BIG Book

of Bonus Experiments

Easy science experiments to do at home!

Adult Supervision is Recommended Read the instructions carefully. Do not ingest. If swallowed, wash out mouth with water and drink some fresh water. If something gets splashed in the eyes or on the skin, flush thoroughly with water. Keep all the contents out of reach of young children and pets. Be sure to wear your goggles and cover your work surface.

To find your local poison control center:

- In USA call 1 (800) 222-1222
- Internationally go to:

http://www.who.int/gho/phe/chemical_safety/poisons_centres/en/

LOCAL POISON CONTROL PHONE NUMBER

Did you know you can make water bend with the power of static electricity?

Have you ever wanted to instantly freeze water, just by touching it?

Have you ever imagined what it would be like if your drawings came to life?

All these things are possible through the wonders of science!

You don't need a fancy laboratory to be a scientist, you just need a few ingredients and tools from home! This book allows you to explore different scientific principles with 86 hands-on science experiments, all with stuff that's just sitting around your house. So, get your workstation ready, it's time to be amazed by science!

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1 Shine your copper coins—or turn them green!

WHAT TO GET

- 3 dull/dirty, copper coins
- ¼ cup (60 mL) white vinegar
- 1 tsp. (5 mL) salt
- Paper towels
- Non-metal bowl
- Plastic container with a lid

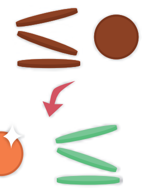
WHAT TO DO

First, we'll shine up those coins:

1. Pour the vinegar into the bowl and stir in the salt until it is dissolved.

2. Put the coins in the bowl and let them sit for a minute or two.

3. Remove the coins and rinse them under running water.



4. Place the coins on the paper towel, let them dry, and admire their shininess. ***Note:*** *Really dirty coins may have to stay longer in the vinegar solution, or may even have to be rinsed and soaked again.*

Now let's get them dirty again:

1. Put a folded paper towel in the bottom of the plastic container, wet it with vinegar, put one coin on the towel and seal the lid.

2. Wet a paper towel with a little vinegar, and put one coin on the towel.

3. Dip one coin in the salt/vinegar mixture you made and place it on a dry paper towel.

Check the coins after 1, 2, 4, and 8 hours and note the differences.

2 Bounce an egg

WHAT TO GET

- A raw egg
- White vinegar
- A bowl

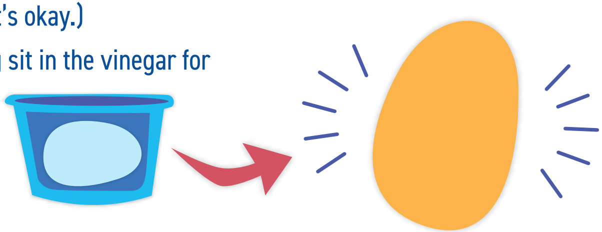
WHAT TO DO

1. Put the egg into the bowl.

2. Pour in enough vinegar to cover the egg completely. (If the egg floats a little bit, that's okay.)

3. Let the egg sit in the vinegar for 24 hours.

4. Rinse the egg GENTLY under running water to remove any white film on it. If the film doesn't want to come off easily, soak the egg for another 8 hours.



THE SCIENCE BEHIND THE EXPERIMENT

The eggshell is made of calcium carbonate which dissolves in vinegar. When the acetic acid in the vinegar reacts with the calcium carbonate, carbon dioxide gas is released as part of the chemical reaction. That's why you see bubbles form on the eggshell as it soaks.

3 Create elephant toothpaste

WHAT TO GET

- An empty one- or two-liter plastic bottle
- Dry yeast
- Warm water
- A clean bowl
- Hydrogen peroxide
- Liquid dish soap
- Liquid food coloring (optional)
- A place that's easy to clean up—this gets messy!

WHAT TO DO

1. Measure ½ cup (120 mL) of hydrogen peroxide and pour it into the plastic bottle.

2. Add a squirt of dish soap, and swirl the bottle gently to mix the two liquids.

3. Add your food coloring now, if you're using it. Either pour a few drops into the bottle and swirl, or put the drops just inside the rim of the bottle and let them run down the sides, without mixing.

4. Put 3 tablespoons (45 mL) of warm water in the bowl.

5. Add 1 tablespoon (15 mL) of yeast and stir for about half a minute.

6. Pour the yeast mixture into the bottle—and stand back!!.

THE SCIENCE BEHIND THE EXPERIMENT

Hydrogen peroxide breaks down into oxygen and water, but that happens very slowly. However, yeast acts as a *catalyst*—something that speeds up chemical reactions. When the yeast hits the liquid in the bottle, the dish soap helps the released oxygen form foamy bubbles that build up until they burst out the top of the bottle.

4 Grow your gummy bears

WHAT TO GET

- A package of gummy bears
- 4 cups or bowls
- Water
- Vinegar
- Salt

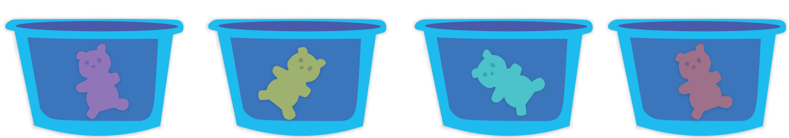
WHAT TO DO

1. Mark each bowl with a number from 1 to 4.

2. Pour ¼ cup (60 mL) of water into bowls 1, 2, and 3.

3. Add 1 tablespoon (15 mL) of salt to bowl number 2, and stir until it's dissolved.

4. Add 2 tablespoons (30 mL) of salt to bowl number 3, and stir until it's dissolved.



5. Add ¼ cup (60 mL) of vinegar to bowl number 4.

6. Put a different color gummy bear into each bowl.

7. Let the gummy bears soak for 24 hours and see if they change size or color.

Check them again after they've soaked for 48 hours. What do you observe?

5 Color a flower

WHAT TO GET

- 3 or 4 fresh, white carnations
- Water
- Liquid food coloring
- 1 glass or vase per flower
- Knife
- ADULT SUPERVISION

WHAT TO DO

1. Pour ½ cup (120 mL) water into each glass or vase.

2. Add 20 drops of food coloring to each glass and stir to mix thoroughly.

3. Have an adult cut the stems of the flower at a 45-degree angle using the knife, not scissors. (Scissors will crush the stems, making them less able to absorb water.)

4. Place one flower into each glass and observe them after 2, 4, 24, 48, and 72 hours.

THE SCIENCE BEHIND THE EXPERIMENT

Water moves through plants by a process known as *capillary action*. The water rises through tiny tubes in the plant's stem until it reaches the petals or leaves, where it evaporates. The food coloring moves with the water, but it does not evaporate, so the petals change color.

6 Pour water down a string

WHAT TO GET

- Measuring cup
- Water
- Cup or glass
- Absorbent cotton string or yarn
- Tape

WHAT TO DO

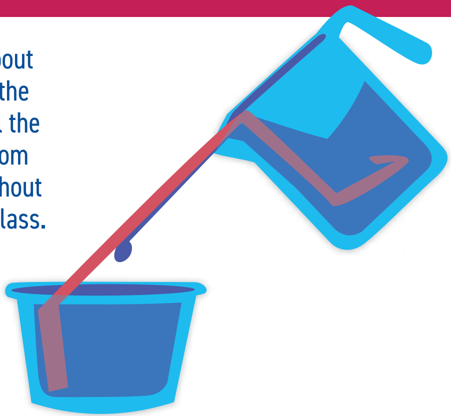
1. Cut a piece of string about 2 feet (60 cm) long.

2. Tape one end of the string firmly to the inside of the glass, near the bottom.

3. Fill the measuring cup with water and soak the rest of the string for half a minute until it is soaked through.

4. Raise the measuring cup about a foot above and to one side of the glass. Hold it far enough to pull the string taut, without pulling it from the bottom of the glass and without letting it touch the side of the glass.

5. Keeping the string taut, pour the water slowly down the string.



7 Fireproof a balloon

WHAT TO GET

- Two balloons
- Votive candle
- ADULT SUPERVISION

WHAT TO DO

1. Have an adult light the candle.

2. Blow up one balloon and pass it over the candle. POP!!

3. Inflate the second balloon, fill it ¾ full of tap water, and then blow it up the rest of the way.

4. Pass the water-filled balloon over the candle. Did it pop?

THE SCIENCE BEHIND THE EXPERIMENT

Water has what is called a *high heat capacity*, which means it takes a lot of energy to change the water's temperature. By contrast, air has a low heat capacity, so when you put the air-filled balloon over the candle, the balloon bursts almost immediately. The air conducts heat poorly, so the spot right over the flame quickly gets overheated and the balloon pops. When you put the water-filled balloon over the candle, the heat is absorbed by the water. Then the heated water rises and is replaced by cooler water. This means that the spot on the balloon that is right over the candle is cooled by new water molecules so the latex of the balloon does not get hot enough to pop. This transfer of heat from the candle to the water will continue until the water can absorb no more heat.

