Statewide Framework Document for: 149991

Engineering Design 1

Standards may be added to this document prior to submission but may not be removed from the framework to meet state credit equivalency requirements. Performance assessments may be developed at the local level. In order to earn state approval, performance assessments must be submitted within this framework. **This course is eligible for 1 credit of Algebra 1.** Washington Mathematics Standards (Common Core State Standards) support foundational mathematical knowledge and reasoning. While it is important to develop a conceptual understanding of mathematical topics and fluency in numeracy and procedural skills, teachers should also focus on the application of mathematics to career fields to support the three (3) key shifts of CCSS. The Standards for Mathematical Practice develop mathematical habits of mind and are to be modeled and integrated throughout the course.

School District Name	
Course Title: Engineering Design I	**Total Framework Hours:** 180
CIP Code: 149991 ☒ Exploratory ☐ Preparatory	**Date Last Modified:** December 30, 2020
Career Cluster: Science, Technology, Engineering, and Mathematics	**Cluster Pathway:** Science and Math
Course Summary: This course teaches problem-solving skills using a design development process. Models of product solutions are created, analyzed, and communicated using modeling computer design software. This framework is based on the Project Lead the Way Introduction to Engineering Design Curriculum.	
Eligible for Equivalent Credit in: Algebra 1	**Total Number of Units:** 10

Unit 1: Design Process	**Total Learning Hours for Unit:** 16

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Students will have several performance assessments in Unit 1. Students are presented with two different challenges with very specific constraints: Instant Challenge #1: Cable Car and Instant Challenge #2: Paper Bridge.

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

1B.4 View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes

2C.5 Reflect critically on learning experiences and processes

2D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions

3B.3 Assume shared responsibility for collaborative work, and value the individual contributions made by each team member

Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=677667&v=b26b7852

1. Students will develop an understanding of the characteristics and scope of technology.

   L. Inventions and innovations are the results of specific, goal-directed research.

2. Students will develop an understanding of the core concepts of technology.

   Z. Selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste.

   AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.

   BB. Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.

4. Students will develop an understanding of the cultural, social, economic, and political effects of technology.

   I. Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.

   J. Ethical considerations are important in the development, selection, and use of technologies.

   K. The transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees.

8. Students will develop an understanding of the attributes of design.

   H. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.

   J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.

9. Students will develop an understanding of engineering design.

I. Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.

J. Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.

10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

J. Technological problems must be researched before they can be solved.

11. Students will develop abilities to apply the design process.

N. Identify criteria and constraints and determine how these will affect the design process.

O. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.

P. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.

Q. Develop and produce a product or system using a design process.

R. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.

12. Students will develop the abilities to use and maintain technological products and systems.

P. Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.

17. Students will develop an understanding of and be able to select and use information and communication technologies.

P. There are many ways to communicate information, such as graphic and electronic means.

Q. Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.

Aligned Washington State Academic Standards	
Mathematics: Common Core	
Mathematical Practices	MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively. MP3 Construct viable arguments and critique the reasoning of others. MP4 Model with mathematics. MP5 Use appropriate tools strategically. MP6 Attend to precision. MP7 Look for and make use of structure.

Unit 2: Technical Sketching and Drawing	**Total Learning Hours for Unit:** 11
Performance Assessments: (Districts to complete for each unit) *Example assessments for this unit include:*	

This unit ends with students creating practice sketches that incorporate all of the previously learned sketching techniques (isometric, perspective, and multi-view).

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

  2A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation

  2C.3 Synthesize and make connections between information and arguments

  2D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions

  3A.5 Communicate effectively in diverse environments (including multi-lingual)

Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=67767&v=b26b7852

17. Students will develop an understanding of and be able to select and use information and communication technologies.

   P. There are many ways to communicate information, such as graphic and electronic means.

   Q. Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.

Aligned Washington State Academic Standards	
Mathematics: Common Core	HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). *
Mathematical Practices	MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively. MP3 Construct viable arguments and critique the reasoning of others. MP5 Use appropriate tools strategically. MP6 Attend to precision. MP7 Look for and make use of structure.

