April 2021

Virtual STEM Fun

The following pages include several STEM activities that you can do with your child.
Choose the appropriate grade level for your child and have fun!

(Note: Your child may be interested in an activity that is a different grade level from the one assigned. As a family, you may want to do several activities!)

STEM-based education teaches children more than science and mathematics concepts. The focus on hands-on learning with real-world applications helps develop a variety of skill-sets, including creativity and 21st century skills. Regardless of the future career path considered by these children, these skill-sets go a long way to preparing them to be innovative. This will provide an opportunity to take traditional learning and pivot it to

prioritize the hands-on experience and real-world application necessary for developing an innovative mind.

*Designed for K-1st grade, but fun for all ages!

Sprout House

Spring is just around the corner and it is a great time start planting seeds. This little DIY sprout house made from sponges will have your kids giddy with excitement! Combining engineering and science into one awesome project is a motivating way to learn about germination. It definitely brings a whole new meaning to the word "greenhouse"!

Getting Ready

To make the sprout house, gather your supplies. For each house, you need:

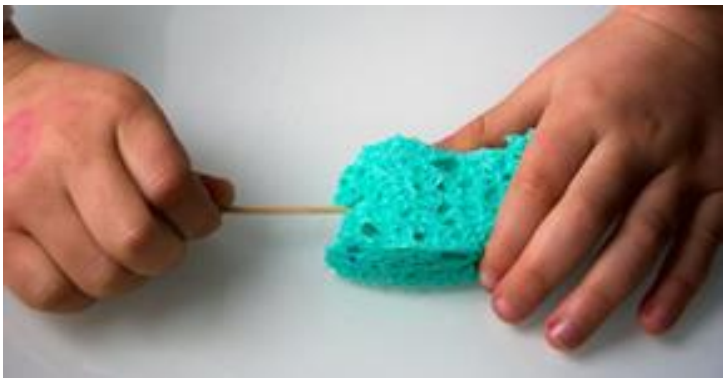
- 4 plain sponges
- Scissors
- Toothpicks
- Hot glue gun (optional, but makes construction easier)
- Plate
- Seeds (suggestions: wheat berries, chia, and alfalfa seeds sprout quickly)

Building the Sprout House

First, let your child select their base. (Choosing green is great, because it looks like grass.) Then, cut a second sponge in half to form 2 walls.

To make the other walls, cut the third sponge in half. Then, cut just one of those halves in half again.

For the roof, cut the last sponge in half. Then, you are ready to put them all together! To hold up the walls, insert two toothpicks in the bottom and sides of each wall with about 1/2 inch of toothpick sticking out.



Your child may need a little help pushing the toothpicks in – especially when connecting two walls. If your walls still seem a little wobbly, you can use a little hot glue to hold them together.

For the roof, use toothpicks as connectors again, but it may be pretty tricky to secure the roof to the walls and to each other. You may want to use the hot glue gun to hold on the roof.

Once the house is built, it is time to cover it with seeds. (Wheat berries are great for the bottom, because it grows wheat grass.)

For the roof, it is great to mix chia and alfalfa seeds. Put about a tablespoon of seeds in a little dish and mix in a little water to make a seed slurry. The chia

seeds absorb a lot of water and become kind of gummy. Therefore, it actually helps make spreading the seeds on the roof a whole lot easier.

Once the seeds are "planted", place the sprout house in a windowsill, so it can receive sunlight. All there is left to do is water and wait. Pour water in the plate and allow the sponge to absorb the water to moisten the wheat berries. For the roof, have your child carefully spray the seeds several times a day with a misting spray bottle. May sure the sponges stay moist. Within two days, the wheat berries should begin to sprout tiny roots.

And a week later, your sprout house may look like it needs mowing. Your child will love checking on his/her house throughout the day and watching to see when and

