Connections to Standards in Engineering

PLTW curriculum is designed to empower students to thrive in an evolving world. As a part of the design process when developing and updating our curriculum, we focus on connections to a variety of standards. PLTW Engineering Essentials connects to standards in the following:

Table of Contents

Common Core State Standards for English Language Arts Anchor Standards

Reading

Integration of Knowledge and Ideas

CCSS.ELA-LITERACY.CCRA.R.7

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

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

Writing

Text Types and Purposes

CCSS.ELA-LITERACY.CCRA.W.1

Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

Production and Distribution of Writing

CCSS.ELA-LITERACY.CCRA.W.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

CCSS.ELA-LITERACY.CCRA.W.6

Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.CCRA.W.7

Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

Common Core State Standards for English Language Arts Anchor Standards

CCSS.ELA-LITERACY.CCRA.W.8

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

CCSS.ELA-LITERACY.CCRA.W.9

Draw evidence from literary or informational texts to support analysis, reflection, and research.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

Range of Writing

CCSS.ELA-LITERACY.CCRA.W.10

Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Common Core State Standards for Mathematics

Creating Equations

Create equations that describe numbers or relationships

CCSS.MATH.CONTENT.HSA.CED.A.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.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑	☐	☐	☐

CCSS.MATH.CONTENT.HSA.CED.A.2

Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑	☐	☐	☐

CCSS.MATH.CONTENT.HSA.CED.A.3

Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non- viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

CCSS.MATH.CONTENT.HSA.CED.A.4

Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law $V = IR$ to highlight resistance R.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☑	☐	☑	☑	☑	☐	☐	☐	☐

Reasoning with Equations and Inequalities

Solve equations and inequalities in one variable

CCSS.MATH.CONTENT.HSA.REI.B.3

Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☑	☑	☐	☑	☑	☐	☐	☐	☐

Common Core State Standards for Mathematics

Represent and solve equations and inequalities graphically

CCSS.MATH.CONTENT.HSA.REI.D.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).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑	☐	☐	☐

Interpreting Functions

Analyze functions using different representations

CCSS.MATH.CONTENT.HSF.IF.C.7.A

Graph linear and quadratic functions and show intercepts, maxima, and minima.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐

CCSS.MATH.CONTENT.HSF.IF.C.7..E

Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐

Building Functions

Build a function that models a relationship between two quantities

CCSS.MATH.CONTENT.HSF.BF.A.1

Write a function that describes a relationship between two quantities.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑	☐	☐	☐

Linear, Quadratic, and Exponential Models

Construct and compare linear, quadratic, and exponential models and solve problems

CCSS.MATH.CONTENT.HSF.LE.A.1

Distinguish between situations that can be modeled with linear functions and with exponential functions.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐

CCSS.MATH.CONTENT.HSF.LE.A.2

Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐

Interpret expressions for functions in terms of the situation they model

CCSS.MATH.CONTENT.HSF.LE.B.5

Interpret the parameters in a linear or exponential function in terms of a context.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☑	☐	☑	☐	☑	☐

Geometric Measurement and Dimension

Explain volume formulas and use them to solve problems

CCSS.MATH.CONTENT.HSG.GMD.A.3

Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑

Modeling with Geometry

Apply geometric concepts in modeling situations

CCSS.MATH.CONTENT.HSG.MG.A.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).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☑	☐	☐	☐	☑	☐	☐	☐	☐

CCSS.MATH.CONTENT.HSG.MG.A.2

Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑

CCSS.MATH.CONTENT.HSG.MG.A.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).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☐	☑	☐	☐	☑	☐	☐	☐	☑

Interpreting Categorical and Quantitative Data

Summarize, represent, and interpret data on a single count or measurement variable

CCSS.MATH.CONTENT.HSS.ID.A.1

Represent data with plots on the real number line (dot plots, histograms, and box plots).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐

CCSS.MATH.CONTENT.HSS.ID.A.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.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐

CCSS.MATH.CONTENT.HSS.ID.A.3

Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐

CCSS.MATH.CONTENT.HSS.ID.B.6

Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐

CCSS.MATH.CONTENT.HSS.ID.B.6.A

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.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐

CCSS.MATH.CONTENT.HSS.ID.B.6.C

Fit a linear function for a scatter plot that suggests a linear association.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑	☐	☐	☐

Common Core State Standards for Mathematics

Standards for Mathematical Practice

CCSS.MATH.PRACTICE.MP1

Make sense of problems and perservere in solving them.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☐	☑	☐	☐	☑	☐	☐	☐	☑

