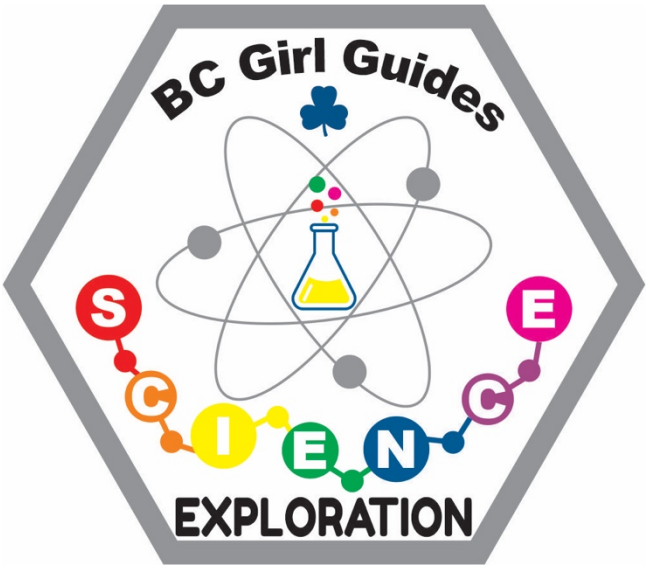
Science Exploration Challenge 2025

BC Program Committee



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Welcome

Welcome to BC Council's **Science Exploration Challenge**. The objective for this challenge is to have fun experimenting with different science concepts. Youth can work individually, in pairs or in teams for these activities. These activities can be done at unit meetings or at camps.

Challenge Activities:

To earn the Science Exploration Challenge crest, you need to complete a specific number of activities, depending on your branch of Guiding.

Sparks: Complete 3 activities.

Embers: Complete 4 activities.

Guides: Complete 5 activities.

Pathfinders and Rangers: Complete 6 activities.

Girls First

We suggest the following Girls First Areas and Themes to match the challenge content. You may find other program matches for this challenge. Feel free to assign the activities as you see fit.

Experiment & Create: Art Studio, Design Space, and Science Lab

Gumdrop Structures (S, E, G, P, R)

Materials: multi-coloured gumdrops, toothpicks

Instructions:

1. Divide into teams of 3s or 4s.

2. Use gumdrops to connect the toothpicks.

3. Consider different shapes that you can build using the gumdrops and toothpicks: Squares, triangles, rectangles, prisms, etc. Which shape will create the strongest and most stable structure?

4. Complete the following challenges:
   -Build the tallest rectangular prism.
   -Build the biggest pyramid.
   -Build a structure that can hold the most weight.

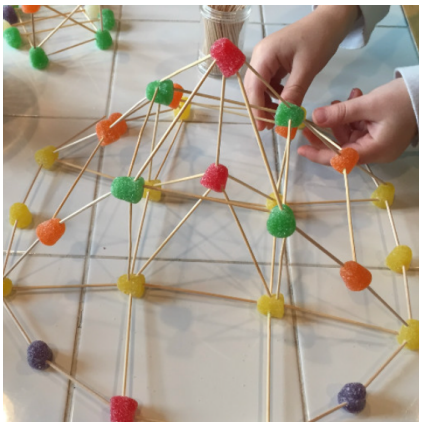

Photo Credit: https://designinplay.com/2015/12/07/gumdrop-engineering/

Science Explanation:

When building a tower, it is important to have a wide stable base. Tall, lean towers can easily fall over. Triangles will provide the strongest support because the angles that form between the toothpicks remain fixed. A square can be stronger if you insert a diagonal beam across the two opposite corners of the square. This will form triangles as braces.

Marshmallow Structure (S, E, G, P, R)

Materials: multi-coloured mini-marshmallows, toothpicks

Instructions:

1. Divide into teams of 3's or 4's.

2. The goal is to build a house out of marshmallows that can support the weight of a paperback book. Guiders should choose a suitable book and show it at the start of the activity so that youth know what they need to work with.

3. Try to create a strong and stable structure. Consider the following: different shaped bases for strength and stability; style of the house; need for a roof.

