--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: Unit 1 Design Process – 16 Days

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: This unit provides a foundation for engineering knowledge and professional practices that will be used through this and other pathway to engineering courses and throughout a student's career. Students will develop skills such as concept sketching, setting up, and maintaining an engineering notebook and portfolio.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

E. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

F. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

G. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions:	**Unit Enduring Understandings:**
1. What is Engineering Design? How do engineers solve problems?	1. Engineering is a profession which lends the data gathering and utilization and organization fo science and mathematics to solve real world problems.

Unit Learning Targets

Student will… Learn information relating to the engineering design process and the scope of engineering as a profession, as well as gain an overview of what they will be learning in the course.

Evidence of Learning

Formative Assessments:

1. **Daily question and response as we go along in the topic**
2. **Students will be asked to provide examples of certain ideas, or to apply ideas to samples of their own choosing.**
3. **Student work will be assessed according to the PLTW rubrics**

Summative Assessment:

1. Students will take a written test on the unit content and its application in accordance with PLTW standards.

Lesson Timeframes	
Lesson Title:	**Timeframe (hours/days)**
Activity 1.1 Instant Challenge: Cable Car	1 class period
Activity 1.2 Instant Challenge: Aerodynamic Distance	1 class period
Activity 1.3 What Is It?	2 class periods
Activity 1.4 Concept Sketching	1 class period
Activity 1.5 Product Improvement	2 class periods
Activity 1.6 Deep Dive	2 class periods
Activity 1.7 Discover Engineering	1 class period
Activity 1.8 Instant Challenge: Paper Bridge	2 class periods
Activity 1.9 Design Innovation	1 class period
PowerPoint Presentations	½ class period each (1 per Activity)

Teacher Notes:

Lesson Plans
Lesson Title: 1 Day Design Challenge Activities
Timeframe: 1 class period
Goals/Objectives: • Reinforce content learned in class • Work as a part of a team to solve a design challenge • Communicate ideas using sketching and writing • Keep a log of activities in an Engineering Notebook.
Learning Activities/Instructional Strategies: • **Students will participate in hands-on design challenges, working as a part of a group** • **Each hands-on program is selected to demonstrate an aspect of the engineering design process** • **Students will document their work with Engineering Notebooks**
Equipment/Resources Needed: • Projector Screen • AutoDesk Software • Associated project materials •
Lesson Assessment: Students work will be graded according to the PLTW rubrics.
Teacher Notes:

Lesson Plans
Lesson Title: PowerPoint Presentations
Timeframe: ½ to 1 class period
Goals/Objectives: • Present content in sequence according to PLTW guidelines • Introduce design challenged based on the day's lesson
Learning Activities/Instructional Strategies: • Students will take notes on topic • Students are encouraged to ask questions for clarification and provide examples.
Equipment/Resources Needed: • Projector Screen • AutoDesk Software
Lesson Assessment: Students will be asked to participate in design challenges which demonstrate understanding, and to take written assessments based on the content and PLTW standards.
Teacher Notes:

--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: Unit 2 Technical Sketching and Drawing – 11 Days

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: As they advance in their experiences and skills through the course, students will learn basic rules of technical sketching in this lesson and will learn the drawing standards that apply. The understanding of technical sketching is critical for designers when effectively conveying their ideas about a product. Sketching is the beginning stage of product development. Students will learn how to sketch isometric, oblique, perspective, and multi-view sketches of various objects.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

E. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

F. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

G. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions:	**Unit Enduring Understandings:**
1. What specific tools do engineers use to communicate ideas? 2. How do different types of drawing give us different kinds of information?	1.Engineers use technical drawing in order to communicate ideas. 2. Different kinds of drawing are used in different way – brainstorming often uses freehand sketching, while technical schematics are done with orthographic projection.

Unit Learning Targets
Student will…

Evidence of Learning

Formative Assessments:

1. **Daily question and response as we go along in the topic**
2. **Students will be asked to provide examples of certain ideas, or to apply ideas to samples of their own choosing.**

Summative Assessment:

1. Students will take a written test on the unit content and its application.

Lesson Timeframes	
Lesson Title:	**Timeframe (hours/days)**
Activity 2.1 Isometric Sketching	3 class periods
Activity 2.2 Perspective Sketching**.**	2 class periods
Activity 2.3 Glass Box	2 class periods
Activity 2.4 Multi-view Sketching.	2 class periods
Activity 2.5 Sketching Practice	2 class periods

Teacher Notes:

