

BD Course Guide

Course Description: Grade 6, PLTW Design and Modeling

In this unit, students begin to recognize the value of an engineering notebook to document and capture their ideas. They are introduced to and use the design process to solve problems and understand the influence that creative and innovative design has on our lives. Students use industry standard 3D modeling software to create a virtual image of their designs and produce a portfolio to showcase their creative solutions. Students are challenged and empowered to use and apply what they've learned throughout the unit to design a therapeutic toy for a child who has cerebral palsy.

This class promotes critical thinking, creativity, innovation, and real-world problem solving skills in students. The hands-on, project-based program engages students on multiple levels, exposes them to areas of study that they typically do not pursue, and provides them with a foundation and proven path to college and career success.

Adopted Course Primary Resource	Supplementary Resources
<ul style="list-style-type: none">Design and Modeling PLTW online course www.pltw.org	<ul style="list-style-type: none">Notebook, course materials, timers, measuring tools (dial calipers, rulers with metric and US Customary)Project based consumables (mechanical pencils, folders, tapes, toy making supplies, paints, paper products, etc.)

Standards Addressed In The Course (Note Essential Standards)		
English Language Arts	Reading	Key ideas and details
		Text Types and Purposes
		Comprehension and Collaboration Conventions of Standard English
Technological Literacy	What is Engineering	Students will develop an understanding of the characteristics and scope of technology Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study. Students will develop an understanding of the cultural, social, economic, and political effects of technology. Students will develop an understanding of the role of society in the development and use of technology.

	Design Process	<p>Students will develop an understanding of the attributes of design.</p> <p>Students will develop an understanding of engineering design.</p> <p>Students will develop the abilities to apply the design process.</p>
	<p>Measurement</p> <p>Designing for Production</p>	<p>Students will develop an understanding of the role of society in the development and use of technology.</p> <p>Students will develop an understanding of the influence of technology on history.</p> <p>Students will develop the abilities to use and maintain technological products and systems.</p> <p>Students will develop the abilities to assess the impact of products and systems.</p> <p>Students will develop the abilities to apply the design process.</p> <p>Students will develop an understanding of and be able to select and use information and communication technologies.</p> <p>Students will develop an understanding of the attributes of design.</p> <p>Students will develop an understanding of engineering design.</p> <p>Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.</p> <p>Students will develop the abilities to apply the design process.</p> <p>Students will develop the abilities to use and maintain technological products and systems.</p> <p>Students will develop an understanding of and be able to select and use information and communication technologies.</p>
Science		<p>Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.</p>

		Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
		<p>Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.</p> <p>Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.</p> <p>Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success</p> <p>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.</p>
Math	What is Engineering	
	Design Process	
	Measurement	Understand congruence and similarity using physical models, transparencies, or geometry software.
	Designing for Production	Understand congruence and similarity using physical models, transparencies, or geometry software.

Units of Study (Sequenced)	Standards Associated	Key Learning Targets & Essential Vocabulary	Essential Question(s)	Pacing
<p>Lesson 1: Introduction to Design</p> <p>Foot Orthosis Instant Design Challenge</p>	<p>English</p> <p>Technological Literacy</p> <p>Math</p> <p>Science</p>	<p>New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.</p> <p>The development of technology is a human activity and is the result of individual and collective needs and the ability to be creative.</p> <p>Technology is closely linked to creativity, which has resulted in innovation.</p> <p>Requirements for design are made up of criteria and constraints.</p> <p>Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum</p> <p>Modeling, testing, evaluating and modifying are used to transform ideas into practical solutions.</p> <p>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.</p>	<p>Describe two benefits of using a design process when solving a problem.</p> <p>Describe two team norms that help teams work effectively.</p> <p>Why is a decision matrix an important tool to use in the design process?</p>	<p>_4_ Weeks</p>
<p>A Picture is Worth a Thousand Words</p>	<p>English</p> <p>Technological Literacy</p> <p>Math</p> <p>Science</p>	<p>Make two-dimensional and three-dimensional representations of the designed solution.</p> <p>The use of symbols, measurements, and drawings promotes a clear communication by providing a common language to express ideas.</p>	<p>What additional information could you add to a sketch to provide other team members with a more accurate design drawing?</p>	

