MS. Engineering Design

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A Performance Expectations MS.ETS1.ED

1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. MS.ETS1.1

2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. MS.ETS1.2

3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. MS.ETS1.3

4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. MS.ETS1.4

B Science and Engineering Practices MS.ED.SEP

1 Asking Questions and Defining Problems MS.ED.SEP.1

a Define a design problem that can be solved through the development of an object, tool, process, or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS- ETS1-1) MS.ED.SEP.1A

2 Developing and Using Models MS.ED.SEP.2

a Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MSETS1-4) MS.ED.SEP.2A

3 Analyzing and Interpreting Data MS.ED.SEP.3

a Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3) MS.ED.SEP.3A

4 Engaging in Argument from Evidence MS.ED.SEP.4

a Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2) MS.ED.SEP.4A

C Disciplinary Core Ideas MS.ED.DCI

Skip to main content

1 ETS1.A: Defining and Delimiting Engineering Problems MS.ED.DCI.ETS1.A

a The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MSETS1-1) MS.ED.DCI.ETS1.A.1

2 ETS1.B: Developing Possible Solutions MS.ED.DCI.ETS1.B

a A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) MS.ED.DCI.ETS1.B.1

b There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2),(MS-ETS1-3) MS.ED.DCI.ETS1.B.2

c Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) MS.ED.DCI.ETS1.B.3

d Models of all kinds are important for testing solutions. (MSETS1-4) MS.ED.DCI.ETS1.B.4

3 ETS1.C: Optimizing the Design Solution MS.ED.DCI.ETS1.C

a Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3) MS.ED.DCI.ETS1.C.1

b The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4) MS.ED.DCI.ETS1.C.2

D Crosscutting Concepts MS.ED.CC

1 Influence of Science, Engineering, and Technology on Society and the Natural World MS.ED.CC.1

a All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MSETS1-1) MS.ED.CC.1A

b The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MSETS1-1) MS.ED.CC.1B