

MS-ETS1.B Developing Possible Solutions

MS-ETS1.C Optimizing the Design Solution

<https://www.nextgenscience.org/dci-arrangement/ms-ets1-engineering-design>

The chart below makes one set of connections between the instruction outlined in this article and the NGSS. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities. The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectation listed below.

Dimensions	Classroom Connections
Science and Engineering Practice	
Planning and Carrying Out Investigations - Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. Constructing explanations and designing solutions - Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. - Optimize performance of a design by prioritizing criteria, making tradeoffs, testing, revising, and retesting.	- Students plan and carry out an investigation to determine how their filter compares to solar disinfection (SoDis) as a method for cleaning water. - Students model, design, and improve a small water filter out of household materials that could filter out small particles and dissolved materials. - Students design and implement a method for solar disinfection and ways to test the effectiveness of their method.
Disciplinary Core Ideas	
MS-ETS1.B Developing Possible Solutions A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)	- Student groups discuss and analyze the impact of waterborne diseases on humans. - Students research and identify sources of waterborne diseases. - Students design, build, and test a prototype water filter, then use the

MS-ETS1.C Optimizing the Design Solution 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)	results of their initial tests to iteratively redesign, build, and test the filter again.
Crosscutting Concept	
Structure and Function Design structures to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.	Students model, build a prototype, and redesign water filters from household materials. In order to select the materials they use in their design, students collect or use provided data to determine what materials would meet the provided criteria. Students also consider how different construction methods impact the effectiveness of their designs by collecting data about each design they develop.
Building Towards Performance Expectation MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. MS-ETS1-4. 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.	