8 Make your drawing float

WHAT TO GET

- A new dry-erase marker
- A clean ceramic or glass plate
- Warm water
- Measuring cup

WHAT TO DO

1. Fill the measuring cup with warm tap water and set it aside.

2. Without pressing too hard on the marker, draw a stick figure or other design on the plate.

3. Let the drawing dry for just a few seconds.

4. Gently pour warm water at the edge of the plate and let it run down to cover the drawing. The water should slip under your drawing, lifting it off the plate.

BONUS ACTIVITY: Once you have your drawing floating on the surface of the water, gently place your palm onto the drawing. Slowly pull your hand away from the water and enjoy your new tattoo.

THE SCIENCE BEHIND THE EXPERIMENT

Dry-erase markers contain an ingredient that keeps the marker from adhering permanently to non-porous surfaces. The ink in the markers does not dissolve in water, and it is also less dense than water.

9 Make water droplets dance

WHAT TO GET

- A clean metal saucepan (not a non-stick pan)
- Kitchen stove
- Water
- A straw or pipette
- ADULT SUPERVISION

WHAT TO DO

1. Turn one burner of the stove on high.
2. Place the empty pan on the burner and heat the pan until it's very hot.
3. Using the straw or pipette, drip water into the pan from at least 6 inches (15.2 cm) above and watch the drops dance! (Be careful as the droplets may bounce out of the pan.)

THE SCIENCE BEHIND THE EXPERIMENT

The first bits of water hitting the pan boil instantly and create a layer of steam beneath the rest of the drop of water. That thin layer insulates the droplets from the heat of the pan, so they do not heat up and turn to steam, and it insulates the pan from the cold water, so it does not cool down. The strong surface tension that holds water droplets together continues to act on the droplets as if they were not even in a hot pan. In fact, the surface tension is strong enough to pull tiny droplets together into a larger drop.

10 Scatter pepper with your finger

WHAT TO GET

- A shallow plate
- Water
- Finely ground black pepper
- Liquid dish soap

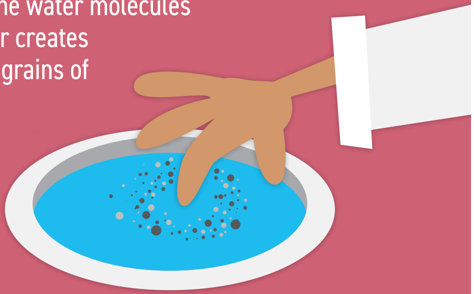
WHAT TO DO

1. Pour water into the plate.
2. Sprinkle pepper all over the surface of the water.
3. Dip your finger into the pepper. Did anything happen?
4. Now, put a dab of dish soap on your finger and dip it again. What happened?

THE SCIENCE BEHIND THE EXPERIMENT

Soap is a *surfactant*, a substance that breaks the water's surface tension. The movement of the water molecules separating from one another creates enough force to push small grains of pepper across the surface.

If you want to repeat this or the next experiment, you'll have to rinse the plate thoroughly to remove any soap residue.



11 Power a boat with dish soap

WHAT TO GET

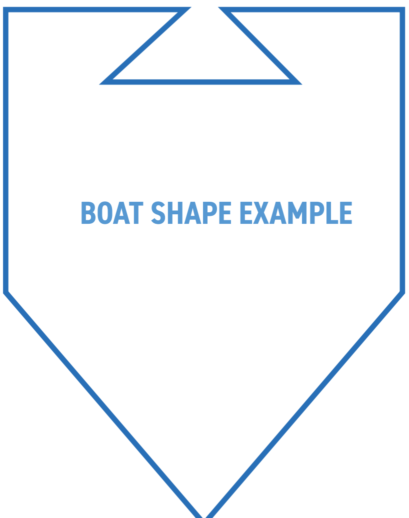
- A foam tray (like the kind meat comes in) or a piece of non-corrugated cardboard
- A shallow tray, bowl, or baking sheet full of water
- Liquid dish soap
- A toothpick
- Scissors

WHAT TO DO

1. Cut the foam tray or cardboard into a boat shape as shown below. A good size is about 2 inches (5.1 cm) long.

2. Dip the toothpick into the liquid soap and use it to put a dab of soap onto the sides of the notch at the back of the boat.

3. Carefully set the boat onto the surface of the water and see what happens.



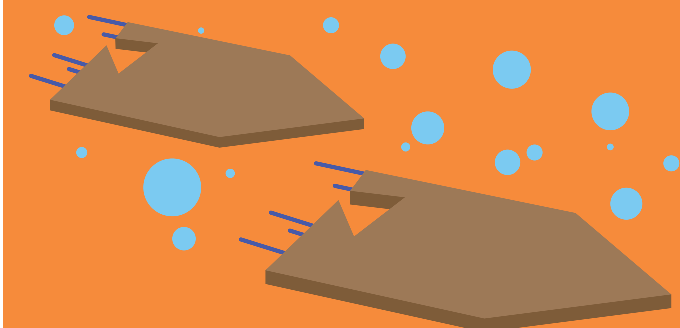
THE SCIENCE BEHIND THE EXPERIMENT

Soap is a *surfactant*, a substance that breaks the water's surface tension. The movement of the water molecules separating from one another creates enough force to push a lightweight boat.

If you want to repeat experiments 10 or 11, you'll have to rinse the tray or the plate thoroughly to remove any soap residue.

SCIENTISTS ASK QUESTIONS

- Could you use solid soap instead of liquid?
- Does the temperature of the water matter? Will the boat go faster if the water is warm?
- What happens if you use more pepper? Less pepper?
- Can you use a different ground spice instead of pepper? Cloves? Cinnamon?



12 Flash freeze a water bottle

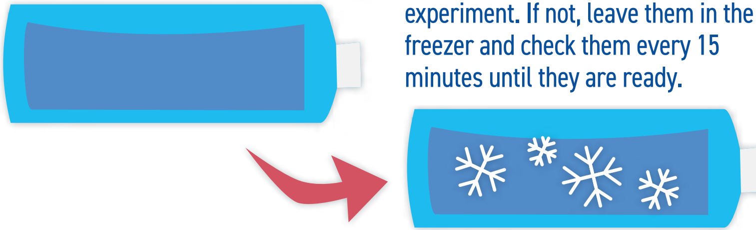
WHAT TO GET

- Several bottles of pure water, either 12 oz. or 16.9 oz. (355 mL or 500 mL)
- A freezer

WHAT TO DO

1. Put the water bottles into the freezer, lying on their sides and not touching one another.

2. Check the bottles after 90 minutes. If you see small flakes of ice floating in the liquid and some condensation on the outside of the plastic, the bottles are ready for the experiment. If not, leave them in the freezer and check them every 15 minutes until they are ready.



3. Remove a bottle VERY GENTLY, being careful not to bump the bottle on anything.

4. Gently wipe off the condensation so you can see the liquid better.

5. Give the bottle a sharp tap, and watch it freeze instantly!

13 Freeze water like Elsa

WHAT TO GET

- Several bottles of pure water, either 12 oz. or 16.9 oz. (355 mL or 500 mL)
- A freezer
- A clean bowl or wide glass
- An ice cube

WHAT TO DO

1. Follow steps 1 through 4 of the instructions for experiment #12, "Flash freeze a water bottle".

2. Open one of your super-cooled water bottles carefully and pour it gently to fill your bowl or glass.

3. Pick up a small piece of ice, then touch the ice to the surface of the water and watch the ice spread outwards.

14 Make a snowman or snow cone

WHAT TO GET

- Several bottles of pure water, either 12 oz. or 16.9 oz. (355 mL or 500 mL)
- A freezer
- A large bowl
- Ice cubes
- Unfrozen freeze-pop tubes, or flavored syrup (optional)

WHAT TO DO

1. Fill the bowl with the ice cubes.

2. Follow steps 1 through 4 of the instructions for experiment #12, “Flash freeze a water bottle”.

3. Open one of your super-cooled water bottles carefully and gently pour it over the bowl of ice. Keep pouring slowly and you can sculpt towers of ice or even make a snowman.

