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| **Title: Water Wheel Lesson** | **Grade Level: 3-5th Grade** |
| **Big Idea:Team Building,**  **Collaboration and Aerodynamics,**  Lesson focuses on the students creating a water wheel that will crank up a paper clip dangling from a string wrapped around a pencil that is serving as the axle to a water wheel. | **Enduring Understanding:** Students will be given an opportunity to explore the design a water wheel through which they will learn the basic concept of movement equating energy. |

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| **SCIENCE STANDARDS** | **TECHNOLOGY STANDARDS** | **ENGINEERING**  **STANDARDS** | **MATH STANDARDS** |
| **Habits of the Mind**  **S5-1CS1. Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.**  a. Keep records of investigations and observations and do not alter the records later.  b. Carefully distinguish observations from ideas and speculation about those observations.  c. Offer reasons for findings and consider reasons suggested by others.  d. Take responsibility for understanding the importance of being safety conscious**.**  **S5-1CS2. Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.**  a. Add, subtract, multiply, and divide whole numbers mentally, on paper, and with a calculator.  b. Use fractions and decimals, and translate between decimals and commonly encountered fractions – halves, thirds, fourths, fifths, tenths, and hundredths (but not sixths, sevenths, and so on) – in scientific calculations.  c. Judge whether measurements and computations of quantities, such as length, area, volume, weight, or time, are reasonable answers to scientific problems by comparing them to typical values.  **S5-1CS3. Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities.**  a. Choose appropriate common materials for making simple mechanical constructions and repairing things.  b. Measure and mix dry and liquid materials in prescribed amounts, exercising reasonable safety.  c. Use computers, cameras and recording devices for capturing information.  d. Identify and practice accepted safety procedures in manipulating science materials and equipment.  **S5-1CS4. Students will use ideas of system, model, change, and scale in exploring scientific and technological matters.**  a. Observe and describe how parts influence one another in things with many parts.  b. Use geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories to represent corresponding features of objects, events, and processes in the real world. Identify ways in which the representations do not match their original counterparts.  c. Identify patterns of change in things—such as steady, repetitive, or irregular change—using records, tables, or graphs of measurements where appropriate.  d. Identify the biggest and the smallest possible values of something.  **Focus Standards:**  **Specific to 4th...**  S4P3. Students will demonstrate the relationship between the application of a force and the resulting change in position and motion on an object. | * Demonstrate the ability use technology for critical thinking, decision making, communication, collaboration and creativity and innovation. * Use a variety of age-appropriate technologies (drawings, presentation software to communicate and exchange ideas. | **Next Generation Engineering Standards**   * Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials and time. * Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. * Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. | **8 Mathematical Practices of Math**   1. Makes sense of the problem and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics 5. Use appropriate tools strategically 6. Attend to precision. 7. Look for and make use of the structure 8. Look for and express regularity in repeated reasoning.   **National Math Standards**   * Analyze data and obtained from testing different materials to determine which materials have the properties that are best suited for the intended purpose. * Using computational strategies to solve real-world problems cooperatively.   **1st Grade Common -Core Math Standards**   * **I can use the same size non-standards objects as repeating units.** * **I can write a numeral to represent a number of objects.** * **I can represent data in 3 categories.** * **I can practice counting using tally marks.** |

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| **INSTRUCTIONAL STRATEGIES** | **LEARNING TARGETS** | **ESSENTIAL QUESTIONS:** |
| indirect instruction  experiential learning  demonstration  discussion  work-based learning  journals  cooperative learning | -I can work cooperatively as a group  -I can use critical thinking to solve a confronted problem.  -I can learn about aeronautical engineering.  -I can learn how engineering can help solve society’s challenges. | What is an effective water wheel design?  What is force? |

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| **KEY VOCABULARY:** Force, Motion, Velocity, Hydro-power, Water-Wheel |

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| **MATERIALS:** bn |
| **OPENING- (Ask and Imagine Step) 10 minutes** | **EVIDENCE** |
| **Day 1**:   * Handout new engineering worksheet   On Worksheet   * Students write down essential question and hypothesis * Go over vocabulary and write down words and accompanying definitions.   **Mini Lesson:**   * Review Engineering Design Process. * Look at examples of water wheels and discuss the parts that are present.   On Worksheet   * Ask: Identify Problem and Constraints. * Design Criteria: What does the water wheel needs to do? * Constraints: What are the rules to the build?   **Day 2:**   * Review engineering design process. * Review essential questions and vocabulary. | * Student Group Discussions * Engineering Design Process Worksheet Filled out |
| **WORK PERIOD- (Plan and Create) 30 minutes** | **EVIDENCE** |
| **Day 1**:  On Worksheet   * Imagine: Students are asked, “How are you going to solve the problem?” They need to write out a response * Plan: Students need to create a diagram of their water wheel using the worksheet template. Teacher needs to model. * Teacher goes over protocol for getting supplies and behavior expectations. * Create: Begin building   **Day 2:**   * Teacher goes over how to use testing station and to take observational notes while also keeping in mind the improve step. * Students will continue to work on their water wheel. * Test water wheel at testing station. Write down observation notes of performance and note ideas how to improve * Stress to students that any changes made must be one at a time so they can specifically see the resulting changes attributed to the single change. More than one change will result in inconclusive data. | * Blueprint Worksheet * Rockets * Photos * Graphs * Data Log Sheets |
| **CLOSING- ( Improve) 8 minutes** | **EVIDENCE** |
| * Students will take notes from testing and reengineer their water wheel for improved performance. * Test alteration. Singular. | **S**tudent Reflection Sheet with Rubric  Teacher Reflection Survey  Math Extension Activity |