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| **Section of Lesson** |  |
| **Title (Required)** | Unit: "We're ALL Engineers" |
| **Introduction (Required)** | These lessons should teach students about the properties of waves and how these things are used in real life by studying various engineers.  This STEM lesson set includes:  **Science:** Students will learn about waves and wave properties including: Longitudinal, Transverse, wave anatomy (crest, trough, wavelength, amplitude), frequency, and speed.   * Assignments include:   + Pre-test (Grade not recorded, but the class average will be marked on class graph)   + Power Point Presentation with guided notes   + Slinky demonstration (In power point)   + Tuning Fork demonstration (In power point)   + Weather activity- Sine/ Transverse waves (In power point)   + Quiz   + Post-Test   **Technology:** Students will use Mac books or any other personal device (if available) for research in lessons 1 and 2.   * Assignments include:   + Research in the first lesson, “Career Day”   + Online videos     - Not only will students use technology, they will be researching technology used in engineering fields.   + Power Point   + Research in the second lesson, “Weather Activity”   **Engineering:** Students will research various types of engineers that are present in a local cable manufacturing company. Each of these engineers uses knowledge of waves daily in the creation, production, and improvement of cable. An engineering representative from the local cable company will visit and speak to the class.   * Assignments include:   + Station rotation   + Web quest   **Math:** Students will write and solve equations for wave velocity, frequency, and period.   * Assignments include:   + Questions for each (velocity, frequency, and period) in the power point. |
| **Real Science Application (If Applicable)** | “All waves transmit energy not matter. Nearly all waves travel through matter. Waves are created when a source (force) creates a vibration. Vibrations in materials set up wavelike disturbances that spread away from the source. Wave behavior can be described in terms of how fast the disturbance spreads, and in terms of the distance between successive peaks of the disturbance (the wavelength). Sound and earthquake waves are examples. These and other waves move at different speeds in different materials. Waves are moving energy. Light waves are unique in their ability to travel through a vacuum (space). Sound is a form of energy that results when vibrating materials produce waves that move through matter. Students will compare sound waves (longitudinal waves) to light waves (transverse waves). Energy will cause materials to vibrate. These vibrations are carried as “waves” and transfer energy. Students will identify the basic characteristics of a transverse wave: trough, crest, amplitude, and wavelength. Students will also identify the basic characteristics of a longitudinal (compressional) wave: amplitude, rarefaction, and compression. " -Iredell-Statesville Schools Curriculum Guide |
| **Curriculum Alignment (Required)** | **This section contains the curriculum alignment of each lesson in the module to the North Carolina Standard Course of Study, specifically the Common Core and Essential Standards, as well as the Next Generation Science Standards.**  **NC Essential Standards**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Content Area** | **Grade Level** | **NC SCS** | **Lesson 1** | **Lesson 2** | | Science | 6 | Scientific Inquiry | Career day/Choose an engineer. |  | | Science | 6 | 6.P.1.1  I can explain wave properties and behaviors. |  | Properties of waves notes/activities | | Science | 6 | Scientific Inquiry |  |  | |
| **Learning Outcomes (Required)** | **The Learning Outcomes list what students are expected to learn after completing the lesson plan.**  **Essential Questions:**  1. What are the characteristics of a wave?  2. How are waves created?  3. What is sound?  4. What is light?  5. What are the basic characteristics of a transverse wave?  6. What are the basic characteristics of a longitudinal wave?  **Criteria for Success:**  A.) Students will identify parts of a wave.  B.) Students will understand what a wave is  C.) Students will demonstrate behaviors of waves.  D.) Students will identify types of wave.  E.) Students will recognize that vibrations produce waves  F.) Students will understand the properties of waves. |
| **Time Required and Location (Required)** | **Lesson 1:** 1 class period (75 minutes)  **Lesson 2:** 3 class periods (75 minutes each) |
| **Materials Needed (Required)** | **Teacher List:**   * Computer * Internet access * Web quest handout * Power Point presentation * Guided notes * 1Slinky ( I recommend a large metal slinky, but any will be fine) * Projector * Smart Board (Not required) * White boards for groups (if they aren’t available, paper plates or white sheets of paper work well.)   **Student List:**   * Mac books or other personal devices (or computer lab) * Internet access * Graph paper * Pencil * Web quest handout * Guided notes |
| **Student Prior Knowledge (Required)** | Students should be able to name types of waves they have seen (water waves, stadium waves, etc…).  Students should know how to use computers to research.  Students should know how to create a graph with all axis labeled and have an appropriate scale. |
| **Teacher Preparations (Required)** | * Students will complete some assignments on their own (pre/post test), and some in groups. * **Lesson 1**   + Career day will involve a "Station Rotation". This needs to be set up prior to class beginning. Each station should have a computer (unless all students have devices).   + If no technology is available this can be done as a whole group assignment on the projector.   + Have tables/desks arranged into 6 stations.     - Engineering     - Product Engineer     - Materials Engineer     - Process Engineer     - Controls Engineer     - Test Engineer   + Print “Career Day” web quest handout (1 per student) OR have students download the link and complete on their device. * **Lesson 2**   + Make copies of the guided notes (1 set for each student)   + Download Power Point Presentation   + Have a slinky and a tuning fork   + Have weather history website loaded and ready to give example on the projector. |
