STEM and Environmental Education Lessons

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STEM Camp Ideas

Tower Building

You will need two types of material for building such as:

- Straws and tape
- Straws and playdough
- Toothpicks and marshmallows
- Spaghetti noodles and marshmallows

Rules: Your tower must be free standing (it cannot touch anything but the floor or desk.) The students then use their own creativity to build their tower.

Building Tips:

- Base: the tower must have a strong, wide base in order to hold the rest of the tower.
- Triangles: triangles are often used in building structures and towers in order to strengthen the design.
- Reinforcement: you may need to add reinforcement to the tower the higher it reaches.

Slime

What you'll need:

- 1/2 Cup of Clear or White School Glue
- 1/4 Cup of Liquid Starch
- 1/2 Cup of Water
- Disposable cups
- Spoon or popsicle stick for mixing
- (optional) food color, or glitter

Step 1: Measure 1/2 cup of glue and pour into a bowl.

Step 2: Add 1/2 cup of water to the glue and mix.

Step 3: (Optional)Add about 10 drops of food coloring of your choice.

Step 4: Pour in 1/4 cup of liquid starch. You will see the slime immediately start to form. Step 5: Start kneading your slime. It will appear stringy at first but just work it around with your hands and you will notice the consistency changes.

Try this using a plastic straw, push it about halfway through into a nicely rolled ball of slime. Stretch some of the slime about halfway up the straw and then blow! See who can make the biggest bubble!

Fluffy Rainbow Slime

What you will need:

- Elmer's Glue
- Food coloring
- Sta-Flo laundry starch
- Glitter
- Shaving cream
- 6 disposable cups (one for each color)
- Spoon or popsicle stick for mixing

Step 1: In each cup put in one color of the rainbow (red, orange, yellow, green, blue or purple). Add one-part glue and one-part shaving cream.

Step 2: Once your shaving cream and glue is mixed, it's time to add the starch. Add the starch slowly and keep mixing. If you add it all at once, the starch will be stringy, so add it a bit at a time. Once the slime is no longer sticky, you have added enough starch. Stretch and play with the starch.

Step 3: Pinch off small pieces to make a rainbow. When you mix them, the colors will slowly mix over time, but fluffy slime mixes more slowly than other slime recipes.

The STEM behind the fun: Slime is formed when a chemical reaction between materials in the glue and the boron in the laundry starch or borax. This reaction alters the chemical bond of the materials combining them into long polymer chains.

Trouble shooting: if the slime is too runny or is too sticky, add more glue.

Silly Putty

What you will need:

- Liquid Starch
- Elmer's Glue
- Plastic cup for mixing
- Popsicle sticks for mixing
- Food coloring (optional)

Step 1: Mix 1-part liquid starch to 2-parts glue. We used ¼ cup of starch and ½ cup of glue which made 2 large balls of silly putty.

Step 2: Mix the two ingredients together. You will notice a blubbery type substance form.

Step 3: If you choose add food coloring.

Step 4: Once the mix is mostly solid, start kneading it with your hands. Knead until most of the liquid substance is absorbed and you have formed a ball the consistency of silly putty.

Step 5: Play with your putty. Try bouncing it. Squeeze it between your fingers or sculpt it into any shape you can image.

No Bake Playdough

What you will need:

- A large mixing bowl
- 1 cup water
- 4 cups flour
- 2-4 tablespoons cooking oil
- 1 ½ C cup salt
- Food coloring
- Glitter (optional)

Step 1: Pour water into a large mixing bowl.

Step 2: Add food coloring.

Step 3: Add the flour to the water mix and blend.

Step 4: Add 2 to 4 tablespoons of oil. Add more oil later, if the mix seems too dry. Oil is the secret to keeping this "no cooking required" recipe soft. If you don't add enough oil, the mix will be very crumbly.

Step 5: Add glitter to the mix. Continue mixing together.

Step 6: Knead and play with the playdough. Store it in plastic bags or a plastic container.

Kinetic Sand

What you will need:

- Baking Soda
- Baking Powder
- Dishwashing liquid
- Mixing bowl
- Spoon

Step 1: Mix together two parts baking soda and one-part baking powder along with one part of dishwashing liquid in a large bowl. For example: ½ cup baking soda, ¼ cup baking powder, ¼ cup Dishwashing liquid.

Step 2: Stir the mixture until a sandy/doughy substance forms. If the powder mixture seems too wet, add baking powder.

Step 3: Knead the mixture together until it feels sandy and dough-like but not wet. Play with the sand.

Step 4: Store in a sealed plastic container.

Cosmic Suncatchers

What you will need:

- White Glue
- Food coloring or liquid watercolors
- Toothpicks
- Plastic lids
- Hole punch
- String

Step One: Pour a generous amount of glue into one of your plastic lids and swish it around to cover the entire inner surface.

Step 2: Have each student put one or two drops of each color of food coloring around the glue.

Step 3: Give each student a toothpick to swirl the colors around in the glue. Stop swirling before the colors get too combined or the final result will be muddy and brown.

Step 4: Let dry. As the colors settle, they will continue to expand and create a dyed psychedelic effect. Depending on how much glue you used, the suncatcher will take one to three days to fully dry. You will know it is ready when the edges start to peel off the lid.

Step 5: When fully dry, peel the suncatcher off the lid, punch a hole through the top, add a string and hang in a sunny spot.

These suncatchers will morph over time. The longer they sit in a sunny window and dry the more they will change. The food coloring will eventually begin to shrink as the glue hardens.

Make Your Own Lava Lamp

Teaching students about liquid density.

What you will need:

- Water
- Empty water bottle
- Vegetable oil
- Food coloring of your choice
- Alka-Seltzer tablets

Step 1: Fill the empty water about 2/3 full of vegetable oil.

Step 2: Fill the rest with water but leave a little bit of space at the top. You will notice that the water sinks below the vegetable oil.

Step 3: Add about 10 drops of food coloring.

Step 4: Put the lid on the bottle and give it a gentle shake. If you shake it too hard it will form bubbles.

Step 5: Break the Alka-Seltzer tablet into four pieces. Drop them one by one into the bottle. Make sure to close the lid after all have been dropped and watch the magic!

You can use your lava lamp over and over again. All you'll need to do is add more tablets!

The STEM behind the fun: The oil floats on the surface because the water is heavier (has a higher density) than oil. When we drop in the Alka-Seltzer it drops to the bottom and begins to dissolve. During this process it forms a gas, which rises to the top and takes the colored water with it. When the gas reaches the top, it breaks which causes the colored water to fall back to the bottom.

Fizzy Rainbows

What you will need:

- Baking Soda
- Vinegar
- Syringes or eye droppers
- Water
- Food coloring (As many colors as possible)
- A bowl
- A tray/baking pan
- Teaspoon
- Spoon

Step 1. Scoop 4 big spoonsful of baking soda into a bowl

Step 2. Add 3-4 drops of food coloring

Step 3. Mix in one teaspoon water.

Step 4. Lay out the colored baking soda on your tray or baking pan in one section. Try to line them vertically. There will be clumps of baking soda however, they should not get wet.

Step 5. Repeat Steps 1-4 with the rest of your colors.

Step 6. Fill your bowl with some vinegar. Have the student pick it up with a syringe or eye dropper and drop it over the baking soda mixture to see the magic!

Step 7. When the students are done experimenting, pour the rest of the vinegar across the whole pan to see a bubbling rainbow!

The STEM behind the fun: This experiment is based on chemical reactions. Baking soda and vinegar are both solutions. Baking soda is classified as a base solution and vinegar is classified as an acid. When an acid and a base solution mix, they form a gas called carbon dioxide. The gas breaking apart from the two solutions creates the "fizz."

Make Your Drawings Float

What you will need:

What you'll need:

- Plate with a smooth surface
- Dry erase markers
- Permanent marker
- Cup
- Water
- Rubbing alcohol
- Paper towel

Prep Work: Find a work area that can tolerate water spills. Fill your cup with room temperature water and set it next to your trays or plates.

Step 1: Choose one color of your dry erase markers and make a drawing on your first plate such as a stick figure, a heart, or text.

Step 2: Let it dry for a couple of seconds and then use a dry finger to wipe across your drawing.

Step 3: If the drawing came off, make a new drawing. Otherwise, keep the old one. Then pour just enough water onto your plate to cover the drawing. Wait and observe. If nothing happens, shake the plate a little bit.

Step 4: Next, use a permanent marker and make a drawing on the second plate.

Step 5: Again, let it dry for a couple of seconds and use a dry finger to wipe across your drawing.

Step 6: If the drawing came off, make a new drawing. Otherwise, keep the old one. Then pour some water on your plate to cover the drawing. Wait and observe.

The STEM behind the fun: You should have seen that the dry eraser marker drawing magically detached from the plate while the permanent marker drawing should have remained stuck to the plate. The difference is the dry eraser is made of a special polymer. The polymer prevents the ink from attaching to the plate, and the ink is lighter than water allowing it to float.

Cloud Dough

What you will need:

- 2 cups Corn Starch
- 1 cup baby lotion
- Food coloring
- Bowls to mix
- Essential oils (optional)

Step 1: Scoop 2 cups of corn starch into a bowl.

Step 2: Add 1 cup of baby lotion and mix

Step 3: Separate into multiple bowls

Step 4: Add food coloring into each and mix. At this point feel free to add in the essential oils to give it a scent.

The STEM behind the fun: Chemistry is a science even if it is as simple as mixing two ingredients together. Cloud dough is fun to touch. For added fun, have the students engineer and shape the dough into an igloo.

Rainbow Walking Water

This activity will help students understand the scientific principal called capillary action.

What you will need:

- 6 Cups
- Paper towels
- Food grade dye (Red, Yellow, and Blue)
- Water

Step 1: Fill each cup half way with water.

Step 2: Line all cups up in a line or circle.

Step 3: First cup uses red dye in the water, second cup just plain water, third cup place yellow dye, fourth just water, fifth use blue dye, sixth cup just water.

Step 4: Next take paper towel and fold it up so you can place one end of the paper towel in a colored cup and the other end in a transparent cup to connect them. Repeat for each cup.

Step 5: Now leave it for a few hours and come back and see the magic!

You will most likely come back to an amazing rainbow of colors and the plain water cups will have mixed and formed new colors!

The STEM behind the fun: When you place the paper towels in the glasses, they should start to absorb water. The water being sucked up is due to something called capillary action which is the ability of a liquid to flow in narrow spaces without the assistance of, or even in opposition to, external forces like gravity. Capillary action is seen in many plants and trees.

Exploding Paint Rockets

What you will need:

- Mason jars to hold paint mixture

- Empty film containers https://www.amazon.com/Houseables-Containers-Developing-Processing-Accessories/dp/B06XS21KMH?tag=schomonk-20
- Alka Seltzer one per film container
- Washable Tempura Paint
- Poster paper

Prep: Mix a paint ratio of 50% paint and 50% water for each color. Store the paint colors in mason jars. Let the students pick what colors they want to use for their rockets. Spread the poster paper on the grass outside. You will want to do this experiment on the grass as the paint could stain the cement.

Step 1: Add a teaspoon or tablespoon of paint to each film canister. Each poster board can take about 8 explosions before the colors get too messy.

Step 2: Drop an Alka-Seltzer tablet into the film canisters, then quickly cap them and flip them upside down.

Step 3: Back away from the film canisters about 20-30 feet and wait for the paint bombs to explode. It usually takes about 30 seconds to pop open and fly into the air. The rockets will leave a pretty paint splatter behind them. Let the paint splatters dry before taking them home.

The STEM behind the fun: The Alka-Selzer tablets work by activating citric acid and baking soda in the water. The gas builds up inside the film canister, but since it doesn't have anywhere to go, it eventually will pop open the bottom of the canister.

Galaxy Sugar Crystals (Won't work in most 3rd world countries)

What you will need:

- Mason jars
- Pure Cane Granulated Sugar
- Liquid Gel fool coloring
- Optional: Pearlized Sugar Food Decorative (Gold color)

Step 1: Boil two cups of water in a medium saucepan.

Step 2: Add six cups of sugar to the solution and stir until dissolved. Be careful not to boil the sugar too long, or else soft candy will start to form which will ruin the crystal shape. You only want to heat the sugar long enough to dissolve in the water.

Step 3: Color one jar blue, one jar pink and one jar orange. Sprinkle some edible glitter into each jar and stir.

Step 4: Add a small bead or marble to the jar to encourage the crystals to form around the center of the jar. If you don't add a small object, the crystals will form around the sides of the jar.

Step 5: Let the solution cool and sit for at least a week. Once the crystals are as large as you would like them, pour out any remaining sugar water. Flip the jars upside down on a paper towel and let any excess liquid drip out.

The STEM behind the fun: A crystal is an example of an ionic bond between molecules. The molecules bond in a specific pattern which makes each type of crystal have a unique structure. Sugar dissolves in water because the bond between sugar molecules is weaker than the bond that forms between sugar and water molecules. Most crystals are formed with minerals but a few other organic materials can form crystallized shapes as well, including snowflakes and sugar.

Popsicle Stick Catapult

What you will need per group.

- 14 large popsicle sticks
- 4 small rubber bands
- 1 plastic spoon
- 12 mini marshmallows

Step 1: Take 12 popsicle sticks and stack them together.

Step 2: Secure the popsicle sticks by wrapping two rubber bands around the stack.

Step 3: Place one popsicle stick under the stack making a “T” shape.

Step 4: Place another popsicle stick on top of the stack making a “T” shape.

Step 5: Attach the two individual popsicle sticks together using a rubber bank at one end.

Step 6: Slide the handle end of a spoon into the last rubber band.

Step 7: Secure the spoon end with one more rubber band.

Step 8: Put a marshmallow on the spoon.

Step 9: Pull on the spoon and let go.

The STEM behind the fun: A catapult works like a lever, which is a simple machine. When you push down on one end of the lever and then let go, it changes the direction of the force and pushes the marshmallow in the opposite direction. Levers are used all around us. For example, a seesaw is a lever and so is a pair of scissors!