Unit 3: Measurement and Statistics	**Total Learning Hours for Unit:** 12

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Applied Statistics Activity: Students use what they've learned from previous measurement activities to perform a statistical analysis of wooden cubes (which   will be used in a later project/activity).
- Instant Challenge: Fling Machine. Students will follow the design process to complete a timed task, while working collaboratively with their peers. This challenge also incorporates some of the measurement skills learned throughout the unit.

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

4A.2	Evaluate information critically and competently
4B.1	Use information accurately and creatively for the issue or problem at hand
6A.1	Use technology as a tool to research, organize, evaluate and communicate information
8B.1	Monitor, define, prioritize and complete tasks without direct oversight

Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=67767&v=b26b7852

2. Students will develop an understanding of the core concepts of technology.

   DD. Quality control is a planned process to ensure that a product, service, or system meets established criteria.

8. Students will develop an understanding of the attributes of design.

   H. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.

   I. Design problems are seldom presented in a clearly defined form.

   J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.

   K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

9. Students will develop an understanding of engineering design.

   I. Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.

   J. Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.

   K. A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.

   L. The process of engineering design takes into account a number of factors.

11. Students will develop abilities to apply the design process.

   N. Identify criteria and constraints and determine how these will affect the design process.

   O. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.

   P. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.

   Q. Develop and produce a product or system using a design process.

   R. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.

13. Students will develop the abilities to assess the impact of products and systems.

   J. Collect information and evaluate its quality.

Aligned Washington State Academic Standards

| **Mathematics: Common Core** | |

	HS.N.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in grapHS. and data displays.
	HS.N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.
	HS.N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
	HS.A.SSE.1 Interpret expressions that represent a quantity in terms of its context.*
	HS.A.SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients.
	HS.A.SSE.1b Interpret complicated expressions by viewing one or more of their parts as a single entity.
	HS.A.SSE.2 Use the structure of an expression to identify ways to rewrite it.
	HS.A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*
	HS.A.SSE.3a Factor a quadratic expression to reveal the zeros of the function it defines.
	HS.A.SSE.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
	HS.A.SSE.3c Use the properties of exponents to transform expressions for exponential functions.
	HS.A.SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.
	HS.A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
	HS.A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
	HS.A.REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
	HS.A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
	HS.G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*
	HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*
	HS.S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).
	HS.S.ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
	HS.S.ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

	HS.S.ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
Mathematical Practices	MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively. MP3 Construct viable arguments and critique the reasoning of others. MP4 Model with mathematics. MP5 Use appropriate tools strategically. MP6 Attend to precision. MP7 Look for and make use of structure.

Unit 4: Modeling Skills	**Total Learning Hours for Unit:** 15

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Puzzle Cube: Students will create a puzzle cube out of wooden cubes (which they performed a statistical analysis on in the previous unit). This puzzle cube is made of 27 individual cubes, where cubes are glued together in 5 puzzle pieces. These puzzle pieces come together to form a cube. Students also use their sketching/drawing skills (learned in unit 2) to create a hand sketch of the puzzle solution.
- 3D CAD Puzzle Cube: After students have physically built their puzzle cube, they will create a computer sketch of their cube. Students will create the individual puzzle cube, assemble these cubes into their 5 separate puzzle pieces, create a multi-view sheet with dimensions for each piece, and finally create a video showing how their cube is assembled together.

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

2A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation

2C.3 Synthesize and make connections between information and arguments

3A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts

9A.1 Know when it is appropriate to listen and when to speak

9B.2 Respond open-mindedly to different ideas and values

Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=677667&v=b26b7852

Cluster: Students will develop an understanding of the core concepts of technology.

AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development. (2.9-12.AA)

BB. Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.

(2.9-12.BB)

Cluster: Students will develop an understanding of the attributes of design.

    H. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints,   exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype. (8.9-12.H)

    J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved. (8.9-12.J)

    K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

(8.9-12.K)   Cluster: Students will develop an understanding of engineering design.

    I. Established design principles are used to evaluate existing designs, to collect data, and to guide the design process. (9.9-12.I)

    J. Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. (9.9-   12.J)

    K. A prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (9.9-12.K)

    L. The process of engineering design takes into account a number of factors.

(9.9-12.L)   Cluster: Students will develop the abilities to apply the design process.