Lesson Plans
Lesson Title: Sketching Lessons
Timeframe: 2-3 class periods
Goals/Objectives: • Students will learn to identify different kinds of drawing • Students will practice creating drawings by hand, including orthographic drawing and freehand sketching.
Learning Activities/Instructional Strategies: • Students will practice different types of sketching based on the day's lesson • Drawings will be progressively more complex as student build on prior knowledge
Equipment/Resources Needed: • Projector Screen • Grid Paper • Isometric Lined Paper • Blank Paper • Pencils and Erasers
Lesson Assessment: Students work will be graded according to the PLTW rubrics.
Teacher Notes:

Lesson Plans
Lesson Title: PowerPoint Presentations
Timeframe: ½ to 1 class period
Goals/Objectives: • Present content in sequence according to PLTW guidelines • Introduce sketching activity based on the day's lesson
Learning Activities/Instructional Strategies: • Students will take notes on topic • Students are encouraged to ask questions for clarification and provide examples.
Equipment/Resources Needed: • Projector Screen • AutoDesk Software
Lesson Assessment: Students will be asked to participate in sketching activities which demonstrate understanding, and will also take written assessments based on the content and PLTW standards.
Teacher Notes:

--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: Unit 3 Measurement and Statistics – 12 Days

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: In this lesson students will learn about measurement and statistics. Since the beginning of science, scientists have realized that laws of nature are not bound to the borders between kingdoms or countries, and that uniform standards of measure form the foundation for changing the secrets of the universe into human knowledge. In the midst of the French Revolution, scientists developed a new system of measurement that was simple, logical, and well-suited to the needs of both scientists and engineers. Since its inception 220 years ago, the metric system has spread throughout the industrialized world and is now the international standard for acquiring and communicating measurements.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

E. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

F. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

G. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions:	**Unit Enduring Understandings:**
1. How do we track progress in solving design problems? 2. How can statistics and mathematics help us in the field of engineering problem solving?	1. Problem solutions are optimized through evaluation and reflection and should be clearly communicated. 2. Statistical analysis of uni-variate data facilitates understanding and interpretation of numerical data and can be used to inform, justify, and validate a design or process.

Unit Learning Targets

- *Student will…* Identify and define the terminology used in engineering design and development, Identify the steps in an engineering design process and summarize the activities involved in each step of the process, complete a design project utilizing all steps of a design process, and find a solution that meets specific design requirements

Evidence of Learning

Formative Assessments:

1 **Daily question and response as we go along in the topic**
2 **Students will be asked to provide examples of certain ideas, or to apply ideas to samples of their own choosing.**

Summative Assessment:

1. Students will take a written test on the unit content and its application.

Lesson Timeframes	
Lesson Title:	**Timeframe (hours/days)**
Activity 3.1 Linear Measurement	1 class period
Activity 3.2 Unit Conversion	1 class period
Introduction to Dimensioning Presentation	1 class period
Activity 3.3 Linear Dimensions	2 class periods
Activity 3.4 Making Linear Measurements	1 class period
Introduction to Summary Statistics Presentation	1 class period
Activity 3.5 Applied Statistics.	2 class periods
Activity 3.6 Statistical Analysis with Excel	2 class periods
Activity 3.7a Instant Challenge: Fling Machine	1 class period
Activity 3.7b Instant Challenge: Oil Spill	1 class period

Teacher Notes:

Lesson Plans
Lesson Title: Sketching Lessons
Timeframe: 1-2 class periods
Goals/Objectives: • Students will learn to identify different kinds of drawing • Students will practice creating drawings by hand, including orthographic drawing and freehand sketching.
Learning Activities/Instructional Strategies: • Students will practice different types of sketching based on the day's lesson • Drawings will be progressively more complex as student build on prior knowledge
Equipment/Resources Needed: • Projector Screen • Grid Paper • Isometric Lined Paper • Blank Paper • Pencils and Erasers
Lesson Assessment: Students work will be graded according to the PLTW rubrics.
Teacher Notes:

Lesson Plans
Lesson Title: 1 Day Design Challenge Activities
Timeframe: 1 class period
Goals/Objectives: • Reinforce content learned in class • Work as a part of a team to solve a design challenge • Communicate ideas using sketching and writing • Keep a log of activities in an Engineering Notebook.
Learning Activities/Instructional Strategies: • Students will participate in hands-on design challenges, working as a part of a group • Each hands-on program is selected to demonstrate an aspect of the engineering design process • Students will document their work with Engineering Notebooks
Equipment/Resources Needed: • Projector Screen • AutoDesk Software • Associated project materials •
Lesson Assessment: Students work will be graded according to the PLTW rubrics.
Teacher Notes:

