FUN WITH PHYSICS:
Magnets/Electricity, Color/Light, and Sound

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Magnets and Electricity

Mystery Hand:

Get your students to put their thinking caps on by taping a strong magnet to the bottom or top of your hand. Show the students that your hands are empty but hide the side of your hand that has the magnet on it. Put a glove on that hand (optional). Mysteriously wave your hand over a pile of pipe cleaner pieces or other magnetic items. Of course they will "stick" to your hand. The stronger the magnet, the more magnetic items it will attract.

Loop the pipe cleaners into "J" shapes. Pick up one of them with your mystery hand. Ask the students to **predict** how many pipe cleaner pieces you can link to the first pipe cleaner. Add one pipe cleaner loop to the first one. Did both pieces still stick to the magnet? Add another pipe cleaner to create a chain of pipe cleaners. Keep adding until the magnet cannot attract anymore. IS IT MAGIC? NO, IT'S SCIENCE!

It is also fun to let the children put a strong magnet on top of one hand. How many pipe cleaners can they pick up? The power of the magnet even works through their hand! Wow! Is there anything the magnet's power will not go through? What about a table? A door? A cup of water? You can also use a stack of playing cards to do this instead of a hand. Put the magnet on top of the cards and pick up pipe cleaners under the cards. How many cards can the magnet's power go through? **Predictions**?

Need: magnets, glove, 10-15 small pieces of pipe cleaner, 15-20 playing cards, duct tape

Magnet Cars:

Use a hot glue gun to glue a small, strong magnet to the back or top of a plastic or metal toy cars. Use cones, blocks, and other objects to create a 3-4 lane obstacle course on a smooth hard floor. For younger children simply have racing lanes marked off.

Children will use the repelling forces between magnets in a relay race. Give each team a magnet and a toy car. Tell them they may not touch their car with the magnet to make it move. It is up to the students to work with their team to determine how to make the cars move without touching them.

Another idea: **Magna Bugs:** Glue magnetic items to toy animals or bugs.

Options: First children can simply use a magnet to "catch" the bugs or to push them around on the table. Another option is to provide a flat surface for the campers to put their magnets underneath to move the bugs around. This could be as simple as a piece of tag board propped up between several books.

Need: toy cars, hot glue gun, glue sticks, bar magnets or larger horseshoe magnets, toy bugs, magnetic items to glue on bugs such as another magnet, a small key, or a large metal washer

Magnet Painting:

Find a large cardboard box or a lid to a box. An aluminum pan works, too. This is now your magnet "palette". Put paper in the bottom of the box and add paint on top of the paper. Place 1-2 nuts, bolts, magnetic marbles, large paper clips, or other magnetic items on top of the paper.

Now for the fun part! Use a magnet underneath the "palette" to move the items around. What beautiful paintings can they make?

Need: cardboard box or lid, light-colored paper, large magnetic marbles and other magnetic items such as keys, metal spoons, large key chain rings, large metal bottle top lids, magnetic numbers or letters, pieces of pipe cleaners, etc., paint, different magnets

Find the Magnetic Items:

Fill a rubber tub or water table about halfway with sand. Add various items that are both magnetic and non-magnetic. The children will love exploring the sand with magnets to see what treasures they can find!

Using magnetic numbers and letters is especially fun. Challenge the children to find:
Numbers: Ask questions such as, "How many red triangles can you find?"
Shapes: Ask your child questions such as, "Can you find the letter "e"? the letter "Z"?

Size: Ask which magnetic letter or number is the largest, or the smallest. Which is the tallest, etc.?
Matching: Pick a letter and have your child find the one that comes after yours in the alphabet. Do the same with numbers.
Color: Ask questions about the colors of the magnetic items, such as: "Hand me a red magnetic number or letter".

Another idea: Give each child a magnet and go for a walk through your campus. What can they find that their magnet sticks to?

Need: rubber tub or other container like a water table, safe magnetic items, safe non-magnetic items, bar or horseshoe magnets

MAGNET SONGS:

"My Magnet" (Sing to tune of "Clementine")
Blake's magnet, Blake's magnet, Blake's magnet's over here.
Stuck right to the faucet, (or whatever)
Blake's magnet is over here!

