# Summit Public Schools
# Summit, New Jersey
# Grade Level 6&7 Content Area: Technical Education
# Course Title: Intro to Technology/ Technical Education
# Length of Course: 9 weeks
# Revised by William Rohrbach 2018
# Curriculum

**Course Description:**
Intro to Technology/Technical Education is a 6th or 7th grade required STEM course designed to introduce students to the world of technology. Students in this introductory class are introduced to the meaning of technology and its relationship to science. They are also introduced to the **Engineering Design Process (EDP)** and its application to solving practical real-world problems. This project-based curriculum focuses on the use of the 21st Century Skills of collaboration, creativity, critical thinking and communication to engineer solutions to a series of problems. Students will follow the 8 step EDP from identification of the problem, through solution brainstorming, design, prototyping and testing and apply them to a design challenge. Students also learn the fundamentals of engineering drawing and create a series of orthographic and isometric drawings. 6th grade students learn gears and other simple machines and build and test Lego™ vehicles; 7th grade students learn gears and other simple machines and build, code and test Lego Mindstorms™ robots. For the final project, students are introduced to basic woodworking hand tools and safety and use computers to produce templates for the final woodworking project. Throughout the course students maintain a professional engineering record (journal) of all activities and projects.

The specific units are:

- The Nature of Technology
- Engineering Design Process
- Engineering Drawing
- Simple Machines/Coding
- Engineering the Solution

**UNIT ONE: The Nature of Technology (1 week)**

| **8.1.8.A. - Technology Operations and Concepts**<br>**8.1.8.B - Creativity and Innovation**<br>**8.1.8.C - Communication and Collaboration**<br>**8.1.8.D Technology, - Digital Citizenship**<br>**8.1.8.E. - Research and Information Fluency**<br>**8.1.8.F – Critical Thinking**<br>**8.2.8.A – Nature of Technology: Creativity and Innovation**<br>**8.2.8.B – Technology and Society**<br>**8.2.8.C.- Design**<br>**8.2.8.D – Abilities for a Technological World**<br>**8.2.8.E- Computational Thinking**<br>**MS-PS-2 Motion & Stability: Forces & Interactions**<br>**MS-PS1-3: Impact of Science, Engineering and Technology on Society**<br>**MS-ETS1 - Engineering Design**<br>**NJSLS Math 8.4, 8.5, 8.6** | |
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| **Big Ideas:** *Course Objectives / Content Statement(s)*<br><br>Technology relates to the man-made world while science relates to the natural world.<br>Engineers use Technology to develop new products and systems<br>Technology to solve one problem sometimes creates new problems<br>A system is a grouping of interrelated parts that work together to produce a desired result | |
| **Essential Questions**<br>*What provocative questions will foster inquiry, understanding, and transfer of learning?* | **Enduring Understandings**<br>*What will students understand about the big ideas?* |
| 1. What is the relationship between technology and science<br><br>2. Can the way technology is used produce unintended consequences?<br><br>3. Why do we study technology?<br><br>4. What is digital citizenship and how does it relate to a middle school student<br><br>5. What is a system and what are its key components? | Students will understand that…<br><br>● Technologists and scientists work cooperatively to solve problems<br>● Technologies, no matter how useful, have intended and unintended consequences that can pose ethical, economic, political, or cultural or environmental issues.<br>● Technological literacy is a necessary 21st century skill<br>● We all have a responsibility to use technology safely and appropriately<br>● A system can be any imaginable size and its size is independent of its complexity |

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| | ● There are guidelines to be followed that ensure safety while working with tools, machines, and materials. |
| **Areas of Focus: Proficiencies (Cumulative Progress Indicators)** | **Examples, Outcomes, Assessments** |
| **Technology Standard 8.1.8.A Technology, Educational Technology: Technology Operations and Concepts**<br>Students demonstrate a sound understanding of technology concepts, systems and operations<br><br>**Technology Standard 8.1.8.B Technology, Educational Technology: Creativity and Innovation**<br>Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.<br><br>**Technology Standard 8.1.8.C Technology, Educational Technology: Communication and collaboration**<br>Students use digital media and environments to communicate and work collaboratively.<br><br>**Technology Standard 8.1.8.D Technology, Educational Technology: Digital Citizenship**<br>Students advocate and practice safe, legal and responsible use of information and technology.<br><br>**Technology Standard 8.1.8.E Technology, Educational Technology: Research and Information Fluency**<br>Students use digital tools to gather, evaluate and use information.<br><br>**Technology Standard 8.1.8.F Technology, Educational Technology: Critical Thinking**<br>Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions. | Instructional Focus:<br>● The core concepts and operations of technology.<br>● The difference between the man-made world and the natural world.<br>● Differentiate between the role of a scientist and the role of an engineer.<br>● The rationale for learning technology and the meaning of technological literacy<br>● The various components of a system and how they interrelate to produce a result<br><br>Sample Assessments:<br>● Vocabulary quiz<br>● Engineering Journal Review<br>● Collaborative Group Response (Describe your experience, share new ideas, etc.)<br>● Brainstorming session on a lighting system<br>● Teacher observation<br><br>Instructional Strategies:<br>● Reading Comprehension Activity<br>● Students watch the video “What is Technology”<br>● Collaborative activity: students brainstorm why technology is important at school and at home.<br>● Students read Chapter 1 from the text “Technology Education”.<br>● Students complete and review the vocabulary quiz.<br>● Journal Entries: quiz responses will be written in students’ Engineering Design notebooks<br><br>Interdisciplinary Connections<br>● Engineering – Create a design brief for a lighting system |