Fourth of July Sensory Bottle

What you will need:

- One plastic water bottle
- ½ cup of corn syrup (with blue food coloring)
- ½ cup of vegetable oil
- ½ cup of red lamp oil (can find at Michaels)
- Glue to seal the lid on

To make: pour in the corn syrup, then the vegetable oil, and then the lamp oil. Seal the lid with glue so little ones won't open up the bottle.

The STEM behind the fun: The syrup is heavy, so it stays on the bottom. The vegetable oil is light and doesn't mix with the corn syrup, so it's in the middle, the top layer is the red lamp oil.

Flying Saucer

What you will need per group:

- Newspaper
- Tin Foil
- String
- Tape
- Construction Paper
- Straws
- Popsicle sticks

Each team will compete to create the most functioning flying saucer using the materials that were given.

Step 1: Give students at least 5-10 minutes to go through a design phase before handing out the materials. Instruct and encourage students to draw their flying saucers.

- Shape: think about things that fly or hover (airplanes, birds, Frisbees, etc.). Make sure to consider this when designing your flying saucer.
- Material: Which materials will be useful in the design of your flying saucer? Do light materials always work better? How can you make your flying saucer both light and durable?

Step 2: When this time is up, hand out the materials that are in each group bag. Tell students that they are not allowed to trade materials with other groups. They have to work with what they have been given.

Step 3: Create their flying saucer.

Step 4: When time is up, test the saucers to see which flies for the longest amount of time, goes the farthest, is the most durable, etc. Have everyone vote on which saucer is the favorite. Give a prize to the winning team.

Food Car Race

What you will need per group:

- 8 hard candy lifesavers
- 10 pretzel sticks
- 1 graham cracker
- 5 large marshmallows
- 5 small marshmallows
- 5 Oreo cookies
- Table, with one set of legs folded down

Teams will be creating race cars out of food items and then compete to see who has the fastest and most durable car. Explain the following concepts:

- Body**:** This is the main part of the vehicle, where people would normally sit. The axle of a car usually goes through the body.
- Axle**:** This is usually a rod that passes through the center of a wheel or group of wheels, allowing the wheels to spin.
- Wheels**:** This is a circular object that revolves on an axle and is found below a vehicle to make it move.
- While materials for the activity are being distributed, brainstorm what materials you might use for each of these important parts of a car.

Rules: You can only use the materials that you have. You cannot ask for more or borrow/trade with other groups.

Step 1: Split into groups. Construct a vehicle using only the materials in your bag.

Step 2: Give groups 15-20 minutes to create their race cars.

Step 3: While the groups are working on their race cars, set up the racing ramp by folding down one set of legs of a table. Or construct another ramp.

Step 4: When groups are ready, have two groups race at a time.

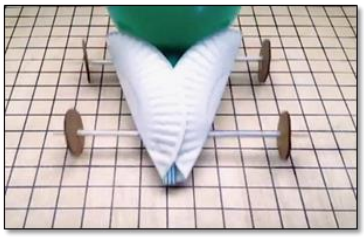
Step 5: The Awards. There will be three different awards: The Fastest car, The Most Durable car, and The Most Creative car. Once teams are finished racing and the winner of each award has been decided, ask the groups to come back to their workspaces so that the whole group can engage in a debrief about what they learned.

Balloon Powered Car Challenge

The challenge is to create a balloon-powered car and make modifications to it to increase the distance it can travel.

What you will need per group:

- Balloon
- Cardboard
- Straws
- Scotch tape
- Marker
- Paper plates
- Large paper clips
- Scissors
- BBQ skewers



Step 1: Introduction: Start by telling the students that cars can run from numerous things like gasoline, diesel, propane, electricity, etc. Then mention, "today, we are going to make a car that travels by air-power." Tell the students that this challenge will test their groups' ability to work together in building a balloon-powered car that will travel as far from the starting point as possible.

The STEM behind the fun: Newton's Third Law states: "For every action, there is an equal and opposite reaction." The action is the air pushed backward out of the balloon. The reaction is the balloon car pushes forward.

Step 2: Build the car and experiment. As you are working to get your car to move, make changes to get it to go farther. (Remember; only make one change at a time.) Observe how your changes affect the car's performance and discuss what to do after each change to make it better.

Based on your practice time (experimentation) are you confident in your vehicle? What are your predictions for the competition? Do you think you will win? Explain.

Step 3: Let the competition begin.

Step 4: Debrief

- How far did your balloon-powered car go?
- If you could change anything about your car, what would you change and why?
- Newton's third Law states that "For every action there is an equal and opposite reaction." What was the action and reaction in this project?

Balloon Rockets

In this activity, students will experiment with propelling a balloon across the room using air pressure.

What you will need:

- Balloon
- String (long enough to cover the room or at least 10 feet)
- 2 chairs or other objects that can hold an end of the string on opposite sides of a room

- Drinking straw, cut into 4 equal pieces
- Craft supplies, such as scissors, tape, and glue
- Permanent Marker
- Small object to be used as cargo (paper clip, bottle cap, candy, etc.)
- Material to make lightweight cargo containers (construction paper, etc.)

Step 1: Tie one end of the string to a chair, doorknob, or any stationary object on one side of the room.

Step 2: Tie the other end of the string to a stationary object on the other side of the room, making sure that the string can easily be untied as needed.

Step 3: Tell students they will be attempting to get a piece of cargo (e.g. a paperclip, button – anything small) from one end of the room to the other using only the materials available and the string. There are lots of different ways to do this. One example is outlined here:

- Untie one end of the string and put it through the piece of straw, then retie it so the straw is suspended on the string.
- Blow up a balloon and pinch the opening so it is closed, but do not tie the end.
- Tape the side of the balloon horizontally to the straw so the top of the balloon is facing one side of the room, and the opening of the balloon is facing the other end of the room, closest to the end of the string.
- Pull the balloon and straw back so they are at the end of the string, which is the starting line.
- Attach the 'cargo' to the straw.

Step 4: Let go of the balloon opening and watch it zoom to the other end of the room.

Step 5: Use a marker to mark a spot on the string where the first trial stopped.

Step 6: Have students create different designs or variations to make the contraption go further, faster, carry more cargo, etc.

Sail Cars

Construct a car that moves by blowing on the sail using supplies provided.

What you will need per group:

- 8 hard candy lifesavers
- 10 straws
- 1 piece of paper
- 1 foot of tape

Rules: Your vehicle must be able to move without touching it. You can only use the materials you have. You cannot ask for more or borrow/trade items with other groups.

Step 1: Tell students they will have to design a car that can move across the room using only their breath. First, we are going to explore a few concepts to remember when designing your food car.

- Sail: This will be the part of the car that you will blow on in order to make the car move
- Body: This is the main part of the vehicle, where people would normally sit, and it the axle of a car usually go through the body.
- Axle: This is usually a rod that passes through the center of a wheel or group of wheels, allowing the wheels to spin.
- Wheels: This is a circular object that revolves on an axle and is found below a vehicle to make it move.

Step 2: Split the students into groups.

Step 3: Distribute materials. While materials for the activity are being distributed, brainstorm what materials you might use for each of these important parts of a car.

Step 4: Create their sail car.

Step 5: While the students are creating their car, set up a track with a start and finish line.

Step 6: The race begins. Have two groups race at a time. They will have to lay down and blow on the sail to move the car forward.

Step 7: Awards

- The Fastest Car
- The Most Durable Car
- The Most Creative Car

Step 8: Debrief

- What challenges did you face in this activity, and how did you overcome them?
- What would you do to improve your design?

Film Canister Rockets

The students will use film canisters and effervescent tablets to create their own mini-rocket. With their groups, students will run tests to see how changing the amount of water and tablets affects the launch.

What you will need per group:

- 2-3 film canisters with lids
- Tape (scotch or masking)
- Scissors
- Beaker or cup with water in it
- 4 “Alka-Seltzer” tablets
- Markers or crayons (optional)
- Meter sticks (optional)
- A few towels to help clean up the area when finished

Step 1: Introduction. Begin the discussion by taking one Alka-Seltzer tablet and dropping it into a beaker or cup of water and ask your students to observe what is happening. Then pose the question "I wonder what would happen if I trapped the gas bubbles coming from that tablet."

Read Newton's 1st Law. "*An object at rest will remain at rest unless acted upon by an outside force."* Tell the students that this challenge will test their group's ability to work together to build a film canister rocket that will launch off the ground. Divide the students into groups. Tell the students to come up with a team name and write it on a strip of masking tape. The teacher, based on the height of the best launch, will place each team's masking tape on the wall.

Warning: Do not allow students to stand above the rocket when launching, and make sure you are launching from a place that can get wet …. Because it WILL get wet.

Step 2: Explain the Activity. Your challenge is to create a film canister rocket, powered by an "Alka-Seltzer" tablet with 3 fins and a cone that will shoot into the air. Can you make your rocket go the highest? Some things that you can experiment with are the size of the tablet piece you use and the amount of water in the rocket.

- What do you think would work better, ¼ of a tablet or ½? Why?
- How much water do you think will be better? ¼ full of water or ½ full of water? Why?

Step 3: Trial Experiment. Remember to change one variable at a time. Experiment with different amounts of "Alka-Seltzer" tablets to determine the best amount. Then experiment with different amounts of water to determine the best volume.

- Based on your trial launches, what amount of tablet and water worked best for your group?
- How did your rocket do? If you could perform more trials, what would you change and why? Are there any other liquids that you would like to try instead of water?
- Newton's 1st Law states, "*An object at rest will remain at rest unless it's acted upon by an outside force."* What was the force in this experiment that brought your rocket out of rest?

Step 4: Final Launch Challenge. Let the contest begin.

Step 5: Debrief:

- How did your rocket do?
- If you could perform more trials, what would you change and why?
- Are there any other liquids that you would like to try instead of water?

Musical Straws

In this activity the students will explore sound. They will cut a normal straw and turn it into a musical instrument. They will cut each straw to a different length and analyze how the length changes the pitch.

What you will need per group:

- 3 plastic straws
- 1 pair of scissors

Step 1: Introduction. Begin a discussion by asking the students how many can play a musical instrument. You can also ask them to share what they play. Tell the students, "today we are going to make a musical instrument from a plastic straw." Depending on the level of your students, you can introduce the concept of pitch. Pitch is an auditory sensation in which a listener assigns musical tones to relative positions on a musical scale based primarily on the frequency of vibration."

Step 2: Present the Challenge. Can you get an ordinary straw to make music? Can you modify your straws to get different noises (pitch) from them? Note: Only let YOUR lips touch YOUR straws.

- Many musical instruments have a reed. Do you know the purpose of the reed?
- What straw length do you think will be best? Why?

Step 3: Demonstrate how to make the musical straw. Take a pair of scissors and cut off the end of the straw in a V shaped pattern. After you have done this, try to flatten your straw as much as possible. (You can bite down on your straw to help accomplish this. Then press your lips on the straw and try to make music.)

Step 4: Work with your group to figure out how to get this to work.

- What was the key to getting your straw to work?
- Cut your straw into a short straw and a medium length straw and compare the different noises that they make? Be sure to cut off the tips like before.
- What is the relationship between the length of the straw and the noise (pitch) that we hear?

Levitating Ping Pong Ball

With this activity, your students will try to get their ping pong balls to levitate (float in the air).

What you will need per group:

- 3 Straws
- 9 Paper Clips
- Tape
- 3 Ping Pong Balls

Step 1: Divide students into groups and give them about five minutes to construct their apparatus.

Step 2: Ask for a volunteer to show what they have learned. Then encourage other students to make modifications to their project based on what they have seen.

Step 3: After students have had time to get their project working, ask them to brainstorm additional ways to get the ping-pong ball to levitate. Based on their responses, you could ask them how they might get the ball to levitate for a longer time. Introduce "Bernoulli's Principle". Bernoulli's principle tells us that an increase in the speed of a fluid (air, in our case) results in a decrease in pressure. The opposite is also true. If the speed of a fluid is decreased, there will be an increase in pressure. Ask students to think

about and share ideas where Bernoulli's Principle is seen in the real world. (i.e. flying machines, baseball, sailing)

Elephant Toothpaste

Students will mix household products to make an "elephant size" chemical reaction.

What you will need:

- Empty, 16 oz. plastic soda pop bottle
- Cake pan with 2-inch sides to catch the exploding material
- 3% or 6% Hydrogen Peroxide
- Dawn Ultra Dishwashing Liquid
- Active yeast
- Funnell
- Warm water
- Cup or bowl
- ½ cup liquid measurer
- Spoon
- Food coloring

Step 1: Place empty soda pop bottle in the center of the cake pan with the funnel in the opening of the bottle.

Step 2: Pour ½ cup of hydrogen peroxide through the funnel and into the bottle.

Step 3: Add about one tablespoon of Dawn Ultra dishwashing liquid to the bottle along with a few drops of food coloring.

Step 4: In the cup or bowl, mix one packet of yeast with warm water (be sure to follow the activation instructions on the yeast label.)

Step 5: Pour the yeast mixture into the bottle, quickly remove the funnel, and step back.

Cup Challenge

What you will need per group:

- 10 small plastic cups
- 1 rubber band
- 4 pieces of string (about 2 feet long)

Step 1: Divide into groups of four and pass out supplies.

Step 2: Explain the instructions to the students

- Tie each string to one of the four corners (or however many group members you have) on each rubber band
- Place 10 small plastic cups in the middle of the group's table (stacked upside down)
- Each group member gathers around the cups and takes hold of one of the strings
- The group must work together to stretch their rubber band around each cup and organize the cups into a pyramid

Step 3: Let the contest begin. The first team to create a pyramid wins.

Paper Plate Challenges

What you will need per group:

- Paper plates
- Scissors
- Paper clips

Challenge 1: STEM Tower

Create a tower with paper plates. If you have tried STEM challenges before, you may have created towers with simple objects like pipe cleaners or playing cards. Because of the plates' shape, it makes this challenge a little more challenging. Some students will cut the plates to make rectangles so they can make challenges in a similar way to what you would do with index cards. What other ways might they create a tower? This is probably the easiest sounding challenge but the most difficult to execute.

