

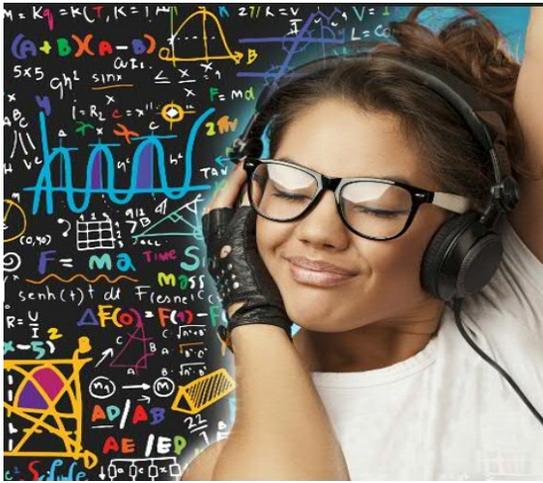


# C5ISR CENTER STEM@Home

## Welcome to STEM@Home!

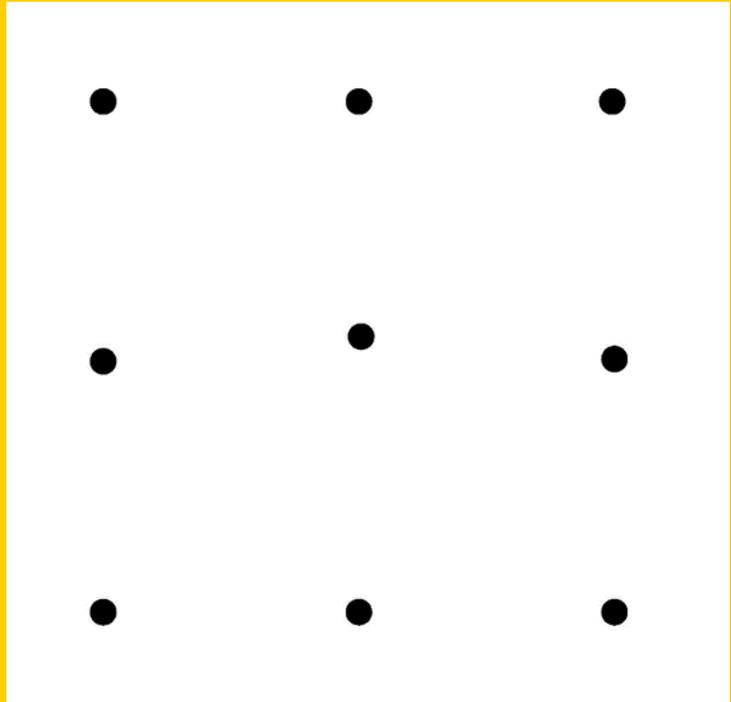
As we maneuver the challenges of the COVID-19 epidemic, we strive to continue to make STEM accessible to all.

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 Activity— Dots in a square

1. Join all nine dots with four straight lines without taking the pencil off the paper.
2. Do not go over any line more than once.



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Issue 12



## 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 Mr. Apurva (A.P.) Shah


**Name:**

Apurva (A.P.) Shah

**Job Title:**

Electronics Engineer

**Length of Time as a U.S. Army Engineer:**

4 Years

**Education:**

Master of Science Degree in Electrical and Computer Engineering, Johns Hopkins University, Baltimore, MD (will graduate in December 2020)

Graduate Certificate in Systems Engineering, Stevens Institute of Technology, Hoboken, NJ

Bachelor of Science Degree in Chemical Engineering, University of Maryland, Baltimore, MD,

**How does your job support the U.S. Soldier?** I work in the Cyber/Offensive Operations Division, and our goal is to develop cyber technology that can help Soldiers. Nowadays, nearly all technology relies on the internet in some way or another (even smart refrigerators and smart microwaves). My job is to research and develop tools that use this for our advantage.

**What is a typical day like for you?** Some days are spent primarily on developing cyber-based software tools. Other days are spent on hardware development (including 3-D printing and soldering different components together). Other days are spent at different locations across the country (and globe) testing out our tools and integrating them with technology built by other engineers for the U.S. Army.

**What drew you to the STEM field originally?** When I was growing up, my parents had me sign me up for everything! Summer camps, science contests – you name it! They really wanted me to give everything a try and see what I enjoyed the most. The STEM internships (specifically the U.S. Army’s Gains in the Education of Mathematics and Science Program and the Science and Engineering Apprenticeship Program) really clicked with me! I enjoyed the concept of researching a problem, thinking critically, and applying scientific concepts; of course, nothing beats the feeling you get when the challenge was completed successfully.