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| **Technology Standard 8.2.8.A Technology, Education, Engineering and Design: Nature of Technology: Creativity and Innovation** Technology products and systems impact every aspect of the world in which they live.<br><br>**Technology Standard 8.2.8.B Technology, Educational Technology, Technology and Society:** Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in a global society.<br><br>**Technology Standard 8.2.8.C Technology, Education, Engineering and Design: Critical Thinking, Problem Solving, and Decision-Making** The design process is a systematic approach to solving problems.<br><br>**Technology Standard 8.2.8.D Technology, Educational Technology: Abilities for a Technological World** The designed world is the product of a design process that provides the means to convert resources into products and systems<br><br>**Technology Standard 8.2.8.E Technology, Education, Engineering and Design: Communication and Collaboration** Digital tools facilitate local and global communication and collaboration in designing products and systems.<br><br>**NGSS Standard MS-PS2-** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.<br><br>**NGSS Standard MS - ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, considering relevant scientific principles and potential impacts on | ● Science concepts – Brainstorm the differences between objects in the man-made world and objects in the natural world.<br>● Language Arts – Read, comprehend and understand technology/science related vocabulary.<br><br>Technology Integration<br>● Exploration: students observe and discuss the positive and negative impacts of technology and consider the associated ethical, societal, economic, political and cultural issues<br>● Research the impacts of technology and the issues that surface after the technology has been developed<br><br>Global Perspectives<br>● Engineers and scientists in different countries collaborate to solve problems<br>● Students can work in groups to research and gather information about three controversial technologies that have been featured "in the news"<br>● There are implications of all invention; even positive intentions can turn negative and must be monitored through the engineering and design process.<br>● When invention and innovation are present in a society, society itself must adapt to provide venue a for them.<br><br>Culturally Responsive Teaching<br>● Digital Citizenship and in particular protection of intellectual property is a basic tenant of society worldwide. |

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| people and natural environment that may limit possible solutions.<br><br>**NGSS Standard MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.<br><br>**NJSLS Math Practice 8.4 - Model with Math**<br>Identify important quantities in practical situations and map their relationships<br><br>**NJSLS Math Practice 8.5 – Use Tools Strategically**<br>Use tools to solve a mathematical problem. Tools may include pencils, paper, rulers, protractor, calculator, spread sheet etc.<br><br>**NJSLS Math Practice 8.6 Attend to Precision**<br>Use clear definitions in discussion with others and in reasoning. Use care in specifying units of measure. | |
| The following skills and themes listed to the right should be reflected in the design of units and lessons for this course or content area. | **21st Century Skills:**<br>Creativity and Innovation<br>Critical Thinking and Problem Solving<br>Communication and Collaboration<br>Information Literacy<br>Media Literacy<br>Life and Career Skills<br>**21st Century Themes:**<br>Financial, Economic, Business, and Entrepreneurial Literacy<br>Civic Literacy<br>Health Literacy<br><br>S.T.E.A.M<br>Science, Technology, Engineering, Art, Mathematics |

**UNIT TWO: Engineering Design Process – Project Tower building (1 week)**

**8.1.8.A. - Technology Operations and Concepts**
**8.1.8.B - Creativity and Innovation**
**8.1.8.C. - Communication and Collaboration**
**8.1.8.D Technology, - Digital Citizenship**
**8.1.8.E - Research and Information Fluency**
**8.1.8.F – Critical Thinking**
**8.2.8.A – Nature of Technology: Creativity and Innovation**
**8.2.8.B – Technology and Society**
**8.2.8.C- Design**
**8.2.8.D – Abilities for a Technological World**
**8.2.8.E- Computational Thinking**
**MS-PS-2 Motion & Stability: Forces & Interactions**
**MS-PS1-3: Impact of Science, Engineering and Technology on Society**
**MS-ETS1 - Engineering Design**
**NJSLS Math 8.4, 8.5, 8.6**

**Big Ideas:** *Course Objectives / Content Statement(s)*

The Engineering Design Process is a series of steps that guides engineering teams as they solve problems. The design process is iterative, meaning that teams may need to repeat steps as needed, making improvements along the way as they learn from failure.

