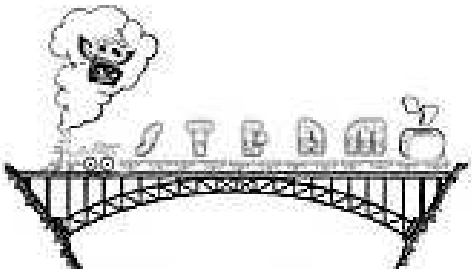
The Flying Toasters

The STEAM Class Resource Book



The Flying Toasters' compilation of interactive, educational, STEAM activities for all ages.

About the Toasters and STEAM Classes

The Flying Toasters have made it their mission to build bridges to the kids in their community. They want to ensure that they spread the message of FIRST and educate the youth on STEAM: Science, Technology, Engineering, Art, and Mathematics.

In 2015 the Toasters came up with the idea of hosting STEAM classes at their local library for students aged K-5. They held fun, interactive stations for each letter of STEAM. It was such a hit that they have continued to hold at least two classes a year at the library, and have since increased their amount of classes and locations. They have further expanded their outreach to include STEAM classes for all ages and a variety of groups from preschoolers to seniors.

This details some of the interactive stations they have used at their STEAM classes.

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Science

Elephant's Toothpaste

Ingredients:

- ❑ A plastic soda bottle/beaker
- ❑ Half of a cup of hydrogen peroxide
- ❑ 1 tablespoon of dry yeast
- ❑ 3 tablespoons of warm water
- ❑ Liquid dish soap
- ❑ Food coloring
- ❑ Small cup
- ❑ Safety goggles

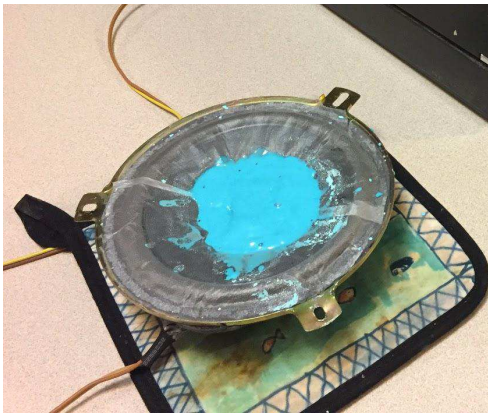
Instructions:

1. Put on safety goggles and pour hydrogen peroxide into the bottle
2. Add a few drops of food coloring into the bottle.
3. Add about a tablespoon of liquid dish soap, swish bottle to mix.
4. In a SEPARATE container mix the warm water and yeast together and stir for about 30 seconds.
5. Pour the mixture of yeast water into the bottle and stand back!
6. After it is done bubbling over, feel the sides of the cup for the exothermic reaction. The cup is warm!

How it Works!

The yeast helps separate the oxygen from the hydrogen peroxide, and since it did it rapidly, it made little bubbles. Each small bubble is filled with oxygen! It also creates heat, so this is known as an exothermic reaction.

Oobleck



Ingredients:

- ❏ 2 cups of cornstarch
- ❏ 1 cup of water
- ❏ 3 or more drops of food coloring

Instructions:

You can make your own. Put some water in a dixie cup (strong enough to stir) and use a popsicle stick to stir it. Add in a bit of cornstarch and mix it slowly until you get the right consistency and then pick a color. You will know it is right when you can "poke" it with your stick and it is solid; if not, slowly stir the liquid. When doing this in a class, the kids can take it home; have them put the whole cup and stick in a plastic bag.

Additional activity: get a speaker covered with plastic and put some oobleck on it. Use a sound generator (on a cell phone from a "sound generator" website or app) and watch the Oobleck "dance". The vibrations from the speaker are the quick motion needed to make the oobleck a solid. When you stop it, it instantly turns back into a liquid.

How it works!!

Oobleck (from Dr. Seuss Book "Bartholomew and the Oobleck") is a Non-Newtonian Fluid, which means it is a liquid that acts like a solid when you put force on it.

Slime

Ingredients:

- ❑ ⅛ cup of glue
- ❑ ¼ cup of water
- ❑ ¼ cup of Borax
- ❑ Food Coloring (optional)
- ❑ 2 cups
- ❑ Stirring Stick

Instructions:

In one cup mix ¼ cups of water and ⅛ cups of glue. If you would like, add food coloring to color your slime. Add ¼ cup of borax to the glue/water solution and stir. The slime will begin to form immediately. Once the slime is too thick to stir, take out and mush with hands. The more you mush the less sticky the slime will be. This is not a clean activity, therefore you should be prepared to get dirty!

How it works!!

Polymers (long chains) in the glue called polyvinyl acetate get linked together in the presence of borax. Once this process is complete, you have one long polymer (chain).

Bouncy Ball

Ingredients:

- ❏ Two cups
- ❏ Measuring spoons
- ❏ A coffee stir stick (or something to stir the solutions)
- ❏ 2 tablespoons warm water
- ❏ 1/2 teaspoon borax (find it in the laundry detergent section of your local store)
- ❏ 1 tablespoon glue
- ❏ 1 tablespoon cornstarch
- ❏ Food coloring (optional)
- ❏ Plastic bag (for storing your ball)

Instructions:

First pour the borax and water into a cup and stir until it is dissolved (hot water works better). In another cup pour (do not stir) the glue, cornstarch, food coloring and a ½ teaspoon from the first cup. Let sit for about 15 seconds and then mix together. Once the mixture is hard to stir, scoop it out of the cup and roll it into a ball.

How it works!!

The molecules in the borax connect the polymer strings in the glue together, forming really long chains. The cornstarch helps the molecules hold their shape. The final result is your bouncy ball that will fly around the room!

Playdough

Ingredients:

- ❑ 1 cup water
- ❑ 1 tablespoon vegetable oil
- ❑ 1/2 cup salt
- ❑ 1 tablespoon cream of tartar
- ❑ Food coloring
- ❑ Saucepan
- ❑ 1 cup flour

Instructions:

1. Combine water, oil, salt, cream of tartar, and food coloring in a saucepan and heat until warm.
2. Remove from heat and add flour.
3. Stir, then knead until smooth. The cream of tartar makes this dough last 6 months or longer, so resist the temptation to omit this ingredient if you don't have it on hand.
4. Store this dough in an airtight container or a Ziploc freezer bag.

How it works!!

Like all recipes, the ingredients in the playdough mix in a chemical reaction. This reaction takes the reactants (ingredients) and combines them together into an entirely new product (playdough)! Even though you can eat a cake you bake, and you can't eat playdough, the science is the same. Chemical change occurs in all recipes that you cook. So every time you bake a cake from scratch, you're performing a science experiment!

Does Air Weigh Anything?

Ingredients:

- ❏ Balloons
- ❏ String
- ❏ Scotch tape
- ❏ Ruler (stick or clothes hanger may also be used)
- ❏ Needle or sharp pin

Instructions:

1. Cut three strings approximately 12 inches long.
2. Blow up two balloons so they are the same size. Tie a string to each balloon.
3. Tie one of the balloons to each end of the ruler tight enough so the string will not slip.
4. Tie a string loosely around the center part of the ruler so that you can slip the knot back and forth until the balloons are balanced.
5. Tape the string in place so it will not move when the balloon is deflated. Prick one of the balloons with a needle or sharp pin.
6. Watch how the ruler moves upward on the side where the balloon was deflated. If this does not happen it might be because the center string was not tight enough and moved when the balloon was deflated.
7. Try the experiment several more times to see if the experiment works consistently. This is the way real scientists do their work. They test their hypothesis several times to make sure the same thing happens consistently.

How it works!!

