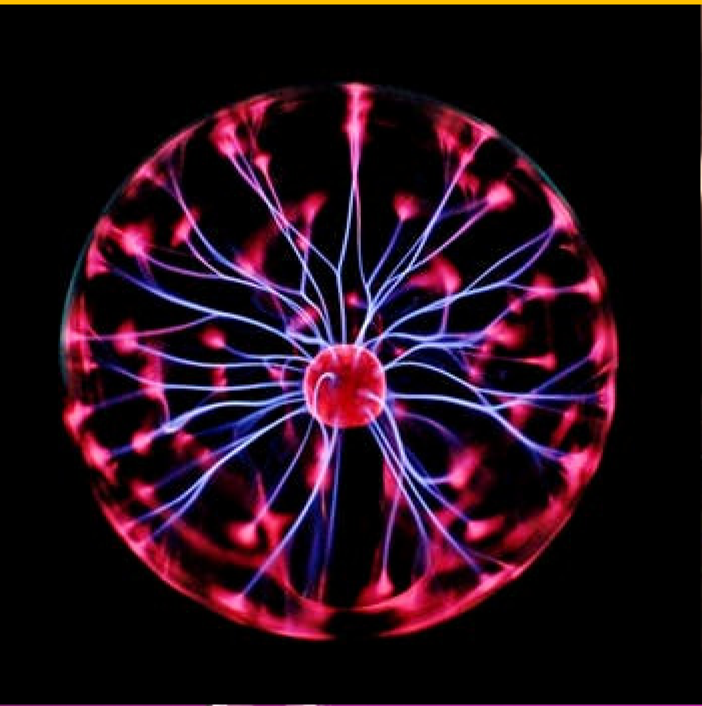
Kids 'R' Kids Mini Camp



Young Scientist Club

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Introduction

Welcome to Young Scientist Camp! Do you enjoy learning about different elements in science? Does the idea of having a new science experiments to try daily sound fun? Science is all around you! This camp is designed with both junior and senior campers in mind! If you want to explore the world of science around you, this camp is for you! Get ready for some serious fun!

Week 1	Theme	**Mad Scientist** - Campers will experiment with surface tension, chemical reactions, capillary action, density, and atoms	▪ Magic Milk ▪ Fizzing Frozen Stars/Cubes ▪ Seven Layer Column ▪ Water Walking Rainbow ▪ Growing Crystals
Week 2	Theme	**Chemical Reactions** – Campers will experiment with chemiluminescense, exothermic reaction, emulsion, Polymer chains, immiscible liquids, and the nucleation process	▪ Glowing Firefly Jars ▪ Elephant Toothpaste ▪ Oil and Water! ▪ Geyser in a Bottle ▪ Leak Proof Bag!
Week 3	Theme	**Weather Science -** Campers will experiment with heat & expansion, creating a vortex, vapor process, saturation & capacity, melting point, solar energy, and condensation	▪ Sun Thermometer ▪ Tornado in a Bottle! ▪ Cloud in a Jar ▪ Rain Clouds ▪ Frost in a Can
Week 4	Theme	**Energy Science -** Campers will experiment with magnetic energy, kinetic & potential energy, static electricity, positive & negative energy flow, and physics	▪ Popsicle Stick Chain Reaction ▪ Magnetic Slime ▪ Fruit Power Battery ▪ Rollback Can Experiment ▪ Gravity Defying Snake
Week 5	Theme	**Inventions -** Campers will experiment with engineering, physics, elastic energy, kinetic energy, chemical reactions, and potential energy	▪ Build a Catapult ▪ Drag Racing Cup ▪ Mousetrap Racer (8+) ▪ Non-Electric Lava Lamp! ▪ Tennis Ball Tower Challenge!
Week 6	Theme	**Just cool experiments!** Campers will experiment with solar energy, chemical reactions, geology, centrifugal force, surface tension, and pressure.	▪ CO2 Sandwich ▪ Rainbow Bubble Snakes ▪ Rock & Mineral Investigation ▪ Solar Oven S'mores ▪ Straw Sprinkler

Hello Teachers!

Welcome to Young Scientist Club! Here are six full weeks of activities for campers between the ages of 5-12! The goal is to expose the children to many different types of science. You can modify and assist the activities based on the age of the campers. You are able to choose the week you like and have the option to do one activity daily five days a week or do multiple activities two to three times a week. It's up to you! Each camper will keep a journal of their experiments and document what they are doing. Take pictures of them doing their experiments. This will be part of their Young Scientist Award at the end of the camp.

Each week is broken down by theme. At the completion of each week, each camper will receive a certificate of recognition for completing that scientific theme. At the end of the camp, the camper will receive a "Young Scientist Award" for completion of the entire program and a photo book that features their experiments.

In the activities, both the common name and the scientific name of the liquids and solids were used as well as the scientific name for the experiment alongside the common name. This will help boost vocabulary and teach the campers that science is all around them. You can make regular table salt sound very scientific when you call it sodium chloride or when you say vinegar is acetic acid! Get ready to expand your camper's minds, stretch their brains, create new synapses, and have fun trying each of these experiments. The materials list for each week is in the back of each week's packet. Weekly awards and a final Young Scientist Award are included. If you would like to make any additional awards, go to the following link to create additional science awards. https://www.123certificates.com/makeit/science-certificate-maker.php?cert=science24

Before each experiment, talk with the campers about:

1) What their hypothesis is?
2) What is their scientific process?
3) What kind of science is being used?
4) What was the result?

For your campers

Each camper will start off with a science bag of essentials that are needed for most of the experiments. These items can be purchased at the dollar store and the bags will be left at school. This also makes the campers feel "official."

Science camper bags should consist of and include:

1. A drawstring lightweight bag
2. Safety glasses
3. Gloves
4. Magnifying glass (plastic)
5. Composition book that will serve as their science journal - Let the campers design the cover of their science journal.
6. A welcome letter from their teacher welcoming them to a fantastic journey through the world of science!
7. A folder with a pocket for the campers to keep their weekly certificates.

Have a fantastic summer!

Week 1 - The Mad Scientist

Activities

- **Magic Milk/Surface Tension**
- **Fizzing Frozen Stars or Bars/Stealing Atoms**
- **Seven Layer Column/Density**
- **Water Walking Rainbow/Capillary Action**
- **Growing Crystals/Chemical Reaction**

Week 1 Materials List

- 6 half sheet paper towels
- 7 clear glass or plastic cups per team
- Baking soda
- Black Construction paper
- Dish soap - used for multiple experiments
- Eye dropper
- Food Coloring - used for multiple experiments
- Full fat milk
- Glass cylinder about 10-12" high
- Honey
- Lamp oil
- Light corn syrup
- Cotton swab
- Rubbing alcohol
- Scissors
- Shallow bowl/pie plate – used for multiple experiments
- Turkey baster
- Vegetable oil
- Vinegar
- Water - used for multiple experiments
- Epsom salt
- Black construction paper

Magic Milk - Surface Tension

The Magic Milk experiment involves learning about surface tension! While it looks fun and cool, there is a lot of science behind what makes it work! What is surface tension? Surface tension is a contractive force that allows the surface of a material to resist an external force. Sounds very scientific! In other words, it's what allows some materials (solid, gel, or liquid) to float or "walk" and some materials to mix and some materials to sink. Let's look at the materials we will be using:

Milk – Milk has a high surface tension and is full of fat. Have you ever seen a bug run or walk across water without sinking? That's because of surface tension!

Food Coloring – When food coloring is added to the milk, depending on the brand, it will either float or sink, but it will never mix with the milk.

This is because milk has a high surface tension and properties that will not allow it to be changed. Therefore, the food coloring will not mix in. The food coloring will just sit on top of the milk.

Dish Soap – Soap is rather complex in this experiment! It does two different things at the same time! Dish soap is a degreaser, and when the dish soap is added, it reduces the surface tension of the milk AND causes a chemical reaction. This reaction allows the food coloring to mix with the milk, and as the fat molecules are pulled towards the soap (degreaser), the milk appears to dance.

Materials: full fat milk, food coloring, dish soap, a cotton swab, shallow bowl

Directions

1) Pour ½" of milk into the bottom of a shallow bowl.

2) Add drops of food coloring around the milk (3-4 drops).

3) Dip the cotton swab into dish soap.

4) Touch the cotton swab to the food coloring and watch what happens.

Fizzing Frozen Stars/Cubes - Stealing Atoms

The fizzing frozen stars/cubes experiment is an introduction into chemical reactions. This activity is appropriate for 3+ (with supervision) and is just as enjoyable at 12+. In scientific terms, we are talking about using an acid (acetic acid aka vinegar) and a base (sodium bicarbonate aka baking soda) to cause a chemical reaction when the baking soda steals an atom from the vinegar. When the vinegar reacts with the baking soda, it creates a gas causing the chemical reaction that liquefies the frozen baking soda. Let's talk about the materials we will be using:

Baking soda – The scientific name is sodium bicarbonate, and it is a base.

Vinegar – The scientific name is acetic acid, and naturally, it is an acid.

Food coloring – Used in water to just add color.

Materials:

star ice cube tray or cube tray, 1 cup water, food coloring, ½ cup baking soda, bowl of vinegar, eye dropper, tray

Directions

1. Add food coloring to one cup of water.
2. Add water to ½ cup of baking soda.
3. Add mixture to the ice cube trays and freeze 4-6 hours or overnight.
4. Pour vinegar into a bowl.
5. Place frozen stars or cubes on a tray with sides and let it sit out for 10 minutes.
6. Use an eye dropper to get vinegar and drop some drops on the baking soda.
7. Watch what happens!

Seven Layer Column - Density

Every liquid has a weight that is known as density. This is what makes some liquids sink fast, some liquids sink slowly, and some liquids float (buoyancy). This is an experiment that tests the density of each household item. Watch this Steve Spangler video before doing the experiment. https://youtu.be/fE2KQzLUVA4 and follow the instructions at https://www.stevespanglerscience.com/lab/experiments/seven-layer-density-column/

Materials	Density of liquid
7 plastic cups	N/A
Turkey baster	N/A
Honey	1.42
Light Corn Syrup	1.33
Dish Soap	1.06
Water	1.00
Vegetable Oil	.92
Rubbing Alcohol	.79
Lamp Oil	.81

1. Put out seven plastic cups and place equal amounts of liquid in each one (about ¼ cup).
2. You will layer each liquid in order of the heaviest density to the lightest density.
3. Add green dye to the alcohol and red dye to the light corn syrup.
4. Pour the honey in the middle, not allowing it to touch the sides. Honey is the densest and heaviest liquid you are using.
5. Repeat with the corn syrup in the middle.
6. Repeat with the dish soap in the middle. Go very slowly.
7. Get your turkey baster and draw up the water. Put the baster in the glass along the inside wall and let the water slowly trickle down the side of the glass. Take your time.
8. Next, add the vegetable oil, allow it to trickle slowly down the glass. Rinse baster.
9. Add the red colored rubbing alcohol slowly along the inside of the glass. Rinse baster.
10. Lastly, add the lamp oil slowly, along the inside of glass.
11. You now have a tower of seven liquids stacked on top of each other!

Worth noting: You will notice that the rubbing alcohol has a lower density than the lamp oil, but in this experiment, it's the top layer and still floats! It's all about density!

Water Walking Rainbow - Capillary Action

Materials

- 7 clear plastic or glass cups
- Red, blue, and yellow food coloring
- 7 half sheet paper towels, folded in half lengthwise, folded in half again, and then creased in half like a V.

