PLTW Engineering Standards Connection
Computer Integrated Manufacturing

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 Computer Integrated Manufacturing connects to standards in the following:

Table of Contents

Common Core State Standards for English Language Arts Anchor Standards

Reading

Key Ideas and Details

CCSS.ELA-LITERACY.CCRA.R.1

Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

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

CCSS.ELA-LITERACY.CCRA.R.2

Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

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

Range of Reading and Level of Text Complexity

CCSS.ELA-LITERACY.CCRA.R.10

Read and comprehend complex literary and informational texts independently and proficiently.

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

Writing

Text Types and Purposes

CCSS.ELA-LITERACY.CCRA.W.2

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

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

CCSS.ELA-LITERACY.CCRA.W.3

Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Common Core State Standards for English Language Arts Anchor Standards

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.

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

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.CCRA.W.8

Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

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

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

Speaking and Listening

Comprehension and Collaboration

CCSS.ELA-LITERACY.CCRA.SL.1

Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

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

CCSS.ELA-LITERACY.CCRA.SL.2

Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

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

Presentation of Knowledge and Ideas

CCSS.ELA-LITERACY.CCRA.SL.4

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

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

Common Core State Standards for English Language Arts Anchor Standards

CCSS.ELA-LITERACY.CCRA.SL.5

Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

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

CCSS.ELA-LITERACY.CCRA.SL.6

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

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

Language

Conventions of Standard English

CCSS.ELA-LITERACY.CCRA.L.1

Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

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

CCSS.ELA-LITERACY.CCRA.L.2

Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

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

Knowledge of Language

CCSS.ELA-LITERACY.CCRA.L.3

Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

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

Vocabulary Acquisition and Use

CCSS.ELA-LITERACY.CCRA.L.4

Determine or clarify the meaning of unknown and multiple-meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.

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

Common Core State Standards for English Language Arts Anchor Standards

CCSS.ELA-LITERACY.CCRA.L.5

Demonstrate understanding of word relationships and nuances in word meanings.

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

CCSS.ELA-LITERACY.CCRA.L.6

Acquire and use accurately a range of 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 encountering an unknown term important to comprehension or expression.

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

Common Core Standards for Mathematics

Quantities

Reason Quantitatively and Use Units to Solve Problems

CCSS.MATH.CONTENT.HSN.Q.A.1

Use units as a way to understand problems and to guide the solution of multistep problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

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

CCSS.MATH.CONTENT.HSN.Q.A.3

Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

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

Vector and Matrix Quantities

Perform Operations on Vectors

CCSS.MATH.CONTENT.HSN.VM.B.4

(+) Add and subtract vectors.

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

CCSS.MATH.CONTENT.HSN.VM.B.4.B

Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.

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

Seeing Structure in Expressions

Interpret the Structure of Expressions

CCSS.MATH.CONTENT.HSA.SSE.A.1.A

Interpret parts of an expression, such as terms, factors, and coefficients.

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

Common Core Standards for Mathematics

Creating Equations

Create Equations That Describe Numbers Or Relationships

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☐	☐	☐	☑	☐	☑	☑	☑	☐	☐	☐

Reasoning with Equations and Inequalities

Understand Solving Equations as a Process of Reasoning and Explain the Reasoning

CCSS.MATH.CONTENT.HSA.REI.A.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.

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

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐

Linear, Quadratic, and Exponential Models

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐

Trigonometric Functions

Model Periodic Phenomena with Trigonometric Functions

CCSS.MATH.CONTENT.HSF.TF.B.7

(+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Similarity, Right Triangles, and Trigonometry

Define Trigonometric Ratios and Solve Problems Involving Right Triangles

CCSS.MATH.CONTENT.HSG.SRT.C.8

Use trigonometric ratios and the Pythagorean theorem to solve right triangles in applied problems.

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

Geometric Measurement and Dimension

Visualize Relationships Between Two-Dimensional and Three-Dimensional Objects

CCSS.MATH.CONTENT.HSG.GMD.B.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.