Air is a real substance and it has weight. That is why it weighs 14.7 pounds per square inch at sea level. What scientists mean when they give this figure is that if a column of air one square inch in size from sea level to the top of the atmosphere above Earth would weigh 14.7 pounds.

If you travel up over a mountain pass air pressure decreases as you move upward. At 18,000 feet above the Earth the air pressure is approximately 7.35 pounds per square inch or half the atmosphere at sea level.

Balloon Kabobs

Ingredients:

- ❏ Balloons
- ❏ Unscented Lotion
- ❏ Wooden Skewers

Instructions:

1. Inflate the balloon.
2. Put lotion on all parts of the skewer.
3. Carefully puncture the skewer through the thick end of the balloon (near where it is tied off) and feed it through to the other side.
4. Puncture the other side of the balloon with the skewer.
5. If you are careful, you are able to put the skewer through the balloon without popping it.

How it works!!

The secret is to use the portion of the balloon where the rubber molecules are under the least amount of stress or strain. If you could see the rubber that makes up a balloon on a microscopic level, you would see many long strands or chains of molecules. These long strands of molecules are called polymers, and the elasticity of these polymer chains causes rubber to stretch. Blowing up the balloon stretches these strands of polymer chains. This allowed for the skewer to be pushed through the balloon without it popping.

The Leak Proof Bag

Ingredients:

- ❏ Zip-up Bag
- ❏ Water
- ❏ Sharpened Pencils

Instructions:

1. Fill up a the ziplock bag halfway with water and seal it
2. Poke the sharpened pencils straight through the bag from one side to the other. If you do it carefully the pencils should go straight through and no water should leak out.
3. Add as many pencils as you want.
4. Remove the pencils over the sink.

How it works!!

Plastic bags are made out of polymers, chains of molecules that are flexible and give the bag its stretchiness. When the sharp pencil pokes through the bag, the stretchy plastic hugs around the pencil, creating a watertight seal around the pencil...and the bag doesn't leak.

Blubber Glove

Ingredients:

- ❑ Two large zipper lock bags (your hand should be able to fit inside)
- ❑ Shortening
- ❑ Spoon
- ❑ Duct tape
- ❑ Water
- ❑ Ice (crushed/cubes)
- ❑ Bucket

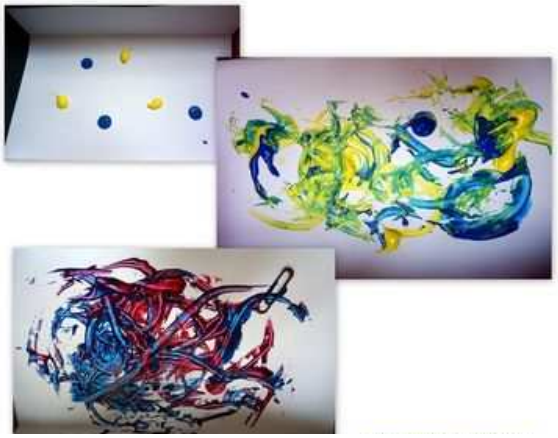
Instructions:

1. Fill a one or two gallon bucket half full with cold water and add ice.
2. Fill a zipper lock bag (make sure the bag is big enough to fit your whole hand inside) with three or four heaping spoonfuls of shortening.
3. Put your hand inside a second zipper lock bag of the same size as the first and push it into the shortening-filled zipper lock bag.
4. Spread the shortening around the zipper lock bags until the inner bag is mostly covered.
5. Fold the top of the inner zipper lock bag over the top of the outer zipper lock bag, keeping the shortening between the two. Duct tape the fold in place so that the shortening does not come out of the bag.
6. Stick your hand in the glove and dip your blubber-gloved hand into the icy water. It should remain quite warm due to the 'blubber' inside the bag.

How it works!!

Shortening is a fat, just like blubber, and is great for thermoregulation. That means fat keeps heat in and cold out. Fats work well as insulators because of their high density and low thermal conductivity relative to water. Despite being submerged in incredibly cold water, fats can maintain a constant temperature. Blubber, in particular, requires very little blood supply, allowing more blood to be circulated to skin surfaces that are more directly exposed to the frigid temperatures. Using the Blubber Glove, your hand isn't directly exposed to the water, so the fat takes the full brunt of the cold, just as blubber insulates animals in Arctic and Antarctic waters.

Magnet Painting



Ingredients:

- ❑ Paper
- ❑ Shoebox
- ❑ Paperclip
- ❑ Magnet
- ❑ Different colors of paint

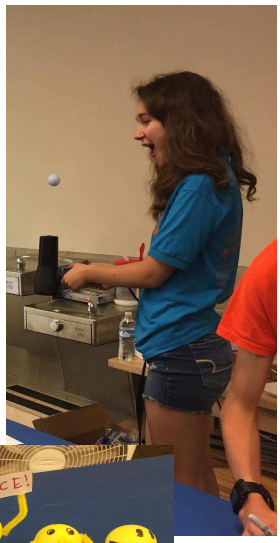
Instructions:

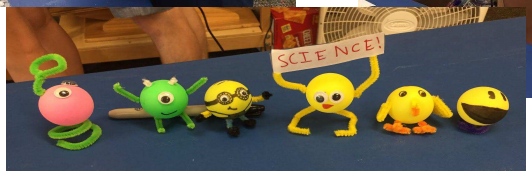
1. Place the piece of paper at the bottom of the shoebox and place a few drops of paint on the piece of paper.
2. Place the paperclip on the piece of paper.
3. Move the magnet around underneath the box, causing the paperclip to move, and watch the paint blend.

How it works!!

Because the paper clip is metal, it is magnetic so when the magnet passes underneath the shoebox, it drags the paperclip with it causing the paint to be blended on the paper.

Bernoulli's Principle Activity





Ingredients:

- ❑ Blank Paper
- ❑ Ping Pong Balls
- ❑ Bendy Straws
- ❑ Hair Dryer
- ❑ Decorations (optional: googly eyes, pipe cleaners, markers)

Instructions:

1. Blow across the top of a piece of paper. It makes the paper float up. Explain that blowing on top of a paper doesn't mean it will go down, like kids would expect.
2. Use the hairdryer to float a ping pong ball on a column of fast moving air (with low pressure).
3. Using a straw and ping pong ball, float the ping pong ball on top of the straw. Then you can decorate the ping pong ball sticky googly eyes, stickers and markers.

How it works!!

When airflow speeds up, its pressure goes down. Objects always seek out a low pressure over high pressure if they can. That is a law of nature.

Blowing on the top of the paper Demo: You are using a lot of air pressure in your stream of air on top of the paper, so the pressure on top of the paper goes down, but the air pressure underneath it stays the same so the paper is "pushed up."

Blowing through a straw on the ping pong ball/hair dryer with ping pong ball: the ball stays up because the strong column of air that you are blowing is a column of low pressure. The ball "likes" to stay in that low pressure, so it will stay in the column of air rather than escaping it and falling out of the air column.

Color Changing Milk

Ingredients:

- ❑ Milk
- ❑ Bowl
- ❑ Cotton Swabs
- ❑ Food Coloring
- ❑ Dish Soap

Instructions:

1. Pour enough milk in the dinner plate to completely cover the bottom to the depth of about 1/4 inch. Allow the milk to settle before moving on to the next step.
2. Add one drop of each of the four colors of food coloring—red, yellow, green, and blue—to the milk. Keep the drops close together in the center of the plate of milk.
3. Find a clean cotton swab for the next part of the experiment. Predict what will happen when you touch the tip of the cotton swab to the center of the milk. It's important not to stir the mix—just touch it with the tip of the cotton swab.
4. Place a drop of liquid dish soap on the other end of the cotton swab. Place the soapy end of the cotton swab back in the middle of the milk and hold it there for 10 to 15 seconds.
5. Add another drop of soap to the tip of the cotton swab and try it again. Experiment with placing the cotton swab at different places in the milk. Notice that the colors in the milk continue to move even when the cotton swab is removed.

