

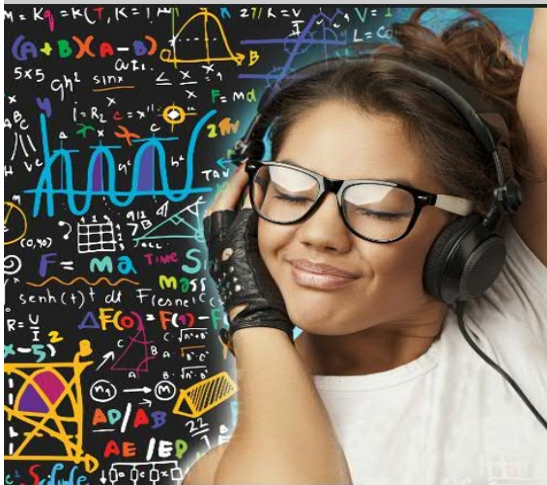


# C5ISR CENTER STEM@Home

## Welcome to STEM@Home!

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

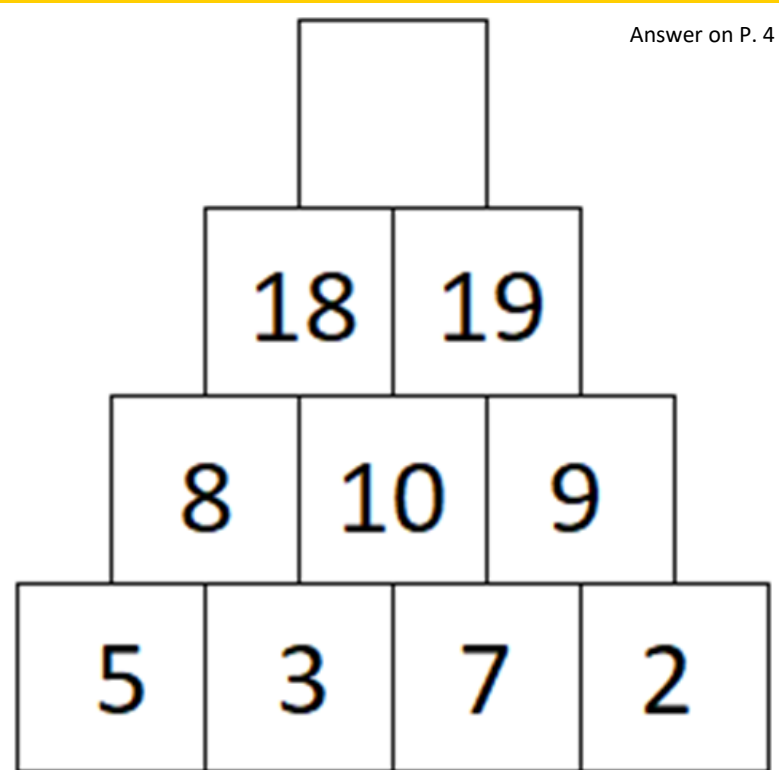
The STEM@Home Newsletter is intended to be a resource to provide engaging and educational activities that can be done with minimal materials and a whole lot of imagination.



## Brain Teaser Activity— Math Pyramid

Look at the patterns in the below pyramid. What number should be placed in the top square?

Answer on P. 4



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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 Mr. Patrick Doyle


**Name:**

Patrick Doyle

**Job Title:**

Electronics Engineer

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

10 Years

**Education:**

Bachelor of Science Degree in Software Engineering, Monmouth University— NJ

Master of Science Degree in Systems Engineering, Stevens Institute of Technology—NJ

**How does your job support the U.S. Soldier?** I lead a team of engineers who build software that lets Soldiers perform their jobs remotely from the safety of their bases rather than having to travel into potentially dangerous areas.

**What is a typical day like for you?** A typical week starts with planning meetings on Monday. Tuesday through Thursday involves finishing the tasks that were assigned to various teams. These tasks can include programming code, writing instructions for Soldiers on how to use our software, and testing the software to make sure it works. On Friday, we meet again to go over what we were able to get done, what problems we ran into, if anyone needs help, and what we should focus on for the next week. Sometimes, we travel to global locations to help people set up and use our software.

**What drew you to the STEM field originally?** I was always interested in helping solve problems from when I was in middle school. This led to an interest in psychology and programming prior to college. My first assignment in college was to program a calculator and build what it would look like to the person who would use it. I realized I could combine my interests into a single path!

**Why is STEM important to our national security and our national future?** No matter where you look, STEM is all around us. Every day, people and Soldiers use smartphones, computers, and other tools such as voice control to help them complete tasks in a variety of fields. STEM is critical to our national security, as it is the main set of tools we use when we design new things – from tanks, drones, and body armor to batteries and secure smartphone software – that help keep our Soldiers and Nation safe.