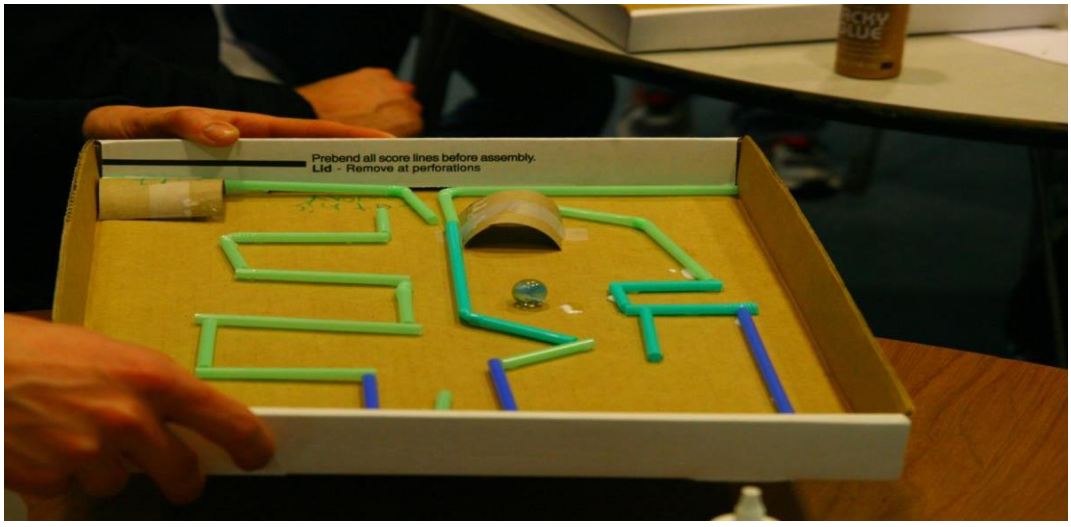
how quickly the different seeds grow. Make sure your child observes carefully to find all the little roots that will travel over the bumpy sponge to find a little nook to get a hold in. You will be able to see that the seeds in the cracks of the roof, where moisture pooled, grew the best.

The Science of Seeds

Seeds, even the tiniest ones, contain the food and all the things necessary to sprout a new plant. All they need are the right conditions: the right temperature, consistent moisture, and a good location. At first, the plant depends on the energy stored within the seed to grow. As the seed soaks up water, its food stored inside begins to be converted into energy in the form of enzymes. The enzymes trigger the seed to send out roots and germinate. First the roots break out of the hard protective outer layer of the seed called the seed coat. They grow downwards and begin to anchor the plant and absorb water and nutrients. Next, the seed begins to grow a stem, a process called germination. Once germination takes place, the plant grows, eventually making its own food from nutrients it takes in from the soil and through photosynthesis with the sunlight.

*Designed for 2nd grade

Marble Maze



Creating a maze for marbles will help children develop spatial relationships, planning skills, and problem solving skills as they work through design challenges. Glue dots work better than tape, as glue dots allow the straws to lay flat on the cardboard without interference from tape edges. If using tape, make sure tape is completely fastened to the box lid so it doesn't stop the marble in its tracks!

Materials

- Shoebox lid or file box lid
- Drinking straws
- Paper
- Tape or glue dots
- Scissors
- Marbles

Instructions

1. Supply your child with scissors, the box lid, drinking straws, and tape (or glue dots).
2. Instruct the child to create a maze using the straws.
3. Encourage him/her to use creativity to add tunnels, ramps, and other features.

Have children swap marble mazes and try to solve their neighbor's mazes!

*Designed for 3rd grade

Lava Lamps!

Materials

- Alka-Seltzer Tablets

- Water Bottle
- Vegetable Oil
- Food Coloring

Instructions

1. Remove labels from the water bottle.
2. Empty ½ of the water bottle. Pour vegetable oil into the bottle.
3. Add a few drops of food coloring and allow the food coloring to fall into the water layer and disperse.
4. When ready to activate the lava lamp, add an Alka-Seltzer tablet. Watch the "lava lamp" action!