**Why is STEM important to our national security and our national future?** STEM plays such an important role to our national security today, and this role will only continue to exponentially increase as time goes on. STEM impacts nearly everything, across all forms of warfare, cybersecurity, and many, many other fields, so it is critical for our national future that we stay ahead.

**What should students study to further their interests in a STEM field?** Students should take things apart and put them back together (with permission from your parents of course). Don’t be afraid to void warranties! Stay curious, try to understand how things work, and more importantly, imagine how they can be improved. Keep asking questions and never stop reading. Also, look into some of the great STEM learning programs available through the Army Educational Outreach Program (<https://www.usaeop.com/>).

**What is the most important STEM-related innovation you’ve witnessed in your career?** This is a really hard question! There are so many critical STEM-related innovations I’ve gotten the chance to see that it’s hard to pick just one. One of the coolest innovations, though, was the use of virtual reality goggles to enable the commander of an operation to control each stage of a mission (including the use of the cyber sensors that my team and I created) from a separate location hundreds of miles away!

**What is your favorite technology for personal use?** I don’t own them yet, but I really find the auto-lacing basketball shoes to be very fascinating! Very convenient, and it gives you the perfect fit automatically. Plus, they give you more time to focus on the sport without having to worry about tying your shoes! There are also shoes with sensors that pair to your phone via Bluetooth and connect to the internet to give feedback on your workout. Who would’ve thought that even shoes are impacted by cybersecurity?

**What is the next great technological frontier?** There are many next great technological frontiers, but artificial intelligence (AI) is one of the most important ones! Sooner or later, we’ll be depending on AI and using machine learning for all decision making. We’re already seeing snippets of this technology with self-driving cars, but this is just the tip of the iceberg.

**Why is it important for engineers and scientists to engage with STEM outreach activities?** It’s so important for engineers and scientists to engage with STEM Outreach. You, the next generation of STEM superstars, have an endless amount of energy and curiosity, which is very motivating. Plus, in a matter of no time, STEM students today will be leading at the forefront of technology, so we (engineers and scientists) need to ensure they are equipped with the proper tools and knowledge to succeed.

## STEM Activity/Challenge



### Apple Oxidation Experiment

Have you ever noticed that if you don't eat an apple fast enough, it will start to turn brown? This is actually a chemical reaction at work. In this experiment, you will learn how oxygen in the air around us causes a chemical reaction called oxidation. With using just a few different liquids in your home, you will be able to test and discover how to keep apples from turning brown.

#### Directions:

1. Pour about  $\frac{1}{4}$  cup of each liquid into its own bowl, cup, or Ziploc bag. Make sure to label each of the liquids and have one empty bag to be your control variable.
2. Make a prediction on what will happen with each liquid. Which liquid do you think will prevent the apple from turning brown?
3. Have an adult help you slice your apple into small pieces.
4. Place one apple piece into each container or bag, including the empty one. Make sure the liquid fully covers the apple. If you are using a Ziploc bag, make sure to shake the bag well.
5. After three minutes, pour any excess liquid out of the bowls, cups, or bags, leaving the apples behind. Make a note on what the apple pieces look like and check on the apple pieces about every 10 minutes for a half hour to see what happens.

**Questions to think about:** Which ones turn brown? Which ones stay fresh? Were your predictions correct?

**Why does this work?** When an apple is cut, the exposed fruit under the skin reacts with oxygen in the air, causing the apple slices to turn brown. This chemical reaction is called oxidation. Oxidation causes fruit to spoil much faster than it normally would. You should have discovered in the experiment that lemon juice was one of the liquids that worked best at preventing the apple from turning brown. This is because the lemon juice is acidic and will react with oxygen before the oxygen reacts with the apple. Using a bit of lemon juice will help keep your apples fresh without changing the taste too much.

#### Materials:

- Apple slices
- Knife or apple slicer (make sure you have an adult to assist you with these materials)
- 6 small bowls, cups, or Ziploc bags
- Marker and small pieces of paper to label your liquid and control variable
- Variety of liquids to test:
  - water
  - milk
  - lemon juice
  - vinegar
  - salt water

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



AEOP offers our nation's youth and teachers opportunities for meaningful, real-world STEM experiences, competitions and paid internships alongside Army researchers. **Learn more at [www.usaeop.com](http://www.usaeop.com)**

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. Teams of three or four students are instructed to ask questions or define problems and then construct explanations or design solutions based on identified problems in their community. Learn more at <https://www.usaeop.com/program/ecybermission/>.



# STEM IN THE NEWS



## A Volcano is Reborn

For the first time, scientists have witnessed the “rebirth” of a volcano. The Bezymianny volcano, located in Russia’s Far East on the Kamchatka Peninsula, erupted and partially collapsed in 1956. The Kamchatka Peninsula is about 1,800 miles from Alaska. Over the last 65 years, volcanologists and researchers from Russia, Germany, and Italy have collected satellite data to observe the site of the volcano to see how Bezymianny has regrown its collapsed sector since last erupting. While volcanoes can physically break down and start to grow again due to activity within its interior, a regrowth on this scale had yet to be documented.

Around 50 years ago, the team monitoring this activity first noticed the growth of two lava dome formations coming from two different vents. Vents are openings on the volcano where molten rock, or the magma at its core, becomes lava as it travels and erupts onto the Earth’s surface. Two decades later, the two vents started growing closer together. Presently, the two domes formed a single vent that has developed its own single cone, which is the scientific term for a hill-shaped landform that develops at the top of and around the volcano.

The research team estimates that Bezymianny will grow back to its original size before collapsing in the next 15 years. The volcano is growing and adding mass at the rate of around 26,400 cubic meters every day. This growth equals the length of around 1,000 dump trucks every 24 hours.

Understanding how volcanoes regrow after a collapse is important as it helps to understand how these sudden changes take place. In addition to studying the collapse, the timeline of regrowth and how the volcano builds itself back up could contribute to predicting if an eruption or collapse could happen again. The team has published their findings in a scientific research journal, *Nature: Communications Earth & Environment*, and will continue to monitor Bezymianny to make predictions on whether the volcano will erupt again.

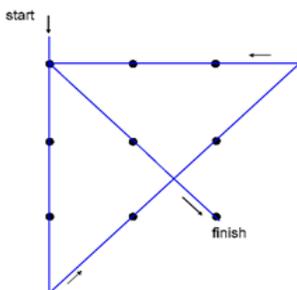
### Fun Fact:

**Volcanoes don’t just occur on land. They can also be found on the ocean floor or under ice caps.**

### Sources:

- “Volcano Being 'Reborn' Observed by Scientists for the First Time” By Hannah Osbourne, Health Technology and Science Correspondent at *Newsweek*, Published 9/10/2020— <https://www.newsweek.com/russia-volcano-reborn-collapse-1531007>
- “The rebirth and evolution of Bezymianny volcano, Kamchatka after the 1956 sector collapse” Shevchenko, A.V., Dvigalo, V.N., Walter, T.R., et al. The rebirth and evolution of Bezymianny volcano, Kamchatka after the 1956 sector collapse. *Commun Earth Environ* 1, 15 (2020). <https://doi.org/10.1038/s43247-020-00014-5>
- Alternate Link: <https://www.nature.com/articles/s43247-020-00014-5#citeas>

### Solution to brain teaser page 1



# STEM Activity/Challenge

## As Autumn Leaves Fall...

Over the years, farmers, landscapers, and families have seen technology improve the ability to complete yard work faster. Think about how lawnmowers have evolved over time. The first mowing machine was invented by Edwin Budding in 1830, and it did not involve gas or electricity; it simply required someone to push the machine across the lawn. Over time, other inventors and engineers made new designs for lawnmowers similar to the ones you see today that require gas or electricity. Now that it is autumn and leaves are beginning to fall, people are looking for tools to help them clean up the leaves in their yards in a timely manner.

**Mission:** You have been contacted by Best Outdoor Tool Company to engineer and design a new device that will allow customers to clean up leaves efficiently and in a timely manner. The company already has several rakes and leaf blowers, and you've been hired to either make an improvement to existing rakes and leaf blowers or come up with a new piece of equipment.

**Requirements:** Design either a new technology or an improvement to something already being sold in the stores.

**Extra Challenge:** Design your technology tool 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 new tool that will be effective and allow customers to clean up leaves quickly.

**IMAGINE:** Brainstorm and decide on one idea. How will your new technology clean up leaves quickly and effectively?

**PLAN:** Draw a picture of the new technology. What will your new technology look like?

**CREATE:** Use the materials to create a prototype.

**IMPROVE:** How can you improve your new technology?



Materials	Cost
Empty bottles	\$250
Plastic fork or spoon	\$75 each
Tape	\$45 for 12 in.
Glue	\$50
Popsicle sticks	\$65 for 15
Straws	\$40 for eight
Cardboard	\$185
String	\$75 for 24 in.
Paper towel roll	\$100
Toothpicks	\$180 for 18
Paper cup	\$200
2 cups the same size	\$220
Rubber bands	\$25 for one
Other item of choice	\$200 each



## Now is a great time to get involved in STEM...

The C5ISR Center Educational 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 extra-curricular opportunities in the areas of Science, Technology, Engineering and Math, or STEM .

For more information about our STEM Outreach Programs, visit us on the web at:

[https://c5isr.ccdc.army.mil/student\\_programs/](https://c5isr.ccdc.army.mil/student_programs/)