**What should students study to further their interests in a STEM field?** There are plenty of free resources online from Google, NASA, the National Security Agency, and schools across the globe. Enroll in some of the programs, and see if they interest you. Even if you do not like exactly what each one offers, you might be able to discover STEM fields you didn't know about before! Alternatively, you can sign up for any clubs or online groups around you that offer STEM-related activities. I was part of a rocket club growing up, and even though mine exploded on takeoff, it taught me a lot about some very cool topics.

**What is the most important STEM-related innovation you've witnessed in your career?** Computers and networking! Everything we used to do by hand or in person can now be done remotely or at incredible speeds. Computers and networking have changed the way our world works, how people work together, how they communicate, and how they live out their everyday lives.

**What is your favorite technology for personal use?** I don't like talking on the phone very much, but my video gaming console has allowed me to stay in touch with my friends, some of whom live thousands of miles away, while we play video games together.

**What is the next great technological frontier?** Personally, I think virtual reality could be the next frontier. It has made great progress over the past few years, and if it continues, I think it could be an amazing tool for use in schools, training, entertainment, and other fields.

**Why is it important for engineers and scientists to engage with STEM Outreach?** If you were to have asked me what engineers and scientists did for the Army when I was in middle school, I would not have had the slightest clue. Having scientists and engineers engage in Outreach helps our next generation discover what careers are available to them as well as understand how the activities that they are interested in now can lead to a future career.

# STEM Activity/Challenge



## Design a Platform for Produce

Engineers design platforms for a variety of reasons that can be used around homes and businesses, and sometimes for recreational activities. Some of these platforms you may see include porches, stages, decks, tree stands for hunting, diving, lifeguard stands, produce stands or displays, and so much more. One important factor when designing a platform is that it must have a purpose. Think of a platform as being a solution to a problem.

Bailey Farms has been preparing for its busy fall season with all their fall produce. They have a variety of products: apples, pumpkins, sweet potatoes, and all different kinds of squash. The farm ran into a problem when the display for their produce was damaged during a storm. The owner of the farm has been in search of a new platform to display all of his produce.

**Mission:** You have been contacted by the manager of Bailey Farms to design a new platform that will display the farm’s fall produce. The manager has requested that you prepare a platform be at eye level and be appealing to customers.

**Requirements:**

- The platform must be free-standing and stable.
- The platform must be able to bear weight. Test it by placing an apple, small pumpkin, or another small item from your home to see what your platform can hold.
- The platform must be elevated at least 4 inches off the table.

**\*\*HINT\*\* There is a required height for your platform (4 inches off of the table) but there is no requirement for the width and depth... how will changes in width and depth impact stability?**

**Design Process:**

**ASK:** What is the problem you need to solve? Design a new platform to display produce for Bailey Farms.

**IMAGINE:** Brainstorm and decide on one idea. How will your platform display the produce?

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

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

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

| Materials                                    | Cost             |
|--|------------------|
| Newspaper                                    | \$70 for 1 sheet |
| Cardboard piece                              | \$200            |
| Printer Paper                                | \$50 for 1 sheet |
| Construction paper                           | \$60 for 1 sheet |
| Popsicle sticks                              | \$100 for 10     |
| Straws                                       | \$75 for 8       |
| Glue   | \$50             |
| Cardboard paper towel roll/toilet paper roll | \$150 each       |
| Tape   | \$50 for 1 foot  |
| Paper/plastic cups                           | \$250            |
| Other item of choice (not listed)            | \$250            |

**Additional Materials:**  
Scissors, paper, pencil

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



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

The C5ISR Center Community Outreach Program is pleased to announce :

**Middle School STEM Night: “It’s Electric”... An Evening with an Army Researcher.**

This one-hour event will include an opportunity to learn from an Army expert as well as games and prizes. This **FREE** opportunity is offered exclusively for **Middle School** students in Baltimore City/County, Cecil County, and Harford County.

Visit <https://usarmyc5isrcenter.submit.com/> to register beginning NOV 10, 2020.



## STEM IN THE NEWS



### Did you know?

Enzymes are responsible for a lot of the work that goes on in cells. They act as catalysts to help produce and speed up chemical reactions. When a cell needs to get something done, it almost always uses an enzyme to speed things along.

### The Future of Plastic Recycling

A team of United States and United Kingdom scientists have re-engineered an enzyme that eats and breaks down one of the most common plastics in the world. The original enzyme, called PETase, is used to break down PET, an acronym for polyethylene terephthalate. PET is the most common of the thermoplastics, which is what we use to create single-use plastic bottles like two-liter soda bottles, cleaning supplies, and plastic food containers found at restaurants and grocery stores. PET is also used in clothing, carpets, tennis balls, and even aluminized Mylar balloons. You can find PET in clothing items such as shirts, socks, and household items like carpet and area rugs because it is part of the polyester family. Under normal circumstances, PET can take hundreds of years to break down in the environment. The U.S.-U.K. team has been working together to discover how to create faster and more energy-efficient ways to break down and recycle PET.

