, 393, 399, 404  Lab – Make a Light Bender – Students will discover how water affects the viewer’s image of an object that is above the water’s surface. - p. 405  Lab – Design Your Own – Polarizing Filters – Students will understand why polarizing filters causes light waves to vibrate in only one direction. - pp. 406-407 | **Academic Vocabulary**  Ray diagram, angle of incidence, angle of reflection, plane mirror, virtual image, concave mirror, focal point, real image, convex mirror, index of refraction, lens, concave lens, convex lens, critical angle, total internal reflection, telescope, reflecting telescope, refracting telescope, camera, microscope, cornea, pupil, iris, retina, rods, cones, nearsightedness, farsightedness, astigmatism  **Performance Tasks**  **Mirrors Compare – Contrast Paragraph –** Students will write a paragraph comparing convex mirrors and concave mirrors.  **Steps in a Process –** Students will write a paragraph describing how a light ray passes through the eye and results in vision.  **Light Transmission – Graphic Organizer –**Students will make a graphic organizer to help them identify the characteristics of opaque, translucent, and transparent objects.  **Integrate Life Science – Color for Photosynthesis –** Plant pigments determine the wavelengths of light for photosynthesis. Leaves usually look green due to the pigment chlorophyll. Chlorophyll absorbs most wavelengths of visible light except green. But not all plants are green. Research different plant pigments to find how they allow pant species to survive in diverse habitats.  **Science and Language – A Haiku Garden: The Four Seasons in Poems and Prints –** p. 408  **Integrate Physics -** Research has determined that there is a connection between color and mood. Warm colors have longer wavelengths, and can be more stimulating. Cool colors, which have shorter wavelengths, tend to have a calming or soothing effect on people. Light and color have long been used as literary symbols. Does the use of color change what you imagine when you read the haiku? |
| **Standard 2 – Energy – 3 Weeks** | | | | |
| CLE 3202.2.4 Probe the fundamental principles and applications of electricity. | CLE 3202.T/E.1 Explore the impact of technology on social, political, and economic systems.  CLE 3202.T/E.2 Differentiate among elements of the engineering design cycle: design constraints, model building, testing, evaluating, modifying, and retesting.  CLE 3202.T/E.4 Describe the dynamic interplay among science, technology, and engineering within living, earth-space, and physical systems.  CLE 3202.Math.2 Utilize appropriate mathematical equations and processes to solve basic physics problems. | Construct circuits described in circuit diagrams and solve application problems related to voltage, resistance, and current in a series circuit (V=IR).  Use print and electronic resources to research how a selected electrical safety device works.  Analyze factors that affect the strength and direction of electric forces and fields.  Describe how electric charges are transferred and explain why electric discharges occur.  Describe electric current and identify the two types of current.  Describe conduction and classify materials as food electrical conductor or good electrical insulators.  Explain how voltage produces electric current.  Calculate voltage, current, and resistance using Ohm’s law.  Analyze circuit diagrams for series circuits and parallel circuits.  Explain how electronics conveys information with analog or digital signals.  Illustrate how semiconductors ae used to make three kinds of solid state components. | **Prentice Hall Physical Science: Concepts in Action, Chapter 20 – Electricity**  20.1 Electric Charge and Static Electricity  20.2 Electric Current and Ohm’s Law  20.3 Electric Circuits  20.4 Electronic Devices  Engage/Explore – Inquiry Activity – How Can You Reverse the Battery Direction in a Flashlight? – Students are introduced to the idea that current consists of moving charged particles. – p. 599  Quick Lab – Modeling Resistance in a Wire – Students will describe how the thickness of a conductor affect its resistance p.606  Math Skills and Practices pp. 611, 613  Quick Lab – Modeling a Fuse Materials – Students will be able to describe the principle of an electric fuse. - p. 612  Forensics Lab – Evaluating Electrical Safety – Students will determine the voltage differences across resistances in series- p. 623  **Glencoe Science – Electricity – Chapter 7**  7.1 Electric Charge  7.2 Electric Current  7.3 Electrical Energy  Launch Lab – Electric Circuits – Students will understand under what conditions electric current flow in an electric circuit.  