

STEM Challenge for Sparks and Embers

Purpose: The purpose of this challenge is for Sparks and Embers to learn more about science, technology, engineering and math.

Complete at least 5 of the following stations.

Station 1 – Mixing Solids and Liquids

- Mix different white solids with different liquids and see what happens
 - Liquids: water, vinegar, Coca-Cola
 - Solids: sugar, salt, baking soda, baking powder, icing sugar

Supplies:

Sugar	Salt	Baking Soda	Baking Powder
Vinegar	Coca-Cola	Icing Sugar	Clear Glasses

Station 2 – Flying Planes

- Make paper airplanes and see who can get theirs the farthest and race from one end of the gym to the other throwing the plane, each time it lands, they go to that spot, pick it up and throw again

Supplies:

Paper

Station 3 – What Floats?

- Using various objects, have the girls guess which ones will float and which will sink
 - Orange, paper clip, penny, egg
- Lemon vs lime
 - Put a lemon and a lime in water, the lemon floats and the lime sinks
- This is because the density of a lemon is 1.02 g/mL and the density of a lime is 1.12 g/mL and the density of water is about 1 g/mL

From: [Floating Lemons and Sinking Limes - Steve Spangler](#)

Supplies:

Orange	Paper Clip	Penny	Egg
Lemon	Lime	Bucket	Water

Station 4 – Penny Boats

- Floating penny boats
 - Using tinfoil, make a boat
 - Try floating pennies on the boats, see whose boat floats the most

Supplies:

Pennies Tinfoil

Station 5 – Magic Mud

- Using 3 tablespoons of corn starch to 1 tablespoon of water, make magic mud. Have the girls look at this when in the bowl and then pick it up and see what happens!

Supplies:

Corn Starch Bucket/Bowl Water

Station 6 – Water Fun!

- Speedboat matches
 - Fill a bowl with water and put a few matchsticks on the water. Have the girls guess what will happen when the dish soap is put in. Drop in a few drops of dish soap and watch the matches go across the water. (Due to oily film that rushes outward, decreasing the surface tension of the water)
- Sugar lump matchsticks
 - Fill a bowl with water and put a few matchsticks on top to form a circle. Dip a sugar cube into the center and watch the matchsticks come closer together (due to increase in surface tension of the water as the sugar absorbs water).
- Moving water molecules
 - Fill 2 glasses with water, one cold and one hot
 - Put a drop of food colouring into both glasses (do this quickly)
 - Guess what will happen (which moves more quickly) before and watch the results (faster in the hot water because the molecules are moving faster)
- Dissolving sugar
 - Fill 2 glasses with equal amounts of hot and cold water (clear glasses)
 - Dissolve in sugar until there is some collecting at the bottom of the glass
 - Do the same with both hot and cold, try to see which will dissolve more (hot because has faster moving particles that allow more space for the sugar molecules to go in)

Supplies:

Dish Soap Food Colouring Clear Plastic Glasses Matches
Sugar Bucket

Station 7 – Balls, Balloons and Eggs

- Raw or boiled egg?
 - Spin both a raw and a boiled egg and guess which one is which.
 - The raw egg wobbles because the Centre of gravity changes (is liquid so moves) but the cooked egg spins
- Floating ping pong ball
 - Using a hair dryer, put the ping pong ball in the airflow and see what happens. Can try 2 or 3 of these.
 - This doesn't go flying because the air from the hair dryer causes a low pressure system and then gravity pushes down on the ball, leaving it in place.
- Static Electricity
 - Rub 1 balloon on your hair and watch what happens when you pull it away
 - Rub 1 balloon on your hair and then hold it beside an aluminum can, watch what happens as you move the balloon slowly away from it
 - Static forces draw the can to the balloon
- Balloons and Amplify Sound.
 - Holding a balloon to your ear, try tapping on the side, see how it sounds louder. Can also try whispering to your friend with the balloon on her ear
 - The trapped air molecules in the balloon are closer together than in the open air so they conduct better

Supplies:

Eggs

Ping Pong Balls

Balloon

Hair Dryer

Station 8 – Fun Lava Lamp

- Using water, clear plastic bottle, vegetable oil, food colouring, Alka-Seltzer
- Pour water into the plastic bottle to be one quarter full
- Fill the rest with vegetable oil until almost full
- Let the oil and water separate
- Add 10-12 drops of food colouring and let this mix with the water
- Cut an Alka-Seltzer tablet into quarters, drop one quarter into the bottle and watch what happens
- When the reaction stops, can add another one. Can also put the lid on the bottle and try turning over the lamp
 - Oil and water don't mix well, and oil is less dense than water so stays on top
 - The Alka-Seltzer releases carbon dioxide gas when mixed with water and this carries the coloured water to the top of the bottle. When the gas escapes, the coloured water goes back to the bottom of the bottle