CCSS.MATH.PRACTICE.MP2

Reason abstractly and quantitatively.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☑	☐	☑	☐

CCSS.MATH.PRACTICE.MP3

Construct viable arguments and critique the reasoning of others.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☑	☐	☐	☐

CCSS.MATH.PRACTICE.MP4

Model with mathematics.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☑	☑	☑	☑	☐	☑	☑	☑	☑

CCSS.MATH.PRACTICE.MP5

Use appropriate tools strategically.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☑	☑	☑	☑	☐	☐	☑	☑	☑	☑

CCSS.MATH.PRACTICE.MP6

Attend to precision.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

Common Core State Standards for English Language Arts

Speaking and Listening (9-10)

Comprehension and Collaboration

CCSS.ELA-LITERACY.SL.9-10.1

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

CCSS.ELA-LITERACY.SL.9-10.1.A

Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐

CCSS.ELA-LITERACY.SL.9-10.1.B

Work with peers to set rules for collegial discussions and decision-making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☐	☑	☑	☐	☑	☐	☐	☑	☑	☐	☐	☑

CCSS.ELA-LITERACY.SL.9-10.1.C

Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☑

CCSS.ELA-LITERACY.SL.9-10.1.D

Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☑	☑	☐	☐	☑	☐	☐	☑	☑	☑	☑	☑

CCSS.ELA-LITERACY.SL.9-10.2

Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑

CCSS.ELA-LITERACY.SL.9-10.3

Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Presentation of Knowledge and Ideas

CCSS.ELA-LITERACY.SL.9-10.4

Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☑

CCSS.ELA-LITERACY.SL.9-10.5

Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑

CCSS.ELA-LITERACY.SL.9-10.6

Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Language (11-12)

Vocabulary Acquistion and Use

CCSS.ELA-LITERACY.L.11-12.6

Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

Common Core State Standards for English Language Arts

Science and Technical Subjects (9-10)

Key Ideas and Details

CCSS.ELA-LITERACY.RST.9-10.3

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐

Craft and Structure

CCSS.ELA-LITERACY.RST.9-10.4

Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

CCSS.ELA-LITERACY.RST.9-10.6

Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Integration of Knowledge and Ideas

CCSS.ELA-LITERACY.RST.9-10.7

Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☑	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

CCSS.ELA-LITERACY.RST.9-10.8

Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

Writing History/Social Studies, Science, and Technical Subjects (9-10)

Text Types and Purposes

CCSS.ELA-LITERACY.WHST.9-10.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

CCSS.ELA-LITERACY.WHST.9-10.2.A

Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☑	☑	☑	☑	☑	☑	☐	☐	☐	☐

CCSS.ELA-LITERACY.WHST.9-10.2.B

Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐

CCSS.ELA-LITERACY.WHST.9-10.2.C

Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐

CCSS.ELA-LITERACY.WHST.9-10.2.D

Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

CCSS.ELA-LITERACY.WHST.9-10.2.E

Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☑	☐	☐	☑	☐	☑	☑	☑	☐	☐

CCSS.ELA-LITERACY.WHST.9-10.2.F

Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐

Production and Distribution of Writing

CCSS.ELA-LITERACY.WHST.9-10.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐

CCSS.ELA-LITERACY.WHST.9-10.6

Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.WHST.9-10.7

Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☑	☐	☐	☑	☐	☐	☑	☐	☑	☑	☑

CCSS.ELA-LITERACY.WHST.9-10.8

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☑	☐	☐	☑	☐	☐	☑	☐	☐	☐	☑

CCSS.ELA-LITERACY.WHST.9-10.9

Draw evidence from informational texts to support analysis, reflection, and research.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☑	☐	☐	☑	☐	☐	☑	☐	☐	☑	☑

Common Core State Standards for English Language Arts

Range of Writing

CCSS.ELA-LITERACY.WHST.9-10.10

Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐

Waves and their Applications in Technologies for Information Transfer

HS.PS4.2

Evaluate questions about the advantages of using a digital transmission and storage of information.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐

Ecosystems: Interactions, Energy, and Dynamics

HS.LS2.7

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑

Earth and Human Activity

HS.ESS3.4

Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☑	☐	☑	☑

HS.ESS3.6

Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐

Engineering Design

HS.ETS1.2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☐	☑	☐	☐	☑	☐	☐	☐	☑

HS.ETS1.3

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☐	☑	☐	☐	☑	☐	☐	☐	☑

HS.ETS1.4

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☑	☐

Disciplinary Core Ideas

PS3.A Definitions of Energy

- “Electrical energy” may mean energy stored in a battery or energy transmitted by electric currents. (secondary to HS-PS2-5)