			How do you decide which type of sketch is best to use to communicate your design idea?	
Measuring Matters Dialed In	English Technological Literacy Math Science	Design and use instruments to gather data. Use information provided in manuals, protocols or by experienced people to see and understand how things work.	Why is it important to measure and document measurements with accuracy? What important piece of information should a sketch include in addition to the numeric dimensions? What is the purpose of hatch marks on a ruler?	
Lesson 2: Solid Modeling: Taking Modeling to another dimension	English Technological Literacy Math Science	Some technological problems are best solved through experimentation. Research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace. Make two-dimensional and three-dimensional representation of the designed solution. Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, refine as needed.	Describe the type of information a 3D image provides that a 2D image does not? Describe the ways in which a CAD drawing makes the details of an image easier to understand.	3 weeks
For Good Measure	English	The use of inventions and innovations has led to changes in society and the creation of new needs and wants.	How is the information you get from a 3D CAD model	

	Technological Literacy Math Science	Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.	different from information you get from a 2D model? How is switching the view on the Workplane helpful?	
It's for the birds	English Technological Literacy Math Science	New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. Knowledge gained from other fields of study has a direct effect on the development of technological products and systems. Design is a creative planning process that leads to useful products and systems.	Why is it necessary to look at finished objects from all views in Tinkercad?	

Lesson 3: Therapeutic Toy Design	English Technological Literacy Math Science	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. Evaluate competing design solutions using systematic processes to determine how well they meet the criteria and constraints of the problem. Analyze data from tests to determine similarities and differences among several	<ol style="list-style-type: none"> 1. How does iteration help you to learn from your failures? 2. In this unit you used the skills of collaboration, problem solving, communication, and creative thinking. How might you use these skills in your daily life? How might you use these skills in your dream job? 3. Look back on all of the Career Connections presented in the unit. What aspects 	1.5 weeks
----------------------------------	--	--	---	-----------

		<p>design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.</p> <p>Develop a model to generate data for iterative testing and modification of proposed object, tool or a process such that an optimal design can be achieved.</p> <p>Design involves a set of steps, which can be performed in different sequences and repeated as needed.</p> <p>Brainstorming is a group problem-solving design process in which each person in the group presents his or her ideas in an open forum</p> <p>Modeling, testing, evaluating and modifying are used to transform ideas into practical solutions.</p> <p>Make a product or system and document the solution.</p>	<p>of the different careers interest you and why?</p>	
	<p>Vocabulary for Units:</p> <p>Communication</p> <p>The transmission of information through a common system of</p>			

	<p>symbols, signs, behavior, speech, writing, or signals.</p> <p>Construction The act or process of building, erecting, or constructing buildings, roads, or other structures.</p> <p>Engineering Using technological and scientific knowledge to solve practical problems.</p> <p>Industrial Of, relating to, or resulting from industry.</p> <p>Innovation An improvement of an existing technological product, system, or method of doing something.</p> <p>Invention A new product, system, or process that has never existed before, created by study and experimentation.</p> <p>Manufacturing The process of making a raw material into a finished product; especially in large quantities</p> <p>Technology</p>			
--	---	--	--	--

	<p>The way people use resources to meet their wants and needs.</p> <p>Aesthetics Pleasing in appearance.</p> <p>Brainstorming A method of shared problem solving in which all members of a group spontaneously, and in an unrestrained discussion, generate ideas.</p> <p>Constraints A limit to the design process. Constraints may be such things as appearance, funding, space, materials, and human capabilities.</p> <p>Consumer A person or household that purchases goods or services.</p> <p>Criteria Desired specifications (elements or features) of a product or system.</p> <p>Decision Matrix A tool for systematically ranking alternatives according to a set of criteria.</p>			
--	---	--	--	--

	<p>Design Brief A written plan that identifies a problem to be solved, its criteria, and its constraints. The design brief is used to encourage thinking of all aspects of a problem before attempting a solution.</p>			
--	---	--	--	--