

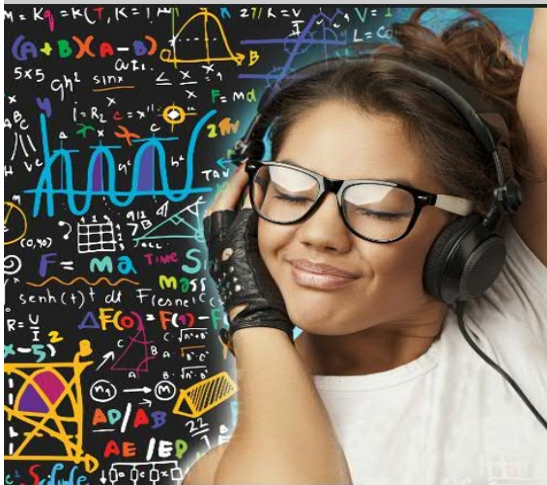


# C5ISR CENTER STEM@Home

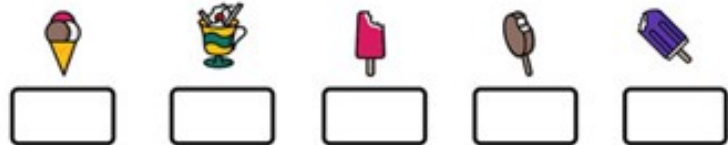
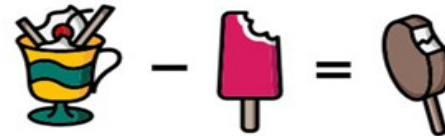
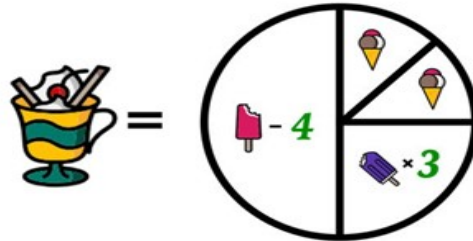
## Welcome to STEM@Home!

As we maneuver the challenges of the COVID-19 epidemic, we strive to continue to make STEM accessible to all.

The STEM@Home Newsletter is intended to be a resource to provide engaging and educational activities that can be done with minimal materials and a whole lot of imagination.



## Brain Teaser: Solve the following puzzle:

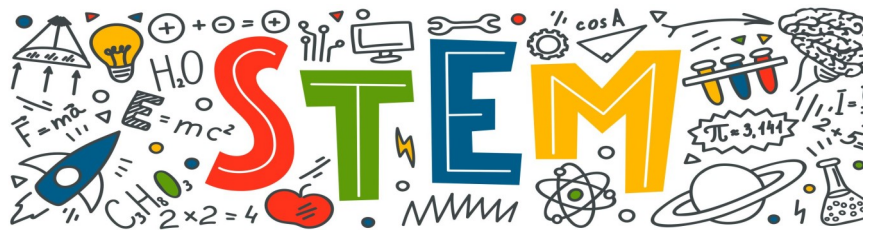


Solution on Page 3

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### SHARE YOUR STEM...

Visit the C5ISR Center on Facebook to post a photo or video of your child completing one of the STEM@Home Activities.



<https://www.facebook.com/CCDC.C5ISR/>

#C5ISRCenterSTEM

## Introducing Ashley Ruth, Ph.D.



**Name:**

Ashley Ruth

**Job Title:**

Research Chemical Engineer

**Length of Time as a U.S.**

**Army Engineer:**

8 Years

**Education:**

B.S. - Materials Science and Engineering, University of Maryland

Ph.D. - Materials Science and Engineering, University of Maryland

**How does your job support the U.S. Soldier?** My work focuses on battery development and making safe, lightweight, long-runtime batteries for the Soldier. It is incredibly important to work on making batteries lighter to reduce the burden on Soldiers so they can effectively perform their duties. Normally, Soldiers carry quite a bit of weight, including up to 18 pounds of batteries. We need the longer runtime so Soldiers can execute missions without having to turn back to collect more batteries.

**What is a typical day like for you?** My day typically involves meeting with various organizations that want to use a battery inside of a device they are developing. As you can imagine, most items require power. We help organizations create that power solution. We help design the battery physically, and we work with battery manufacturers in industry to help them create the best, safest, light-weight, long-runtime battery for the proposed device. When I was working in the lab pre-pandemic, I used my background in materials science and worked on synthesizing battery cathode materials, studying it for its high-energy content. I can physically create new materials, put them into a battery cell, and test the performance.

**What drew you to the STEM field originally?** It's much more fun to do something you can do well! I never took to history or English, but I excelled in math and science. For me, heading into STEM was simply natural. When it came to selecting my major, Materials Science, I had observed a set of demonstrations of a shape memory alloy as well as a magnet dropped through a copper tube. I decided then and there I needed to know how the observations of those demonstrations happened. Then I wanted to be able to make materials do more.