Applying Math pp. 199, 205, 213  Electric Power Equation pp. 211, 212  Mini Lab – Investigating Charged Objects – p. 198  Mini Lab – Investigating Battery Addition – Students will determine the voltage difference for D cell batteries - p. 202  Lab – Identifying Conductors and Insulators – Students will identify which materials are conductors and which materials are insulators. - p. 206  Lab – Design Your Own – Comparing Series and Parallel Circuits – Students will compare and contrast the behavior of series and parallel circuits. - pp. 214-215 | **Academic Vocabulary**  Electric charge, electric force, electric field, static electricity, law of conservation of charge induction, electric current, direct current alternating current, electrical conductor, electrical insulator, resistance, superconductor, potential difference, voltage, battery, Ohm’s law, electric circuit, series circuit, parallel circuit, electric power, fuse, circuit breaker, grounding, electronics, electronic signal, analog signal, digital signal, semiconductor, diode, transistor, integrated circuit, computer  **Performance Tasks**  **Series of Events** Students will write a paragraph explaining the series of events that cause them to receive a shock from a metal door knob on a dry winter day.  **Concepts in Action – Using Computers –** Read the article on pages 616 – 617. Student will use the library or internet to research how making computer circuits smaller allows a computer to operate at a faster speed. Write a paragraph describing one technology that has increased processing speed.  **Lightning Strikes**  Students will write a paragraph explaining in detail why you could be struck by lightning if you stand outside during a thunderstorm. Include a sketch that illustrates the ideas in you paragraph.  **Electricity –Graphic Organizer –** Students will make a graphic organizer to help them organize information about electricity.  **Integrate Career** – The installation of electrical wiring in any building usually requires an electrician. Electricians must have a thorough understanding of electricity. They also must constantly be aware of the safety issues involved in working with electricity. Research other skills that electricians must have.  **Science and Language – The Invisible Man –** Read the article on page 216. Write a prologue to a make-believe book describing Edison’s invention of the lightbulb. Recall that a prologue is not a summary of the book. Rather, it can state general themes that the work of literature will address or set the stage or describe the setting of the story. |
| CLE 3202.2.4 Probe the fundamental principles and applications of electricity. | CLE 3202.T/E.1 Explore the impact of technology on social, political, and economic systems.  CLE 3202.T/E.2 Differentiate among elements of the engineering design cycle: design constraints, model building, testing, evaluating, modifying, and retesting.  CLE 3202.T/E.4 Describe the dynamic interplay among science, technology, and engineering within living, earth-space, and physical systems.  CLE 3202.Math.2 Utilize appropriate mathematical equations and processes to solve basic physics problems. | Describe the effects of magnetic forces and magnetic fields and explain how magnetic poles determine the direction of magnetic force.  Describe Earth’s magnetic field and its effect on compasses.  Describe how a moving electric charge creates a magnetic field and determine the direction of the magnetic field based on the type of charge and the direction of its motion.  Describe how electromagnetic devices use the interaction between electric currents and magnetic fields.  Describe how electric current is generated by electromagnetic induction.    Compare AC and DC generators and explain how they work.  Analyze factors that determine the output voltage and current produced by a transformer.  