How it works!!

The secret of the bursting colors is in the chemistry of that tiny drop of soap. Like other oils, milk fat is a nonpolar molecule and that means it doesn't dissolve in water. When soap is mixed in, however, the nonpolar (hydrophobic) portion of micelles (molecular soap structures in solution) break up and collect the non-polar fat molecules.Then the polar surface of the micelle (hydrophilic) connects to a polar water molecule with the fat held inside the soap micelle. The molecules of fat bend, roll, twist, and contort in all directions as the soap molecules race around to join up with the fat molecules. During all of this fat molecule gymnastics, the food coloring molecules are bumped and shoved everywhere, providing an easy way to observe all the invisible activity. As the soap becomes evenly mixed with the milk, the action slows down and eventually stops. This is why milk with a higher fat content produces a better explosion of color—there's just more fat to combine with all of those soap molecules.

Coke and Mentos

Ingredients:

- ❏ 2 Liter of Diet Coke®
- ❏ One pack of Mint Mentos® candy

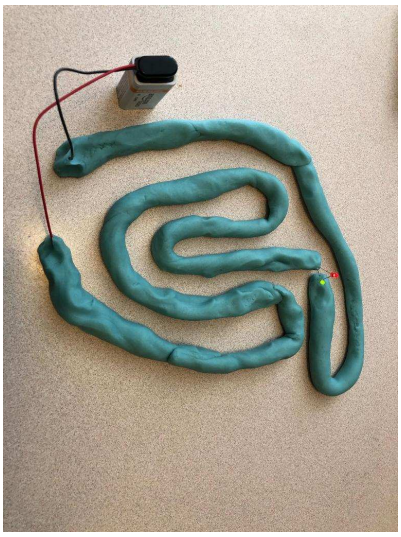
Instructions:

1. Set up a place outdoors or find a open area that is easy to clean up; this is a messy activity!
2. Unscrew the lid on the Coke bottle and stand it upright.
3. Open the package of Mentos so that the candies will more easily drop in.
4. Drop the candies in the Coke bottle, and stand back to watch! The reaction starts very quickly.

How it works!!

Coke and Mentos is a classic activity in clubs and schools to showcase science using everyday materials. The candies disrupt the chemical bonds inside the Diet Coke, and releases the carbon dioxide (this is what makes the pop fizzy), causing an exciting eruption.

Squishy Circuits



Ingredients:

- ❑ LED's
- ❑ 9 Volt battery & Battery Snap Connector
- ❑ Buzzers
- ❑ Motors
- ❑ Similar Powered Devices

Conductive Dough Recipe
(Most Commercial Dough is Conductive)

- ❑ 1½ Cup Flour
- ❑ 1 Cup Water
- ❑ ¼ Cup Salt
- ❑ 3 Tbsp. Cream of Tartar*(* 9 Tbsp. (133 mL) of Lemon Juice may be substituted)
- ❑ 1 Tbsp. Vegetable Oil
- ❑ Optional: food coloring
- ❑ (Follow instructions for playdough recipe instructions on page 7)

Insulating Dough Recipe

- ❑ 1 ½ cup flour
- ❑ ½ cup sugar
- ❑ 3 tbsp. Vegetable oil
- ❑ ½ cup deionized (or distilled) water
- ❑ (regular tap water can be used, but the resistance of the dough will be lower.)

Instructions:

1. Roll conductive dough into 2 parallel rolls ("snakes").
2. Put 1 battery contact into each of the rolls.
3. Put the longer lead wire from the LED into the log that has the positive battery lead, and the shorter lead wire into the log with the negative battery lead. Use the insulating dough between the 2 logs so they do not touch and short out the circuit.
4. Experiment making circuits on other creations that you light up with LEDs, make noises with buzzers, and spin with the motors.

How it works!!

Electricity needs a complete, unbroken circuit to flow. The conductive dough conducts electricity, which completes a circuit, while the insulating dough prevents electricity from flowing.

Big Ben

Ingredients:

- ❏ A small oven rack
- ❏ 2 lengths of string

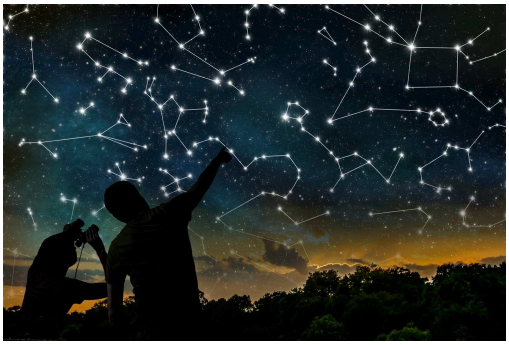
Instructions:

1. Attach a piece of string to one side of the oven rack. Attach another piece of equal length to the other side of the rack, so that it hangs evenly from both pieces of string.
2. Place the ends of the string up against your ears. Bang the oven rack against something hard: a table, for example.
3. The noise it makes sound something like a large clock tower or gong going off.

How it works!!

Try it without putting the string up to your ears, and try banging it against different surfaces. Can you hear the difference? The sound waves (vibrations) that are created are different depending on the surface. The string will direct the sound into your ears, and therefore it sounds different than when the sound waves travel without direction through the air and into your ears.

Constellation Cups



Ingredients:

- ❑ A picture of a constellation
- ❑ A paper cup
- ❑ A push pin
- ❑ A flashlight

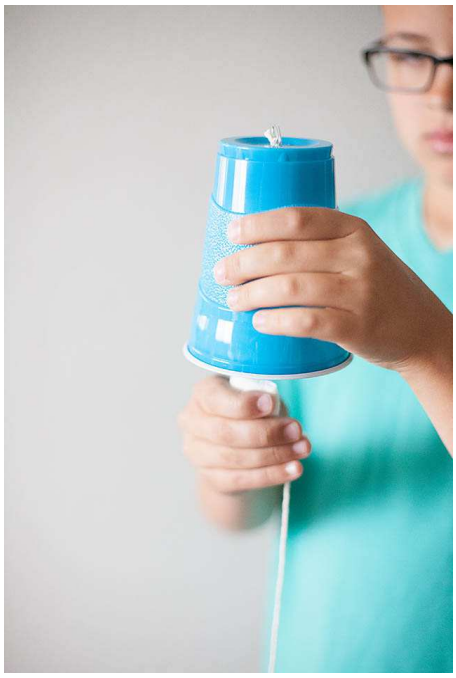
Instructions:

1. Using the picture of the constellation as a guide, draw dots on the bottom of the paper cup to represent that constellation.
2. Poke holes where the dots are.
3. Take the cup into a dark room. Put a flashlight inside the cup so that the light is directed through the holes in the bottom of the cup.
4. The constellation should appear on the ceiling!

How it works!!

The cup traps the light from the flashlight, except for where the holes are poked through. This allows you to create your own starry night sky! Try creating different or more complicated constellations. Name them, and then try to look outside at night and see if you can find them in the sky!

Turkey Call



Ingredients:

- ❑ A paper cup
- ❑ A pencil or push pin
- ❑ A string
- ❑ A paperclip

Instructions:

1. Poke a hole through the bottom of the cup with the pencil or pushpin
2. Attach one end of the string to the paperclip, and tie the other end in a knot inside the cup, so that it cannot fit through the hole.
3. Pull the string up and down through the hole quickly.
4. Try wetting the string and repeat.

