

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 Aerospace Engineering connects to standards in the following:

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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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Craft and Structure

CCSS.ELA-LITERACY.CCRA.R.4

Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

CCSS.ELA-LITERACY.CCRA.R.6

Assess how point of view or purpose shapes the content and style of a text.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

CCSS.ELA-LITERACY.CCRA.R.8

Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

CCSS.ELA-LITERACY.CCRA.R.9

Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts Anchor Standards

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 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.CCRA.W.7

Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts Anchor Standards

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts Anchor Standards

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Vector and Matrix Quantities

Represent and Model with Vector Quantities

CCSS.MATH.CONTENT.HSN.VM.A.3

(+) Solve problems involving velocity and other quantities that can be represented by vectors.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Reasoning with Equations & 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Common Core Standards for Mathematics

Interpreting Functions

Interpret Functions That Arise in Applications in Terms of the Context

CCSS.MATH.CONTENT.HSF.IF.B.6

Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Building Functions

Build a Function That Models a Relationship Between Two Quantities

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

(+) Compose functions. For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Similarity, Right Triangles & 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 | 4.1 4.2 4.3

Circles

Understand and Apply Theorems About Circles

CCSS.MATH.CONTENT.HSG.C.A.2

Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Modeling with Geometry

Apply Geometric Concepts in Modeling Situations

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 | 4.1 4.2 4.3

Common Core Standards for Mathematics

Interpreting Categorical & 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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Common Core State Standards for English Language Arts

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 | 4.1 4.2 4.3

Writing (9-10)

Text Types and Purposes

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 | 4.1 4.2 4.3

CCSS.ELA-LITERACY.W.9-10.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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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

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

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.W.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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

CCSS.ELA-LITERACY.W.9-10.9.B

Apply grades 9-10 Reading standards to literary nonfiction (e.g., "Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning").

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Writing (11-12)

Text Types and Purposes

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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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

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

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

CCSS.ELA-LITERACY.W.11-12.3.D

Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

CCSS.ELA-LITERACY.W.11-12.3.E

Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.W.11-12.7

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

CCSS.ELA-LITERACY.W.11-12.8

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

Speaking and Listening (9-10)

Comprehension and Collaboration

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Speaking and Listening (11-12)

Comprehension and Collaboration

CCSS.ELA-LITERACY.SL.11-12.1

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11–12 topics, texts, and issues, 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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

Knowledge of Language

CCSS.ELA-LITERACY.L.9-10.3.A

Write and edit work so that it conforms to the guidelines in a style manual (e.g., MLA Handbook, Turabian's Manual for Writers) appropriate for the discipline and writing type.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Integration of Knowledge and Ideas

CCSS.ELA-LITERACY.RH.9-10.7

Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

History/Social Studies (11-12)

Integration of Knowledge and Ideas

CCSS.ELA-LITERACY.RH.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (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 | 4.1 4.2 4.3

Science and Technical (9-10)

Key Ideas and Details

CCSS.ELA-LITERACY.RST.9-10.1

Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Science and Technical (11-12)

Key Ideas and Details

CCSS.ELA-LITERACY.RST.11-12.1

Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Writing (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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

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 | 4.1 4.2 4.3

Writing (11-12)

Text Types and Purposes

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Research to Build and Present Knowledge

CCSS.ELA-LITERACY.WHST.11-12.7

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Common Core State Standards for English Language Arts

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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Next Generation Science Standards

Matter and Its Interactions

HS.PS1.3

Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Motion and Stability: Forces and Interactions

HS.PS2.1

Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

HS.PS2.3

Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

HS.PS2.4

Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

HS.PS3.2

Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as either motions of particles or energy stored in fields.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Next Generation Science Standards

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Earth's Place in the Universe

HS.ESS1.4

Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Engineering Design

HS.ETS1.1

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Next Generation Science Standards

Disciplinary Core Ideas

PS2.A Motion and Stability: Forces and Interactions - Forces and Motion

- Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1)

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4)

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

PS3.A Energy - 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- 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. (HS-PS3-1), (HS-PS3-2)

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- 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 | 4.1 4.2 4.3

- These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Next Generation Science Standards

- 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 | 4.1 4.2 4.3

- 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 | 4.1 4.2 4.3

- 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 | 4.1 4.2 4.3

- Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS-PS3-4)

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

PS3.C Energy - Relationship Between Energy and Forces

- When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5)

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

PS3.D Energy - Energy in Chemical Processes and Everyday Life

- Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment. (HS-PS3-3), (HS-PS3-4)

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

ETS1.A Engineering Design - 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Next Generation Science Standards

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

ESS1.B Earth's Place in the Universe - Earth and the Solar System

- Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. (HS-ESS1-4)

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

ESS2.D Earth's Systems - Weather and Climate

- Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2- 6), (HS-ESS2-4)

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

ESS3.C Earth and Human Activity - Human Impacts on Earth Systems

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Science and Engineering Practices

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.

- 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 | 4.1 4.2 4.3

Next Generation Science Standards

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. Consider possible variables or effects and evaluate the confounding investigation's design to ensure variables are controlled.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- 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 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Next Generation Science Standards

- 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- 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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

- 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 | 4.1 4.2 4.3

Next Generation Science Standards

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.

- 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

- 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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Systems and System Models

Systems can be designed to do specific tasks.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Next Generation Science Standards

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

Structure and Function

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

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Stability and Change

Feedback (negative or positive) can stabilize or destabilize a system.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

STEL-1P

Analyze the rate of technological development and predict future diffusion and adoption of new technologies.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Standards for Technological and Engineering Literacy

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

STEL 3 Integration of Knowledge, Technologies, and Practices

STEL-3H

Analyze how technology transfer occurs when a user applies an existing innovation developed for one function for a different purpose.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

STEL-3J

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

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

STEL 4 Impacts of Technology

STEL-4P

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

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

STEL-4Q

Critique whether existing or proposed technologies use resources sustainably.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

STEL-4R

Assess a technology that minimizes resource use and resulting waste to achieve a goal.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

STEL-4S

Develop a solution to a technological problem that has the least negative environmental and social impact.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Standards for Technological and Engineering Literacy

STEL-4T

Evaluate how technologies alter human health and capabilities.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

STEL 6 History of Technology

STEL-6F

Relate how technological development has been evolutionary, often the result of a series of refinements to basic inventions or technological knowledge.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

STEL-6H

Evaluate how technology has been a powerful force in reshaping the social, cultural, political, and economic landscapes throughout history.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

STEL-7Z

Apply principles of human-centered design.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

Standards for Technological and Engineering Literacy

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

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

STEL-8P

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

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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 | 4.1 4.2 4.3

STEL-8R

Interpret the results of technology assessment to guide policy development.

1.1 1.2 1.3 | 2.1 2.2 2.3 | 3.1 3.2 | 4.1 4.2 4.3

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