4. The ice will quickly turn slushy, so you can pour some unfrozen flavoring over the bowl and treat yourself to a delicious snow cone.

THE SCIENCE BEHIND THE EXPERIMENT

When water gets to its freezing point, it requires some site around which ice crystals can form. In a process called *nucleation*, the water molecules start to gather into small clusters around a nucleus, or central site. Nucleation can begin with a mechanical method, such as a sharp tap on the bottle.

15 Make ice cream in a bag

WHAT TO GET

- 1 cup (240 mL) half & half or whipping cream
- 2 tablespoons (90 mL) granulated sugar
- ½ teaspoon (2.5 mL) vanilla extract
- Coarse salt (rock salt or kosher salt)
- Lots of ice
- 1 gallon-size resealable freezer bag
- 2 pint-size resealable freezer bags
- Optional: frozen berries, mini chocolate chips, or other flavoring
- Optional: dish towels or gloves to keep hands warm

WHAT TO DO

Note: This recipe is for one serving.

1. Combine sugar, vanilla, half & half, and any desired flavorings in one of the small bags. Push out excess air and seal tightly. Place this bag into the other small bag, squeeze out the air, and seal tightly.

2. Put 6–7 cups of ice and 1 cup (240 mL) of coarse salt into the large bag.

3. Put the small bag into the large bag and seal tightly.

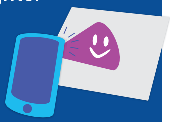
4. Shake the bag of ice vigorously for 7 to 10 minutes, until the ice cream has hardened to your preferred thickness. You may need to add more ice if the ice in your bag melts while shaking.

5. Remove the bag of ice cream and rinse the outer bag quickly under cold water to remove the salt. Then open the inner bag and enjoy your ice cream!

16 Turn your smartphone into a UV light

WHAT TO GET

- A smartphone with an LED light
- Transparent tape
- A purple marker
- A blue marker
- Fluorescent highlighter
- White paper



WHAT TO DO

1. Place a small piece of tape over the flash on the back of your phone.

2. Using the blue marker, color in a circle large enough to cover the LED flash completely.

3. Place another piece of tape over the first one, and color it with the blue marker.

4. Place a third piece of tape over the first two, and color it with the purple marker.

5. Draw or write something on the paper with the highlighter.

6. Turn off all the lights or take your phone and drawing into a dark closet or bathroom. Shine your light and see the writing glow.

THE SCIENCE BEHIND THE EXPERIMENT

Light is a form of electromagnetic energy that travels in waves, some that we can see and some that we can't. The wavelengths that the human eye can see are called *visible light*. The white light we see can be broken up into a spectrum, with red having the longest waves and violet the shortest. Ultraviolet (UV) waves are shorter than violet (*ultra* means "beyond" in Latin) so we can't see them.

17 Make a coin disappear

WHAT TO GET

- Two coins
- Two jars or glasses
- Water
- Tape

WHAT TO DO

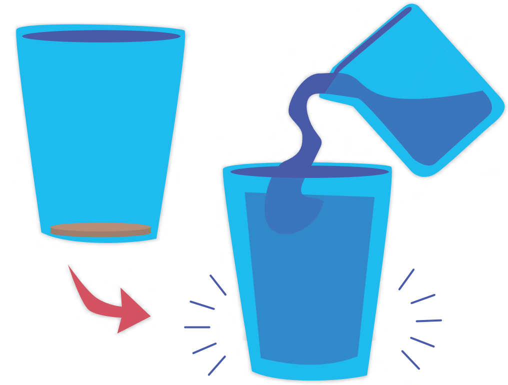
1. Place one jar or glass on top of one coin.

2. Fill the glass with water and watch the coin disappear.

3. Tape the other coin to the inside wall of the jar.

4. Fill the glass with water. Can you see the coin? Does it look larger than before?

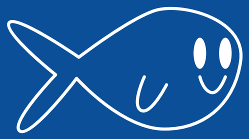
5. Rotate the glass while looking at the coin from the side. Did it disappear?



18 Turn a fish

WHAT TO GET

- A glass or jar
- Water
- A fish drawing, like the one below:

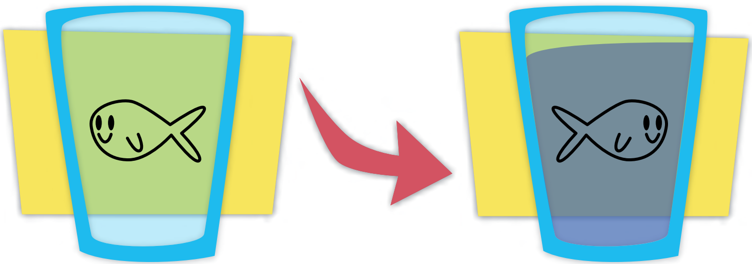


WHAT TO DO

1. Prop the drawing up so that it stands vertically.

2. Place the glass or jar a few inches (7-10 cm) in front of the drawing and observe the drawing through the glass.

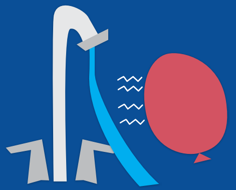
3. Slowly fill the glass with water and watch what happens to the fish. (You may have to move the glass closer to or further from the fish to see this illusion.)



19 Bend water

WHAT TO GET

- A balloon
- A source of running water



WHAT TO DO

1. Blow up the balloon and tie it off.

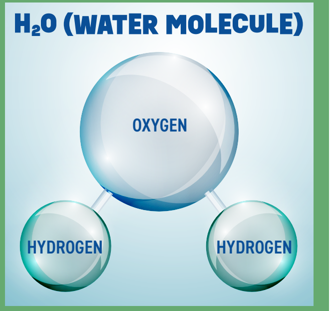
2. Rub the balloon on your head until your hair stands on end.

3. Turn on the tap just enough to make a small, steady stream of water.

4. Hold the balloon next to (but not touching) the water and watch what happens.

THE SCIENCE BEHIND THE EXPERIMENT

Water molecules have one end that is positively charged and one end that is negatively charged. The balloon becomes negatively charged when you rub it on your head. As you bring it toward the water, the positively charged sides of the water molecules move toward the balloon, while gravity keeps the water moving downward, causing the stream of water to bend.



20 Make dancing ghosts

WHAT TO GET

- Tissue paper
- Markers
- Scissors
- A ruler
- A balloon
- ADULT SUPERVISION

WHAT TO DO

1. Fold the tissue paper so you have four layers, making a rectangle a little larger than your hand.

2. Draw a “ghost” shape on the top layer of tissue paper.

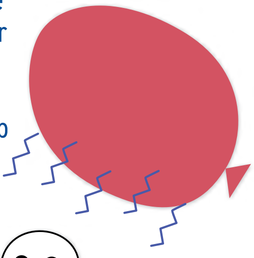
3. With adult supervision, cut through all layers of the paper at once, cutting out your ghost shapes.

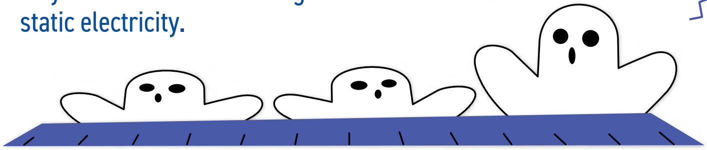
4. Separate the ghosts and draw a spooky face on each one.

5. Line up the ghosts side by side on a table, and place the ruler on top of the bottom edges of the ghosts.

6. Blow up the balloon and rub it on your head until it is charged with static electricity.

7. Pass the balloon over the ghosts, and watch them rise up and wave around.





21 Roll a can without touching it

WHAT TO GET

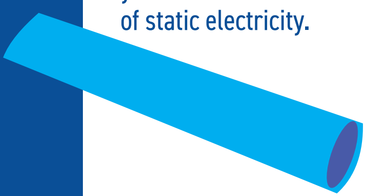
- A piece of PVC pipe about 2 feet (60 cm) long
- A dry wash cloth
- An empty soda can

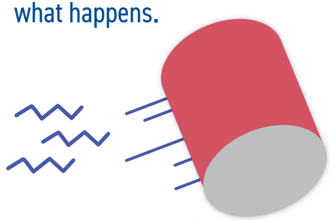
WHAT TO DO

1. Rub the cloth up and down the PVC pipe for about 30 seconds, until you can hear the crackle of static electricity.

2. Place the soda can on its side on a level countertop.

3. Move the pipe toward the can and see what happens.





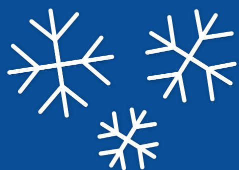
THE SCIENCE BEHIND THE EXPERIMENTS:

Both the tissue paper and the soda can are positively charged. When you bring the negatively charged balloon or PVC pipe close, the opposites charges attract and the tissue paper and can move toward the balloon and pipe.