Challenge 2: Longest Paper Plate STEM Transformation

You may have done something similar before with a regular sheet of paper, but starting with a circle changes is up quite a bit. How long can you make one paper plate by cutting it in some way? The students may need several plates because working it out on paper is a bit tough. They will likely change their design more than once and test it out.

Challenge 3: Airborne Paper Plate STEM

It is always fun to throw things. Make a paper plate airplane, flying disc, or even a parachute! There are so many possibilities. I recommend doing this one in a large area or outdoors because all the students will be launching their aircraft in the same direction.

Basketball Tower

Create a strong enough support to hold the weight of a basketball.

What you will need:

- Newspaper (or other paper)
- Masking tape
- Basketball

Step 1: Catch the students' attention by bouncing a basketball. Then show them a stack of newspaper. Ask the students if they think newspaper could hold a basketball. Explain that they will be constructing a tower that will hold a basketball. They can use only newspaper and masking tape.

Step 2: Divide the students into groups and ask them to create their design

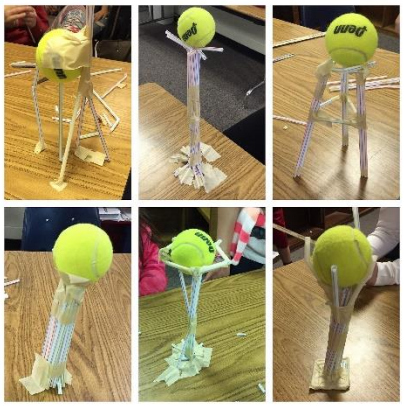
Step 3: When completed, have the students measure the height of their towers.

Step 4: To test, place a basketball on the tower, and measure the time.

Step 5: If you have time, allow the students to improve and rebuild their design.

Step 6: Retest.

Tennis Ball Towers



What you will need per group:

- 1 Tennis ball
- 8 Craft sticks
- 4 Straws
- String (2 feet)
- Masking Tape (3 feet)
- 4 Coffee stir sticks

Step 1: Divide students into groups. Begin with a discussion about towers. What is the purpose of a tower? How are towers supported? What can towers hold?

Ask the following question: How can you use the given supplies to design and build a tower that will support a tennis ball?

Step 2: Constraints of the Tennis Ball Tower Challenge

- You may only use the given supplies. You may also use scissors and rulers.
- You must use ALL of the supplies in some way. They do not have to be functional.
- The tower can be any height.
- The tennis ball must be held aloft and the bottom of the ball must be at least 4 inches from the tabletop.
- You may not pierce the tennis ball.
- The tower can be attached to the table.

Step 3: Plan and build your design.

Step 4: Improve your design. What changes can you make?

Step 5: Test. Check the structure to see if it follows the constraints. This will include measuring the height of the tennis ball and seeing if all supplies were used.

Step 6: Reflect. Describe your success or lack of success and explain why it occurred. Explain what you learned.

Exploding Bags

Students will mix two substances to observe how an "explosive" new substance is formed through a chemical reaction. Please do this activity outside.

What you will need:

- Vinegar
- Baking Soda
- Warm water
- Sandwich sized sealable bag
- 2 squares of Charmin toilet paper
- ½ cup liquid measurer
- Spoon

Step 1: Scoop two large spoonsful of baking soda to the center of a square of Charmin® toilet paper.

Step 2: Wrap the toilet paper around the baking soda.

Step 3: Wrap a second square of Charmin® toilet paper around the first so the baking soda is held in the paper.

Step 4: Have one student hold the plastic bag open, and another student add ¼ cup vinegar and ¼ cup warm water to the bag.

Step 5: Seal the bag almost entirely closed and hold the wrapped baking soda over a small opening in the corner.

Step 6: Have one student drop the baking soda into the bag and another student quickly seal the bag.

Step 7: Gently swirl the contents of the bag so the toilet paper soaks up the liquid, then place the bag on the table. Watch as the bag inflates and pops!

Make Your Own Compass

What you will need:

- A cork
- Scissors for cutting the cork
- A cup, drinking glass, or bowl
- Water
- A magnet. It can be a flat refrigerator magnet or a more powerful magnet, such as a neodymium magnet. A stronger magnet will work better.
- A pair of pliers

- Metal sewing needle

Step 1: Rub the magnet against the sewing needle at least five times. (If you are using a weaker magnet, such as a flat refrigerator magnet, rub the needle at least a dozen times.) Always rub the magnet in the same direction against the needle. Your needle should now be magnetized.

Step 2: Now cut off about ¼ inch of the cork from one of its ends, making a small cork disc that is about ¼ inch tall.

Step 3: Carefully push the needle through the side of the disc by using the pair of pliers. Push the needle all the way through the disc so that about the same amount of needle shows on either side of the disc.

Step 4: Fill a cup, drinking glass, or bowl with at least an inch of water.

Step 5: Put the cork disc (with the needle) on the water in the cup. Try to keep the disc floating in the center of the water, away from the sides of the cup.

The STEM Behind the fun: This is a great STEM activity to help the students understand magnets and the interaction with the Earth's magnetic field. When you rub the sewing needle against the magnet, you magnetize the needle. Although Earth's magnetic field is relatively weak, it could clearly affect the needle because it was freely floating in the cork disc on the water. Once the needle stops moving, the needle then aligns with the Earth's north and south poles.

Clothespin Airplane Engineering Challenge

What you will need:

- Wooden clothespins
- Popsicle sticks (jumbo size)
- Scissors
- Hot glue gun and glue sticks
- Acrylic Paint
- Paintbrushes
- Pony beads

Design 1 – Modern Flying Plane: 2 popsicle sticks and 1 clothespin (spring removed).

Design 2 –Triplane: 5 popsicle sticks, 1 clothespin, 5 pony beads

Paper Pinwheel

What you will need per individual

- Paper
- Scissors
- Glue Stick or Dot Glue
- Thumb tack
- Cork
- Pinwheel Template: http://buggyandbuddy.com/paper-helicopter-pinwheel-with-free-template

Step 1: Use your printer to print the pinwheel template directly onto your paper, or trace the template onto your paper. You may also have the students color their own design.

Step 2: Cut out the square and then cut along the diagonal lines located in each corner.

Step 4: Attach each corner to the center of a square using a glue stick or dot glue.

Step 5: Flip your pinwheel over and use a tack to attach it to a cork.

Step 6: Hold the pinwheel up really high with the cork facing down and let go. The pinwheel spins as it drops to the ground.

The STEM behind the fun: The force of gravity is pulling the pinwheels to the ground. Air resistance is pushing against each fold of the pinwheel making it spin.

Paper Helicopter

What you will need per individual:

- Template: https://cdn.babbledabbledo.com/wp-content/uploads/2020/03/Paper-Helicopter-TEMPLATE.pdf
- Construction paper or card stock
- Paper clips
- Tape
- Scissors

Step 1: Cut your paper and draw guide.

Step 2: Fold section D along dotted line.

Step 3: Fold Section C along dotted line towards you.

Step 4: Fold Section A along dotted line towards you.

Step 5: Fold Section B along dotted line away from you.

Step 6: Fold bottom edge of section C/D towards you.

Step 7: Tape folded end of C/D.

Step 8: Add a paper clip to the taped end.

Step 9: Take them outside and throw them like you would throw a ball or paper airplane. They should spin like a helicopter to the ground.

The STEM behind the fun: Actual helicopters fly by generating lift. Lift is an upward pushing force that occurs when the blades of a helicopter rotate and a difference in air pressure is created on either side of the blades. Under the blades the air pressure is high and above the blades the air pressure is lower. This allows the helicopters to ascend into the air.

CD Spinning Top

What you will need:

- CD
- Marble
- Small plastic cap from water bottle
- Hot glue gun or glue dots
- Chalk Markers or Permanent Magic Markers

Step 1: Decorate your CD.

Step 2: Turn your decorated CD over and use your hot glue gun or glue dots to glue a marble onto the center hole of the CD. You can place a CD on a lid to hold it in place while gluing.

Step 3: Turn your CD right side up and glue a plastic cap to the center of the top of the CD.

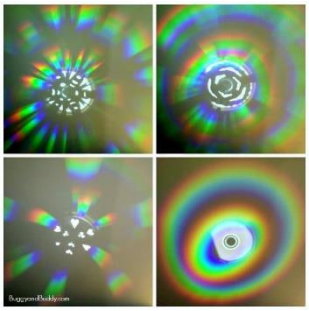
Step 4: Once the glue is dry, use the plastic cap to spin your top.

The STEM behind the fun: When you initially spin the top, you are turning the top's stored energy (potential energy) into energy of motion (kinetic energy). The top eventually stops spinning because of friction and gravity. The surface below the top provides friction, eventually causing the spinning to slow down, and the top begins to wobble. As it begins to wobble, the top tilts, allowing gravity to pull it over. More Fun: Have a top spinning competition.

Rainbow Science: Creating Light Patterns with a CD

What you will need:

- Blank or old CD
- Paper
- Scissors
- Tape
- Pencil



Step 1: Use the shiny side of the CD to reflect the sunlight onto your poster board or blank wall and notice the rainbow. What does it look like? Notice the shape and colors. What happens when you change the angle of the CD?

Step 2: Trace your CD a few times onto paper so you have circles the exact size of your CD and cut them out.

Step 3: Cut out various snowflake shapes using the paper circles.

Step 4: Tape one of your paper snowflakes over the shiny side of the CD and reflect the sunlight onto your poster board or wall. How do the patters of light look different than before?

Step 5: Experiment again using different cut-out patterns.

The STEM behind the fun: A CD is a mirrored surface with spiral tracks or pits. These tracks are evenly spaced and diffract the sunlight, separating the colors. Because the CD's surface is mirrored, the light is reflected to your eye. The paper is blocking some light rays from the CD, but letting others through creating all kinds of patterns and designs.

Exploring Colors with Baking Soda and Vinegar

Students will explore chemical reactions but also explore color mixing and create some colorful artwork.

What you need per group:

- Tray
- Baking soda
- White Vinegar
- Pipettes
- Food Coloring

Prior to the activity, read a book about colors such as: A Color of his Own by Leo Lionni

Step 1: Give each group of children a tray.

Step 2: Fill the tray with baking soda. Use one box per tray.

Step 3: Fill each ice cube tray with vinegar and add food coloring to the vinegar so each group has a variety of colors to use.

Step 4: Use a pipette or dropper to place a few drops of the colored vinegar onto the tray of baking soda and watch what happens.

Step 5: Continue exploring with other colors.

Step 6: After cleaning up, you might want to read, I Ain't Gonna Paint No More! by Karen Beaumont. The book has many illustrations that will look similar to their colorful trays.

The STEM behind the fun: This experiment is based on chemical reactions. Baking soda and vinegar are both solutions. Baking soda is classified as a base solution and vinegar is classified as an acid. When an acid and a base mix, they form a gas called carbon dioxide. The gas breaking apart from the two solutions creates the "fizz."

Straw Rocket – Younger Students

What you will need per person:

- Straws
- Tape or glue dots
- Plastic pipettes (or straws with a larger diameter than the other set of straws
- Markers, crayons or colored pencils
- Scissors
- Rocket Template: https://drive.google.com/file/d/0B-cVjZBMBNNXUVZfX0RLd2ZycWs/view

Step 1: Let the children color and cut out their rocket.

Step 2: Cut the bottom off a plastic pipette and attach it to the back of a rocket using tape or glue dots. You could use a straw instead. Just make sure this straw is wider than the other straw you will be using for launching. Cut the straw to fit the length of the rocket and tape one end shut so it is completely sealed. Attach it to your rocket with glue dots or tape.

Step 3. Slip a straw into your pipette and you are ready to launch. Give your straw a big puff of air, and watch it take off.

Big Smelly Bear STEM Challenge

Possible items that you can use:

- Popsicle sticks
- Straws
- Spoons
- Forks
- Tape
- Pipe cleaners
- Cardboard

Step 1: Read the children's book, Big Smelly Bear by Britta Teckentrup. A YouTube reading can be accessed here: https://www.youtube.com/watch?v=qcfFuaM44Ts&feature=youtu.be

Step 2: Ask, “What are the problems Big Smelly Bear faces in the story? He can’t scratch his back and he stinks.

Step 3: Introduce the challenge. How can we help the Big Smelly Bear? Today we are going to engineer a device to help the bear scratch the middle of his back. You can only use the materials provided. You have to be able to reach the middle of your back with your back scratcher.

Step 4: Plan. In your group discuss different ways to solve the problem.

Step 4: Create and test your back scratcher.

Step 5: Share your back-scratcher design with the class.

Flying Spiders

What you will need per group:

- A small plastic spider or spider ring
- 2 3X5 index cards
- 2 paper clips
- 1 rubber band
- 1 balloon
- 1 drinking straw
- 1 coffee filter
- 3 feet of string or yarn
- 3 craft sticks
- ½ sheet of sticky dot labels

Step 1: Explain the spider glider challenge. Set a starting line and a finish line. Students should try to get their spiders to cross the finish line using items listed above.

Step 2: Let the groups brainstorm their ideas for a spider glider. They will need to find a way to attach the spider to the device.

Step 3: Once they have created the device, they can stand at the starting line and launch their spider toward the finish line. The winner is the spider who travels the farthest.

Little Miss Muffet’s Spider Trap

What you will need for each group

- Toy plastic spider
- Lid
- Paper cup
- Clothespin
- Pipe cleaner

- String
- Paperclips
- Straws

Step 1: Read "*Little Miss Muffet*" nursery rhyme by Mother Goose.

Little Miss Muffet sat on a tuffet,
Eating her curds and whey;
Along came a spider who sat down beside her
And frightened Miss Muffet away.