Lesson Plans
Lesson Title: PowerPoint Presentations
Timeframe: ½ to 1 class period
Goals/Objectives: • Present content in sequence according to PLTW guidelines • Introduce design challenged based on the day's lesson
Learning Activities/Instructional Strategies: • Students will take notes on topic • Students are encouraged to ask questions for clarification and provide examples.
Equipment/Resources Needed: • Projector Screen • AutoDesk Software
Lesson Assessment: Students will be asked to participate in design challenges which demonstrate understanding, and to take written assessments based on the content and PLTW standards.
Teacher Notes:

--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: Unit 4 Modeling Skills – 15 Days

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: In this lesson students will learn how to create a product from conception to reality and will employ a variety of modeling techniques. They will do this by applying the design process steps first-hand in the creation of their product. Students will live the life of a product designer and create a solution to a problem that exists for a company.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

D. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

E. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

F. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions:

1. .How do we initially draft a course of action to solve a design problem?
2. What is the purpose of a physical model?

Unit Enduring Understandings:

3. A solution path is selected and justified by evaluating and comparing competing design solutions based on jointly developed and agreed-upon design criteria and constraints.
4. Physical models are created to represent and evaluate possible solutions using prototyping technique(s) chosen based on the presentation and/or testing requirements of a potential solution.

Unit Learning Targets

- *Student will…* Identify the steps in an engineering design process and summarize the activities involved in each step of the process, Complete a design project utilizing all steps of a design process, and find a solution that meets specific design requirements.

Evidence of Learning

Formative Assessments:

1. **Daily question and response as we go along in the topic**
2. **Students will be asked to provide examples of certain ideas, or to apply ideas to samples of their own choosing.**

Summative Assessment:

1. Students will take a written test on the unit content and its application.

Lesson Timeframes

Lesson Title:	Timeframe (hours/days)
Project 4.1 Puzzle Design Challenge.	2 class periods
Activity 4.1a Puzzle Part Combinations.	1 class period
Activity 4.1b Graphical Modeling.	1 class period
Activity 4.1d Software Modeling Introduction	1 class period
Additive and Subtractive Solid Modeling Presentation	1 class period
Creating Drawings in CAD Presentation	1 class period
Activity 4.2 Puzzle Cube Package	2 class periods

Teacher Notes:

Lesson Title: Sketching Lessons

Timeframe: 1-2 class periods

Goals/Objectives:

- Students will learn to identify different kinds of drawing
- Students will practice creating drawings by hand, including orthographic drawing and freehand sketching.

Learning Activities/Instructional Strategies:

- Students will practice different types of sketching based on the day's lesson
- Drawings will be progressively more complex as student build on prior knowledge

Equipment/Resources Needed:

- Projector Screen
- Grid Paper
- Isometric Lined Paper
- Blank Paper
- Pencils and Erasers

Lesson Assessment: Students work will be graded according to the PLTW rubrics.

Teacher Notes:

Lesson Title: 1 Day Design Challenge Activities

Timeframe: 1-2 class period

Goals/Objectives:

- Reinforce content learned in class
- Work as a part of a team to solve a design challenge
- Communicate ideas using sketching and writing
- Keep a log of activities in an Engineering Notebook.

Learning Activities/Instructional Strategies:

- Students will participate in hands-on design challenges, working as a part of a group
- Each hands-on program is selected to demonstrate an aspect of the engineering design process
- Students will document their work with Engineering Notebooks

Equipment/Resources Needed:

- Projector Screen
- AutoDesk Software
- Associated project materials
-

Lesson Assessment: Students work will be graded according to the PLTW rubrics.

Teacher Notes:

Lesson Title: PowerPoint Presentations

Timeframe: ½ to 1 class period

Goals/Objectives:

- Present content in sequence according to PLTW guidelines
- Introduce design challenged based on the day's lesson

Learning Activities/Instructional Strategies:

- Students will take notes on topic
- Students are encouraged to ask questions for clarification and provide examples.

Equipment/Resources Needed:

- Projector Screen
- AutoDesk Software

Lesson Assessment: Students will be asked to participate in design challenges which demonstrate understanding, and to take written assessments based on the content and PLTW standards.