22 Make glue snowflakes

WHAT TO GET

- White or clear glue
- Disposable plates
- Liquid food coloring
- Liquid dish soap
- Cotton swabs



WHAT TO DO

1. Pour some glue into each plate and let it spread into a thin layer, tipping the plate as necessary. White glue can be especially thick, so you may need to dilute it with water at a ratio of 4 parts glue to 1 part water.

2. Drip a few drops of different colors of food coloring in the center of the glue. You can put the drops one on top of the other or spread them out.

3. Dip a cotton swab into the dish soap and poke it into each drop of the food coloring. Use a fresh cotton swab for each colored drop if you don't want to mix the colors.

THE SCIENCE BEHIND THE EXPERIMENT

Glue contains water and a chemical called polyvinyl acetate that has long, flexible molecules that intertwine in the water like boiling spaghetti. These molecules keep the food coloring from spreading, but when you add the dish soap the molecules of detergent break up the connection between the water and the polyvinyl acetate.

23 Grow a coffee filter flower

WHAT TO GET

- White basket-style coffee filters
- Washable markers
- Water
- Plastic cups
- Paper towels or wax paper
- Pipe cleaners

WHAT TO DO

NOTE: You might want to cover the work area with newspaper first because the ink can bleed through as you draw and as the filters dry:

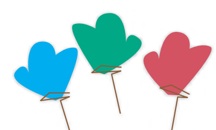
1. Pour about ½ inch (1.3 cm) of water into each cup.

2. Use your washable markers to draw a circle on the base of each coffee filter. Each circle should be about 4 inches (10.2 cm) in diameter.

3. Fold the coffee filters in half, then in half again. Put one into each cup, with only the white tip of each filter touching the water.

4. Let the filters sit in the water until the colors reach the edges of the filters—about 30 to 45 minutes.

5. Spread the filters flat to dry on paper towels or wax paper.



6. Once completely dry, stack two or more filters together and fold them in half twice.

7. Fold the outer flap outward, flip the filters over, and fold the outer flap from the other side outward. Your filter should now form a zig-zag shape.

8. Tie the base of the filters to the pipe cleaner, twisting tightly so the filters are secure. Separate the filters and fluff them outward to form a flower.

24 Tie-dye a shirt with permanent markers

WHAT TO GET

- 100% cotton t-shirt
- Permanent markers in various colors
- Rubbing alcohol (Isopropyl alcohol)
- Eyedropper
- Cardboard or paper grocery bag
- A well-ventilated area to work in

WHAT TO DO

1. Launder the t-shirt.
2. Lay the shirt out flat and slide the cardboard or paper bag up inside the shirt to keep the ink from bleeding through to the back. Try to stretch the shirt so that there are no wrinkles.
3. Make designs on the shirt in whatever colors you like. Don't try to write on the shirt, but rather tap to make circles and dots.
4. Keeping the shirt flat and smooth, use the eyedropper to drip the alcohol slowly into the center of each design. You don't want to soak the shirt.
5. Keep adding drops until the design is nearly the size you want, as it will continue to spread a bit after you stop dripping.
6. Let the shirt dry completely and then press it with a hot iron.

THE SCIENCE BEHIND THE EXPERIMENT

Permanent markers do not wash out of clothing because the ink is not soluble in water. However, the ink does dissolve in alcohol. The shirt's cotton fibers are hollow, so they act like tiny straws, carrying the alcohol out from the center of each drop and bringing the ink along with it.

25 Make fireworks in your milk

WHAT TO GET

- Milk
- Dinner plate
- Liquid food coloring
- Liquid dish soap
- Cotton swabs

WHAT TO DO

1. Pour the milk onto the dinner plate until it covers the bottom evenly.
2. Place a few drops of food coloring near the center of the plate.
3. Dip the swab in the dish soap.
4. Hold the soapy swab in the middle of the plate and watch what happens.

THE SCIENCE BEHIND THE EXPERIMENTS

This experiment depends on surface tension, but it also has a new element: fat. Milk is mostly water, but it also contains fat molecules that don't dissolve in that water. Soap molecules have one end that is attracted to water and one end that is repelled by it. When the soap hits the milk in the plate, one end of the molecule wraps and twists around trying to surround all the fat molecules it is attracted to, while the other end attaches to the water molecules and breaks up the surface tension. The food coloring is soluble, so it is attached to the water molecules, making it possible to see all the dramatic molecular action that's taking place.

26 Suspend objects in a glass

WHAT TO GET

- A tall glass or vase
- Vegetable oil
- Honey
- Water
- Liquid food coloring (optional)
- Small objects like paperclips, screws, raisins, water bottle caps, dice

WHAT TO DO

1. Add ¼ to ½ cup (60–120 mL) of water to the glass, and then a drop of food coloring.

2. Now add the same amount of honey, pouring it slowly into the center of the glass so that the liquid does not touch the sides.

3. Repeat step #2 with vegetable oil and let the liquids fully separate into layers.

4. Gently place each of your small objects on the surface of the top layer of liquid and let it drop. Do they all land at the bottom?

THE SCIENCE BEHIND THE EXPERIMENT

The fluids in this experiment differ in *density*: the amount of molecules (*mass*) packed into the same amount of space (*volume*). This is why they separate into layers. When you drop things into the column of liquids, each object will drop through any liquid that is less dense than the object, but it will stop when it reaches a layer that is more dense.

27 Fill an upside-down glass

WHAT TO GET

- A short candle, like a votive candle
- A glass that is taller than the candle
- A pie plate
- Water
- Liquid food coloring (optional)
- ADULT SUPERVISION

WHAT TO DO

1. Pour water into the pie plate until it's about ½ inch (1.3 cm) deep.

2. Add a drop of food coloring and stir to distribute.

3. Place the candle in the center of the pie plate and have an adult light it.

4. When the candle is burning brightly, lower the glass over it with the rim resting evenly on the pie plate.

5. Watch what happens when the candle goes out!

THE SCIENCE BEHIND THE EXPERIMENT

The candle flame warms the air, which expands, but when the candle has no more oxygen to burn it goes out, and the air inside the glass cools and contracts. Because it takes up less space and because no more air can get in, the air inside the glass now has a lower pressure than the air outside the glass. This creates a vacuum that will last until the pressure is the same inside and outside the glass. As the water rises to fill the glass, it compresses the space available to the air and equalizes the pressure.

28 Sink a ketchup diver

WHAT TO GET

- A plastic water bottle, 500 mL or 1 liter
- Several packets of condiments: ketchup, mustard, soy sauce

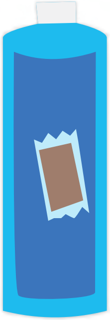
WHAT TO DO

1. Open the water bottle and push the condiment packets into it one by one until you find one that floats (not all of them do).

2. With the condiment packet floating inside the bottle, fill the bottle up to the very top and screw the cap on tightly.

3. Squeeze the bottle and the packet should sink.

4. Release the pressure and the packet should rise.



THE SCIENCE BEHIND THE EXPERIMENT

The condiment packet floats because there is a small amount of air sealed inside it. When you push on the sides of the bottle, the only thing that can contract is the air. The volume of the air decreases, but the amount of mass is the same, so the density of the packet has increased. If you apply enough pressure, the packet's density will be greater than the density of the water, so it will sink. Releasing the pressure lets the air expand once more, lessening the packet's density so it can rise.

29 See what you say

WHAT TO GET

- A bowl
- A plate
- Clear plastic wrap
- Candy sprinkles

WHAT TO DO

1. Cover the bowl tightly with the plastic wrap, stretching it across the whole bowl and removing any wrinkles. (You can use a rubber band to hold the wrap in place if it seems too loose.)

2. Put the bowl onto the plate to catch any runaway sprinkles.

3. Drop some candy sprinkles onto the plastic wrap.

4. Bring your lips close to the edge of the bowl without touching it.

5. Hum loudly and see what happens. Vary the pitch and volume of your humming to see what makes the sprinkles dance best.

SCIENTISTS ASK QUESTIONS

- Which makes the sprinkles dance more, higher or lower pitches?
- Does it matter how loudly or softly you hum?
- Can you make the sprinkles dance by talking instead of humming?