    N. Identify criteria and constraints and determine how these will affect the design process. (11.9-12.N)

    O. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (11.9-12.O)

    P. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for   proper design and to note areas where improvements are needed. (11.9-12.P)

    Q. Develop and produce a product or system using a design process. (11.9-12.Q)

    R. Evaluate final solutions and communicate observations, processes, and results of the entire design process, using verbal, graphic, quantitative,   virtual, and written means, in addition to three-dimensional models. (11.9-12.R)

Cluster: Students will develop the abilities to use and maintain technological products and systems.

    L. Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques. (12.9-12.L)

    P. Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.   (12.9-12.P)

Cluster: Students will develop an understanding of and be able to select and use information and communication technologies.

    P. There are many ways to communicate information, such as graphic and electronic means. (17.9-12.P)

    Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that   incorporate a variety of visual, auditory, and tactile stimuli. (17.9-12.Q)

Aligned Washington State Academic Standards

Mathematics: Common Core	HS.N.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in grapHS. and data displays. HS.N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.

| | HS.A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
HS.A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
HS.A.REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
HS.F.IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
HS.F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
HS.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
HS.F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*
HS.F.BF.1 Write a function that describes a relationship between two quantities.*
HS.F.BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.
HS.F.BF.5 (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.
HS.G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
HS.G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
HS.G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
HS.G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
HS.G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* |

	HS.S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
	HS.S.ID.6a Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
	HS.S.ID.6c Fit a linear function for a scatter plot that suggests a linear association.
	HS.S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
Mathematical Practices	MP1 Make sense of problems and persevere in solving them.
	MP2 Reason abstractly and quantitatively.
	MP3 Construct viable arguments and critique the reasoning of others.
	MP4 Model with mathematics.
	MP5 Use appropriate tools strategically.
	MP6 Attend to precision.
	MP7 Look for and make use of structure.

Unit 5: Geometry Design	**Total Learning Hours for Unit:** 13

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Calculating properties of shapes and solids (first using paper shapes, then using 3D objects)
- Making Sketches in CAD (Here, students will be assessed on their ability to create rather simple 3D sketches using CAD software.)
- CAD Models (Here, students will be assessed on their ability to make modifications to previously-generated CAD sketches.)

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

    2A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation

    2C.3 Synthesize and make connections between information and arguments

    3A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts

In Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=67767&v=b26b7852

Cluster: Students will develop the abilities to use and maintain technological products and systems.

    P. Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.   (12.9-12.P)

 Cluster: Students will develop an understanding of and be able to select and use information and communication technologies.

Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that   incorporate a variety of visual, auditory, and tactile stimuli. (17.9-12.Q)

Aligned Washington State Academic Standards

| Mathematics: Common Core | HS.A.SSE.1 Interpret expressions that represent a quantity in terms of its context.*
HS.A.SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients.
HS.A.SSE.1b Interpret complicated expressions by viewing one or more of their parts as a single entity.
HS.A.SSE.2 Use the structure of an expression to identify ways to rewrite it.
HS.A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*
HS.A.SSE.3a Factor a quadratic expression to reveal the zeros of the function it defines.
HS.A.SSE.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
HS.A.SSE.3c Use the properties of exponents to transform expressions for exponential functions.
 HS.A.SSE.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.
HS.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
HS.A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
HS.A.REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
HS.A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
HS.A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
HS.A.REI.4 Solve quadratic equations in one variable.
HS.G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
HS.G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
HS.G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. |

	HS.G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
	HS.G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
	HS.G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
	HS.G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
	HS.G.GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.
	HS.G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*
	HS.G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
	HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*
	HS.G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).*
	HS.G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).*
	HS.S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).
	HS.S.ID.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
	HS.S.ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
	HS.S.ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
Mathematical Practices	MP1 Make sense of problems and persevere in solving them.
	MP2 Reason abstractly and quantitatively.
	MP3 Construct viable arguments and critique the reasoning of others.
	MP4 Model with mathematics.
	MP5 Use appropriate tools strategically.

	MP7 Look for and make use of structure.

Unit 6: Reverse Engineering	**Total Learning Hours for Unit:** 13

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- The key performance assessment of this unit comes in the final activity. As the final stage of the reverse engineering unit, teams of students physically disassemble their 'automoblox' (toy car that comes apart into several pieces) and give a presentation to their peers. Their presentation should include documentation of all the parts, their properties, and their functions within the automoblox. In addition, students explain the strengths, weaknesses, and potential for improvements for each part.

