Builders’ Boot Camp with the STEMonade Stand

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TAKE A PROJECT
What are you waiting for?

TAKE A PROJECT!
Today, we’re skill-sharing through play.
Moving Colors

Supplies:

- Bath Tabs ($10)
- 3 oz. Cups ($15)
- Paper Towels (Maintenance will spot us a roll.)

Total cost: ~$25 for 100 kits
Moving Colors

Watch how colored water can travel and mix colors together.

Kit contains:
- 3 Small cups
- 2 Pieces of paper towel
- 2 Bath color tablets

You will need: water.
INSTRUCTIONS

Step 1. Fill two cups about 3/4 of the way with water. Put the three cups in a row with the empty one in the middle.

Step 2. Put one color tablet in each cup of water. Watch the water turn red, blue, or yellow!

Step 3. Fold the paper towels the long way. Take one towel and form a bridge from the bottom of a water cup to the bottom of the empty cup. Make a second bridge from the other water cup as shown.

Step 4. Watch the water move up the paper towels and into the middle cup! This takes some time; you can leave and keep checking back.

Step 5. After some time, the middle cup will fill with water! Observe what color it is. Why do you think that happened?

WHAT’S GOING ON?

Two cool things are happening here! The first is color mixing. Your color tabs are primary colors (red, yellow, and blue). Mixing two primary colors creates a secondary color (orange, green, and purple).

The second is capillary action. The paper towel is made of fibers and the water is able to travel through the gaps in the fibers. These gaps act like small tubes and pull the water upward, almost like a drinking straw. This is similar to the way plants use water — the roots soak it up from the ground, then it travels through "tubes" in the plant to reach leaves, stems, flowers, branches, everything!

Source: https://funlearningforkids.com/rainbow-walking-water-science-experiment-kids/
LEARN MORE ABOUT IT!

Books (Available at MGPL):
- Incredible Plants by Barbara Taylor
- All About Roots by Claire Throp
- What Do Roots, Stems, Leaves, and Flowers Do? by Ruth Owen
- What Is Color? by Tea Benduhn
- Mixed: A Colorful Story by Arree Chung
- Mouse Paint by Ellen Stoll Walsh
- Mix it Up! by Herve Tullet
- This Book Is Gray by Lindsay Ward

A Fun Sesame Street Song About Color Mixing:
https://youtu.be/yu44JRTIxSQ

NOTE: This experiment is easy to repeat. Bath color tablets are often available in the dollar store/dollar section, or you can use food dye. Reuse the cups, replace the paper towels, and you can see how all sorts of colors mix!
The STEMonade Stand went live.

110 “Grow Your Own Lettuce” Kits
Yes, portmanteaus are cool.
The mission of the STEMonade initiative is to support the Morton Grove community with fun and free educational experiences. To that end, we endeavor to get STEM kits into the hands of our local families.

If MGPL can nurture a love of building and learning in our community, then we’re still connected, even during a pandemic. Life gave us lemons, but we made STEMonade.
10,000 STEMonade Kits and Counting...

- Grow Your Own Lettuce
- Balloon-Powered Car
- Mr. Robot Paper Circuit
- Pipe Cleaner Ninja
- Levitating Pom-Pom Challenge
- Curve Stitching
- Paper Plate Abacus
- Butterfly Feeders
- Straw Rockets
- Walk ‘n’ Roll
- Harmonica
- Roman Arch
- Thaumatrope
- Beaded Mask Chain
- Pool Noodle Boats
- Caesar Cipher Disks
- Brain Hats
- Pantograph
- Catapult
- Crystal Spider
- Tangle of Knots
- Shrinky Dinks
- Rubber Band Banjo
- Button Hockey
- Balloon Zipline
- Tiny Bow & Arrows
- Pom-Pom Popper
- Toothpick Polyhedrons
- Balancing Dragonfly
- Ice Sun-Catchers
- Llama Weaving
- Wind Turbine
- Snow Writing
- Bird Feeders
- Moving Colors
- Hex-a-Puzzles
10,000 STEMonade Kits and Counting...