Step 2: Introduce the challenge. Today we will make a spider trap that can catch Little Miss Muffet's Spider.
Step 3: Let the groups brainstorm their ideas for a spider trap. They will need to find a way to catch the spider using the items they were given.

Step 4: Once they have created the device, they can share their design with the class.

Step 5: Encourage the students to think about the trap they created and discuss the following:

- Was your trap successful? How could you tell?
- Which designs worked the best?
- Which designs struggled.
- What was the most challenging thing about this experiment?

The STEM behind the fun: There are many science topics that can be addressed with this project. It will depend on the design. For a pulley, you can point out the potential and kinetic energy, the way that the pulley lessens the force required, equal and opposite forces and transfer of energy. For a lever, you can also address kinetic and potential energy, center of balance, work and force.

Lego Star War Challenges

What you will need:

- Lego's for each group
- STEM Mat's copied below for each group
- Ruler

Step 1: Pass out the Legos and the Challenge Mats. Decide ahead of time how you will have groups do the challenges.

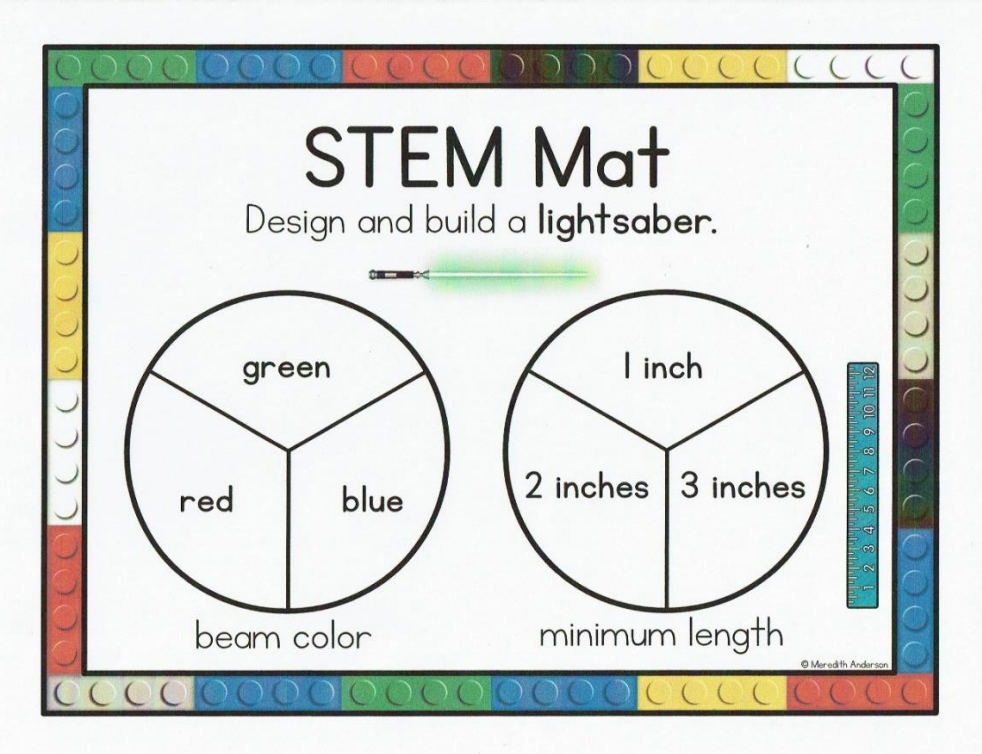
Step 2: Present the challenge. Let the groups brainstorm their ideas and come up with a plan.

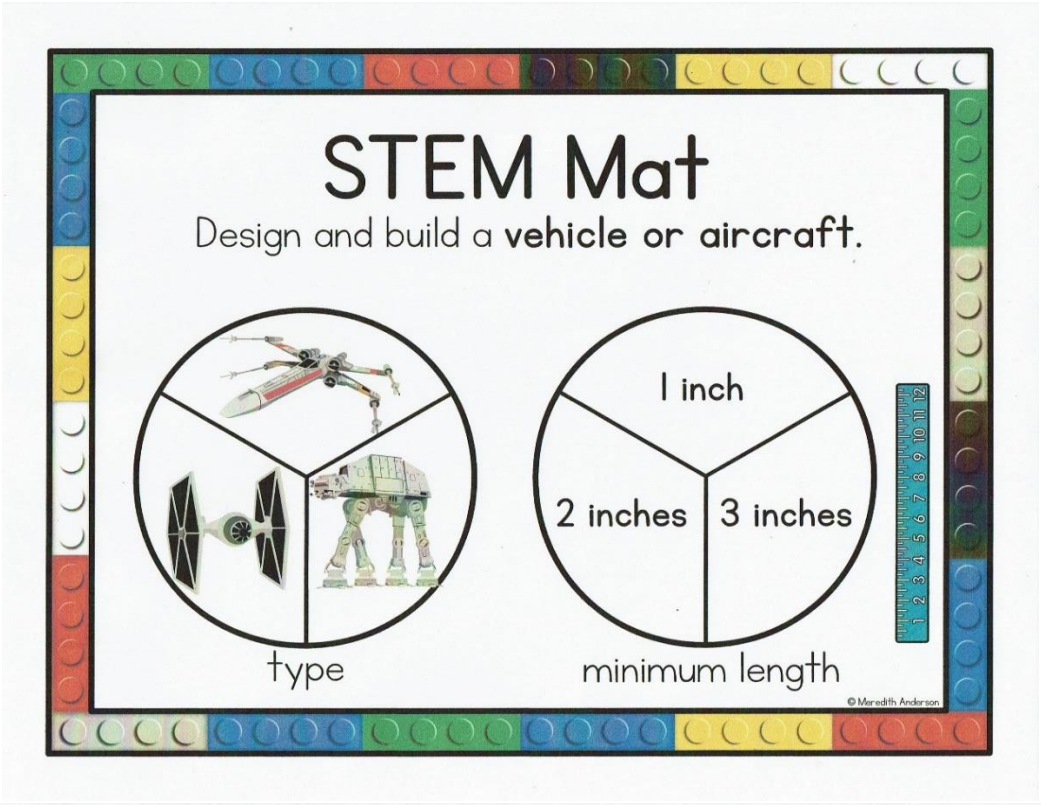
Step 3: Create your lightsaber, space vehicle or aircraft.

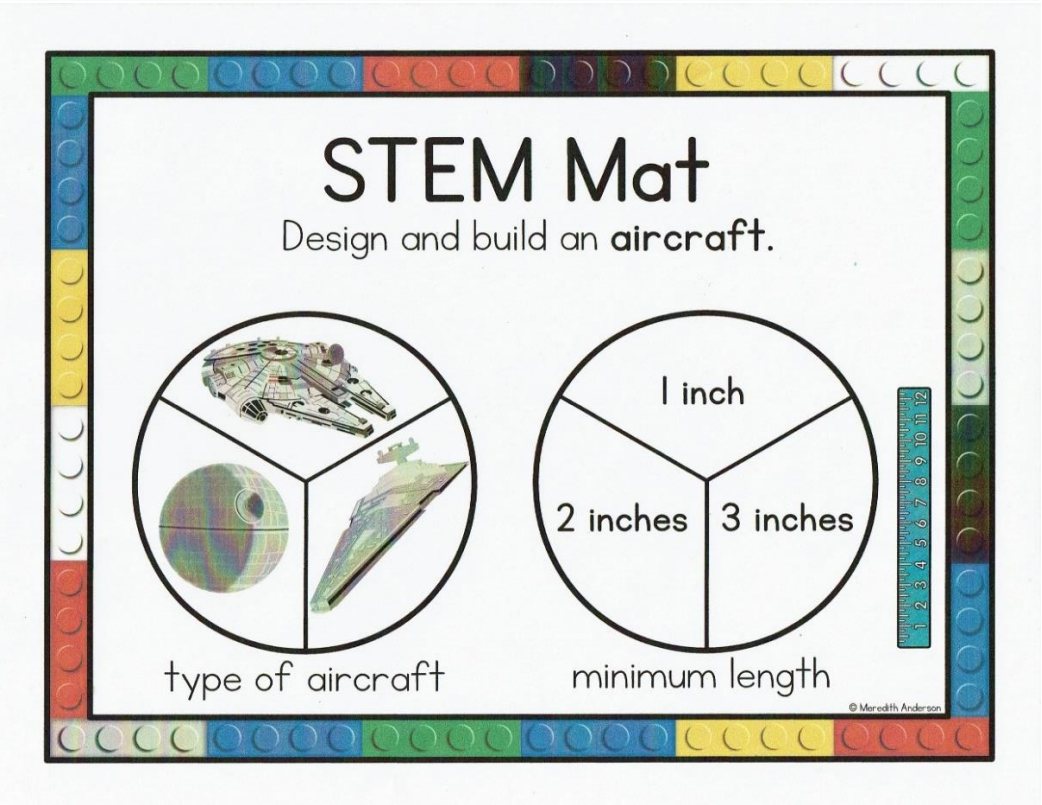
Step 4: Share inventions with your class

Other Lego Building Challenges:

- Create Simple words like: pet, pit, pot, hit, hut, cut, cot, cup, cop, lip, let, lot
- American Flag and another Country's flag
- Build famous landmarks like: Eiffel Tower, Pyramid, etc.
- Halloween Challenge: Pumpkin or Haunted House
- Christmas Challenge: Reindeer, Christmas Tree, Sleigh
- St. Patrick's Day: Pot of Gold, Rainbow
- Earth Day: Garden planter, recycle bin
- Winter: Igloo, sled
- Summer: Insect, sports equipment, swimming pool, sand castle




STEM Mat
Design and build a vehicle or aircraft.
1 inch
2 inches
3 inches
type
minimum length
© Meredith Anderson


STEM Mat
Design and build an aircraft.
1 inch
2 inches
3 inches
type of aircraft
minimum length
© Meredith Anderson

Hoop Glider Challenge

What you will need per group:

- 3-4 index cards (3x5)
- 1 roll of tape (scotch or masking)
- 1 pair of scissors
- 3-4 straws
- Markers (optional)

Step 1: Divide students into groups.

Step 2: Ask the students, "Who is good at making a paper airplane?" Throw a paper airplane that you have made and point out that it is actually a type of glider. Today we will be building hoop gliders and trying to see what group can get theirs to glide the farthest.

Step 3: Demonstrate how to make a hoop glider. Take a note card and cut it into thirds lengthwise. Take one strip of the note card and form a loop by overlapping the edge about ½ inch. Now put tape over the seam to hold it. This will be your small loop. Now take the other two strips and make one big loop the same way. Finally, tape your straw to the inside of the loops. Discuss:

- What do you think would work better, a shorter straw or a longer straw? Why?
- Do you think the small hoop should be in front of your glider or the back?

Step 4: Construction and Experiment time. Experiment with changing the length of the straw, the position of the hoops and the direction you throw the hoop glider.

Step 5: Let the competition begin.

Step 6: Discussion:

- How did your glider do?
- Approximately how far did your glider go?
- If you could change something or perform more trials, what would you change about your hoop glider? Why?

Crystal Art

Students mix a variety of solid crystals into water, then use the solutions to paint on black paper and watch solid crystals form again. Students learn about solubility of solids and the process of crystallization.

What you will need per individual or per group:

- 3 Clear plastic cups
- 3 Cotton swabs
- 3 Teaspoons
- Table salt
- Epsom Salt
- Sugar
- Warm water
- Black Construction Paper
- Masking tape
- Pen or marker

Step 1: Divide a piece of black construction paper into three equal sections. Using the masking tape and pen, label the sections “salt,” “sugar,” and “Epsom salt.”

Step 2: Label the three plastic cups “salt,” “sugar,” and “Epsom salt.”

Step 3: Fill ¼ of each cup with warm water and place on the corresponding labeled sections of the paper.

Step 4: Add one level teaspoon of salt into the cup labeled “salt” and stir until all the crystals dissolve. Continue to add teaspoons of salt until no additional salt can be dissolved. (You will see crystals in the water even after stirring.)

Step 5: Repeat step 4 with the sugar and Epsom salt in their corresponding cups.

Step 6: Dip one end of a clean cotton swab into the salt solution, and use it to paint a design into the salt section of the paper. Using new cotton swabs, do the same with the sugar and Epsom salt solutions.

Step 7: Allow water to evaporate (about 30+ minutes) and examine the designs.

Troll Bridge

What you will need per group:

- Popsicle sticks (25)
- Straws (25)
- Pipe Cleaners (25)
- Pencils (10)
- Masking Tape (1 roll)
- Dental Floss (1 container)
- Pennies (50-100)
- Small cup (to put pennies in on the bridge)
- Small Troll doll (optional)

Step 1: Divide the students into groups.

Step 2: Plan. Your bridge will need to go between two objects across a span of one foot. Look at the materials you have, which will you use. What will your bridge look like? What will you do to make the bridge as strong as possible? How many pennies do you think your bridge will be able to hold?

Step 3: As a team, use your plan as a guide and build your bridge. Everyone in your group must participate.

Step 4: Start adding pennies to your bridge. How many can it hold before breaking?

Step 5: Analyze. Was your bridge able to hold as many pennies as you thought? What were the strengths of your bridge? What were your bridges weaknesses? Why?

Power Up: Introduction to Circuits

Materials Needed:

- Power Tile Circuit Kit per group https://www.lakeshorelearning.com/products/stem/building-engineering/power-tiles-circuit-kit-starter-set/p/PP738/
- D Battery per group

Introduction

1. Begin by explaining that there are many jobs that work with electricity; examples include electricians, line workers, systems engineers, power plant operators, and more.

2. What is a circuit? A circuit is the path that electricity takes from a positive charge to the ground. There must be a complete circuit (or circle) for the electricity to be able to flow. When the electricity flows through something on the circuit, such as a lightbulb, it provides power.