Summarize how electrical energy is produced, transmitted, and converted for use in the home. | **Prentice Hall Physical Science: Concepts in Action, Chapter 21– Magnetism**  21.1 Magnets and Magnetic Fields  21.2 Electromagnetism  21.3 Electrical Energy Generation and Transmission  Engage/Explore – How do Magnet Interact with One Another? – Students will learn how magnetic fields attract or repel each other. - p. 629  Quick Lab – Observing Magnetic Field Lines – Students will recognize the magnetic fields of two magnets combine. - p. 632  Quick Lab – Making an Electromagnet – Students will predict the number of turns of wire that affect the strength of the electromagnet. - p. 637  Application Lab – Investigating an Electric Generator – Students will describe how an electric generator works. - pp. 648-649.  **Glencoe Physical Science – Magnetism and its Uses – Chapter 8**  8.1 Magnetism  8.2 Electricity and Magnetism  8.3 Producing Electric  Mini Lab – Observing Magnetic Interference - Students will identify materials that can cause magnetic interference. - p. 227  Applying Science – How can magnetic parts of a junk car be salvaged? p. 228  Mini Lab – Making You Own Compass – p. 229  Applying Math pp. 230, 237, 244  Lab – Magnets, Coils, and Currents – Students will explain how a magnet, and a wire coil can be used to produce an electric current - p.245  Lab – Design Your Own – Controlling Electromagnets – students will determine which factors affect the strength of an electromagnet. - pp. 246-247 | **Academic Vocabulary**  Magnetic force, magnetic pole, magnetic field, magnetosphere, magnetic domain, ferromagnetic material, electromagnetic force, solenoid, electromagnet, galvanometer, electric motors, electromagnetic induction, generator, transformer, turbine  **Concepts in Action – Peeking Holes Inside the Human Body –** Students will read the article on pages 641-642. Items such as jewelry, watches, coins, keys, and credit cards must be removed before beginning an MRI. Research in the library or on the internet why these items interfere with the procedure or post a risk to the patient.  **Transformers Compare – Contrast –**Students will write a paragraph comparing and contrasting what step-up and step-down transformer do. (Hint: Use the terms voltage, primary coil, secondary coil, input, and output.)  **Creating an Educational Booklet**  Students will write a booklet for elementary students describing how electricity is brought from the power plant to their homes. Include illustrations and caution statements that young children can understand.  **Time - Science and History – Body Art –** Students will read the article on page 248. Research how tools such as MRI have changed over the years. Make a list of the tools and how they have helped improve medicine. |

| **TOOLBOX** | |
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| **Standard 2 - Energy --- 1.5 Weeks** | |
| **Plans** | <http://www.compadre.org/precollege/static/unit.cfm?sb=7&course=2>   1. Variety of power point to differentiate instructions according to student learning levels:   [http://www.slideshare.net/jakaczma/heat-transfer-10112193?next\_slideshow=1](%20http:/www.slideshare.net/jakaczma/heat-transfer-10112193?next_slideshow=1)   1. Site to quickly develop flash card, formative and comprehensive assessments:   <http://www.problem-attic.com/account/documents/ipuQ91K37dRKC81IXsI/nodes/14971?current=17311>   1. Heat Transport Method Sort: <http://www.sharemylesson.com/taxonomysearchresults.aspx?mode=browse&parametrics=90011,90152,90901,92638> 2. Save the Penguins: Ice Cube Protection: Metal Spoon-Vs-Plastic spoon: <http://www.auburn.edu/~cgs0013/Schnittka_Bell_Richards_2010.pdf> 3. <http://www.compadre.org/precollege/static/unit.cfm?sb=7&course=2> 4. http://www.middleschoolchemistry.com/lessonplans/chapter2/lesson1   <http://groups.physics.umn.edu/physed/Talks/standards%20document%2010_5_2010.pdf> |
| **Background for Teachers** | For a quick review of specific heat capacity, go to <http://hyperphysics.phy-astr.gsu.edu/hbase/thermo/spht.html>  A concise summary of concepts related to heat energy is followed by a multiple choice quiz. <http://www.school-for-champions.com/science/thermal_energy.htm> |