| **Essential Questions**<br>*What provocative questions will foster inquiry, understanding, and transfer of learning?* | **Enduring Understandings**<br>*What will students understand about the big ideas?* |
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| 1. What are the steps of the Engineering Design Process<br><br>2. Why do engineering teams follow a process<br><br>3.How does diversity impact the efficacy of the team<br><br>3. How do criteria and constraints impact a design?<br><br>4. How can we apply the Engineering design process to design and prototype a model tower | Students will understand that…<br><br>● The Engineering Design Process is an iterative systematic problem-solving strategy, with criteria and constraints.<br><br>● How the design process is used to solve real-world problems<br><br>● There are no bad ideas<br><br>● The importance of sketches, engineering drawings and engineering journals |

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| | ● Technological advances have flaws and there is no perfect design<br><br>● Failure is an essential part of the process |
| **Areas of Focus: Proficiencies (Cumulative Progress Indicators)** | **Examples, Outcomes, Assessments** |
| **Technology Standard 8.1.8.A Technology, Educational Technology: Technology Operations and Concepts**<br>Students demonstrate a sound understanding of technology concepts, systems and operations<br><br>**Technology Standard 8.1.8.B Technology, Educational Technology: Creativity and Innovation**<br>Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.<br><br>**Technology Standard 8.1.8.C Technology, Educational Technology: Communication and collaboration**<br>Students use digital media and environments to communicate and work collaboratively.<br><br>**Technology Standard 8.1.8.D Technology, Educational Technology: Digital Citizenship**<br>Students advocate and practice safe, legal and responsible use of information and technology.<br><br>**Technology Standard 8.1.8.E Technology, Educational Technology: Research and Information Fluency**<br>Students use digital tools to gather, evaluate and use information.<br><br>**Technology Standard 8.1.8.F Technology, Educational Technology: Critical Thinking**<br>Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions. | Instructional Focus:<br>● Understand the core concepts of technology and technology systems<br>● Work productively in collaborative groups<br>● Brainstorming techniques<br>● Identify the 8 steps of the Engineering design process<br>● Identify criteria and constraints of the design process<br>● Requirements for a design include both criteria and constraints<br><br>Sample Assessments:<br>● Engineering Design Process Quiz<br>● Tower Building Project Assessed in accordance with the Paper Tower grading rubric.<br><br>Instructional Strategies:<br>● Requirements for a design include both criteria and constraints<br>● Students watch the NASA video series “The Engineering design Process”<br>● Identify and describe the major steps in the Engineering Process<br>● Complete the design process quiz.<br>● Students watch the video “Building the Eiffel Tower”<br>● Students use Chromebooks to research tower designs.<br>● Students working in groups of two brainstorm a tower design made |

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| **Technology Standard 8.2.8.A Technology, Education, Engineering and Design: Nature of Technology: Creativity and Innovation** Technology products and systems impact every aspect of the world in which they live.<br><br>**Technology Standard 8.2.8.B Technology, Educational Technology, Technology and Society:** Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in a global society.<br><br>**Technology Standard 8.2.8.C Technology, Education, Engineering and Design: Critical Thinking, Problem Solving, and Decision-Making** The design process is a systematic approach to solving problems.<br><br>**Technology Standard 8.2.8.D Technology, Educational Technology: Abilities for a Technological World**<br>The designed world is the product of a design process that provides the means to convert resources into products and systems<br><br>**Technology Standard 8.2.8.E Technology, Education, Engineering and Design: Communication and Collaboration**<br>Digital tools facilitate local and global communication and collaboration in designing products and systems.<br><br>**NGSS Standard MS - ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, considering the relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions.<br><br>**NGSS Standard MS-ETS1-2** Evaluate competing design solutions using a systematic | from 3 sheets of copy paper and 12 inches of masking tape.<br>● Students record their sketches in their engineering journals.<br>● Student groups build their towers during one class period.<br>● Students brainstorm why some towers achieved greater height.<br>● Students brainstorm methods for improving their designs and report to the class.<br>● Research: key words and concepts associated with efficient designs (force, compression, tension, reinforcing, lamination, structural profiles)<br><br>Interdisciplinary Connections<br>● Engineering - sketches, concept drawings, scale drawings, prototype model, data and testing<br>● Math – measurements, center of a rectangle<br>● Science – free body diagrams of the effect of gravity on a non-perpendicular tower.<br>● Science - Newton's Laws relative to force and motion<br>● Art - Aesthetically appealing design of a truss bridge<br><br>Technology Integration<br>● Chromebooks for research on towers and materials<br>● Google Drive for collaboration, brainstorming of ideas, analysis of data, maintaining log and portfolio, communication of results<br><br>Global Perspectives<br>● Architects and engineers use the same drawing methods to convey their ideas to others |