Instructions

1. You can set this up in a straight line with cups touching or in a circle.
2. Fill the 1st, 3rd, 5th, and 7th cup to about 1/2" below the top.
3. Add 15 drops of red food dye in the 1st and 7th cup.
4. Add 15 drops of yellow food dye in the 3rd cup.
5. Add 15 drops of blue food coloring in the 5th cup.
6. Take the V-shaped paper towels and place it upside down over the 1st/2nd cup, 2nd/3rd cup, 3rd/4th cup, 4th/5th cup, 5th/6th cup, 6th/7th cup.
7. Check back at 20 minutes, 60 minutes, 2 hours, and then leave the cups overnight.

What makes this work?

The colored water travels up the paper towel by a process called capillary action. Capillary action is the ability of a liquid to flow upward, against gravity, in narrow spaces. This is the same thing that helps water climb from a plant's roots to the leaves in the treetops. Click on the link below to follow the step-by-step instructions and more information about the Rainbow Water Walking Activity at https://thestemlaboratory.com/walking-water-rainbow/

Paper towels, and all paper products, are made from fibers found in plants called cellulose. In this demonstration, the water flowed upwards through the tiny gaps between the cellulose fibers. The gaps in the towel acted like capillary tubes, pulling the water upwards. The water is able to defy gravity as it travels upward due to the attractive forces between the water and the cellulose fibers.

The water molecules tend to cling to the cellulose fibers in the paper towel. This is called adhesion.

The water molecules are also attracted to each other and stick close together, a process called cohesion. So as the water slowly moves up the tiny gaps in the paper towel fibers, the cohesive forces help to draw more water upwards.

At some point, the adhesive forces between the water and cellulose and the cohesive forces between the water molecules will be overcome by the gravitational forces on the weight of the water in the paper towel. When that happens, the water will not travel up the paper towel anymore. That is why it helps to shorten the length that colored water has to travel by making sure your paper towel isn't too tall and making sure you fill your colored liquid to the top of the glass.

Growing Crystals - Chemical Reaction

Appropriate for 8+

What happened?

Magnesium sulfate is a chemical that is commonly known as Epsom. When the magnesium sulfate is dissolved in the hot water then rapidly cooled, a chemical reaction takes place! The temperature of the water determines how much magnesium sulfate can stay dissolved and how much will turn into crystals when it's cooled. When the solution is placed in the refrigerator, a rapid cooling process begins. As the solution cools, the atoms in the magnesium sulfate literally run into to each other! This is what creates the spike crystals!

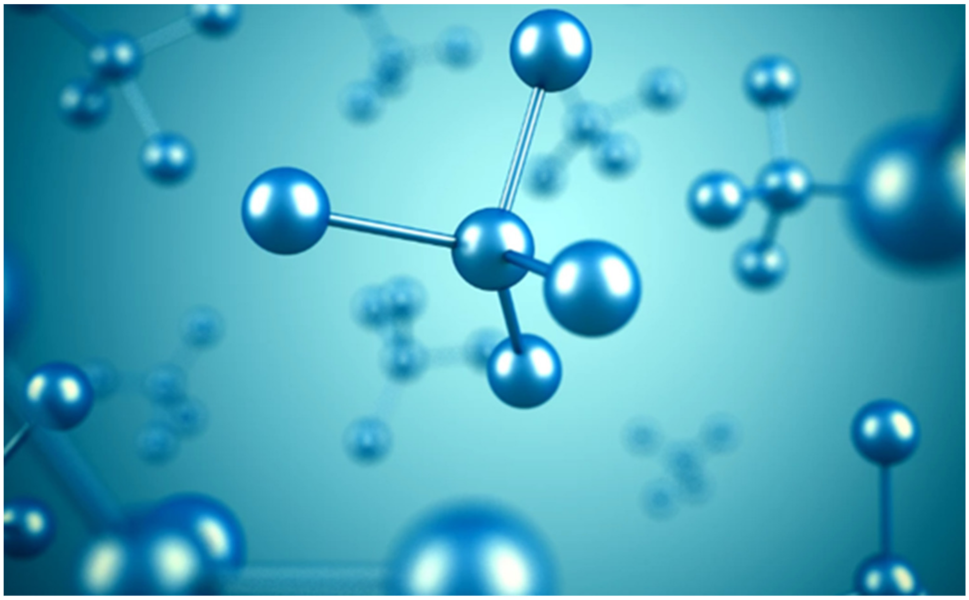
Materials

- Black construction paper
- Hot water (H2O)
- Epsom salt (Magnesium Sulfate)
- Food coloring
- Small/Medium jar
- Scissors

Instructions

1. Cut construction paper to fit into the bottom of the jar.
2. Add 12 drops of food coloring to a ½ cup of hot water.
3. Mix 1 tablespoon of Epsom (Magnesium sulfate) with a ½ cup of medium hot water (H2O) and stir until it is dissolved.
4. Put the black construction paper in the bottom of the jar.
5. Pour the salt solution over the black paper.
6. Put the jar in the refrigerator.
7. Check back on the solution at 2 hours, 4 hours, and overnight.
8. Pour off the excess solution to touch the crystals.

Week 2 - Chemical Reaction



Activities

- **Glowing Firefly Jars/Chemiluminescence**
- **Elephant Toothpaste/Exothermic Reaction**
- **Oil and Water!/Immiscible Liquids & Emulsion**
- **Geyser in a Bottle/Nucleation**
- **Leak Proof Bag!/Polymer Chains**

Week 2 Material List

- 1 cup of water
- 1 tsp table salt
- 10 pencils (per camper)
- 16-20 oz. jars with lids (1 per Camper & goes home with camper)
- 2-liter diet soda
- 4 glow sticks per camper
- 6% Hydrogen peroxide (3% will work, but it’s less effective)
- Bowl
- Dish soap
- Disposable tablecloth
- Eye dropper or syringe
- Food coloring
- Gallon zip lock bag
- Glass jars (with secure lids if you want to shake them)
- Gloves
- Mentos®
- Mesh netting ribbon or tulle
- Scissors
- Small container
- Vegetable oil
- Water
- Yeast package

Glowing Firefly (or Fairy) Jars - Chemiluminescence

Materials

- Jar with a lid
- Two 12” pieces of Mesh netting or tulle
- 4 skinny glow sticks per jar
- Scissors
- Gloves

Instructions

1. Everyone put on their gloves, teacher included.
2. Let the camper choose if they would rather use netting or tulle.
3. Let the camper choose if they are making a fairy or firefly jar.
4. Cut off a 12” piece of netting and let the camper push it into the jar.
5. Let the camper activate the glow stick.
6. Teacher: While holding the glow stick over the jar, cut off the tip. You can then allow the camper to gently shake it into the jar of tulle or netting.
7. Repeat the glow stick step with 2nd glow stick.
8. Have the camper add the 2nd piece of netting or tulle.
9. Repeat the glow stick part two more times.
10. Put the lid on the jar.
11. Have your camper shake the jar so the chemicals get all over the netting or tulle.
12. Now turn off the lights or find a dark area to show the Chemiluminescence.

What makes the jars glow?

It comes down to a simple chemical reaction called chemiluminescence! Chemiluminescence is the process of releasing energy in the form of light! Glow sticks are tubes that contain a small capsule filled with hydrogen peroxide. Floating around the capsule is tert-butyl alcohol that is colored with a fluorescent dye. When the glow stick is bent and the capsule breaks, the hydrogen peroxide and tert-butyl alcohol mix causing a chemiluminescence chemical reaction that makes light as its byproduct. This occurs because the electrons are super-charged causing the glow stick material to glow. This process is active for up to 24 hours. As the electrons cool back down to their normal level, they lose the chemiluminescence light and become dim. You can slow this process by placing them in the freezer, and it will reactivate when it comes back to room temperature!

Elephant Toothpaste - Exothermic Reaction

Materials

- Empty plastic soda or water bottle (about 16 oz.) or a tall cylinder
- 1/2 cup of 6% hydrogen peroxide (3% will work, but it's not as effective)
- 1 package of yeast (1 tbsp.)
- 3 tbsp. of warm water
- Dish soap
- Cup
- Funnel
- 10 drops of food coloring
- Disposable tablecloth

Preparation

This is a teacher driven activity. The campers will love the reaction! Do this outside on a table with a plastic table cloth cover.

Instructions

1. Teachers: Use a funnel to pour the peroxide into the bottles.
2. Have the campers place a few drops of food coloring into the bottles with the peroxide.
3. Add a squirt of dish soap and swirl the bottle to mix.
4. In the cup, mix the water and yeast. Stir for a few seconds to combine.
5. Teacher: Use the funnel to pour the yeast into the bottle with the peroxide and let the campers watch what happens!
6. Do not touch the foam, but campers can feel the heat radiate from the foam. This is the exothermic reaction.

What makes the elephant toothpaste so big?

The foam you made in this classic Elephant's Toothpaste reaction is extra special because each tiny foam bubble is filled with oxygen. The yeast acted as a catalyst: a catalyst is used to speed up a reaction. It quickly broke apart the oxygen from the hydrogen peroxide. Because it did this very fast, it created lots and lots of bubbles. Did you notice the bottle got warm? Your experiment created a reaction called an Exothermic Reaction – that means it not only created foam, it also created heat! The foam produced is just water, soap, and oxygen so you can clean it up with a sponge and pour any extra liquid left in the bottle down the drain.

https://www.stevespanglerscience.com/lab/experiments/elephants-toothpaste/

Oil and Water! - Immiscible Liquids & Emulsion

Materials

- Glass jars (with secure lids if you want to shake them)
- 1 cup of water
- Vegetable oil
- Dish soap
- Food coloring
- Small container
- Eye dropper or syringe
- 1 tsp table salt

Instructions

1. Pour one cup of water into the jar.
2. Pour vegetable oil into the jar.
3. Stop and observe. Does the oil and water mix? If you have already done the other density test in week one, ask the camper, "Is oil more or less dense than the water?"
4. Test: Shake the jar. What happens?
5. In a separate container, mix a generous squirt of dish soap with 7 drops of food coloring.
6. Using a dropper or syringe, draw up the colored soap and squirt into the jar. What happens?
7. Optional: add 1 tbsp. of table salt. What happens now?

Why don't oil and water mix?

That's because they are immiscible: meaning they can't mix! Oil molecules are attracted to other oil molecules. The same goes for water, it's attracted to other water molecules. The oil and water will always separate leaving oil on top and water on bottom. This is because of density. Oil is less dense (weighs less) than water, therefore it floats!

Now let's talk about soap! Dish soap is attracted to oil and water! Wow! When you shook the jar, the soap molecules attached to the oil and water creating an emulsion. An emulsion is a combination of molecules that aren't normally attracted to each other, that don't mix, but when they emulsify, they do mix!

Geyser in a Bottle - Nucleation

Materials

- 2-liter bottle of diet soda
- 13 Mentos®
- Geyser tube - You can make your own with a tube of paper or buy a Geyser tube kit on Amazon (found on https://www.amazon.com/Steve-Spangler-Science-Geyser-Experiment/dp/B082MS6V17/ref=sr_1_2?dchild=1&keywords=geyser+tube&qid=1588637376&sr=8-2

Instructions

1. Go outside into the grass. Have the campers stand back at least 10'.
2. Place the 2-liter bottle of diet soda on the table.
3. Fill your paper tube (tape one end closed) or the geyser tube with 13 Mentos.
4. Take the lid off the soda. With your finger over the open end of the tube, turn over the tube and let the Mentos fall into the soda all at once.
5. Step back quickly and watch the geyser erupt!

