

Topic	Primary School (Grades K-2)	Elementary School (Grades 3-5)	Middle School (Grades 6-8)	High School (Grades 9-12)
Engineering, Technology, and the Application of Science ETS1: Engineering Design	<ul style="list-style-type: none"> A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. (K-2-ETS1-1) (secondary to K-PS2-2) Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) (secondary to K-ESS3-2) Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1) 	<ul style="list-style-type: none"> Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1) (secondary to 4-PS3-4) 	<ul style="list-style-type: none"> 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 is likely to limit possible solutions. (MS-ETS1-1) (secondary to MS-PS3-3) 	<ul style="list-style-type: none"> 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) (secondary to HS-PS2-3) (secondary to HS-PS3-3) 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. (HS-ETS1-1)
	<ul style="list-style-type: none"> Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-1) (secondary to K-ESS3-3) (secondary to 2-LS2-2) 	<ul style="list-style-type: none"> Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2) At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2) Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3) Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2) 	<ul style="list-style-type: none"> A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) (secondary to MS-PS1-6) There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3) (secondary to MS-PS3-3) (secondary to MS-LS2-5) Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) Models of all kinds are important for testing solutions. (MS-ETS1-4) 	<ul style="list-style-type: none"> 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. (secondary to HS-LS2-7) (secondary to HS-LS4-6) (secondary to HS-ESS3-2), (secondary HS-ESS3-4) (HS-ETS1-3) 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) (secondary to HS-LS4-6)
<ul style="list-style-type: none"> Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-1) (secondary to 2-ESS2-1) 	<ul style="list-style-type: none"> Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3) (secondary to 4-PS4-3) 	<ul style="list-style-type: none"> 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 the characteristics may be incorporated into the new design. (MS-ETS1-3) (secondary to MS-PS1-6) 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. (METS1-4) (secondary to MS-PS1-6) 	<ul style="list-style-type: none"> 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. (HSETSI-2) (secondary to HS-PS1-6) (secondary to HS-PS2-3) 	
ETS1.A: Defining and Delimiting an Engineering Problem				
ETS1.B: Developing Possible Solutions				
ETS1.C: Optimizing the Design Solution				