From: <http://www.sciencekids.co.nz/experiments/easylavalamp.html>

Supplies:

Alka-Seltzer

Plastic Bottle

Vegetable Oil

Food Colouring

Station 9 – Blowing Up a Balloon

- Using a balloon, 40 mL of water, plastic bottle, straw, lemon juice or vinegar, 1 tsp of baking soda
- Stretch out the balloon first
- Pour the 40 mL of water into the bottle, add the baking soda and stir with the straw until dissolved
- Quickly pour in the lemon juice or vinegar and put the balloon over the mouth of the bottle and watch it inflate
 - The acid of the vinegar or lemon juice mixes with the base of the baking soda, creating carbon dioxide. The gas rises and goes into the balloon, blowing it up.

From: <http://www.sciencekids.co.nz/experiments/inflatingballoons.html>

Supplies:

Balloon	Straw	Vinegar	Baking Soda
Bottle			

Station 10 – Paper Cutting

- You will be able to cut an index card so that it can fit over your head!
 - Use a standard 3x5 inch index card and scissors
 - Fold the card in half lengthwise and make 13 partial cuts. Cut through the folded side first, then turn the card around and cut toward the fold, keep repeating this (cut to a half centimeter of the edge of the card)
 - Carefully open this up and cut lengthwise along the fold, careful not to cut the 2 end sections
 - Stretch the card gently and put it over your head

From: [Math Magic: The Index Card Trick | Macaroni KID National](#)

Supplies:

Index Cards	Scissors
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Station 11 – Rainbow in a Glass and Black Magic

- Using different coloured liquids, create a rainbow in a plastic glass
 - Tall plastic glass, one quarter cup each of dark corn syrup or honey, dishwashing liquid, water (with a couple drops of food colouring in this), vegetable oil, rubbing alcohol (with a couple drops of food colouring in this)
 - Put in the different layers in order, having the girls guess if it will go on top or below the layer already in the glass. Be careful with the last 2 layers as they will mix easier with the other layers
 - This is based on the densities of the liquids
- Black Magic
 - For black magic, you need to cut a circle out of a coffee filter, about the same size as your hand spread out.
 - Put a line with black marker (not permanent) about 2.5 cm from the bottom of the circle. Put some water in the bottle of a cup and put the circle in the cup so the bottom of the circle with the line is covered and the top is coming up the cup.
 - Watch as the water comes up the filter and past the black line – what do you see?
 - Non-permanent markers use inks that are made of coloured pigments and water so that, on a coffee filter, the pigments and water are drawn up and as the water dries, the pigment remains.

From: http://www.exploratorium.edu/science_explorer/black_magic.html

Supplies:

Tall Plastic Glasses	Dark Corn Syrup	Dishwashing Detergent	Non-permanent Black markers
Vegetable oil	Rubbing Alcohol	Coffee Filters	Food Colouring

Station 12 – Silly Putty

- Using household materials, make a fun lump of putty!
 - Mix 4 cups of water with one quarter cup of Borax until dissolved
 - In a second container, mix 1 cup of water and 1 cup of white craft glue (can add food colouring to this for colour)
 - Pour 1 cup of the Borax mix into a cup and add one quarter of the glue solution, stir quickly.
 - Remove the putty solution and knead it to make the putty
 - Occurs because of a polymer being formed

From: http://www.sciencekidsathome.com/science_experiments/pushy-putty-or-flubber.html

Supplies:

Borax	White Craft Glue	Food Colouring	Bowls/Containers
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Station 13 – Colour Mixing Wheel

- Trace the pattern onto cardboard or card stock
- For the inside circle, colour half blue and half yellow
- For the middle circle, colour half red and half yellow
- For the outer circle, colour half blue and half red
- Poke 2 holes in the cardboard, equal distance from the middle
- Using a 4 foot piece of wool or string, thread this through the hole and tie the ends of the string together
- Hold the strings with both hands, having the disc in the middle. Spin the strings similar to a skipping rope to
- wind it up. Once it is twisted on both sides, pull the string tight.
- See what happens to your primary colour wheel.