The science…

This experiment opens the door for many things! What was each camper's hypothesis? Did you measure the volume of soda in the bottle before and after the geyser? Perhaps you make teams and each team chooses a different brand of diet soda to see whose geyser reaches the highest? The reason why Mentos work so well is twofold - tiny pits on the surface of the mint and the weight of the Mentos itself. Each Mentos mint has thousands of tiny pits all over the surface. These tiny pits act as nucleation sites - perfect places for CO_2 bubbles to form. As soon as the Mentos hit the soda, bubbles form all over the surfaces of the candies and then quickly rise to the surface of the liquid. Couple this with the fact that the Mentos candies are heavy and sink to the bottom of the bottle and you've got a double whammy. The gas released by the Mentos literally pushes all of the liquid up and out of the bottle in an incredible soda blast. You can find this experiment at: https://www.stevespanglerscience.com/lab/experiments/original-mentos-diet-coke-geyser/

Leak Proof Bag! - Polymer Chains

Materials

- Gallon bag
- Water
- 5 sharpened pencils each

Preparation

Watch https://youtu.be/LdVN9GxJHCg and learn more about this experiment

Instructions

1. Fill the gallon bag halfway full of water and seal it.
2. Let the campers push the pencil into the bag and have it come out the other side.
3. Repeat with all of the pencils.
4. What was the reaction?
5. Did the bag leak?
6. Why do you think it didn't leak?

The science behind the leak-proof bag

This is a pretty amazing experiment! How often can you poke a hole in something and nothing happens? Or did something happen and you just didn't see it? What took place is a Polymer chain reaction. The plastic bag is made up of Polymer which is long flexible chains of molecules. When you poke a pencil through the bag, the polymer chains spread out and seal themselves around the pencil, not allowing it to leak!

Tip: You can try using different types and sizes of bags to compare and contrast the difference. You can see how many pencils you can poke through one bag. Try sandwich bags, freezer bags, storage bags, and more. Enjoy!

https://www.stevespanglerscience.com/lab/experiments/leak-proof-bag/

Week 3 - Weather Science

Activities

- **Sun Thermometer/Heat & Expansion**
- **Tornado in a Bottle!/Creating a Vortex**
- **Cloud in a Jar/Vapor Process**
- **Rain Clouds/Saturation & Capacity**
- **Frost in a Can/Melting Point & Condensation**

Week 3 Material List

- 2 empty aluminum cans without labels
- A clear straw, non-bendable
- Aerosol hairspray
- Bottle with or without a lid
- Duct tape
- Food coloring
- Ice
- Jar with a lid
- Metal washer (one for each bottle)
- Molding clay
- Pipette or eye dropper
- Plastic cups
- Rubbing alcohol
- Salt
- Shaving cream
- Tray
- Two 1-liter bottles
- Vegetable oil
- Water

Sun Thermometer - Heat & Expansion

Materials

- Bottle with or without a lid
- Molding clay
- A clear straw
- Food coloring
- Rubbing alcohol
- Pipette or eye dropper
- Vegetable oil

Instructions

1. Fill your bottle with alcohol and add 7 drops of food coloring.
2. To a separate bowl, add 2 tbsp. of alcohol and 2 drops of food coloring. Set aside.
3. If your lid has an opening, use it. Put the straw in the center. If it does not already have a hole in the lid, make your own dome around the top of the bottle sealing it. Make sure air cannot get into the bottle.
4. Once the straw is sealed, add 2" of the extra alcohol.
5. Place in a sunny window.
6. Check on it every hour to see if the liquid is rising from the heat. Once the liquid is stable and no longer rising, use your pipette to add a drop or two of oil to seal it.

The science behind it

Water, like all substances, is comprised of molecules. In water, an individual molecule has the chemical formula H_2O, dihydrogen monoxide. When water molecules are heated, their bonds stretch out and expand. In the Water Thermometer experiment, you've created a sealed environment around the water. That is to say, there is nowhere for the water to go as it expands because the rest of the space is filled with air. The straw gives the expanding water an area where it can expand, thus it rises up the straw.

In comparison, the opposite happens when water is cooled. The molecular bonds that hold the H_2O molecules together contract, bringing the molecules closer together. Just as the water level in the straw rises when the water is heated, it lowers when the water is cooled.

https://www.stevespanglerscience.com/lab/experiments/water-thermometer-sick-science/

Tornado in a Bottle! - Creating a Vortex

Why did this happen?

When you first tipped the bottle over to get water to pour into the empty container, you will notice nothing happened. That is because the empty bottle was full of air (O2) while the other bottle was full of water (h2o). They have equal pressure when not moving which does not allow for water to fall into the empty bottle. When you swirl the bottle and create a vortex, air is added into the bottle of water and water is then pulled into the empty bottle! You've created a tornado in a bottle by making a vortex!

Materials

1. Two 1-liter bottles
2. A metal washer
3. Duct tape
4. Water

Instructions

1. Add water to one bottle.
2. Place metal washer over the opening of the bottle with water.
3. Flip the other bottle over and put it opening to opening and wrap tightly with duct tape.
4. Flip the bottle over to move the water into the empty bottle. What happens?
5. Now with empty bottle on the bottom, shake the bottle with water in a circle. What happens?
6. You've created a vortex & a tornado!

Cloud in a Jar - Vapor Process

What made the cloud form?

Clouds form when water vapor rises into the atmosphere and then condenses onto microscopic particles. The warm water in the jar caused the air inside the jar to heat up. When this happened, some of the water evaporated into the air. This evaporation caused water vapor in the jar.

Then the warm moist air (water vapor) rose from the surface of the water to the top of the jar. Once it reached the top of the jar, the warm moist air then began to cool down. This is because of the ice that was on the lid of the jar. The water vapor in the cooling air then condensed onto the particles of hairspray and formed a cloud in the jar. If you observe the cloud carefully, you'll notice that it swirls around in the jar. This swirling is caused by the circulating air (i.e. warm air rising and cold air sinking).

http://coolscienceexperimentshq.com/make-a-cloud-form-in-a-jar/

Materials

- Glass jar
- Cup of hot water
- 3-5 ice cubes
- Aerosol hairspray (teacher only uses this)
- Blue food dye

Instructions

1. Add blue food dye to hot water.
2. Pour water into the jar.
3. Quickly spray hairspray into the jar.
4. Immediately place the lid on the jar.
5. Place 3-5 ice cubes on the lid of the jar.
6. Watch the cloud form.
7. After a few minutes of watching the cloud form, remove the lid and watch the cloud leave the jar.

Rain Clouds - Saturation & Capacity

What makes the rain fall through the cloud?

The water represents air; the shaving cream represents the clouds and the colored solution represents the rain. Clouds are part of the water cycle and are formed from molecules. When a cloud is filled with rain, it becomes saturated (full) and is at its capacity (limit). This is when rain falls through the cloud to the ground. You will notice that the longer the shaving cream cup sits, the more "rain" falls through.

Materials

- Shaving cream (not shave gel)
- Food coloring
- Water
- Glass or plastic jar
- 4 small cups for water color
- Eye dropper or pipette

Instructions

1. Before the experiment, ask the campers what they think will happen when the rain is dropped onto the cloud? Have the camper document it in their journal.
2. Fill 4 small cups with 1/4 cup of water and 4 drops of food coloring.
3. Fill the jar 2/3 with water (air).
4. Add 2-3" of shaving cream (clouds).
5. Use an eye dropper to drop colored water (rain) into the clouds.
6. What happens?

Frost in a Can - Melting Point & Condensation

Materials

- 2 Empty aluminum cans with label peeled off
- Ice
- Salt
- Tray

Instructions

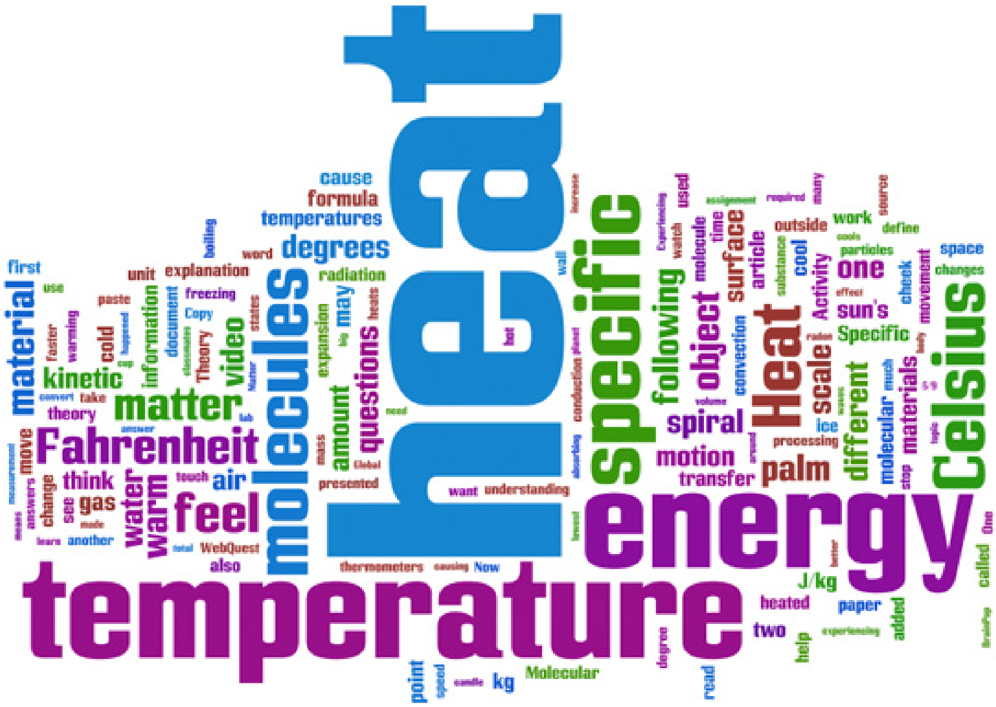
1. Set up two cans. One with just ice and one with ice and a teaspoon of salt.
2. Ask the campers which can they think will form frost first?
3. At 2 minutes, do they notice any changes on the outside of the can?
4. Add more salt to the can. Does that make more condensation form?
5. Shake the can. Does that make more condensation form?
6. Which can made the most condensation?

How does this experiment work?

Most people have heard of using salt on icy sidewalks and roads to melt the ice. Salt lowers the melting point of ice (good for icy walkways). Salt encourages ice to melt and turn to frost. When this happens, the water vapor around the can falls below freezing. This causes frost to form on the outside of the can when the water vapor is freezing.

The can without the salt has a higher melting point that is above freezing. That is why the water vapor only makes condensation and not frost in that can.