4. When you are done building your house, test out your house with the book. How does it do with supporting the book? Do you need to make adjustments to your marshmallow house to make it more stable or stronger?

Parachute (S, E, G, P, R)

Materials: two plastic bags, scissors, string, tape, object for weight (e.g,. action figure, washer, small stuffie, etc.)

Instructions:

1. Divide into pairs for this activity.

2. Make a parachute that falls to the ground as slowly as possible. It will be released at a height of 2 metres above the ground.

3. Cut the plastic bag into any shape you wish (e.g., square, rectangle, circle, hexagon, octagon, etc.).

4. Attach the string to the plastic canopy either by using tape or by punching holes in the canopy and tying knots.

5. Attach the weight (e,g., action figure, washer) to the other ends of the strings.

6. Have a leader stand on a table or a ladder and drop the parachute to test if it can fall straight and slowly to the ground.

Science Explanation:

Parachutes with the largest surface area will have more air resistance and therefore fall more slowly. If the parachute can create sufficient drag (air resistance) to slow down the descent, it will provide the most stable descent.

Paper Airplanes (S, E, G, P, R)

Materials: sheets of paper, scissors, glue or tape, markers

Instructions:

1. Divide into pairs for this activity.

2. Use paper to fold some different paper airplanes. Consider some different designs (e.g., dart airplane, sea glider, hunting flight, trapezium airplane, heavy nose airplane, paper helicopter) for paper airplanes and adding some features (e.g., rudders, winglets, elevators, ailerons, etc.).

   Paper Airplane Folding Instructions: https://www.foldnfly.com/36.html#Canard

3. Complete the following challenges:
   -Build a paper airplane that can fly the farthest.
   -Build a paper airplane that can do spins, loops, and spirals.

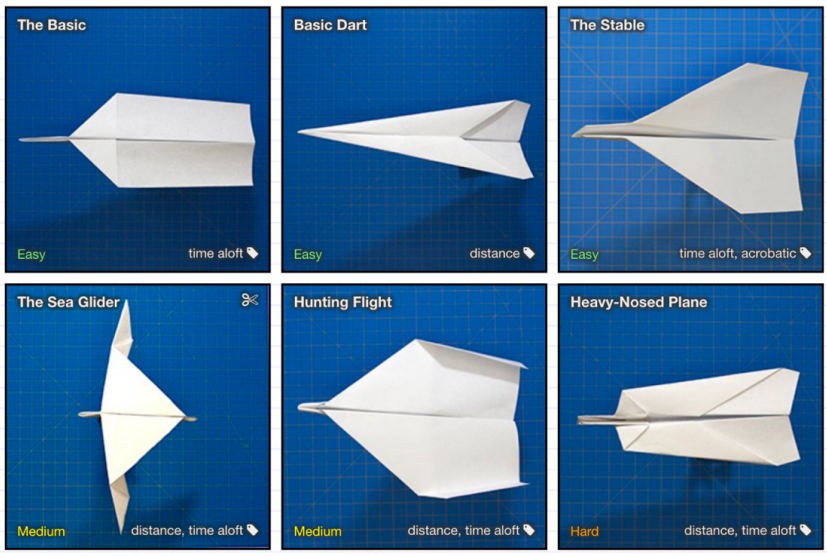

Photo Credit: https://boingboing.net/2018/10/19/paper-airplane-designs.html

Science Explanation:

There are four forces that act on a paper airplane: drag, gravity, thrust, and lift. **Drag** is the resistant force that opposes movement through the air. If you want a plane to fly a greater distance, you want it to have less drag. **Gravity** is the force that pulls the airplane towards the ground. You want your airplane to be as light as possible to stay up in the air. **Thrust** is the force that moves the airplane forward. This comes from the initial launch of the plane when you throw it into the air. **Lift** is a result of the air below the airplane wing pushing up harder than the air above it is pushing down it. You want a balance between drag, gravity, thrust, and lift.

