

2020

Mass STEM Week G6-8 Engineering Design Challenge



Museum of Science





Welcome to the Grade 6 – Grade 8 Engineering Design Challenge!

This **Engineering Journal** is designed to guide learners at home working through the challenge. Depending on the situation, your teacher will let you know which parts of this will be done at home independently and which will be done in a group setting.

Learners, please read through the Engineering Journal and be prepared to gather materials for each lesson. You may want to print part or all of the journal, but using blank paper to complete the activities is perfectly acceptable as well.

Parents, when supporting your engineer at home, besides helping with materials, setup, and safety, consider engaging them in conversation about what they are doing and asking questions to let them tell you their ideas. As part of Massachusetts STEM Week, we will be celebrating the work students are doing. Consider taking picture and videos of the work your engineer is doing and posting them on social media. Be sure to tag **@museumofscience** and **@eie_org** and use the hashtag **#MASTEMEiE**. You can search using the hashtag to find other Massachusetts engineers' posts. If you want additional ideas for posting, check out the STEM Week Choice Board.

Follow us and use the hashtag #MASTEMEiE    

S	T	E	M
Draw and share a plan or blueprint	Show us your materials	Learn about the Sustainable Development Goals and post your findings	Demonstrate how you used critical thinking to break down your challenge
Post your best design failure	Imagine multiple solutions and share at least two	Communicate with peers by creating and sharing a process	Ask and investigate by researching engineering schools in your state
Share how you are improving your design	Research female engineers and share what you learn	Post about the fields of engineering that interest you most	Capture evidence while you test your design
What does an engineer look like? Remember, we are ALL engineers!	Ask and investigate environmental engineers	Share how you are using math and science knowledge to design a solution	Ask and investigate famous engineers in your state

You can also encourage your engineers to record short videos sharing their thoughts and experiences to be posted to **Flipgrid**. Visit <https://flipgrid.com/mosstem>. The Student Username will be G6Engineer, G7Engineer, or G8Engineering, depending on your engineer's grade level. Select your grade level topic before recording. For helpful information, watch a tutorial video [here](#).

Have fun engineering!



Lesson 1

Goal

Ask questions and investigate local water systems.

Pre-work

From watching the pre-work videos and talking to household members, write down three things you have learned about water systems (for example: What is a watershed? Where do you get your potable water? Where does your wastewater go? What kind of water system is your house connected to?)

Activity

Part 1: Use an [interactive watershed map](#) to identify the watershed path upstream and downstream of your neighborhood. Research and identify the source of your potable water and use the map to determine the watershed path from your local area to a body of water. In the space below, use the blank map of Massachusetts to mark, label, and color code your water source, its approximate path to your location, and its path from your location to a body of water.



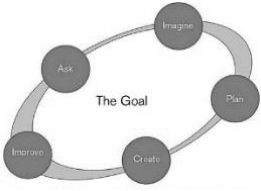


Part 2: Use Google Maps satellite and street views to zoom and identify drainage sites on roads in your neighborhood. In the blank space below, draw and label the road where you live and mark locations of drains, houses, and other structures connected to water systems. Draw hypothetical underground water systems connecting these marked sites to a main system along the road.

A large, empty rectangular box with a thin black border, intended for students to draw and label a road, drainage sites, and hypothetical underground water systems.

Share your Learning (optional)

1. Record a video on Flipgrid to share what you have learned about water systems in your neighborhood.
2. With an adult, choose a topic from the STEM Choice Board and post online. Be sure to tag @museumofscience and @EiE_org, and use the hashtag #MASTEMEiE.



Lesson 2

Goal

Observe pollutants in local water systems.

Pre-work

Walk around your neighborhood with one or more household members and identify the kinds of trash and other pollutants that may end up in the stormwater system. Document the pollutants you identify in the space below and take photos and/or videos to share (optional). Then gather household materials that you can use to model how these pollutants might act in a water system.

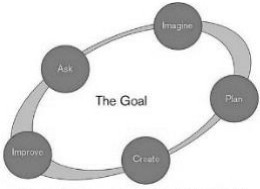
Activity

Use a paint tray, crumpled foil, or bucket as a base to make a small area for water to run along and collect. Experiment by adding different household materials (one at a time or a pre-mixture of different items) to the base and test how each material moves or collects on the base when water is poured or sprayed onto the base. Use the table below to record data about which materials you tested and how the materials acted.

Household Material	Observations <i>(For example: How did the material interact with water? Did it change the color, quality, or flow of the water?)</i>

Share your Learning (optional)

1. Record a video on Flipgrid to share about the items you used, their properties, and how they were affected by being in water.
2. With an adult, choose a topic from the STEM Choice Board and post online. Be sure to tag @museumofscience and @EiE_org, and use the hashtag #MASTEMEiE.



Lesson 3

Goal

Imagine, plan, and create a design solution to transport stormwater.

Pre-work

Gather household materials that you can use to create a stormwater system.

- Cardboard box, shoe box, or cereal box
- Various household items that you can use as potential building materials (for example: paper towel tubes, plastic bottles, Styrofoam, yarn, straws, tape, glue, scissors, etc.)
- Identify a source of tap water you can use to test your design
- Identify a design testing location that can get wet (for example: sidewalk)

Activity

You must design a stormwater system that can transport water from a designated ground surface level to an output location without spilling water. Below, list the materials you will use and draw a diagram to show how you will put them together. Then create your design!

Criteria

Design solutions must:

- Transport water from one location to another

Constraints

Design solutions must not:

- Be built above a designated ground surface level
- Spill water during transport

Planning: Materials List

Material	Quantity	Size	Properties



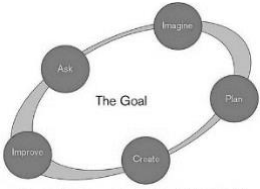
Planning: Design Sketch *(Include the angle you have chosen to use and label materials)*

Testing *(How well does your design transport water?)*

Water input	Water output	Water loss	Observations and possible design changes

Share your Learning (optional)

1. Record a video on Flipgrid to share your design, building process, and your design in action transporting water.
2. With an adult, choose a topic from the STEM Choice Board and post online. Be sure to tag @museumofscience and @EiE_org, and use the hashtag #MASTEMEiE.



Lesson 4

Goal

Improve a design solution to filter stormwater during transport.

Pre-work

Finish creating the design from Lesson 3 if needed.

Gather household materials that you can use as model pollutants and to improve your design:

- 1-2 selected model pollutants (chosen in Lesson 2)
- Household materials you can use to filter the pollutants (for example: coffee filters, cotton ball, cloth, etc.)

Activity

Criteria

Design solutions must:

- Result in cleaner water output compared to water input

Planning: Design Sketch *(Include design changes for filtering and label materials)*



Testing: After discussing how to measure the effectiveness of your filter design with your class, record the measure you are going to use in the space below:

After discussing how to measure the effectiveness of your filter design with your class, record the measure you are going to use

Pollutant material	Effectiveness of your filter design	Observations and possible design changes

Share your Learning (optional):

1. Record a video on Flipgrid to share your improved design and your design in action filtering pollutants out of water.
2. With an adult, choose a topic from the STEM Choice Board and post online. Be sure to tag @museumofscience and @EiE_org, and use the hashtag #MASTEMEiE.