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐

- At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. (HSPS3-2), (HS-PS3-3)

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐

PS3.B Conservation of Energy and Energy Transfer

- Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HS-PS3-1), (HS-PS3-4)

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐

ETS1.A Defining and Delimiting Engineering Problems

- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☑	☐	☑	☑	☐	☐	☐	☑

• Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☑	☐	☐	☐	☑	☑	☐	☐	☑	☑	☑	☑

ETS1.B Developing Possible Solutions

• When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3)

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☑	☐	☐	☐	☑	☐	☐	☑	☑	☐	☑	☑

ETS1.C Optimizing the Design Solution

• Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. (secondary to HS-PS1-6)

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☑	☐	☑	☐	☐	☑	☑	☐	☑	☑

ESS3.C Human Impacts on Earth Systems

• Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☑	☐

Science and Engineering Practices

Practice 1 Asking Questions and Defining Problems
Asking questions and defining problems in 9-12 builds on K-8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

• Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information. that arise from examining models or a theory, to clarify and/or seek additional information and relationships.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☑	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐

• Evaluate a question to determine if it is testable and relevant.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

- Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☑	☑	☑	☑	☐	☐	☑	☐	☐	☐

- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☑	☐	☐	☑	☑	☑	☑	☐	☑	☐	☐	☑	☐

- Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐	☑

Practice 2 Developing and Using Models
Modeling in 9-12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism or system in order to select or revise a model that best fits the evidence or design criteria.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☑	☐	☐	☐

- Design a test of a model to ascertain its reliability.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☐	☐	☐	☑	☑	☐	☐	☐	☐

- Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

- Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☐	☐	☐

- Develop a complex model that allows for manipulation and testing of a proposed process or system.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☐	☑	☐	☑	☑	☑	☑	☑	☐	☐	☑	☐

- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Practice 3 Planning and Carrying Out Investigations
Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐	☑	☐

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☑	☑	☑	☑	☐	☐	☑	☐	☐	☐

- Select appropriate tools to collect, record, analyze, and evaluate data. Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☑	☑	☑	☑	☐	☐	☑	☐	☐	☐

Practice 4 Analyzing and Interpreting Data
Analyzing data in 9-12 builds on K-8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☑	☐	☑	☑	☑	☑	☑	☐	☐	☐

• Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☑	☐	☑	☐	☐	☑	☐	☐	☐

• Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☑	☐	☑	☐

• Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

• Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☑	☑	☑	☐	☐	☑	☑	☑	☐	☐

Practice 5 Using Mathematics and Computational Thinking
Mathematical and computational thinking in 9- 12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

• Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☑	☐

• Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐	☑	☐

• Apply techniques of algebra and functions to represent and solve scientific and engineering problems.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☑	☐	☑	☐	☐	☑	☐	☑	☐

- Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model “makes sense” by comparing the outcomes with what is known about the real world.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐

- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3, acre-feet, etc.)

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

Practice 6 Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 9-12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☑	☑	☐	☑	☐	☑	☑	☐	☐	☐

- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☑	☑	☑	☐	☐	☐	☐	☑	☐

- Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☑	☑	☑	☑	☑	☑	☐	☑	☑

- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☑	☑	☑	☑	☐	☑	☑	☐	☐	☐

- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☐	☑	☑	☑	☑	☐	☑	☑	☑	☐	☑	☑

Practice 7 Engaging in Argument from Evidence
Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.

- Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☐	☑	☑	☑	☑	☐	☐	☑	☐	☐	☐	☑

- Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

- Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence, challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining additional information required to resolve contradictions.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

- Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

- Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☐	☑	☑	☐	☑	☐	☐	☐	☑

- Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☐	☑	☐	☐	☑	☐	☐	☐	☑

Practice 8 Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in 9-12 builds on K-8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

- Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

- Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☑	☑	☐

- Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

- Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Crosscutting Concepts

- Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐	☐	☐	☐

- Mathematical representations are needed to identify some patterns.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐

- Empirical evidence is needed to identify patterns.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐

Next Generation Science Standards

- Patterns observable at one scale may not be observable or exist at other scales.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐

- Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth).