- Wiggly Worm Puppets
- Circle Art & Pi-Ku Poems
- Paper Building Blocks
- Tightrope Walker
- Paper Kite
- Gear Flinger
- Weather Vane
- Zombie Horde
- Mechanical Monster
- Finger Twister
- Unicorn Weightlifter
- Nature Quest: LEAVES
- Paper Helicopter
- Mr. Chompy
- Egg-speriment
- Snake Puzzles
- Skytale Cipher
- Constellation Luminary
- Digestive System (No Guts, No Glory!)
- LED Flashlight
- Plastic Egg Parachute
- Pan Pipes
- Shadow Lab
- Pirate Paddleboat
- Straw Jump Rope
- Sun Buddy
- Nature Quest: BUGS
- The Matchstick Game
- Legendary Sports Stats
- Balancing Robot
- Cookie Quest
- Fingerprint Detective
- Autumn Nature Sprites
10,000 STEMonade Kits and Counting...

- Solar System Mobile
- Glove Monster
- Roly-Poly Daruma Doll
- Slingshot Rocket
- Pop-Up Geometry
- Coffee Filter Chromatography
- Shark Attack
- Twirling T-Rex
- Coding with Pixels
- Crystal Snowflake
- Whirligig Spinner
- Symmetrical Snowflakes
- Hanging Marble Run
- Ice Lanterns
- Cup & String Telephone
- Anglerfish
- Tessellation Creation
- Magnetic Ice Skaters
- Kaleidoscope
- Waterwheel
- Pi Skyline
- Nature Quest: BIRDS
- Drink Pouch Stomp Rocket
- Germination Lab
- Comet on a Stick
- Star Wheel
- Refraction Lab
- Flappy Bird

(We’re pretty hardcore.)
Quick Regroup!

- We’ve got four more STEMonade kits.
- We will play with three of them now.
- You can take home Slingshot Rockets or create conference mayhem at your discretion.
Skytale Cipher

Supplies:
- Pipe Insulation ($16)
- PVC Pipe ($22)
- Paper ($0)

Total cost: $38* for 100 kits

*This counts as a “prestige” level kit.
Skytale Cipher

**Kit contains:**
- 2 secret messages
- 1 length of PVC pipe
- 1 length of pipe insulation
- Extra strips of paper

**You will need:** tape and a pencil.
WHAT IS A SKYTALE CIPHER?

A skytale cipher is a way to disguise and share secret messages. A long strip of paper is wrapped around a cylinder, and then a message is written on the surface. When the strip is unwound, all you see are mixed up or transposed letters. Your message is safely hidden. Only a person who has the right size cylinder can decipher the message. Skytale cipher was used by the Spartans in military campaigns. In fact, skytale is the ancient Greek word for “baton.” To wrap up, the cylinder is the skytale, which is used for ciphering and deciphering the messages.

ACTIVITY 1: DECIPHER THE HIDDEN MESSAGES

There are two hidden messages and two cylinders with different diameters in your STEMOnade kit. Wrap the strips of paper tightly around the pieces of PVC pipe and pipe insulation. Can you decipher the messages? What happens if you wrap the message around the wrong skytale?

Skytale is pronounced “skee-TA-lee,” not “sky tale.” I regret to inform you that there are no space kitties in this activity.
ACTIVITY 2: CREATE YOUR OWN SECRET MESSAGES

Use the blank strips of paper to create your own secret messages.

Step 1. Wrap a strip of paper around the skytale of your choice. You can use a cylinder from your kit or something sneaky such as the frame of a bicycle. Tape the ends of your paper in place.

Step 2. Write a message across the resulting paper surface. Then untape the strip of paper.

Step 3. To let someone decipher your message, give them the strip of paper and reveal the identity of the correct skytale.
Project Criteria

- Is it fun to make?
- Is the end result interesting?
- Will it occupy at least 10 minutes?
- Does it require specialized supplies?
- Is it possible to replicate by the average 9-year-old with some adult assistance?
- Is prep time acceptable?
- Can we afford it?
Reasons to Reject a Project Idea

• Too expensive!
• Prep work is too time-intensive
• Difficult to replicate results
• The internet lied / I am inept and it didn’t work
Nature Quest: BIRDS

Supplies:
- Brads ($3.79)

Not bad for 100 kits!