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| process to determine how well they meet the criteria and constraints of the problem.<br><br>**NGSS Standard MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.<br><br>**NJSLS Math Practice 8.4 - Model with Math**<br>Identify important quantities in practical situations and map their relationships<br><br>**NJSLS Math Practice 8.5 – Use Tools Strategically**<br>Use tools to solve a mathematical problem. Tools may include pencils, paper, rulers, protractor, calculator, spread sheet etc.<br><br>**NJSLS Math Practice 8.6 Attend to Precision**<br>Use clear definitions in discussion with others and in reasoning. Use care in specifying units of measure. | ● Scientists and engineers use the same design process globally<br>● There is a universal language of design and measurement using the metric system of measurement<br>● Drawings and renderings of a design must be drawn accurately to scale and dimensionally precise to allow for success in the manufacturing process worldwide.<br><br>Culturally Responsive Teaching<br>● Different cultures have historically viewed towers as great engineering accomplishments and even as religious monuments. |
| The following skills and themes listed to the right should be reflected in the design of units and lessons for this course or content area. | 21st Century Skills:<br>Creativity and Innovation<br>Critical Thinking and Problem Solving<br>Communication and Collaboration<br>Information Literacy<br>Media Literacy<br>Life and Career Skills<br><br>21st Century Themes (as applies to content area):<br>Financial, Economic, Business, and Entrepreneurial Literacy<br>Civic Literacy<br>Health Literacy<br>S.T.E.A.M. Science, Technology, Engineering, Arts, Mathematics |

**UNIT Three: Engineering Drawing (2 weeks)**

| **8.1.8.A. - Technology Operations and Concepts**<br>**8.1.8.B - Creativity and Innovation**<br>**8.1.8.C - Communication and Collaboration**<br>**8.1.8.D - Technology, - Digital Citizenship**<br>**8.1.8.E. - Research and Information Fluency**<br>**8.1.8.F – Critical Thinking**<br>**8.2.8.A – Nature of Technology: Creativity and Innovation**<br>**8.2.8.B – Technology and Society**<br>**8.2.8.C - Design**<br>**8.2.8.D – Abilities for a Technological World**<br>**8.2.8.E- Computational Thinking**<br>**MS-ETS1 - Engineering Design**<br>**NJSLS Math 8.G**<br>**NJSLS Math 8.4, 8.5, 8.6** | |
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| **Big Ideas:** *Course Objectives / Content Statement(s)*<br><br>Engineering Drawings are the international language of the engineer/designer. Accurately drawn and dimensioned drawings, drawn to convention, enable the communication and subsequent manufacture of a design globally. | |
| **Essential Questions**<br>*What provocative questions will foster inquiry, understanding, and transfer of learning?* | **Enduring Understandings**<br>*What will students understand about the big ideas?* |
| 1. Why should every design begin with concept sketches and basic drawings<br><br>2. What do we mean by drawing convention<br><br>3. What types of information are communicated through drawing technology?<br><br>4.How has CAD impacted the design process | Students will understand<br><br>● Creativity and technology are important to inventions and innovations<br>● Drawings made to “convention “are readable and interpretable globally.<br>● Computer Aided Design (CAD) has streamlined and accelerated the engineering drawing process<br>● The importance of dimensions in modeling |

| Areas of Focus: Proficiencies (Cumulative Progress Indicators) | Examples, Outcomes, Assessments |
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| **Technology Standard 8.1.8.A**<br>**Technology, Educational Technology: Technology Operations and Concepts**<br>Students demonstrate a sound understanding of technology concepts, systems and operations<br><br>**Technology Standard 8.1.8.B**<br>**Technology, Educational Technology: Creativity and Innovation**<br>Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.<br><br>**Technology Standard 8.1.8.C**<br>**Technology, Educational Technology: Communication and collaboration**<br>Students use digital media and environments to communicate and work collaboratively.<br><br>**Technology Standard 8.1.8.D**<br>**Technology, Educational Technology: Digital Citizenship**<br>Students advocate and practice safe, legal and responsible use of information and technology.<br><br>**Technology Standard 8.1.8.E**<br>**Technology, Educational Technology: Research and Information Fluency**<br>Students use digital tools to gather, evaluate and use information.<br><br>**Technology Standard 8.1.8.F**<br>**Technology, Educational Technology: Critical Thinking**<br>Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions. | Instructional Focus:<br>● The meaning of convention and its importance globally<br>● The language of line types<br>● The three views of a conventional orthographic drawing<br>● The importance of proper dimensioning and the importance and contents of a title block<br>● The relationship between orthographic and isometric projection.<br><br>Sample Assessments:<br>● Line quiz<br>● Front View drawing<br>● Top View drawing<br>● Right side View Drawing<br>● Three View Drawing<br>● Isometric Drawing<br>● Engineering Journal evaluation<br><br>Instructional Strategies:<br>● Watch the video “Engineering Drawing Line Types”<br>● Use Chromebooks to complete the interactive exercise “Interpreting Engineering Drawings”<br>● Students complete the “Line Quiz”.<br>● Watch the video “3 View Drawings 101”<br>● Complete the exercise “How to Draw a Front View”<br>● Complete the exercise “How to Draw a Top View”<br>● Complete the exercise “How to Draw a Right-Side View”<br>● Create a 3-view drawing of an object using pencils, rulers or triangles, templates and graph paper.<br>● Watch the Video “Creating an Isometric Drawing from a Standard Orthographic Drawing”. |