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

8A.3   Utilize time and manage workload efficiently

9A.2   Conduct themselves in a respectable, professional manner

10A.2 Prioritize, plan and manage work to achieve the intended result

11B.1 Act responsibly with the interests of the larger community in mind

Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=67767&v=b26b7852

  Cluster: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

        I. 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. (10.9-12.I)

  Cluster: Students will develop the abilities to use and maintain technological products and systems.

         L. Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques. (12.9-12.L)

Aligned Washington State Academic Standards	
Mathematics: Common Core	HS.G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. HS.G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). HS.G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

	HS.G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
	HS.G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another. HS.G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line. HS.G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. HS.G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* HS.G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* HS.G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).*
Mathematical Practices	MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively. MP3 Construct viable arguments and critique the reasoning of others. MP4 Model with mathematics. MP5 Use appropriate tools strategically. MP6 Attend to precision. MP7 Look for and make use of structure.

Unit 7: Documentation	**Total Learning Hours for Unit:** 24

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:
- At this point in the curriculum, students are becoming very proficient in the engineering design process and the 3D CAD software. As a result, the Performance Assessment becomes an even bigger part of the curriculum. In this unit (and in upcoming units), students will be using all of the aspects they've learned from previous units to complete a large, group task. In this unit, students design and construct one or more "Product Enhancement(s)" for the Automoblox.
- Students are required to follow the design process to create this product.

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.
Example:
    1A.1 Use a wide range of idea creation techniques (such as brainstorming)
    1B.3 Demonstrate originality and inventiveness in work and understand the real-world limits to adopting new ideas
    2B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems
    3A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts	

Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=67767&v=b26b7852

 Cluster: Students will develop an understanding of the core concepts of technology.

    AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final   design and development. (2.9-12.AA)

 Cluster: Students will develop an understanding of the attributes of design.

    K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.

 (8.9-12.K)   Cluster: Students will develop the abilities to apply the design process.

    M. Identify the design problem to solve and decide whether or not to address it. (11.9-12.M)

    N. Identify criteria and constraints and determine how these will affect the design process. (11.9-12.N)

    O. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (11.9-12.O)

    P. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for   proper design and to note areas where improvements are needed. (11.9-12.P)

    Q. Develop and produce a product or system using a design process. (11.9-12.Q)

    R. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual,   and written means, in addition to three-dimensional models. (11.9-12.R)

 Cluster: Students will develop the abilities to use and maintain technological products and systems.

    P. Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.   (12.9-12.P)

 Cluster: Students will develop an understanding of and be able to select and use information and communication technologies.

    Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that   incorporate a variety of visual, auditory, and tactile stimuli. (17.9-12.Q)

Aligned Washington State Academic Standards	
Mathematics: Common Core	HS.N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. HS.G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. HS.G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as

	outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
	HS.G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
	HS.G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
	HS.G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
	HS.G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
	HS.G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
	HS.G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
	HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*
	HS.G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).*
Mathematical Practices	MP1 Make sense of problems and persevere in solving them.
	MP2 Reason abstractly and quantitatively.
	MP3 Construct viable arguments and critique the reasoning of others.
	MP4 Model with mathematics.
	MP5 Use appropriate tools strategically.
	MP7 Look for and make use of structure.

Unit 8: Advanced Computer Modeling	**Total Learning Hours for Unit:** 20

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Students work on creating CAD sketches and multi-view drawings of their sketches (which will include orthographic and auxiliary views) for one of three projects (Button Maker, Arbor Press, or Toy Train). Students will be required to produce each component (on CAD) to fully assembly their project.
- Students create a video showing how each component comes together to create their final assembly.

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

> 2A.1 Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation
>
> 2D.2 Identify and ask significant questions that clarify various points of view and lead to better solutions
>
> 3B.1 Demonstrate ability to work effectively and respectfully with diverse teams
>
> 4A.2 Evaluate information critically and competently

Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=677767&v=b26b7852

Cluster: Students will develop an understanding of the attributes of design.

