Computer Integrated Manufacturing (CIM)

Lesson 1.1

Common Core State Standards for English Language Arts

AS.R.1 - Reading

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.

AS.R.2 - Reading

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

AS.R.7 - Reading

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

AS.R.10 - Reading

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

AS.W.2 - Writing

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

AS.W.4 - Writing

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

AS.W.8 - Writing

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

AS.W.9 - Writing

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

AS.SL.2 - Speaking and Listening

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

AS.SL.4 - Speaking and Listening

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.

AS.SL.5 - Speaking and Listening

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

AS.SL.6 - Speaking and Listening

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

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.3 - Language

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.

AS.L.4 - Language

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.

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.RL.1 - Reading Literature

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

11-12.RI.7 - Reading Informational

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.

9-10.W.1.c - Writing

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.

9-10.W.1.d - Writing

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

9-10.W.1.e - Writing

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

9-10.W.2 - Writing

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.

9-10.W.2.a - Writing

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.

9-10.W.2.b - Writing

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.

9-10.W.2.d - Writing

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

9-10.W.2.e - Writing

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

9-10.W.2.f - Writing

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).

9-10.W.4 - Writing

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.)

9-10.W.8 - Writing

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.

9-10.W.9 - Writing

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

11-12.W.1.c - Writing

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.

11-12.W.1.d - Writing

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

11-12.W.1.e - Writing

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

11-12.W.2 - Writing

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.

11-12.W.2.a - Writing

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.

11-12.W.2.b - Writing

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.

11-12.W.2.d - Writing

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

11-12.W.2.e - Writing

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

11-12.W.2.f - Writing

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).

11-12.W.4 - Writing

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.)

11-12.W.8 - Writing

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 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.

11-12.W.9 - Writing

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

9-10.SL.2 - Speaking and Listening

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

9-10.SL.4 - Speaking and Listening

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.

9-10.SL.5 - Speaking and Listening

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.

9-10.SL.6 - Speaking and Listening

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

11-12.SL.2 - Speaking and Listening

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.

11-12.SL.4 - Speaking and Listening

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.

11-12.SL.5 - Speaking and Listening

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.

11-12.SL.6 - Speaking and Listening

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

9-10.L.1 - Language

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

9-10.L.1.b - Language

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.

9-10.L.2 - Language

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

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

9-10.RH.1 - Reading History/Social Studies

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

11-12.RH.1 - Reading History/Social Studies

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.

11-12.RH.9 - Reading History/Social Studies

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

11-12.RST.7 - Reading Science/Technical

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.

11-12.RST.9 - Reading Science/Technical

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.

9-10.WHST.1.d - Writing HS/S/T

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

9-10.WHST.1.e - Writing HS/S/T

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

9-10.WHST.2 - Writing HS/S/T

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

9-10.WHST.2.a - Writing HS/S/T

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.

9-10.WHST.2.b - Writing HS/S/T

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.

9-10.WHST.2.d - Writing HS/S/T

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.

9-10.WHST.2.e - Writing HS/S/T

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

9-10.WHST.2.f - Writing HS/S/T

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).

9-10.WHST.4 - Writing HS/S/T

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

9-10.WHST.8 - Writing HS/S/T

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.

9-10.WHST.9 - Writing HS/S/T

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

11-12.WHST.1.d - Writing HS/S/T

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

11-12.WHST.1.e - Writing HS/S/T

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

11-12.WHST.2 - Writing HS/S/T

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

11-12.WHST.2.a - Writing HS/S/T

Introduce a topic and 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.

11-12.WHST.2.b - Writing HS/S/T

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.

11-12.WHST.2.d - Writing HS/S/T

Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

11-12.WHST.2.e - Writing HS/S/T

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).

11-12.WHST.4 - Writing HS/S/T

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

11-12.WHST.8 - Writing HS/S/T

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.

11-12.WHST.9 - Writing HS/S/T

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

Computer Integrated Manufacturing (CIM)

Lesson 1.1

Standards for Technological Literacy

1.9-12.K Students will develop an understanding of the characteristics and scope of technology.

K. The rate of technological development and diffusion is increasing rapidly.

2.9-12.X Students will develop an understanding of the core concepts of technology.

X. Systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems.

2.9-12.Y Students will develop an understanding of the core concepts of technology.

Y. The stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.

2.9-12.CC Students will develop an understanding of the core concepts of technology.

CC. New technologies create new processes.

2.9-12.DD Students will develop an understanding of the core concepts of technology.

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

2.9-12.EE Students will develop an understanding of the core concepts of technology.

EE. Management is the process of planning, organizing, and controlling work.

2.9-12.FF Students will develop an understanding of the core concepts of technology.

FF. Complex systems have many layers of controls and feedback loops to provide information.