Here’s where things get fun: Kids may only spend 5 minutes assembling their kits but hours learning and exploring.
Nature Quest

BIRDS

Go on a Nature Quest to see which birds you can find around your neighborhood!

**Kit contains:**
- Bird dial template
- Brass fastener

**You will need:** scissors and a sharp pencil, thumbtack, or nail.

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Youth Info Desk 847-925-5102 | mgpl.org
INSTRUCTIONS

(1) Assemble your Bird Identifier using the directions on the template.

(2) Can you find all eight birds outside around your neighborhood? When you see them, act like a scientist and **observe** (watch and listen closely). What are they doing? How do they sound? What other things do you notice?

**Try This! Make a Bird Feeder**

If you want to attract many birds to your yard, you can make a simple bird feeder!

- Shape a pipe cleaner/chenille stick into a circle or other shape. String Cheerios on it and hang it on a tree.

More easy bird feeder ideas here: [https://happyhooligans.ca/32-homemade-bird-feeders/](https://happyhooligans.ca/32-homemade-bird-feeders/)

**Cardinal:** The picture on your Bird Identifier is male cardinal. Female cardinals look similar, but are mostly brown.

**Crow:** Crows are one of the smartest animals—they make tools, remember people’s faces and can even bring “gifts” to people who feed them!

**Canadian Goose:** You may see those geese flying in a V shape. They work together so they don’t get tired flying over long distances.

**House Finch:** Like the cardinal, the picture on your Bird Identifier is male house finch. Female house finches look similar, but are all brown.

**Red-Bellied Woodpecker:** You may hear this bird before you see it! Listen for it tapping on a tree. They make little holes with their beaks to get at insects living in the tree bark.
**American Robin:** Robins are migratory birds, which means they live different places at different times of the year. They live around Chicago from spring to fall, then fly south to warmer weather for the winter.

**Mourning Dove:** Mourning doves got their name because their song sounds sad (mourning is another word for being sad). You can hear it and more bird calls here: [https://www.bird-sounds.net/](https://www.bird-sounds.net/)

**Sparrow:** Sparrows live in groups with several families living together to make a community that works together for protection, to find food, etc.

_books to Learn More_

- *Mama Built a Little Nest* by Jennifer Ward
- *Bird Singing, Bird Winging* by Marilyn Singer
- *Our Yard Is Full of Birds* by Ann Rockwell
- *Superlative Birds* by Leslie Bulion
- *Birds* by Pamela Dell
- *Hooray for Birds!* by Lucy Cousins
- *Beautiful Birds* by Jean Roussen
Let's Make a Project!

Find Something Awesome:

- Do you covet it?
- Futz with it enough to prove that it's do-able.
- Brainstorm STEM connections.

(proverbial)
Let’s Make a Project!

Consult the Group Brain:

- Is this idea good, terrible, and/or interesting?
- Does it set off anyone’s inner 12-year-old “teehee” alert?
Let’s Make a Project!

Design:

- Prototype & test (repeat as needed).
- Cost out parts.
- Find cheaper alternatives.

Cheap magnets leave skid marks. Not okay.
Let’s Make a Project!

Natalie, will you draw us some dudes?

Happy little trees?

100 cereal boxes?
Nope! Dollar Tree plates ($5)

Craft sticks ($1.25)
Magnets – we’ve got some in the stash ($2.50)

2 washers per kit instead of more magnets ($8)
Let's Make a Project!

Make it happen!

- Write the booklet.
- Prep the parts.
- Pack the kits.

Total cost: $16.75 for 100 kits
Anglerfish

**Supplies:**

- Clothespins ($2.50)
- 22 AWG Wire ($15)
- LED Lights ($5)
- Coin Batteries ($17)
- Coverstock ($0)

**Total cost:** $39.50 for 100 kits
Anglerfish

Kit contains:
- Anglerfish template
- Clothespin
- 2 Wires
- Coin battery
- LED light

You will need: scissors and tape.

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Youth Info Desk: 847-929-5102 | mgpl.org
INSTRUCTIONS

**Step 1.** Cut out your two anglerfish. Cut off the “fishing rod” spines and luminescent esca “bait.” You are making your own!