From: <https://stevespangler.com/experiments/color-mixing-wheel/>

Supplies:

Cardboard String Markers/Crayons Scissors

Station 14 – Pouring Water

- Find a fun way to get water from one cup to another!
 - Cut string about 2-3 feet long
 - Tape one end of the string on the inside bottom of one cup
 - Fill another cup with water and put the other end of the string in this
 - Hold the cup with water above the other cup until the string is almost taut but not coming out of the cup
 - Slowly pour the water down the string and see what happens
 - Try the same experiment but using a wet string first
 - This occurs because of cohesion and adhesion properties of the water molecules

From: <https://www.greenkidcrafts.com/water-travel-string/>

Supplies:

String Tape Food Colouring Glasses

Station 15 – The Spinning Penny

- Squeeze a penny through the mouth of a clear balloon. Blow up the balloon and tie this off.
- Grip the balloon at the stem end and swirl this in a circular motion. The penny will bounce at first but will begin to roll around the inside of the balloon.
- Once the coin is spinning, put your other hand on the bottom of the balloon to stabilize this. The penny should spin for about 30 seconds more.
- Try this with other coins and see how long each takes to stop spinning when you stop swirling the balloon.
 - This uses centripetal force to move the coin

From: <https://stevespangler.com/experiments/spinning-penny/>

Supplies:

Balloons Pennies Other Coins

Station 16 – Racing Ladybugs!

- Create a ladybug out of black and red construction paper (black body and red wings with black dots).
- Cut a section of straw to glue to the bottom of the ladybug.
- Mark out 10 cm intervals on a piece of string or wool, having a total of 100 cm on the string.
- Run the string through the ladybug and tie the other end to something.
- Try and race the ladybug on each string using air pressure to push this forward (blow on this). Race against each other. Also try just blowing enough to go 10 cm, or 20 cm along the string.

From: <https://stevespangler.com/experiments/spinning-penny/>

Supplies:

Black construction paper Red construction paper String Straws Scissors

Station 17 – Magic Changing Colours

- Mix frozen grape juice in an equal amount of water in a pitcher
- Put the grape juice into two glasses to see what colour changes occur.
- Pour a little bit of lemon juice into one glass and see what happens
- The grape juice turns blue because the lemon juice is acidic and the grape juice is an indicator that will turn blue with acids
- Pour two spoons of baking soda to the second glass of juice and see what happens
 - The grape juice turns green because it is a base
- Add baking soda to the blue liquid (the mixture of lemon juice and grape juice) and watch it turn back to purple
 - The grape juice is now neutral again

From: http://www.education.com/activity/article/Explore_Color_Science_with_Grape/

Supplies:

Lemon Juice Baking Soda Frozen Grape Juice Clear Glasses

Station 18 – The Cartesian Diver

- Use a ketchup or sauce package or candy that will barely float. Put this in a clear plastic bottle and fill the bottle to the brim with water and put the cap on tight.
- Squeeze the bottle and see what happens to your “diver”
 - When you squeeze the outside, pressure is increased inside the bottle. This compresses the air in the packet or candy, changing the density of the diver to be heavier than water, causing the packet to sink. When you release the outside of the bottle, the air in the packet expands and the packet will rise again.
- Try squeezing the bottle to get the diver to go to various depths. Can also try racing each other’s divers to see who can get to the bottom of the bottle first. Also, try to get the diver to be suspended in the middle of the bottle.

From: <http://www.scifun.org/homeexpts/diver.htm>

Supplies:

Candy or Sauce Packet Bottles

Station 19 – Floating M’s

- This experiment will look to separate the M from the colour of M&M candies
 - Put about 5 cm of warm water in a bowl. Select candies of different colours that have a clear M on them. Put the M side up in the water. Watch what happens.
 - The colour starts to dissolve and the M is left floating on the top. The colours separate into specific colour sections.
 - Now try the experiment with cold water – what do you think will happen?
 - The differences are even more striking with the colours in this.
 - The colours have different densities so go to different areas in the water.

From: <http://nicholasacademy.com/scienceexperiment251floatingms.html>

Supplies:

M&M Candies Clear Bowls

Station 20 – Making Things Move Without Touching Them!

- Magic Coin
 - Fill a bowl with cold water. Place the bottle neck of a bottle and a coin in the water to cool them down. Place the coin on the top of the bottle. Wrap your hands around the bottle and wait for a few seconds to see what happens. Now remove your hands from the bottle and see what happens.
 - Holding the bottle heats the air up inside the bottle, the warm air pushes harder than the cooler air outside the bottle, forcing the air up and the coin jumps. When hands are removed, the air inside the bottle cools down and the coin stops jumping.
- Magic Balloons
 - Cut two equal lengths of string and tape them to the top of a door frame or wall, about 2.5 cm apart.
 - Blow up 2 balloons and tie them to the end of each string.
 - Rub each of the balloons on hair or a piece of wool clothing to charge them.
 - Watch what happens when you let them go.
 - The balloons are both negatively charged so they repel each other.
 - Try putting your hand between and see what happens

Supplies:

Balloons

Bottles

String

Tape

Coins

Program Tie-Ins:

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