The study was a team effort that involved scientists and engineers at all stages in their careers. Leading the team that created PETase is Professor John McGeehan, director of the Centre for Enzyme Innovation at the University of Portsmouth in Portsmouth, England, and Dr. Gregg Beckman, senior research fellow at the National Renewable Energy Laboratory in Washington, D.C. After many months and multiple experiments, the team was able to link PETase with a second enzyme called MHETase. This pairing has improved the speed at which PET breaks down and is able to be recycled. Instead of taking hundreds of years, the PETase-MHETase super enzyme shortens this period to just a few days.



This decomposition occurs when PETase attacks the surface of the plastic, then MHETase breaks things down even further. The re-engineered enzyme combination works to digest PET plastic, return it to its original building blocks, and allow the plastic to be remade and reused in an endless cycle. Professor McGeehan described the new enzyme as two Pac-Men joined by a string, eating away and breaking down the plastic.

In order to see the individual atoms and molecules of PETase and MHETase, Professor McGeehan used a synchrotron. A synchrotron is a powerful machine the size of a football field that uses a light that is 10 billion times brighter than the Sun, allowing a user to study the molecular structure of each enzyme. This technology allowed the team to visualize PETase on a microscopic level and gave them the blueprints to engineer the faster enzyme combination. The enzyme is not yet available for commercial use, but this research is a step in the direction towards recycling plastic more effectively and efficiently all over the world.

#### Sources:

- "Scientists create 'super enzyme' that eats plastic bottles six times faster," by Jack Guy, CNN, Sept. 28, 2020. <https://www.cnn.com/2020/09/29/world/plastic-eating-super-enzyme-scli-intl-scn/index.html>
- "Plastic-eating enzyme 'cocktail' heralds new hope for plastic waste," University of Portsmouth, ScienceDaily, Sept. 28, 2020. [www.sciencedaily.com/releases/2020/09/200928152913.htm](http://www.sciencedaily.com/releases/2020/09/200928152913.htm)
- "New Enzyme cocktail digests plastic waste six times faster," University of Portsmouth, Sept. 28, 2020. <https://www.port.ac.uk/news-events-and-blogs/news/new-enzyme-cocktail-digests-plastic-waste-six-times-faster>



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)

**Answer to  
puzzle on Page 1:**

**37**



## STEM Activity/Challenge

### Fall Leaf Science Experiment

Explore the science behind the transformation of leaves that occurs every fall. Go outside and collect some leaves to try this experiment using just a few materials from your home.

#### Directions:

1. Go outside and collect some leaves. Choose leaves from the same tree, but at varying stages of color.
2. Cut the leaves or tear them into small pieces, and then place the pieces of each leaf into its own cup or small bowl. Be sure to label each cup with what color leaf is inside.
3. Pour the rubbing alcohol or nail polish over into each cup or small bowl. Make sure to pour just enough to cover the leaves.
4. Use a spoon to mix and mash the leaves until the mixture turns slightly green.
5. Cover your cups or jar with a plastic baggie or plastic wrap and place in a larger dish or bowl. Pour hot water around them. Leave them in the water for about 20 minutes. Please make sure to have an adult help you with the hot water. You can also place your mixtures out in the sun instead.
6. Cut your coffee filters or paper towels into one-inch-wide strips. Place the strips into each of your mixtures with the top half hanging on the edge of your cup or jar. Use a piece of tape to keep the strips in place.
7. Allow the strips to sit in the leaf mixture for at least an hour. If you want to explore further, see what happens if you allow the strips to sit in the mixture overnight. The colors may become bolder.
8. Pull the strips from your mixtures and record your observations.



#### Materials:

- 3-4 leaves from the same tree (try to find different color of leaves: green, yellow, orange, red)
- One clear cup, small bowl, or jar for each leaf
- Rubbing alcohol or nail polish remover
- Coffee filters or paper towels
- Spoon
- Scissors
- Tape
- Plastic wrap or plastic baggie
- Hot water
- Flat bowl or dish
- Paper and pencil



### SAFETY NOTICE

Make sure you have an adult's permission and supervision when handling the rubbing alcohol, nail polish remover or hot water.

#### The Science Explained:

In this experiment, the rubbing alcohol and the energy (hot water or sunlight) separated the colors from the leaf mixtures. You may have noticed that the liquid mixture traveled up the coffee filter or paper towel strips, and the colors separated as the alcohol evaporated from the strips.

#### Why do leaves change color?

Like all green plants, leaves contain chlorophyll. Chlorophyll is a green pigment that traps energy from the sun. It is also a big part of photosynthesis, which allows plants to get energy from the sun. The chlorophyll that gives a leaf the green color tends to be very dominant, causing it to hide the other colors in a leaf during the spring and summer. However, in the fall, the chlorophyll in leaves breaks down, allowing the other natural colors to shine through, showing beautiful red, yellow, and orange colors. During the autumn, the days become shorter, and there is less sunlight, giving the leaves a sign to prepare for winter by producing chlorophyll. When that happens, the green color starts to fade and allows the other colors to become visible.

Resource: [scijinks.gov/leaves-color/](http://scijinks.gov/leaves-color/)