SWENext Newsletter - K-8

In this edition:

What is Materials Science and Engineering?

Have you ever wondered how some of the things we use every single day are made? The shoes you wear, the cars and buses that get you to and from school, your cell phone and even airplanes are made up of materials that were designed by Materials Science Engineers!

Materials Science Engineers study all different types of materials. They try to understand how they behave and how to make them better. They do mechanical testing to break materials on purpose to see how strong they are. They look at materials through microscopes to see what they look like. Some Materials Science Engineers will use electricity to test material properties, too. The work can be pretty cool.

Materials Science Engineers can also mix materials together or design processes to make materials do what we want them to. Some mix metals into alloys. Others will add metals or particles like carbon to a plastic. This makes composites. Depending on what the material is going to be used for, we may want the material to be strong, and other times, we want it to be soft. Materials Science Engineers come up with different ways to make a material harder, softer or tougher.

Think about a kitchen knife. Kitchen knives are made out of steel. We want the steel to be hard, so Materials Science Engineers will make an alloy with steel and carbon. Then, they will heat it up, and immediately cool it down by dunking it into ice water. This is just one example of how Materials Science Engineers treat materials to make them do what we want them to so we can build some really cool and important things!

Materials Science and Engineering Spotlight

Meet Courtney, a graduate student studying Materials Engineering at the University of Nebraska.

Courtney earned her bachelor's degree in physics from the University of Northern Iowa. She is a PhD student at the University of Nebraska-Lincoln in Lincoln, Nebraska.

What made you decide to study Materials Science and Engineering?

I have always loved STEM. When I was little, I enjoyed playing with chemistry kits. I remember I got a microscope when I was little and thought it was so cool!

Math and science classes were my favorite while growing up. Engineering was a great combination of both math and science.

What are some really cool things that Materials Scientists and Engineers work on?

Some Materials Science Engineers are working on 3D printing organs, like the heart, for people who need new ones. There are some Materials Science Engineers who work on strengthening the glass on your smartphone, so it won't shatter if you drop it. They also work on making your smartphone thinner and more flexible! There are also some Materials Science Engineers that help design and build rockets and work to ensure that the overall weight of the rocket is minimal, so less fuel is needed.

What is your research like?

An exciting project I am working on is making better bypass grafts for arteries in legs of patients with peripheral artery disease. When someone has peripheral artery disease, their arteries in their legs are shrinking and blood cannot get through their legs. The grafts I am designing are going to be used to make the arteries larger to let blood circulate better through patients' legs. I get to work with surgeons, biologists and other engineers to test these devices and help improve how we treat people with cardiovascular diseases and injuries.

Tell us about a time you failed. How did you move on from that?

Oh, I fail all the time during my experiments. That's the beauty of being an engineer. You design, build and test your finished product. If it doesn't work, you find out what went wrong and go back to the beginning and try again. You must realize not everything is going to work out smoothly and you might fail. **You just need to pick yourself back up and keep trying.**

What kind of advice can you share with us?

Never let anyone tell you that you are not smart enough to do something you are passionate about. You can do anything you set your mind to!

It's great being a woman! Did you know that March is Women's History Month?

Women's History Month started out as a week-long celebration in Sonoma, California. The school district there started it in 1978 to celebrate the amazing things that women have done throughout history.

In 1980, President Jimmy Carter declared the week of March 8th as National Woman's History Week. Now, we celebrate March 8th as the International Women's Day. By 1986, the entire month of March became National Women's History Month.

It is really important to celebrate the things that we as women do to make the world a better place. A hundred years ago, it was rare for a woman to earn a college degree. By 2011, women were more likely to earn a college degree than men. While there are still fewer women studying engineering than men, that number is still climbing.

There is a long way to go for equal rights for women. It is up to us to dare to stand out against the crowd and stand up for each other. We'd like to introduce you to some incredible women who have helped pave the way for all women in STEM.

Thelma Estrin - Computer Engineering Pioneer in the Medical Industry

Thelma was one of the first people to use computers in medicine back in 1961. For 40 years, Thelma spent time using computers to understand the central nervous system. She used computers to map the brain. The work she did is used every day to scan the brains of people with head injuries. She also helped doctors treat people with chest pain in emergency rooms.

The things that Thelma did in her career have saved countless lives. In 1982, Thelma earned an award from the Society of Women Engineers for her awesome work.

Christina Hammock Koch - NASA Astronaut Setting the Longest Record for a Woman in Space

Christina received a Bachelor of Science degrees in Electrical Engineering and Physics, and a Master of Science in Electrical Engineering from North Carolina State University.

In 2013, Christina was one of 8 people out of 6,100 applicants to become an astronaut. By 2015, she graduated from astronaut training. In October of 2019, Christina was part of the first spacewalk done by a team of women. She did 5 spacewalks in a row.

In February 2020, Christina just set the record for the longest spaceflight by a woman. She spent almost a year in outer space, 328 days to be exact! She dared to dream and beat the odds! The work of Christina and her fellow female astronauts inspire the rest of us.