How it works!!

The friction caused by the string going through the hole causes the molecules to vibrate. This vibration is expressed through sound waves, which when they reach your ear, becomes the sound you hear!

Balloon Rockets

Ingredients:

- ❑ Balloons
- ❑ A balloon pumps (using your mouth to inflate works as well)
- ❑ Straws
- ❑ Tape
- ❑ String

Instructions:

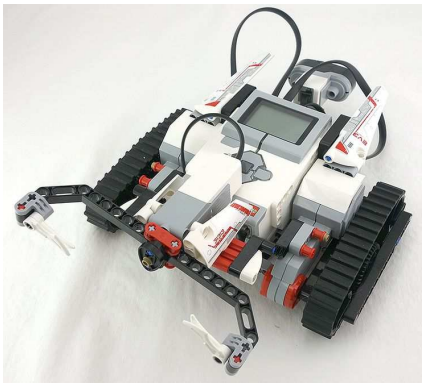
1. Attach a string from one surface to another. Thread straws onto the string so that they can slide back and forth.
2. Fill the balloon with air. Do not put too much air in; only do around 5 pumps or large breaths of air.
3. Hold the end of the balloon closed so no air escapes.
4. Tape the end of the balloon to a straw.
5. Let it go and see it fly.

How it works!!

When the air is released from the balloon, it propels it forward. The rushing of air out of the small opening is what is powering it. Think of a space rocket. The streams of fire and smoke coming out of the bottom is a form or propulsion as well, pushing the rocket up into the air.

Technology

Mindstorms



Materials:

- ❏ Lego mindstorms robots
- ❏ Controllers
- ❏ Blocks

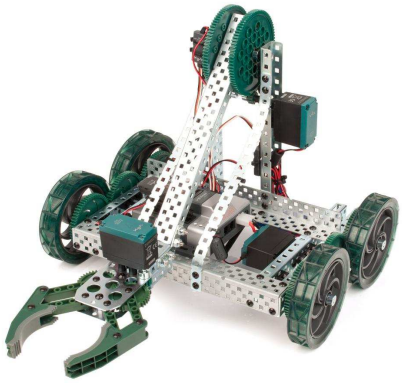
Instructions (Demonstration):

1) Set up the mindstorms with the controllers so that kids can drive them around.
2) Let kids drive around the robots with different objectives such as...
    a) Knocking over block structures
    b) Driving through block obstacle courses
3) Kids that are not driving can help build the block structures.

How it works!!

Kids love being able to drive around mindstorms robots. Because they are Lego, the robots seem approachable and something they can build. Be sure to point out parts on the robots such as motors, sensors, and the 'brain'.

Similar Robots



Materials:

- ❏ Robot (similar to FIRST regulation robots)
- ❏ Controllers
- ❏ Blocks

Instructions:

1) Set up the robot with the controllers so that kids can drive them around.
2) Let kids drive around the robots with different objectives such as...
    a) Knocking over block structures
    b) Driving through block obstacle courses
    c) Picking up various objects with a claw on the robot
3) Kids that are not driving can help build the block structures.

How it works!!

Kids love being able to drive around these robots. Be sure to point out parts on the robots such as motors, sensors, and the 'brain'. Having a robot with a claw arm really adds to the various activities and obstacle courses you can create.

Code-A-Pillar

Materials:

- ❏ Fisher Price Code-A-Pillar toy
- ❏ Hallway or open area

Instructions:

1. Set up the green start pad and the red stop pad across from each other in the hallway.
2. Tell kids that they have to connect parts to the code-a-pillar in order to get it from the green to the red pad.

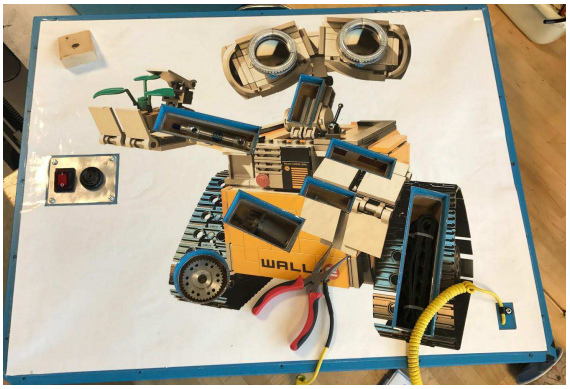
How it works!!

Each segment on the code-a-pillar gives a specific command, similar to programming. Explain to kids the parallels between the code-a-pillar and other robots such as the need for step by step instructions. Also, giving kids unlimited test runs teaches them the importance of testing and improvement as well as the design process.

Wall-E

Materials:

- ❏ Wall-E themed operation
- ❏ Various metal parts to put inside Wall-E



Instructions:

Plug in the Wall-E operation game and have kids play. Teach students about electric circuits using the game. When the buzzer sounds, explain that the circuit was connected causing electricity to flow.

How it works!!

We built a large Wall-E out of plywood, sheet metal, and various metal parts around the machine shop. Similar to the original operation game, when a player accidentally touches the metal outline of the hole with the part or with the tweezers, a buzzer sounds.

Bring your own Team Robot

Materials:

- ❏ Team robot
- ❏ Field elements from that year's game
- ❏ Plenty of robot batteries or a way to charge them

Instructions (Demonstration):

1. Set up your team robot.
    a. Robots from years that shoot nerf balls make for an easy, interactive station
        i. Stronghold
        ii. Aerial Assist
2. Show off your robot and its shooting skills by allowing kids to catch the ball from your robot.
3. Show kids the motors, sensors, and other various parts on your robot.

How it works!!

Kids love to interact with the large FRC robots and allowing them to catch a ball makes them feel like they are part of the action. Make sure that the shooter is calibrated so that it doesn't shoot the ball too fast. FTC or FLL robots also work as great demonstrations!

Coding Jam-boree

Materials:

- ❏ Peanut Butter
- ❏ Jelly
- ❏ Bread
- ❏ Plastic Knives
- ❏ Paper Plates

Instructions:

1. Set the materials next to each other on a table.
2. Tell students that they need to teach you how to make a PB&J sandwich.
3. When students give complex commands such as "open the jelly" ask for clarification on the task until it becomes simple gestures such as "raise your right hand up."
4. Try to make them break down the steps as much as possible and follow them exactly, even if it means getting a little messy.
5. Explain how this is similar to programming robots because every step must be broken down into tiny parts.

How it works!!

In this activity the facilitator becomes a robot and therefore can only follow commands like a robot would. Kids must work together and use critical thinking skills to finally make a successful sandwich while learning programming skills throughout. **Note:** If peanut allergies are an issues, you can change the task into anything else that requires multiple steps such as having the facilitator go through an obstacle course blindfolded.