Week 4 - Energy Science



Activities

- **Popsicle Stick Chain Reaction/Kinetic Energy**
- **Magnetic Slime/Magnetic Elements**
- **Fruit Power Battery/Positive & Negative Energy Flow**
- **Rollback Can Experiment/Potential Energy**
- **Gravity Defying Snakes/Static Electricity**

Week 4 Material List

- 1 mini led lightbulb (link at the bottom)
- 2 paperclips
- 4 lemons
- 4 pennies (copper plate zinc)
- 4 zinc galvanized nails (zinc)
- 5 dual end alligator clips with wire attached (link at the bottom)
- 8 oz. white school glue
- 9 oz. plastic cup
- Any color of Tissue paper (gift wrap tissue works great)
- Black marker
- Borax
- Colored paper for decorating
- Dinner plate
- Iron fillings
- Knife – to be used by the teacher
- Large mixing bowl
- large nut (hardware store) or 9 volt battery
- Measuring cups and spoons
- Metal can (coffee or oat can)
- Neodymium magnet
- Plastic Ruler
- Scissors
- Screwdriver
- Something made of wool like a sweater or carpet
- Spoon
- Tape
- thick rubber band
- Water
- Wide Popsicle sticks
- Ziploc bag

Popsicle Stick Chain Reaction - Kinetic Energy

Materials
- Colorful popsicle sticks
- A friend or two

Preparation
Watch the video of this experiment being done:
https://www.youtube.com/watch?v=r7j7l39ZAsU&feature=youtu.be

Instructions
1. Start off with two popsicle sticks. Lay them in an "X" on a flat surface.
2. Weave the end of a third popsicle stick underneath the end of the popsicle stick on the bottom of the "X." The rest of the third stick should go over top of the popsicle stick on the top of the "X." Make sure to keep pressure on the third stick.
3. Repeat step 2 with a fourth popsicle stick. This time, start underneath the second popsicle stick and weave over the third.
4. Continue adding popsicle sticks in this fashion until you have a really long chain!
5. Once you've extended the chain to your heart's content… let go! The popsicles will release in a chain reaction that will have everyone in the area jumping for joy.

The science behind the activity
The key to the popsicle stick chain-reaction comes from potential (or stored) energy in the over/under weaving and kinetic (or motion) energy in the release. As you weave the popsicle sticks together, you're gradually and continually building potential energy in the popsicle sticks (or the system). Each popsicle stick is slightly bent over a stick on one end and held under a stick on the other. This twisting and bending creates lots of potential energy in the wood fibers because it's not a normal position. They want to return to a normal position and lose the added energy, but they can't. When you have the chain length you want, you let go. All of the potential energy is converted down the line in a chain-reaction of kinetic energy!

This incredible experiment was brought to you by Steve Spangler Science
https://www.stevespanglerscience.com/2013/07/08/popsicle-stick-chain-reaction-sick-science/

Magnetic Slime - Magnetic Elements

Materials

- 8 oz. white school glue
- 1 tsp of Borax
- Large mixing bowl
- 9 oz. plastic cup
- Measuring cups and spoons
- Zip lock bag
- Iron filings
- Neodymium magnet
- Water
- Spoon
- Dinner plate

Instructions

1. Empty the entire bottle of white school glue into the large mixing bowl.
2. Fill the empty bottle nearly full with water, cap it, and shake it up to recover all the glue.
3. Pour the water and glue solution into the bowl.
4. Add a generous amount of iron filings to the water and glue mixture. Stir the new mixture thoroughly with a spoon.
5. Measure a 1/2 cup (118 ml) of warm water and pour it into the plastic cup.
6. Add 1 teaspoon of borax powder to the water in the cup and stir the solution. Be sure the borax dissolves completely.
7. Add the borax solution to the glue solution in the bowl.
8. Mix the glue and borax solutions together completely. It's a totally safe combination so use your fingers but be sure to wash your hands with soap first. There's no point loading your new slime with dirt from your hands. It may take a few minutes to get all of it to mix but it will come together. When the chemistry has done its job, you'll be holding a large blob of a familiar looking toy. Lay the putty-like mass on the plate and flatten the goo so it has a smooth surface.
9. Bring the magnet close to the surface of the flattened slime and watch the slime spring upward and grab it. The slime is stretchy but it doesn't want to move easily out of place. Use the magnet to build miniature volcanoes in the slime. If the slime is clean (because you made it with clean hands), then store it in the zip lock bag in the fridge. When you've made all the discoveries you want with it, you can toss it – bag and all – in the trash.

Variation

You can make magnetic putty by using 1 tbsp. of borax in this recipe

How does this work?

The iron filings cause this slime to be magnetic. Iron is one of three elements (cobalt – Co, iron – Fe, and nickel – Ni) that are magnetic at room temperature.

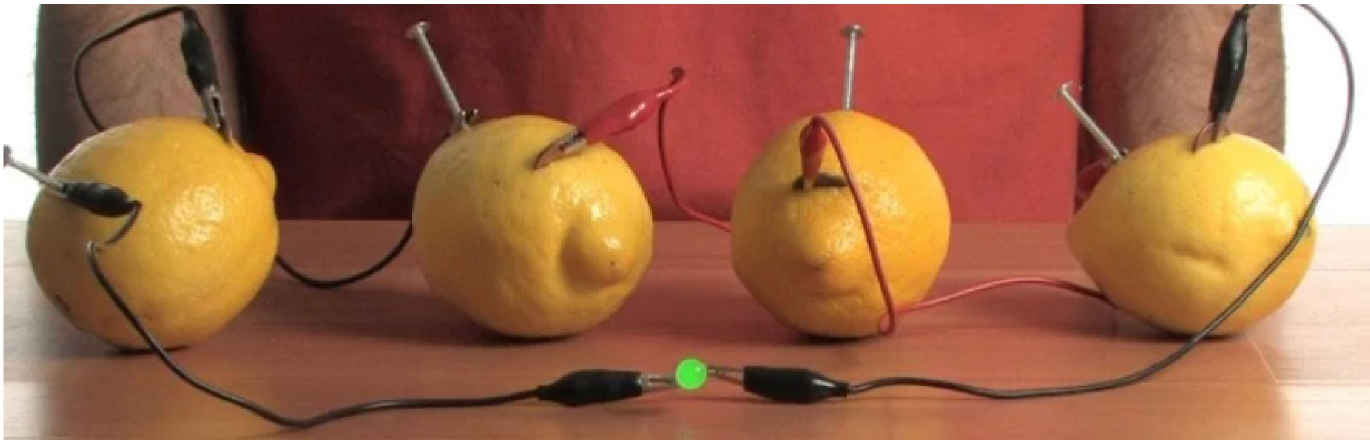
The solution of school glue with borax and water produces a putty-like material that's elastic and flows very slowly. The glue is actually made of a polymer material. In simplest terms, a polymer is a long chain of identical, repeating molecules. You can use the image of tiny steel chains to understand why this polymer behaves the way it does. Each link in a chain is a molecule in the polymer and one link is identical to another. When the chains are in a pile and you reach in to grab one, that's what you get: one. If you dump them on the floor, they're not connected to each other so they spread out everywhere like water. The strands flow over each other like the liquid glue in the bowl. Something caused a change, however.

Let's say you toss a few trillion tiny, round magnets into the pile of steel chains. Now when you reach in to grab one strand, you grab hundreds because the magnets have linked the strands together. If the molecules stick together at a few places along the strand, then the strands are connected to each other and the substance behaves more like a solid. Sodium tetraborate is the chemical in borax that hooked the polymers in the glue together to form the putty-like material. This process is called cross-linking.

The magnet is very strong but something prevents the iron filings from leaving the slime and clinging to the magnet. The slime holds onto the iron filings by adhesion. Adhesion is a force that holds molecules of different substances together. In addition to adhesion, the slime polymer is bonded by cohesion. That's a force that holds molecules of the same substance together. It's the combination of magnetism pulling one way and adhesion and cohesion pulling the other that results in the weird, stretchy "volcanoes" appearing when you hover the magnet near the slime. So much is happening in such a small space!

You can find this experiment at:
https://www.stevespanglerscience.com/lab/experiments/magnetic-slime/

Fruit Power Battery - Positive & Negative Energy Flow



Materials

- 4 lemons
- 4 pennies (copper plate zinc)
- 4 zinc galvanized nails (zinc)
- 1 mini led lightbulb (link at the bottom)
- 5 dual end alligator clips with wire attached (link at the bottom)
- Knife – to be used by the teacher

Preparation

Talk with the campers about negative and positive energy. In this experiment, the penny acts as the positive electrode and the energy current flows through the lemon juice (acid) to the negative electrode which is the galvanized zinc nail.

Ask the campers what they think will happen when they complete the circuit? Will the light be illuminated?

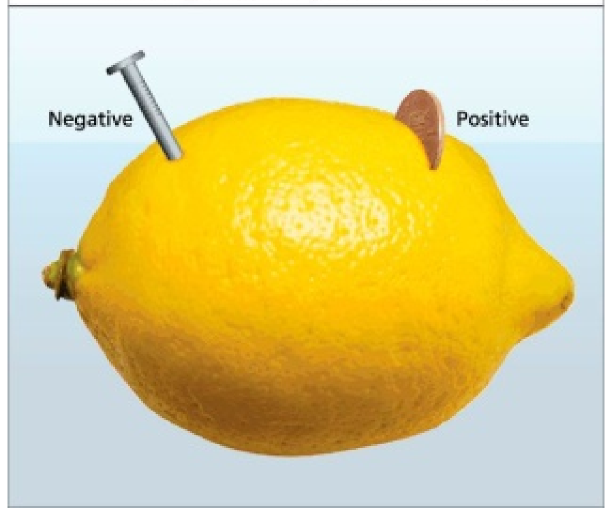
Watch the video on how this experiment is done:
https://youtu.be/XtHt00AN0pU

Instructions

1. Place a small slit on one end of the lemon, just deep enough for the penny to fit.
2. At the opposite end, insert the galvanized nail as shown above.
3. Use a set of alligator clips to connect a nail on one lemon to a penny on another lemon.
4. Connect all four lemons together with alligator clips. Each set of alligator clips should connect a nail to a penny.
5. Connect one of the last alligator clips to the only open penny.
6. Connect the other clip to the only open nail. Now you have two unused clips on two separate alligator clips. You know what to do!
7. Attach the two loose alligator clips to the LED. Check it out! The chemical energy in the lemons has been used to power the LED with electrical energy.

How does this work?

Batteries are comprised of two different metals suspended in an acidic solution. With the Fruit Power Battery, the two metals are zinc and copper. The zinc is in the galvanization on the nails, and the pennies are actually copper-plated zinc. The acid comes from the citric acid inside each lemon.



The two metal components are electrodes, the parts of a battery where electrical current enters and leaves the battery. With a zinc and copper setup, the electron flow is out of the penny (copper) and into the nail (zinc) through the acidic juice inside the lemon. In the exchange of electrons between the zinc and the copper over the acid bridge, copper accepts two electrons from zinc which accounts for the current.

Once the Fruit Power Battery is connected to the LED, you've completed a circuit. As the electrical current passes through the LED, it powers the LED and then passes back through all of the lemons before getting to the LED again. By the way, an LED is polar sensitive. That means an LED will glow only if the current is flowing through it in the right direction. If you hook up the LED and it doesn't glow, switch the alligator clips attached to its legs. That should do it.