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| **Technology Standard 8.2.8.A**<br>**Technology, Education, Engineering and Design: Nature of Technology: Creativity and Innovation** Technology products and systems impact every aspect of the world in which they live.<br><br>**Technology Standard 8.2.8.B**<br>**Technology, Educational Technology, Technology and Society:** Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in a global society.<br><br>**Technology Standard 8.2.8.C**<br>**Technology, Education, Engineering and Design: Critical Thinking, Problem Solving, and Decision-Making** The design process is a systematic approach to solving problems.<br><br>**Technology Standard 8.2.8.D**<br>**Technology, Educational Technology: Abilities for a Technological World**<br>The designed world is the product of a design process that provides the means to convert resources into products and systems<br><br>**Technology Standard 8.2.8.E**<br>**Technology, Education, Engineering and Design: Communication and Collaboration**<br>Digital tools facilitate local and global communication and collaboration in designing products and systems.<br><br>**NGSS Standard MS - ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, considering the relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions. | ● Watch the Tinkercad ™ Tutorial<br><br>Interdisciplinary Connections<br>● Mathematics - measurement of all requirements and constraints Mathematics - reading and developing scale drawings<br>● Art - Drawing Methods<br>● Art - Exploration of Design<br>● Language Arts – Engineering Drawing vocabulary<br>● Engineering - Iterative process of redesign to increase accuracy and efficiency.<br><br>Technology Integration<br>● Chromebooks for interactive exercises.<br>● Overhead projector for videos and illustrations.<br>● Tinkercad™ and 3D printing.<br><br>Global Perspectives<br>● Models and drawings of conceptual innovations and inventions must be clear in objective as it is often the first step to engineering as projects need capital for funding.<br>● Ideas for innovations and inventions must be thought of from a global and cultural perspective before manufacture There is a universal language of design and measurement drawing convention.<br>● Drawings and renderings of an innovation and invention must be drawn accurately to scale and be precise to allow for success in the manufacturing process.<br><br>Culturally Responsive Teaching<br>● Engineering drawings may be dimensioned using a different standard (metric) by other cultures. |

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| **NJSLS Math Content 8.G.C.9**<br>Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems<br><br>**NJSLS Math Practice 8.4 - Model with Math**<br>Identify important quantities in practical situations and map their relationships<br><br>**NJSLS Math Practice 8.5 – Use Tools Strategically**<br>Use tools to solve a mathematical problem. Tools may include pencils, paper, rulers, protractor, calculator, spread sheet etc.<br><br>**NJSLS Math Practice 8.6 Attend to Precision**<br>Use clear definitions in discussion with others and in reasoning. Use care in specifying units of measure.<br><br>The following skills and themes listed to the right should be reflected in the design of units and lessons for this course or content area. | 21st Century Skills:<br>Creativity and Innovation<br>Critical Thinking and Problem Solving<br>Communication and Collaboration<br>Information Literacy<br>Media Literacy<br>Life and Career Skills<br><br>21st Century Themes:<br>Financial, Economic, Business, and Entrepreneurial Literacy<br>Civic Literacy<br>Health Literacy<br>S.T.E.A.M. - Science, Technology, Engineering, Arts, Mathematics |