3. Begin by explaining the tiles in the set one by one.

- The red battery tile provides the electricity that the circuit will need. The electricity flows out of the battery and into the tiles that are connected to it. Point out that there is an on/off switch, and that if the switch is off, or if it's on but the light isn't on, the battery pack won't work.
- Gray tiles are called action tiles, and each action tile does something different – they have lights, buzzers, or motors.
- Yellow tiles are called control tiles, and they adjust the flow of electricity. They include buttons, switches and dials, and can affect how action tiles behave.
- Blue tiles are connectivity tiles, and they control where the flow of electricity goes. Some connectivity tiles are four-way, some are two-way, and some block electricity altogether.

4. Explain that the tiles must be connected in a specific way. They must be connected so that a side with three tabs is connected to a side with two tabs, otherwise they won't fit properly.

5. The arrows on the tiles indicate which directions electricity can flow. If there are no arrows, electricity won't flow through that side of the tile. If there are arrows only pointing in, the tile will allow electricity

to flow in through that side, but not out, and vice versa. Show a few examples of circuits that would and would not work.

Activity

Challenge 1: Use three tiles to create a light that turns on with a button.

- The power button controls the light because the electricity flows through the button to get to the light, and when the button is not pushed the circuit is open. When the button is pushed, it closes the circuit and electricity can get to the light.
- Rearrange the tiles so that electricity flows into the action tile, and then into the button. Notice that the button doesn't control the light now, because electricity flows directly into the light from the battery, without having to go through the button.

Challenge 2: Use four tiles to create a circuit that allows you to control the volume and frequency of a buzzer. This challenge requires the battery pack, the frequency dial, the power dial, and the buzzer.

Challenge 3: Build a moving car with a headlight. At minimum, this challenge requires a battery pack, an LED light, the motor, and connectivity tiles. The finished result might be a cube, but it might be other shapes as well. Remind students that electricity will still flow in the direction of the arrows, even though the car is three-dimensional.

Conclusion

Once students have completed the activity and put away their materials, discuss with them the ways that they used electricity in their challenges. Remind them that there are many careers that use electricity, including electricians, line workers, systems engineers, power plant operators, and more.

Robotics Programming

This lesson will teach students the fundamentals of programming a robot. Bee-Bot will help students learn directions, estimation and sequencing.

Materials Needed:

- 1 Bee-Bot kit for each group https://www.lakeshorelearning.com/products/stem/building-engineering/bee-botsup-sup-programmable-robot/p/BT363
- 1 charger for each group
- Painters tape or Masking Tape

Introduction

- Ask students to identify two popular robots – Wall-E and R2-D2. This gets them thinking about what a robot is, what they look like, and what they do.
- Ask students what a robot is. Explain that a robot is a machine that does what we tell it to. Telling a robot what to do is called programming. We have to use the language that the robot

understands. If we tell the robot to do something in English, it's not going to know what to do. The language that Bee-Bot understands is the arrow buttons on his back.

- Let students know that there are lots of people who work with robots – engineers, programmers, astronauts, military personnel, police, and electricians, just to name a few. Ask students how each of these people might work with robots.

Activity:

Step 1: Explain to students that they are going to be programming robots called Bee-Bots.

Step 2: In order to give Bee-Bot instructions, we use the arrows on its back. Let them explore what they think each arrow means.

Step 3: Explain that the pause button adds a pause into the Bee-Bot's program, and the x button deletes the Bee-Bot's program. Remind them that Bee-Bot will remember every instruction they've given it until they hit the X button.

Step 4: Let students explore the directions that Bee-Bot will go. Forward for the Bee-Bot is always the direction its eyes are facing, so if it turns, forward becomes a different direction than it was before it turned. Demonstrate by standing in front of the class facing forward. Then turn, as the Bee-Bot would, and ask students which way would be forward for you now?

Step 5: Remind students that the left and right buttons only turn the Bee-Bot – they don't make Bee-Bot drive right and left. If they want their robot to drive left, they'll need to program it to turn left so that its eyes are facing left, then drive forward.

Step 6: Give students their first challenge. They will program Bee-Bot to drive forward 5 steps, turn right, drive forward 2 steps, turn right, and then drive forward five steps. This will create a U-shape. Give students plenty of time to work through this challenge. If students finish early, they might be ready for the next challenge.

Step 7: Give students their second challenge. Lay down a single piece of masking or painter's tape, about 1' long. Have students program Bee-Bot to drive all the way around the tape without touching it.

Step 8: Give students their third challenge. In this challenge, they will be entering a program without knowing what the result will be. They'll program Bee-Bot to drive forward 6 steps, turn all the way around, drive backwards 3 steps, and then drive forward 9 steps. If they have entered the program correctly, Bee-Bot will end up back where it started.

Step 9: For students that finish early, encourage them to come up with their own challenge. Build a maze out of pencils for Bee-Bot to go through, weave around the legs of a chair, or find an item in your desk to drive around.

Conclusion: Once students have completed the activity and put away their materials, discuss with them the ways that they used programs to make their robots complete tasks. Remind students that there are a variety of jobs that work with robots, including engineers, programmers, astronauts, military, police, and electricians.

Blow Up a Balloon

What you will need:

- Empty soda or water bottle
- Balloon
- Baking Soda
- Vinegar
- Paper Towel

Step 1: Tear the paper towel in half. Take one half and tear it in half again. You will use one of these smaller squares as your wrapper.

Step 2: Place about a tablespoon of baking soda on your wrapper. Fold it up and twist the ends closed so that the baking soda is neatly inside.

Step 3: Pour about 1/4 cup of vinegar into your bottle, and add the wrapper of baking soda.

Step 4: Quickly place the balloon securely over the top of the bottle and watch the balloon blow up by itself!

Note: You can swirl the liquid in the bottle to help the two chemicals react once the balloon is fastened to the top.

The STEM behind the fun: This experiment works because the vinegar and baking soda mixed together produce a gas which fills the bottle and the balloon. The paper towel is used to protect the baking soda for a short period of time while the balloon gets placed on the bottle.

Bouncy Balls

What you will need:

- ½ Cup of Warm Water
- 1 Tablespoon Borax
- 1 – 2 Tablespoons of Clear Elmer's Glue or Elmer's Clear Glitter Glue
- Container and mixing spoon

Step 1: Stir together ½ cup of warm water and 1 tablespoon of borax until it is completely dissolved. Add more water if it doesn't all dissolve.

Step 2: Add your glue.

Step 3: Squish and squeeze until it is no longer sticky. Roll mixture between your hands to make it ball shaped.

Note: The bouncy balls are basically very thick slime. So if you leave them for any length of time they will slowly go flat and make a disc. Just roll them in your hand to make them ball shaped again.

Pudding Slime

What you will need:

- ¼ cup instant pudding mix
- 1 cup corn starch
- 1/3 cup warm water
- Mixing container and spoon

Step 1: Add instant pudding mix and half of your cornstarch to a mixing bowl. Add 1/3 cup water and stir until slime begins to form (it will be pretty sticky at this point.)

Step 2: Slowly add the rest of your cornstarch, stirring as you go. When slime thickens and is hard to stir with a spoon, finish it by kneading by hand.

Note: If slime is dry add more water. If slime is sticky add more corn starch. Keep in mind that this pudding slime won't behave exactly like stretchy glue/borax slime, as they have different properties and react differently.

Magnetic Slime

What you will need:

- Liquid Starch
- Elmer's glue
- Iron Oxide powder
- A bowl and spoon for mixing
- ½ cup measuring cup
- 1 Tablespoon
- Neodymium magnet (a regular magnet won't be strong enough)

Step 1: Pour ½ cup of white glue into your mixing bowl. You may have to use a spoon to scrape all the glue out of the measuring cup.

Step 2: Add 2 tablespoons of iron oxide powder. Stir well.

Step 3: Pour in ½ cup of liquid starch.

Step 4: Stir the glue and starch mixture really well. As soon as you begin to stir, the starch will react to the glue and the slime will start to form.

Step 5: Knead the slime with your hands and experiment with magnet.

The Great Desert Island STEM Challenge (Five Different Challenges)

This activity is built around the story of a shipwrecked traveler stranded on a deserted island. The students will complete five different challenges to help him get back to civilization.

Read story: Not too long ago, a group of adventurous travelers set sail for a week on the open seas. Unfortunately, on the second night, a great storm came upon them while they slept in the cabin below deck. The violent storm tossed the passengers from one side of the ship to the other. The captain tried to take control but was knocked overboard by a massive wave! Eventually, the ship came to a crashing halt when the storm threw it onto the rocky shore of a deserted island. Sadly, only one traveler survived - Sir Harley Houndstooth III. It is now your job to help him survive the island and get back to the civilized world. Are you up to the challenge?

Challenge 1: Island Architect – Construct a Hut

For this challenge, students will plan, design, and build a hut that will withstand a small wind storm. Concepts: linear measurement, area, force and motion, scientific process, properties of shapes.

What you will need:

- Hair dryer for wind (if unavailable you can use a balloon for wind)
- Straws
- Popsicle sticks
- String or ribbon
- Newspaper or construction paper
- Tape
- Glue
- Cardboard (one inch by one inch)
- Rulers

Challenge design requirements: Completed huts must have a door that opens. The door is one inch high and the structure should be no more than eight by eight inches. To be considered successful, designs must not fall apart or tip over during the wind storm.

Step 1: Read the following: My first night on this dreaded island is over. I slept fitfully, alert for wild animals that might be lurking in the jungle. This is no place for a man like me. I am hopeful that help will arrive soon but must make the best of things while I'm here. Today I will find more suitable sleeping arrangements. Perhaps I can construct a hut of some sort to at least keep the wind from ruffling my hair. Yes, a cozy hut shouldn't be too difficult to build. Now, let's see what I can find on this island to start the job.

Step 2: Discuss the problem and brainstorm ideas together.

Step 3: Divide into groups and have each group discuss their plan together.

Step 4: Build your hut.

Step 5: Testing the structure. Place the structures on a flat surface two feet away from the hair dryer using the lowest setting. If electricity is unavailable you may use a balloon for your wind source.

Step 6: Discussion Questions:

- How far did your hut move?
- Did your hut fall over?
- Did your hut fall apart?
- How long did your hut withstand the wind storm?
- What worked? What would you do differently?

Challenge 2: Crocodile Crossing – Build a Bridge

For this challenge, students will plan, design and build a bridge that will hold weight. Concepts: linear measurement, force, scientific process

What you will need:

- Popsicle sticks
- String
- Gumdrops
- Index cards
- Toothpicks
- Q-tips
- Tape
- Paper
- Bar erasers
- Rulers
- Scissors

Challenge design requirements: Complete bridges must include four gumdrops and be able to span a ten-inch space. To be considered successful, designs must be able to hold the weight of one bar eraser for at least five seconds.

Step 1: Read the following: Today my fears were confirmed. Yes, there are wild beasts living on this island. Just a short distance from my hut, I discovered an incredible grove of fruit trees which include: mangoes, bananas and lemons. Yet, I cannot reach them, for standing in my way is a lagoon full of the most terrifying crocodiles I've ever seen. I must find a way to reach that grove. Perhaps I could find enough branches and vine to build a bridge. But would it be strong enough? Or would I fall into the awaiting jaws of those hungry crocs?

Step 2: Discuss the problem and brainstorm ideas together.

Step 3: Divide into groups and have each group discuss their plan together.

Step 4: Build your bridge.

Step 5: Test each structure by bridging it between two desks spaced ten inches apart. Place one bar eraser on the center of the bridge. After five seconds, add another bar eraser. Continue adding erasers until the bridge collapses.

Step 6: Discussion Questions:

- How long is your bridge?
- How wide is your bridge?
- How many gumdrops did you use?
- How many erasers did your bridge hold before breaking?
- What worked? What would you do differently next time?

Challenge 3: Message in a Bottle – Waterproof Container

For this challenge students will plan, design and create a watertight container that can float. Concepts: linear measurement, weight measurement, buoyancy, scientific process.

What you will need:

- Foil
- Plastic wrap
- Toilet paper rolls
- Small Dixie cups
- Paper
- Masking tape
- Straws
- Rubber bands
- Scissors
- Rulers
- Tub of water

Challenge design requirements: Complete containers must be between four to six inches long and include a message written on paper inside. To be considered successful, designs must be able to float and keep water out for 30 seconds.

Step 1: Read the following: Today marks one week in this rotten place. It is hot, dangerous, and lonely. Oh, how I wish to go home. I wonder if anyone knows what happened to our ship or is looking for survivors. Surely my family misses me by now. If there is any hope of being rescued, I must let someone know that I am here. Perhaps I could send a message in a bottle. Does that really work? I must try. It's my only chance. If I could just find a bottle of some sort . . .

Step 2: Discuss the problem and brainstorm ideas together.

Step 3: Divide into groups and have each group discuss their plan together.

Step 4: Build your container.

Step 5: Test each structure by placing it in the tub of water for 30 seconds. Have each team open their container to see if water was able to get inside.

Step 6: Discussion Questions:

- How long is your bottle?
- Does your bottle float?
- Did your message get wet?
- What worked? What would you do differently next time?

Challenge 4: Pirate Defense – Coconut Catapult

For this challenge, students will plan, design, and create a device that can launch a projectile at least 12 inches.

What you will need:

- Marshmallows
- Pom-poms
- Rubber bands
- Plastic spoon
- Clothespins
- Tape
- Popsicle sticks
- Binder clips
- Ruler
- Glue

Challenge design requirements: Complete a catapult. To be considered successful, designs must be able to launch one the projectiles (pom-pom or marshmallow) at least 12 inches.

Step 1: Read the following: A most disturbing discovery - pirates! Yes, it appears that actual real pirates inhabit these waters. Imagine my joy when I looked out upon the horizon yesterday and spotted a ship in the distance! I was quite sure that my message in the bottle had been found and my rescuers had arrived. But upon close inspection, I realized the ship was not a friendly one, for flying from the mast was the Jolly Roger. Now I must find a way to protect myself in case the pirates come ashore.

Step 2: Discuss the problem and brainstorm ideas together.

Step 3: Divide into groups and have each group discuss their plan together.

Step 4: Build your catapult.