3.9-12.G Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

G. Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.

4.9-12.I Students will develop an understanding of the cultural, social, economic, and political effects of technology.

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

7.9-12.G Students will develop an understanding of the influence of technology on history.

G. Most technological development has been evolutionary, the result of a series of refinements to a basic invention.

7.9-12.H Students will develop an understanding of the influence of technology on history.

H. The evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.

7.9-12.I Students will develop an understanding of the influence of technology on history.

I. Throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape.

7.9-12.N Students will develop an understanding of the influence of technology on history.

N. The Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.

7.9-12.O Students will develop an understanding of the influence of technology on history.

O. The Information Age places emphasis on the processing and exchange of information.

9.9-12.L Students will develop an understanding of engineering design.

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

10.9-12.I Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.

I. Research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.

17.9-12.L Students will develop an understanding of and be able to select and use information and communication technologies.

L. Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information.

17.9-12.M Students will develop an understanding of and be able to select and use information and communication technologies.

M. Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.

17.9-12.N Students will develop an understanding of and be able to select and use information and communication technologies.

N. Information and communication systems can be used to inform, persuade, entertain,control, manage, and educate.

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

19.9-12.O Students will develop an understanding of and be able to select and use manufacturing technologies.

O. Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.

19.9-12.P Students will develop an understanding of and be able to select and use manufacturing technologies.

P. The interchangeability of parts increases the effectiveness of manufacturing processes.

Computer Integrated Manufacturing (CIM)

Lesson 1.2

Common Core State Standards for English Language Arts

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

9-10.RST.3 - Reading Science/Technical

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.

9-10.RST.10 - Reading Science/Technical

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

11-12.RST.3 - Reading Science/Technical

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.

11-12.RST.10 - Reading Science/Technical

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

Computer Integrated Manufacturing (CIM)

Lesson 1.2

Standards for Technological Literacy

2.9-12.X Students will develop an understanding of the core concepts of technology.

X. Systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems.

2.9-12.Y Students will develop an understanding of the core concepts of technology.

Y. The stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.

2.9-12.FF Students will develop an understanding of the core concepts of technology.

FF. Complex systems have many layers of controls and feedback loops to provide information.

9.9-12.K Students will develop an understanding of engineering design.

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

9.9-12.L Students will develop an understanding of engineering design.

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

12.9-12.O Students will develop the abilities to use and maintain technological products and systems.

O. Operate systems so that they function in the way they were designed.

12.9-12.P Students will develop the abilities to use and maintain technological products and systems.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

Computer Integrated Manufacturing (CIM)

Lesson 1.3

Common Core State Standards for English Language Arts

AS.W.2 - Writing

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

AS.W.3 - Writing

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

AS.W.4 - Writing

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

AS.SL.1 - Speaking and Listening

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.

AS.SL.4 - Speaking and Listening

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.

AS.SL.5 - Speaking and Listening

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

AS.SL.6 - Speaking and Listening

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

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.3 - Language

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.

AS.L.4 - Language

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.

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.W.1.d - Writing

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

9-10.W.2 - Writing

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.

9-10.W.2.d - Writing

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

9-10.W.2.e - Writing

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

9-10.W.2.f - Writing

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).

9-10.W.3 - Writing

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

9-10.W.4 - Writing

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.)

11-12.W.1.d - Writing

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

11-12.W.2 - Writing

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.

11-12.W.2.d - Writing

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

11-12.W.2.e - Writing

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

11-12.W.3 - Writing

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

11-12.W.4 - Writing

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.)

9-10.SL.4 - Speaking and Listening

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.

9-10.SL.5 - Speaking and Listening

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.

9-10.SL.6 - Speaking and Listening

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

11-12.SL.4 - Speaking and Listening

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.

11-12.SL.5 - Speaking and Listening

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.

11-12.SL.6 - Speaking and Listening

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

9-10.L.1 - Language

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

9-10.L.1.b - Language

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.

9-10.L.2 - Language

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

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

9-10.WHST.1.d - Writing HS/S/T

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

9-10.WHST.2 - Writing HS/S/T

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

9-10.WHST.2.d - Writing HS/S/T

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.

9-10.WHST.2.e - Writing HS/S/T

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

9-10.WHST.4 - Writing HS/S/T

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

11-12.WHST.1.d - Writing HS/S/T

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

11-12.WHST.2 - Writing HS/S/T

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

11-12.WHST.2.d - Writing HS/S/T

Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

11-12.WHST.4 - Writing HS/S/T

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

Computer Integrated Manufacturing (CIM)

Lesson 1.3

Next Generation Science Standards

HS.ETS1.2 - Engineering Design

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

HS.ETS1.3 - Engineering Design

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.

DCI - 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)

DCI - 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)

Science and Engineering Practice - 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.