**UNIT Four: Simple Machines/Robots (2 weeks)**

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<tr><td colspan="2">8.1.8.A. - Technology Operations and Concepts<br>8.1.8.B - Creativity and Innovation<br>8.1.8.C - Communication and Collaboration<br>8.1.8.D Technology, - Digital Citizenship<br>8.1.8.E. - Research and Information Fluency<br>8.1.8.F – Critical Thinking<br>8.2.8.A – Nature of Technology: Creativity and Innovation<br>8.2.8.B – Technology and Society<br>8.2.8.C - Design<br>8.2.8.D – Abilities for a Technological World<br>8.2.8.E- Computational Thinking<br>MS-ETS1 - Engineering Design<br>NJSLS Math 8.G<br>NJSLS Math 8.4, 8.5, 8.6</td></tr>
<tr><td colspan="2">Big Ideas: Course Objectives / Content Statement(s)<br>A simple machine is a mechanical device that changes the direction or magnitude of a force. Simple machines like gears are found in most complex machines designed to perform specific actions.<br>Robots are complex machines that perform a series of actions automatically.</td></tr>
<tr><td>Essential Questions<br>What provocative questions will foster inquiry, understanding, and transfer of learning?</td><td>Enduring Understandings<br>What will students understand about the big ideas?</td></tr>
<tr><td>1. What are simple machines and how can they be used?<br><br>2. What are the four things gears are able to do?<br><br>3. What is a gear train and how are they designed to produce different outputs?<br><br>4. How is the gear train in a tractor different from a gear train in a dragster?<br><br>For grade 7:<br><br>5. What differentiates a robot from other complex machines?</td><td>Students will understand that…<br><br>● Simple machines like gears are essential to almost all modern machinery<br>● Different gear types offer different capabilities and are used in different applications.<br>● Gear trains are based on ratios and these ratios can be calculated.<br>● Different machines require different gear ratios.<br><br>For Grade 7<br><br>● Robots are complex machines that are controlled by a computer program.</td></tr>
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| Areas of Focus: Proficiencies (Cumulative Progress Indicators) | Examples, Outcomes, Assessments |
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| **Technology Standard 8.2.8.B**<br>**Technology, Educational Technology, Technology and Society:** Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in a global society.<br><br>**Technology Standard 8.2.8.C**<br>**Technology, Education, Engineering and Design: Critical Thinking, Problem Solving, and Decision-Making** The design process is a systematic approach to solving problems.<br><br>**Technology Standard 8.2.8.D**<br>**Technology, Educational Technology: Abilities for a Technological World**<br>The designed world is the product of a design process that provides the means to convert resources into products and systems<br><br>**Technology Standard 8.2.8.E**<br>**Technology, Education, Engineering and Design: Communication and Collaboration**<br>Digital tools facilitate local and global communication and collaboration in designing products and systems.<br><br>**NGSS Standard MS - ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, considering relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions.<br><br>**NGSS Standard MS-ETS1-2** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.<br><br>**NGSS Standard MS-ETS1-4** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. | ● Brainstorm the reasons why some tractors pulled more weight.<br>And/or<br>● Using Lego™ instruction booklet #18, build a dragster for high speed low torque.<br>● Race the dragsters in heats of 2 each and record times.<br>● Calculate average speed in MPH.<br>● Brainstorm the reasons why some dragsters were faster than others.<br>For Grade 7<br>● Organize class into teams of 2.<br>● Conduct a Lego Mindstorms™ kit inventory.<br>● Using Chromebooks review the Lego Mindstorms™ curriculum for building an EV3 robot with touch, color and ultrasonic sensors<br>● Organize into teams of two and build the Lego Mindstorms™ robot.<br>● Write pseudocode representing the specific challenge.<br>● Using Chromebooks review the Lego Mindstorms ™ curriculum for coding the EV3 robot to conduct a “follow a line” challenge and/or completing the “color selector” challenge.<br><br>Interdisciplinary Connections<br>● Mathematics - measurement of all requirements, calculating speed, distance, ratios, circumference<br>● Art - Drawing Methods<br>● Art - Exploration of Design<br>● Engineering - Iterative process of redesign to increase accuracy and efficiency.<br>● Computer Programming – Develop an algorithm to solve an assigned problem using a specified set of commands. |

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| **NJSLS Math Content 8.G.C.9**<br>Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems<br><br>**NJSLS Math Practice 8.4 - Model with Math**<br>Identify important quantities in practical situations and map their relationships<br><br>**NJSLS Math Practice 8.5 – Use Tools Strategically**<br>Use tools to solve a mathematical problem. Tools may include pencils, paper, rulers, protractor, calculator, spread sheet etc.<br><br>**NJSLS Math Practice 8.6 Attend to Precision**<br>Use clear definitions in discussion with others and in reasoning. Use care in specifying units of measure.<br><br>The following skills and themes listed to the right should be reflected in the design of units and lessons for this course or content area. | Technology Integration<br>● Chromebooks for interactive exercises.<br>● Chromebooks for following tutorials<br>● Chromebooks for coding robots<br>● Robots for completing assigned challenges.<br>● Overhead projector for videos and illustrations.<br><br>Global Perspectives<br>● Ideas for innovations and inventions must be thought of from a global and cultural perspective before manufacture.<br>● Pseudocode and robotic coding are a universally adopted way of converting ideas into machine instructions.<br><br>Culturally Responsive Teaching<br>● Pseudocode and robotic coding are a universally adopted way of converting ideas into machine instructions that transcend language.<br><br>21st Century Skills:<br>Creativity and Innovation<br>Critical Thinking and Problem Solving<br>21st Century Themes<br>Financial, Economic, Business, and Entrepreneurial Literacy<br>Civic Literacy<br>Health Literacy<br>S.T.E.A.M-Science, Technology, Engineering, Arts, Mathematics |