"Magnets LOVE Metals!" (Sing to the tune of "If You're Happy and You Know It!)
Magnets love metals, yes they do! Hold thumb and index finger in "U" shape like a magnet. (clap, clap)
Magnets love metals, yes they do! Do the same. (clap, clap)
Magnets love metals and they always stick together, "U" shape, then stick "magnet" to other hand.
Magnets love metals, yes they do! Back to the "U" shape. (clap, clap)

Water Magnet Play:

Fill a tall jar with water and add small keys or other magnetic items to it. Use the magnetic wand to pull them out of the water or to move them around in the water.

For ice magnet play, you need a few ice cube trays, magnetic objects, and a magnetic wand or other strong magnet to use. Freeze magnetic items in the ice cube trays. When frozen, empty the cubes on a large glass baking dish. Prop the dish up on books or large blocks so that the children can run a magnet under it.

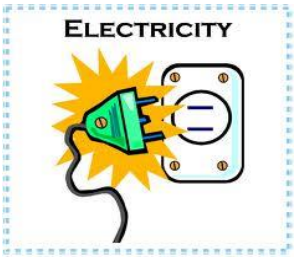
Model how to move the magnet over and then under the ice cubes. What do they do? What happens as the ice melts? Try different magnets. What happens? Wave the magnet in a circular motion above an ice cube. What does the cube do? (It may spin in a fast circle. If not, try again.) How many can be picked up at one time?

Extension: Make this into a sorting challenge. Ask your students to sort the ice cubes by the color of the magnet inside or by the color of the cubes if you use food coloring, by item type (sort the keys, sort the pipe cleaners, etc.) or by letter (use magnetic letters).

How does it work? Water allows the force of magnetism to work through it. As some ice melts the magnets become a little easier to pick up. The slippery surface of the ice to the glass baking dish is perfect.

Need: ice cube trays, magnetic items to freeze, magnets, food coloring (optional)

Electricity is Exciting:



Discuss what electricity is. Focus on what is does—it provides power to things around us like lamps, TV, computers, etc. Electricity is very helpful to us! But we can't see it, hear it, or smell it! What do you see in our classroom that works because of electricity? Of course, emphasize that electricity can be powerful and dangerous, for example lightning. And we need to be very careful around electrical outlets. (Go over safety rules about touching outlets or other electrical things.)

Electricity enters your home through wires. (Show an electrical cord.) Discuss safety. We can control how we use electricity. Use the light switch in your room to teach the children about turning electricity on and off. **Electricity ON! Electricity OFF!**

There is a safe way to learn about electricity. Show your "special" Energy Stick. Tell them that only certain things will allow electricity to travel, like the electrical cord and this energy stick. Touch both ends of the stick with your fingers. It lights up and buzzes! Your body is conducting electricity to make a circuit, or a pathway through which the electricity can move. **Electricity ON! Electricity OFF!**

You can do the same thing with an entire circle of people. Have everyone stand in a circle. Have one child touch one electrode and the person next to him or her hold the other electrode. Everyone holds hands. It lights up and buzzes! Tell one child to let go. Touch again, release again. **Electricity ON! Electricity OFF!**

Ask for predictions about other conductors. Will the electricity stay on or off when both children touch water? **(ON!)** Try other materials like a toy, a piece of paper, a table, a pie tin, an aluminum can, etc. What keeps the circuit closed? What causes the circuit to break open?

How does it work? The Energy Stick is an open circuit featuring electrodes on each end of its tube. When the electrodes are connected by a conductor (such as the human body) the circuit is closed. The closed circuit is shown by flashing LEDs inside the tube and a buzzing noise from the tube. This demonstrates current electricity.

Need: electrical cord, energy stick, bowl of water, other items like a toy, paper, furniture, soda can

Savvy Static!

There is one type of electricity that is safe for you make on your own. It is called static electricity. Lightning is an example of static electricity. It is made by rubbing two things together like rubbing a balloon on a piece of wool. Static electricity is not as powerful as the current electricity that runs through wires. Ask the children if they have ever been shocked by static electricity when they walk across a carpet or when they rub against something else. What does it do to their hair?