30 Snuff a candle with sound waves

WHAT TO GET

- A votive candle
- An empty oatmeal or large yogurt container with a tight-fitting lid
- A coin
- A pen
- Scissors
- ADULT SUPERVISION

WHAT TO DO

1. Place the coin in the center of the container's lid, and trace around the edges.
2. Carefully cut out the circle you marked so that you have a nice hole in the middle of the lid, and then put the lid back on the container.
3. Place the candle near the edge of a table or countertop and have an adult light it.
4. Hold the container so that the hole is aligned with the candle flame and about 2 inches (5.1 cm) away.
5. Give the bottom of the container a sharp tap and see what the sound waves do.
6. Try blowing out the candle from different positions and see what works best.

THE SCIENCE BEHIND THE EXPERIMENT

Vibrating objects create sound waves by bumping into air molecules, which bump into the air molecules next to them, and so on. Just as vibrating objects create sounds, sound can also set up vibrations in the air. When those vibrations reach our eardrums, they cause vibrations that our brain interprets as sound.

31 Fizzy, foamy lemon

WHAT TO GET

- Lemon
- Food coloring
- Dish soap
- Baking soda
- Plate
- Knife
- Fork
- ADULT SUPERVISION

WHAT TO DO

1. Have an adult cut a lemon in half and place one half on a plate with the cut side up.
2. Poke holes in the lemon with the fork.
3. Add a few drops of food coloring and then a drop or two of dish soap.
4. Sprinkle some baking soda all over the top of the lemon.
5. Take the second half of the lemon and squeeze it over the first half.

THE SCIENCE BEHIND THE EXPERIMENT

When something has lots of electrically charged hydrogen atoms—called *hydrogen ions*—then that substance is an *acid*. When a substance has lots of hydroxide ions, then it is an *alkaline*—also referred to as a *base*.

When you combine the lemon (an acid) and the baking soda (a base), they react to form carbon dioxide gas. You can see the reaction clearly because the gas creates bubbly foam as it passes into the dish soap.

32 Building bricks volcano

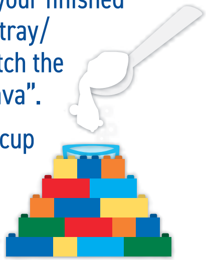
WHAT TO GET

- Small building bricks
- Baking soda
- Vinegar
- Water
- Red food coloring
- Dish soap
- Flat board or plate
- Tall cup or jar
- Measuring cup
- Large tray or container to catch the mess

WHAT TO DO

1. On the base plate, build a building brick volcano around the tall cup. Move your finished volcano onto a tray/ container to catch the overflowing "lava".

2. Fill the tall cup about ⅔ full of baking soda.



3. In the measuring cup, mix 1 cup (240 mL) of white vinegar with a few drops of food coloring and another few drops of dish soap.

4. Pour some vinegar mixture into the tall cup and stand back!

5. It's likely that not all the baking soda was used up in your first eruption. Just to be sure, try adding more of the vinegar mixture to your volcano to make a new eruption.

THE SCIENCE BEHIND THE EXPERIMENT

When an acid and base are mixed, hydrogen ions in the vinegar react with the sodium and bicarbonate ions in the baking soda to create carbon dioxide. As the gas travels through the dish soap, it creates the bubbling foam of your volcanic eruption.

33 Swirling rice

WHAT TO GET

- Long-grain rice, uncooked
- White vinegar
- Baking soda
- Water
- Food coloring (optional)
- Clear jar
- Spoon
- Measuring cup and spoons

WHAT TO DO

1. Pour 1 cup (240 mL) of water into the jar. Add food coloring if desired.

2. Add 1 Tbsp. of baking soda and stir until it's completely dissolved.

3. Add ¼ cup (50 g) of rice.

4. Add 1 to 2 Tbsp. of vinegar.

THE SCIENCE BEHIND THE EXPERIMENT

Vinegar and baking soda mixed together produce carbon dioxide gas that causes the initial foaming reaction. The gas bubbles cling to the rice grains and float them to the top of the jar. Then the bubbles pop and the rice sinks to the bottom, only to be caught by the ongoing bubbling reaction which rises the grains to the surface again.

34 Yeast feeders

WHAT TO GET

- 10 packages (or 1 jar) of dry yeast
- Sugar
- Salt
- Baking soda
- Vinegar
- Warm tap water
- 5 clear plastic 2-liter bottles with caps
- Permanent marker
- Measuring cups and spoons
- Small funnel
- 5 balloons

WHAT TO DO

1. Rinse each plastic bottle thoroughly and remove any labels. Using the marker, number them from 1 to 5.

2. Using the funnel:

- Add 2 Tbsp. of sugar to bottles 2 through 5.
- Add 2 Tbsp. of salt to bottle number 3.
- Add 2 Tbsp. of baking soda to bottle number 4.
- Add 2 Tbsp. of vinegar to bottle number 5.

3. Run the tap until water comes out that is almost too hot to hold your hands under. Fill each bottle with 2.5 cups of warm water.

4. Put the caps on the bottles and shake them thoroughly to dissolve all the ingredients.

5. Add 2 packages or 4.5 tsp. of yeast to each bottle. Replace the cap and shake gently to mix in the yeast.

6. Remove the caps from the bottles and stretch a balloon completely over the opening of each bottle.

7. Set the bottles in a warm location, but out of direct sunlight, for 1 hour.

WHAT HAPPENED

Write your observations here:

Bottle #1: Water only ______________________

Bottle #2: Sugar ______________________

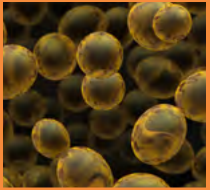
Bottle #3: Sugar and salt ______________________

Bottle #4: Sugar and baking soda ______________________

Bottle #5: Sugar and vinegar ______________________

THE SCIENCE BEHIND THE EXPERIMENT

Yeasts are tiny, microscopic organisms that get their food from their surrounding environment to grow and reproduce or make more yeast. Yeasts feed on sugars and starches, and as they turn their food into energy, they release carbon dioxide (CO_2) gas that fills the balloons. This process is known as *fermentation.*



35 Turn milk into plastic

WHAT TO GET

- Milk
- White vinegar
- Food coloring
- Measuring cups and spoons
- Mug or heat-resistant cup
- Paper towels
- Spoon
- Plate
- Microwavable container
- Cookie cutters (optional)
- ADULT SUPERVISION

WHAT TO DO

1. Have an adult heat 1 cup (240 mL) of milk in the saucepan or microwave until the milk is just steaming. Do not let it boil.

2. Add 4 tsp. of vinegar to a mug or heat-resistant cup.

3. Add the hot milk to the mug. You should see the milk form white clumps. Add food coloring and stir slowly for a few seconds.

4. Stack 4 layers of paper towels on the plate. When the milk mixture has cooled a bit, scoop out the clumps, tilting the spoon against the side of the cup to let as much liquid drain off as possible.

5. Put the clumps onto the paper towels. When you have as many as you can get, fold the edges of the paper towels over the clumps and press on them to absorb excess liquid from the clumps. Use more paper towels to remove as much water as possible.

6. Press the dough flat and use cookie cutters to create fun shapes. Let the plastic milk dry until it is hard, and then decorate it however you wish. Be creative!

**Be sure to throw any unused plastic milk into the trash, not down the sink.*

36 Salt crystal feathers

WHAT TO GET

- 3 faux feathers
- 26 oz. box of salt
- 3 canning jars
- 3 clothespins
- Pot
- Oven mitts
- ADULT SUPERVISION

WHAT TO DO

1. Fill your canning jars all the way full with water.

2. Pour that water into a pot and add your salt. Have an adult boil the water until the salt dissolves.

3. Keep adding salt until the pot forms a layer of crystallized salt on top of the boiling water. It will look like crushed ice.

4. Pour the salty water into the canning jars. ***Note:*** *You'll see a layer of salt in the bottom of the pot but you do not need to add that to the canning jars.*

5. Clasp the end of your feather with a clothespin so it looks like the letter "T". Place the clothespin over the top of the jar so the feather is suspended over the center of the jar in the salty water.

