

Family Engineering Journal

Mass STEM Week PK-G2 Engineering Design Challenge



Museum of Science



Welcome to the PreK – Grade 2 Engineering Design Challenge!

This **Family Engineering Journal** is designed to guide adults at home working with their young learners throughout 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.

Be sure to read through the entire unit 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. 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.

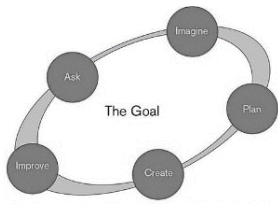
As part of Massachusetts STEM Week, we will be celebrating the work students are doing. Consider taking picture and videos of the work your young engineer is doing and posting them on social media. Be sure to tag **@museumofscience** and **@eie_org** and use the hashtag **#MASTEMEiE**. You can search 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 Student Username will be **PreKEngineer**, **GKEngineer**, **G1Engineer**, or **G2Engineer**, depending on your engineer's grade level. Be sure to select your learner's grade level from the Topic menu before recording.

Have fun engineering!



Lesson 1: Context Setting

Goal

Ask what makes a healthy habitat for a turtle.

Pre-work

Gather your materials:

- Family Engineering Journal pages 1 and 2 or two sheets of plain paper
- Colored pencils, crayons, or markers

Introduction

Think about a time you saw a turtle. Where was it? What do you already know about turtles?

Watch the video from the Museum of Science: <https://tinyurl.com/SWturtle1>

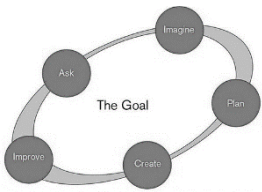
Use this space to write or draw one thing you learned about turtles from the video:

Activity

Color the turtle to look like one you would find in Massachusetts. (Or draw your own turtle on a plain piece of paper.) If you want to do some extra research on types of turtles, check out this website:

<https://tinyurl.com/MAturtles>





Lesson 2: Materials Exploration

Goal

Explore how some materials are affected by water and **Imagine** ways to use the materials to create a turtle habitat with wet and dry areas.

Pre-work

Gather your materials:

- A small container of water (with a few drops of food coloring in the water, if possible)
- A dropper, pipette, drink straw, or your tiniest spoon
- 3 or more different types of paper: writing paper, wax paper, tissue paper, newspaper, magazine paper, brown paper bag, parchment paper, etc.

TIP: Check your recycling or trash basket to find different types of paper to use.

- At least 3 building materials such as rocks, pebbles, sand, sticks, leaves, grass, pinecones.

TIP: If you do not have access to natural materials, replace with items like pencils, craft sticks, aquarium gravel, play sand, buttons, beads, used and dried coffee grounds.

- Chart (p. 5) to record results or blank piece of paper to make your own

Prepare a space for testing with water. This might be a small pan, lunch tray, plastic basin, etc.

Practice picking up small amounts of water with dropper, straw, or measuring spoon and releasing drops.

Activity

Watch Designing a Turtle Habitat video: <https://tinyurl.com/SWturtles2>

Guiding Question: What materials can help us make a wet area and a dry area in our model habitat?

Step 1 – Place a sample of each type of paper and each additional material in your prepared workspace.

Step 2 – In the left column of the data chart provided, write the name or draw a picture of each different material you will test. (Or you can make your own data chart.)

Step 3 – Add a few drops of water to each material and observe what happens.

Step 4 – Put an x in the column on your data chart to show how the water affected the material.

Think about it!

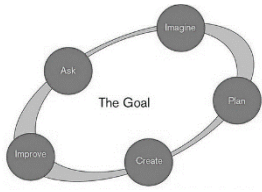
Talk about what materials you imagine might work to create both a wet and dry space for your test turtle. On your data chart, circle the materials you think will work well.



Data Chart

Record your results from the water test here

Material (write or draw)	Soaks in quickly	Soaks in slowly	Stays on top or rolls off	Other result (write or draw)



Lesson 3: Design a Solution

Goal

Use what you learned in your materials tests to make a **plan** and **create** your model turtle habitat.

Pre-work

Gather your materials:

- Pan or basin in which to build habitat – like a baking pan at least 2” deep
- The materials that you’ve chosen to create your habitat (based on testing in Lesson 2)
- Water (tinted with food coloring, if possible)
- Test turtles (p. 6) or plain copy paper
- Optional: Watercolor markers to decorate the shell of the test turtle
- Prepare your workspace to protect the area from water spills or other damage

Design Challenge

Make a model turtle habitat in which one area is wet and another area stays dry.

Step 1 – Think about what the model habitat needs to do to be successful (criteria) and the limitations on the design (constraints).

Criteria

- wet area must remain wet for at least 12 hours
- dry area must remain dry for at least 12 hours

Constraints

- must use water and at least 2 other materials in the habitat
- must not use a pre-made container inside the pan

Step 2 – Draw a plan for your habitat in the space provided or on a separate sheet of paper. Label to show which part will be wet and which part will be dry. Add details about which materials you will use, where you will use them, and how to put them together.

Step 3 – Follow your plan and create your model turtle habitat.

Step 4 – Add 1 cup of water to the wet area of your habitat.

Step 5 – Place a test turtle in the dry portion of the habitat.

Think about it!