| **Student Activities** | Find out about convection, conduction, and radiation. Click on the "Heat Review Game" link for a fun online quiz. <http://www.mansfieldct.org/schools/mms/staff/hand/convcondrad.htm>  Great inexpensive experiments and student activities:  <http://coolcosmos.ipac.caltech.edu/cosmic_classroom/light_lessons/thermal/detect.html>  Learn about heat transfer by advancing from page to page using the "Next" button. View illustrations with a boiling ball and discuss three types of heat transfer involved. Includes questions with answers. <http://apollo.lsc.vsc.edu/classes/met130/notes/chapter2/htrans_intro.html>  “Adjusting your Water Heater to conserve Energy”. Students are introduced to the Law of Conservation of Energy, specific heat, thermal energy and heat capacity as they discover ways to conserve energy. <http://serc.carleton.edu/sp/mnstep/activities/27295.html>  Students investigate exothermic and endothermic reactions. <http://carleton.edu/sp/mnstep/activities/19869.html>  Video on how heat and energy move through your home:<https://www.teachingchannel.org/videos/stem-lesson-ideas-heat-loss-project> |
| **Other Resources** | This site provides a variety of resources for every aspect of your study of thermal energy and heat.<http://www.nea.org/tools/lessons/clean-energy-education.html>  STEM Activity: Students use household materials to design and create a solar water heater  Easy to read passages to support the CCSS standards. Articles are based on 8th grade reading level. <http://www.readworks.org/passages/what-heat> (Heat Wave, Heat, Energy, and Bicycling in New York City) (**FREE REGISTRATION)**  Gain access to numerous videos to support various science concepts and the CCSS standards using [www.teachingchannel.org](http://www.teachingchannel.org) (**FREE REGISTRATION)** |
| **Standard 2- Energy – 2 Weeks** | |
| **Plans** | This PhET "Gold Star Winner" is an instructional unit on the topic of Waves, created by a high school teacher.   It was designed to be used with interactive simulations developed by PhET, the Physics [Education Technology](http://www.compadre.org/precollege/items/detail.cfm?ID=6883) project.  Included are detailed lessons for integrating labs, simulations, demonstrations, and concept questions to introduce students to properties and behaviors of waves. <http://phet.colorado.edu/en/contributions/view/3023>  The objectives of the lesson plan at the following site include identifying the parts of a wave, distinguishing between a transverse wave and a compressional wave and describing how musical instruments produce sounds. <http://mypages.iit.edu/~smile/ph8813.html>  <http://www.discoveryeducation.com/teachers/free-lesson-plans/the-electromagnetic-spectrum-waves-of-energy.cfm> |
| **Background for Teachers** | This physics tutorial on waves can be used by teachers or students. It is followed by a multiple-choice quiz to test comprehension.  <http://www.physicsclassroom.com/Class/waves/u10l2a.cfm>  Click on any part of the illustration of the electromagnetic spectrum at this site to get detailed information. The site also includes wave property calculators. <http://hyperphysics.phy-astr.gsu.edu/hbase/ems1.html> |
| **Student Activities** | NASA sponsored site that allows students to learn more about the electromagnetic spectrum. <http://spaceplace.nasa.gov/ir-photo-album/en/>  Interactive website where the students experiment with light to produce images. [www.learner.org/teacherslab/science/light/](http://www.learner.org/teacherslab/science/light/)  The lab activities described in this document explore the properties of waves. <http://mypages.iit.edu/~smile/ph9403.html>  Students explore why mint lifesavers glow in the dark- <http://discoverykids.com/activities/light-up-lifesavers/>  Observe and measure transverse, longitudinal, and combined waves on a model of a spring moved by a hand. Adjust the amplitude and frequency of the hand, and the tension and density of the spring. The speed and power of the waves is reported, and the wavelength and amplitude can be measured.  <http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=1053>  Watch a string vibrate in slow motion. Wiggle the end of the string and make waves, or adjust the frequency and amplitude of an oscillator. Adjust the damping and tension.  The end can be fixed, loose, or open. Download or run this simulation at <http://phet.colorado.edu/en/simulation/wave-on-a-string> |
| **Other Resources** | A printable worksheet on longitudinal and transverse waves is provided at <http://betterlesson.com/lesson/18026/waves-101#/document/73281/ws-longitudinal-and-transverse-waves?&_suid=136991851144107308125790018388>????????????  Find cool teacher demos using this website! <http://www.exploratorium.edu/snacks/iconlight.html>  Two articles you can use- <http://discoverymagazine.com/tags/light>  <http://science.howstuffworks.com/light.htm> |
| **Standard 2 - Energy --- 1.5 Weeks** | |