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

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☐	☐	☐	☐	☐	☑	☐	☐	☐	☐	☐

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐

Common Core Standards for Mathematics

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☐	☐	☐	☑	☐	☑	☐	☐	☐	☐	☐

Common Core English Language Arts Standards

Reading Literature (9-10)

Key Ideas and Details

CCSS.ELA-LITERACY.RL.9-10.1

Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

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

Reading Informational Text (11-12)

Integration of Knowledge and Ideas

CCSS.ELA-LITERACY.RI.11-12.7

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

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

Writing (9-10)

Text Types and Purposes

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

Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

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

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

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

CCSS.ELA-LITERACY.W.9-10.1.E

Provide a concluding statement or section that follows from and supports the argument presented.

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

Common Core English Language Arts Standards

CCSS.ELA-LITERACY.W.9-10.2

Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

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

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

Introduce a topic; organize complex 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

CCSS.ELA-LITERACY.W.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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

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

Use precise language and domain-specific vocabulary to manage the complexity of the topic.

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

CCSS.ELA-LITERACY.W.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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

CCSS.ELA-LITERACY.W.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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

CCSS.ELA-LITERACY.W.9-10.3

Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

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

Common Core English Language Arts Standards

Production and Distribution of Writing

CCSS.ELA-LITERACY.W.9-10.4

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.W.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 following a standard format for citation.

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

CCSS.ELA-LITERACY.W.9-10.9

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

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

Writing (11-12)

Text Types and Purposes

CCSS.ELA-LITERACY.W.11-12.1.C

Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.

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

CCSS.ELA-LITERACY.W.11-12.1.D

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

CCSS.ELA-LITERACY.W.11-12.1.E

Provide a concluding statement or section that follows from and supports the argument presented.

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

Common Core English Language Arts Standards

CCSS.ELA-LITERACY.W.11-12.2

Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

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

CCSS.ELA-LITERACY.W.11-12.2.A

Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

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

CCSS.ELA-LITERACY.W.11-12.2.B

Develop the topic thoroughly by selecting the most significant and relevant 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

CCSS.ELA-LITERACY.W.11-12.2.D

Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

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

CCSS.ELA-LITERACY.W.11-12.2.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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

CCSS.ELA-LITERACY.W.11-12.2.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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

CCSS.ELA-LITERACY.W.11-12.3

Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

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

Production and Distribution of Writing

CCSS.ELA-LITERACY.W.11-12.4

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.W.11-12.8

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

CCSS.ELA-LITERACY.W.11-12.9

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

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

Speaking and Listening (9-10)

Comprehension and Collaboration

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☑

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☑

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☑

Speaking and Listening (11-12)

Comprehension and Collaboration

CCSS.ELA-LITERACY.SL.11-12.2

Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

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

Presentation of Knowledge and Ideas

CCSS.ELA-LITERACY.SL.11-12.4

Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

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

CCSS.ELA-LITERACY.SL.11-12.5

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☐	☑	☐	☐	☐	☑	☑

CCSS.ELA-LITERACY.SL.11-12.6

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

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

Language (9-10)

Conventions of Standard English

CCSS.ELA-LITERACY.L.9-10.1

Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

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

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

Use various types of phrases (noun, verb, adjectival, adverbial, participial, prepositional, absolute) and clauses (independent, dependent; noun, relative, adverbial) to convey specific meanings and add variety and interest to writing or presentations.

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

CCSS.ELA-LITERACY.L.9-10.2

Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

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

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

Spell correctly.

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

Common Core English Language Arts Standards

Vocabulary Acquisition and Use

CCSS.ELA-LITERACY.L.9-10.6

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Language (11-12)

Conventions of Standard English

CCSS.ELA-LITERACY.L.11-12.1

Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

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

CCSS.ELA-LITERACY.L.11-12.2

Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

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

CCSS.ELA-LITERACY.L.11-12.2.B

Spell correctly.

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

Vocabulary Acquisition and Use

CCSS.ELA-LITERACY.L.11-12.5

Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.

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

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Common Core English Language Arts Standards

History/Social Studies (9-10)

Key Ideas and Details

CCSS.ELA-LITERACY.RH.9-10.1

Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.

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

History/Social Studies (11-12)

Key Ideas and Details

CCSS.ELA-LITERACY.RH.11-12.1

Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.

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

Integration of Knowledge and Ideas

CCSS.ELA-LITERACY.RH.11-12.9

Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.