Last Call to Apply for SWENext Awards in Des Moines – Apply Now

Do you live within a couple of hours of **Des Moines**? Are you willing to travel to Des Moines in mid-April with your friends and parents? If so, read on!

We are excited to announce the 2020 SWENext STEM in Action Award.

The **SWENext STEM in Action Award** recognizes girls in **grades 6-12** who are actively interested in STEM and doing something in their community about it (ex:, raising awareness, mentoring students, participating in SWENext, etc.). STEM in Action Award recipients will attend the DesignLab event where they will meet women engineers, learn about careers in engineering, learn how to be a role model and view the DesignLab presentations. They will also receive a certificate during the awards ceremony.

You must attend the DesignLab event in order to receive the award. See the dates of the event below.

We are using a rolling application process, which means we will review your application and notify the award recipients. Apply early so you can save your seat at

the DesignLab event! Learn more and apply today!

The DesignLab Event in Des Moines will be held on April 18, 2020.
STEM in Action Award Application Deadline: March 22, 2020 - **STEM in Action Application**

Materials Science and Engineering Activity

Have you ever noticed that different types of food have different textures in your mouth? Some might be hard and crunchy, while others might be soft and chewy. The study of different materials and their properties—like how flexible they are and how they break—is called Materials Science Engineering.

Real-world Materials Science Engineers try to improve materials that we use to build things, like making stronger metals for buildings and cars or creating plastics that are easier to recycle and reuse. In this project, you will learn the basics about Materials Science Engineering using tasty (but not necessarily healthy) snacks.

You have probably noticed that some types of food, like a cooked piece of spaghetti or a gummy worm, are very flexible. They are very easy to bend with your hands and some of them will even bend under their own weight. Materials that maintain their bent shape are called ductile. Other foods, like pretzel sticks or uncooked pasta, tend to snap or crack very easily when you try to bend them. These materials are called brittle.

Ductile fracture occurs when a material stretches out or bends permanently before it breaks. Imagine bending a paper clip; how far do you have to keep slowly bending the paper clip before it finally breaks? This is ductile fracture.

Brittle fracture occurs when a material bends very little before it breaks. Think about

flexing a wooden ruler or pencil. You can bend them slightly and they will spring back to their original shape. However, if you bend them too much, they will instantly break in half. This is brittle fracture

What You Will Need

- 2 Snickers Bars (you can use a 3 Musketeers, Milky Way or other chewy candy bar)
- 2 Airheads, or any chewy, taffy-type candy
- 6 Gummy worms
- 2 Kit Kat bars (you can use a plain Hershey bar, Butterfinger or other crisp candy bar)
- Freezer

Put half of each type of candy in the freezer and leave the other half out at room temperature.

Now you're ready to test the properties of your four different materials! Use the table provided to keep track of how ductile or brittle each one is using the scale below.

- 1 = Food is totally flexible, very easy to bend with your hands, or bends under its own weight, but does not permanently hold its bent shape.
- 2 = Food is somewhat ductile. You can bend it and it will only partially return to its original shape and retain some of its bent shape.
- 3 = Food is ductile. You can bend it and it holds the bent shape.
- 4 = Food is somewhat brittle. You can bend it a little bit and it will hold the bent shape. If you bend it too much, it snaps.
- 5 = Food is totally brittle. If you bend it, it will not retain its bent shape at all, and if you bend it too far, it snaps suddenly.

CANDY NAME	ROOM TEMPERATURE	FROZEN

Take one of your room-temperature candy items and hold it on both ends (using both hands). Slowly start to bend it in half. Pay close attention to how hard it is to bend it. Is it very stiff and difficult to bend at all? Is it super-flexible and easy to bend?

Continue bending the candy until it breaks. Pay close attention to how it breaks. Does it snap very suddenly (brittle) or does it stretch out and break gradually (ductile)?

Note: Some items, such as gummy worms, are very flexible, so you might not be able to break them at all by bending them. Can you break them by pulling them apart? If so, how does that break occur—suddenly (brittle) or stretchy and gradually (ductile)?

Now, take the matching candy out of the freezer and repeat the steps above. Remember to carefully observe how the candy breaks. Is the candy easier or harder to bend? Does the candy break in a different way?

Repeat the procedure for each type of your other candy items.

Did the matching candies behave differently depending on their temperatures? How did different candies of the same temperature compare with one another during the bending test? What do you think would happen if you tried bending these candies when they were warmer than room temperature?

Try expanding the project to test more foods. What if you test non-candy items, like pasta, pretzel sticks, or slices of bread? Can you find food items whose flexibility does not appear to depend on temperature? For example, a food that is always ductile, or a food that is always brittle?

This is the sort of experiment that Materials Science Engineers do to find out how materials behave at different temperatures and in different configurations so they can pick the best materials for any given application.

130 East Randolph Street, Suite 3500
Chicago, IL 60601
swe.org | #BeThatEngineer