Aluminum Barge (S, E, G, P, R)

Materials: sheets of aluminum foil (10 cm x 20 cm), scissors, tape, dimes, water, large tub (at least 30 cm in diameter)

Instructions:

1. Divide into pairs for this activity.

2. Fold the aluminum foil sheet into the shape of a boat using the materials Provided (e.g., aluminum, foil, tape, scissors).

3. Fill a tub with water. The water should be at least 10 cm in depth.

4. When the boat is complete, place it gently onto the water. Slowly place the dimes into the boat and count how many dimes are placed in the boat before it boat sinks.

Science Explanation:

The key to holding the most dimes is to build a boat with the largest surface area. This will help spread out the weight better over the entire boat.

Pringles Chips (G, P, R)

Materials: one can of Pringles Chips per group

Instructions:

1. Stack the Pringles chips so that they form a ring. Try to use only unbroken chips so that the ring is as strong as possible.

Photo Credit: https://dfgardner.weebly.com/home/stem-activity-lets-make-a-pringles-ring

Science Explanation:

As the chips are added to the sides of the ring and it gets taller, gravity will push down on the chips. The key to not having the chips slide is to make sure there is enough friction on the sides of the ring.

Mixing Candy Colours (S, E, G, P, R)

Materials: a package of Skittles or Gobstoppers candy, ceramic plate or pie plate, water

Instructions:

1. Open up a package of Skittles or Gobstoppers. Separate and group the same colour candies together.

2. Place each cluster of candies around the outer edge of the plate. Make sure clusters are equal distance from each another.

3. Add enough water to cover the bottom half of the candies. You can vary this experiment by using different liquids: room temperature water, salt water, juice, milk, olive oil, etc.

4. Let the candy sit in the water and observe what happens. How long does it take? What do you observe happening?

Photo Credit: https://childhoodmagic.com/skittles-experiment/

Science Explanation:

When water is added to the plate, this causes the colour on the candies to run. The different colours do not mix, but instead just stop and form a clear barrier. If you agitate the plate or create movement, the colours will start to mix.

Straw Cartesian Diver (S, E, G, P, R)

Materials: 1 L plastic pop bottle, paper clips, bendy straw, scissors, water

Instructions:

1. Fold a bendy straw until it forms a U shape. Use a pair of scissors to cut the bendy straw so that it is about 2-3 cm in length. The longer the straw, the harder it is to squeeze.

2. Push a paperclip through the two open ends of the bendy straw so it holds the two ends of the straw together.

3. Now hook two to three more paperclips on the original paper clip to add some mass to the Cartesian diver.

4. Fill a pop bottle to the top with water so that no air is left in it.

5. Place the paperclip-straw Cartesian diver into the pop bottle and screw the lid back on top.

6. Now squeeze the bottle from the outside. Observe what happens to the Cartesian diver.

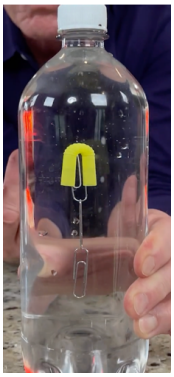

Photo Credit: https://stevespangler.com/experiments/straw-cartesian-diver/

Science Explanation:

When you squeeze the bottle, the air in the straw compresses and the water goes into it, which causes the Cartesian diver to sink to the bottom. When you release the bottle, the air in the straw is no longer compressed, the Cartesian diver floats and rises to the top.

Homemade Fire Extinguisher (S, E, G, P, R)

Materials: vinegar, baking soda, lighter, tealight candles, paper towels, clear plastic pitcher, cookie sheet

Instructions:

1. Place the clear plastic pitcher on a cookie sheet.

2. Add 2 tablespoons of baking soda to the pitcher.

3. Pour some vinegar into the pitcher with the baking soda. The baking soda and vinegar will react and foam will appear. Wait until the foam settles down.

4. Use a lighter to light all the tealight candles.

5. Now hold the pitcher above each flame on the tea light candles. Pretend you are pouring the “gas” from the pitcher onto the flame. Be careful not to pour out the liquid portion in the pitcher. Watch what happens to the flame on the candles.