> H. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype. (8.9-12.H)
>
> I. Design problems are seldom presented in a clearly defined form. (8.9-12.I)
>
> J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved. (8.9-12.J)
>
> K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (8.9-12.K)

Cluster: Students will develop an understanding of engineering design.

> I. Established design principles are used to evaluate existing designs, to collect data, and to guide the design process. (9.9-12.I)
>
> J. Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. (9.9-12.J)
>
> K. A prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (9.9-12.K)
>
> L. The process of engineering design takes into account a number of factors(9.9-12.L)

Cluster: Students will develop the abilities to apply the design process.

> N. Identify criteria and constraints and determine how these will affect the design process. (11.9-12.N)
>
> O. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (11.9-12.O)
>
> P. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for   proper design and to note areas where improvements are needed. (11.9-12.P)
>
> Q. Develop and produce a product or system using a design process. (11.9-12.Q)
>
> R. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual,   and written means, in addition to three-dimensional models. (11.9-12.R)

Cluster: Students will develop the abilities to use and maintain technological products and systems.

> P. Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.   (12.9-12.P)

Cluster: Students will develop an understanding of and be able to select and use information and communication technologies.

> P. There are many ways to communicate information, such as graphic and electronic means. (17.9-12.P)

	Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli. (17.9-12.Q)

Aligned Washington State Academic Standards

Mathematics: Common Core	HS.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
	HS.A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
	HS.A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
	HS.F.LE.5 Interpret the parameters in a linear or exponential function in terms of a context.
	HS.G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
	HS.G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
	HS.G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
	HS.G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
	HS.G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
	HS.G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
	HS.G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
	HS.G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
	HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*
	HS.G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).*

	HS.G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).*
Mathematical Practices	MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively. MP3 Construct viable arguments and critique the reasoning of others. MP4 Model with mathematics. MP5 Use appropriate tools strategically. MP6 Attend to precision. MP7 Look for and make use of structure.

Unit 9: Design Team	**Total Learning Hours for Unit:** 23

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- Students complete one of five design challenges, where they are following the design process to solve a very specific challenge. They are working in groups to create a unique product that meets the challenge. Instructors intentionally minimize students' ability to communicate face-to-face, so students must be creative in how they communicate with each other (this can take many forms, such as Skype, email, Twitter, Facebook, phone calls, paper message, etc. This creates numerous challenges to the students and requires them to utilize many of the 21st Century Skills they have been learning/using in previous activities from this course.
- Ultimately, this unit assesses students on their performance in the design challenge. Components that make up this assessment include:
  1) Team Rubrics
  2) Teammate Evaluations
  3) Engineering Notebook Evaluation
  4) Summary Presentation

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

    1A.1 Use a wide range of idea creation techniques (such as brainstorming)

    1B.3 Demonstrate originality and inventiveness in work and understand the real-world limits to adopting new ideas

    2B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

    3A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts

Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=67767&v=b26b7852

  Cluster: Students will develop an understanding of the core concepts of technology.

     Z. Selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste.

      (2.9-12.Z)   Cluster: Students will develop an understanding of the cultural, social, economic, and political effects of

technology.

    H. Changes caused by the use of technology can range from gradual to rapid and from subtle to obvious. (4.9-12.H)

    I. Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects. (4.9-12.I)

    J.Ethical considerations are important in the development, selection, and use of technologies.
     (4.9-12.J)

Cluster: Students will develop an understanding of the effects of technology on the environment.

    L. Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the   environment. (5.9-12.L)

Cluster: Students will develop an understanding of the attributes of design.

    H. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints,   exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype. (8.9-12.H)

    I. Design problems are seldom presented in a clearly defined form. (8.9-12.I)

    J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved. (8.9-12.J)

    K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.
     (8.9-12.K)   Cluster: Students will develop an understanding of engineering design.

    I. Established design principles are used to evaluate existing designs, to collect data, and to guide the design process. (9.9-12.I)

    J. Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. (9.9-12.J)

    K. A prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (9.9-12.K)

    L. The process of engineering design takes into account a number of factors.(9.9-12.L)

Cluster: Students will develop the abilities to apply the design process.