This experiment can be found at:
https://www.stevespanglerscience.com/lab/experiments/fruit-power-battery/

Links for dual ended alligator clips with wire attached & led lightbulb
https://www.amazon.com/MCIGICM-Circuit-Assorted-Science-Experiment/dp/B07PG84V17/ref=sr_1_1?dchild=1&keywords=mini+led+light+for+science&qid=1588682405&sr=8-1

https://www.amazon.com/Shappy-Pieces-Plastic-Handle-Alligator/dp/B072FJQ7BG/ref=sr_1_25?crid=3J5PYYLZ938EQ&dchild=1&keywords=mini+alligator+clips&qid=1588681644&sprefix=mini+alligator%2Caps%2C148&sr=8-25

Rollback Can Experiment - Potential Energy

Materials

- Metal can (coffee or oat can)
- A large nut (hardware store) or 9 volt battery
- 2 paperclips
- A thick rubber band
- Screwdriver
- Tape
- Colored paper for decorating

Preparation

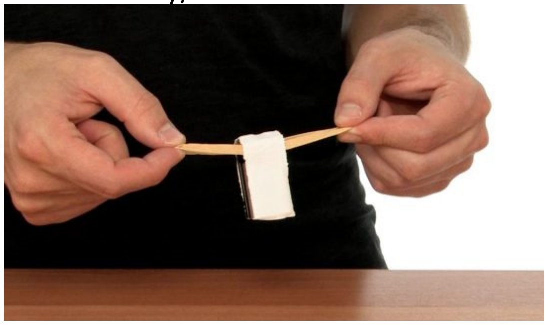
Watch https://youtu.be/bQyK47SBkHw

Instructions

1. Place the lid of the can on the bottom.

2. Using the screwdriver, make a hole in the middle of the bottom of your metal can (through the lid and can itself). Be extra careful when using sharp objects. Also, be careful around the sharp metal edges that you may create when making the hole. Separate the punctured lid from the can.

3. Tape the large metal nut to the middle of the rubber band. Make sure both sides of the rubber band are taped to the bottom of the battery/nut.



4. Push one end of your rubber band loop through the hole in the bottom of the can. Secure it there by attaching one of the paperclips. Once you have it secured, tape the paperclip down.

5. Stretch the rubber band across the length of the can and push the other end of the rubber band loop through the hole in the lid – securing the rubber band with a paperclip once again. NOTE: The battery should NOT rub against the side of the can. If it does, try a shorter rubber band.

6. Decorate the can. (optional)

7. Set the can on its side on a hard surface or short carpet floor and give it a roll. Once the can comes to a stop, try to contain your excitement as it begins to roll back to you!

The Science Behind the Experiment

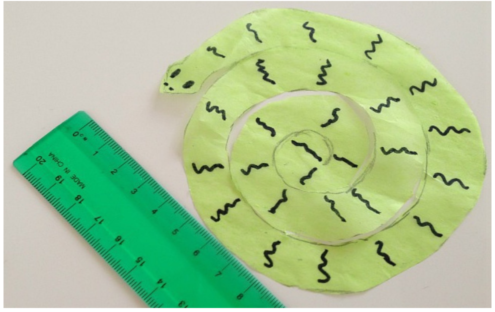
The Rollback Can Experiment is a great example of transfer of energy. When you roll the can, it has kinetic energy. As it slows down, the energy is transferred into potential energy within the twisted rubber band inside the can. The twisted rubber band's potential energy is then transferred back to the can in kinetic energy as it untwists.

The secret to all this energy transfer comes from the weight that you've taped to the rubber band inside the can. While the weight is being pulled down by gravity, it is also being subjected to a twisting force from the rubber band. As long as the force being exerted by gravity on the weight is greater than the twisting rubber band's force on the weight (meaning the weight never goes over the rubber band), the rubber band will continue to twist.

Once all of the kinetic energy from the rolling can has been exhausted by converting to heat (friction) or potential energy (twisted rubber band), the can stops rolling and the weighted rubber band is able to unwind. Because of the weight in the middle of the rubber band, only the ends of the loop are able to unwind. Therefore, the can begins to roll backwards.

This experiment can be found at:
https://www.stevespanglerscience.com/lab/experiments/magic-rollback-can-sick-science/

Gravity Defying Snake - Static Electricity



Materials

- Any color of Tissue paper (gift wrap tissue works great)
- Black marker
- Plastic Ruler
- Scissors
- Something made of wool like a sweater or carpet

Preparation

Talk with the campers about static electricity. A static charge happens when two surfaces touch each other and the electrons move from one object to another. One of the objects will have a positive charge and the other a negative charge. If you rub an object quickly, like a balloon or your feet on the carpet, these will build up a rather large charge. Ask the campers have they ever received a shock from touching something?

Ask campers to predict what will happen when they rub the ruler over the carpet?

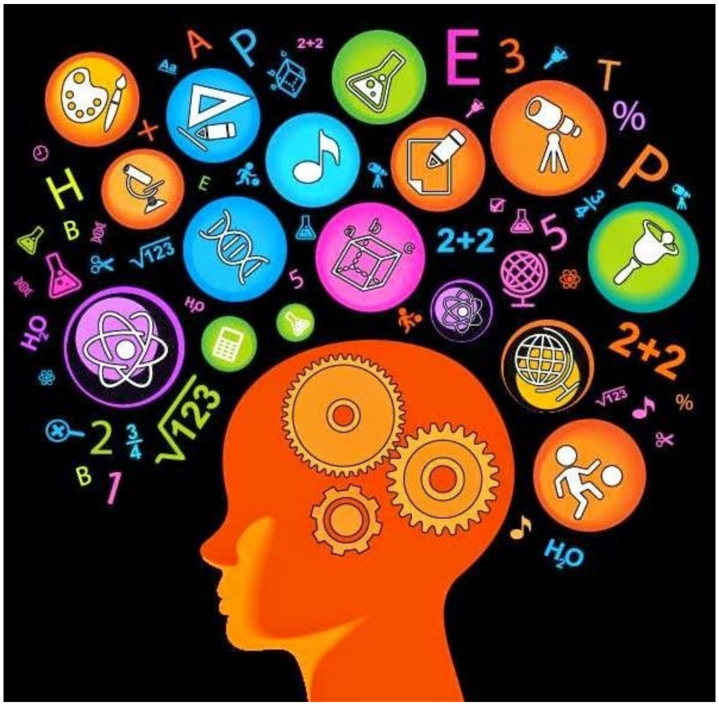
Instructions

1. Use the pattern that is included for the snake or create your own.
2. Place the tissue paper over the template and draw the design on to the tissue paper.
3. Cut out the snake following the lines you have traced on the tissue paper. If you like, draw on a face and some wiggly lines with a felt tip pen.
4. Rub the plastic ruler vigorously over the wool carpet or a pullover, then hover the ruler over the snake's head.
5. The snake will begin to rise off the table!

After the experiment, challenge the campers! Will other types of paper get the same result? Repeat the experiment with notebook paper, copy paper, and/or newspaper. Was the result the same or different?

This is experiment can be found at: https://kidsactivitiesblog.com/26633/static-electricity-3

Week 5 - Scientific Inventions



Activities

- **Build a Catapult/Elastic Energy**
- **Drag Racing Cups/Potential Energy**
- **Mousetrap Racer/Kinetic Energy**
- **Non-Electric Lava Lamp/Chemical Reaction**
- **Tennis Ball Tower Challenge/Physics**

Week 5 Material List

- 10" x 3.5" piece of cardboard
- 2 Tall identical jars or bottles, such as empty, clear, plastic1-liter or 2-liter bottles
- A soda or milk cap.
- An Alka-Seltzer tablet.
- Cutting board
- Duct tape or other strong tape
- Extra cardboard
- Food coloring
- Four cd’s or DVDs
- Four zip ties
- glue
- Knife
- Mousetrap
- Paperclip
- Pen or pencil
- Pipe cleaners
- Plastic bead with a hole (pony bead)
- Popsicle sticks
- Quarter
- Ribbon or similar material
- Rubber bands
- Scissors
- Small metal washer
- Straws
- String
- Strong tape (electrical & duct tape works well for this)
- tennis balls
- Things to be launched – baby marshmallows, cotton balls, mini pompoms, ping pong balls, Three wooden skewers
- Timer or clock that shows seconds
- Two disposable coffee cups and lids
- Vegetable oil
- Water
- Wire cutters

Build a Catapult

Potential Energy, Engineering, Elastic Energy, & Kinetic Energy or just a fancy way to say projectile physics!

Materials

- 8 craft sticks or tongue depressor
- 3-5 rubber bands
- A soda or milk cap
- Glue
- Things to be launched – baby marshmallows, cotton balls, mini pompoms, ping pong balls, anything that's safe to be airborne – it's up to you and your teacher!

Instructions

1. Take six craft sticks, stack them one on top of the other. Secure these sticks together by wrapping rubber bands around both ends of the stack. You will anchor the launching stick to this stack, as described in the next step.
2. To add the launching stick, take one stick and attach it perpendicular to the stack you just made, around the middle, so you get a cross shape. You can do this with one or two rubber bands that are crossed in an X over the sticks. If you cross it this way, the sticks will stay nicely perpendicular.
3. Next, add the base by attaching a stick to one end of the launching stick with a rubber band. If it were not for the stack of sticks in between, the launching stick would fall flat on top of the base. Now the launching stick and the base form a V shape lying on its side with the stack of sticks in the middle.
4. Put your catapult on its base. Locate the end of the launching stick that sticks up and glue the bottle cap there so it forms a small cup to hold the missile.
5. Wait until the glue is dry and let the games begin!

This experiment can be found at:
https://www.scientificamerican.com/article/build-a-catapult/

Drag Racing Cups - Potential Energy

Materials

- Two disposable coffee cups and lids
- Several rubber bands
- Plastic bead with a hole (pony bead)
- Paperclip
- Straw
- Small metal washer
- Quarter
- Pen or pencil
- Scissors
- Duct tape or other strong tape

Teacher

The original directions fit on one page. Larger images were added to show the steps and make it easier. This made it three pages. No worries! It's still the same length as all the other projects just with more visuals.

Preparation

Prepare to hold a drag racing competition with your campers! Show them this video and have them recreate the experiment with the goal of seeing whose drag racing cup can go the farthest!
https://youtu.be/9vNJC0MG33w
You can have your campers decorate and design the exterior of the cups (optional).

Instructions

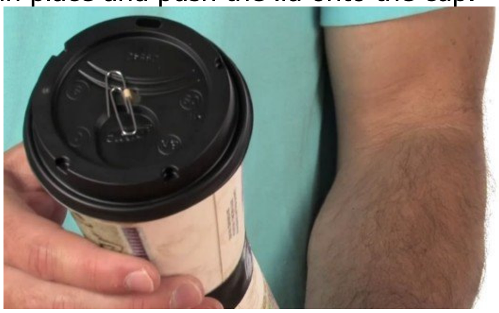
1. On the bottom of both cups, trace the edge of a quarter with a pen or pencil. Try to keep the traced circle as centered on the bottom of the cups as possible.

2. Cut the traced circles out of the bottom of both cups using a pair of scissors.
3. Tape the cups together, bottom to bottom, using a strip of duct tape. The holes in the bottom should line up.

4. Poke a hole in the middle of each disposable lid using the pen or pencil. The hole shouldn't be any wider than 5 mm.
5. Link several rubber bands together to make a chain that is close to the combined length of the cups. To link the rubber bands, lay two down with the ends overlapping. Then, pull the overlapped portion of the top rubber band around the bottom rubber band and up through the center hole. Pull them tight and the rubber bands should link together.

6. Run your rubber band chain through the middle of the cups.

7. Push one end of the rubber band chain through the hole in one disposable lid. Attach a paper clip to hold the rubber band in place and push the lid onto the cup.



8. Push the opposite end of your rubber band chain through the hole in the other lid and attach it to the cup.

9. Thread the rubber band through the middle of a small washer and then the bead. Put the straw through the end of the rubber band, just past the bead. Slide the straw through so that the rubber band is about 2 cm from one end of the straw.

