NEXT GENERATION SCIENCE STANDARDS
For States, By States

MS-ETS1-1 Engineering Design

Students who demonstrate understanding can:

MS-ETS1-1. 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.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Asking Questions and Defining Problems

Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.

- 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.

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems

- 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.

Crosscutting Concepts

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

- 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.
- 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.

Observable features of the student performance by the end of the course:			
1	Identifying the problem to be solved		
	a	Students describe a problem that can be solved through the development of an object, tool, process, or system.	
2	Defining the process or system boundaries and the components of the process or system		
	a	Students identify the system in which the problem is embedded, including the major components and relationships in the system and its boundaries, to clarify what is and is not part of the problem. In their definition of the system, students include:	
		i.	Which individuals or groups need this problem to be solved.
		ii.	The needs that must be met by solving the problem.
		iii.	Scientific issues that are relevant to the problem.
		iv.	Potential societal and environmental impacts of solutions.
		v.	The relative importance of the various issues and components of the process or system.
3	Defining criteria and constraints		
	a	Students define criteria that must be taken into account in the solution that:	
		i.	Meet the needs of the individuals or groups who may be affected by the problem (including defining who will be the target of the solution).
		ii.	Enable comparisons among different solutions, including quantitative considerations when appropriate.
	b	Students define constraints that must be taken into account in the solution, including:	
		i.	Time, materials, and costs.
		ii.	Scientific or other issues that are relevant to the problem.
		iii.	Needs and desires of the individuals or groups involved that may limit acceptable solutions.
		iv.	Safety considerations.
		v.	Potential effect(s) on other individuals or groups.
		vi.	Potential negative environmental effects of possible solutions or failure to solve the problem.