Disciplinary Core Idea

3.ETS1.A: Defining and Delimiting Engineering Problems

Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

Disciplinary Core Idea

3.ETS1.B: Developing Possible Solutions

Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)

Disciplinary Core Idea

3.ETS1.B: Developing Possible Solutions

At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)

Disciplinary Core Idea

3.ETS1.B: Developing Possible Solutions

Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

Disciplinary Core Idea

3.ETS1.C: Optimizing the Design Solution

Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)

Disciplinary Core Idea

3.PS3.B: Conservation of Energy and Energy Transfer

Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-4)

Disciplinary Core Idea

3.PS3.D: Energy in Chemical Processes and Everyday Life

The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)

Disciplinary Core Idea

3.ETS1.A: Defining and Delimiting Engineering Problems

Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (4-PS3-4)

Disciplinary Core Idea

3.PS4.C: Information Technologies and Instrumentation

Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4-PS4-3)

Disciplinary Core Idea

3.ETS1.C: Optimizing the Design Solution

Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (4-PS4-3)

Disciplinary Core Idea

3.ESS3.B: Natural Hazards

A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (4-ESS3-2)

Disciplinary Core Idea

3.ETS1.B: Developing Possible Solutions

Testing a solution involves investigating how well it performs under a range of likely conditions. (4-ESS3-2)

Performance Expectation

3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Clarification Statement: none
Assessment Boundary: none

Performance Expectation

3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

Clarification Statement: none
Assessment Boundary: none

Performance Expectation

3-5-ETS1-3: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Clarification Statement: none
Assessment Boundary: none

Performance Expectation

4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.
Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.

Performance Expectation

4-PS4-3: Generate and compare multiple solutions that use patterns to transfer information.

Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.
Assessment Boundary: none

Performance Expectation

4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.
Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.

Science and Engineering Practice

Asking Questions and Defining Problems

Asking questions and defining problems in grades 3–5 builds from grades K–2 experiences and progresses to specifying qualitative relationships.

Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

Science and Engineering Practice

Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)

Science and Engineering Practice

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)

Science and Engineering Practice

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

Apply scientific ideas to solve design problems. (4-PS3-4)

Science and Engineering Practice

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3)

Science and Engineering Practice

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-ESS3-2)

Crosscutting Concept

Energy and Matter

Energy can be transferred in various ways and between objects. (4-PS3-4)

Crosscutting Concept

Patterns

Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3)

Crosscutting Concept

Cause and Effect

Cause and effect relationships are routinely identified, tested, and used to explain change. (4-ESS3-2)

Connection to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

People's needs and wants change over time, as do their demands for new and improved technologies. Engineers improve existing technologies. (3-5-ETS1-1)

Connection to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (3-5-ETS1-2)

Connection to Engineering, Technology, and Applications of Science

Science Is a Human Endeavor

Science affects everyday life. (4-PS3-4)

Connection to Engineering, Technology, and Applications of Science

Science Is a Human Endeavor

Most scientists and engineers work in teams. (4-PS3-4)

Connection to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

Engineers improve existing technologies or develop new ones. (4-PS3-4)

Connection to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3)

Connection to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2)

Common Core State Standards for ELA/Literacy

Reading Informational Text

RI.5.1 - Key Ideas and Details

Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS1-2)

Common Core State Standards for ELA/Literacy

Reading Informational Text

RI.5.7 - Integration of Knowledge and Ideas

Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS1-2)

Common Core State Standards for ELA/Literacy

Reading Informational Text

RI.5.9 - Integration of Knowledge and Ideas

Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS1-2)

Common Core State Standards for ELA/Literacy

Card Type name

W.5.7 - Research to Build and Present Knowledge

Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1), (3-5-ETS1-3)

Common Core State Standards for ELA/Literacy

Card Type name

W.5.8 - Research to Build and Present Knowledge

Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1), (3-5-ETS1-3)

Common Core State Standards for ELA/Literacy

Card Type name

W.5.9 - Research to Build and Present Knowledge

Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1), (3-5-ETS1-3)

Common Core State Standards for Mathematics

Card Type name

3.OA - undefined

Operations and Algebraic Thinking (3-5-ETS1-1), (3-5-ETS1-2)

Common Core State Standards for Mathematics

Mathematical Practices

MP.2 - Reason abstractly and quantitatively

Reason abstractly and quantitatively. (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)

Common Core State Standards for Mathematics

Mathematical Practices

MP.4 - Model with mathematics

Model with mathematics. (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)

Common Core State Standards for Mathematics

Mathematical Practices

MP.5 - Use appropriate tools strategically

Use appropriate tools strategically. (3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)