10. Wind your racer by holding the cups in place and repeatedly spinning the straw around the bead.

11. Set the racer down and watch it go!

What makes this work?

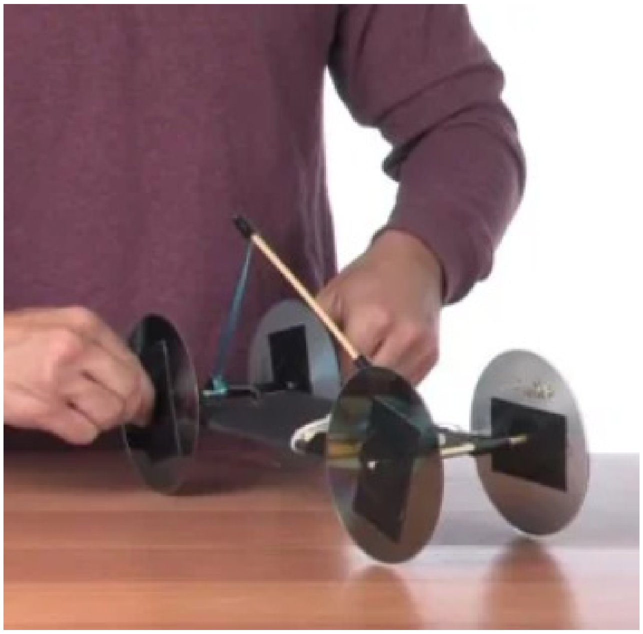
When you twist the rubber band chain with the straw, you stretch the rubber band and wind it up. This winding and stretching creates and stores potential energy. Potential energy is energy that has the ability to do work in the future, but is not currently performing any work. The more twisting you apply to the rubber band, the more potential energy you create. When you put the Drag Racing Cups down on a surface, the rubber band unwinds and converts the potential energy into kinetic energy, the energy of a moving object, as it makes the cups roll.

Are your campers up for a modified challenge? You can change this up by modifying the variables. Try different length & thickness of rubber bands, different size cups and see what the new results are!

You can find this fun experiment using potential and kinetic energy by visiting https://www.stevespanglerscience.com/lab/experiments/drag-racing-coffee-cups/

Mousetrap Racer - Kinetic Energy

For senior campers 9+



Materials

- Mousetrap
- 10" x 3.5" piece of cardboard
- Extra cardboard
- Scissors
- Strong tape (electrical tape works well for this)
- Four cd's or dvd's
- Four zip ties
- Ribbon or similar material
- Three wooden skewers
- One straw
- Pencil
- Wire cutters

Preparation

Watch how this experiment is done at:
https://youtu.be/mVNFxlEMWvw

Challenge your campers to build their mouse trap cars in teams and race against each other! Whose mouse trap car went the farthest?

Teacher

This is a longer experiment with more steps and is geared towards 9+. I recommend doing this one after the campers have become more familiar with kinetic and potential energy from earlier experiments. The additional tools like wire cutters are meant to have help from the teacher. Thank you and enjoy!

Instructions

1. Start by removing the "hold-down bar" from the mousetrap. The "hold-down bar" is the long, slightly hooked bar that dangles off of one end of the trap. Don't throw the piece away as you will use it later.
2. Using the wire cutters, cut the lever (or hammer) leaving only one side. The lever is the metal piece that threads through the spring. Be sure not to cut the spring lever.
3. Use a pair of scissors to cut an 8" piece of wooden skewer.
4. Attach the skewer to the cut piece of lever on the mousetrap using two zip ties. Make sure the skewer and lever are securely fastened. Trim the zip ties.
5. Use a strong tape to further secure the skewer to the lever by adding the tape just above the zip ties.
6. Attach the mouse trap. Position the mousetrap so that the end of the trap is lined up with one end of the 10" x 3.5" piece of cardboard. This is going to be the back of your car.
7. Use a strip of tape around the middle of the mousetrap to attach the mousetrap to the cardboard.
8. Use two zip ties, one at each end of the mousetrap, to finish securing the mousetrap to the cardboard. Trim the zip ties.

9. On the opposite end of the cardboard, measure one inch from each edge. Connect these marks with a triangle that cuts inwards towards the mousetrap.
10. Preparing the axles: use scissors to cut two wooden skewers into 5″ pieces.
11. Find a piece of metal that you trimmed off the mousetrap. Make sure that it's long enough to bend. From the metal, make a shape that is a 90-degree angle (right angle) with a hook on one side.
12. Tape the piece of metal to the middle of one 5″ piece of skewer. Make sure that the straight side is pointing straight off of the skewer.
13. Attaching the Axles to the Base: use scissors to cut four 1″ pieces of a drinking straw.
14. Tape two of the straw pieces onto the end of the cardboard near the mousetrap. Thread the 5 inch skewer without the hook through the straws.
15. Put the other 1-inch straw pieces onto each end of the skewer with the hook. Then, tape the straws onto the triangle side of the cardboard. The hook should be aligned with the cut-out triangle.
16. Making and attaching the wheels: use scissors to cut cardboard into eight 1.5″ diameter circles.
17. Place a cardboard circle on the middle of each side of four compact discs and tape them in place with strong tape.
18. Push a wheel onto each side of the axles. Push each wheel 1/4″ onto the axles.
19. Making the engine: measure a strip of ribbon (or similar material) from the end of the skewer to the metal piece on the opposite axle and cut it with scissors.
20. Use tape to secure the ribbon onto the end of the skewer. Make sure it is secured very well.
21. Tie a loop in the loose end of the ribbon. Make sure the loop will not come loose. You may want to reinforce it with tape.
22. Start Your Engines…Put the loop of ribbon around the metal piece of the front axle.

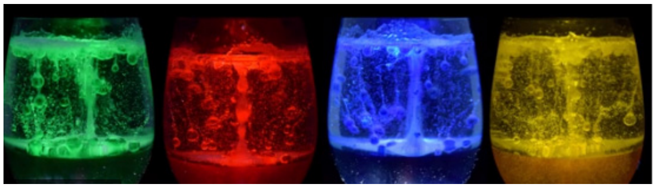
How does it work?

Whew! It took some effort, but the Mousetraps in Motion experiment was totally worth it! As you wind the ribbon around the front axle, you are creating potential energy that is stored in the spring of the mousetrap. Releasing the axle also releases the spring, converting potential energy into kinetic energy. The spring pulls the ribbon and unwinds it from the front axle making the axle spin and pull the rest of the car along. It's just like a front-wheel-drive car!

Tip

For full instructions with pictures, visit: https://www.stevespanglerscience.com/lab/experiments/mousetraps-in-motion/

Non-Electric Lava Lamp! - Chemical Reaction & Carbonation



Materials

- Tall identical jars or bottles, such as empty, clear, plastic 1-liter or 2-liter bottles (2)
- Knife
- Cutting board
- Timer or clock that shows seconds
- Water
- Food coloring
- Vegetable oil (enough to fill the jars nearly full)
- An Alka-Seltzer® tablet
- A way to make one jar hot and one cold, such as by using a large bowl filled with hot water and access to a refrigerator or freezer

Preparation

For fun, try holding a lit flashlight under your jar/bottle after you've made your lava lamp. Watch this video on:
https://youtu.be/jTE2IV8vJ48

Instructions

1. To the bottle/jars, add 2" water + 5 drops of food coloring
2. Fill the bottle 3/4 full of vegetable or mineral oil.
3. Place one bottle/jar in a bowl of hot water for 10 minutes while placing the other bottle/jar in the freezer for 10 minutes.
4. Open the Alka-Seltzer packet and cut the tablet into quarters.
5. Once one jar is hot and one is cold, get a timer or clock ready and drop a quarter of a tablet into the heated jar. Note that the tablet piece may take a moment to sink through the vegetable oil to reach the water where it will react. Start timing as soon as the tablet piece reaches the water and starts reacting.
6. How long does it take for the tablet to disappear? How vigorous are the bubbles?
7. Now drop a quarter of a tablet in the cold jar. Time how long it takes the tablet to disappear this time.
8. How long does it take the tablet to disappear in the colder liquid?
9. Think about how the two reactions looked. Do you notice other differences in how the reaction happens in the colder liquid versus in the hotter liquid? Why do you think you got the results that you did?

How this works

The ingredients in Alka-Seltzer combine with water to form a gas called carbon dioxide. The oil and Alka-Seltzer do not combine in this way though because they are immiscible (won't mix). The Alka-Seltzer tablets sink through the vegetable oil until they reach the layer of colored water. There the Alka-Seltzer dissolves in the water and forms a gas called carbon dioxide. The gas is lighter than the water and oil, so it bubbles up taking a bit of colored water with it as it moves through the oil layer. You should have seen those bubbles, looking like colorful blobs, float through the oil layer to the top of the jar. At the top, the bubbles should have burst (releasing the carbon dioxide gas), and then the colorful blobs should have sunk back to the bottom (now without carbon dioxide gas). The effect should have been reminiscent of a lava lamp. The chemical reaction that causes the carbon dioxide to form happens more quickly in warmer water. For this reason, you should have seen that the Alka-Seltzer tablet dissolved more quickly in the hot water, in approximately 20-30 seconds depending on the temperature. This should have resulted in lots of rapid bubbling and an energetic lava lamp display. In contrast, the Alka-Seltzer tablet in the cold water should have dissolved more slowly, with most of it disappearing in the first two to three minutes, resulting in a calmer and longer lasting lava lamp effect.
https://www.sciencebuddies.org/stem-activities/make-a-lava-lamp#instructions

Tennis Ball Tower Challenge - Physics, Engineering, & Force

Instructions

1. Challenge your campers to use all the materials provided to create a tower that will support a tennis ball.
2. The tower must be 10 inches off the table to qualify.
3. Whoever can create the tallest tennis ball tower and has it standing for 1-minute wins the challenge!