    M. Identify the design problem to solve and decide whether or not to address it. (11.9-12.M)

    N. Identify criteria and constraints and determine how these will affect the design process. (11.9-12.N)

    O. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (11.9-12.O)

    P. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for   proper design and to note areas where improvements are needed. (11.9-12.P)

    Q. Develop and produce a product or system using a design process. (11.9-12.Q)

    R. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual,   and written means, in addition to three-dimensional models. (11.9-12.R)

Cluster: Students will develop the abilities to use and maintain technological products and systems.

    P. Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.   (12.9-12.P)

Cluster: Students will develop an understanding of and be able to select and use information and communication technologies.

    M. Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and   machine to machine. (17.9-12.M)

P. There are many ways to communicate information, such as graphic and electronic means. (17.9-12.P) Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli. (17.9-12.Q)	
Aligned Washington State Academic Standards	
Mathematics: Common Core	HS.G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).*
Mathematical Practices	MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively. MP3 Construct viable arguments and critique the reasoning of others. MP4 Model with mathematics. MP5 Use appropriate tools strategically. MP6 Attend to precision. MP7 Look for and make use of structure.

Unit 10: Design Challenge	**Total Learning Hours for Unit:** 33

Performance Assessments: (Districts to complete for each unit)

Example assessments for this unit include:

- The culminating project, where students will select a problem that exists in their life/community and generate a solution to this problem, will require students to use almost every single skill from the course.
- Working in collaborative teams, students will select a problem facing them, their community, or others. They will then follow the design process to generate a solution to this problem. Students will be assessed on this process the following ways:

  1) Engineering Notebook

  2) Design Proposal (which will include a title page, abstract, design brief, technical drawings, hand sketches, disassembly chart, rendered images, and overall summary

  3) Group Presentation

Leadership Alignment: (Districts to complete for each unit)

Leadership alignment must include a unit specific project/activity that aligns with the 21st Century Leadership Skills.

Example:

     1A.1 Use a wide range of idea creation techniques (such as brainstorming)

     1B.3 Demonstrate originality and inventiveness in work and understand the real-world limits to adopting new ideas

     2B.1 Analyze how parts of a whole interact with each other to produce overall outcomes in complex systems

     3A.1 Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts

Industry Standards and/or Competencies:

Resource: International Technology and Engineering Educators Association:

https://www.iteea.org/File.aspx?id=67767&v=b26b7852

 Cluster: Students will develop an understanding of the core concepts of technology.

Z. Selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste. (2.9-12.Z)

AA. Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development. (2.9-12.AA)

BB. Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints. (2.9-12.BB)

Cluster: Students will develop an understanding of the attributes of design.

H. The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype. (8.9-12.H)

J. The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved. (8.9-12.J)

K. Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other. (8.9-12.K)

Cluster: Students will develop an understanding of engineering design.

I. Established design principles are used to evaluate existing designs, to collect data, and to guide the design process. (9.9-12.I)

J. Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. (9.9-12.J)

K. A prototype is a working model used to test a design concept by making actual observations and necessary adjustments. (9.9-12.K)

L. The process of engineering design takes into account a number of factors. (9.9-12.L)   Cluster: Students will develop the abilities to apply the design process.

M. Identify the design problem to solve and decide whether or not to address it. (11.9-12.M)

N. Identify criteria and constraints and determine how these will affect the design process. (11.9-12.N)

O. Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product. (11.9-12.O)

P. Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed. (11.9-12.P)

Q. Develop and produce a product or system using a design process. (11.9-12.Q)

R. Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models. (11.9-12.R)

Cluster: Students will develop the abilities to use and maintain technological products and systems.

P. Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate. (12.9-12.P)

Cluster: Students will develop an understanding of and be able to select and use information and communication technologies.

P. There are many ways to communicate information, such as graphic and electronic means. (17.9-12.P)

Q. Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that   incorporate a variety of visual, auditory, and tactile stimuli. (17.9-12.Q)

Aligned Washington State Academic Standards

Mathematics: Common Core	HS.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* HS.G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).*
Mathematical Practices	MP1 Make sense of problems and persevere in solving them. MP2 Reason abstractly and quantitatively. MP3 Construct viable arguments and critique the reasoning of others. MP4 Model with mathematics. MP5 Use appropriate tools strategically. MP6 Attend to precision. MP7 Look for and make use of structure.