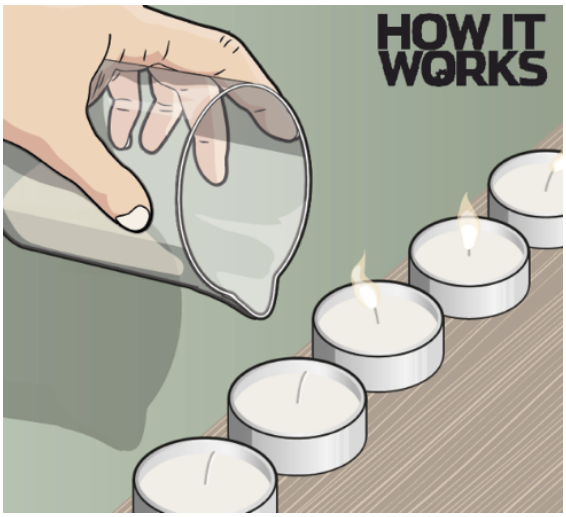

Photo Credit: https://www.howitworksdaily.com/how-to-put-out-a-candle-with-co2/

Science Explanation:

When baking soda reacts with vinegar, **carbon dioxide gas** and water are produced. The bubbles that you see foaming in the pitcher is carbon dioxide. When you tilt the pitcher, carbon dioxide gas moves onto the flame of the tealight candle and therefore air cannot get to the flame. Due to the lack of **oxygen gas**, the flame goes out. The flame requires oxygen to burn.

Leakproof Bag (S, E, G, P, R)

Materials: large Ziploc bag, water, 6 sharpened pencils, paper towel

Instructions:

1. Sharpen all the pencils.

2. Fill the Ziploc bag with water until it is half full. Close the seal to the bag.

3. Hold the top of the bag with one hand. Take a pencil in your other hand. Slowly push the pencil right through one side of the bag and halfway out the other side. Observe what happens. NOTE: Do not push the pencil all the way through the holes, otherwise, water will start leaking out of the bag.

4. Continue to spear the bag with more pencils.

5. When it is time for cleanup, hold the bag over a sink and slowly remove the pencils from the bag. Dispose of the Ziploc bag in the garbage.

Photo Credit: https://funlearningforkids.com/leak-proof-bag-science-experiment-kids/

Science Explanation:

The Ziploc bag is made up of a **polymer** called **low-density polyethylene**. A polymer is a long molecule made up of repeating units, so these substances are often quite strong and elastic. The sharp tip of the pencil can push apart the flexible strands of the polymer yet also form a temporary seal against the edge of the pencil to prevent the water from leaking out.

Lava Lamp (S, E, G, P, R)

Materials: clear plastic pop bottle with a cap, vegetable oil, food colouring, Alka-Seltzer tablet, water

Instructions:

1. Fill the plastic pop bottle with vegetable oil until it is ¾ full.

2. Fill the rest of the bottle with water, all the way to the top. Make sure it does not overflow.

3. Add about 8-10 drops of food colouring. The food colouring will mix with the water and not the vegetable oil.

4. Break the Alka-Seltzer tablet in half so that it is two pieces.

5. Drop one of the Alka-Seltzer tablet pieces into the bottle. Observe what happens. When the bubbling stops, add the second Alka-Seltzer tablet piece.

6. Once the bubbling has stopped, place the cap back on the top of the bottle. Tip the bottle back and forth and observe what happens.

Photo Credit: https://sciencebob.com/blobs-in-a-bottle-2/

Science Explanation:

The oil and water do not mix because water is a **polar molecule** has negative and positive ends, while vegetable oil is **non-polar**. The food colouring only mixes with water because food colouring is also polar. When the Alka Seltzer table reacts with water, it produces carbon dioxide gas, which is evident from the tiny bubbles in the bottle. The bubbles attach themselves to the coloured water and make them float to the surface. When the bubbles pop, this causes the colour blobs to sink to the bottom of the bottle.