Science and Engineering Practice - Using Mathematics and Computational Thinking

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

Science and Engineering Practice - Engaging in Argument from Evidence

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.

Crosscutting Concepts - 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.

Crosscutting Concepts - Systems and System Models

Systems can be designed to do specific tasks.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Systems and System Models

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.

Computer Integrated Manufacturing (CIM)

Lesson 1.3

Standards for Technological Literacy

1.9-12.M Students will develop an understanding of the characteristics and scope of technology.

M. Most development of technologies these days is driven by the profit motive and the market.

2.9-12.W Students will develop an understanding of the core concepts of technology.

W. Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems.

2.9-12.Z Students will develop an understanding of the core concepts of technology.

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

2.9-12.AA Students will develop an understanding of the core concepts of technology.

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

2.9-12.BB Students will develop an understanding of the core concepts of technology.

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

2.9-12.DD Students will develop an understanding of the core concepts of technology.

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

2.9-12.FF Students will develop an understanding of the core concepts of technology.

FF. Complex systems have many layers of controls and feedback loops to provide information.

8.9-12.H Students will develop an understanding of the attributes of design.

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

8.9-12.J Students will develop an understanding of the attributes of design.

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

8.9-12.K Students will develop an understanding of the attributes of design.

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

9.9-12.I Students will develop an understanding of engineering design.

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

9.9-12.J Students will develop an understanding of engineering design.

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

9.9-12.K Students will develop an understanding of engineering design.

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

9.9-12.L Students will develop an understanding of engineering design.

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

11.9-12.N Students will develop the abilities to apply the design process.

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

11.9-12.O Students will develop the abilities to apply the design process.

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

11.9-12.P Students will develop the abilities to apply the design process.

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

11.9-12.Q Students will develop the abilities to apply the design process.

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

11.9-12.R Students will develop the abilities to apply the design process.

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

12.9-12.O Students will develop the abilities to use and maintain technological products and systems.

O. Operate systems so that they function in the way they were designed.

12.9-12.P Students will develop the abilities to use and maintain technological products and systems.

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

17.9-12.N Students will develop an understanding of and be able to select and use information and communication technologies.

N. Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.

17.9-12.P Students will develop an understanding of and be able to select and use information and communication technologies.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

Computer Integrated Manufacturing (CIM)

Lesson 2.1

Common Core State Standards for English Language Arts

AS.R.1 - Reading

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.

AS.R.2 - Reading

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

AS.R.7 - Reading

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

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

Computer Integrated Manufacturing (CIM)

Lesson 2.1

Common Core State Standards for Mathematics

N.Q.1 - Quantities

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.

N.Q.3 - Quantities

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

A.CED.4 - Creating Equations

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.

A.REI.3 - Reasoning with Equations and Inequalities

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

G.GMD.4 - Geometric Measurement and Dimension

Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

G.MG.2 - Modeling with Geometry

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

G.MG.3 - Modeling with Geometry

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).

Computer Integrated Manufacturing (CIM)

Lesson 2.1

Standards for Technological Literacy

4.9-12.J Students will develop an understanding of the cultural, social, economic, and political effects of technology.

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

9.9-12.L Students will develop an understanding of engineering design.

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

17.9-12.P Students will develop an understanding of and be able to select and use information and communication technologies.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

Computer Integrated Manufacturing (CIM)

Lesson 2.2

Common Core State Standards for English Language Arts

AS.R.1 - Reading

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.

AS.R.2 - Reading

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

AS.R.7 - Reading

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

AS.R.10 - Reading

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

AS.W.2 - Writing

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

AS.W.4 - Writing

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

AS.W.8 - Writing

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

AS.W.9 - Writing

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

AS.SL.2 - Speaking and Listening

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

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.RL.1 - Reading Literature

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

11-12.RI.7 - Reading Informational

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.

9-10.W.1.c - Writing

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.

9-10.W.1.d - Writing

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

9-10.W.1.e - Writing

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

9-10.W.2 - Writing

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.

9-10.W.2.a - Writing

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.

9-10.W.2.b - Writing

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.

9-10.W.2.d - Writing

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

9-10.W.2.e - Writing

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

9-10.W.2.f - Writing

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).

9-10.W.4 - Writing

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.)

9-10.W.8 - Writing

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.

9-10.W.9 - Writing

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

11-12.W.1.c - Writing

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.

11-12.W.1.d - Writing

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

11-12.W.1.e - Writing

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

11-12.W.2 - Writing

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.

11-12.W.2.a - Writing

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.

11-12.W.2.b - Writing

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.

11-12.W.2.d - Writing

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

11-12.W.2.e - Writing

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

11-12.W.2.f - Writing

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).

11-12.W.4 - Writing

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.)

11-12.W.8 - Writing

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 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.

11-12.W.9 - Writing

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

9-10.SL.2 - Speaking and Listening

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

11-12.SL.2 - Speaking and Listening

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.

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

9-10.RH.1 - Reading History/Social Studies

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

11-12.RH.1 - Reading History/Social Studies

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.

11-12.RH.9 - Reading History/Social Studies

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

11-12.RST.7 - Reading Science/Technical

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.

11-12.RST.9 - Reading Science/Technical

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.

9-10.WHST.1.d - Writing HS/S/T

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

9-10.WHST.1.e - Writing HS/S/T

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

9-10.WHST.2 - Writing HS/S/T

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

9-10.WHST.2.a - Writing HS/S/T

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.

9-10.WHST.2.b - Writing HS/S/T

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.

9-10.WHST.2.d - Writing HS/S/T

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.

9-10.WHST.2.e - Writing HS/S/T

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

9-10.WHST.2.f - Writing HS/S/T

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).

9-10.WHST.4 - Writing HS/S/T

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

9-10.WHST.8 - Writing HS/S/T

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.

9-10.WHST.9 - Writing HS/S/T

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

11-12.WHST.1.d - Writing HS/S/T

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

11-12.WHST.1.e - Writing HS/S/T

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

11-12.WHST.2 - Writing HS/S/T

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

11-12.WHST.2.a - Writing HS/S/T

Introduce a topic and 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.

11-12.WHST.2.b - Writing HS/S/T

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.

11-12.WHST.2.d - Writing HS/S/T

Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

11-12.WHST.2.e - Writing HS/S/T

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).

11-12.WHST.4 - Writing HS/S/T

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

11-12.WHST.8 - Writing HS/S/T

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.

11-12.WHST.9 - Writing HS/S/T

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

Computer Integrated Manufacturing (CIM)

Lesson 2.2

Standards for Technological Literacy

9.9-12.K Students will develop an understanding of engineering design.

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

9.9-12.L Students will develop an understanding of engineering design.

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

17.9-12.P Students will develop an understanding of and be able to select and use information and communication technologies.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

19.9-12.O Students will develop an understanding of and be able to select and use manufacturing technologies.

O. Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.

Computer Integrated Manufacturing (CIM)

Lesson 2.3

Common Core State Standards for English Language Arts

AS.W.2 - Writing

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

AS.W.3 - Writing

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

AS.W.4 - Writing

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

AS.SL.4 - Speaking and Listening

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.

AS.SL.5 - Speaking and Listening

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

AS.SL.6 - Speaking and Listening

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

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.3 - Language

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.

AS.L.4 - Language

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.

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.W.1.d - Writing

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

9-10.W.2 - Writing

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.

9-10.W.2.d - Writing

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

9-10.W.2.e - Writing

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

9-10.W.2.f - Writing

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).

9-10.W.3 - Writing

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

9-10.W.4 - Writing

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.)

11-12.W.1.d - Writing

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

11-12.W.2 - Writing

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.

11-12.W.2.d - Writing

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

11-12.W.2.e - Writing

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

11-12.W.3 - Writing

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

11-12.W.4 - Writing

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.)

9-10.SL.4 - Speaking and Listening

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.

9-10.SL.5 - Speaking and Listening

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.

9-10.SL.6 - Speaking and Listening

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

11-12.SL.4 - Speaking and Listening

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.

11-12.SL.5 - Speaking and Listening

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.

11-12.SL.6 - Speaking and Listening

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

9-10.L.1 - Language

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

9-10.L.1.b - Language

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.

9-10.L.2 - Language

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

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

9-10.RST.3 - Reading Science/Technical

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.

9-10.RST.10 - Reading Science/Technical

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

11-12.RST.3 - Reading Science/Technical

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.

11-12.RST.10 - Reading Science/Technical

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

9-10.WHST.1.d - Writing HS/S/T

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

9-10.WHST.2 - Writing HS/S/T

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

9-10.WHST.2.d - Writing HS/S/T

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.

9-10.WHST.2.e - Writing HS/S/T

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

9-10.WHST.4 - Writing HS/S/T

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

11-12.WHST.1.d - Writing HS/S/T

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

11-12.WHST.2 - Writing HS/S/T

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

11-12.WHST.2.d - Writing HS/S/T

Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

11-12.WHST.4 - Writing HS/S/T

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

Computer Integrated Manufacturing (CIM)

Lesson 2.3

Common Core State Standards for Mathematics

N.Q.1 - Quantities

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.

N.Q.3 - Quantities

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

N.VM.4 - Vector and Matrix Quantities

(+) Add and subtract vectors.

N.VM.4.b - Vector and Matrix Quantities

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

A.SSE.1.a - Seeing Structure in Expressions

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

A.CED.4 - Creating Equations

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.

A.REI.1 - Reasoning with Equations and Inequalities

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.

A.REI.3 - Reasoning with Equations and Inequalities

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

A.REI.10 - Reasoning with Equations and Inequalities

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).

F.LE.5 - Linear, Quadratic, and Exponential Models

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

G.SRT.8 - Similarity, Right Triangles, and Trigonometry

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

G.GMD.4 - Geometric Measurement and Dimension

Identify the shapes of two-dimensional cross-sections of three- dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

G.MG.1 - Modeling with Geometry

Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

G.MG.3 - Modeling with Geometry

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).

Computer Integrated Manufacturing (CIM)

Lesson 2.3

Next Generation Science Standards

HS.ETS1.2 - Engineering Design

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

HS.ETS1.3 - Engineering Design

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.

HS.ETS1.4 - Engineering Design

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.

DCI - 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)

DCI - 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)

DCI - 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)

Science and Engineering Practice - 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.

Science and Engineering Practice - Using Mathematics and Computational Thinking

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

Science and Engineering Practice - Engaging in Argument from Evidence

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.

Crosscutting Concepts - 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.

Crosscutting Concepts - Systems and System Models

Systems can be designed to do specific tasks.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Systems and System Models

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.

Computer Integrated Manufacturing (CIM)

Lesson 2.3

Standards for Technological Literacy

2.9-12.W Students will develop an understanding of the core concepts of technology.

W. Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems.

2.9-12.Z Students will develop an understanding of the core concepts of technology.

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

2.9-12.AA Students will develop an understanding of the core concepts of technology.

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

2.9-12.BB Students will develop an understanding of the core concepts of technology.

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

2.9-12.DD Students will develop an understanding of the core concepts of technology.

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

8.9-12.H Students will develop an understanding of the attributes of design.

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

8.9-12.J Students will develop an understanding of the attributes of design.

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

8.9-12.K Students will develop an understanding of the attributes of design.

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

9.9-12.I Students will develop an understanding of engineering design.

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

9.9-12.J Students will develop an understanding of engineering design.

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

9.9-12.K Students will develop an understanding of engineering design.

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

9.9-12.L Students will develop an understanding of engineering design.

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

11.9-12.N Students will develop the abilities to apply the design process.

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

11.9-12.O Students will develop the abilities to apply the design process.

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

11.9-12.P Students will develop the abilities to apply the design process.

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

11.9-12.Q Students will develop the abilities to apply the design process.

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

11.9-12.R Students will develop the abilities to apply the design process.

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

12.9-12.O Students will develop the abilities to use and maintain technological products and systems.

O. Operate systems so that they function in the way they were designed.

12.9-12.P Students will develop the abilities to use and maintain technological products and systems.

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

17.9-12.N Students will develop an understanding of and be able to select and use information and communication technologies.

N. Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.

17.9-12.O Students will develop an understanding of and be able to select and use information and communication technologies.

O. Communication systems are made up of source, encoder, transmitter, receiver, decoder,storage, retrieval, and destination.

17.9-12.P Students will develop an understanding of and be able to select and use information and communication technologies.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

Computer Integrated Manufacturing (CIM)

Lesson 3.1

Common Core State Standards for English Language Arts

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

9-10.RST.3 - Reading Science/Technical

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.

9-10.RST.10 - Reading Science/Technical

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

11-12.RST.3 - Reading Science/Technical

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.

11-12.RST.10 - Reading Science/Technical

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

Computer Integrated Manufacturing (CIM)

Lesson 3.1

Common Core State Standards for Mathematics

N.Q.1 - Quantities

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.

N.Q.3 - Quantities

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

A.CED.4 - Creating Equations

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.

A.REI.3 - Reasoning with Equations and Inequalities

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

F.TF.7 - Trigonometric Functions

(+) 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.

G.SRT.8 - Similarity, Right Triangles, and Trigonometry

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

Computer Integrated Manufacturing (CIM)

Lesson 3.1

Standards for Technological Literacy

9.9-12.L Students will develop an understanding of engineering design.

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

12.9-12.P Students will develop the abilities to use and maintain technological products and systems.

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

17.9-12.P Students will develop an understanding of and be able to select and use information and communication technologies.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

Computer Integrated Manufacturing (CIM)

Lesson 3.2

Common Core State Standards for English Language Arts

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

Computer Integrated Manufacturing (CIM)

Lesson 3.2

Common Core State Standards for Mathematics

N.Q.1 - Quantities

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.

N.Q.3 - Quantities

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

A.CED.4 - Creating Equations

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.

A.REI.3 - Reasoning with Equations and Inequalities

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

Computer Integrated Manufacturing (CIM)

Lesson 3.2

Next Generation Science Standards

HS.PS3.1 - Energy

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.

HS.PS3.3 - Energy

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

HS.ETS1.2 - Engineering Design

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

HS.ETS1.3 - Engineering Design

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.

DCI - 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. (HSPS3-1), (HS-PS3-2)

DCI - PS3.A - Energy - Definitions of Energy

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

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer

Conserv ation 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)

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer

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

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer

Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relativ e 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. (HS-PS3-1)

DCI - PS3.B - Energy - Conservation of Energy and Energy Transfer

The availability of energy limits what can occur in any system. (HS-PS3-1)

DCI - 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)

DCI - 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)

Science and Engineering Practice - 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.

Science and Engineering Practice - Using Mathematics and Computational Thinking

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

Science and Engineering Practice - Engaging in Argument from Evidence

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.

Crosscutting Concepts - 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.

Crosscutting Concepts - Systems and System Models

Systems can be designed to do specific tasks.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Energy and Matter: Flows, Cycles, and Conservation

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

Crosscutting Concepts - Energy and Matter: Flows, Cycles, and Conservation

Energy cannot be created or destroyed—only moves between one place and another place, between objects and/or fields, or between systems.

Computer Integrated Manufacturing (CIM)

Lesson 3.2

Standards for Technological Literacy

2.9-12.W Students will develop an understanding of the core concepts of technology.

W. Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems.

2.9-12.Z Students will develop an understanding of the core concepts of technology.

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

2.9-12.AA Students will develop an understanding of the core concepts of technology.

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

2.9-12.BB Students will develop an understanding of the core concepts of technology.

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

8.9-12.H Students will develop an understanding of the attributes of design.

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

8.9-12.I Students will develop an understanding of the attributes of design.

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

8.9-12.J Students will develop an understanding of the attributes of design.

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

8.9-12.K Students will develop an understanding of the attributes of design.

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

9.9-12.I Students will develop an understanding of engineering design.

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

9.9-12.J Students will develop an understanding of engineering design.

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

9.9-12.K Students will develop an understanding of engineering design.

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

9.9-12.L Students will develop an understanding of engineering design.

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

11.9-12.N Students will develop the abilities to apply the design process.

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

11.9-12.O Students will develop the abilities to apply the design process.

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

11.9-12.P Students will develop the abilities to apply the design process.

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

11.9-12.Q Students will develop the abilities to apply the design process.

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

11.9-12.R Students will develop the abilities to apply the design process.

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

12.9-12.P Students will develop the abilities to use and maintain technological products and systems.

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

16.9-12.J Students will develop an understanding of and be able to select and use energy and power technologies.

J. Energy cannot be created nor destroyed; however, it can be converted from one form to another.

16.9-12.K Students will develop an understanding of and be able to select and use energy and power technologies.

K. Energy can be grouped into major forms: thermal, radiant, electrical, mechanical,chemical, nuclear, and others.

16.9-12.N Students will develop an understanding of and be able to select and use energy and power technologies.

N. Power systems must have a source of energy, a process, and loads.

17.9-12.N Students will develop an understanding of and be able to select and use information and communication technologies.

N. Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.

17.9-12.P Students will develop an understanding of and be able to select and use information and communication technologies.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

Computer Integrated Manufacturing (CIM)

Lesson 3.3

Common Core State Standards for English Language Arts

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

9-10.RST.3 - Reading Science/Technical

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.

9-10.RST.10 - Reading Science/Technical

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

11-12.RST.3 - Reading Science/Technical

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.

11-12.RST.10 - Reading Science/Technical

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

Computer Integrated Manufacturing (CIM)

Lesson 3.3

Standards for Technological Literacy

9.9-12.L Students will develop an understanding of engineering design.

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

12.9-12.O Students will develop the abilities to use and maintain technological products and systems.

O. Operate systems so that they function in the way they were designed.

12.9-12.P Students will develop the abilities to use and maintain technological products and systems.

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

17.9-12.P Students will develop an understanding of and be able to select and use information and communication technologies.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

Computer Integrated Manufacturing (CIM)

Lesson 4.1

Common Core State Standards for English Language Arts

AS.R.10 - Reading

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

AS.W.2 - Writing

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

AS.W.3 - Writing

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

AS.W.4 - Writing

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

AS.W.9 - Writing

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

AS.SL.4 - Speaking and Listening

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.

AS.SL.5 - Speaking and Listening

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

AS.SL.6 - Speaking and Listening

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

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.3 - Language

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.

AS.L.4 - Language

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.

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.RL.1 - Reading Literature

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

11-12.RI.7 - Reading Informational

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.

9-10.W.1.c - Writing

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.

9-10.W.1.d - Writing

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

9-10.W.1.e - Writing

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

9-10.W.2 - Writing

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.

9-10.W.2.a - Writing

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.

9-10.W.2.b - Writing

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.

9-10.W.2.d - Writing

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

9-10.W.2.e - Writing

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

9-10.W.2.f - Writing

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).

9-10.W.3 - Writing

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

9-10.W.4 - Writing

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.)

9-10.W.8 - Writing

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.

9-10.W.9 - Writing

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

11-12.W.1.c - Writing

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.

11-12.W.1.d - Writing

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

11-12.W.1.e - Writing

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

11-12.W.2 - Writing

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.

11-12.W.2.a - Writing

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.

11-12.W.2.b - Writing

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.

11-12.W.2.d - Writing

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

11-12.W.2.e - Writing

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

11-12.W.2.f - Writing

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).

11-12.W.3 - Writing

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

11-12.W.4 - Writing

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.)

11-12.W.8 - Writing

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 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.

11-12.W.9 - Writing

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

9-10.SL.2 - Speaking and Listening

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

9-10.SL.4 - Speaking and Listening

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.

9-10.SL.5 - Speaking and Listening

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.

9-10.SL.6 - Speaking and Listening

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

11-12.SL.2 - Speaking and Listening

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.

11-12.SL.4 - Speaking and Listening

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.

11-12.SL.5 - Speaking and Listening

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.

11-12.SL.6 - Speaking and Listening

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

9-10.L.1 - Language

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

9-10.L.1.b - Language

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.

9-10.L.2 - Language

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

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

9-10.RH.1 - Reading History/Social Studies

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

11-12.RH.1 - Reading History/Social Studies

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.

11-12.RH.9 - Reading History/Social Studies

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

11-12.RST.7 - Reading Science/Technical

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.

11-12.RST.9 - Reading Science/Technical

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.

9-10.WHST.1.d - Writing HS/S/T

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

9-10.WHST.1.e - Writing HS/S/T

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

9-10.WHST.2 - Writing HS/S/T

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

9-10.WHST.2.a - Writing HS/S/T

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.

9-10.WHST.2.b - Writing HS/S/T

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.

9-10.WHST.2.d - Writing HS/S/T

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.

9-10.WHST.2.e - Writing HS/S/T

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

9-10.WHST.2.f - Writing HS/S/T

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).

9-10.WHST.4 - Writing HS/S/T

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

9-10.WHST.8 - Writing HS/S/T

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.

9-10.WHST.9 - Writing HS/S/T

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

11-12.WHST.1.d - Writing HS/S/T

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

11-12.WHST.1.e - Writing HS/S/T

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

11-12.WHST.2 - Writing HS/S/T

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

11-12.WHST.2.a - Writing HS/S/T

Introduce a topic and 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.

11-12.WHST.2.b - Writing HS/S/T

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.

11-12.WHST.2.d - Writing HS/S/T

Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

11-12.WHST.2.e - Writing HS/S/T

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).

11-12.WHST.4 - Writing HS/S/T

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

11-12.WHST.8 - Writing HS/S/T

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.

11-12.WHST.9 - Writing HS/S/T

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

Computer Integrated Manufacturing (CIM)

Lesson 4.1

Standards for Technological Literacy

2.9-12.EE Students will develop an understanding of the core concepts of technology.

EE. Management is the process of planning, organizing, and controlling work.

9.9-12.L Students will develop an understanding of engineering design.

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

17.9-12.N Students will develop an understanding of and be able to select and use information and communication technologies.

N. Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.

17.9-12.P Students will develop an understanding of and be able to select and use information and communication technologies.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

19.9-12.O Students will develop an understanding of and be able to select and use manufacturing technologies.

O. Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.

Computer Integrated Manufacturing (CIM)

Lesson 4.2

Common Core State Standards for English Language Arts

AS.W.2 - Writing

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

AS.W.3 - Writing

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

AS.W.4 - Writing

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

AS.SL.1 - Speaking and Listening

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.

AS.SL.4 - Speaking and Listening

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.

AS.SL.5 - Speaking and Listening

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

AS.SL.6 - Speaking and Listening

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

AS.L.1 - Language

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

AS.L.2 - Language

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

AS.L.3 - Language

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.

AS.L.4 - Language

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.

AS.L.5 - Language

Demonstrate understanding of word relationships and nuances in word meanings.

AS.L.6 - Language

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 considering a word or phrase important to comprehension or expression.

9-10.W.1.d - Writing

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

9-10.W.2 - Writing

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.

9-10.W.2.d - Writing

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

9-10.W.2.e - Writing

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

9-10.W.2.f - Writing

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).

9-10.W.3 - Writing

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

9-10.W.4 - Writing

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.)

11-12.W.1.d - Writing

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

11-12.W.2 - Writing

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.

11-12.W.2.d - Writing

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

11-12.W.2.e - Writing

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

11-12.W.3 - Writing

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

11-12.W.4 - Writing

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.)

9-10.SL.4 - Speaking and Listening

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.

9-10.SL.5 - Speaking and Listening

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.

9-10.SL.6 - Speaking and Listening

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

11-12.SL.4 - Speaking and Listening

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.

11-12.SL.5 - Speaking and Listening

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.

11-12.SL.6 - Speaking and Listening

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

9-10.L.1 - Language

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

9-10.L.1.b - Language

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.

9-10.L.2 - Language

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

9-10.L.2.c - Language

Spell correctly.

9-10.L.6 - Language

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.

11-12.L.1 - Language

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

11-12.L.2 - Language

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

11-12.L.2.b - Language

Spell correctly.

11-12.L.5 - Language

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

11-12.L.6 - Language

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.

9-10.WHST.1.d - Writing HS/S/T

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

9-10.WHST.2 - Writing HS/S/T

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

9-10.WHST.2.d - Writing HS/S/T

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.

9-10.WHST.2.e - Writing HS/S/T

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

9-10.WHST.4 - Writing HS/S/T

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

11-12.WHST.1.d - Writing HS/S/T

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

11-12.WHST.2 - Writing HS/S/T

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

11-12.WHST.2.d - Writing HS/S/T

Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

11-12.WHST.4 - Writing HS/S/T

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

Computer Integrated Manufacturing (CIM)

Lesson 4.2

Next Generation Science Standards

HS.PS3.3 - Energy

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

HS.ETS1.2 - Engineering Design

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

HS.ETS1.3 - Engineering Design

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.

DCI - 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)

DCI - 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)

Science and Engineering Practice - Asking questions and defining problems

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.

Science and Engineering Practice - Developing and Using Models

Design a test of a model to ascertain its reliability.

Science and Engineering Practice - Developing and Using Models

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.

Science and Engineering Practice - Developing and Using Models

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

Science and Engineering Practice - 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.

Science and Engineering Practice - Using Mathematics and Computational Thinking

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

Science and Engineering Practice - Constructing Explanations and Designing Solutions

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

Science and Engineering Practice - Constructing Explanations and Designing Solutions

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.

Science and Engineering Practice - Engaging in Argument from Evidence

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.

Science and Engineering Practice - Engaging in Argument from Evidence

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.

Science and Engineering Practice - Engaging in Argument from Evidence

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).

Crosscutting Concepts - Patterns

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

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Systems can be designed to cause a desired effect.

Crosscutting Concepts - Cause and Effect: Mechanism and Prediction

Changes in systems may have various causes that may not have equal effects.

Crosscutting Concepts - 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.

Crosscutting Concepts - Systems and System Models

Systems can be designed to do specific tasks.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Systems and System Models

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.

Crosscutting Concepts - Systems and System Models

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.

Computer Integrated Manufacturing (CIM)

Lesson 4.2

Standards for Technological Literacy

2.9-12.W Students will develop an understanding of the core concepts of technology.

W. Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems.

2.9-12.Z Students will develop an understanding of the core concepts of technology.

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

2.9-12.AA Students will develop an understanding of the core concepts of technology.

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

2.9-12.BB Students will develop an understanding of the core concepts of technology.

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

2.9-12.DD Students will develop an understanding of the core concepts of technology.

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

8.9-12.H Students will develop an understanding of the attributes of design.

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

8.9-12.I Students will develop an understanding of the attributes of design.

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

8.9-12.J Students will develop an understanding of the attributes of design.

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

8.9-12.K Students will develop an understanding of the attributes of design.

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

9.9-12.I Students will develop an understanding of engineering design.

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

9.9-12.J Students will develop an understanding of engineering design.

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

9.9-12.K Students will develop an understanding of engineering design.

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

9.9-12.L Students will develop an understanding of engineering design.

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

11.9-12.N Students will develop the abilities to apply the design process.

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

11.9-12.O Students will develop the abilities to apply the design process.

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

11.9-12.P Students will develop the abilities to apply the design process.

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

11.9-12.Q Students will develop the abilities to apply the design process.

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

11.9-12.R Students will develop the abilities to apply the design process.

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

12.9-12.O Students will develop the abilities to use and maintain technological products and systems.

O. Operate systems so that they function in the way they were designed.

12.9-12.P Students will develop the abilities to use and maintain technological products and systems.

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

17.9-12.N Students will develop an understanding of and be able to select and use information and communication technologies.

N. Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.

17.9-12.P Students will develop an understanding of and be able to select and use information and communication technologies.

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

17.9-12.Q Students will develop an understanding of and be able to select and use information and communication technologies.

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

19.9-12.O Students will develop an understanding of and be able to select and use manufacturing technologies.

O. Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.