Wind Tube

Ingredients:

- ❑ A Wind Tube
- ❑ String
- ❑ Coffee Filters
- ❑ Straws
- ❑ Tape

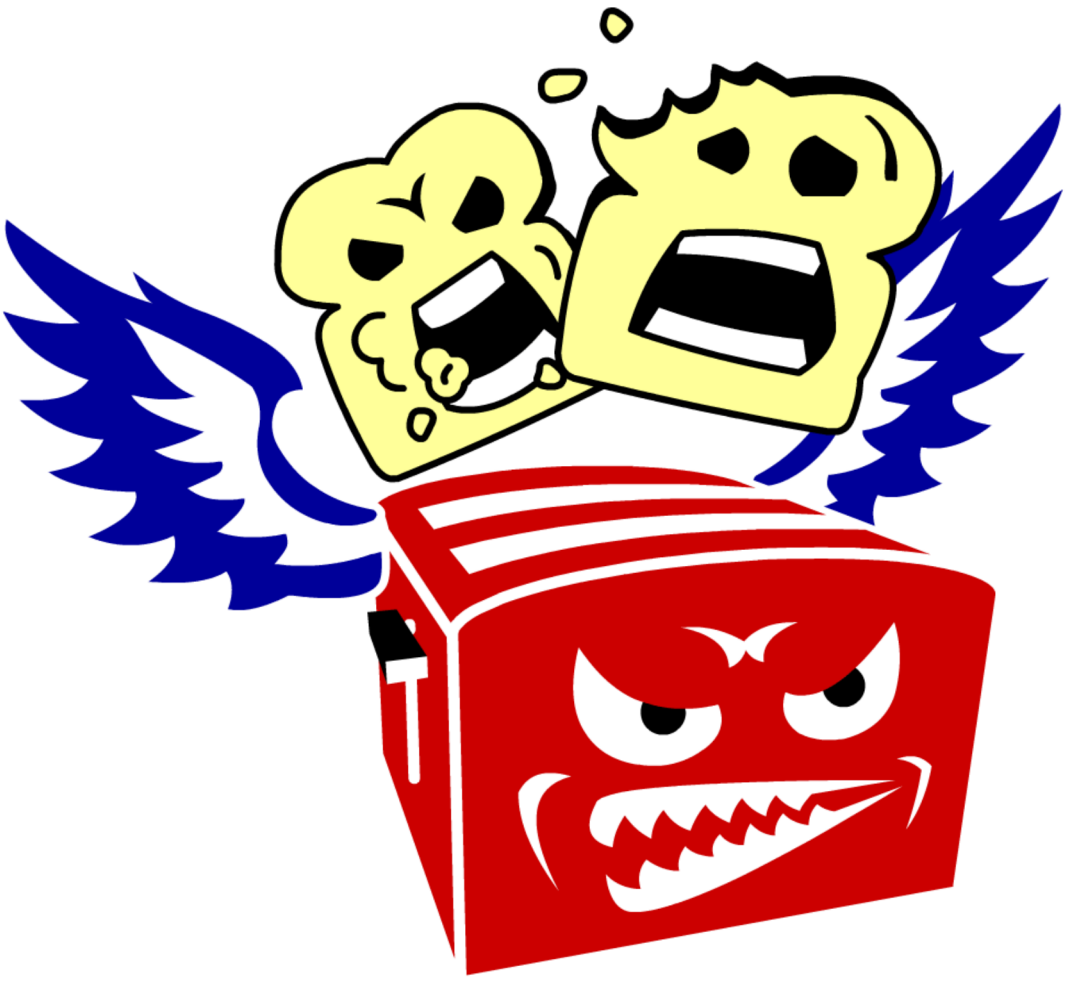
Instructions:

1. Place a coffee filter beneath the wind tube. The wind produced will push the coffee filter up the tube and out the other end.
2. Using String, Tape, Straws, and other similar materials, try to build your own parachute. The goal is to make something that will float on the air, and not get pushed out the other end of the tube.

How it works!!

The bottom of the wind tube contains a fan that pushes air up through the tube. Using coffee filters and other materials, you can create a parachute type device that will float on the wind instead of being pushed away. This depends on the weight and shape of the device that is constructed. Something that has more surface area or weight distributed evenly will have more drag, and thus resist the air pushing it out of the tube.

Engineering



Floatation Devices

Materials:

- ❏ Packing Peanuts
- ❏ Straws
- ❏ Tape
- ❏ Rubber Bands
- ❏ Plastic Wrap
- ❏ Any other floating material
- ❏ Toys
- ❏ Large Bucket or Sink
- ❏ Water

Instructions:

1. Test the toys to make sure they sink in the bucket of water
2. Build a raft or flotation device for your selected toy

How it works!!

The floating objects have a high buoyancy compared to the toy that sinks. They can help the toy stay afloat in the bucket of water.

Extension Activity:

Give them a time limit or make it a competition to see who can float the most toys on one raft.

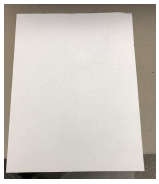
Paper Airplanes

Materials:

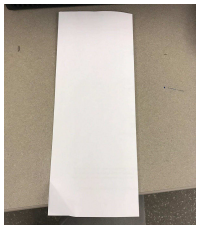
- ❑ Paper

Instructions:

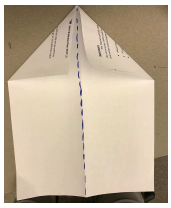
1) Take a piece of 8" x 11" printer paper:



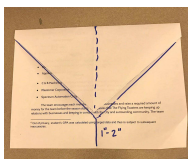
2) Fold it in half lengthwise:



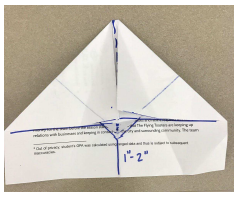
3) Unfold it so that there is a crease in the middle of the paper. Take the top two corners of your paper and fold them over so that their sides are touching the midline:



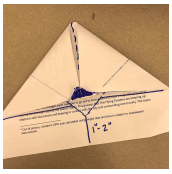
4) Fold the paper over so that the pointed top of the paper comes within one to two inches of the bottom line:



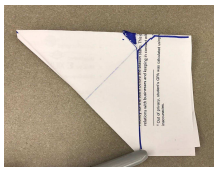
5) Take the top two corners of the paper and fold them towards the midline of the paper, similar to step three:



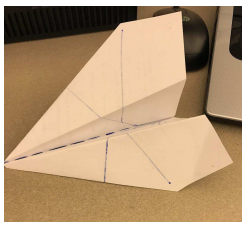
6) Fold the remaining triangle over on top of the folded over wings:



7) Fold the paper in half longwise, folding on the crease made in step two:



8) Fold each of the wings in half:

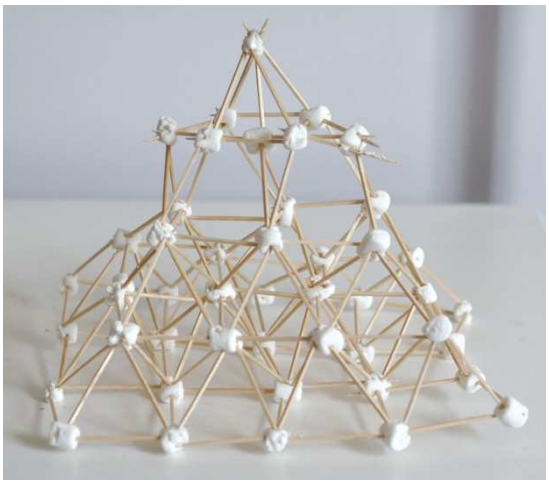


9) Decorate and fly your plane! Add tape or weights to it if needed to make it fly how you want it to.

Extension Activity:

- Take your airplane and add some tape or brads to add weight to your airplane. How does it change the flight of the airplane? Does it matter where you put your weight?

Toothpicks & Marshmallows



Materials:

- ❏ Toothpicks
- ❏ Mini Marshmallows

Instructions:

1. Stab toothpicks into the marshmallows, using the marshmallows as corners to hook the toothpicks together
2. When you attach a lot of them together you can make a variety of large structures

Extension Activity:

Use a variety of different size marshmallows or string beads onto the toothpicks before you attach them to the marshmallows to create colorful structures. You can also use uncooked spaghetti instead of toothpicks and break the spaghetti to create the ideal length for the 'beams'.