6. Set it in a sunny window. Your crystals will start to form in just a few minutes!

7. Leave your feathers in the salty water for at least one hour to grow the biggest crystals.

8. Remove the crystals from the jar and let them dry on a paper towel.

9. Examine your crystals with a magnifying glass.

37 Hot and cold water magic

WHAT TO GET

- Cold water
- Hot water
- Food coloring
- Thin plastic or cardboard
- Aluminum foil
- 2 small glass jars
- Large baking pan or tray

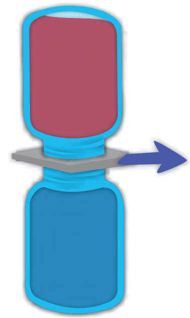
WHAT TO DO

1. Cut a square of cardboard slightly larger than the opening of your jars. Cover it with foil as smoothly as possible.

2. Place the jars in the baking pan and fill one with cold water and the other with hot water. Fill them to the top until they're just about to overflow.

3. Add a few drops of food coloring to the jars using different colors for cold and hot water.

4. Place the cardboard over the jar with hot water, making sure it completely covers the jar's opening.



5. Holding the cardboard tightly in place, carefully invert the jar of hot water and balance it on top of the cold water jar. Then, without jostling the jars, carefully slide the cardboard out.

6. Observe the jars and see if the two colors mix together.

7. Try it again with the opposite set-up, placing the cold water jar on top of the hot water jar and see what happens.

38 Water color magic

WHAT TO GET

- Water
- Salt
- Food coloring
- 2 clear glasses
- Spoon

WHAT TO DO

1. Prepare some salt water: add 1 Tbsp. salt to 1 cup (240 mL) of hot water and stir well until all the salt is dissolved. Let the water stand until it is room temperature.

2. Fill the two glasses, one with plain water and one with salt water, both at room temperature.

3. Add a few drops of food coloring to each glass and compare.

THE SCIENCE BEHIND THE EXPERIMENT

Adding salt to water changes the density of the water, even though the amount of water stays the same. The food coloring floats because it is less dense than the salt water.

39 Layer liquids

WHAT TO GET

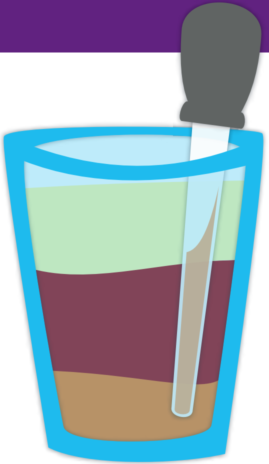
- Orange juice
- White grape juice
- Cranberry juice
- A tall narrow glass
- Eye dropper or turkey baster

WHAT TO DO

1. Pour white grape juice into the glass, filling it about ¼ of the way up.

2. Hold the dropper or baster against the inside of the glass and slowly let the same amount of cranberry juice drip down the side into the glass.

3. Repeat step 2 with the orange juice.



THE SCIENCE BEHIND THE EXPERIMENT

The density of a liquid depends on how much stuff—like sugar, in the case of juice—is in a particular volume of the liquid. The juices with more sugar are actually heavier (denser) than those with less sugar, so they will sink. Check the sugar content of various juices and try this experiment with your own selection of liquids.

40 Rainbow rain

WHAT TO GET

- Vegetable oil
- Water
- Food coloring
- 2 clear 16-oz. glasses or jars
- Spoon

WHAT TO DO

1. Add 1 cup (240 mL) of water to one glass or jar.

2. Add ½ cup (120 mL) of vegetable oil to the other jar, and then add 5-7 drops of different colors of food coloring to the oil.

3. Using the spoon, stir the oil vigorously until it is all a single color.

4. Quickly pour the oil solution into the glass with the water, and watch the rain fall.

THE SCIENCE BEHIND THE EXPERIMENT

Oil and water do not ordinarily mix, but you can force them to mix temporarily by stirring quickly, breaking up the water droplets (or in this case food coloring) and suspending them in the oil. When the oil layer is poured onto the plain water, it rises to the top, but as the food coloring droplets separate from the oil, they fall down into the water, drop by drop.

41 Cup of lava

WHAT TO GET

- Water
- Vegetable oil
- Food coloring (red or orange)
- Effervescent antacid tablet
- Clear drinking glass

WHAT TO DO

1. Fill the glass ¼ full of water, add a drop of food coloring, and then fill the rest of the glass with oil.

2. Break an antacid tablet into quarters, and add them one at a time into the cup. When the bubbling stops, add more of the tablet.

THE SCIENCE BEHIND THE EXPERIMENT

The antacid tablet releases carbon dioxide gas bubbles as it reacts with the water. The bubbles stick to water droplets, bringing them to the surface as they rise through the oil floating on top of the water. When the bubbles pop, the water droplets sink back down through the oil because they are more dense.

42 Solar filter

WHAT TO GET

- Water
- Salt
- Glass bowl
- Small glass jar
- Plastic wrap
- A rock

WHAT TO DO

1. Add a few tablespoons of salt to warm water and stir until dissolved.

2. Pour the salt water into the bowl and then place the empty jar in the middle of the bowl. Push it down but be sure that no water slips in.

3. Cover the bowl and jar with plastic wrap and seal it tightly. Place the rock in the center to weigh it down.

4. Place your bowl in warm sunlight for a few hours, until a small amount of water has collected in the jar.

5. Unwrap the bowl and taste the water in the jar.

THE SCIENCE BEHIND THE EXPERIMENT

The primary source of all the energy on Earth comes from the waves of light from the sun. The energy from the waves gets turned into *thermal* (heat) energy that people for thousands of years have used for heating, cooking, and drying.

As sunlight heats the water, it evaporates as water vapor. When the vapor cools, the droplets condense on the plastic wrap, and then gravity sends them down into the jar. The salt is left behind.

43 Solar oven s'mores

WHAT TO GET

- Pizza box, the bigger the better
- Black paper
- Graham crackers
- Marshmallows
- Chocolate
- Pencil or pen
- Ruler
- White school glue
- Utility knife
- Aluminum foil
- Plastic wrap
- Shipping tape or black electrical tape
- Wooden skewer
- ADULT SUPERVISION

WHAT TO DO

1. On the lid of the pizza box, draw a square about one inch (2.5 cm) inside the edge of the box.

2. Have an adult cut with the utility knife along three sides of the square you drew, leaving the side that runs along the box hinge uncut. Fold this flap slightly back toward the hinge.

3. Line the inside of the flap with aluminum foil, keeping the foil as smooth as possible. Fold the edges of the foil over the flap and secure them with glue.

4. Cover the opening you made in the box lid with plastic wrap, and secure it in place with the tape, making sure there are no holes or gaps.

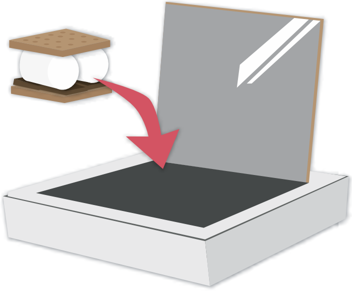
5. Line the inside of the whole box with aluminum foil, gluing it into place as you go. Be sure to cover the cardboard around the plastic-covered window.

6. Cut a piece of black paper slightly smaller than the bottom of the box and glue or tape it to the box's interior.

7. Use the skewer and some tape to prop the flap up at a 90-degree angle from the rest of the box.

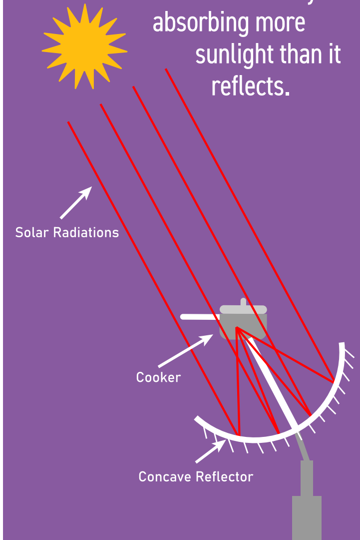
8. Place a piece of foil onto the black paper to use as your plate. Arrange the graham crackers, marshmallow, and chocolate on the foil, and put it into your solar oven.

9. Place the oven outside in strong, direct sunlight, facing the sun, for at least 30 minutes.



THE SCIENCE BEHIND THE EXPERIMENT

Your solar oven uses thermal energy from the sun to cook your food. The foil, plastic wrap, and black paper trap the heat inside the oven. The foil reflects the sunlight into the box; the plastic wrap acts like a greenhouse roof, trapping the heat; and the black paper acts as a “heat sink” by absorbing more sunlight than it reflects.



44 Sun prints

WHAT TO GET

- Dark-colored construction paper
- Leaves, flowers, or other small flat items
- Clear plastic wrap
- A few small rocks

WHAT TO DO

1. Place the paper on a sunny driveway, sidewalk, or table.
2. Arrange the leaves and flowers on top of the paper, and then cover them with plastic wrap weighted with rocks so that things don't blow away.
3. Leave the paper in the sun for two or three hours and then remove the plastic wrap and plants to see the designs.