**Step 2.** Poke the more exposed end of one of the wires through a hole in the clothespin. Wrap it around the grippy part. Repeat with the second wire on the other jaw of the clothespin. (*Note:* The clothespin should still open and close freely.)

Now it’s time to hook up the electronic components.

**Step 3.** Twist the insulated wires together into a single stalk. Leave it loose enough on the clothespin end to permit it to open and close.

**Step 4.** Connect your LED light. Twist a lead onto each of the wires. Important: the exposed metal on the wires should not touch each other.

**Step 5.** Chomp the battery between the jaws of the clothespin. Does the bulb light up? If not, try flipping the battery upside down. Still no? Check that each wire touches one side of the battery and one diode of the LED.

**Step 6.** Tape an anglerfish picture to each side of the clothespin.

Go forth and terrify your friends with this denizen of the deep!
The anglerfish (scientific name Lophiiformes) is a carnivorous fish that lives in the ocean. There are more than 200 species. They grow from 8 to 40 inches in length and can weigh up to 110 pounds.

Female anglerfish have a dorsal spine that protrudes from above their mouths like a fishing pole, luring in prey with bioluminescent bait. **Bioluminescence** is light produced by a chemical reaction within a living organism.

Yes, anglerfish look very, very creepy.

https://www.nationalgeographic.com/animals/fish/facts/anglerfish

“The girls are running around with them saying it’s their nightlight.”
Community Response

- Pandemic lifeline for families
- Integral part of the MGPL patron experience
- School connections
- Yes, we did a survey!
We prioritize resource sharing!
mgpl.org/stemonade

STEMonade Stand

You might have noticed a blue newspaper box on the Library's front porch. This is a STEMonade Stand, your portal for STEM project kits to do at home.

What's Inside

Inside the Stand you will find kits sealed in zip-top bags with instructions and STEM connections. (For the uninitiated, STEM stands for Science, Technology, Engineering, Math.) Previous kits include:

- Paper Circuits
- Thermomimics
- Crystal Spiders
- Robo Cleaner Ninjas

We will do our best to keep the Stand stocked, but supplies are limited. Please be kind and take only what you need.

View full STEMonade archive
STEMonade Archive

• Make project booklets & tips available to all
• Find one you like? We’ll send you printables.
Slingshot Rocket

Supplies:

- Straws ($1.25)
- Pencil Top Erasers ($3.75)
- Craft Sticks ($1.25)
- Index Cards ($0)
- Paper Clips ($0)
- Rubber Bands ($0)

Total cost: $6.25 for 100 kits
Slingshot Rocket

Kit contains:
- 1 straw
- 1 paper clip
- 1 pencil top eraser
- 1 craft stick
- 1 rubber band
- 1/2 index card

You will need: scissors and tape (masking tape works best).
**INSTRUCTIONS**

**Step 1.** Slide the pencil top eraser onto the straw. Tape it in place.

**Step 2.** Straighten out ONE bend of the paper clip. Then fold the U side 90 degrees to create a hook.

**Step 3.** Tape the hook to the straw at the base of the eraser as shown.

**Step 4.** Cut the index card into 3 or 4 triangular fins. (It helps to cut two equal rectangles, and then cut them along the diagonal.)

**Step 5.** Tape the fins at regular intervals to the other end of the straw, leaving an inch of straw free.

**Step 6.** To build your slingshot, tape the rubber band to the top of the craft stick. Add a SECOND piece of tape for reinforcement.

**Now you are ready to launch!**
Hold the slingshot in one hand. Grip the rocket behind the fins with your other hand. Hook the rubber band, pull back, and release the rocket.
Slingshot Rocket

**BUILDING MOMENTUM**

Imagine that a small marble and a gigantic boulder are rolling down a hill at the same velocity (speed). They’re both heading toward a banana cream pie. What happens next? The pie stops the marble, but the boulder squishes the pie and keeps on rolling. The heavier boulder has more momentum than the lighter marble.

Momentum = mass \times velocity

Did you worry that your slingshot rocket would be too heavy to fly? Adding mass (weight) to the straw rocket’s body with the eraser and all of that tape actually helped it fly farther through the air.
Slingshot Rocket

(Woohoo!)
Thanks for Listening

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