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☑	☐	☑	☐	☐	☑	☐	☐	☐

- A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

- Systems can be designed to do specific tasks.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☐	☑	☑	☐	☑	☑	☐	☐	☑	☑

- When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☐	☑	☑	☑	☑	☑	☑	☑	☐	☑	☐	☐

- Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximations inherent in models.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☐	☐	☑	☑	☑	☑	☑	☐	☑	☑	☐	☐

- The way an object is shaped or structured determines many of its properties and functions.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☑	☑	☐	☑	☑	☐	☐	☑	☑

Next Generation Science Standards

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☑	☑	☐	☑	☑	☑	☑	☑	☑

- The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☑	☑	☐	☑	☑	☑	☐	☐	☐

Standards for Technological and Engineering Literacy

STEL 1 Nature and Characteristics of Technology and Engineering

STEL-1N

Explain how the world around them guides technological development and engineering design.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑

STEL-1O

Assess how similarities and differences among scientific, mathematics, engineering, and technological knowledge and skills contributed to the design of a product or system.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☑	☑	☐	☐	☐	☐	☐	☐

STEL-1Q

Conduct research to inform intentional inventions and innovations that address specific needs and wants.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☐	☐	☐	☐	☐	☐	☑	☑	☐	☑

STEL-1R

Develop a plan that incorporates knowledge from science, mathematics, and other disciplines to design or improve a technological product or system.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☑	☐	☐	☐	☐	☑	☑	☐	☑	☑

STEL 2 Core Concepts of Technology and Engineering

STEL-2T

Demonstrate the use of conceptual, graphical, virtual, mathematical, and physical modeling to identify conflicting considerations before the entire system is developed and to aid in design decision making.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

STEL-2V

Analyze the stability of a technological system and how it is influenced by all of the components in the system, especially those in the feedback loop.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐

STEL-2W

Select resources that involve tradeoffs between competing values, such as availability, cost, desirability, and waste while solving problems.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐

STEL-2X

Cite examples of the criteria and constraints of a product or system and how they affect final design.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☐	☑	☐	☐	☐	☑	☐	☐	☑

STEL-2Y

Implement quality control as a planned process to ensure that a product, service, or system meets established criteria.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☐	☑	☐	☐	☑	☑	☐	☐	☑

STEL-2Z

Use management processes in planning, organizing, and controlling work.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☑	☑	☑	☑	☑	☑	☑	☑	☑

STEL 3 Integration of Knowledge, Technologies, and Practices

STEL-3I

Evaluate how technology enhances opportunities for new products and services through globalization.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	☐	☐	☐	☑

STEL-3J

Connect technological progress to the advancement of other areas of knowledge and vice versa.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	☑	☐	☐

STEL 4 Impacts of Technology

STEL-4P

Evaluate ways that technology can impact individuals, society, and the environment.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☐	☐	☐	☐	☐	☑	☐	☐	☐	☑

STEL-4T

Evaluate how technologies alter human health and capabilities.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐

STEL 5 Influence of Society on Technological Development

STEL-5H

Evaluate a technological innovation that arose from a specific society's unique need or want.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☐	☐	☐	☐	☑	☐	☐	☑	☐	☐

STEL 7 Design in Technology and Engineering Education

STEL-7W

Determine the best approach by evaluating the purpose of the design.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☑	☐	☑	☐	☐	☐	☐	☑	☑	☑

STEL-7X

Document trade-offs in the technology and engineering design process to produce the optimal design.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑

STEL-7Y

Optimize a design by addressing desired qualities within criteria and constraints.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☑	☐	☑	☐	☑	☑	☑	☐	☐	☑

STEL-7Z

Apply principles of human-centered design.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☑	☐	☑	☑	☐	☑	☐	☑

STEL-7AA

Illustrate principles, elements and factors of design.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	☑	☐	☑

STEL-7BB

Implement the best possible solution to a design.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☑	☑	☐	☐	☐	☐	☑	☐	☐	☐	☐

STEL-7CC

Apply a broad range of design skills to their design process.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☑	☑	☑	☑	☐	☑	☐	☑	☑	☑	☐	☑	☑

STEL-7DD

Apply a broad range of making skills to their design process.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☑	☑	☐	☑	☐	☑	☑	☐	☐	☑	☑

STEL 8 Applying, Maintaining, and Assessing Technological Products and Systems

STEL-8N

Use various approaches to communicate processes and procedures for using, maintaining, and assessing technological products and systems.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☑

STEL-8O

Develop a device or system for the marketplace.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☑	☐	☐	☑	☑	☐	☑	☐	☑	☑	☐	☐	☑	☑

STEL-8P

Apply appropriate methods to diagnose, adjust and repair systems to ensure precise, safe and proper functionality.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☐	☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐

STEL-8Q

Synthesize data and analyze trends to make decisions about technological products, systems, or processes.

1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	4.4
☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	☑	☐	☑	☐

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