Make a Compass (S, E, G, P, R)

Materials: sewing needle, magnet, water, cork, bowl, Sharpie marker, compass

Instructions:

1. To magnetize the sewing needle, rub the tip of the needle with the “north” pole of the magnet about 50 times.

2. Colour this end of the needle with the black Sharpie marker.

3. Now rub the other end of the sewing needle with the “south” pole of the magnet about 50 times.

4. Place the sewing needle on a piece of cork.

5. Fill a bowl half-way with water.

6. Place the cork on the water so it floats freely. The black end of the sewing needle will rotate on the water and point north. Check the direction with your compass.

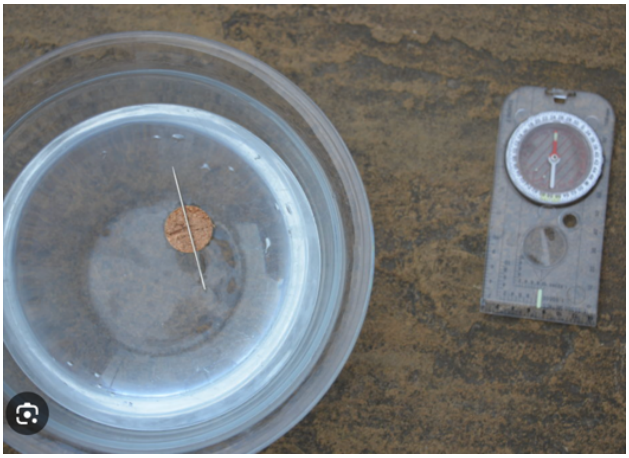

Photo Credit: https://www.science-sparks.com/make-a-compass-with-a-magnet/

Science Explanation:

When you rub the sewing needle on the magnet, this **magnetizes** the needle. When you place the magnetized needle on the water, the needle will act as a compass and point in the direction of north because of the Earth’s **magnetic field**.

Static Electricity Fun with Aluminum Balls (S, E, G, P, R)

Materials: aluminum foil, clean and empty plastic water bottle, wool, balloon

Instructions:

1. Cut small square pieces of aluminum foil.
2. Roll the aluminum foil pieces up into small balls. Make about 20 small balls.
3. Place the small aluminum balls into a clean, empty water bottle.
4. Rub a balloon with a piece of wool to charge it.
5. Bring the balloon close to the water bottle with the aluminum foil balls. Observe what the balloon does to the aluminum balls when the balloon runs along the length of the bottle. Make sure not to touch the balloon to the bottle.

Science Explanation:
Everything around us is made of atoms, which are made up of even smaller particles called protons and electrons. Protons have a positive charge, and electrons have a negative charge. If two atoms bump into each other, electrons from one atom can get rubbed off onto the other atom. A build up of positive and negative charge creates electricity. When the balloon is rubbed on your head or on a wool cloth, this causes a buildup of charges on the balloon. When the charged balloon is brought close to the water bottle, the aluminum balls start to move along the length of the bottle.

Static Electricity Fun with Balloons (S, E, G, P, R)

Materials: balloons, salt, hole punched paper pieces, pie plate, aluminum pop can

Instructions:

1. Place some salt on a pie plate. Place some paper confetti on a second pie plate.

2. Rub a balloon on your head.

3. Now bring the balloon to the pie plate with salt on it. What happens to the salt?

4. Rub the balloon on your head again. Now bring it above the pie plate with paper confetti. Observe what happens to the confetti.

5. Rub the balloon on your head once again. Now bring it close to an empty aluminum pop can without touching it. What happens to the aluminum pop can?

Science Explanation:

When the balloon is rubbed on your head or on a wool cloth, this causes a buildup of electrical charges on the balloon. When the charged balloon is brought close to the neutral salt or neutral paper confetti, the salt and confetti jump up towards the balloon because they are attracted to the balloon. When the balloon is brought close to the pop can, the pop can will move (roll) towards the balloon due to the same electrical attraction.

