HS. Engineering Design

Students who demonstrate understanding can:

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

**HS-ETS1-2.** 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-ETS1-3.** 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-ETS1-4.** 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.

**Science and Engineering Practices**

**Asking Questions and Defining Problems**

- Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.
  - Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (HS-ETS1-1)

**Using Mathematics and Computational Thinking**

- Mathematical and computational thinking in 9–12 builds on K–8 experiences and progress to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
  - 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)

**Constructing Explanations and Designing Solutions**

- Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories.
  - 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)

- 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)

Connections to HS-ETS1-A: Defining and Delimiting Engineering Problems include:

- **Physical Science:** HS-PS2-3, HS-PS3-3
- **Earth and Space Science:** HS-ESS3-2, HS-ESS3-4, Life Science: HS-LS2-7, HS-LS4-6
- **Connections to HS-ETS1-C: Optimizing the Design Solution include:**
  - **Physical Science:** HS-PS1-6, HS-PS2-3

Articulation of DCLs across grade-bands: **HS-ETS1-A** (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4); **HS-ETS1-B** (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4); **HS-ETS1-C** (HS-ETS1-2), (HS-ETS1-4)

Common Core State Standards Connections:

**ELA/Literacy** –

- **RST.11-12.7** 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. (HS-ETS1-1), (HS-ETS1-3)

- **RST.11-12.8** Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ETS1-1), (HS-ETS1-3)

- **RST.11-12.9** 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. (HS-ETS1-1), (HS-ETS1-3)

**Mathematics** –

- **MP.2** Reason abstractly and quantitatively. (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-4)

- **MP.4** Model with mathematics. (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4)


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