Did your habitat turn out like you planned?	YES	NO
Do you think the wet area will stay wet until tomorrow?	YES	NO
Do you think the dry area will stay dry until tomorrow?	YES	NO

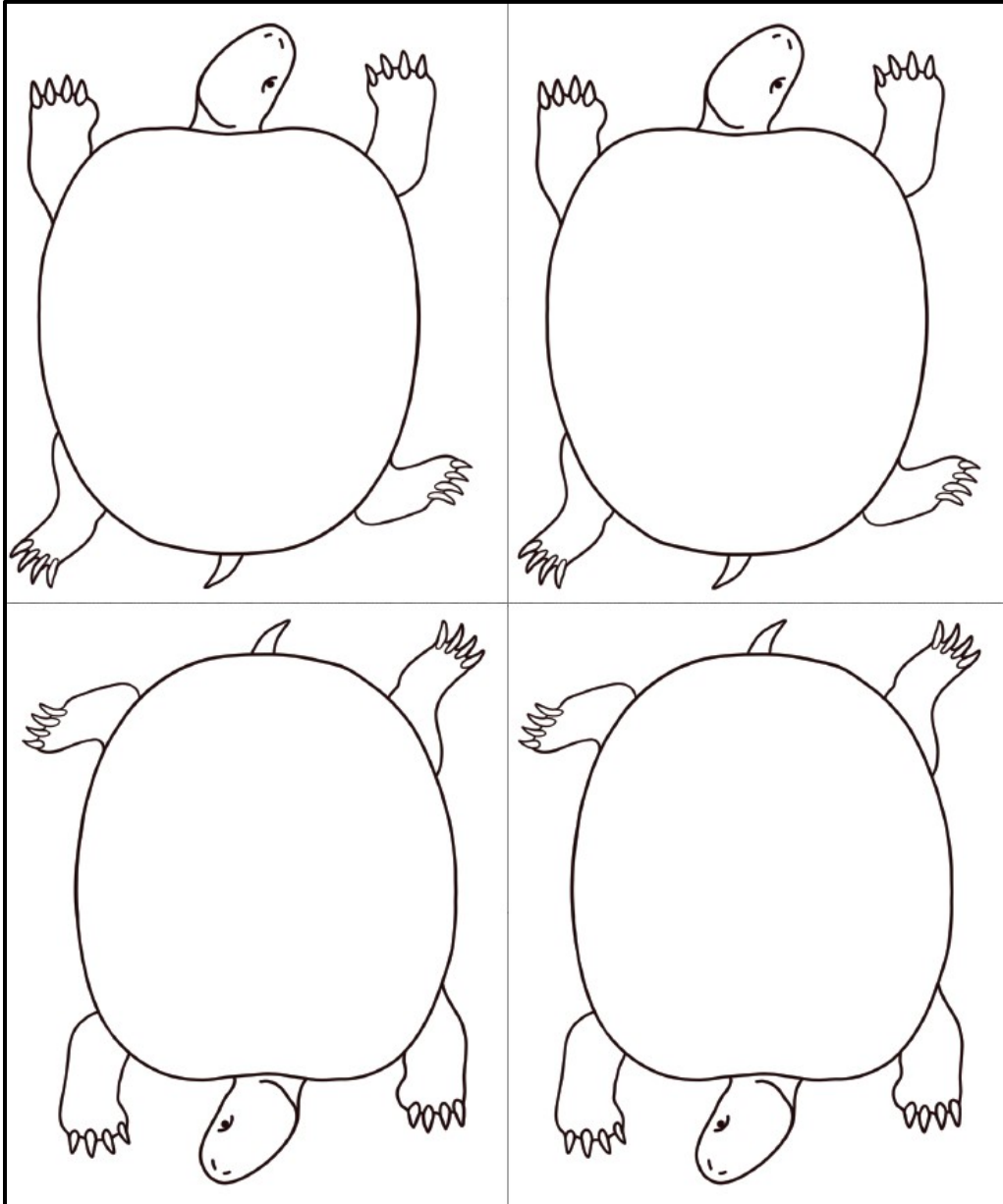


Draw the plan for your model turtle habitat:

A large, empty rectangular box with a thin black border, intended for drawing the plan for a model turtle habitat.

Test Turtles

Cut out and use these turtles to test whether the basking area stays dry. Print on regular weight copy paper.





Lesson 4: Analyze and Improve

Goal:

Test your model habitat and **improve** your design.

Pre-work

Gather your materials

- Your model habitat
- Test turtles or plain copy paper
- Additional materials to improve your design

Prepare your workspace to protect area from water spills or other damage.

Activity

Step 1 – Observe the wet area in your model habitat.

Is that area still wet? Yes No

Has any water leaked out? Yes No

Step 2 – Observe the test turtle in the dry area of your model habitat. If your test turtle got wet, you should be able to see the water spots.

Are there water spots on your test turtle? Yes No

If so, circle the wet spots with a pencil or crayon and save the test turtle to compare with your improved design.

Testing option: Another way to test is to fold a square paper towel into fourths, touch the folded corner to the dry area for 30 seconds, and then unfold it to see how big the wet spot is. Circle the wet spot with a pencil or crayon.)

Think about it!

If your turtle got wet, what could you change to keep the turtle dry next time? Draw your improved plan for your turtle habitat in the space provided or on a separate sheet of paper.

Next Step (optional)

Use your new plan to create an improved model habitat based on what you've learned. Test again and compare the results to see if the design actually works better.



Draw the plan for your IMPROVED model turtle habitat:

A large, empty rectangular box with a thin black border, intended for students to draw their improved model turtle habitat plan.