HS. Engineering Design

A Performance Expectations HS.ETS1.ED

1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS.ETS1.1

2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS.ETS1.2

3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. HS.ETS1.3

4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. HS.ETS1.4

B Science and Engineering Practices HS.ED.SEP

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

a Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1) HS.ED.SEP.1A

2 Using Mathematics and Computational Thinking HS.ED.SEP.2

a Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. (HS-ETS1-4) HS.ED.SEP.2A

3 Constructing Explanations and Designing Solutions HS.ED.SEP.3

a Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2) HS.ED.SEP.3A

b Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3) HS.ED.SEP.3B

C Disciplinary Core Ideas HS.ED.DCI

1. ETS1.A: Defining and Delimiting Engineering Problems HS.ED.DCI.ETS1.A
   a. Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) HS.ED.DCI.ETS1.A.1
   b. Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HSETS1-1) HS.ED.DCI.ETS1.A.2
2. ETS1.B: Developing Possible Solutions HS.ED.DCI.ETS1.B
   a. 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) HS.ED.DCI.ETS1.B.1
   b. Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4) HS.ED.DCI.ETS1.B.2
3. ETS1.C: Optimizing the Design Solution HS.ED.DCI.ETS1.C
   a. 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. (HS-ETS1-2) HS.ED.DCI.ETS1.C.1

D Crosscutting Concepts HS.ED.CC

1. Systems and System Models HS.ED.CC.1
   a. 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. (HS-ETS1-4) HS.ED.CC.1A
2. Influence of Science, Engineering, and Technology on Society and the Natural World HS.ED.CC.2
   a. New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1) (HSETS1-3) HS.ED.CC.2A