

# Design Thinking/Technology/Career Readiness/Life Skills- 4th Grade

Design and Technology	Time: September-June	Standards:
<p><b>Essential Questions</b></p> <p><b>Zipline Design</b></p> <ul style="list-style-type: none"> <li>• How do gravity and friction affect design?</li> <li>• Why is it useful or important to determine how fast an object is moving towards the ground?</li> <li>• How can you manipulate the speed of an object to ensure the safety and enjoyability of the</li> <li>• object/passengers?</li> </ul> <p><b>Solar Energy</b></p> <ul style="list-style-type: none"> <li>• What is solar energy and how can it be harnessed?</li> <li>• What makes energy “renewable?”</li> <li>• What are the benefits and detriments to solar energy?</li> <li>• What are various design considerations an engineer must consider when designing with solar</li> <li>• energy?</li> <li>• On a local and global scale, what effects could solar power have on the environment?</li> </ul> <p><b>Wind Energy</b></p> <ul style="list-style-type: none"> <li>• What is wind energy and how can it be harnessed?</li> <li>• What makes energy “renewable?”</li> <li>• What are the benefits and detriments to wind energy?</li> <li>• What are various design considerations an engineer must consider when designing with solar</li> <li>• energy?</li> <li>• On a local and global scale, what effects could wind power have on the environment?</li> </ul>	<p><b>Enduring Understandings</b></p> <ul style="list-style-type: none"> <li>• I can individually or collaboratively create two and three-dimensional models employing the elements and principles of the subject material.</li> <li>• I can distinguish pros and cons of different sketches and models.</li> <li>• I can recognize and use various media and materials to represent different models or possible solutions.</li> <li>• I can employ appropriate vocabulary for such categories as solar energy, wind energy, and computer modeling.</li> <li>• I can use basic Solar Energy vocabulary while discussing models.</li> <li>• I can use basic Wind Energy vocabulary while discussing models.</li> <li>• I can use basic 3D printing vocabulary while creating and discussing models.</li> <li>• I can design and describe an object that solves a selected problem.</li> <li>• I can apply the engineering design process to solve a problem.</li> <li>• I can analyze results to figure out how materials and forces affect the design of a zip line transportation/carrying system.</li> <li>• I can analyze results to figure out how materials and weather conditions affect the design of a solar home.</li> <li>• I can analyze results to figure out how materials and weather conditions affect the design of a sail/wind propelled car.</li> <li>• I can reflect on ways to improve an idea or design.</li> </ul>	<p>8.2.5.ED.1: Explain the functions of a system and its subsystems.</p> <p>8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.</p> <p>8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.</p> <p>8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).</p> <p>8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.</p> <p>8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade-offs identified in the design process.</p> <p>8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.</p> <p>8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.</p> <p>8.2.5.ITH.4: Describe a technology/tool that has made the way people live easier or has led to a new business or career.</p> <p>8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.</p> <p>8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.</p> <p>8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.</p> <p>8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.</p>

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## Computer Aided Design

- How is computer technology used to create designs and to effectively communicate ideas?
- How can CAD be used in engineering design and problem solving?
- How can I communicate my design ideas clearly and efficiently?
- How does an object go from an idea to a 3-dimensional, physical object?
- How has (or can) CAD impact the field of engineering and design?
- I can engage in scientific reasoning to predict and understand findings.
- I can utilize Computer Aided Design (CAD) software to design a customized item that can be fabricated using the 3D printer.
- I can explain how CAD and 3D printing can be used in real-world scenarios.
- I can explain how conductors and insulators work with regards to circuitry.
- I can investigate with various materials to determine which are conductors and which are insulators and determine how each will affect their circuit design.
- I can engage in scientific reasoning to predict and understand findings.
- I can reflect on ways to improve the idea.
- I can apply knowledge of electrons, conductors, insulators and circuits and use the Makey Makey board to play different computer games.
- 8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.
- 8.2.5.EC.1: Analyze how technology has contributed to or reduced inequities in local and global communities and determine its short- and long-term effects.
- 9.4.5.TL.3: Format a document using a word processing application to enhance text, change page formatting, and include appropriate images, graphics, or symbols.
- 9.4.5.TL.5: Collaborate digitally to produce an artifact (e.g., 1.2.5.CR1d).
- 9.4.5.IML.2: Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
- 9.4.5.IML.3: Represent the same data in multiple visual formats in order to tell a story about the data.
- 9.4.5.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions
- 9.4.5.CI.2: Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue.
- 9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity.
- 9.4.5.CI.4: Research the development process of a product and identify the role of failure as a part of the creative process.
- 9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process.
- 9.4.5.CT.2: Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.
- 9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global.

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## Benchmark Assessment(s)

- SWBAT complete a Zip Line Design Challenge- Students will build carriers that can safely transport a ping pong ball from a height down to the ground.
- SWBAT complete a Solar Energy activity-Students will design and build models of homes that run on Solar Energy.
- SWBAT complete a Wind Energy activity-Students will design Sail Cars that capitalize on the benefits of Wind Energy.
- SWBAT complete a Computer Aided Design (CAD) & 3D Printing- Students will create and design a 3D model of a keychain to be printed and taken home.

## Other Assessments

- ✓ Teacher observation
- ✓ Class discussions and group work

## Materials

### Building/Modeling Materials: \*

- Stopwatch
- Ruler
- Yarn
- Scissors
- Hole Puncher
- Wind Energy Science Kit
- 3D Printer
- Filament
- Makey Makey Boards
- Ping Pong Ball
- Plastic Straws
- Cups
- Cardboard Tubes
- Construction Paper
- Pipe Cleaners
- Solar Panel
- Glue Stick
- Masking Tape
- Popsicle Sticks
- Aluminum Foil
- Rubber Bands
- Paper Clips
- Graph Paper
- Water Bottles
- Little Suns
- Toilet Paper Tubes
- Paper Plates
- Axles

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## SUGGESTED ACTIVITIES

- Engineering is Elementary (Museum of Science, Boston)
- Google Apps for Littles by Christine Pinto & Alice Keeler
- Solar Energy Defenders
- Google SketchUp or TinkerCAD
- Solar Energy Review Video
- Solar Energy: 1st Slide is Questionnaire Review

## REINFORCEMENT

- Extra practice on devices.
- Pair students with a partner.
- Repeat activities, as needed.

## ENRICHMENT

### Circuitry

- How does electricity work and how can we harness it to complete some of our day-to-day tasks?
- What are electrons, conductors, and insulators and how do they interact to create a working circuit
- and a way to power some of our household items?

## Suggested Websites

- [www.discoveryeducation.com](http://www.discoveryeducation.com)
- [www.brainpopjr.com](http://www.brainpopjr.com)

## Suggested Materials

- ITEEA's Engineering byDesign™ Program

## Cross-Curricular Connections

### Computer Science-

8.1.5.CS.2- Model how computer software and hardware work together as a system to accomplish tasks.

8.1.5.IC.1- Identify computing technologies that have impacted how individuals live and work and describe the factors that influenced the changes.

8.1.5.DA.5 Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

### 21<sup>st</sup> Century Skills –

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

### Science-

3-5-ETS1-1 - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2 - 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.

3-5-ETS1-3 - 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.

4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

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## **English Language Arts-**

NJSLSA.R7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.

NJSLSA.R8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.

RI.4.4. Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.

RI.4.5. Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text

RI.4.7. 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.