Teacher Notes:

--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: Unit 5 Geometry of Design – 12 Days

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: In this lesson students will apply the skills learned in prior units. They will learn how to calculate the area of two-dimensional shapes. Students will also learn how to calculate the surface area, volume, and weight of three-dimensional solids and the interaction of volume and weight to determine material density. Students will also improve their skill in the use of CAD modeling software to enhance their understanding of plane and solid geometry.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

E. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

F. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

G. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
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8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions:	**Unit Enduring Understandings:**
1. Why is it important to be fully descriptive when creating drawings/ 2. What are some elemental forms of geometry?	3. Physical properties of objects are used to describe and model objects and can be used to define design requirements, as a means to compare potential solutions to a problem, and as a tool to specify final solutions. 4. Geometric shapes and forms are described and differentiated by their characteristic features

Unit Learning Targets

- *Student will…* Identify and differentiate geometric constructions and constraints such as horizontal lines, vertical lines, parallel lines, perpendicular lines, colinear points, tangent lines, tangent circles, and concentric circles.

Evidence of Learning

Formative Assessments:

1.Daily question and response as we go along in the topic

2. Students will be asked to provide examples of certain ideas, or to apply ideas to samples of their own choosing.

Summative Assessment:

1. Students will take a written test on the unit content and its application.

Lesson Timeframes	
Lesson Title:	**Timeframe (hours/days)**
Geometric Shapes and Area Presentation	1 class period
Activity 5.1 Calculating Properties of Shapes	1 class period
Work Points, Axes, and Planes Presentation	1 class period
Activity 5.2 Making Sketches in CAD	2 class periods
Activity 5.3 Determining Density	1 class period
Properties of Geometric Solids Presentation	1 class period
Activity 5.4 Calculating Properties of Solids	1 class period
Physical Property Analysis Presentation	1 class period
Activity 5.6 Physical Property Analysis	1 class period
Activity 5.7 Instant Challenge: Choremaster	2 class periods
Teacher Notes:	

Lesson Plans

Lesson Title: CAD / Sketching Lesson Days

Timeframe: 1-2 class periods

Goals/Objectives:

- Students will learn to identify different kinds of drawing
- Students will practice creating drawings by hand, including orthographic drawing and freehand sketching.

Learning Activities/Instructional Strategies:

- Students will practice different types of sketching based on the day's lesson
- Drawings will be progressively more complex as student build on prior knowledge
- Students will use AutoDesk Inventor

Equipment/Resources Needed:

- Projector Screen
- AutoDesk Inventor Software

Lesson Assessment: Students work will be graded according to the PLTW rubrics.

Teacher Notes:

Lesson Plans

Lesson Title: 1 Day Design Challenge Activities

Timeframe: 1-2 class periods

Goals/Objectives:

- Reinforce content learned in class
- Work independently in order to practice modeling skills and concepts
- Communicate ideas using sketching and writing
- Keep a log of activities in an Engineering Notebook.

Learning Activities/Instructional Strategies:

- Students will participate in hands-on design challenges, working as a part of a group
- Each hands-on program is selected to demonstrate an aspect of the engineering design process
- Students will document their work with Engineering Notebooks

Equipment/Resources Needed:

- Projector Screen
- AutoDesk Software
- Associated project materials
-

Lesson Assessment: Students work will be graded according to the PLTW rubrics.

Teacher Notes:

Lesson Plans
Lesson Title: PowerPoint Presentations
Timeframe: ½ to 1 class period
Goals/Objectives: • Present content in sequence according to PLTW guidelines • Introduce design challenged based on the day's lesson
Learning Activities/Instructional Strategies: • Students will take notes on topic • Students are encouraged to ask questions for clarification and provide examples.
Equipment/Resources Needed: • Projector Screen • AutoDesk Software
Lesson Assessment: Students will be asked to participate in design challenges which demonstrate understanding, and to take written assessments based on the content and PLTW standards.
Teacher Notes:

--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: Unit 6 Reverse Engineering – 13 Days

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: Students will perform a functional analysis through non-destructive methods of observation – the product under investigation will remain intact. As part of the functional analysis students will then generate hypotheses of the sequential operations of their products, and identify the inputs and outputs that are indicative of those systems.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

F. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

G. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

H. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions:	
I. What is reverse Engineering?	1. Reverse engineering involves disassembling and analyzing a product or system in order to understand and document the visual, functional, and/or structural aspects of its design.

Unit Learning Targets

- *Student will…* Describe the process of reverse engineering, justify the use of reverse engineering and explain the various reasons to employ reverse engineering, including discovery, documentation, investigation, and product improvement, Perform a functional analysis of a product in order to determine the purpose, inputs and outputs, and the operation of a product or system.