Step 5: Test each device by placing it at a starting line. Mark another line 12 inches away. Each team gets two launches. They will measure and record the actual distance their projectile travels.

Step 6: Discussion Questions:

- How far did the marshmallow travel?
- How far did the pom-pom travel?

- Which projectile are you using for your test?
- What worked? What would you do differently next time?

Challenge 5: Float your Boat – Raft Design

For this challenge, students will plan, design, and build a raft with a mast that floats and holds weight. Concepts: Linear measurement, weight measurement, area, buoyancy, scientific process.

What you will need:

- Foil
- Popsicle sticks
- Rubber bands
- Paper
- Cardboard
- Yarn or string
- Masking or duct tape
- Small Dixie cups
- Ruler
- Glue
- Pennies for weights
- Tub of water

Challenge design requirements: Completed rafts must have a mast and a base no larger than 8 inches. To be considered successful, rafts must be able to float while holding at least one penny. Points can be added for additional pennies.

Step 1: Read the following: I am beginning to lose hope of ever getting home. At least if I am stuck here, I now have a safe shelter to sleep in, food to eat and a way to fight off the pirates. I have done all of this with my bare hands and only the resources of this island! My family would be surprised and proud. Oh, my dear family. I miss them so! I am determined to find a way back. There is nothing left of the ship that brought me here but perhaps I can build my own. Yes, a raft made of the very wood on this island will get me home.

Step 2: Discuss the problem and brainstorm ideas together.

Step 3: Divide into groups and have each group discuss their plan together.

Step 4: Build your raft.

Step 5: Test each raft by placing it in the tub of water. After demonstrating the ability to float, teams will place one penny on the raft, adding more slowly to see how many the raft can hold while staying afloat.

Step 6: Discussion Questions:

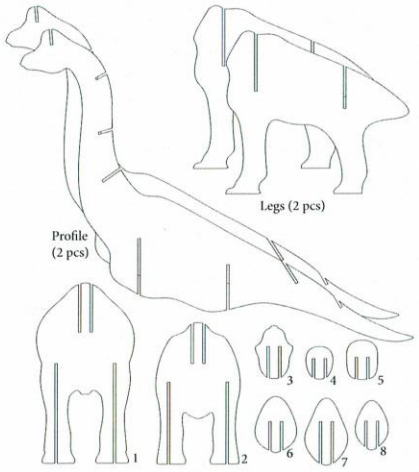
- How large is the base of your raft?
- Does the raft float?
- How many pennies did your raft hold before flipping or sinking?
- What worked? What would you do differently next time?

Dinosaur Craft: Brachiosaurus and Parasaurolophus

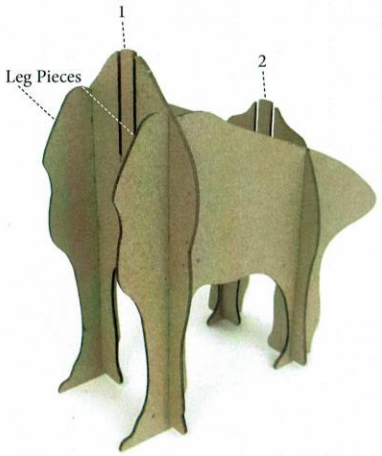
Copy the images on cardstock. Cut out the parts, making sure to cut each slip as shown. Have students color and put together their dinosaur.

Youthlinc

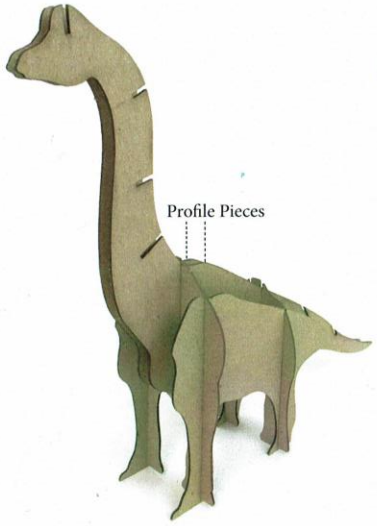
Brachiosaurus Assembly Instructions



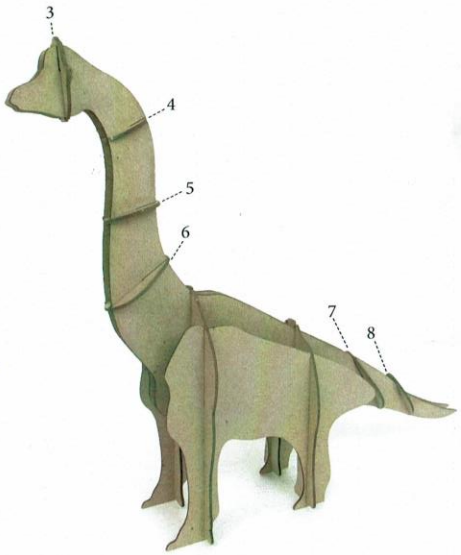
1. Identify all pieces and read instructions before beginning.



2. Fit bottom slots of #1 and #2 into corresponding slots in Leg pieces as shown.

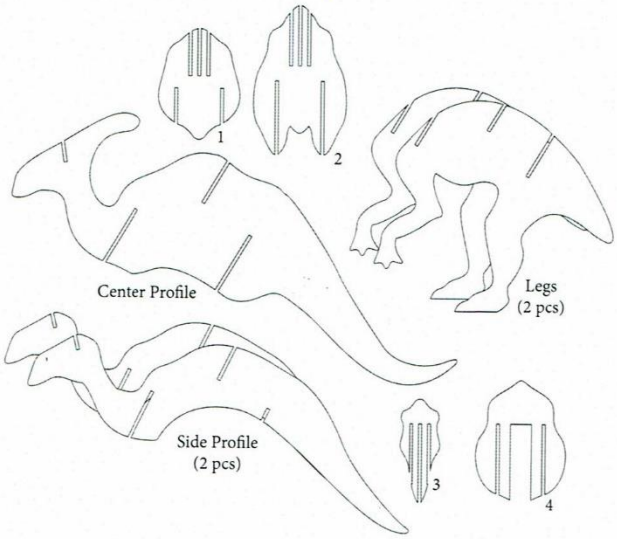


3. Fit Profile pieces down into top slots in #1 and #2 as shown.

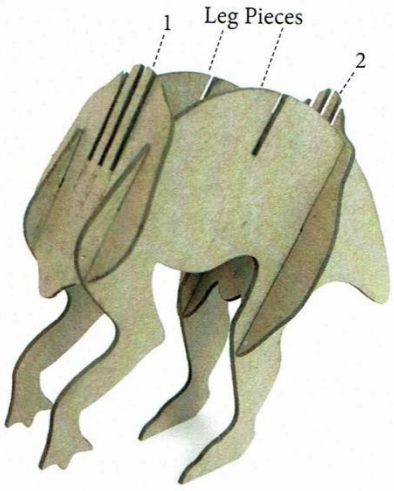


4. Fit #3 through #8 into the corresponding slots in Profile pieces as shown. You're done!

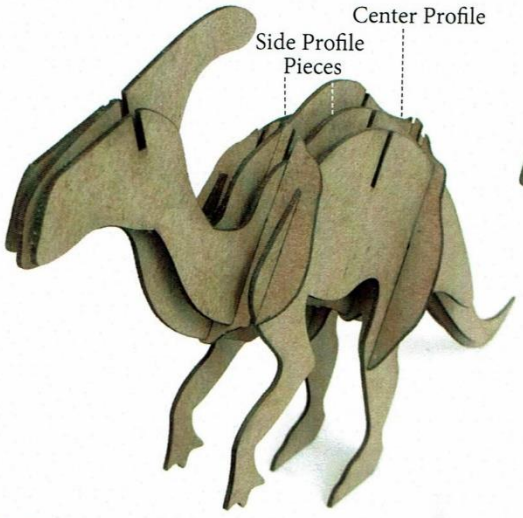
Parasaurolophus Assembly Instructions



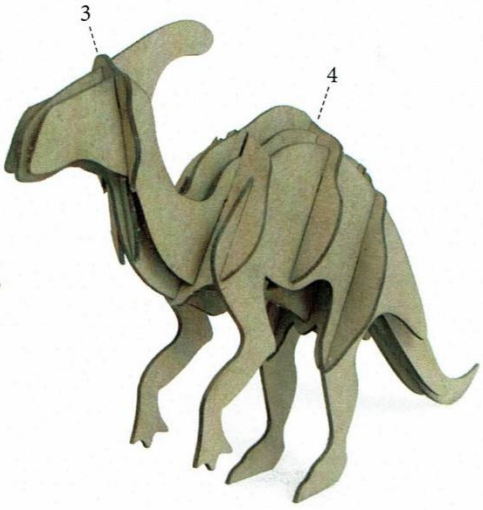
1. Identify all pieces and read instructions before beginning.



2. Fit bottom slots of #1 and #2 down into corresponding slots in leg pieces as shown.



3. Fit Center Profile piece down into center top slots in #1 and #2. Fit Side Profile pieces down into side top slots in #1 and #2 as shown.



4. Fit #3 and #4 into the corresponding slots in profile pieces as shown. You're done!

Environmental Lesson Ideas

Pepper and Water Science Trick

This activity will stress the importance of thorough hand washing.

What you will need:

- Clear paper cup
- Dish soap
- Pepper

Step 1: Fill the container with about 4 oz of water.

Step 2: Shake pepper all over the water for 5-10 seconds.

Step 3: Have a student dip their finger in the water. They will notice that the pepper sticks to them. The pepper represents the COVID-19 virus (or other virus) when we don't properly wash our hands.

Step 4: Next drop a little bit of dish soap on the student's finger and have them dip it back into the container. The pepper will immediately float away from their finger. This gives children an accurate representation of how soap defends from COVID-19 (or other viruses).

The STEM behind the fun: Other than educating children on the value behind hand washing, it also teaches them about STEM principles. The reason why the pepper moves away so quickly when you use soap is because of surface tension. Water molecules (H20) like to stick together. The way that the molecules are organized creates tension at the surface of the water (this is also why the pepper floats). The addition of soap changes the water tension. The water wants to keep the surface tension so the molecules pull away from the soap, bringing the pepper with them.

Effects of Pollution on our Water Supply

Before the lesson mix up two cups of water, one with regular water and another that looks dirty (mix in dirt, plastic, paper, etc.). Ask students which one would be safe to drink? Why? Ask students how water in our environment can get dirty. Tell them that we all need clean water, air and land to live on. If we do not take care of our air, water and land, it might not be usable for everyone. Tell students that today we will learn about how water can be affected by pollution and how we can keep it clean.

What you will need:

- 8 large clear plastic containers
- 4 Tongs
- 4 Funnels
- 4 Coffee filters
- Bottle of vegetable oil
- Pieces of plastic

- Paper
- Dirt
- Water

Step 1: Arrange students into four groups.

Step 2: Fill four plastic containers 3/4 full of water.

Step 3: Students can add trash to the water (oil, paper, plastic and dirt).

Step 4: Students should note the changes to the water after each item is added, for example the dirt makes the water muddy, the oil floats on top, the paper falls apart into tiny pieces, plastic floats at the top, etc.

Step 5: Ask students for ideas on how it can be cleaned up.

Step 6: Use tongs to remove large pieces of trash.

Step 7: Filter the water into a new container to remove more trash.

Step 8: Ask students if they have removed all the pollution. (Some, but not all.)

Step 9: Since it is hard to remove all the pollution, brainstorm ways to prevent that water from being polluted in the first place.

Homemade Hand Sanitizer

What you will need:

- 1 cup of 99% isopropyl alcohol
- 1 tablespoon of 3% hydrogen peroxide
- 1 teaspoon of 98% glycerin
- ¼ cup distilled or boiled cold water

Step 1: Pour the alcohol into a medium-sized container with a pouring spout. The percentages on the labels of isopropyl alcohol refer to the alcohol concentration in them. You're dealing with almost pure alcohol if you've got 99.8%, whereas 70% means the bottle is only a little more than two-thirds alcohol, and the rest is water.

Step 2: Add the hydrogen peroxide.

Step 3: Add the glycerin and stir. This ingredient is thicker than both alcohol and hydrogen peroxide, so it'll take some stirring to combine everything. You can use a clean spoon for this or, if your container has a lid, you can put that on and shake it well.

Step 4: Measure and pour in the water. Measure ¼ of a cup of distilled or boiled cold water and add it to your mix. Stir.

Step 5: Sanitize your spray bottles and pour in your hand sanitizer. Spray some of your leftover alcohol into your bottles and let them sit until the alcohol has evaporated. Pour in your sanitizer.

The STEM behind the fun: Creating homemade hand sanitizer is a great way to showcase STEM to your kids. It allows them a real chemistry experience and helps create an effective agent for battling viruses and germs.

Rain Cloud Experiment

This activity will help students understand rain clouds.

What you will need:

- A large clear jar or glass
- Shaving cream (must be foaming shaving cream)
- Gel food coloring or washable watercolors
- Pipettes or droppers

STEP 1: In a small cup, combine the food coloring with some water. Make sure to mix it well.

STEP 2: Fill the large jar or glass with water until it is about 3/4 full.

STEP 3: Place the jar and the cups of colored water on the table. Place a pipette in each cup of colored water.

STEP 4: Right before the students are ready to do the experiment, spray a bunch of shaving cream in the jar until it is just a small bit above the top of the jar. Make sure it completely covers the surface of the water.

STEP 5: Get your students to pick up the colored water with the pipette or droppers and squirt it on the top of the shaving cream and repeat. As they are doing this, get them to pay close attention to what is going on underneath the "cloud". The colored water will fall through the shaving cream and flow through the water below… just like rain!

The STEM behind the fun: Be sure to explain that the shaving cream represents the clouds and the water represents the air. As clouds become more saturated, they become very heavy. When the water is released it rains.

For more information click on this link: Why Does It Rain?