**Why is STEM important to our national security and our national future?** STEM is critically important to our nation. From a national security standpoint, having the best technology gives us wins on the battlefield, or even better, prevents a war altogether.

**How should students further their interests in a STEM field?** Students should get involved in a variety of activities and programs. Go to STEM camps during the summer. Participate in after-school STEM programs. In high school, plan to have internships over the summer and begin to network with your family or your friends' family to see if maybe you can get an opportunity to work with them in a STEM field. Get involved with eCYBERMISSION and Army Education Outreach Programs.

**What is the most important STEM-related innovation you've witnessed in your career?** I believe one of the most impactful innovations is the ability to incorporate very high energy density materials into everyday batteries. Silicon anode technology has overcome enough technical barriers that even Tesla recently announced their batteries will switch over to adopting this new material. Depending upon the application, you can see a 20% to 100% increase in the runtime of a battery. While weight and volume matter, as it does for Soldiers that are overburdened, this is an extremely important innovation that can enable amazing warfighting capabilities.

**What is your favorite technology for personal use?** My favorite technology for personal use is wireless charging. It's such a basic feature, but I love being able to just set my watch or phone down to charge.

**Why is it important for engineers and scientists to engage with STEM Outreach?** It is important for engineers and scientist to engage in STEM Outreach to keep the passion alive! Students want to see that adults in their intended career field really enjoy their work. Interestingly enough, this interaction gives as much as it receives, and it can reinvigorate the passion inside of you. We all have a story to share and those connections make big impacts on youth. You just have to share the story!

# STEM Activity/Challenge



Materials	Cost
Plastic spoon or forks	\$150
Cardboard piece	\$200
Pipe cleaners	\$50 each
Construction paper	\$60 dollar per sheet
Popsicle sticks	\$100 for 10
Straws	\$75 for 8
Plastic bag	\$125
Cardboard paper towel/ toilet paper roll	\$150
Tape	\$50 for 12 inches
Cups	\$225
Bowl	\$240
Other item of choice (not listed)	\$250

## Apple Remover

To prepare for winter, orchards must clean up any remaining fruit on the ground or left on the tree. Cleaning up the apples and any fallen leaves around the apple tree is important in preventing a common fungal disease called apple scab. This disease is caused by spores released from dead apples and leaves on the ground. Farmers can prevent this without any chemical application by removing the leaves and fruit in a timely manner.

### Mission:

To prepare for the upcoming colder weather, the manager of Bailey Orchards has contacted your engineering company to design a device that will allow their workers to remove any apples remaining on the trees and on the ground efficiently and in a timely manner.

**Requirements:** The device must not require workers to use their hands.

**Extra Challenge:** Design your device within a budget of \$1,000 using the cost list on the side.

### Design Process:

**ASK:** What is the problem you need to solve? Design a device that will remove apples from trees and the ground.


**IMAGINE:** Brainstorm and decide on one idea. How will your device work?

**PLAN:** Draw a picture of the device for the removal of apples. What will your device look like?

**CREATE:** Use the materials to create a prototype of your device.

**IMPROVE:** How can you improve your device? If you had more choices of materials, what would you use and why?

Ask an adult to **Share your STEM** on Facebook. **#C5ISRCenterSTEM**

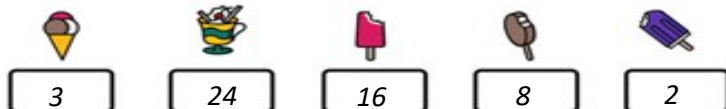


## The C5ISR Center Community Outreach Office

The C5ISR Center Community Outreach Program is a collection of kindergarten through college-level programs designed to give the students of northeast Maryland and Northern Virginia access to educational and extracurricular opportunities in the areas of science, technology, engineering, and math, or STEM.

For more information visit us on the web:  
[https://c5isr.ccdc.army.mil/student\\_programs/](https://c5isr.ccdc.army.mil/student_programs/)

Solution to Puzzle on Page 1:



## STEM IN THE NEWS

### Did you know?

It has become a tradition for astronauts to pack a stuffed animal or small plush toy with them on missions as a zero gravity indicator. For their zero-g indicator, Crew-1 brought a plush version of Baby Yoda, the Child, from the Disney+ *Star Wars* series *The Mandalorian*.

### Sources:

NASA. "NASA's SpaceX Crew-1 astronauts headed to International Space Station." ScienceDaily. ScienceDaily, Nov. 16, 2020.

[www.sciencedaily.com/releases/2020/11/20116005227.htm](http://www.sciencedaily.com/releases/2020/11/20116005227.htm)

<https://www.nasa.gov/press-release/nasa-s-spacex-crew-1-astronauts-arrive-at-space-station-nasa-leaders-and-crew-to>

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## NASA and SpaceX Launch First Commercial Human Spacecraft System

On Sunday, Nov. 15, 2020, at 7:27 p.m. Eastern Standard Time, the first NASA-certified commercial human spacecraft successfully launched from the Kennedy Space Center in Merritt Island, Florida, as part of a six-month mission to the International Space Station (ISS). NASA and SpaceX joined forces to send the SpaceX Crew-1 into orbit on the Crew Dragon spacecraft, propelled by a SpaceX Falcon 9 rocket.

The mission has several firsts, including the first flight of the Commercial Crew Program, which is the official name of the partnership between NASA and the privately owned company SpaceX to transport crews of astronauts into space. The mission also includes the first international crew to be launched in an American commercial spacecraft. Crew-1 is made up of three NASA astronauts – Mike Hopkins, Victor Glover, and Shannon Walker – and Japan Aerospace Exploration Agency astronaut Soichi Noguchi.

The Crew Dragon spacecraft, named Resilience, docked at the ISS on Nov. 16 and joined the Expedition 64 crew of three, increasing their size to seven. The name Resilience was given to the spacecraft to highlight the “dedication displayed by the teams involved, and to demonstrate that when we work together, there is no limit to what can be achieved,” according to ScienceDaily. The spacecraft is commanded and monitored from the SpaceX mission control center in Hawthorne, California, and NASA’s Johnson Space Center in Houston, Texas.

The crew will conduct multiple experiments and scientific investigations onboard the ISS over the next six months. The Crew-1 team brought 500 pounds of cargo that include materials for studies on food physiology and how an optimized diet can impact crew health. They also brought a student-designed experiment to understand how spaceflight affects the brain. Both experiments are meant to provide more information on how to maintain astronauts’ health during long missions.

Other experiments include studying the effects of gravity on human tissue, which could improve human health on Earth; growing radishes with different types of soil and degrees of light to further our knowledge of growing food in space; and testing a new way to remove heat and regulate body temperature in NASA’s next spacesuit. Aboard the ISS, the astronauts are able to conduct experiments and obtain results that are not possible on Earth, which will pave the way for future missions and future research breakthroughs for the next generation. During the duration of their mission, Crew-1 will receive visits from unmanned spacecrafts, complete spacewalks, and host additional astronauts in 2021.

At the conclusion of the mission, the crew members will re-board the Crew Dragon spacecraft and return to Earth with newfound data on how this NASA-SpaceX partnership will open more opportunities for space exploration. This is the first step toward potential future missions to the moon, and perhaps, even Mars.



The Army Education Outreach Program (AEOP) eCYBERMISSION registration is open for students, team advisors, and volunteers! eCYBERMISSION is a web-based STEM competition that helps students grades 6-9 learn about real-life applications of STEM. **ACCEPT THE CHALLENGE TODAY!**

Learn more at <https://www.usaeop.com/program/ecybermission/>.

## STEM Activity/Challenge



### Salt Crystal Leaves Experiment

With colder weather just around the corner, you may notice on some mornings, there is frost covering the grass and fallen leaves. Using a few ingredients found in your kitchen, you can mimic the appearance of frost on an autumn leaf in this fun, simple experiment.

#### Directions:

1. Prepare your leaf: You can use a leaf from your backyard. You can also shape a pipe cleaner into a leaf or cut a leaf out of construction paper or fabric. You will want to attach string or a pipe cleaner to your leaf so you can hang it from the side of your cup or bowl.
2. Tape your leaf to the side of your cup or bowl so that it hangs inside.
3. Have an adult help you boil about 1.5 cups of water.
4. Add salt to the water. The more salt, the better, because you want to oversaturate the mixture. A good way to tell when your mixture is oversaturated is when crystals start forming on the surface of the water.
5. Pour the salt mixture in your glass or bowl, making sure to cover your leaf.
6. Set your glass or bowl aside for at least two days. The longer you allow the leaf to remain in the mixture, the more crystals should grow.
7. After allowing your leaf to sit in the mixture for a few days, remove it from the water and dry it on a paper towel.
8. You can now observe the crystals you created on your leaf.

**For a variation:** Try this experiment again, but use cold water. This will allow you to compare the differences in the amount of salt needed for the mixture and see the difference in the results of the crystals.



### SAFETY NOTICE

Make sure you have an adult's permission and supervision before beginning this activity.

#### The Science Explained:

This simple experiment uses a supersaturated solution. A supersaturated solution is a mixture that cannot hold any more particles. This occurs when there is too much salt in the water to fully bond with the water molecules. When you added salt to the water, you filled all the space in the water, and the rest was left behind. In cold water, the molecules are closer together, but when the water is heated, it allows the molecules to spread away from each other. This is what allows you to add more salt to bond with water, making the solution even more supersaturated.

Now let's look at how salt crystals grow. When the water starts to cool, it makes conditions unstable, and the dissolved salt will start to attach to your leaf. As the water evaporates, the salt stays behind, and the salt crystals begin to cling to each other, which forms large squares of salt.

Source: [thebeakerlife.com/salt-crystals-experiment-bdcb9f7f1d3](http://thebeakerlife.com/salt-crystals-experiment-bdcb9f7f1d3)