

2024 NATIONAL ENGINEERS WEEK

at



hosted by



February 19 & 24, 2024



WELCOME!

Welcome to the annual National Engineers Week exhibition at Liberty Science Center! We have a fun-filled day of engineering activities planned for all attendees. There are some very exciting exhibitors to show you real projects that engineers are working on. Be sure to check them all out!

On Monday, February 17, visit the robotics exhibit to see the top award-winning New Jersey robotics teams from FIRST Tech Challenge and FIRST LEGO League in a joint robotics exhibition. Alongside these teams, we also have DIY 3-D printers made by students!

Speak to working engineers from civil to mechanical to optical to biomedical engineering about what a day in the life of an engineer is like!

Additionally, be sure to check out the hands-on activities and demonstrations throughout the exhibition. There are also some activities included throughout this brochure for you to try at home to continue your engineering experience!

We would like to extend a big thank you to all of our volunteers who came out to help with this event. Without them, Engineers Week would not be possible. Be sure to thank a volunteer today!

ENGINEERING: Q&A

WHO can be an engineer?

YOU! You can be an engineer! If you have an interest in thinking creatively and changing the world, engineering is the right field for you.

WHAT do engineers do?

Engineers use science and math to solve problems. Here are some typical engineering careers:

Aerospace Engineering	Environmental Engineering
Agricultural & Biosystems	Industrial Engineering
Bioengineering & Biomedical	Manufacturing Engineering
Chemical Engineering	Mechanical Engineering
Civil Engineering	Nuclear Engineering
Computer Science	Ocean Engineering
Electrical Engineering	Optical Engineering

WHEN can I start engineering?

Today! Engineering is everywhere, and it is happening all the time. Any time you design, build, or create, you're engineering!

WHERE do engineers work?

Engineers work everywhere, from research labs to outer space!

WHY be an engineer?

Because it's fun! Because you can make a difference!



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AWWA is the world's largest association of water professionals. We are a community where current and future water professionals can learn, network, and gain the resources and tools to achieve our vision of *A Better World Through Better Water.*

www.njawwa.org

INFLATE A BALLOON

Materials:

-  plastic bottle
-  balloon
-  2 funnels
-  vinegar
-  baking soda

Baking soda and vinegar react with each other as an acid-base reaction. One of the products of this reaction is carbon dioxide gas. The gas expands and needs somewhere to go, so it fills up the balloon!

1. Using a funnel, fill up the plastic bottle about 1/3 full with the vinegar.
2. Using the other funnel, fill up the balloon about 1/2 full with the baking soda.
3. Take the balloon and pinch the neck closed so no baking soda comes out. Wrap the balloon around the top of the uncapped plastic bottle
4. Once you have it in place, unpinch the balloon and lift it so the baking soda pours into the bottle.
5. Watch the balloon inflate!

CABBAGE ACIDITY TEST

Materials:

- 🍴 1 red cabbage
- 🍴 medium bowl
- 🍴 grater
- 🍴 cold water
- 🍴 strainer
- 🍴 plastic bowl
- 🍴 clear plastic cups
- 🍴 baking soda
- 🍴 teaspoon
- 🍴 testing liquids: vinegar, soda, lemon juice

1. Prepare cabbage juice by grating some red cabbage into the medium bowl. Cover with cold water and let sit for an hour. Strain liquid into the plastic bowl.
2. Pour an equal amount of cabbage juice into each plastic cup. Add 1 teaspoon of baking soda to all but one of the cups. This will turn the cabbage juice blue.
3. Now you can add the testing liquids to see how much it will take to turn the juice back to its original color. Add a testing liquid 1 teaspoon at a time to one of the cups. How many teaspoons do you need to get back to the original color? Test the rest if the liquids the same way.

The baking soda turns the cabbage juice blue because it is a base. Acids will turn the juice red, bringing it back to its original color. If the juice stays blue, the liquid you are adding is probably not an acid.



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PARACHUTES

Materials:

-  different sizes of plastic bags
-  yarn
-  tape
-  scissors
-  small paper cup
-  pennies

1. Using a plastic bag, yarn, and tape, devise a parachute for your paper cup.
2. Assemble a parachute with one of your plastic bags so that it will hang above your cup for testing.
3. Fill your paper cup with as few or as many pennies as you would like to run your first test with.
4. Have an adult help you launch your parachute from a high place. Did your parachute make it safely to the ground?
5. If your parachute flew, count how many pennies it could hold. Add more pennies and test again, to see how many pennies your parachute can hold.
6. If your parachute collapsed, take away a few pennies and try again.
7. Now try again with a different sized plastic bag, or a different parachute configuration.

How many pennies can your parachute hold? How high can you launch your parachute? Can you use more than one plastic bag to make it stronger, or does the parachute get too heavy?