| **Activities (Required)** | **Lesson 1: Career Day (One class period: 10-12 mins/station)**   * Today students will explore what kinds of engineers are involved in manufacturing facilities. * They will research several types then choose one to explore deeper. * 6 Stations should be set up around the room:   + - Engineering     - Product Engineer     - Materials Engineer     - Process Engineer     - Controls Engineer     - Test Engineer * Each station should have a computer set to the webpage that is on the web quest OR students can carry their personal devices to each station.   + \*If students do not have a personal device and there are not enough classroom computers this can be done as a whole group and the webpages can be shown on a projector. * Each student should have either a hard copy of the web quest questions OR they can download the file and complete the questions on their computer. * Students should be in small groups as the rotate around the room visiting each station. * Each station has a video or a website that provides information about a certain type of engineering.   + Students will use these sites to learn and answer questions about this type of engineer. * They will complete the short answer questions on the web quest handout as they watch the videos. * Make sure that students are on task and on the correct webpage at all times. * They should be allowed to pause videos to write and replay them (as long as time allows). * Each station will take approximately 10-12 mins to complete. * At the end of the station rotations students should choose 1 engineering type to learn more about. * **Extension- \*\*Homework\*\***    + **Writing assignment:** Students should choose a type of engineer they have learned about today to do learn more about. They will write a 5 paragraph essay about the following prompt:     - Pretend you are a (choice of engineer) at a large company. Describe, in detail, a project that you will work on. What is the purpose of the project? What are you creating? How will you accomplish the project? Will you need help from other engineers? Will your project have a societal impact?   **Lesson 2: Properties of Waves**   * Pass out Guided Notes handout to each student. * Turn projector on * Students should be filling in blanks on the guided notes handout throughout the entire presentation. * Open Properties of Waves Power Point (The following is on the Power Point)   5 minutes for actions listed above\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   * + Explain the definition of waves   + Activity #1 2-5 mins: Types of waves     - Have students work as small groups/partners to quickly think of several types of waves.   + Activity #2 5 minutes: Slinky Activity     - Power Point explains activity   + Activity #3 30 minutes: Weather Activity     - Power point explains activity     - Students should get out their Mac Books or other personal devices. \*Or computer lab computer     - Go to this website:   [**http://www.wunderground.com/history/**](http://www.wunderground.com/history/)   * + - Choose a city, enter city or zip code     - Anywhere in the world! \***Global Extension**\*     - Choose April 1, 2013 as the date     - Click Monthly     - On their graph paper they should make a graph     - X axis labeled with the months     - Y axis labels with temperatures       * 0-110 degrees Fahrenheit     - Plot the point for the Average (AVG), Mean temperature.     - Click “next month”     - Continue plotting the points on your graph   + Activity #4 20 minutes: Assigning parts to the wave     - Follow along the power point     - Students will assign appropriate points to their wave, according to the presentation * Finish power point as students fill out guided notes   \*\*As a global extension students will look up average temperatures from places all over the world. Realistically places farther from the equator will have higher amplitudes and places closer to the equator will have smaller amplitudes. \*Places close to the ocean may skew results so these should be avoided since weather patterns are a 7th grade standard.\*   * As an exit ticket students will summarize their notes and what they learned including any questions they have. |
| **Assessment (Required)** | * Pre-Assessment- Energy Properties of Waves * Post-Assessment- Energy Properties of Waves—given again at the end to accurately show growth |
| **Critical Vocabulary (Required)** | **Wave**- a wave is a disturbance that travels through a medium from one location to another.  **Transverse waves**- a wave vibrating at right angles to the direction of its propagation.  **Longitudinal waves**- a wave vibrating in the direction of propagation  **Trough**- A point on the wave is a trough if the displacement of the medium at that point is at a minimum. The bottom point of the wave.  **Crest**- A crest is a point on the wave where the displacement of the medium is at a maximum. The top point of the wave.  **Amplitude**-The height of the wave from the point of equilibrium.  **Frequency**- the number of crests of a wave that move past a given point in a given unit of time. The most common unit of frequency is the hertz (Hz), corresponding to one crest per second.  **Wavelength-**The point from one wave crest to the next wave crest.  **Rarefaction-**  A decrease in density and pressure in a medium, such as air, caused by the passage of a sound wave compression  **Sound-** vibrations that travel through the air or another medium and can be heard when they reach a person's or animal's ear.  **Vibration-** an oscillation of the parts of a fluid or an elastic solid whose equilibrium has been disturbed, or of an electromagnetic wave.  **Medium-** An intervening substance through which something else is transmitted or carried on.  **Vacuum-** An intervening substance through which something else is transmitted or carried on. |
| **Community Engagement (Required)** |  |
| **Extension Activities (Optional)** |  |
| **Modifications (Optional)** |  |
| **Alternative Assessments (Optional)** |  |
| **References**  **(Optional)** |  |
| **Supplemental Information (Optional)** |  |
| **Comments (Optional)** |  |
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