Evidence of Learning

Formative Assessments:

1. Daily question and response as we go along in the topic

2. Students will be asked to provide examples of certain ideas, or to apply ideas to samples of their own choosing.

Summative Assessment:

1. Students will take a written test on the unit content and its application.

Lesson Timeframes

Lesson Title:	Timeframe (hours/days)
Elements and Principles of Design Presentation	1 class period
Activity 6.1 Elements and Principles of Design Identification	2 class periods
Activity 6.2 Visual Analysis	1 class period
Reverse Engineering and Functional Analysis Presentation	1 class period
Activity 6.3 Functional Analysis	1 class period
Simple Machines Presentation	1 class period
Product Disassembly Display Presentation	1 class period
Activity 6.4 Product Disassembly	2 class periods
Activity 6.5 Product Disassembly Display	2 class periods

Teacher Notes:

Lesson Plans

Lesson Title: 1 Day Design Challenge Activities

Timeframe: 1-2 class periods

Goals/Objectives:

- Reinforce content learned in class
- Work as a part of a team to solve a design challenge
- Communicate ideas using sketching and writing
- Keep a log of activities in an Engineering Notebook.

Learning Activities/Instructional Strategies:

- Students will participate in hands-on design challenges, working as a part of a group
- Each hands-on program is selected to demonstrate an aspect of the engineering design process
- Students will document their work with Engineering Notebooks

Equipment/Resources Needed:

- Projector Screen
- AutoDesk Software
- Associated project materials
-

Lesson Assessment: Students work will be graded according to the PLTW rubrics.

Teacher Notes:

Lesson Plans
Lesson Title: PowerPoint Presentations
Timeframe: ½ to 1 class period
Goals/Objectives: • Present content in sequence according to PLTW guidelines • Introduce design challenged based on the day's lesson
Learning Activities/Instructional Strategies: • Students will take notes on topic • Students are encouraged to ask questions for clarification and provide examples.
Equipment/Resources Needed: • Projector Screen • AutoDesk Software
Lesson Assessment: Students will be asked to participate in design challenges which demonstrate understanding, and to take written assessments based on the content and PLTW standards.
Teacher Notes:

--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: **Unit 7 Documentation – 24 Days**

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: The drafting, dimensioning, and tolerance standards are a design language that allow designers to clearly and accurately communicate their ideas about form and function to people all over the world, regardless of what language they speak. It is important that everyone involved with the design process understands the proper documentation of technical drawings to insure that the design will achieve its full potential.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

E. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

F. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

G. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions:	
1. Why is documentation important in the field of engineering design?	1. Documentation can help define and justify a design problem, and express the concerns, needs, and desires of the primary stakeholders, Present and justify design specifications, and clearly explain the criteria and constraints associated with a successful design solution

Unit Learning Targets

- *Student will…* Define and justify a design problem, and express the concerns, needs, and desires of the primary stakeholders, present and justify design specifications, and clearly explain the criteria and constraints associated with a successful design solution, and write a design brief to communicate the problem, problem constraints, and solution criteria.

Evidence of Learning

Formative Assessments:

1. Daily question and response as we go along in the topic

2. Students will be asked to provide examples of certain ideas, or to apply ideas to samples of their own choosing.

Summative Assessment:

1. Students will take a written test on the unit content and its application.

Lesson Timeframes	
Lesson Title:	**Timeframe (hours/days)**
Activity 7.1 More Dimensioning	2 class periods
Dimensioning Standards Presentation	2 class periods
Alternate Views Presentation	1 class period
Activity 7.2 Sectional Views	2 class periods
Holes and Hole Notes Presentation	1 class period
Tolerances Presentation	1 class period
Activity 7.3 Tolerances	2 class periods
Assembly Constraints Presentation	1 class period
Activity 7.4 Assembly Models	2 class periods
Documentation Presentation	1 class period
Project 7.5 Engineering Documentation	5 class periods
Writing a Design Brief Presentation	1 class period
Activity 7.6 Design Brief	1 class period
Activity 7.7 Product Improvement	1 class period
Decision Matrix Presentation	2 class periods
Technical Writing Presentation	5 class periods
Teacher Notes:	

Lesson Plans
Lesson Title: Activities Days
Timeframe: 1-2 class period
Goals/Objectives: • Reinforce content learned in class • Work independently on documenting design work • Communicate ideas using sketching and writing • Keep a log of activities in an Engineering Notebook.
Learning Activities/Instructional Strategies: • Students will participate in hands-on design challenges, sometimes alone, or as a part of a group • Each hands-on program is selected to demonstrate an aspect of the engineering design process • Students will document their work with Engineering Notebooks
Equipment/Resources Needed: • Projector Screen • AutoDesk Software • Associated project materials •
Lesson Assessment: Students work will be graded according to the PLTW rubrics.
Teacher Notes:

Lesson Plans

Lesson Title: CAD / Sketching Lessons

Timeframe: 1-2 class periods

Goals/Objectives:

- Students will learn to identify different kinds of drawing
- Students will practice creating drawings by hand, including orthographic drawing and freehand sketching.