**UNIT FIVE**: **Engineering the Solution (3 weeks)**

<table>
<tr><td colspan="2">8.1.8.A. - Technology Operations and Concepts<br>8.1.8.B - Creativity and Innovation<br>8.1.8.C - Communication and Collaboration<br>8.1.8.D Technology, - Digital Citizenship<br>8.1.8.E - Research and Information Fluency<br>8.1.8.F – Critical Thinking<br>8.2.8.A – Nature of Technology: Creativity and Innovation<br>8.2.8.B – Technology and Society<br>8.2.8.C- Design<br>8.2.8.D – Abilities for a Technological World<br>8.2.8.E- Computational Thinking<br>MS-ETS1 - Engineering Design<br>NJSLS Math 8.4, 8.5, 8.6</td></tr>
<tr><td colspan="2">Big Ideas: Course Objectives / Content Statement(s)<br><br>Wood is a renewable resource that is readily available in North America. Most wood species can be cut and shaped relatively easily. Wood comes in many different colors and grain patterns and can be finished to produce a pleasing appearance. Wood is a very important construction product that can be quite strong.</td></tr>
<tr><td>Essential Questions<br>What provocative questions will foster inquiry, understanding, and transfer of learning?</td><td>Enduring Understandings<br>What will students understand about the big ideas?</td></tr>
<tr><td>1. What is wood and where does it come from?<br><br>2. Why is wood described as a renewable resource?<br><br>3. What is the difference between soft woods and hardwoods and what species of trees produce each type?<br><br>4. What are the ways wood can be manipulated to produce a finished product?<br><br>5. What are some common hand and machine woodworking tool and how can they be used safely?</td><td>Students will understand that…<br><br>● A proper engineering drawing or computer-generated template is an essential first step in producing any product.<br>● The choice of wood type and grain direction will impact the products durability.<br>● Hand and machine tools make the production of a wood product possible.<br>● Safety when working with tools and machines is always the first priority.<br>● Care, patience and attention to detail have a material impact on the aesthetic nature of the finished product.<br>● Wood finishing improves the aesthetics, and adds durability and preservation to the product.</td></tr>
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| Areas of Focus: Proficiencies (Cumulative Progress Indicators) | Examples, Outcomes, Assessments |
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| **Technology Standard 8.1.8.A**<br>**Technology, Educational Technology: Technology Operations and Concepts**<br>Students demonstrate a sound understanding of technology concepts, systems and operations<br><br>**Technology Standard 8.1.8.B**<br>**Technology, Educational Technology: Creativity and Innovation**<br>Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.<br><br>**Technology Standard 8.1.8.C**<br>**Technology, Educational Technology: Communication and collaboration**<br>Students use digital media and environments to communicate and work collaboratively.<br><br>**Technology Standard 8.1.8.D**<br>**Technology, Educational Technology: Digital Citizenship**<br>Students advocate and practice safe, legal and responsible use of information and technology.<br><br>**Technology Standard 8.1.8.E**<br>**Technology, Educational Technology: Research and Information Fluency**<br>Students use digital tools to gather, evaluate and use information.<br><br>**Technology Standard 8.1.8.F**<br>**Technology, Educational Technology: Critical Thinking**<br>Students use critical thinking skills to plan and conduct research, manage projects, solve problems and make informed decisions. | Instructional Focus:<br>● Application of the design process.<br>● Engineering drawings or computer-generated templates.<br>● Hand and power woodworking tools and machines, shop safety and discipline.<br>● How to properly use each tool to achieve a desired result.<br>● How to decorate and finish wood products.<br>● Projects: wooden name plaque or wooden key holder.<br>● Evaluation of the design, determine accuracy and consistency<br><br>Sample Assessments:<br>● Wooden plaque of 5-7 letters using coping saws, drill presses, scroll saws, files and sandpaper, or:<br>Key holder using coping saws, drill presses, scroll saws, files and sandpaper.<br>● Assessment according to either the Plaque grading rubric or the key holder grading rubric.<br><br>Instructional Strategies:<br>● Compare/Contrast: The differences between a designer and engineer<br>● Explore wood types and their density and the kinds of trees that produce them.<br>● Students watch the video" Types of Woods"<br>● Grain structure and how to work on wood based on grain orientation.<br>● Proper and safe use of woodworking hand tools and machines.<br><br>● Benchmark Lessons (Whole Group): Students will watch the Videos "How to use the Drill Press", "Scroll Saw |

