



# 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.



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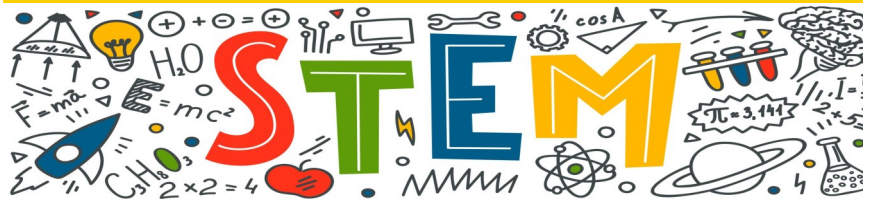
Issue 18

**Math Challenge:** Solve the pattern puzzle below. Every number 1 through 9 must be used once (and only once). 3,5,7 & 8 have already been used.

	+	8	+		=	18
+		x		+		
3	+		x		=	27
x		+		x		
5	+		+	7	=	14
=		=		=		
24		50		29		

*\*Hint... don't forget order of operation (PEMDAS)*

Solution on Page 3



### 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. Jeremy Zwirn


**Name:**

Jeremy Zwirn

**Job Title:**

Electronics Engineer

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

**Army Engineer:**  
17 Years

**Education:**

Bachelor of Science Degree in  
Computer Science from  
Rutgers University, N.J.

Master of Science Degree in  
Telecommunications  
Management from Stevens  
Institute of Technology, N.J.

**How does your job support the U.S. Soldier?** My team and I develop, test, and integrate technologies designed to ensure uninterrupted communications across satellite constellations.

**What is a typical day like for you?** Being part of such a cutting-edge organization really prevents any day or week from being typical. Some days may be spent working on contracts to ensure industry is correctly designing the technology the Army needs. Other days are spent in the lab, running tests and integrating new technologies. There are also times when my team and I will travel to different sites in the United States and worldwide to work alongside the brave men and women in all branches of the military to get our technology into the field and give our warfighters the greatest advantages possible.

**What drew you to the STEM field originally?** I've always been fascinated with engineering and technology since a young age, taking things apart and putting them back together to figure out how they work. I found computer programming – to include software, database design, and network engineering – to be an art form. This extended into telecommunications and learning how to manipulate radio waves and energy to transport data anytime and anywhere.

**Why is STEM important to our national security and our national future?** The world has come a long way since the times of ancient battles we see on the History Channel. More and more conflicts are being won by the military with the best intelligence capabilities. A great example of this was the Allied Forces breaking the German codes during World War II. There is also a safety aspect – the more drones and autonomous vehicles that can be used on the battlefield, the less cost in human life.

**How should students further their interests in a STEM field?** There are so many resources available for students at all levels to engage in STEM, from electronics and programming kits available in stores and online to virtual STEM sessions available to stream live at home. The most important aspect to realize is that STEM is not “one size fits all.” There are many different branches and paths in this field – some which overlap and some which are on opposite ends of the spectrum.

**What is the most important STEM-related innovation you've witnessed in your career?** I would say the integration of computers with our everyday lives through the Internet. Due to COVID-19, many people are staying home more, and yet, we can still do so many things that would not have been possible years ago, such as performing our duties out of the office, going shopping, or ordering food online. Growing up, the only virtual face-to-face meetings seemed to occur on *The Jetsons*; now, this is something we not only do every day, but it far exceeds what we thought possible in science fiction. Even the research and development of a coronavirus vaccine in such a short amount of time would not have been possible without today's technology integrated into the pharmaceutical industry to speed the process up considerably.

**What is your favorite technology for personal use?** My smartphone and watch. I use them for everything from phone calls, e-mail, and looking up information to paying at stores and riding the subway. Everything is digital and secure.

**What is the next great technological frontier?** Just as the internet has enabled virtual travel to anywhere in the world, I think the transportation industry will be the next frontier, with faster trains and planes, and possibly even space travel. The world will become much more connected, and people will find it easier to travel to destinations they once thought out of reach.

**Why is it important for engineers and scientists to engage with STEM Outreach?** STEM is a continuous process, with each new block built on previous discoveries. Without future engineers and scientists, the progress would cease and possibly regress as ideas are lost. Engaging with Outreach gives the next generation an idea of all the amazing fields to work in and all the discoveries still to come.

# STEM Challenge



## MATERIALS:

- Popsicle sticks
- Skinny wooden dowel or meter stick
- Paper towel roll tubes
- Pipe cleaners
- Straws
- Tape
- Glue
- Plastic spoons
- Aluminum foil
- Styrofoam balls or rectangles
- Card stock or cardboard
- Small boxes
- Egg cartons
- String
- Other useful items in your home
- Markers, crayons, sequins, streamers, and glitter for decorating

## New Year's Countdown

On every New Year's Eve since 1907, a giant ball in Times Square, New York City, is dropped during the last 10 seconds of the year. Since then, other states and cities have adopted the tradition and designed their own ball drop. Some examples include a giant potato drop in Boise, Idaho; a pinecone drop in Flagstaff, Arizona; an orange drop in Miami, Florida; a peach drop in Atlanta, Georgia; and even a duck drop in Havre de Grace, Maryland.

**Mission:** The mayor of Sunnyville has contacted your engineering company for help. The ball drop they had in the town center broke as they were celebrating the New Year for 2020. The mayor wants to be better prepared to bring in the New Year for 2021 and has requested your company to design a creative countdown device. The mayor is open to any and all possibilities for what the countdown device could look like.

**Requirements:** Your countdown device must take as close to 10 seconds as possible to drop.

### Design Process:

**ASK:** What is the problem you need to solve? Design a countdown device for the mayor of Sunnyville that will drop in 10 seconds.

