STEM@Home Volume 3 Issue 7

Approved for Public Release

Welcome to STEM@Home!

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. To learn more about C5ISR Center Community Outreach, visit C5ISR Center U.S.ARMY CCDC | Student

In this Issue…

Math Moment:

Lieutenant Leprechaun has 300 items in his pot at the end of the rainbow. Of the items, 5/12 are four-leaf clovers, 1/6 are miniature rainbows, and the rest of them are pieces of gold. How many pieces of gold does Lt. Leprechaun have?

Answer on Page 6

The C5ISR Center Community Outreach Office would like to take the time to thank our volunteers who supported our programs throughout the month of February.

STEM Programing at CYS

Gary Micah and Holly Nathaniel

CCPS Science Fair Judges

Sydney Johns and Emanuel Merulla

If you would like to participate in the C5ISR Center Outreach Program, register at https://submit.link/Fe

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

Facebook.com/DEVCOM.C5ISR

SME Feature

Adam McCaulley
Chief, C5ISR Ground Activity Branch

Number of Years:

16+years in DoD; <6 months in Current Position

Education:

Bachelors of Science in Computer Engineering (Villanova University)

Masters of Science in Systems Engineering (Stevens Institute of Technology)

1. What is your job and how does it support the US soldier?

Government and Industry partners to design and execute experiments to see how well new technologies perform and can be used by our Soldiers. We get to work side-by-side with both technology developers and Soldiers; always meeting new people and working with the latest tech!

2. What drew you to the STEM field originally?

When I was in 6th or 7th grade, I remember taking apart our family computer and trying to install a modem to connect to the Internet. When my older brother got home that day, I had the entire computer disassembled on the kitchen table. The experience hooked me and I started to really gravitate towards computers and software.

3. What is the most important STEM related innovation you've witnessed in your career?

I started working for the Army in the summer of 2006; the first iPhone was released in the summer of 2007. It's been amazing to see how much smartphones have come, both to perform routine tasks, and being used in tactical environments. Quick shout-out also to 3D-printing! In a field experiment venue, it's *awesome* to have access to folks that can print brackets and other parts that we can install on vehicles and towers.

4. Why is STEM important to our national security and our national future?

Something Adm. (Retired) William McRaven once said really resonated with me, that "America's biggest threat to national security is the K-12 education system." In a forward-looking way, he's talking about investing in our future generations to make sure that they're empowered to make the right decisions and advance the right technologies for future national security matters.

5. What should students be engaging in order to further their interests in a STEM field?

Learn and be curious! Always! Take advantage of the many clubs and sessions that are available at your local libraries and schools. (With permission,) start taking things apart to see how they work!

STEM Challenge

Rainbow Bridge Challenge

When celebrating St. Patrick's Day this month, we need to be on the lookout for some sneaky Leprechauns who are looking for a great spot to hide their pot of gold. Everyone knows that Leprechauns often hide their gold at the ends of rainbows. What if we tried to trick a Leprechaun into leaving his pot of gold on a rainbow bridge that we made?

Materials:

- 7 different colors of construction paper
- Craft Sticks or Popsicle sticks
- Rainbow pipe cleaners
- Glue gun
- Glue sticks
- Paperclips
- Stapler
- Tape
- Scissors
- Ruler
- Pencil
- Markers
- 20-40 Pennies
- Glitter
- Two toilet paper rolls

Requirements:

- Be as creative as possible
- Use a variety of colors
- Must look like a rainbow

Mission: Using the items listed, design and construct a rainbow bridge that will be strong enough to hold at least 20 pennies. Bonus if the bridge can hold more than 20. We want you to be as creative as you can, using only the materials listed. We would also like to see how many pennies your bridge will hold in total. The more pennies the bridge can hold, the better off you will be at retrieving all the Leprechauns gold. This means that you will have to test the bridge twice. The first time, placing 20 pennies on the bridge to test its weight. The second time, placing as many pennies on the bridge as you can.

Design Process:

Ask: What is the problem that needs to be solved? A bridge that looks like a rainbow and can hold at least 20 pennies.

Imagine: Brainstorm different ideas. What type of structure will hold at least 20 or more pennies without breaking?

Plan: Draw out a picture of your build. Write a list of items and steps that you will take to complete this idea.

Create: Use the materials listed to create the bridge. Remember, the goal is to trick the Leprechaun into thinking it is a rainbow.

Improve: Place pennies on the bridge as you build it to test its hold. Use that evidence to improve your build along the way.

Questions to ask: If you had more choices of materials, what would you use and why?

Fun Fact: The Leprechauns name comes from the Irish word Luchorpan meaning "small body".