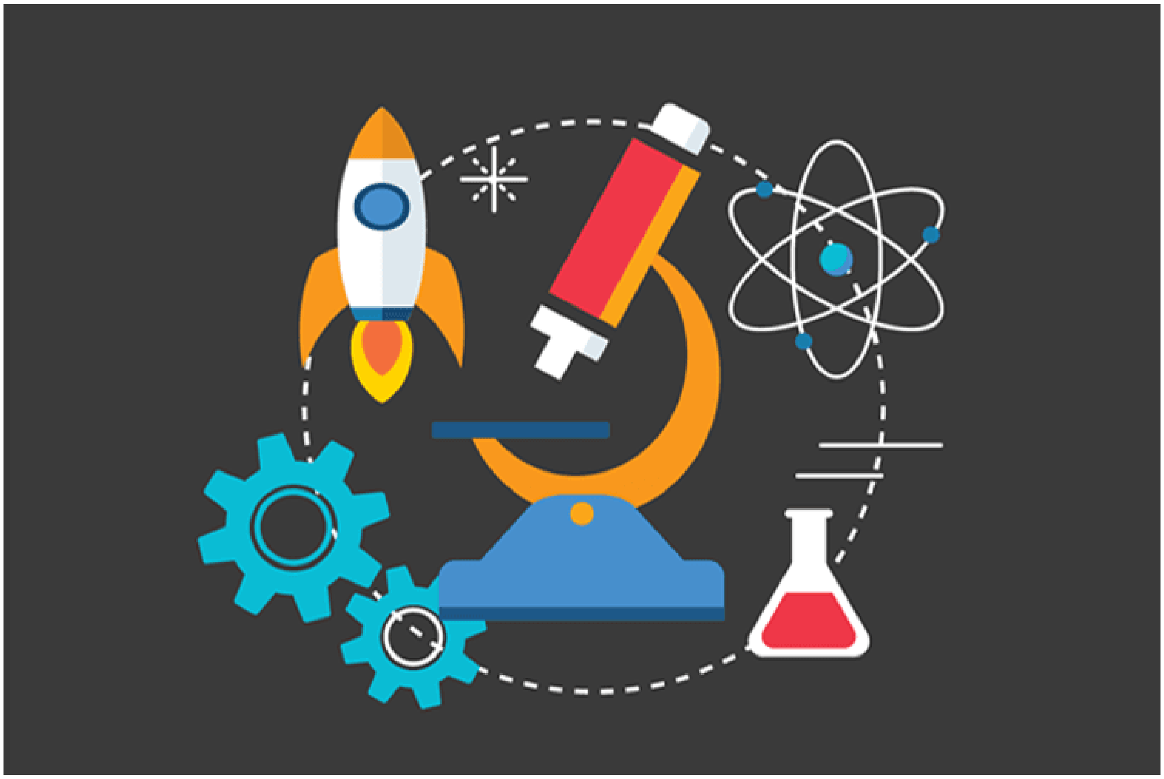
Materials

- Straws
- Popsicle sticks
- Tape
- Rubber bands
- String
- Pipe cleaners
- A tennis ball

Preparation

This video will talk about what makes the tennis ball challenge work and show how it's similar to the same type of engineering as the Eiffel tower: https://stemplayground.org/activities/tennis-ball-tower/

Week 6 - Just Cool Experiments



Activities

- **Build a Catapult/Elastic Energy**
- **Drag Racing Cups/Potential Energy**
- **Mousetrap Racer/Kinetic Energy**
- **Non-Electric Lava Lamp/Chemical Reaction**
- **Tennis Ball Tower Challenge/Physics**

Week 6 Material List

- 3 quart-size bags
- 3 sandwich bags
- A collection of rocks and minerals (camper's provide10-15 rocks)
- A sock that is missing its match
- Aluminum foil (wide, heavy duty if possible)
- Baking soda
- Black and white construction paper
- Box knife
- Clear page protectors -2
- Colorful Duct tape & packing tap
- dawn Dish soap or glycerin 2-3 tbsp. (glycerin makes stronger bubbles)
- Empty water bottle
- Food coloring
- Glue stick (Elmer's Glue® works, too.)
- Large pizza box (in pretty good shape)
- magnifying glass
- Measuring cup and spoons
- Pen or pencil
- plastic cup
- Rubber bands
- Ruler
- Safety glasses
- Scissors
- Straws, non-flexible
- Thermometer (optional)
- Vinegar
- Water
- Wooden food skewer 12"
- Wooden skewer

Co2 Sandwich - Chemical Reaction & Force

Materials

- Measuring cup and spoons
- Vinegar
- Baking soda
- 3 quart size bags
- 3 sandwich bags
- Safety glasses

Preparation

Watch this video on the experiment at:
https://youtu.be/spplZiR6dJA

Instructions

1. Fill three quart-size zip lock bags with approximately 1 tablespoon of baking soda.
2. Fill three smaller snack-size zip lock bags with varying amounts of vinegar. For example, fill one bag with 60 mL (1/4 cup) of vinegar, the next bag with 80 mL (1/3 cup) of vinegar, and the last bag with 120 mL (1/2 cup) of vinegar.
3. Seal the vinegar bags and leave as much air as you can in the bag with vinegar. Place them inside the bags with the baking soda. When you seal the outside bags, make sure to remove as much of the air as possible.
4. Put the bags on a table where it's okay for things to get a little wet and messy (outside tables would be good).
5. Now get ready for the fun… The goal is to break open the smaller bag filled with vinegar in order for it to mix with the baking soda. One way to bust open the bag is to smack your fist down on the vinegar bags inside the baking soda bags to break them open. Immediately shake the bags to make sure the substances mix.
6. Stand back.
7. Make observations about how large each bag gets and how long it takes before you hear the giant Pop!

How does it work?

Sure, bubbling liquids and popping bags are fun, but what's the science behind the exploding sandwich bag? When you mix vinegar and baking soda, a chemical reaction takes place producing a gas called carbon dioxide.
The reaction that happens from mixing vinegar and baking soda is caused by the chemical reaction between the acetic acid (CH3COOH) in vinegar and the sodium bicarbonate (NaHCO3) in baking soda. This reaction forms sodium acetate (NaCH3COO), water (H2O), and carbon dioxide (CO2). The bag puffs up because the CO2 takes up lots of space, eventually filling the bag. If there's more gas than the bag can hold… KABOOM! If you're lucky, the zip lock seal will bust open, but the bag will not break. Now you can reuse the bag to make another CO2 sandwich. Separating the substances in bags is a clever way of slowing down the reaction.

Additional tips and pictures are at the following link!
https://www.stevespanglerscience.com/lab/experiments/puff-pop-how-to-make-a-co2-sandwich/

Rainbow Bubble Snakes - Surface Tension, Hydrogen, Oxygen, & Atoms… Oh My!

Materials

- Empty water bottle
- A sock that is missing its match
- Colorful Duct tape or a rubber band
- 2-3 tbsp. dawn Dish soap or glycerin (glycerin makes stronger bubbles)
- Food coloring
- 8 oz. water

Instructions

1. Start by cutting the bottom of the water bottle off.
2. Next slide the sock over the bottom of the bottle.
3. Use duct tape to secure the sock.
4. Pour some dish soap into a shallow container and mix with a little bit of water.
5. Dip the sock into the soap mixture.
6. Have the camper add food coloring directly to the sock. Use one or more colors.
7. Have your camper blow into the bottle opening to see the bubble snake form.

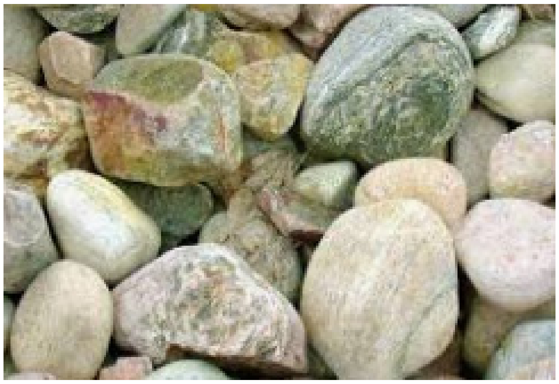
Experiment and photo courtesy of: http://www.housingaforest.com/rainbow-bubble-snakes/

How does this work?

Bubbles form because of the surface tension of water. Hydrogen atoms in one water molecule are attracted to oxygen atoms in other water molecules. They like each other so much, they cling together. So why are bubbles round? The physicists will tell you that bubbles enclose the maximum volume of air in the minimum amount of bubble solution which is why they are always round.

When you blow air through your Bubble Snake maker, you are creating hundreds of tiny bubbles. As the air wiggles through the fabric, bubbles are continuously being made. The bubbles attach to each other when they come out of the fabric. It's all thanks to the same hydrogen bonds that make bubbles possible!

The science behind bubble snakes courtesy of Steve Spangler Science: https://www.stevespanglerscience.com/lab/experiments/bubble-snakes/



Preparation

Visit the following website before you do these experiments:
https://www.rocksforkids.com/RFK/identification.html#Hardness
Share the information about Mohs scale of hardness, different types of rocks, and minerals. There is a wealth of information you can arm yourself with to share with the campers! Add your own activities to the investigations to make this more in depth. Super cool!

Materials needed for rock investigation #1

- A collection of rocks and minerals (campers provide 10-15 rocks)
- A magnifying glass
- Black and white construction paper

Instructions for rock investigation #1

1. Place white and black paper on table.
2. Form a hypothesis as to which rocks will leave a mark.
3. Separate rocks into two containers based on which rocks leave a mark on the paper when you scratch it on the paper (test both black and white paper).
4. Document your findings.

Materials needed for rock investigation #2

- A collection of rocks and minerals (campers provide 10-15 rocks)
- A magnifying glass
- Nails of various sizes

Instructions for rock investigation #2

1. For this experiment, use a nail to attempt to make a mark on the rock.
2. You will notice one of two things: A) the rock will scratch, leaving a line, a crack, or dust OR B) the nail will rub off on the rock leaving a silver mark on the rock.
3. If you see a scratch, a line, or dust, this means that your NAIL is HARDER than your ROCK.
4. If you see a silver line on your rock, this means that your ROCK is HARDER than your NAIL.

This incredible activity brought to you by:
https://lemonlimeadventures.com/rocks-minerals-scratch-test/
AND
https://www.rocksforkids.com/RFK/identification.html#Hardness

Solar Oven S'mores - Solar Energy

Materials

- Large pizza box (in pretty good shape)
- 2 Clear page protectors
- Black construction paper
- Duct tape
- Wide, clear packing tape
- Box knife
- Scissors
- Thermometer (optional)
- 12" (30 cm) Wooden food skewer
- Glue stick (Elmer's Glue® works, too.)
- Aluminum foil (wide, heavy duty if possible)
- Ruler
- Pen or pencil

Preparation

Watch this video to see how this experiment is done:
https://youtu.be/xZJmz_tF4NU
The following instructions plus step-by-step photos of this experiment can be found on:
https://www.stevespanglerscience.com/lab/experiments/solar-oven/

Instructions

1. On the outside of the lid of the pizza box, measure and draw a square that's about 2′′ (5 cm) from the four edges of the box. Cut along the front and two sides of the square using a box cutter or scissors. Don't cut along the hinge side, but you may need to score the cardboard slightly along the hinge side. The square becomes a flap that lifts up on the hinge side in place of the lid.
2. Measure and cut a piece of aluminum foil large enough to line the entire bottom and two sides of the pizza box. Be sure to use the foil with the shiny side out. You may need to join two narrower pieces to do this. Fold them together along an edge and press the seam between them flat and tight against the table.
3. Apply glue to the bottom and two sides of the box and lay the foil piece on it. Smooth and press the foil onto the glue.
4. Measure and cut a piece of aluminum foil large enough to cover the inside surface of the flap you cut into the lid in Step 1. Cover this inside surface with glue then smooth and press the foil onto it, shiny side out.
5. Measure and cut a piece of black construction paper that's 1-2′′ (2-5 cm) smaller along each edge than the bottom of the pizza box. You may need to use more than one piece of paper if the box was for a large pizza.
6. Center the black paper on the foil bottom of the box. Hold it in place using the clear, wide packing tape around the edges of the paper. Tape it directly to the foil.
7. Grab both page protectors and carefully pull the thin sheets apart along the short, bottom edge of each sheet. Lay out both rectangles and tape two long edges together to make a single large piece of plastic.