Parachutes

Materials:

- ❏ Tissue paper
- ❏ Coffee filters
- ❏ Various small action figures
- ❏ Tape
- ❏ Yarn/String

Instructions:

1. Have each student choose an action figure
2. Let them use any of the materials with the goal being to create a functional parachute to 'save' the action figure
    a. Tying string around the action figure and then taping it to a coffee filter works quite well
3. Have them test their parachutes by dropping an un-parachuted action figure alongside the 'protected' action figure with the parachute. The action figure with a functioning parachute should fall to the ground more gently.

How it works!!

The parachute creates a greater surface area therefore causing the action figure with the parachute to have greater air resistance. The greater air resistance causes the action figure with the parachute to fall to the ground at a slower rate.

Dixie Cup Towers

Materials:

- ❑ Dixie Cups

Instructions:

1. Attempt to create the tallest structure possible using only dixie cups
2. See if you can make any other cool structures

Extension Activity

Use various sizes of cups and see if you can use them to make even taller towers. See if you can create curved structures, cylindrical towers, etc.

Pool Noodle Roller Coaster

Materials:

- ❏ Pool Noodles
- ❏ Marbles
- ❏ Duct Tape

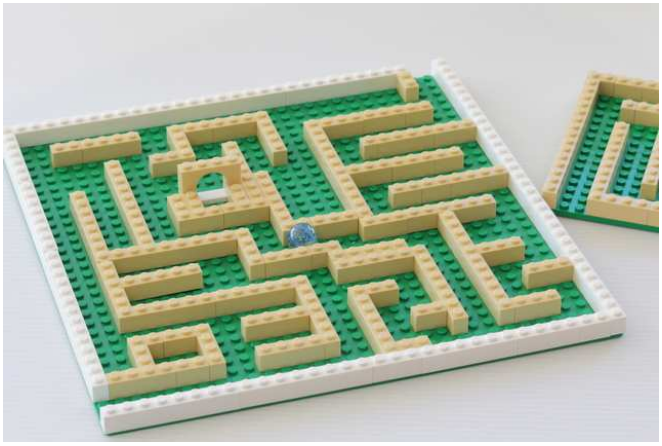
Instructions:

1. Twist the pool noodles into the desired shape and have the kids hold them there.
2. Tape the ends of the pool noodles so that the holes line up
3. Put a marble in one end and hope it comes out the other.

Extension Activity:

Cut the pool noodles in half lengthwise and get the kids to have the marble go through a loop de loop without falling out.

Lego Marble Run



Materials:

- ❏ Lego Maze
- ❏ Marbles

Instructions:

1. Build a maze out of Lego.
2. Take a marble and use it to find your way out of the maze.

Extension Activity

Experiment with the types of mazes you make. Can you make one that is really hard? Modeled after a Pac Man game? What about a flat surface (like pictured above), or one that is 3D, has different level, or is higher on one end than on the other? Don't limit yourself to a simple maze. Use all the types of Lego if you can, not just the blocks! Try using moving parts, like in a game of Mousetrap.

Art

Dropper Art

Ingredients:

- ❑ Small plastic droppers
- ❑ Paper towel
- ❑ Dixie cups or other small cups
- ❑ Food coloring
- ❑ Water

Instructions:

1) In small cup, mix ¼ of a cup of water and 3 drops of food coloring
2) Spread two layers of paper towel over a surface you don't mind getting messy (optional: do this on a baking sheet if you don't want to get food coloring on your table!)
3) Use dropper to pick up colored water and drop onto paper towel (optional: try making a picture or mixing colors!)

How it works!!

As the paper towel soaks up the liquid, the colors spread out, resulting in colors mixing and creating cool designs!

Whirligig

Ingredients:

- ❑ Empty water bottle
- ❑ Scissors
- ❑ Sharpie markers
- ❑ String or yarn

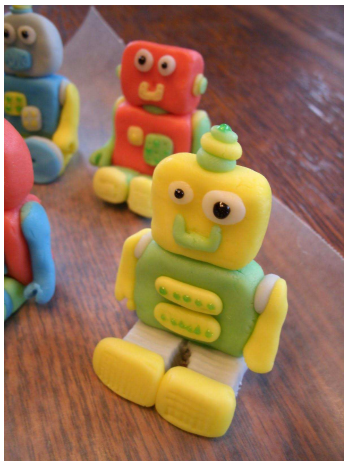
Instructions:

1) Take the wrapping and cap off a plastic water bottle.
2) Using Sharpie or other permanent markers to color the water bottle to your personal liking.
3) Cut the bottom inch of the water bottle completely off.
4) Starting at the top, by the cap, cut diagonally down the water bottle so that the water bottle resembles a coil, or stretched slinky.
5) Tie a piece of string around the cap in order to hang the whirly-gig. Attach it outside so that the wind makes it spin!

How it works!!

By cutting the water bottle into a coil-like structure, this allows it to spin in the wind. Try creating new patterns with the colors on the water bottle to see how it looks in the wind.

Playdough



Ingredients:

- ❑ Playdough or clay

Instructions:

1. Use play dough or clay to create your own unique robot or machine
2. Describe what your creation can do!

Extended Activity:

Give a task or a problem that robot or machine should do or solve and see what creation everyone came up with!

How it works!!

This activity gives everyone the opportunity to use their creativity to make their very own 3D creation.

Colored Light Mixing

Ingredients:

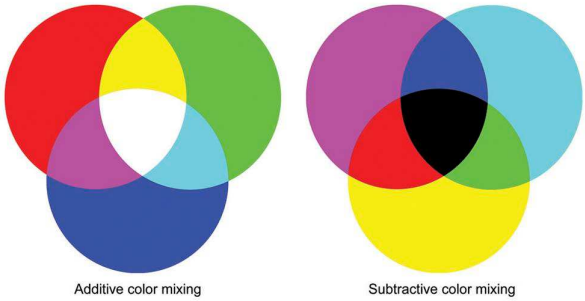
- ❏ Flashlight
- ❏ Colored lenses/filters (could be pretty much any transparent colored sheet)
- ❏ Flat surface (works best with white surface)
- ❏ Dark room

Instructions:

1. Fix one colored lense or filter over the flashlight
2. Shine onto flat surface to see what the color looks like
3. Try adding another colored lense of filter on top of the first one and shining it onto a surface to see what color you can make!

How it works!!

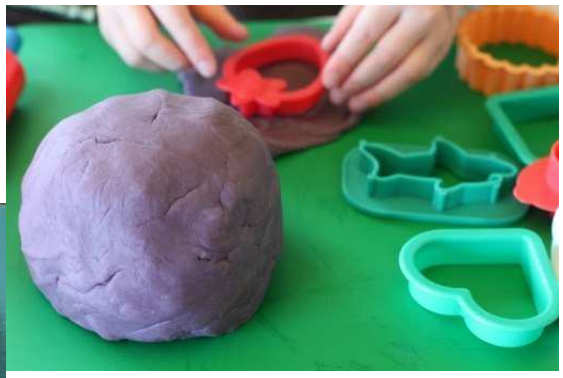
Light is actually a type of electromagnetic radiation, meaning it behaves like a wave. Each type of light (or color), has a different frequency. But just like numbers, you can add or subtract these frequencies to create new colors. For example, in additive color mixing, red + green = yellow. In subtractive color mixing (this is the type of mixing that occurs in some printers), magenta + yellow = red.



Additive color mixing

Subtractive color mixing

Machine to Make Life Easier



Ingredients:

- ❏ Playdough, clay, or crayons and paper

Instructions:

1. Tell participants they are designing a machine to make life easier
2. Draw or sculpt a machine for a few minutes
3. Have everyone describe what it does and how life will benefit from their machine

How it works!!

This activity encourages creativity in problem solving, and introduces the idea that technology can be used for more than just building fun robots.

Marble Art

Ingredients:

- ❑ Marble
- ❑ Paper
- ❑ Shoebox
- ❑ Paint

Instructions:

1. Each person gets a shoe box, a piece of paper to fit the bottom of the shoebox, and a marble.
2. Put paper flat on the bottom of the shoe box.
3. Take your marble and dip it in the paint, put it in your box with paper, and roll the marble around the box.
4. You can re dip the marble as many times as time allows, make sure to wash it off so the colors don't mix.
5. The end result should be an abstract piece of paper with streaks of paint where the marble rolled.

How it works!!

The paint sticks to the marble and comes off when you roll it around in the box. The marble makes streaks of paint that are unique to however you move the box, and removing the paper means that you can keep your creation!

Secret Messages

Ingredients:

- ❑ White paper
- ❑ Lemon juice (optional: you can also use milk!)
- ❑ Q-tip
- ❑ Small cup or bowl
- ❑ Iron

Instructions:

1) Squeeze some lemon juice into small cup or bowl
2) Dip Q-tip into lemon juice and write/draw a message on the white paper
3) Wait for the juice to dry so that the message is completely invisible
4) With help from an adult, iron the piece of paper to read the secret message!

How it works!!

Lemon juice is an organic substance that turns brown when heated. The lemon juice makes it very hard to notice when you apply it the paper, so no one will be able to see the secret message until it is heated and revealed!

Sharpie Art

Ingredients:

- ❑ Paper towel
- ❑ Sharpies
- ❑ Hydrogen peroxide
- ❑ Dropper
- ❑ Baking Sheet-optional

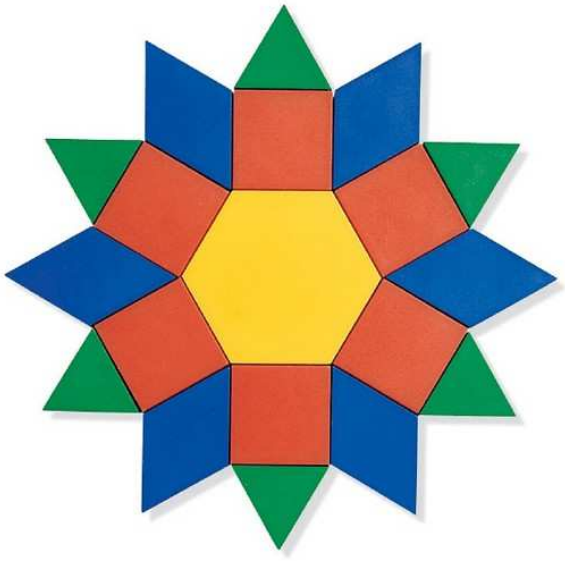
Instructions:

1. Draw on paper towel with black marker whatever design you want
2. Use dropper to drop hydrogen peroxide onto paper towel to make cool, tie dye like images (put a baking sheet under paper towel during this step if you don't want Sharpie on your table!)
3. Let paper towel dry to save creation

How it works!!

As the sharpied paper towel soaks up the hydrogen peroxide, it spreads out the dye and gives your design an interesting, new aspect.

Pattern Blocks



Ingredients:

- ❏ Pattern blocks set (optional: you can print pattern blocks out and cut them out from cardstock paper if you do not own your own set of pattern blocks!)

Instructions:

1. Put pattern blocks together to make unique art!
2. Optional: use templates online or try to make specific objects out of these basic, geometric shapes

How it works!!

Pattern blocks can teach kids about geometric shapes and how they fit together. They can also teach about repeating patterns and uses a lot of creativity.

Scrapbox

Ingredients:

- ❏ Clean recycled materials (optional: we went to the Scrap Box in Ann Arbor, Michigan, which sells recycled donations in bulk!)

Instructions:

1. Take the bits and bobs and tape/glue/staple the parts together until you have constructed your desired robot.
2. Have everyone present what their robot can do once you are finished!

How it works!!

Using recycled materials can teach kids how to be resourceful within creations. This also teaches that one man's trash can be another man's treasure, and almost anything can be reused if we use our creativity!

Mathematics

Car Racing

Ingredients

- ❑ Hot Wheels cars
- ❑ Hot Wheels car track
- ❑ Stopwatch

Instructions:

1. Hold the various Hot Wheels cars and rank them from heaviest to lightest.
2. Release the Hot Wheels cars down the track and time how long it takes for each car to make it to the bottom using the stopwatch.
3. Examine how the weight of the car relates to how fast the car went down the track.

Extensions:

Think about the shape of the track. Some are simple hills, and others have turns and curves. How does the shape of the track determine how long it takes the cars to reach the end? Does the amount of turns in a track change how fast it will going at the finish line?

Mix and Measure Volcanoes

Ingredients:

- ❑ 1 tablespoon liquid dishwashing soap
- ❑ 3 drops red food coloring
- ❑ 1 cup vinegar
- ❑ 1 ½ cups warm water
- ❑ 2 tablespoons baking soda
- ❑ Empty 25 oz plastic bottle
- ❑ Large spoon
- ❑ Funnel-optional

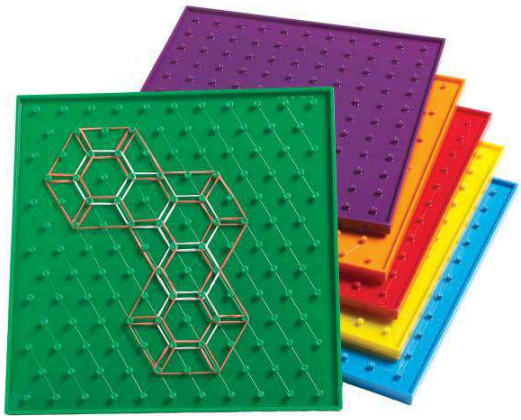
Instructions:

1. Combine the soap and food coloring in the bottle
2. Add vinegar and pour water almost to the top
3. In the large spoon combine the water and baking soda
4. Carefully pour the water/baking soda mixture into the bottle using the spoon and funnel
5. There will be a chemical reaction causing the mixture to 'erupt' out of the bottle

Math Concept

Use the measurements a an opportunity to teach kids about fractions and measurement types.

Geoboards



Ingredients:

- ❏ Rubber bands
- ❏ Geoboards

Instructions:

1. Give each student a geoboard and a variety of rubber bands
2. Have students make shapes such as triangles, squares, pentagons, and hexagons
3. Using those shapes, have students try to 'design' a robot using the rubber bands and geoboards.

Extensions:

While this may seem like a fairly simple activity, there is much you can experiment with. Try having competitions to see who can create a robot using the smallest amount of rubber bands. Or, what patterns can you create using the entire board? Can you create words? What letters and shapes are the hardest to make? Why?

Penny Boats

Ingredients:

- ❑ Aluminum foil
- ❑ Pennies
- ❑ Tub of water

Instructions:

1. Give each student a sheet of aluminum foil
2. Have the students mold the aluminum foil into a boat
3. Place the boats into the tub of water and see how many pennies can be put into the boat without sinking

Math Concept:

Have the students count the pennies as they are placed into the boat. You can also measure the bottom surface area of the boats and see how surface area relates to how many pennies the boat could hold.

Drops on Coin

Ingredients:

- ❑ Eye Droppers/Pipettes
- ❑ Water
- ❑ Pennies

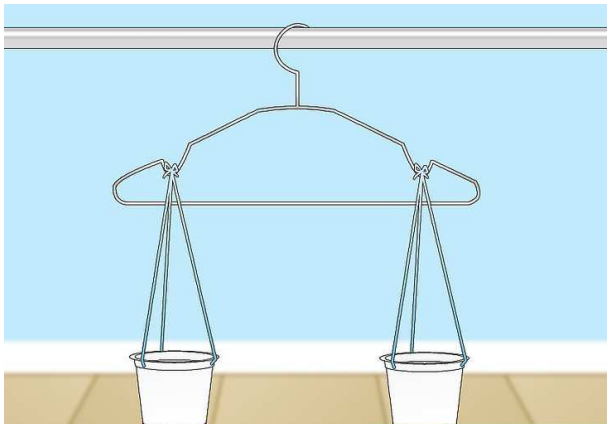
Instructions:

1. Start with a penny and an eye dropper (or pipette) with a small cup of water
2. See how many drops of water you can fit on the face of a penny using the eyedropper.
3. Optional: repeat the process to see if the results are the same every time. What might be some reasons for error/discrepancy?

Math Concept:

Count the number of drops of water. As an extension activity, have each person use a different type of coin (penny versus a dime) and see which one holds the most drops of water.

Quarter Scale



Ingredients:

- ❑ Wire clothing hanger
- ❑ String
- ❑ Dixie cups
- ❑ Duct Tape
- ❑ Quarters
- ❑ Action figures or other toys

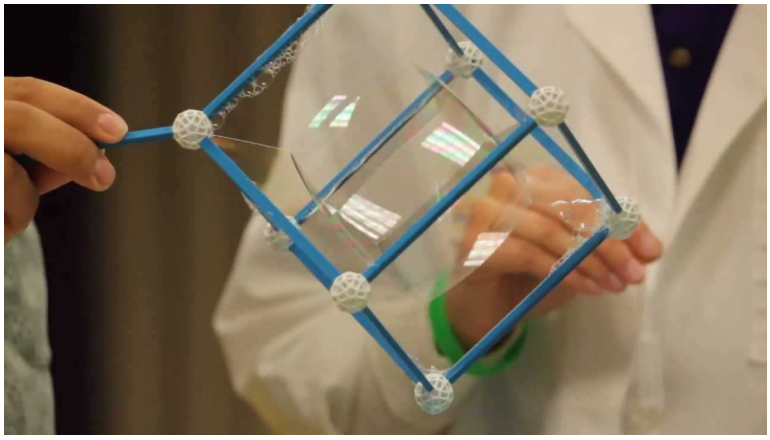
Instructions:

1. Tie dixie cups to opposite sides of a wire hanger, using duct tape where necessary, as shown in diagram above.
2. Put a toy in one of the dixie cups
3. Add quarters to the other dixie cup until the scale is balanced.

How it works!!

The hanger acts as a makeshift scale, so you can use it to figure out how much your toy weighs in quarters! Try expanding this activity by changing the type of coins you are measuring in, and see which one is heaviest and lightest. Does it match your prediction?

Bubble Cube



Ingredients:

- ❑ Straws
- ❑ Pipe Cleaners
- ❑ Bubble Solution

Instructions:

1. Cut the straws into smaller pieces and determine what shape (3D or 2D) you would like to construct.
2. Thread the pipe cleaners through the middle of the straws and connect the pieces of straws to obtain the desired shape.
3. Attach a pipe cleaner to an edge of the shape as a wand.
4. Dip the shape into the bubble solution. The 3D shapes will lend themselves to creating very interestingly shaped bubbles, such as a bubble cube or pyramid.

How it works and expansion activities:

This activity works with creating tensile structures, or structures that only carry tension between several points, and not compression, bending, etc. It is also a way to explore which shapes lend themselves better to creating structures that may be used in common architectural practices. Expand on this activity by creating your own unique shapes!

Fish for Numbers

Ingredients:

- ❑ Paper/Foam Sheets
- ❑ Magnets
- ❑ String
- ❑ Paper Clips
- ❑ Sharpie

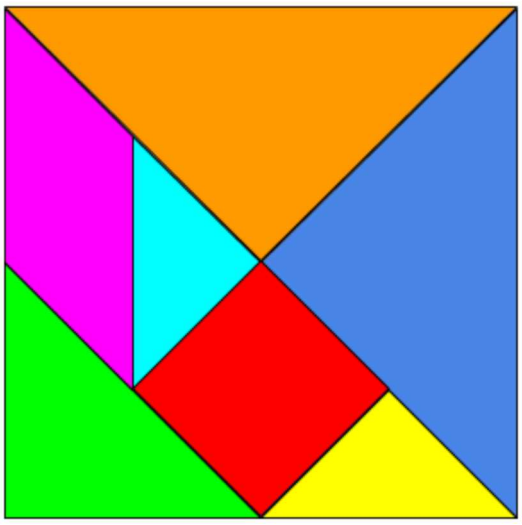
Instructions:

1. Cut out the paper or foam sheets into the shape of fish. On these shapes, write numbers (one per fish, on each side). These can goes as high as you want, but suggested is 1-25 at least.
2. Attach a paper clip to each fish.
3. Attach a magnet to the end of the string. If you have a short wooden pole or similar object, attach the other end of the string to that to create the "fishing pole."
4. Using the pole, "fish" for the numbers. The magnet will pick up the paper clips attached the fish.

How to play!!

There are several activities you can do with this set up. Depending on what level of math you want to practice, you can go from learning the numbers (every time the player catches a fish, they name it), to addition or multiplication (adding up the fish they catch, or multiplying to find the total), to fishing for specific numbers in order to reach a final total (for example, start a round with the number 25. Fish for numbers that you can add, subtract, multiply, or divide in order to get the number 25).

Tangrams



Ingredients:

- ❏ Shape Blocks

or

- ❏ Paper and scissors

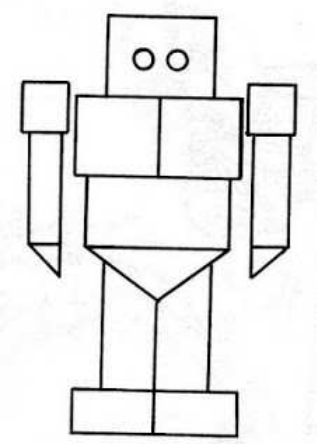
Instructions:

1. Cut out several geometric shapes (most commonly used are the ones pictured) or use shape blocks in these general forms.
2. Using these shapes, try to form different shapes and patterns. You can create a square, a rectangle, or unique patterns such as dogs and robots.

How it works!!

These geometric shapes are found to fit very well together. Think of a bridge or a beehive. Bridges and most architectural practices use triangles in structural supports, as it proves to be able to hold more weight than a square, for example, would, and they fit together seamlessly. Bee's use the hexagon to create their honeycombs, and this hexagon shape optimizes space more than a simple circle would, as they fit together without space between. Try creating unique patterns using your basic geometric shapes!

Robot Shaped Puzzle



Ingredients:

- ❏ Paper
- ❏ Scissors

Instructions:

1. Cut out the paper into either geometric shapes or unique shapes. **Important:** make sure these shapes all fit together. This is easier if you keep it limited to triangles and quadrilaterals, or puzzle piece shapes.
2. Using these pieces, put them together in order to form a robot. This can be a specific shape (a template), or a unique shape.
3. Compare results!

How it works and extension activity:

This works in a very similar way to the tangrams. Try mixing it up by using shapes that have more than four sides and see if this makes it easier or harder to form the robot. Use different templates or robots you'd like to make or have a competition to see how many different robots can be made using the same pieces.

The Flying Toasters | Team 3641

It's time to tackle your own STEAM activity night! The Flying Toasters are always open to mentoring and helping out teams interested in starting their own STEAM activity nights. Feel free to reach out to the Toasters with any questions or concerns! Thank you for coming to the Toasters for ideas and resources!

Contact the Toasters!

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