2020

Mass STEM Week
G3-5 Engineering Design Challenge

Image credit: https://lesotho.un.org/sdgs/6

Museum of Science | EiE

Welcome to the Grade 3 – Grade 5 Engineering Design Challenge!

This **Student 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,

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

Parents,

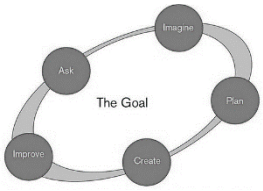
When supporting your engineer at home, besides helping with materials, setup, and safety, consider engaging them in conversation about what they are doing and asking questions to let them tell you their ideas. As part of Massachusetts STEM Week, we will be celebrating the work students are doing. Consider 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, too. If you want some 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 Learner Username will be G3Engineer, G4Engineer, or G5Engineer, depending on your engineer's grade level. Be sure to select your grade level topic before recording. For helpful information watch this brief video at http://bit.ly/MASTEMFlipgridSupport.

Have fun engineering!



Lesson 1

Goal

Ask questions, investigate local animals, and build connections about the importance of ecological balance and clean water.

Pre-work

Think about where you live in Massachusetts. What animals do you see in your backyard, neighborhood, park, or school? Choose several animals and research what each one eats, what eats it, and what local waterway it relies on for survival (pond, river, ocean, etc.)

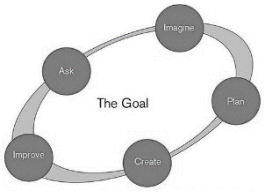
Animal	What does this animal eat?	What eats this animal?	How does this animal rely on the local waterway?

Activity

Collaborate with your group to create a food web. Can you include animals from your pre-work investigation? Label your food web using the names of the animals.

Share your Learning (optional)

1. Record a video on Flipgrid to share about the animals you investigated and how they rely on an ecological balance and clean 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 2

Goal

Analyze the properties of "trash" and **imagine** how environmental engineers would design a solution.

Pre-work

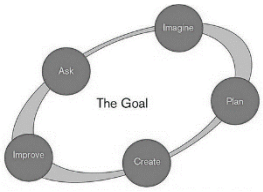
Think about the trash you see scattered on the ground and in local waterways. Collect household items that you can use to represent the pollution you've observed. With permission and assistance from an adult, test your trash.

1. Gather your materials.
    - Bowl, sink basin, or medium to large pan
    - Various house-hold items for "trash" (items you don't mind getting wet): toilet paper, paper towels, paper clips, small plastic toys, sponge, receipt paper, etc.
    - 1/2 gallon of tap water
2. Record your observations about the properties of each material in the table below.
3. Fill the bowl, sink, or pan with ½ gallon of tap water.
4. One at a time, please a piece of "trash" into the water and leave for one (1) minute.
5. Record your observations about how the "trash" was affected after being in the water in the table below.

Item(s)	Properties *(color, hardness, reflectivity, solubility, shape, size)*	Observations *(How did it change the item's properties? Did it sink or float, dissolve, absorb water, change in shape or size…?)*

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

Explore material properties in order to **plan** and **create** a design solution.

Pre-work

Think about the materials you and your fellow engineers tested during Lesson 2. Now ask yourself, "Which of those materials would be best for collecting and sorting trash collected out of waterways?"

Gather your materials from Lesson 2.

- Bowl, sink basin, or medium to large pan
- Various house-hold items for "trash" (items you don't mind getting wet): toilet paper, paper towels, paper clips, small plastic toys, sponge, receipt paper, etc.
- 1/2 gallon of tap water

Activity

While outside, observe small pieces of trash in the in the water. Think about how this trash could affect your food web ecology. You must design a solution that can filter and sort the trash in order to eliminate visible pollution, produce cleaner water, and prevent an imbalanced ecosystem. 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

- be impermeable in water.
- be made of recycled materials.

Constraints

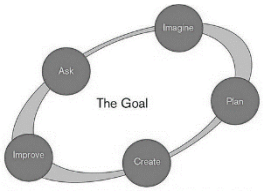
Design solutions must not

- collect more water than trash (no more than 2 tablespoons of water).
- allow animals to become trapped.

Planning: Material List

Material	Quantity	Size	Properties

Planning: Diagram



Lesson 4

Goal

Test and collect data in order to **improve** your designed solutions.

Pre-work

Finish creating your design planned in Lesson 3.

Showcase your results (optional):

Activity

1. Gather your materials from Lesson 3.
   - Bowl, sink basin, or medium to large pan
   - Various house-hold items for "trash" (items you don't mind getting wet): toilet paper, paper towels, paper clips, small plastic toys, sponge, receipt paper, etc.
   - 1/2 gallon of tap water
   - Completed design
2. Place 10 pieces of “trash” in your water and leave for one (1) minute.
3. Use your designed solution to remove as much trash as possible in one (1) scoop.

Trial(s)	Fraction Removed in one (1) scoop	Fraction Left	Notes and Observations
Example	*2 out of 10 pieces 2/10*	*8 out of 10 pieces 8/10*	*There is more trash left in the water way that this design removed from the water. 2/10 < 8/10*
1			
2			
3			
4			
5			

Create a line plot (dot plot) to track the fraction of trash left in the water way.

Reflection

Was your design effective? Why or why not?

What will you do next time to improve your design?

Share your Learning (optional):

1. Record a video on Flipgrid to share your results.
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.