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| **Technology Standard 8.2.8.A Technology, Education, Engineering and Design: Nature of Technology: Creativity and Innovation** Technology products and systems impact every aspect of the world in which they live.<br><br>**Technology Standard 8.2.8.B Technology, Educational Technology, Technology and Society:** Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in a global society.<br><br>**Technology Standard 8.2.8.C Technology, Education, Engineering and Design: Critical Thinking, Problem Solving, and Decision-Making** The design process is a systematic approach to solving problems.<br><br>**Technology Standard 8.2.8.D Technology, Educational Technology: Abilities for a Technological World** The designed world is the product of a design process that provides the means to convert resources into products and systems<br><br>**Technology Standard 8.2.8.E Technology, Education, Engineering and Design: Communication and Collaboration** Digital tools facilitate local and global communication and collaboration in designing products and systems.<br><br>**NGSS Standard MS - ETS1-1** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, considering relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions. | Safety", How to use a Coping Saw"; teacher demonstrates each.<br>● Use Chromebooks to research key design.<br>● Complete the drawing or use Computers to select and print letters of print key template. or template, attach to the wood, fashion the product, decorate and finish.<br><br>Interdisciplinary Connections<br>● Mathematics - measurement of all requirements and constraints Mathematics - reading and developing scale drawings<br>● Art - Profile and top views (Perspective Drawing)<br>● Art - Exploration of Design<br>● Science – Natural Products<br><br>Global Perspectives<br>● Architects and engineers use the same drawing methods to convey their ideas to others<br>● Scientists and engineers all use the same design process all over the world<br>● There is a universal language of design and measurement. Drawings and renderings of an innovation and invention must be drawn accurately to scale and be precise to allow for success in the manufacturing process<br>● Wood is a global resource used in: building, manufacturing, making art, furniture etc., all over the world.<br><br>**Culturally Responsive Teaching**:<br>● How people manipulate the wood is different all over the world and is a function of availability.<br>● A short survey will be given to assess prior knowledge and woodworking experience of students. |

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| **NJSLS Math Practice 8.4 - Model with Math**<br>Identify important quantities in practical situations and map their relationships<br><br>**NJSLS Math Practice 8.5 – Use Tools Strategically**<br>Use tools to solve a mathematical problem. Tools may include pencils, paper, rulers, protractor, calculator, spread sheet etc.<br><br>**NJSLS Math Practice 8.6 Attend to Precision**<br>Use clear definitions in discussion with others and in reasoning. Use care in specifying units of measure. | |
| The following skills and themes listed to the right should be reflected in the design of units and lessons for this course or content area. | 21st Century Skills:<br>Creativity and Innovation<br>Critical Thinking and Problem Solving<br>Communication and Collaboration<br>Information Literacy<br>Media Literacy<br>Life and Career Skills<br><br>21st Century Themes (as applied to content area):<br>Financial, Economic, Business, and Entrepreneurial Literacy<br>Civic Literacy<br>Health Literacy<br>S.T.E.A.M. (Science, Technology, Engineering, Arts, Mathematics) |

## Curricular Addendum

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| **Career-Ready Practices**<br>**CRP1**: Act as a responsible and contributing citizen and employee.<br>**CRP2**: Apply appropriate academic and technical skills.<br>**CRP3**: Attend to personal health and financial well-being.<br>**CRP4**: Communicate clearly and effectively and with reason.<br>**CRP5**: Consider the environmental, social and | **Interdisciplinary Connections**<br>● Close Reading of works of art, music lyrics, videos, and advertisements<br>● Use Standards for Mathematical Practice and Cross-Cutting Concepts in science to support debate/inquiry across thinking processes<br><br>**Technology Integration**<br>Ongoing: |

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.
**CRP9**: Model integrity, ethical leadership and effective management.
**CRP10**: Plan education and career paths aligned to personal goals.
**CRP11**:. Use technology to enhance productivity.
**CRP12**: Work productively in teams while using cultural global competence.

- Listen to books on CDs, Playaways, videos, or podcasts if available.
- Use document camera or overhead projector for shared reading of texts.

Other:

- Use Microsoft Word, Inspiration, or SmartBoard Notebook software to write the words from their word sorts.
- Use available technology to create concept maps of unit learning.

**Instructional Strategies:**
**Supports for English Language Learners:**

| Sensory Supports | Graphic Supports | Interactive Supports |
|---|---|---|
| Real-life objects (realia) | Charts | In pairs or partners |
| Manipulatives | Graphic organizers | In triads or small groups |
| Pictures & photographs | Tables | In a whole group |
| Illustrations, diagrams, & drawings | Graphs | Using cooperative group |
| Magazines & newspapers | Timelines | structures |
| Physical activities | Number lines | With the Internet (websites) or software programs |
| Videos & films | | In the home language |
| Broadcasts | | With mentors |
| Models & figures | | |

from https://wida.wisc.edu

**Media Literacy Integration**

- Use multiple forms of print media (including books, illustrations/photographs/artwork, video clips, commercials, podcasts, audiobooks, Playaways, newspapers, magazines) to practice reading and comprehension skills.

**Global Perspectives**

- The Global Learning Resource Library

**Differentiation Strategies:**

| Accommodations | Interventions | Modifications |
|---|---|---|
| Allow for verbal responses | Multi-sensory techniques | Modified tasks/ expectations |
| Repeat/confirm directions | Increase task structure (e.g., directions, checks for understanding, feedback) | Differentiated materials |
| Permit response provided via computer or electronic device | Increase opportunities to engage in active academic responding (e.g., writing, reading aloud, answering questions in class) | Individualized assessment tools based on student need |
| Audio Books | Utilize prereading strategies and activities: previews, anticipatory guides, and semantic mapping | Modified assessment grading |