GSK Science in the Summer™

Be an Environmental Engineer

This summer, your child is invited to play the role of a scientist—an environmental engineer—to explore basic concepts of engineering and solve a real-world problem.

Welcome to *GSK Science in the Summer*, brought to you in partnership between GSK and The Franklin Institute.

This free summer science program aims to inspire the next generation of scientists and engineers by inviting children to experience real science careers by practicing science skills and using real science tools—all while having fun!

This at-home science activity is supported by a series of online resources, including videos and a live, interactive virtual experience. Here is the recommended sequence for your *GSK Science in the Summer* Be an Engineer experience:

1. Start by watching **short introductory videos** to help your child set up their lab and learn about their engineering project.
2. Do your **at-home experiments**, using the guide in this booklet and the provided science materials. Remember to follow the safety guidelines during all activities.
3. Join a live **Environmental Engineer Team Meeting** to share the results of your research with other *GSK Science in the Summer* participants.

Find all the videos, resources, and event registration information at scienceinthesummer.fi.edu/be-an-engineer.

Are you ready to be an engineer? It's time to set up your lab and get started on your research!

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THE FRANKLIN INSTITUTE

Environmental Engineer

You work for a city government, making sure public spaces like parks and playgrounds are safe for people to use. The city wants to build a new playground on a hillside, but they are worried that when heavy rainstorms come, rainwater will run down the hill and flood the park.

Your job is to design a stormwater system that will keep rainwater from the top of the hill away from the rest of the park.

MATERIALS

- Paint tray
- Small cup
- Modeling clay
- Wooden craft sticks
- Cardboard
- Cotton balls
- Masking tape
- Lab notebook
- Pencil

ADDITIONAL MATERIALS:

- Thick books or blocks to support the paint tray
- Small pitcher or easy-to-pour container
- Water
- Pen or marker
- (Optional) food coloring
- (Optional) other building materials like aluminum foil, felt, or sponges
- Sponge or towel to clean up spills

LAB SET-UP AND SAFETY

1. Gather your supplies. Make sure you have all your science tools and materials from the list above in one place.
2. Find a flat, hard surface like a table or desk to use as your lab bench. You'll need plenty of space for building your designs and storing your materials.
3. Place a few thick books or sturdy blocks under the shallower end of the paint tray to create a surface that slopes down toward the deeper end. This is your model of the hillside where the playground will be built.

4. Fill a small pitcher or container with water. If you like, you can add a few drops of food coloring to the water to make it easier to see on your model.
5. Use tape or a marker to mark a line on the outside of the small cup, about three quarters of the way up from the bottom of the cup. You'll use this mark to make sure you fill the cup with the same amount of water each time you use it.

Part 1: Research

Use your model landscape to find out how rainwater behaves when it falls on the playground site.

1. Start by thinking about the requirements of your stormwater system. Make some notes on page 12 of your lab notebook:

- *What should it be able to do when it is working correctly?*
- *What other limits does it have?*
  For example, are there any materials it can or can't be made of?
- *If children will be playing near the stormwater system, are there requirements for keeping them safe?*

2. Next, create a model rainstorm on your landscape to research what happens to stormwater on the playground site. Fill the small cup with water up to the line you marked. Pour the water from the cup slowly back and forth along the top edge of your paint tray "hillside" and notice what happens.

– *What paths does the water take? Where does it end up?*

3. Try this two or three more times, refilling the cup to the line each time. Look for patterns in how the water behaves. Draw or write about your observations on p. 13 of your lab notebook.

– *Does the water take the same paths each time?*
– *Does it end up in the same place?*
– *What happens as more and more water is added to the landscape?*

4. Look again at the requirements you wrote in your notebook.

– *Do you need to add anything based on this research?*

5. Empty the water from the paint tray back into your water pitcher.

For complicated projects like a stormwater system, it's a good idea to test smaller parts of the project before building the whole system.

For example, you might want to build a small section of wall to find out how well it blocks water or test a material to see if it soaks up water the way you expected.

Part 2: Design

Create a plan for building a stormwater system to keep rainwater away from the playground.

1. Brainstorm different ways to keep rainwater from flooding the playground during a storm. In your lab notebook, write or draw as many different ideas as you can for building a stormwater system.

– *Which part of the landscape would be the best place to build the playground?*
– *What could you build or add to the landscape to control how water flows on the hillside?*
– *How could you keep the water away from the playground?*
– *Where will the water go instead?*

2. Choose one idea that you think will work the best. Decide which materials you will use and how you will place them or connect them together. Draw a new picture of your design or circle it in your notebook.

Designing a Stormwater System

Part 3: Build, Test, Redesign

Try out your design for a stormwater system and improve it until it works as well as it can.

1. Decide where on the hillside the playground will be located and find a way to mark that area on your model landscape.
2. Choose part of your design to try out first. Test it by creating a rainstorm like you did in Part 1: fill the cup to the mark with water and pour it back and forth across the top of the hillside.

– *What happens to the rainwater?*
– *Does that part of your system work like you planned?*

3. Make changes or add something to your system and test it again. Notice which parts work well, and which parts you could change to make it better. Use p. 14 in your lab notebook to record your observations and ideas.
4. Keep changing, testing and trying new ideas until your stormwater system is as close as possible to matching all the requirements you wrote in your notebook. (It might take a lot of tries! Engineers often test many ideas before finding the one that works best.)
5. (Optional) A very strong storm, like a hurricane, might make even more rain than you have tested so far. Try adding two or three cups of water instead of just one.

– *Does your system work even in a hurricane? If not, how could you improve it so that it does?*

6. Draw a picture or take a photo of your final, best design for a stormwater system.

Part 4: Reflect

1. Think about the results of your research to create a stormwater system for a city playground.

– *What suggestions would you give to the city about where to build their playground and how to control the rainwater?*
– *Which parts of your design worked the best?*
– *What things did you try that didn't work?*
– *How did your design change from the beginning of the project to the end?*

2. Think about how you were like an environmental engineer in this activity. Use page 15 in your lab notebook to draw or write about your ideas. Add some skill stickers from the sticker sheet to show some of the science skills you used in this activity.

– *What did you do that might be like what an environmental engineer does?*
– *What science skills did you use?*

3. Find out more about being an engineer! Try out the three other engineer activities featured in your lab notebook using the other Be an Engineer videos and activities found at scienceinthesummer.fi.edu/be-an-engineer. Or check out some of the books and websites listed on the back of your lab notebook.