Give each child a small plastic comb. Rub the comb vigorously with a piece of wool. Bring the comb close to some confetti. Watch the paper. At first it is attracted to the comb. But after a while a few of the pieces will suddenly shoot off. Then more and more of the paper shoots off.

Put a bowl of Rice Krispies on the table. Rub the comb with the wool. Then dip it into the bowl of Rice Krispies and quickly pull it out. What has happened? Lots of the cereal is stuck to the comb but in an instant the grains begin to pop off as if they were shot from a gun! Why does that happen? Encourage predictions.

Another fun option is to make the wings of a butterfly move! Make a butterfly out of construction paper with tissue paper wings. Glue the body to the tissue paper wings but leave the outer edges of the wings free to move.

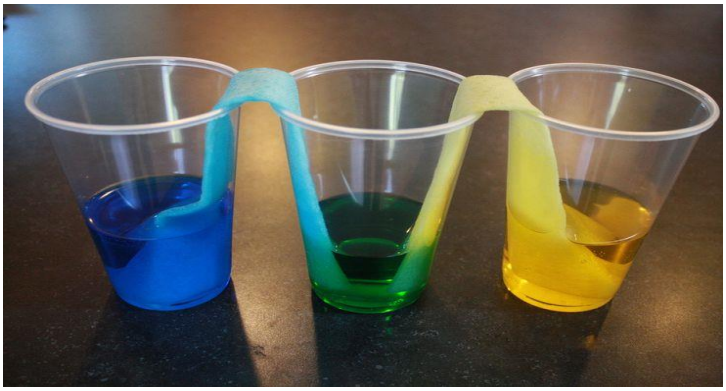
Put the butterfly on a dry table or piece of cardboard and hold the comb about 2 inches above it. Nothing much should happen.

Now rub the comb with the wool and then hold it above the butterfly. The wings will begin to move up and down!

How does it work? Rubbing the comb gives it a strong negative charge. The comb then attracts the uncharged Rice Krispies. As soon as the cereal touches the comb, the grains acquire some of the negative charge. When the charge wears off, the cereal falls back on the table. Remember that like charges repel (like the poles of magnets)? That is why the cereal hops off the comb when it becomes negatively charged.

Need: small plastic comb, small amount of confetti, small piece of wool or a wool sock, small amount of Rice Krispies (Reuse as long as they work), piece of tissue paper, piece of construction paper, glue

Color and Light



Color Caterpillar:

Fill 3 plastic cups to the top with water. These will be for the red, blue and yellow colors. Fill 2 plastic cups about halfway with water. These 2 cups will be for the newly mixed colors as they travel up the paper towels.

Use either food coloring or washable water color paint. Adding in the dye is part of the fun so you may want to consider using washable paint.

Add drops of paint to the full cups so you have red, blue, and yellow water. Once the primary colors are set up, you can add the paper towels. Use a half sheet of paper towel. Fold it into quarters lengthwise. Fold 4 lengths of paper towel strips.

Set up the cups in a row with the primary colors separated by a cup of clear water. So your set-up could be: a cup of **blue water** next to a cup of **clear water** (will turn green) next to a cup of **yellow water** next to a cup of **clear water** (will turn orange) next to a cup of **red water**.

Stick one end of a paper towel strip into a cup of colored water and the other end into a less-filled cup of clear water. Place the paper towel strips between the cups until you have made a "crawling caterpillar**"** between the 5 cups.

How does it work? Due to capillary action, the water moves up the paper towels into the cup(s) next to it. The 2 less-filled cups fill up with water until the water levels of all the jars are equal. As the water levels even out, the colors mix to create new colors in the 2 cups of clear water.

Teacher tips: You may be able to see results within minutes. If you don't it may be the type of paper towels you are using. Choose a brand where you can select the smaller sizes instead of a larger sheet. If it still takes a long time to see any action, try a different type of paper towel.
Need: 5 clear plastic cups or jars, blue, yellow and red food coloring or washable paint, 2-3 paper towels

Painting with Bubbles:

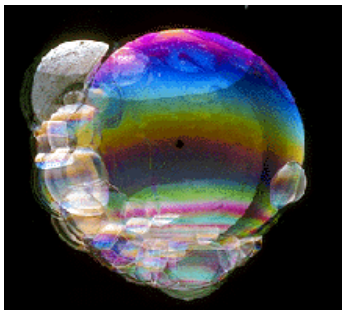
If you mix a little bubble solution with paint, the bubbles will appear clear, but the soap will carry some of the color with it. Transfer the bubbles to paper (or to a paper towel) and make lovely art!

Put two tablespoons of one color of paint into a plastic cup. Add one tablespoon of water. Add two tablespoons of dish soap and mix them together.

Place the cup in an aluminum pan to protect the table. Put a straw into the mixture and blow bubbles until the cup overflows. Lay the paper on top of the bubbles to make the prints.

Another fun option is to blow bubbles directly onto the paper and watch them pop.

What happens to the paint? Now put small blobs of paint on the paper. Use the straw to blow the paint over the paper. What designs can you make by using the air from your mouth to blow the paint?



Add more paint to the bubble solution if the colors are too light.
Extension for older children: Shine a flashlight on the bubbles. What do you see?

How does it work? Similar to the way we perceive the colors in a rainbow or an oil slick, we see the colors in a bubble as light waves reflect and refract off the bubble walls. A bubble reflects color from its surroundings. The water in the bubble holds the paint and transfers it to the paper.

Need: aluminum pan, light colored construction paper or paper towel, Dawn dish soap (not antibacterial), watercolor paints- various colors, straws cut in half, For extension: a flashlight

Shadow Puppet Fun:

Make shadow puppets from items in the book Goodnight Moon or another popular book. Tape an old white sheet between two chairs. This is the screen. Place a lamp or other light source behind the screen to complete the shadow puppet theater! Put dark paper over windows in the classroom if needed.
Turn on the lamp and turn out the overhead lights. Read the book Goodnight Moon. By crouching behind the sheet, a helper can dance the puppets around to make shadows on the screen in line with the story.

Allow the children to use a shadow puppet and to make up their own lines. Or read through the book again and let the children be the puppet masters! Make shadow puppets for other favorite books or topics like dinosaurs!

Need: shadow puppets made with construction paper, craft sticks, glue, Goodnight Moon by Margaret Wise Brown, 2 chairs, small amount of tape, 1 white flat sheet, a lamp or other light source, dark paper and tape as needed to cover windows

Color Potion:

All you need are a few different colors and flavors of Kool Aid. Use the primary colors to add color mixing to the fun! Make the Kool Aid according to the package directions and then pour it into ice cube trays. For brighter colors, add a few drops of food coloring to the Kool Aid. It also helps to use a different ice cube tray for each color. Give each child a clear plastic cup and 2-3 frozen Kool Aid ice cubes. As the ice cubes melt, the liquid will turn cool colors and change flavors, too!

Need: clear plastic cup for each child, at least 2 different colors of Kool Aid, ice cube trays, straws (optional), food coloring (optional)

When we think of magnets and electricity it might seem like they cause things to happen by magic. The reason why magnetism and electricity seem to be so mysterious is that their forces are invisible to us. Have you ever seen the wind? Think about it. We see the effect the wind has on objects around us everyday, but we know it's not magic. We know it is windy because we see the trees moving or see leaves in the air. We have also learned to measure the wind and use it for pleasure and industry. Originally, electricity and magnetism were considered to be two separate forces. This view changed with the publication of James Clerk Maxwell's 1873 A Treatise on Electricity and Magnetism in which the interactions of positive and negative charges were shown to be mediated by one force.Â An electric current inside a wire creates a corresponding circumferential magnetic field outside the wire. Its direction (clockwise or counter-clockwise) depends on the direction of the current in the wire. If electricity produces magnetism, can magnets produce electricity? What you have just discovered in this experiment is that electricity can be generated by moving a wire through a magnetic field. This process is called electromagnetic induction. When an electrical wire cuts across magnetic lines of force, a current is produced in the wire. We know this because the current is detected by watching the needle on a galvanometer, which is an instrument that can measure electric current in wires.