8. Tape your plastic creation to the inside of the box lid so it's smooth and tight. DON'T tape it to the flap you cut out; tape it inside the lid. The flap should still move freely and the plastic should cover the flap's opening from underneath the lid.
9. Use the sharp end of the skewer to poke two small dents about 2" (5 cm) apart into one side of the lid. Make them about .5" (1 cm) from the flap and about halfway along the flap. Don't poke all the way through. You'll use these dents as a way to prop the flap open during cooking. See Step 12.
10. Wrap a 5" (13 cm) piece of sticky tape around the skewer near its flat end. Do it in such a way that the tape crosses itself on the stick. The skewer and tape make the letter "T". This will be the "kickstand" you use to prop open the flap.
11. Use the sticky tape on the skewer to attach the skewer to the side of flap that has the dents in the lid you made in Step 9. The pointy end of the skewer goes toward the hinge of the flap. The top half of the tape goes over the flap and the bottom half goes under the flap.
12. You're almost ready to cook! Open the lid and load your oven with a few s'mores. For this recipe, use one graham cracker as a "pan" to hold the chocolate and the marshmallow. (Put the top cracker on when you're ready to eat it.) Keep the s'mores kind of spread out on the black paper in your oven.
13. Before you close it up for cooking, you might want to tape a thermometer near the black paper inside the box. Put it in a spot that you can see through the plastic liner so you can keep track of the temperature inside your solar oven.
14. When you're ready, go out into the midday sunshine, set up in a spot that will have full sun for a long time, and open the flap. Adjust the flap to reflect as much heat as possible into the oven. You'll have to leave it for a while but check on it every so often so you can keep it pointed toward the oven in the sky. Your treats will be ready soon!

How does this work?

The "Solar Oven" you made is more correctly known as a solar cooker. A true oven can reach temperatures far above the heat trapped inside a pizza box. Your cooker works on the principle of collecting heat energy and retaining or directing it for cooking. To make the process work, you cover as much of the interior of the box as possible (including the flap) with reflective material in order to direct as much heat as possible into the center of the cooker. In this case, you use the shiny side of aluminum foil. It's important to adjust the flap and the position of the box to grab all the heat you can as the sun moves across the sky. The actual "cooking" surface is black construction paper because black retains heat very well. As heat is retained, the air inside the oven also heats up and the plastic helps hold it in the small space. You load in your treats and the next thing you know, you're eating delicious, melted-by-the-Sun s'mores!

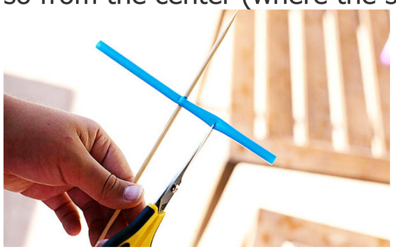
Straw Sprinkler - Centrifugal Force

Materials

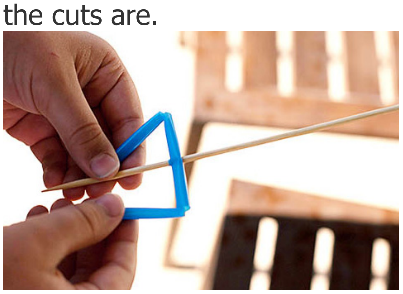
- 16 oz. plastic cup
- Straw
- Scissors
- Wooden skewer
- Water
- Tape

Instructions

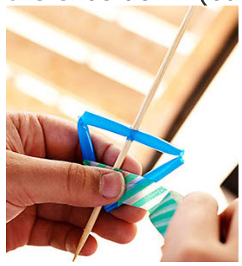
1. Poke the skewer through the center of the straw.
2. Snip the straw 3/4 of the way down an inch or so from the center (where the skewer is).



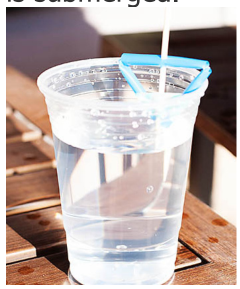
3. Repeat on the other side and fold down where the cuts are.



4. Tape around the base of the triangle to keep the ends down (but don't cover the holes).



5. When you're ready, place the sprinkler in a cup or bowl of water so the bottom of your triangle is submerged.



6. Twist the top of the skewer and water will be pulled up the straws and out the sides you cut!

How does this work?

When you spin the straw, it forces the water inside to spin. When an object is spinning anything on that object will feel a force pushing it outward. This is called centrifugal force. The water in your straw is pushed outward and the only way it can move outward is to move up the straw. If you spin the straw fast enough, the water will fly out like a sprinkler. Many pumps use the same principle. It is a very simple pump to build, so it is used in machines such as washing machines and vacuums.

This incredible experiment was courtesy of:
https://allfortheboys.com/diy-centrifuge-sprinkler/

Teacher Resources

Certificates

https://www.123certificates.com/science.php
Example certificates are attached. You can print the PDF version for a clean copy, or you can go to the website above which is where the included certificates were created.

Name Badges

Printable name badges have been included for your campers. It is recommended to laminate them and put them on a lanyard.

Young Scientist Welcome Bag

The components of the bag are on the "Hello Teacher" page. Please take a look at what should be in each bag. It's meant to be a welcome bag, but at the forefront, it has safety in mind and includes personal protective equipment for doing experiments.

Young Scientist Journal

This is to be used for every experiment campers do. This is where they can record their hypothesis, document the outcome of the experiment, or make notes about different attempts they have made to modify the variable. This is also a component of the welcome bag.

Steve Spangler Website

https://www.stevespanglerscience.com/lab/experiment-library/
You can find so many experiments to do with your campers or your school age children year-round on this site. It's nothing short of incredible! There are hundreds of cool experiments that each come with a video and detailed instructions.

Pinterest

www.pinterest.com
Search "Steam Activities or STEM Activities" There are so many fun activities to find, especially for summer for your campers! If you are looking for something to do, check Pinterest for S.T.E.A.M. and STEM activities!

Certificate of Achievement

has earned this certificate for

Completing the Mad Scientist Camp

Future Scientist!

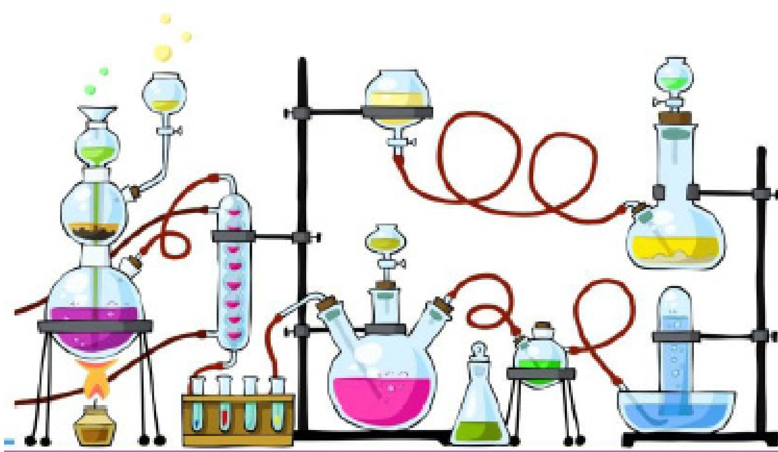
teacher's name

date

Certificate of Achievement

has earned this certificate for

Scientific Chemical Reactions



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Certificate of Achievement

has earned this certificate for

Completing Weather Science Camp

Keep up the great work!

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Certificate of Achievement

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Completing Energy Science Week

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Certificate of Achievement

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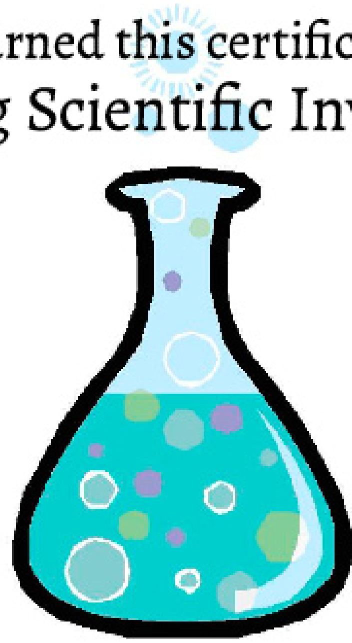
Completing Scientific Invention Camp



Keep up the great work!

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Certificate of Achievement

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Completing Cool Science Experiment Week

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Certificate of Achievement

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Becoming a Young Scientist!

You conquered Biology, Chemistry, Engineering, Physics, Meteorology, Geology & Invention Experiments!

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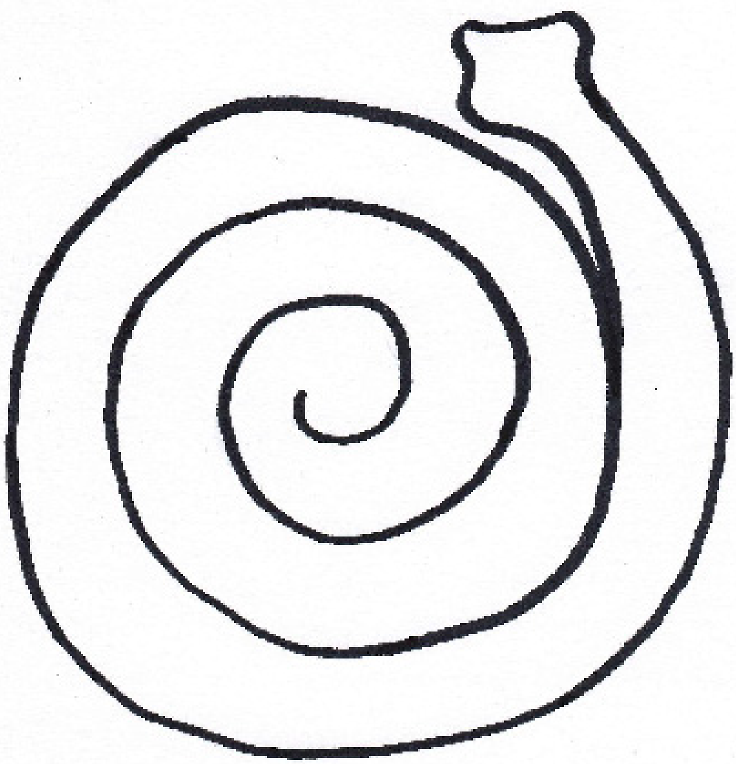
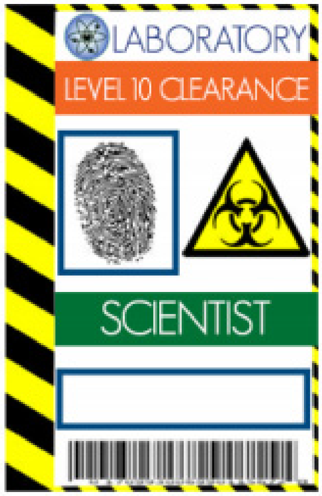
teacher's name

date

To be used with the Gravity Defying Snake activity.

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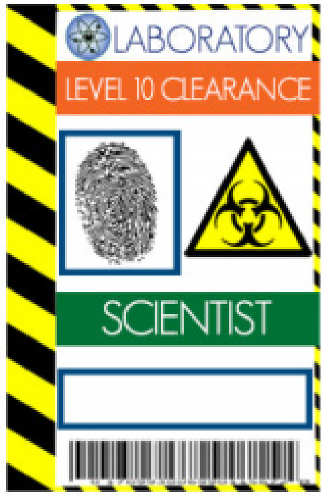
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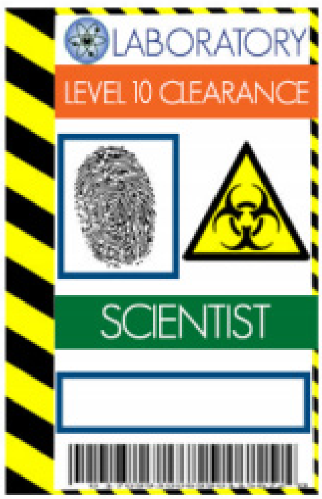
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