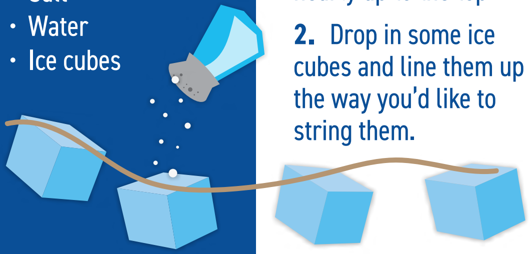
THE SCIENCE BEHIND THE EXPERIMENT

The energy from sunlight comes in waves of different lengths, some we can see and others we cannot. The ultraviolet waves we cannot see have enough energy to break down the chemical dyes in the construction paper, changing its color. The places where the paper was shaded by leaves or flowers didn't receive those rays and so remained the original color.

45 String of ice cubes

WHAT TO GET

- Shallow container
- String
- Salt
- Water
- Ice cubes



WHAT TO DO

1. Fill the container with very cold water nearly up to the top.
2. Drop in some ice cubes and line them up the way you'd like to string them.
3. Lay a piece of string over all the ice cubes. If the ice isn't high enough, add a bit more water to the container.
4. Sprinkle salt on the string wherever it touches the ice cubes and wait a few seconds. Then lift the string.

THE SCIENCE BEHIND THE EXPERIMENT

Freezing happens when the molecules of a liquid get so cold that they slow down enough to hook onto each other, forming a solid crystal. For pure water, this happens at 32°F, and unlike most other solids, ice expands and is actually less dense than water. That is why ice cubes float!

Saltwater has a freezing point about 4°F lower than fresh water, so sprinkling salt on the ice cubes makes them melt a bit where the salt hits. Then the water quickly refreezes around the string, causing the ice cubes to stick to the string when you lift it out of the water.

46 Tin can Snowman

WHAT TO GET

- 2 clean empty tin cans
- Ice
- Salt
- Water
- Markers
- Spoon

WHAT TO DO

1. Remove any labels from the cans and make sure there are no sharp edges where the lid was removed.

2. Using the markers, draw your snowman on the can.

3. Fill one can half full of water and add 4 Tbsp. salt. Stir until the salt is dissolved.

4. Add an equal number of ice cubes to the two cans and then fill with water to the top.

5. Observe what happens over the next few hours.

THE SCIENCE BEHIND THE EXPERIMENT

The temperature of icy water is near 32°F, but it needs to be lower for frost to form. Adding salt reduces the temperature on the surface of the can to below freezing point, which causes water vapor in the air to condense and freeze on the can.

47 Instant ice

WHAT TO GET

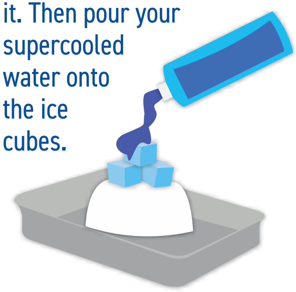
- Bottled or distilled water
- Ice cubes
- Several plastic water bottles (500mL works great)
- Bowl
- Shallow pan

WHAT TO DO

1. Fill several bottles with purified water and place them on their sides in the freezer.

2. After 90 minutes, check them to see if ice crystals formed when you gently jostle the bottles. If not, leave them in the freezer for another 15-20 minutes.

3. Turn the bowl upside down in the shallow pan, and put a few ice cubes on it. Then pour your supercooled water onto the ice cubes.



THE SCIENCE BEHIND THE EXPERIMENT

To freeze, water needs a *nucleation* site—somewhere for the ice crystals to grow. Without this you can cool water to below its freezing point before it becomes solid. The ice cube gave the pouring water some place to build crystals on, so the ice could form.

48 Iceberg science

WHAT TO GET

- Water
- Salt
- Balloon
- Two deep containers
- Spoon
- Ruler
- Scissors

WHAT TO DO

1. Fill a balloon with water and leave it in the freezer overnight.

2. Make some salt water in one of the bowls. Start by adding 4 Tbsp. salt to 1 cup (240 mL) of hot water and stirring until the salt dissolves. Then fill the bowl halfway and let the water come to room temperature. (Depending on the size of your containers, you may need more salt.)

3. About 10 minutes before you take the balloon out of the freezer, fill the second bowl halfway with cold tap water. Add ice cubes to both bowls until they are ¾ full.

4. When the water in both bowls is very cold, remove the balloon from the freezer and use scissors to cut and peel the balloon away from the ice inside.

5. Place the ice in one of the bowls and stand your ruler up inside the bowl to see how much of the ball rises out of the water. Repeat in the second bowl.

WHAT HAPPENED

Write your observations here:

Bowl #1: ____________________

Bowl #2: ____________________

49 Tornado in a bottle

WHAT TO GET

- Water
- Glitter
- Tall bottle with a lid
- Funnel

WHAT TO DO

1. Using the funnel, pour glitter into the bottle. The more, the better!

2. Fill the jar ¾ full of water and close the cap tightly.

3. Turn the bottle upside down and move it quickly in a circular motion for 10-15 seconds.

4. Set the bottle down on a table, still upside down, and watch the tornado.

THE SCIENCE BEHIND THE EXPERIMENT

Weather refers to the daily conditions of the sky and air around which are constantly changing: warm or cold, dry or rainy, cloudy or clear. Tornadoes, rainbows, and lightning are also parts of the weather we live with.

When you spin the bottle in a circular motion it creates a vortex that looks like a tornado. The water spins around the center of the vortex because of *centripetal force*—that is, any force that causes an object (in this case water) to move in a circular path. Because there is glitter in the water you can see the spinning water more clearly. The glitter is like the dust and debris that are found spinning in an actual tornado.

50 Water cycle in a bag

WHAT TO GET

- Water
- Food coloring
- 16 oz. plastic sandwich bag with a zipper-type closure
- Permanent marker
- Cup
- Tape

WHAT TO DO

1. Using the marker, decorate your plastic bag. Include the sun and some clouds in your picture.

2. Add some blue food coloring to 1 cup (240 mL) of water and then pour the water into the plastic bag.

3. Close the bag tightly and then use the tape to hang it on a sunny window.

4. Check on your experiment after a few hours to see if there are water droplets forming on the inside of the bag. This may take a few days, depending on how sunny it is.

THE SCIENCE BEHIND THE EXPERIMENT

As the water in the bag heats up, some of it turns to vapor (gas) through evaporation. Ordinarily, that gas would disappear into the atmosphere, but in our experiment, it is trapped so it sticks to the sides of the bag. The water vapor condenses until drops are large enough to slide back down through the force of gravity.

51 Measure the rain

WHAT TO GET

- Rain
- Plastic 2-liter bottle, with the labels removed
- Scissors or utility knife
- Duct tape
- Ruler
- Permanent marker
- ADULT SUPERVISION

WHAT TO DO

1. Have an adult cut the top off the bottle just below where it starts to taper toward the cap. Save this piece.

2. Cut a piece of duct tape the same length as the straight sides of the bottle.

3. Using the ruler and marker, make a copy of the measurements on the duct tape, either in millimeters or inches.

4. Attach the tape to the bottle so that the zero mark is right above the bottom bulge of the bottle, where the sides become straight.

5. Turn the cut piece of the bottle upside down, set it into the bottle like a funnel, and tape it into place.

6. Add water to the bottle until it just reaches the zero mark on your tape ruler.

7. Place your rain gauge outside and see how much it rained!

52 Wintergreen lightning

WHAT TO GET

- Wintergreen breathmints
- Pliers
- A dark room

WHAT TO DO

1. Go into a completely dark room and let your eyes adjust to the darkness.

2. Using the pliers, crush a mint and watch for the flash of lightning.

3. Try crushing the mint in your teeth and see if there is more lightning.

THE SCIENCE BEHIND THE EXPERIMENT

The mints contain wintergreen oil that absorbs short wavelengths of light and then emits them as a longer wavelength that we can see. Crushing the mints breaks some electrons free from their molecules, and when those electrons bump into nitrogen molecules in the air, they get rid of their excess energy by emitting light.

53 Gummy bear slime

WHAT TO GET

- Gummy bears
- Powdered sugar
- Cornstarch
- Coconut oil (optional)
- Microwave safe bowl (not plastic)
- Measuring cup and spoons
- ADULT SUPERVISION

WHAT TO DO

1. Have an adult heat 1 cup of gummy bears in the microwave for 10-15 seconds, stir, and repeat several times until the gummy bear shape breaks down.