Volcano Science Experiment

What you will need:

- Ketchup or tomato paste
- Vinegar
- Dish soap
- Baking Soda

- Play Dough
- Small bottle
- Funnel

Step 1: Place about 2 tablespoons of baking soda into a bowl. Add about 10 drops of dish soap on top of the baking soda and about ¼ cup of ketchup or tomato paste. Mix together gently with a spoon so you don't make too many suds.

Step 2: Cover the bottle with play dough and place it on a tray. Carefully pour the baking soda mixture into the bottle using a funnel.

Step 3: Add vinegar to the bottle slowly, a little at a time. If you use too much vinegar, the eruption will not be as great.

Tornado in a Jar

What you will need:

- Mason Jar
- Dish soap
- Glitter

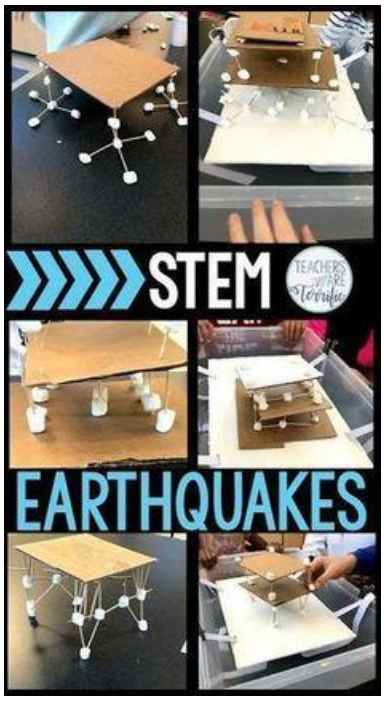
Step 1: Fill the jar mostly full of water. Drop no more than two drops of dish soap into the mixture.

Step 2: Add a tiny sprinkle of glitter and close the lid.

Step 3: Shake in a circular motion to reveal your tornado

The STEM behind the fun: A tornado (vortex) is formed in the center of a jar when you shake it up. This is due to centripetal force, which forces the water toward the center of the jar. The reason you can see it when you add dish soap is because the soap suds slightly, making the vortex more visible. The glitter is just for fun.

Earthquake Challenge



In this challenge, students will be using materials to design a three-story structure that can withstand being shaken in a mild earthquake simulation. The structures are built using only three materials, must be a least three floors tall, resemble a building (not a tower), and be stable enough to keep standing.

What you will need per group:

- Toothpicks (1 small box)
- Mini marshmallows (8 oz. cup)
- Cardboard pieces (3)
- Ruler
- Scissors
- Stopwatch (optional)

Step 1: Introduce the challenge by talking about the earth and its layers. How do earthquakes occur? What do engineers do to make a structure withstand the forces of an earthquake? Explain to the students that they will be building a structure that must stay intact during a mild earthquake (shaking time of 15 seconds.)

Step 2: Constraints of the Earthquake Challenge

- You may only use the supplies above.
- You must build a structure that will survive a mild earthquake simulation of 15 seconds.
- The structure will rest on top of the earth (a layer of gelatin or other structure like sand, or a structure like the one in the picture.) The structure is not attached to the earth layer.
- The structure must be at least 3 floors tall.
- You will build the structure completely before placing it on the earth layer for testing.

Step 3: Plan. How will you make the structure stable?

Step 4: Build your structure.

Step 5: Test your structure by sitting it on the earth layer and shaking.

Step 6: You may improve your structure after testing it.

Step 7: Your final structure will be presented and tested with the entire class. Describe what happened during your presentation and earthquake simulation.

Step 8: Reflect: Was your structure successful? Why or why not? What was your favorite part of this challenge? What was the hardest part of this challenge?

Ocean Water Pollution

What you will need:

- Container
- Water
- Vegetable Oil
- Cocoa
- Dawn Dish Soap
- Cotton Balls
- Toothbrush & Sponge
- Tweezers
- Ocean Life Plastic Toys
- Rocks, Seashells
- Other misc. garbage (plastic bags, wrappers, bottlecaps, fishing string, plastic lid, etc.

Step 1: Let students know that pollution is a substance that can be seen or unseen that causes our environment to be unhealthy. Pollution is anything that isn't naturally created on our Earth. Water pollution is caused by fertilizer, oil spills and human debris.

Step 2: Add examples of things that actually belong in the water to the container and begin adding water.

Step 3: Take about 1/3 cup of oil and add 1 tablespoon of cocoa to it and mix it well. With a spoon or dropper begin adding the mixture slowly to that water. This mixture represents the oil.

Step 4: Add the other garbage you have collected to the water and point out that this is what pollution looks like

Step 5: Using a toothbrush, sponge and some Dawn soap, help your students clean up the ocean.

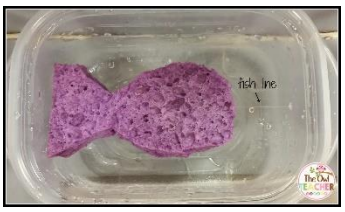
Children's Books on Pollution:

- Earth Day, Every Day by Lisa Bullard
- The Adventures of a Plastic Bottle by Pete Whitehead
- Pesky Plastic by Tamara Visco
- Water, Water Everywhere! By Phiffikus

Polluting a Fish

What you will need:

- Reusable plastic bowl container
- Sponge cut out in the shape of a fish
- Fishing line
- Pollutants in different containers
    - Soil
    - Raisins
    - Green food coloring for fertilizer
    - Salt
    - Garbage – holes from paper punch
    - Dish soap for acid rain
    - Coffee grounds
    - Syrup for oil



Step 1: Create a water environment with the plastic bowl and fish with a fishing line attached. Add the water.

Step 2: Read the story of Freddie the fish taking his journey in the river downstream and being exposed to various pollutants along the way. Each time Freddie was being exposed to a toxin, pour in a new item into the water environment. As you progress downstream, Freddie's environment will be getting filthier and more dangerous for him. Through this activity talk about how Freddie must be feeling.

<u>Story of Freddie the Fish:</u>

- This is Freddie the Fish. He is a happy fish that lives in crystal clear water, enjoys the shade of the tall trees along the river bank and gets lots of insects to munch on each day. How do you think Freddie feels?
- One day, Freddie wondered what was beyond his little part of the river. He decided to go on a little journey and explore. He heads on downstream. He is ready to see the world.
- Along the river, Freddie first comes across a spot where bulldozers are taking out trees and clearing land. Soil and dirt roll into the river because there are no tree roots to hold the soil in place. Poor Freddie gets soil in his gills. Without the trees, Freddie notices he is feeling warmer. (Pour in the soil)
- As Freddie continues down the river, he spots some black and white animals moving closer and closer to the river. While these animals are getting a drink, they drop a "present" into the water for Freddie. Freddie is not impressed with the smell or that the sediment is being stirred up. (Pour in Raisins)

- As Freddie rounds the corner, he has to dodge a golf ball that nearly lands in the river. The golf club likes to keep their courses looking nice, so they us a lot of fertilizer. Unfortunately, when it rained last, it caused it to run off into the river. (Pour in green food coloring)
- Freddie noticed that this area had a lot of tall plants growing and actually was starting to feel smothered. However, Freddie is a trooper and charged on. He was determined to see all the river had to offer.
- After a while of swimming, Freddie began to notice a salty taste to the water, and he started to feel the sting of salt in his gills. All the salt that was used on the roads had worked its way into the river. (Pour in salt.) How do you think Freddie is feeling?
- Freddie continues on and passes a picnic site at a local park. As he was passing, the wind began blowing littler into the river from the park. (Pour in paper)
- Freddie is starting to feel a bit distressed, but he keeps moving on. It begins to rain, and Freddie notices this rain is different. It turns out this rain is acid rain caused by the air pollution. (Pour in dish soap)
- Along the river edge, Freddie comes across an old abandoned factory. There are a lot of toxic pollutants and rusty materials seeping into the river. This creates a sludge in the river. Freddie tries to swim through it. (Pour in coffee)
- After struggling, Freddie Finally gets through the toxic pollutants in the river. Along the side of the river, Freddie notices a man dumping oil from his car into the river. The oil gets into his gills and he starts to have difficulty breathing. He gasps and takes his last breath. (Pour in syrup)

Step 3: Brainstorm what could have been done differently with each pollutant so Freddie could have had a healthier environment.

Step 4: After discussing the impact humans have on Freddie's environment, discuss how it impacts the Earth. You can use this idea as a possible additional activity.

Water Filtration Activity

What you will need:

- 2 glass jars
- Sand
- Gravel
- 3-4 coffee filters
- Dirty water
- A plastic cup with a hole cut in the bottom

Step 1: Fill the jar full of dirty water.

Step 2: In the plastic cup line the bottom with coffee filters then place a layer of clean sand followed by a layer of gravel.

Step 3: Place the cup into an empty jar. Pour the dirty water into the cup so it can filter down through the gravel, sand and coffee filters.

Step 4: Look at the difference in the water before and after. The filter collects all of the dirt and particles in it making the water much cleaner.

More Pollution Activity Ideas

Click here.

Weathering and Erosion

Students will explore the science of weathering and erosion to understand how Earth's surface changes.

What you will need:

- Photo of a tree growing out of a rock

Station 1:

- Sugar Cubes
- Plastic tray
- Plastic bag (Ziploc)

Station 2:

- Water and watering can
- Potting soil or sand
- Clear basin

Station 3:

- Coarse sand paper
- Limestone, calcite, or other soft stone

Step 1: Show the students a picture of a tree growing through a rock. Ask the students to describe what they see in the image. Focus on the crack that is formed from the plant growing. Ask students to think of other places they have seen cracks in the Earth's surface. Examples include: potholes, road or sidewalk cracks, etc. Let the students know that weathering causes these changes. Explain that they will be exploring the process of weathering and erosion.

Step 2: Set up the stations.

Step 3: Explore.

- Station 1: Physical Weathering

- Focus Question: Why dd the sugar cubes crush?
- Have students model the process of physical weathering using sugar cubes. Place a tray on the table and put six sugar cubes in a plastic bag. Put this plastic bag containing the sugar cubes on the tray. Have the students press down on the sugar cubes so that they crush apart.

- Station 2: Water Erosion and Deposition
  - Focus Question: Which part of the demonstration models erosion and which part models deposition?
  - Take a clear basin and fill one side of the basin with a steep slope of soil. Have the students take a watering can and pour water over the steep slope. They should see water and soil falling down the slope. They should also see evidence of deposition based on where the soil settles on the other side of the basin.

- Station 3: Wind Erosion
  - Focus Question: What happens when sand travels in the wind as it is constantly blasted against a rock?
  - Place a rock on the table with coarse sandpaper. Have students sand the rock for a few minutes to demonstrate wind erosion with sand.

Step 4: After the students complete all of the stations, talk about the differences between weathering and erosion. Many factors cause weathering. Explain that Station 1 provided a visual of what happens to soft pieces of rock during weathering. Station 2 demonstrated what happens during water erosion, and Station 3 showed what happens when the wind blows particles such as sand against rock over a period of time.

Learning About Trees

http://firstieland.com/learning-about-trees/

Talk about the importance of trees on our environment and all the thing we get from trees. Let the students participate in one of the following activities.

Activity 1: The students each wrote one thing that we get from trees on a paper leaf that we attached to a tree chart. Examples include: paper, boxes, pencil, rubber, eraser, wood, shade, oranges, lemons, apples, money, chairs, oxygen, sap, animal homes, etc.

Activity 2: Paper bag trees

Step 1: Using paper lunch bags, cut strips about halfway down the bag about ½ inch apart.

Step 2: Pull the strips apart and twist tightly to form the branches of the tree.

Step 3: Twist the bag around to form the trunk and attach to a sheet of paper.

Step 4: Have the students add leaves to their trees. Have them write some of the things that we get from trees on the leaves.

Step 5: (Optional) Have the students add details to their project like animals, flowers, etc.

Cloud in a Jar (Two different Methods)

https://www.giftofcuriosity.com/weather-science-how-to-make-a-cloud-in-a-jar/

The science behind the fun. A cloud is formed when water vapor condenses into water droplets that attach to particles in the air (dust, pollen, smoke, etc.) When billions of these water droplets join together, they form a cloud.

Method 1: How to Make a Cloud in a Jar Using Hairspray

What you will need:

- A jar with a lid
- 1/3 cup hot water
- Ice
- Hairspray

Step 1: Start by pouring the hot water into the jar. Swirl it around a bit to warm up the sides of the jar.

Step 2: Turn the lid upside down and place it on the top of the jar. Place several ice cubes onto the lid, and allow it to rest on the top of the jar for about 20 seconds.

Step 3: Remove the lid. Quickly spray a bit of hairspray into the jar and then replace the lid with the ice still on top. Watch the cloud form.

Step 4: When you see a good amount of condensation form, remove the lid and watch the cloud escape into the air.

Step 5: Explain how it works. When you add the warm water to the jar, some of it turns to water vapor. The water vapor rises to the top of the jar where it comes into contact with cold air, thanks to the ice cubes on top. Water vapor condenses when it cools down. However, a cloud can only form if the water vapor has something to condense on to. In the case of this activity, the water vapor condensed onto the hairspray.

Method 2: How to Make a Cloud in a Jar Using a Match (This method will work best for most countries.)

What you will need:

- A jar with a lid
- A match
- A balloon with the bottom cut off (so you can get the balloon over the mouth of the jar)
- Warm water
- A Flashlight

Step 1: Pour enough warm water into your jar to cover the bottom ½" of the jar.

Step 2: Light a match, then hold the lit end in the jar for a few seconds to allow smoke to enter the jar. Then remove the match (or you can simply drop it into the jar. The flame will extinguish when the match hits the water).

Step 3: Quickly cover the opening of the jar with the cut balloon.

Step 4: With this next step, the goal is to change the air pressure in the jar by gently pushing and releasing the balloon. Be gentle as you do this to ensure that the balloon does not come off the top of the jar. With your finger, gently push the balloon into the jar a little bit to increase the air pressure in the jar. Then release. As you release, you should notice a cloud instantly form inside the jar. You may want to shine a flashlight at the jar to help you see the cloud more clearly.