Making Carbon Dioxide and Oxygen (E, G, P, R)

Materials: two tall narrow plastic clear cups of the same size, measuring spoons, flat wooden stir stick/popsicle sticks, lighter, hydrogen peroxide, white vinegar, yeast, baking soda, safety glasses

Instructions:

1. Add 1 teaspoon of baking soda to each tall plastic clear cup.

2. Add 1 teaspoon of yeast to each tall plastic clear cup.

3. Shake and twirl the plastic cups so the baking soda is mixed well with the yeast.

4. To Cup #1, add some hydrogen peroxide. There will be some bubbling and fizzing.

5. To Cup #2, add some white vinegar. There will be some bubbling and fizzing.

6. Use a lighter to light the flat wooden stir stick so that there is a flame on the stick.

7. Place the burning stir stick down into Cup #2 with the vinegar. Do not submerge the stick in the liquid. Observe what happens.

8. Use a lighter to light a second flat wooden stir stick. Once the flame has burned for a while, blow out the flame so that you now have a glowing stick with no

flame.

9. Place the glowing ember stick down into Cup #1 with the yeast. Do not submerge the stick in the liquid. Observe what happens.

Science Explanation:

When you place the burning stick with the flame down Cup #2 with the vinegar, the flame goes out. This is because the flame is exposed to carbon dioxide produced from the reaction with baking soda and vinegar. The lack of oxygen makes the flame go out.

When you place the glowing ember stick down Cup #1 with the hydrogen peroxide, the stick starts to glow again with a flame. This is because of the presence of oxygen. The oxygen makes the heat source from the glowing ember more intense, leading to the flame igniting.

Racer Cups (E, G, P, R)

Materials: two disposable cups and lids, paper clip, quarter, duct tape, four rubber bands, pony bead, straw, pencil, scissors, small washer

Instructions:

1. Place a quarter in the centre of the bottom on the outside of the cup.

2. Use a pencil to trace the outline of the quarter on the bottom of the cup. Do this to both cups.

3. Use scissors to cut out the traced circles on the bottom of both cups.

4. Place the bottoms of the two cups together so the top ends face outward. Use duct tape to connect the two cups together.

5. Use a pencil to puncture a hole in the middle of the disposable lid. Make sure the hole is at least 5 mm big.

6. Connect two rubber bands together by linking the top end of one rubber band to the bottom end of the second rubber band. Make a chain of 3 to 4 rubber bands.

7. Run the rubber band chain through the middle of the cups.

8. Thread the rubber band chain through the hole of one lid. Use a paper clip to hold the rubber band in place. Now place the lid onto the cup.

9. Push the rubber band chain through the other end of the cup. Thread the rubber band through the hole in the middle of a small washer and then through a pony

bead. Twist the rubber band chain around a straw. Make sure this is done at about 2 cm from the end of the straw. Once done, place the second lid onto the second cup.

10. Wind up the racer by repeatedly spinning the straw around and around. Place the racer car on the ground and release the straw. Observe what happens.

Photo Credit: https://stevespangler.com/experiments/drag-racing-coffee-cups/

Science Explanation:

When you twist the rubber band around the straw, this creates **potential energy**. The potential energy is then stored in the rubber band. When the rubber band unwinds, this causes the potential energy to be converted to kinetic energy. The **kinetic energy** causes the racer cup to roll and move.

Flying Popsicle Sticks Chain Reaction (G, P, R)

Materials: at least 2 packages of coloured large popsicle sticks

Instructions:

1. Place two popsicle sticks on a table so they make an “X”.

2. Place the end of a 3rd popsicle stick under the end of the popsicle stick on the bottom of the “X”. The rest of the 3rd popsicle stick should be placed on top of the popsicle stick on the top of the “X”. Be sure to keep pressure on the 3rd popsicle stick. The 3rd popsicle stick should be bent over the 2nd stick and pinned under the 1st stick.

3. Place the end of a 4th popsicle stick under the end of the second popsicle stick on the bottom of the “X”. The rest of the 4th popsicle stick should be placed on top of the 3rd popsicle stick on the top of the “X”. Make sure to keep pressure on the 4th popsicle stick. The 4th popsicle stick should be bent over the 3rd stick and pinned under the 2nd stick.

4. Continue adding popsicle sticks in this manner until you have a long chain of popsicle sticks. You may need help holding the popsicle sticks down.