Learning Activities/Instructional Strategies:

- Students will practice different types of sketching based on the day's lesson
- Drawings will be progressively more complex as student build on prior knowledge
- Students will use AutoDesk Inventor

Equipment/Resources Needed:

- Projector Screen
- AutoDesk Inventor Software

Lesson Assessment: Students work will be graded according to the PLTW rubrics.

Teacher Notes:

Lesson Plans
Lesson Title: PowerPoint Presentations
Timeframe: ½ to 1 class period
Goals/Objectives: • Present content in sequence according to PLTW guidelines • Introduce design challenged based on the day's lesson
Learning Activities/Instructional Strategies: • Students will take notes on topic • Students are encouraged to ask questions for clarification and provide examples.
Equipment/Resources Needed: • Projector Screen • AutoDesk Software
Lesson Assessment: Students will be asked to participate in design challenges which demonstrate understanding, and to take written assessments based on the content and PLTW standards.
Teacher Notes:

--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: Unit 8 Advanced Computer Modeling –11 Days

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: This unit presents many of the 3D functions used to develop individual and assembly CAD solid models. Students will use these modeling skills to develop their design solutions to various projects and problems throughout the rest of the course. The goal of this lesson is to provide an opportunity for students to acquire the knowledge and experience to effectively utilize CAD as a design tool in an engineering design process.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

E. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

F. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

G. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions:

1. What are some advantages to computer modeling?

2. Computer aided drafting and design (CAD) software packages facilitate virtual modeling of parts and assemblies and the creation of technical drawings. They are used to efficiently and accurately detail parts and assemblies according to standard engineering practice.

Unit Learning Targets

- *Student will…* Create three-dimensional solid models of parts within CAD from sketches or dimensioned drawings using appropriate geometric and dimensional constraints, Generate CAD multi-view technical drawings, including orthographic projections, sections view(s), detail view(s), auxiliary view(s) and pictorial views, as necessary, showing appropriate scale, appropriate view selection, and correct view orientation to fully describe a part according to standard engineering practice

Evidence of Learning

Formative Assessments:
1.Daily question and response as we go along in the topic
2. Students will be asked to provide examples of certain ideas, or to apply ideas to samples of their own choosing.

Summative Assessment:

1. Students will take a written test on the unit content and its application.

Lesson Timeframes	
Lesson Title:	**Timeframe (hours/days)**
Work Points, Work Axes, and Work Planes Presentation	1 class period
Project 8.1c Model Miniature Train	5 class periods
Parametric Modeling Presentation	1 class period
Activity 8.2 Parametric Constraints.	2 class periods
Auxiliary Views Presentation	1 class period
Activity 8.3 Auxiliary Views	2 class periods
Exploded CAD Assembly Models Presentation	2 class periods
Animating Assembly Models and Exporting Video	2 class periods
Activity 8.4c Part Drawings (Miniature Train)	2 class periods
Activity 8.5 Instant Challenge: Air Vehicle	1 class period
Teacher Notes:	

Lesson Plans
Lesson Title: CAD / Sketching Lessons
Timeframe: 1-2 class periods
Goals/Objectives: • Students will learn to identify different kinds of drawing • Students will practice creating drawings by hand, including orthographic drawing and freehand sketching.
Learning Activities/Instructional Strategies: • Students will practice different types of sketching based on the day's lesson • Drawings will be progressively more complex as student build on prior knowledge • Students will use AutoDesk Inventor
Equipment/Resources Needed: • Projector Screen • AutoDesk Inventor Software
Lesson Assessment: Students work will be graded according to the PLTW rubrics.
Teacher Notes:

Lesson Plans
Lesson Title: Projects and Activities
Timeframe: 1-5 class periods, dependent on project
Goals/Objectives: • Reinforce content learned in class • Work independently on documenting design work • Communicate ideas using sketching and writing • Keep a log of activities in an Engineering Notebook.
Learning Activities/Instructional Strategies: • Students will participate in hands-on design challenges, sometimes alone, or as a part of a group • Each hands-on program is selected to demonstrate an aspect of the engineering design process • Students will document their work with Engineering Notebooks • Students will mainly be working in the AutoDesk Inventor Software
Equipment/Resources Needed: • Projector Screen • AutoDesk Software • Associated project materials
Lesson Assessment: Students work will be graded according to the PLTW rubrics.
Teacher Notes:

Lesson Plans
Lesson Title: PowerPoint Presentations
Timeframe: ½ to 1 class period
Goals/Objectives: • Present content in sequence according to PLTW guidelines • Introduce design challenged based on the day's lesson
Learning Activities/Instructional Strategies: • Students will take notes on topic • Students are encouraged to ask questions for clarification and provide examples.
Equipment/Resources Needed: • Projector Screen • AutoDesk Software
Lesson Assessment: Students will be asked to participate in design challenges which demonstrate understanding, and to take written assessments based on the content and PLTW standards.
Teacher Notes:

--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: Unit 9 Design Team – 33 Days

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: Engineers create products that affect public safety and well-being. Because of this engineers have a high level of responsibility to society and require adherence to high ethical standards. In this unit students will experience shared decision-making as they investigate different materials, manufacturing processes, and the short and long term impacts that their decision-making may have on society or potentially on the world.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

E. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

F. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

G. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.
8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions:	
1. What are some attributes of a good team member?	1. In order to be an effective team member, one must demonstrate positive team behaviors and act according to accepted norms, contribute to group goals according to assigned roles, and use appropriate conflict resolution strategies.

Unit Learning Targets

- *Student will…* Demonstrate positive team behaviors and contribute to a positive team dynamic, establish common goals, equitable workloads, accountability, and create a set of team norms, contribute equitably to the attainment of group goals based on assigned roles, practice appropriate conflict resolution strategies within a team environment.

Evidence of Learning

Formative Assessments:
1. Daily question and response as we go along in the topic
2. Students will be asked to provide examples of certain ideas, or to apply ideas to samples of their own choosing.

Summative Assessment:

1. Students will take a written test on the unit content and its application.

Lesson Timeframes

Lesson Title:	**Timeframe (hours/days)**
Global, Human, and Ethical Impacts Presentation	1 class period
Activity 9.1 Product Lifecycle	3 class periods
Problem 9.2 Engineering Design Ethics Design Brief	4 class periods
Project 9.3 Virtual Design	1 class period
Teamwork Presentation	1 class period
Gantt Chart Presentation	1 class period
Activity 9.4 Team Norms	2 class periods
Activity 9.5 Product Research	4 class periods
Project 9.3d Periodic Teammate Ten Point Evaluation	1 every 5 class periods
Project 9.3e Periodic Self-Evaluation	1 every 5 class periods
Decision Matrix Presentation	1 class period
Project 9.3i Summary Presentation Evaluation	3 class periods
Project 9.3j Teammate Performance Summary	2 class periods

Teacher Notes:

Lesson Plans

Lesson Title: Activity Days

Timeframe: Ongoing (2-5 class periods)

Goals/Objectives:

- Reinforce content learned in class
- Work as a part of a team to solve a design challenge
- Communicate ideas using sketching and writing
- Keep a log of activities in an Engineering Notebook.
- Maintain CAD files of designs

Learning Activities/Instructional Strategies:

- Students will participate in hands-on design challenges, working as a part of a group
- Each hands-on program is selected to demonstrate an aspect of the engineering design process
- Students will document their work with Engineering Notebooks
- Students will use AutoDesk Inventor for computer modeling
-

Equipment/Resources Needed:

- Projector Screen
- AutoDesk Software
- Associated project materials
-

Lesson Assessment: Students work will be graded according to the PLTW rubrics.

Teacher Notes:

Lesson Plans
Lesson Title: PowerPoint Presentations
Timeframe: ½ to 1 class period
Goals/Objectives: • Present content in sequence according to PLTW guidelines • Introduce design challenges based on the day's lesson
Learning Activities/Instructional Strategies: • Students will take notes on topic • Students are encouraged to ask questions for clarification and provide examples.
Equipment/Resources Needed: • Projector Screen • AutoDesk Software
Lesson Assessment: Students will be asked to participate in design challenges which demonstrate understanding, and to take written assessments based on the content and PLTW standards.
Teacher Notes:

Lesson Plans

Lesson Title: Student Presentations

Timeframe: 2-3 class periods (for entire class)

Goals/Objectives:

- Students will practice communication skills in addressing an audience
-

Learning Activities/Instructional Strategies:

- Students will take notes on topic
- Students are encouraged to ask questions for clarification and provide examples.

Equipment/Resources Needed:

- Projector Screen
- AutoDesk Software

Lesson Assessment: Students will be asked to participate in design challenges which demonstrate understanding, and to take written assessments based on the content and PLTW standards.