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 students access to educational and extracurricular opportunities in STEM. For more information about our STEM Outreach Programs, visit us on the web: https://c5isr.ccdc.army.mil/student_programs/

To reach our office, you can email us at usarmy.apg.devcom-c5isr.mbx.outreach@army.mil

STEM in our World

Sending Messages In Space

Since the beginning of space travel, communication from earth to its astronauts has been a top priority for NASA engineers. Space communication is crucial for most space expeditions such as performing spacewalks, conducting experiments, safety protocols, and general communication. While this type of space communication has been made possible and is now a typical procedure, scientists want to expand their means of communication to areas that have not yet been explored. While exploring certain areas of space can be dangerous for humans, some scientists believe we can begin to explore forbidden areas, such as wormholes, in a safer manner - starting with communication.

If you are not familiar with the term "wormhole", here is a little description. "A wormhole is like a tunnel or giant hole in space that connects two distant points in our universe and cuts the travel time from one point to the other." They are very similar to portals in that if you were to travel through one, it is very unlikely that you would be able to come back because the hole will snap itself shut once you enter it. While scientists are not ready to send a human through a wormhole, they are ready to send a message through.

Why a message? Physicists have studied wormholes in the past and found that when they become extremely unstable, they often collapse once any form of matter enters it. Therefore, in order to start exploring things like wormholes, they would need to send something through that is not only matter-less, but that could make a round trip before the hole collapsed. Ben Kain, a physicist at the College of the Holy Cross in Worcester MA, and his team proposed sending a message through because they contain no matter.

Prior studies of wormholes have concluded that the "cosmic passageways could potentially stay open for repeated trips back and forth, provided they're supported by a form of matter that is exotic. They are referring to something called "ghost matter," states Kain. Ghost matter is essentially matter that responds to gravity in the opposite way then normal matter; objects fall up instead of down. In using a new computer program, Kain was able to test this theory through a simulation. He was able to show how one type of wormhole would respond when something travels through it. He then tested the "ghost matter" theory with a message. This simulation resulted in the hole expanding rather than collapsing.

The results of the simulation were as expected. Kain concluded however, that while his simulation provides proof that his theory is possible, he still doesn't imagine us sending humans through wormholes anytime soon. "It is possible though that with ghost mattered materials, or in this case messages, things can pass through wormholes. This simulation may open up a whole new form of exploration of forbidden places in outer space" states Kain. As long as one has the right materials; a fast-moving probe that transmits "ghost matter" in and out of a space portal (like wormholes) at light-speed, or just before the wormhole shuts.

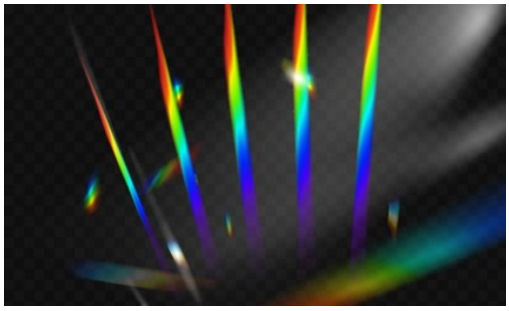
Resources:

Conversation, Dejan Stojkovic The. "What Are Wormholes?" *Astronomy.com*, 23 Aug. 2022, https://astronomy.com/news/astro-for-kids/2022/08/what-are-wormholes-an-astrophysicist-explains-these-shortcuts-through-space-time#:~:text=A%20wormhole%20is%20like%20a,down%20to%20hours%20or%20minutes.

Riordon, James R. "We Could Get Messages Back from Spacecraft Sent through a Wormhole." *Science News*, 3 Jan. 2023, https://www.sciencenews.org/article/get-messages-sent-through-wormhole-relativity.

STEM Experiment

Rainbow Science



Springtime is the time of year when nature awakes from its wintery slumber and begins to sprout its beauty. One of the natural beauties that is commonly seen in the spring is the rainbow. In this fun experiment, you will be able to make your own rainbow inside your house by creating a simple illusion with sunlight and water particles.

Directions:

1) Fill the glass container/jar with water.
2) Place the small mirror into the container/jar making sure that the mirror is angled towards the top.
3) Place the container in direct sunlight.
4) Position the container towards the sun so that the mirror is directly in the sunlight.
5) Keep adjusting the mirror until you see a rainbow form on the wall or ceiling. Notice that depending on the angle in which you place the mirror, the rainbow will either remain or disappear.

Materials:

- A clear glass jar or container
- Water
- Small mirror that can fit in the jar
- Direct sun light

How Does This Work?