5. Now let go and observe the release of the potential energy. What happens?

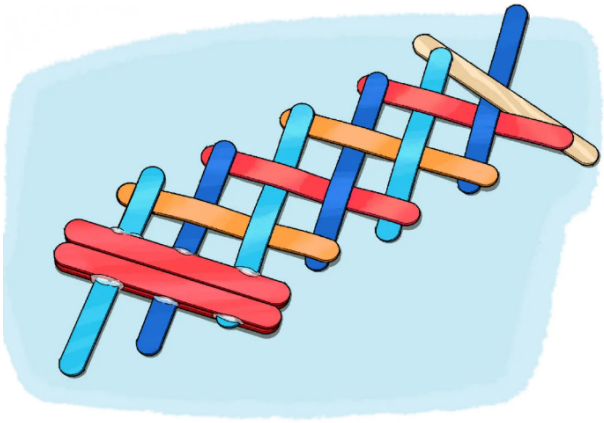

Photo Credit: https://www.scientificamerican.com/article/flying-stick-chain-reaction/

Science Explanation:

As you weave one popsicle stick over the one before it and pin it under the stick before that, you are creating tension in the wood. This is stored potential energy. When you release the popsicle sticks, the potential is converted into kinetic energy, causing all the popsicle sticks to fly up in the air.

Shrinking Plastic Art (S, E, G, P, R)

Materials: "6" plastic food containers, aluminum foil, Sharpie markers, scissors, hole punch, safety pin, parchment paper, oven mitt, countertop toaster oven or a regular oven

Instructions:

1. Go through your recycling bin and look for clear plastic food containers with the "6" inside the recycling arrows on the bottom of the container. **NOTE:** Only use this type of plastic for this activity. Wash and dry the containers so they are clean.

2. Use a pair of scissors to cut away the outer edges so that only a flat sheet of plastic remains. You can do this with the top and bottom portion of the container.

3. Use permanent Sharpie markers to draw anything you want on the plastic sheet (e.g., trefoil, campfire, flower, bugs, etc.). Draw the art image about 3 times the size you want it to actually be. This is because the plastic will shrink in the oven.

4. Use a pair of scissors to cut out the shrinky art images. Then use a hole punch to punch through the plastic piece. This will allow a place for you to insert a safety

pin later for it to be a hat craft trader.

5. Preheat the toaster oven to 350°F. Make sure that the oven rack is in the lowest position.

6. Use an aluminum foil to cover the cookie sheet. Place a piece of parchment paper on top of the aluminum foil.

7. Place all your shrinky art creations on the lined cookie sheet.

8. Place the cookie sheet with the shrinky art into the toaster oven. It will take the plastic about 1- 4 minutes to shrink. Use oven mitts to remove the cookie sheet after this time.

9. Make sure that the shrinky art is on a flat surface as it cools. Once cooled, you can then insert a safety pin through the hole in the shrinky art.

Photo Credit: https://www.wordrocks.me/2018/09/rainbow-themed-shrink-dinks.html

Science Explanation:

Clear plastic containers with the “6” indicates that it is made of **polystyrene**. When exposed to heat, the polystyrene shrinks a lot. It will start to curl and then eventually flatten itself out.

Shrinking Mini Chip Bags (S, E, G, P, R)

Materials: empty mini chip bags, hole punch, safety pin, microwave

Instructions:

1. Flatten out an empty mini chip bag.

2. Place the chip bag in the microwave oven. Cook the bag for 5 seconds on high power. **CAUTION:** Do not let it cook for more than 5 seconds. There will be some sparks due to the mylar interior picking up the heat. This is normal.

3. Allow the chip bag to cool inside the microwave. Wait 60 seconds before taking the mini chip bag out of the microwave.

Photo Credit: https://ca.pinterest.com/pin/36169603230265216/

Science Explanation:

Mini chip bags are made of a plastic exterior and a mylar interior. The two materials shrink at different rates. The plastic is made of **polymers** which are long chains of molecules. When the chip bag is exposed to the heat in the microwave, the stretched out state of the polymer converts to a bunched-up state.