Teacher Notes:

--Unit Overview

Content Area: Introduction to Engineering Design - Project Lead The Way

Unit Title: Unit 10 Design Challenges – 10 Days

Target Course/Grade Levels: Introduction to Engineering Design - Project Lead The Way / 9-12

Unit Summary: In this unit students will work in teams of two. They will choose a problem from a list of design briefs and create a solution to the problem. Each team will apply the design process steps in the development of their solution. Students will work together as a product design team to create a solution to their chosen problem. The design challenges are written up in such a way that teams will experience a design work environment. Design challenges include redesigning a fluid power system, designing a executive desk set, as well as others. Students will then make plans to market their solution to the company.

Interdisciplinary Connections: This course is heavily based on the practical application of geometry and mathematical concepts in solving problems, both in guided exercises and in creative projects. The course also involves problem solving an working as a part of a team.

21st-Century Life & Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.

Learning Targets

Standards: 8.2 Technology Education, Engineering, and Design All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world, as they relate to the individual, global society, and the environment.

Content Statements:

A. Nature of Technology: Creativity and Innovation: Technology products and systems impact every aspect of the world in which we live.

B. Design: Critical Thinking, Problem Solving, and Decision-Making: The design process is a systematic approach to solving problems.

C. Technological Citizenship, Ethics, and Society : Knowledge and understanding of human, cultural, and societal values are fundamental when designing technology systems and products in the global society

E. Communication and Collaboration: Digital tools facilitate local and global communication and collaboration in designing products and systems.

F. Resources for a Technological World: Technological products and systems are created through the application and appropriate use of technological resources.

G. The Designed World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

CPI #	Cumulative Progress Indicator (CPI)
8.2.12.A.1	Design and create a technology product or system that improves the quality of life and identify trade-offs, risks, and benefits.

8.2.12.B.1	Design and create a product that maximizes conservation and sustainability of a scarce resource, using the design process and entrepreneurial skills throughout the design process.
8.2.12.B.2	Design and create a prototype for solving a global problem, documenting how the proposed design features affect the feasibility of the prototype through the use of engineering, drawing, and other technical methods of illustration.
8.2.12.B.3	Analyze the full costs, benefits, trade-offs, and risks related to the use of technologies in a potential career path.
8.2.12.C.1	Analyze the ethical impact of a product, system, or environment, worldwide, and report findings in a web-based publication that elicits further comment and analysis.
8.2.12.C.2	Evaluate ethical considerations regarding the sustainability of resources that are used for the design, creation, and maintenance of a chosen product.
8.2.12.C.3	Evaluate the positive and negative impacts in a design by providing a digital overview of a chosen product and suggest potential modifications to address the negative impacts.
8.2.12.E.1	Use the design process to devise a technological product or system that addresses a global issue, and provide documentation through drawings, data, and materials, taking the relevant cultural perspectives into account throughout the design and development process.
8.2.12.F.1	Determine and use the appropriate application of resources in the design, development, and creation of a technological product or system.
8.2.12.F.2	Explain how material science impacts the quality of products.
8.2.12.F.3	Select and utilize resources that have been modified by digital tools (e.g., CNC equipment, CAD software) in the creation of a technological product or system.
8.2.12.G.1	Analyze the interactions among various technologies and collaborate to create a product or system demonstrating their interactivity.

Unit Essential Questions: 1. What are some attributes of a good team member?	1. In order to be an effective team member, one must demonstrate positive team behaviors and act according to accepted norms, contribute to group goals according to assigned roles, and use appropriate conflict resolution strategies.

Unit Learning Targets

- *Student will…* Demonstrate positive team behaviors and contribute to a positive team dynamic, establish common goals, equitable workloads, accountability, and create a set of team norms, contribute equitably to the attainment of group goals based on assigned roles, practice appropriate conflict resolution strategies within a team environment.

Evidence of Learning

Formative Assessments:

1.Students will be assessing their own progress daily and logging all important documentation steps.

Summative Assessment:

1. Students will be assessed according to the PLTW rubrics associated with this project.

Lesson Timeframes

Lesson Title:	**Timeframe (hours/days)**

Project 10.1 Design Challenge	10 class periods

Teacher Notes:

Lesson Title: Design Challenge

Timeframe: 10 Days

Goals/Objectives:

- Students will work in a team of 2 to put into praxis the entire design process, from creating a design brief and gantt chart, to choosing and implementing a solution to the design problem.

Learning Activities/Instructional Strategies:

- **Students will work in teams of 2**
- **Students will document all design work**
- **Students will share work equitably and responsibly**

Equipment/Resources Needed:

- Projector Screen
- AutoDesk Software

Lesson Assessment: Students work will be graded according to the PLTW rubrics.

Teacher Notes: