Grade 1

Engineering Design

- 1.K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change that can be solved by developing or improving an object or tool
- 1.K-2-ETS1-2. Generate multiple solutions to a design a problem and make a drawing (plan) to represent one or more of the solutions

Grade 2

Engineering Design

- 2.K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same design problem to compare the strengths and weaknesses of how each object performs.
  Clarification Statements:
  - Data can include observations and be either qualitative or quantitative.
  - Examples can include how different objects insulate cold water or how different types of grocery bags perform.

Grade 3

Engineering Design

- 3.3-5-ETS1-1. Define a simple design problem that reflects a need or want. Include criteria for success and constraints on materials, time, or cost that a potential solution must meet.
- 3.3-5-ETS1-2. Generate several possible solutions to a given design problem. Compare each solution based on how well each is likely to meet the criteria and constraints of the design problem.
  Clarification Statement:
  - Examples of design problems can include adapting a switch on a toy for children who have a motor coordination disability, designing a way to clear or collect debris or trash from a storm drain, or creating a safe movable playground equipment for a new recess game.
- 3.3-5-ETS1-4(MA). Gather information using various informational resources on possible solutions to a design problem. Present different representations of a design solutions.
  Clarification Statements:
  - Examples of informational resources can include books, videos, and websites.
  - Examples of representations can include graphic organizers, sketches, models, and prototypes.

Grade 4

Engineering Design

- 4.3-5-ETS1-3. Plan and carry out tests of one of more design features of a given model or prototype in which variables are controlled and failure points are considered to identify which features need to be improved. Apply the results of tests to redesign a model or prototype.
  Clarification Statement:

    - Examples of design features can include materials, size, shape, and weight.
- 4.3-5-ETS1-5(MA). Evaluate relevant design features that must be considered in building a model or prototype of a solution to a given design problem.

Grade 5

Technological Systems

- 5.3-5-ETS3-1(MA). Use information text to provide examples of improvements to existing technologies (innovations) and the development of new technologies (inventions). Recognize that technology is any modification of the natural or designed world done to fulfill human needs or wants.
- 5.3-5-ETS3-2(MA). Use sketches or drawings to show how each part of a product or device relates to other parts in the product or device.

Grade 6

Engineering Design

- 6.MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution. Include potential impacts on people and the natural environment that may limit impossible solutions.
- 6.MA-ETS1-5(MA). Create visual representations of solutions to a design problem. Accurately interpret and apply scale and proportion to visual representations.
  Clarification Statements:
    - Examples of visual representations can include sketches, scaled drawings, and orthographic projections.
    - Examples of scale can include ¼ = 1’0’’ and 1 cm = 1 m.
- 6.MS-ETS1-6(MA). Communicate a design solution to an intended user, including design features and limitations of the solution.
  Clarification Statement:
    - Examples of intended users can include students, parents, teachers, manufacturing personnel, engineers, and customers.

Materials, Tools, and Manufacturing

- 6.MS-ETS2-1(MA). Analyze and compare properties of metals, plastics, wood, and ceramics, including flexibility, ductility, hardness, thermal conductivity, electrical conductivity, and melting point.
- 6.MA-ETS2-2(MA). Given a design task, select appropriate materials based on specific properties needed in the construction of a solution.
  Clarification Statement:
    - Examples of materials can include metals, plastics, wood, and ceramics.
- 6.MS-ETS2-3(MA). Choose and safely use appropriate measuring tools, hand tools, fasteners, and common hand held power tools used to construct a prototype.
  Clarification Statements:
    - Examples of measuring tools include a tape measure, a meter stick, and a ruler.
    - Examples of hand tools include a hammer, a screwdriver, a wrench, and pliers.

    - Examples of fasteners include nails, screws, nuts and bolts, staples, glue, and tape.
    - Examples of common power tools include jigsaw, drill, and sander.

Grade 7

Engineering Design

- 7.MS-ETS1-2. Evaluate competing solutions to a given design problem using a decision matrix to determine how well each meets the criteria and constraints of the problem. Use a model of each solution to evaluate how variations in one or more design features, including size, shape, weight, or cost, may affect the function or effectiveness of the solutions.
- 7.MS-ETS1-4. Generate and analyze data from iterative testing and modification of a proposed object, tool, or process to optimize the object, tool, or process for its intended purpose.
- 7.MS-ETS1-7(MA). Construct a prototype of a solution to a given design problem.

Grade 8

Materials, Tools, and Manufacturing

- 8.MS-ETS2-4(MA). Use informational text to illustrate that materials maintain their composition under various kinds of physical processing; however, some material properties may change if a process changes the particulate structure of a material. Clarification Statements:
    - Examples of physical processing can include cutting, forming, extruding, and sanding.
    - Examples of changes in material properties can include a non-magnetic iron material become magnetic after hammering and a plastic material becoming rigid (less elastic) after heat treatment.
- 8.MS-ETS2-5(MA). Present information that illustrates how a product can be created using basic processes in manufacturing systems, including forming, separating, conditioning, assembling, finishing, quality control, and safety. Compare the advantages and disadvantages of human vs. computer control of these processes.