Step 5: Repeat pushing and releasing several times and you will see additional clouds form.

Step 6: Explain how it works. When you add the warm water to the jar, some of it turns to water vapor. When you press on the balloon, you increase the air pressure in the jar, which results in warmer air. When you release the balloon, you decrease the air pressure in the jar, which results in cooler air. As the air cools, the water vapor in the jar condenses. The condensed water vapor is able to collect on the smoke particles from the match and you see the cloud form.

Books about Clouds:

- Clouds by Anne Rockwell
- Explore My World: Clouds by Marfe Ferguson Delano
- The Cloud Book by Tomie de Paola
- Shapes in the Sky: A Book About Clouds by Josepha Sherman

Poster Downloads

http://www.internationalpaper.com/company/publications-and-resources/life-of-the-forest-posters

- History of a Tree as Seen Through Its Rings
- Can You Tell Which leaves & Needles Go To Which Tree?
- A Tree Breathes Through Its Leaves & Roots
- Seeds Come in Many Different Sizes & Shapes

For a fun craft idea using natural wood slices, click here.

Photosynthesis

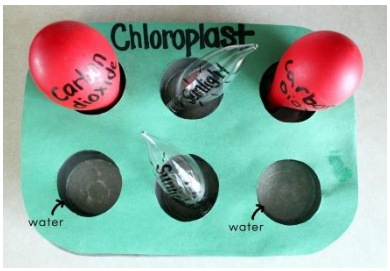
http://www.primarythemepark.com/2015/02/photosynthesis-kids/

What you will need:

- A small muffin tin
- Green construction paper
- Balloons (two red, three white)
- Black Sharpie
- Two light bulbs
- Water
- Sugar

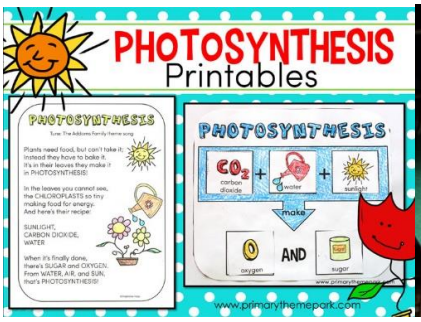
Step 1: Explain that plants are living things. All living things need food for energy. Our bodies get energy from the food we eat. Plants get their energy another way.

Explain that the word photosynthesis is made up of two parts. (Photo, meaning light and synthesis, meaning to put together, compose, arrange.) During photosynthesis plants are using light to create energy.



Step 2: Cut holes from the green construction paper and place over the muffin tin to create a chloroplast model (the green plant cell). Chloroplasts only need three items to create energy: Water, carbon dioxide and sunlight. Place water into two of the holes. Add 2 lights bulbs to represent sunlight and two small balloons to represent sunlight. Explain that you are going to cook up some energy for the plants.

Step 3: Have students work on the top half of the photosynthesis worksheet.



Step 4: While the students are working on the worksheet. Take the muffin tin and fill it with sugar and small balloons. Show the students the new tin. Let them know that the three ingredients turned into two very important things: sugar and oxygen. The sugar is the plant's food and source of energy. Oxygen is not important to the plant so it releases it into the air. Oxygen is vital to us. We breathe in this oxygen that the plants give off.

Step 5: Have the students complete the photosynthesis worksheet.

Step 6: Teach the song, Photosynthesis. It is sung to the tune of Addams Family.

Layers of Earth Activity

https://www.thechaosandtheclutter.com/archives/layers-earth-hands-science-activity/

What you will need:

- 5 colors of modeling clay

- Waxed dental floss

Step 1: Form a ball to represent the inner core. We chose red to represent the intense heat of the inner core.

Step 2: Roll out a circle of another color and wrap around the ball and gently roll. This next layer represents the outer core.

Step 3: Each subsequent color will need more modeling clay than the last. You will need a color to represent the low mantle, another for the upper mantle and the outer later for the crust.

Step 4: Once your ball of five layers of modeling clay is complete, use a piece of waxed dental floss to cut the ball down the middle, revealing all the layers underneath.

** Be sure not to press too firmly together so that the colors don't mix.

Making Groundwater

https://www.thechaosandtheclutter.com/archives/simple-science-making-groundwater

What you will need:

- 2 large clear glasses or vases
- Sand
- Gravel (aquarium gravel works well)
- Water
- Container to pour water

Step 1: In each of the glass containers, layer sand and gravel alternating between the two until they are about ¾ of the way full. This will create an aquifer. An aquifer is the layers of rock, soil and sand that contain water.

Step 2: Slowly pour water into one of the containers. Have the students observe how the water is making its way through the small openings as it goes down. In the first container, continue pouring the water until the container is full (above e the aquifer).

Step 3: Continue to slowly pour water into the second container, stopping about an inch BELOW the top of the aquifer. The level of the water in the second container is the water table. Below that, the aquifer is saturated. The glass of the container in this demonstration acts as impermeable rock.

Step 4: Create what would happen if it were to rain by very slowly adding a bid more water to the second container. Have your student observe and talk about what is happening. This demonstrates the recharging of groundwater.

Step 5: Keep the containers for a few weeks so the students can see that in the first one, there was never any room for more water, but in the second, the ground soaked up more of the water and as time passed, we were able to add a bit more water at a time as long as we never filled it above the top of the aquifer.

Creating a Wormery

https://runwildmychild.com/wormery/

Fun Facts About Worms: Charles Darwin called earthworms "the intestines of the soil," since worms can eat up to 75% of their own body weight every day, turning waste into rich and fertile soil. Worms play a crucial role in the environment by breaking down organic matter like leaves and grass into things that plants can use. When they eat, they leave behind castings that are a very valuable type of fertilizer. Here are a few other fun facts about worms:

- There are over 6,000 different types of earthworms
- Worms have no bones or skeletons
- Worms do not have ears, a nose or eyes, but do have cells that can detect light
- The mouth of a worm is covered by a flap of skin so the worm doesn't swallow everything
- Worms have a mouth, but do not breathe through it – it is just for eating
- The worm has 5 simple hearts, a stomach, and a gizzard
- The gizzard contains tiny rocks and sand that mash up the worm's food, because worms don't have teeth to chew it up
- An earthworm can have over 100 segments between its two ends
- Each segment has tiny little bristles that help the worm move and hold on to things
- All worms have a complete set of both male and female organs on the inside so there are no boy or girl worms

What's a wormery? A wormery is a place where worms can grow, compost and make more worms. A wormery will recycle food waste into superb fertilizer for your garden or yard. Wormeries are also great for growing and storing worms to use for bait when fishing. Wormeries can also be used at home or in classrooms for observing the life cycle and work of worms. After a few days/weeks, the worms and soil can be returned to your yard or garden.

What you will need:

- A container with a lid
- Shredded newspaper or bedding
- Soil, sand, rocks/gravel
- Worms

Step 1: Choose the proper container. There are many different containers you could use to make your wormery – anything from a bucket to a Rubbermaid container to an old Styrofoam cooler. Worms are active on the top layer of soil, so your container doesn't need to be very deep. A lid will keep the

wormery dark and prevent any worms from escaping. Just make sure to poke or drill some small holes in the container and lid to ensure they get plenty of air.

Worms like the dark, so if you're going to be keeping your wormery for a while, make sure you use a container that will keep the soil dark. However, if you're building a wormery specifically for kids to observe the worms, use a transparent glass container or plastic jar/bottle (an empty 2-liter soda bottle works great) and cover it with dark construction paper during the time while the kids aren't watching them.

Step 2: Prep the wormery. Put a small layer of rocks or gravel at the bottom of your container. This helps with drainage and gives the wormery a solid base to prevent it from tipping over. Next, shred up some black and white newspaper to place in the bottom of the container as bedding (or you can buy worm bedding). Spray the bedding with enough water to dampen it, but make sure it's not too wet. It should feel like a damp sponge or wrung flannel. Once the bedding is made, add some gardening soil or worm compost and give it a good mix. Finish by putting some dead leaves or vegetable scraps on top of the soil. If your dirt mixture is really dry, add some water to your container as well – just enough to make the soil damp, but not soggy.

Step 3: Find your worms. This is the part that kids love the most! Let your kids search and dig for worms to add to your wormery. Search damp and dark spots in your yard or local park. Lift up rocks, look under bushes, dig beneath piles of leaves. Worms will be easier to find and closer to the surface after a light rain. You might even find them trying to cross the sidewalk. If you can't find any, you could always snag some at a local bait shop or even order them online. Red worms work the best for wormeries, but if you're building this mainly for observation or fun, use any worms you can find.

This is an excellent time to talk to kids about how to handle the worms and the anatomy of worms. Let the kids touch them, hold them and observe them. Talk about how important it is to be gentle and respectful of your worms. Don't let small kids injure the worms or cause any undue stress or damage to them.

Step 4: Add your worms. Add the worms to the top of the bin and allow them to dig down. Do not try to assist them with burrowing because it will scare them. It can take up to a day for all of the worms to burrow down. Any worms that do not go down after being there for a day or two are dead or weak and should be removed. If you think you've found a dead worm sprinkle it with a little bit of warm water. If that doesn't revive them, the worm is dead or dying and should be left out of the wormery.

Step 5: Feed your worms. Once you've found worms and added them to the wormery, you'll need to feed them occasionally. Worms can eat up to two times their body size every day so always feed them according to the amount they'll eat. However, worms can last their entire lives feeding only off of nutrients in the soil so food is always extra. Have your kids save their fruit and veggie peels and scraps to feed the worms. This is a fun way for them to care for the worms while also finding a use for the scraps. Let kids add scraps such as apple cores, banana peels, or pears to the wormery daily. Do not use meat, poultry, fish, dairy, potato chips, candy, oils, oranges, lemons, and limes because these are not

good for the worms. Food will grow mold if left uneaten for a while if you find a piece of food that is moldy remove it. If you don't want to use actual food scraps, you can also buy worm food.

Step 6: Keep them damp, dark and cool. Worms prefer cool temperatures, so keep them indoors in a cool dark place. A basement or a refrigerator is perfect. In addition to adding food periodically, make sure you add some moisture so the soil/bedding doesn't dry out. Compost will be ready in 2-3 weeks. If you have a transparent wormery for the kids, observe it indoors for a few days and then carefully dump it outside in a shady spot in the early morning.

Additional Ideas to teach students about composting and worms. Click here.

Composting

http://www.acottonkandilife.com/gardening-composting-toddler-school-uni/

You will need five baskets filled with the following materials (40% green and 60% brown):

- Basket 1 – sticks for filtration – 1-part brown
- Basket 2 – Dry Leaves – 1-part brown
- Basket 3 – Green spinach leaves – 1-part green
- Basket 4 – Compostable food from breakfast – 1-part green
- Basket 5 – organic potting soil that you layer between all of the parts
- Compost Container. For ideas on how to build a compost container, click here.
- Book, Compost Stew by Mary McKenna Siddals

Step 1: Read the book, Compost Stew by Mary McKenna Siddals. Tell them that today they are going to make Compost Stew in the garden. Explain there are many reasons to make a compost: it saves resources, saves money, reduces our impact on the environment and improves your soil.

Step 2: Begin layering the compost using the items listed above.

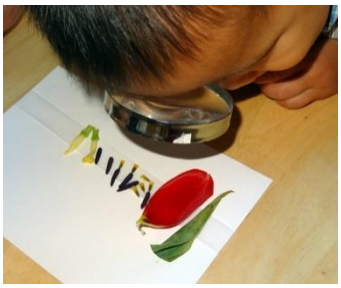
Step 3: Take turns "stirring the stew." As the book teaches, "put it in a pot . . . and let it rot."

For other compost ideas: Click here.

Flower Dissection: Hands on Botany

What you will need:

- A flower for each student (tulips or gladiolas work well)
- White cardstock paper cut in half for each student
- Scotch tape. Secure it so the students can stick each part of the plant on it.



Step 1: Pass out the flowers. Have the students tear off the leaves and talk about what they are called.

Step 2: Take off and talk about the petals. Add to the strip of tape right next to the leaf.

Step 3: Once the petals are off, show the pistol and stamen. Explain that the stamen is the "male" part of the flower since they contain the pollen. The pistol is the "female" part of the flower since it contains the eggs that get fertilized by the pollen. Add the stamen and pollen to the tape strip. Talk about how the pollen needs to go down the pistol to reach the eggs.

Step 4: Pass around a magnifying glass and allow the students to look more closely at the various parts of the flower.

Step 5. Place another strip of tape on top of the parts so they stay in place.

**** The following PDF's are located in the Youthlinc Google Drive. Shareable Link's are listed below. If the links change or are moved, please contact the Local Service Director.**

Reduce, Reuse, Recycle Activity

https://drive.google.com/open?id=1Xwt-z_v6HnJB2G142LgofymmJYF8ntxH

Recycle Sorting Activity

https://drive.google.com/open?id=1sIgd9TXdXoCCxhDiKY2QdyqdQmt6g51d

Earth Day Word Search 1

https://drive.google.com/open?id=1xHVdHad_7F3D3bmpHgtko8xxtWAeQue6

Earth Day Word Search 2

https://drive.google.com/open?id=1-RzyOdy1bDgckeLbm1F2UlKzJ9xDmiKg

Earth Day Cootie Catcher

https://drive.google.com/open?id=1WcI_Fek6rueQptW59KjzkdeiHQnSC_Dn

Earth Day Bingo

https://drive.google.com/open?id=1U_VoQyCvkvkSwVRF0frrkZw5qq0OQWpp

Recycle Board Game

https://drive.google.com/open?id=1yp11pxKtANx-uexVnZuV5jkKxeAFoiX-

Earth Day Activities Flip Book

https://drive.google.com/open?id=1STzjn6fu2s46g4awM6URG5_mQaj7uNSY

Earth Day Activity

https://drive.google.com/open?id=1p9eZoavTpq2C_9BJPQ3d50l7ClMbY974