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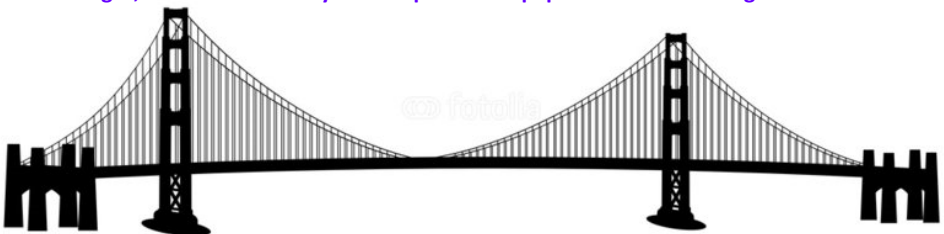
PAPER BRIDGE

Materials:

-  sheet of paper
-  ruler
-  2 books or blocks
-  100 pennies or coins

1. Using the ruler, place the books or blocks 8 inches apart.
2. Brainstorm on how you can manipulate the paper to make it stronger.
3. Once you have decided on your design – using only the paper! – construct your bridge.
4. Place your bridge across the gap between the two books or blocks.
5. Test your bridge by loading it with pennies, one at a time, until it collapses.
6. Count how many pennies your bridge supported, and try a re-design!

Try your first run without doing anything to the paper! Doesn't hold very much weight, does it? How can you manipulate the paper to make it stronger?



WHY ENGINEERING?

Here are 10 reasons why you will love engineering!

1. Know how things work

Engineers learn to be very intuitive to how things work, from how airplanes fly to how we get energy from solar power!

2. Get creative

Engineering is the perfect outlet for your imagination!

3. Work with great people

Engineering takes teamwork, and you will work with many great people both inside and outside of the field!

4. Solve problems, design things that matter

Come up with solutions to new problems every day!

5. Never be bored

Creative problem solving will always keep you thinking on your feet! Engineering is never short of excitement.

6. Challenge yourself

Through engineering, you never run short of new challenges to conquer!

7. Find your dream job

Engineers are capable of applying their knowledge to so many different opportunities.

8. Travel

Engineers are needed everywhere! You could find yourself going around the world, from designing a skyscraper in London to working on telescopes in Hawaii!

9. Make a difference







Everywhere you look, you will see how engineering is changing lives – manufacturing safer cars, building bridges to new places, making computers faster, and more!

10. Change the world!

The things that engineers do save people, prevent diseases, and protect our planet.

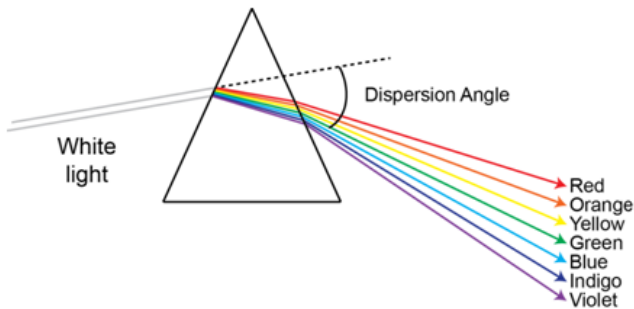
SPIN THE COLOR WHEEL

Materials:

-  white paper plate
-  scissors
-  ruler
-  pencil with eraser
-  pushpin
-  markers in rainbow colors





What colors do you see? Does it matter how fast you spin the wheel? Does it matter what direction you spin the wheel in? When you combine all these colors they should appear white, like a lightbulb!

1. Trim the edge off the paper plate to create a flat circle.
2. Using the ruler and pencil, divide the circle into six equal slices.
3. Color each section a different rainbow color.
4. Pull the eraser out of the top of the pencil. Color side up, stick the pushpin through the center of the circle and into the eraser.
5. Holding the pushpin, spin the color circle on a hard surface like a top. What do you see?



CATCH THE RAINBOW!

Materials:

-  sunny window
-  bowl of water
-  mirror
-  white sheet of paper

1. Set the bowl of water near a sunny window.
2. Place the mirror halfway down into the water.
3. Hold the paper up so that it intercepts the reflection.

What do you see on the paper? This phenomenon is called light refraction! When light enters a substance of different density, it changes speed. White light is made of different wavelengths, and each of these wavelengths bends differently. The difference in bending creates what you see on the paper!

THE BROOKLYN BRIDGE



The Brooklyn Bridge is one of the oldest suspension bridges in the United States. It connects the New York City boroughs of Manhattan and Brooklyn, spanning the East River. This bridge was completed in 1883.

FUN FACTS

- 🏗️ At the time of its completion, the Brooklyn Bridge was the largest suspension bridge in the world
- 🏗️ At one point, the Brooklyn Bridge was the only land passage between Manhattan and Brooklyn
- 🏗️ The towers are built of limestone, granite, and Rosendale cement
- 🏗️ The total weight of the bridge is 14,680 tons

ADDITIONAL RESOURCES

DiscoverE

Check out DiscoverE for fun engineering activities!

www.discovere.org

Future City

Learn more about how to get your school involved in the national Future City competition!

www.futurecity.org

Livingston Robotics Club

A NJ community science and robotics club for K-12, coached by volunteer parents!

www.livingstonrobotics.org

American Society of Civil Engineers North Jersey Branch

Reach out to a local ASCE chapter to learn about civil engineers!

www.ascenjb.org

American Society of Civil Engineers North Jersey Branch Younger Member Group

Learn more about the local rising generation of professional engineers!

www.ascenjb.org/ymg-overview

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