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

Science and Technical (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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☐	☑	☐	☐	☐	☑	☑	☐	☑	☐	☐

Range of Reading and Level of Text Complexity

CCSS.ELA-LITERACY.RST.9-10.10

By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

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

Common Core English Language Arts Standards

Science and Technical (11-12)

Key Ideas and Details

CCSS.ELA-LITERACY.RST.11-12.3

Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

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

Integration of Knowledge and Ideas

CCSS.ELA-LITERACY.RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

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

CCSS.ELA-LITERACY.RST.11-12.9

Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

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

Range of Reading and Level of Text Complexity

CCSS.ELA-LITERACY.RST.11-12.10

By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.

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

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

Text Types and Purposes

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

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

Common Core English Language Arts Standards

CCSS.ELA-LITERACY.WHST.9-10.1.E

Provide a concluding statement or section that follows from or supports the argument presented.

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

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

Common Core English Language Arts Standards

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

Research to Build and Present Knowledge

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 following a standard format for citation.

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

CCSS.ELA-LITERACY.WHST.9-10.9

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

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

Writing History/Social Studies, Science, and Technical Subjects (11-12)

Text Types and Purposes

CCSS.ELA-LITERACY.WHST.11-12.1.D

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

CCSS.ELA-LITERACY.WHST.11-12.1.E

Provide a concluding statement or section that follows from or supports the argument presented.

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

CCSS.ELA-LITERACY.WHST.11-12.2

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

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

Common Core English Language Arts Standards

CCSS.ELA-LITERACY.WHST.11-12.2.A

Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

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

CCSS.ELA-LITERACY.WHST.11-12.2.B

Develop the topic thoroughly by selecting the most significant and relevant 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

CCSS.ELA-LITERACY.WHST.11-12.2.D

Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.

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

CCSS.ELA-LITERACY.WHST.11-12.2.E

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

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

Production and Distribution of Writing

CCSS.ELA-LITERACY.WHST.11-12.4

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☑	☐	☑	☑	☐	☐	☐	☑	☑

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.WHST.11-12.8

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐

Common Core English Language Arts Standards

CCSS.ELA-LITERACY.WHST.11-12.9

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

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

Next Generation Science Standards

Energy

HS.PS3.1

Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

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

HS.PS3.3

Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

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

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☐	☐	☑	☐	☐	☑	☐	☑	☐	☐	☑

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
☐	☐	☑	☐	☐	☑	☐	☑	☐	☐	☑

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Next Generation Science Standards

Science and Engineering Practices

Practice 1 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.

- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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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.

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- Develop a complex model that allows for manipulation and testing of a proposed process or system.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Practice 3 Planning and Carrying Out Investigations

- Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Practice 5 Using Mathematics and Computational Thinking

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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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.

- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Disciplinary Core Ideas

PS3.A Energy - Definitions of Energy

- Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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PS3.B Energy - Conservation of Energy and Energy Transfer

- Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. (HS-PS3-1)

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- The availability of energy limits what can occur in any system. (HS-PS3-1)

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Next Generation Science Standards

PS4.A Waves and their Applications in Technologies for Information Transfer - Wave Properties

- Information can be digitized (e.g., a picture stored as the values of an array of pixels); in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses. (HS-PS4-2), (HSPS4-5)

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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ETS1.B Engineering Design - 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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ETS1.C Engineering Design - 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Crosscutting Concepts

Patterns

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Cause and Effect: Mechanism and Prediction

- Systems can be designed to cause a desired effect.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- Changes in systems may have various causes that may not have equal effects.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Next Generation Science Standards

Systems and System Models

- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- Systems can be designed to do specific tasks.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- 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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Energy and Matter: Flows, Cycles, and Conservation

- The total amount of energy and matter in closed systems is conserved.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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- Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Standards for Technological and Engineering Literacy

STEL 1 Nature and Characteristics of Technology and Engineering

STEL-1Q

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL-2U

Diagnose a flawed system embedded within a larger technological, social, or environmental system.

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

STEL-2Z

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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Standards for Technological and Engineering Literacy

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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL 7 Design in Technology and Engineering Education

STEL-7X

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL-7Y

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL-7Z

Apply principles of human-centered design.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL-7AA

Illustrate principles, elements and factors of design.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL-7BB

Implement the best possible solution to a design.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL-7CC

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL-7DD

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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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	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL-8O

Develop a device or system for the marketplace.

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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STEL-8Q

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

1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
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