| **Plans** | In this lesson, the student will understand The Law of Reflection in practical application as it applies to a plane mirror. <http://mypages.iit.edu/~smile/ph9303.html>  <https://www.learner.org/sphider/search.php?search=1&query=sound+and+optics&x=5&y=14> |
| **Background for Teachers** | This encyclopedia entry on optics provides links to a variety of topics for further information. <https://en.wikipedia.org/wiki/Optics>  <http://mcdonaldobservatory.org/teachers/classroom> |
| **Student Activities** | Discovery Education provides quality resources to support the needs of the educator. <http://www.discoveryeducation.com/teachers/free-lesson-plans/the-phenomenom-of-sound-waves.cfm>  <https://www.scienceproject.com/projects/index/Senior/physics.asp>  Acoustics in buildings concerns controlling the quality and amount of sound inside a building. It is used to allow for pleasant sound in a concert hall and to reduce echoes and noise within an office building. Acoustics also concerns suppressing sound coming from outside the building, such as in apartments. <http://www.school-for-champions.com/science/sound_building_acoustics.htm> |
| **Other Resources** | Additional project ideas are provided that may be used during your study of optics as extensions to the other activities. These enrichment opportunities will help you learn more about the human eye, vision problems, ophthalmology, the design of optical devices, and the history of theories involving light and its properties. <http://micro.magnet.fsu.edu/optics/activities/students/projectideas.html>  Supports CCSS!!! [www.readworks.org](http://www.readworks.org) **(FREE REGISTRATION) (The Sounds of Baseball, Digitized Signals are the Future of the Black Box, using cellphones and computers to Transmit Information)**  The Physic Front:  <http://www.compadre.org/precollege/static/unit.cfm?sb=8&course=5> |
| **Standard 2 - Energy** | |
| **Plans** | [In this lesson students](http://mypages.iit.edu/~smile/ph8917.html) wire dry cells either in series or in parallel when given several dry cells, pieces of wire and bulbs. <http://mypages.iit.edu/~smile/ph8917.html>  An electronics kit in your computer! Build circuits with resistors, light bulbs, batteries, and switches. Take measurements with the realistic ammeter and voltmeter. View the circuit as a schematic [diagram](http://phet.colorado.edu/en/simulation/circuit-construction-kit-dc), or switch to a life-like view. Select an appropriate lesson plan for using this simulation from the list in the middle of the page. <http://phet.colorado.edu/en/simulation/circuit-construction-kit-dc>  <http://cse.ssl.berkeley.edu/SEGwayed/lessons/exploring_magnetism/magnetism_and_electromagnetism/mag_electromag.pdf> |
| **Background for Teachers** | In this concise article basic concepts of electrical circuits are explained. There are links to additional information, including information about safety devices. <http://www.wisegeek.org/what-is-an-electrical-circuit.htm>  Physics tutorials at this site include a chapter on current electricity. The site may be useful for both teachers and students. <http://www.physicsclassroom.com/Class/circuits/> |
| **Student Activities** | This online tutorial includes hands-on activities on building circuits. <http://www.energyquest.ca.gov/story/chapter04.html>  See a 1-minute video illustration of a simple circuit at <http://www.bbc.co.uk/learningzone/clips/a-simple-electrical-circuit/2190.html> |
| **Other Resources** | STEM activities can be found here!!! <https://www.teachengineering.org/lessons/view/gat_visual_art_lesson01>  Find science-related reading passages here! [www.readworks.org](http://www.readworks.org)  Informational text about various topics associated with electricity. Supports CCSS!!! [www.cleanlineenergy.com/sites/cleanline/media/resources/students/electricity/Electricity\_Infobook-High\_School.pdf](http://www.cleanlineenergy.com/sites/cleanline/media/resources/students/electricity/Electricity_Infobook-High_School.pdf)  Explore how circuits work at <http://science.howstuffworks.com/environmental/energy/circuit.htm> (**Informational article to support CCSS)**  These interactive webpages allow you to set up simple electric circuits and run them. They include a link to information for teachers. <http://gwydir.demon.co.uk/jo/elect/>  How to build an engine: <http://www.ieee.org/contrib/groups/public/@ieee/@web/@org/@educ/documents/file/20041417.pdf> |