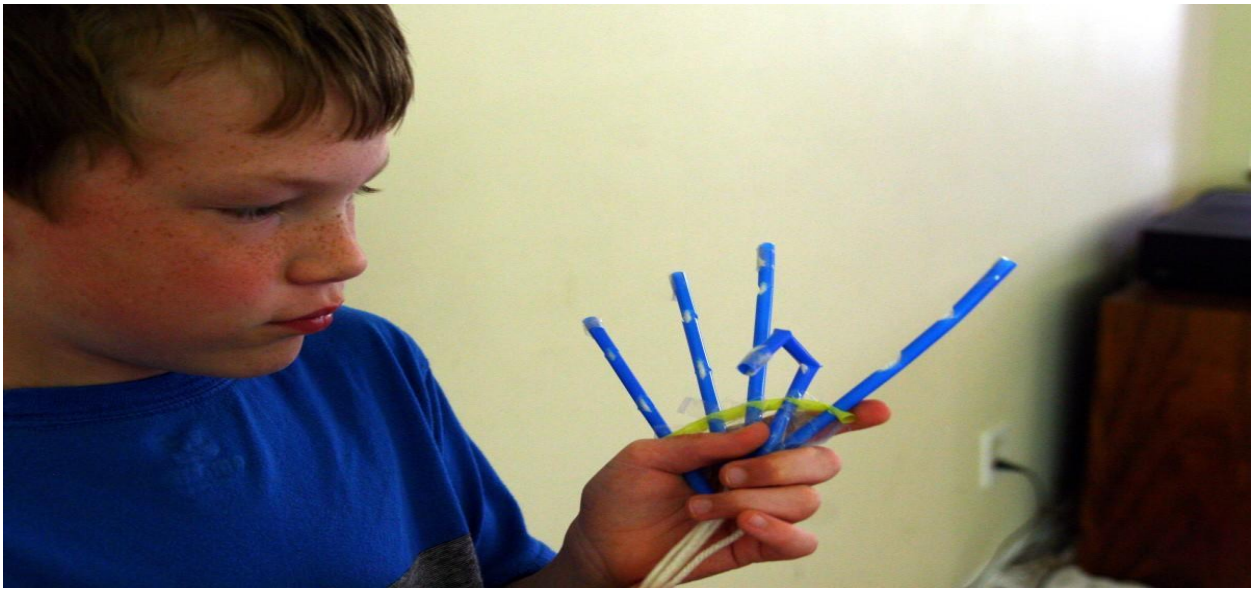
Density, solubility, and chemical reactions are discovered with this activity.

The Science of the Lava Lamp

A carbon-dioxide powered lava lamp is a low-cost, safe activity for third graders. Oil and water are added to a container, along with food coloring. The food coloring will not dissolve in the oil layer, but it will dissolve in the water layer. When an Alka-Seltzer tablet is added, the carbon dioxide bubbles created by the tablet will carry droplets of colored water into the oil layer. When the bubbles reach the surface, the colorful water droplet is released and will sink back to the bottom of the bottle.

*Designed for 3rd grade

Robotic Hands



Understanding how tendons work to control finger movements and the use of robotics to create prosthetic limbs helps to inspire students to consider the real-

world benefits of using science to benefit humanity. While this project does not create a true robot (there are no motorized parts), the use of strings and straws creates a very clever "robotic" hand that is actually able to grasp light materials. Use crumpled paper towels and have your child perform a relay race using his/her robotic hands to pick up the paper and place it in a basket.

Materials

- 5 plastic drinking straws
- Scissors
- String
- Tape
- Cardstock or cardboard

Instructions

1. Cut small divots ½" from the end of each drinking straw. Do not cut all the way through the straw. This step may be performed by an adult prior to the activity.
2. Cut small divots 1" below the first set of divots. These cuts will create the "knuckles" for the robotic hand. This step may be performed by an adult prior to the activity.
3. Tape the bottom of the drinking straws to cardboard or cardstock to form and brace the straw fingers.
4. Thread yarn or string through each "finger," taping the string to the top of the straw.
5. Pull on the strings to move the fingers of the robotic hand!

*Designed for 4th-5th grades

Ice Cream in a Bag

Materials

- Measuring spoons
- Measuring cup
- Sugar
- Half-and-half. Alternatively, milk or heavy whipping cream may be used.
- Vanilla extract
- Salt. Different types of salts, such as table salt or rock salt, will all work, but may give slightly different results.
- Ice cubes (8 C)
- Small, sealable bags, such as pint-sized or sandwich-sized Ziplocs (2)
- Gallon-sized sealable bags (2)
- Oven mitts or a small towel
- Timer or clock

Instructions

1. In each small sealable bag, place one tablespoon of sugar, ½ cup of half-and-half (or milk or heavy whipping cream), and ¼ teaspoon of vanilla extract. Seal both bags well.

2. Add four cups of ice cubes to one of the large, gallon-sized bags. Then add ½ cup of salt to the bag.

What do you think the salt will do?

3. Put one of the small bags you prepared into the large bag with the ice cubes. Be sure both bags are sealed shut.

4. Put on oven mitts or wrap the bag in a small towel and then shake the bag for five minutes. Feel the smaller bag every couple of minutes while you shake it, and take a peek at it.

   What happens to the ingredients over time? When five minutes are up, how do the ingredients look? What about the ice cubes — how do they change over time, and how do they look by the end?

5. Now add four cups of ice cubes to the other large, gallon-sized bag, but this time, do not add any salt to it.

   What do you think will happen without using salt?

6. Put the other small bag you prepared into this large bag. Be sure both bags are sealed.

7. Put on oven mitts or wrap the bag in a small towel and then shake the bag for five minutes, as you did before. Again, feel the smaller bag every couple of minutes while you shake it, and take a peek at it.

   What happens to the ingredients over time now? When five minutes are up, how do they look now compared to last time? What about the ice cubes — did they change in the same way?

8. You can also compare how cold the different ice cube bags feel. Does one feel much colder than the other?

9. If you successfully made some ice cream, you can enjoy it now as a tasty reward for your chemistry challenge!

The Science of Ice Cream

You should have seen that the ice cubes in the large bag with salt melted much more, and felt much colder, than the ice cubes in the large bag without salt. Because it was cold enough (several degrees below freezing), the ice cube bag with salt should have been able to cool the ingredients enough to harden them and turn them into ice cream. In contrast, the ice cube bag without salt was not cold enough to do this, and the ingredients should have remained fluid.

Do not worry, the second bag is not wasted — you can go back and turn the still liquid ingredients into ice cream! Simply put the small bag in the large bag that had ice cubes and salt and shake them for another five minutes.

If you have ever made ice cream with an old-fashioned hand-crank machine, you probably packed a mixture of ice and rock salt around the container holding the cream. The salt allows the ice and salt mixture to get colder than pure water ice. This extra-cold mixture of salt and ice is able to freeze the ingredients in the ice cream machine (and in the bags you used in this activity) and turn them into ice cream. (This is the same process that goes on when icy roads have salt spread on them to melt the ice.) While pure water freezes at 0 degrees Celsius (32 degrees Fahrenheit), water mixed with salt will freeze below 0 degrees Celsius.

Digging Deeper

To understand how the salt causes the ice to melt and lowers the overall temperature in the bag, you need to learn a little more about ice. Ice is the crystallized form of water. In order for the crystals to form, the water molecules have to slow down and carefully line up in an orderly pattern. The warmer the

surrounding temperature, the more the molecules bounce around, and the harder it is to get them to line up. Basically, they act like excited kids! As it gets colder, the molecules slow down; their slower movements allow them to line up more carefully and thus form ice crystals. Even after ice is formed, two things are constantly happening at the surface of the ice. One, the ice at the surface is melting. Two, the melted water is re-freezing. The rate at which these two things happen determines what you see.

In the case of the two ice cream bags, one with salt and ice and one with just ice, you have the same outside temperature, so the molecules are moving around at the same rate. The difference is the salt. As the ice cubes start to melt a little bit, the water molecules mix with the salt molecules. Now that you have salt and water molecules moving around together, the mixture makes it harder for the water molecules to make an orderly pattern — the salt molecules keep interfering. This means that the rate of the ice re-freezing at the surface goes down. So, overall the ice cubes start melting faster. As they melt, the ice cubes release more cold, making the temperature inside the bag with ice and salt colder than the temperature inside the bag with just the ice. In fact, because the salt molecules make the freezing process of water more difficult, it is possible for a mixture of salt and ice water to get below 0 degrees Celsius (the temperature water normally freezes at). In technical terms, the salt causes a freezing point depression. This means it makes the temperature at which water freezes lower than it is for pure water. Freezing point depression is not unique to mixtures made of water and salt; it can also happen with some other liquid mixtures.

Dig Even Deeper?

- If one of your bags did not make ice cream, try putting it back in the large bag that had ice cubes and salt and then shake them for five minutes. Did it turn into ice cream? Why do you think you got the results that you did?
- Instead of half-and-half, you could use milk or heavy whipping cream to make ice cream in this activity. How does making ice cream with half-and-half compare to making it using milk or heavy whipping cream?
- You can make ice cream in this activity using different types of salts, but you may get different results. How does ice cream made in a bag with table salt compare to ice cream made with rock salt or some other type of salt? Can you explain your results?