Rainbows are not just pretty sights in the sky, they are also very fascinating when it comes to science. The rainbow effect is an optical illusion that happens when sunlight and rain droplets collide. When light enters through a water droplet, the light slows down and begins to bend as it passes through the air to the denser water. The light then reflects off the inside of the droplet, separating into two components. One of those components being color. What is interesting about rainbows is that this scientific illusion can only happen if the sunlight strikes the droplets at the precise angle. This means that in order to see a rainbow, *you* must be standing in the right spot.

Did you know?

A rainbow is not shaped like an arch. It is actually a complete circle. From the ground, we can only see a semi-circle. There is no "end of the rainbow".

As you might have seen in this experiment, you probably had to stand at different angles and/or you had to try angling your mirror in different positions until you made a rainbow. This is because the very center of the rainbow, or the antisolar point, has to line up exactly opposite to the sun or the light it is hitting in order to create the illusion. You might have also noticed that your rainbow was straight instead of curved. This is because when light hits the water droplets, it first refracts, and then it reflects off the back of the droplet. As the light leaves the droplet it refracts again, thus allowing the lights to bend, creating that arch in the rainbow. In this experiment, we are using a mirror which is flat. When the light passes through the water droplets in the jar and hits the mirror, it creates a straighter rainbow illusion instead of an arched effect.

The colors we get from the rainbow are caused by the light's reflection off the water droplets. "When sunlight hits a droplet, some of the light is reflected. The suns electromagnetic radiation spectrum is made up of many different wavelengths, and each is reflected at a different angle. Thus, the radiation is separated into different colored lights, producing a rainbow" (Edwin). In your experiment, the sun's rays reflect off the mirror and then refract once more as they exit the mirror, casting a rainbow image on the wall. The colors appear muted as opposed to the colors of an actual rainbow. Why is this? The rain droplets magnify the light and spread out the electromagnetic radiation causing the light to appear softer. The mirror condenses the radiation causing the light and its colors to appear more vibrate.

STEM Highlight of the Week:

GEMS Program Article

On February 8th, 2023, DEVCOM headquarters published an article featuring a former participate of our GEMS program. Meilina Amaral, a current systems engineer participated in three of the GEMS programs here on Aberdeen Proving Ground. In the article titled "DEVCOM Engineer Credits GEMS Program for Current Role" by Argie Sarantinos, Amaral went on to thank the GEMs program facilitators by saying it opened a whole new world of STEM for her.

"GEMS exposed me to a lot of interesting topics that I would not have had the chance to explore as a regular high school student."

GEMS is a summer program that provides an opportunity for middle and high school students to engage in multi-disciplinary, age-appropriate hands-on activities which are led by Army scientists, engineers, and soldiers.

"I highly recommend the GEMS program to students who are unsure about what they want to do in the future," stated Amaral. "The Army is truly a great resource and provides a lot of support to its communities."

For the full article, please visit the link below.
https://secure-web.cisco.com/1imgAUcqsjLO6-KxuQAcJGjE0cm-kocdxaPX8selXn_WxCMv6lMZOJRolADrxLtP6hOemTLm9793ZrzoRAfihGCFT1qkC8U8LvOet3ntIcg_yTy3tulnBCF9TixyHXL9YKtPOt5nNY-ABcdXuqRtoxNV6A8Vz_Sc60UDdrPemgncQs_u5JpPoeT1I_VKeyGwBE1-aUVycz2WIaDUMUGGr1mNXBBEpFfKQSgyfLvU4ruXRxlfQfjW7adsRtlCh8-5wz431YR8E9vGzTQn49EJnFvNe33Vrwb-dkS51lGONf3tF8cySGXxfxPaVsbcn2XNjP4BbTFqAWB0z5h8rvZYtFkZODRHaUoeMcvemKFIyav1k/https%3A%2F%2Fwww.army.mil%2Farticle%2F263824

For more information about the GEMS program, please visit: https://www.usaeop.com/program/gems/

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

THE NEXT GENERATION OF INNOVATORS

Math Moment Answer: First, we need to get the fractions to all have the same denominator (bottom number). The smallest number that both 6 and 12 can divide into is 12 (lowest common denominator). So, we need to make sure both fractions have a denominator of 12. If we multiply both the numerator and denominator of 1/6 by 2, we get 2/12. Now, we have 5/12 are four-leaf clovers, 2/12 are miniature rainbows, and the "rest" are pieces of gold. Of all 12 parts, we have decided 7 of them already, so we have 5 leftover parts, or 5/12 of the pot left. Next, we divide 300 into 12 parts and get 25. If 1/12 of 300 is 25, then 5/12 of 300 is 125. Lt. Leprechaun has 125 pieces of gold!