**IMAGINE:** Brainstorm and decide on one idea. How will your design move down the pole?

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

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

**IMPROVE:** How can you improve your countdown device?

### Questions to ask:

- If you had more choices of materials, what would you use and why?
- Do you need to slow down your structure or speed it up?

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



## The C5ISR Center Community Outreach Office Invites you to GET YOUR STEM ON...

The C5ISR Center Community Outreach Program is dedicated to providing quality STEM programs to students K-12. For more information about our STEM Outreach Programs, visit us on the web:

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

**\*Due to COVID-19, programs are currently virtual.**

9	+	8	+	1	=	18
+		x		+		
3	+	6	x	4	=	27
x		+		x		
5	+	2	+	7	=	14
=		=		=		
24		50		29		

**Solution to Page 1:** Did you use the correct order of operations... multiplication before addition.... So  $3 \times 5 = 15 \dots 15 + 9 = 24$



## STEM IN THE NEWS

### VOCABULARY:

**Density:** how much space an object or substance takes up (its volume) in relation to the amount of matter in that object or substance (its mass).

**Specific heat:** A property that states the amount of heat required for a single unit of mass of a substance to be raised by one degree of temperature.

**Viscosity:** A measure of a fluid's resistance to flow.

**Compressibility:** The ability of something (such as a fluid) to be reduced in volume or size under pressure.

## Two Different Liquid States of Water

An international team of scientists has discovered that water can exist in two different liquid states. The study was a collaborative effort between researchers from Stockholm University in Sweden, Pohang University of Science and Technology and the Pohang Accelerator Laboratory in Korea, the SLAC National Accelerator Laboratory in California, Brooklyn College in New York, and St. Francis Xavier University in Canada. The study, led by Stockholm University professor of chemical physics Anders Nilsson, proves that when water is at the extremely cold temperature of -63 degrees Celsius, it exists in two completely different liquid states. This is because the properties of water react differently than other liquids.

Water is one of the main building blocks of life and is necessary for life here on Earth. Water also has properties like density, specific heat, viscosity, and compressibility that respond to changes in pressure and temperature differently than other liquids. Using an X-ray laser and by rapidly changing the pressure before the water could freeze, the team was able to observe and prove that a low-density liquid and a high-density liquid can exist simultaneously. The research highlights that under these specific conditions, the water in both forms have different properties and differ in density by 20 percent.

The possibility that water could exist in two different liquid states was first considered and proposed more than 30 years ago. Unfortunately, experiments could only be conducted using computer simulations, which provided contradictory and inconclusive results. This time, the team was aided by the speed of an X-ray, which allowed the team to conduct their measurements before the water changed forms and turned to ice.

The topic of water and the origins of its strange properties have been researched, and even debated, long before Nilsson and his team begin their study. Now, Nilsson says researchers studying the physics and chemistry of water can all settle on the fact that water can exist as two liquids in this "supercooled" state. The next challenge, according to the team, is to look further into the point at which the two liquids become one.

### Sources:

[www.sciencedaily.com/releases/2020/11/201119141756.htm](http://www.sciencedaily.com/releases/2020/11/201119141756.htm)

[www.brooklyn.cuny.edu/web/news/bcnews/bcnews\\_201120.php#:~:text=However%2C%20the%20paper%20shows%20that,by%2020%20percent%20in%20density](http://www.brooklyn.cuny.edu/web/news/bcnews/bcnews_201120.php#:~:text=However%2C%20the%20paper%20shows%20that,by%2020%20percent%20in%20density)

<https://science.sciencemag.org/content/370/6519/978.full>

<https://interestingengineering.com/water-has-two-different-liquid-states-study-finds>



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



### Fireworks in a Jar

One way people like to celebrate the new year is with fireworks. With just a few simple ingredients from your kitchen, you can create your own safe, homemade fireworks in a jar. (Plus, with these Fireworks, there are no loud noises!)

#### Materials:

- Jar or tall clear glass
- Food coloring (3 or 4 colors)
- 3 to 4 tablespoons of cooking oil
- Small bowl
- Warm water
- Spoon

#### Directions:

1. Fill your jar or clear glass about  $\frac{3}{4}$  full of warm water.
2. In your small bowl, add 3 to 4 tablespoons of cooking oil along with several drops of food coloring. You will want to add about 4 drops of each color that you are using.
3. Use a spoon to stir the food coloring into the oil. They will not mix, but stirring will help break the food coloring drops into smaller droplets.
4. Carefully pour the food coloring and oil mixture into the jar or glass of water.
5. See what happens. After a few moments, the oil will settle at the top of the jar, while the food coloring will begin to fall down and mix in the water, which will create a “fireworks” effect. The food coloring will continue to fall into the water until all of the droplets have left the oil.



#### SAFETY NOTICE

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

#### The Science Explained:

This simple, but fun, experiment shows the science of liquid densities as it combines a bit of physics and chemistry. Liquids have different densities because of their molecular structure, and water and oil have different amounts of molecules. Water is heavier than oil, so it will sink to the bottom while the oil will float on the top.

As you saw in the experiment, food coloring dissolves in water but not in oil. That is why the food coloring and the oil remained separated in your jar or glass. As you poured the mixture of oil and food coloring into the glass of water, the food coloring drops began to sink because they are heavier than the oil. When the drops hit the water, they began to dissolve, which created the fireworks in your glass. The reason you add the food coloring to the oil is because it slowed down the water and food coloring mixing.

Source: [www.growingajeweledrose.com/2019/02/fireworks-in-jar.html](http://www.growingajeweledrose.com/2019/02/fireworks-in-jar.html)

**Did you know?** Fireworks generate three forms of energy: sound, light, and heat. The booming sound you hear after an explosion is the result of a quick release of energy. This causes the air to expand faster than the speed of sound, causing a shockwave.