2. Mix 2 Tbsp. cornstarch and 2 Tbsp. powdered sugar in a small bowl and then stir the dry ingredients into the melted gummies, a little at a time. The more you add, the thicker and less stretchy the slime will be.

3. Adding a small amount of coconut oil will make the mixture stretchier.

4. Have fun playing with your sticky, icky slime! ***Note:*** *The slime mixture will harden as it cools.*

THE SCIENCE BEHIND THE EXPERIMENT

No matter how thick it seems to be, your slime is a liquid since it gradually takes on the shape of the container that it's in. See what other non-Newtonian properties it has. Try pulling slowly vs. quickly, hitting it hard on the counter vs. letting it flow.

54 Rainbow paper

WHAT TO GET

- A bowl filled with water
- Clear nail polish
- Rectangles of black construction paper or black card stock (about 3-5 inches [7.6-12.7 cm] long on the sides)
- Paper towels

WHAT TO DO

1. Lay a double layer of paper towels on a table for your art to dry on.
2. Fill your bowl 75% full of water
3. Drop one drop of clear nail polish into the bowl of water.
4. Submerge the black construction paper into the water, pull out and lay on paper towels to dry.
5. Watch as your rainbows magically appear on the paper.

THE SCIENCE BEHIND THE EXPERIMENT

When you dip the paper into the water it gets coated with a thin layer of nail polish. The rainbow colors you see are caused by thin-film interference.

You will notice that the colors on the paper change as the you tip the paper back and forth. This happens because light hits the paper at different angles as you tip it.

This is the same effect you will see when oil mixes with water on the road on rainy days. Thin film interference is also visible on the surface of soap bubbles at just the right angle to the light.

55 Oobleck

WHAT TO GET

- Cornstarch (at least a 16-oz. box)
- Water
- Food coloring
- Large bowl
- Measuring cup

WHAT TO DO

1. Measure 1 cup of cornstarch into a large bowl.
2. Add a few drops of food coloring to ½ cup (120 mL) water and slowly add the water to the cornstarch, mixing while you pour. Use your hands to mix thoroughly.
3. When you can roll the slime into a ball that turns back into a liquid when you stop rolling, your slime is done!

THE SCIENCE BEHIND THE EXPERIMENT

"Newtonian fluids" typically take the shape of the container they are poured into, and they remain as liquids even if you apply stress or force to them. "Non-Newtonian fluids," on the other hand, do strange things when stress is applied. Some will get thicker and act like solids when you shake or hit them. Others get runnier when you apply stress.

Oobleck is a type of suspension. The cornstarch does not dissolve in water. Rather, the tiny grains of starch are suspended and spread through the water.

56 Static electricity butterflies

WHAT TO GET

- Cardboard
- Tissue paper
- Card stock
- Googly eyes (optional)
- Latex balloon
- Scissors
- Pencil
- Glue stick
- ADULT SUPERVISION

WHAT TO DO

1. Cut a square of cardboard to use as your base, about 8 x 8 inches.

2. With the pencil, draw the shape of a butterfly's wings on the tissue paper, making it slightly smaller than your cardboard square.

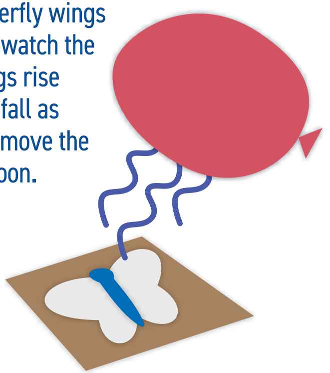
3. Cut out the wings and place the tissue paper on the square, but don't glue it down.

4. Cut out a butterfly body shape from the cardstock. It should be slightly longer than the center of your butterfly wings.

5. Glue the body down the center of the wings, overlapping onto the cardboard base. Add googly eyes and draw in some antennae if you wish.

6. Blow up the balloon and rub it in your hair to give it an electric charge.

7. Hold the balloon near the butterfly wings and watch the wings rise and fall as you move the balloon.



57 Egg yolk vacuum

WHAT TO GET

- Eggs
- Empty plastic water bottle
- 2 bowls or plates

WHAT TO DO

1. Crack an egg onto a plate or bowl, being careful not to break the yolk.

2. Turn the water bottle upside down, lightly squeeze it in your hand, and hold it that way.

3. Touch the mouth of the bottle to the egg yolk so that it forms a seal against the egg, and slowly release the squeeze on the bottle.

THE SCIENCE BEHIND THE EXPERIMENT

Pressure is a measurement of how much force is acting over a specific area. A strong push on a small area creates high pressure, but if you spread that push over a bigger area it creates only a little pressure.

Squeezing the bottle pushes air out, decreasing the volume of air in the bottle, creating a vacuum. When you release the pressure on the bottle, it will want to suck in something to fill the void. If it can't get air, it will take what it can get: the egg yolk. The higher air pressure outside the bottle pushes the egg into the area with lower pressure.

58 Levitate a ping pong ball

WHAT TO GET

- Ping pong ball
- Hair dryer

WHAT TO DO

1. Turn the hair dryer on to the highest setting and point it toward the ceiling.

2. Position the ping pong ball above the dryer and balance it in the stream of air.

3. Slowly tilt the dryer side to side, still pointing upwards, and watch the ball float.

4. Change the setting on the dryer and see what happens.

THE SCIENCE BEHIND THE EXPERIMENT

Though you can't see them, molecules in the air exert force or pressure on everything around us. The ball will rise to the point where the force of the air stream from the dryer balances the force of gravity that tries to pull the ball down. See what happens if you turn the dryer to a higher or lower setting.

59 Bottle fountain

WHAT TO GET

- Water
- Empty plastic water bottle
- Push pin
- Scissors or a nail for punching holes
- Tape
- Sink or large pan to catch the water
- ADULT SUPERVISION

WHAT TO DO

1. Have an adult poke a vertical row of small holes in the bottle, about 2 inches (5.1 cm) apart. Start the hole with a push pin and then enlarge it with a nail or screw.

2. Cover the holes with tape.

3. Fill the bottle with water, remove the tape, and see how the water drains through the holes.

THE SCIENCE BEHIND THE EXPERIMENT

Gravity exerts force on everything, and the more mass something has, the more force is exerted. Water is heavy, and the water at the top of the bottle is pushing on and compressing the water below. You can see how water pressure varies inside the bottle, because the water is pushed out of the lower holes with much more force than the upper ones.

60 Paper helicopter

WHAT TO GET

- Paper
- Paper clips of different sizes and weights
- Scissors
- ADULT SUPERVISION

WHAT TO DO

1. Fold the paper in thirds along the longest side. Have an adult help cut along the folds so yo have three 8.5 x 3.5-inch pieces of paper.

2. Fold each piece in half, short end to short end, and then unfold it.

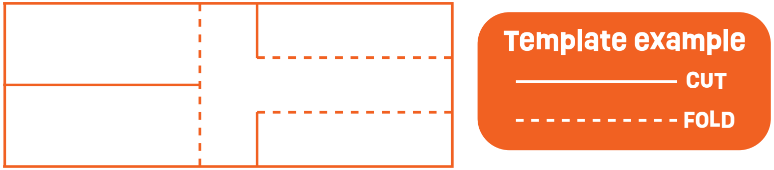
3. Cut one end of the paper along the center to the middle fold.

4. On the other side, an inch away from the fold, cut a 1-inch slit from each side toward the center. Fold both of those sides to the center.

5. Clip those folds together along the bottom edge with the paper clip.

6. Fold the two top flaps away from each other, forming a propeller.

7. Hold the contraption by the paper clip, toss it gently into the air, and watch it spin. Try with different sizes and number of clips.



61 Spinning spiral

WHAT TO GET

- Paper
- Small votive candle
- Scissors
- Pen
- Needle and thread
- Wooden skewer
- ADULT SUPERVISION

WHAT TO DO

1. On the paper, draw a spiral shape, with the lines about ¾ inch apart, closing the spiral with the last part of the line.

2. Cut along the lines and unfold your spiral.

3. Cut a 12 inch (30 cm) piece of thread, put a knot at one end, and then, using the needle, thread it through the center of your spiral. Tie the other end of the thread to the skewer.

4. Set the votive below the spiral and have an adult light it.

5. Using the skewer like fishing rod, suspend your spiral so that it hangs freely without touching the votive. ***Note:*** *Be very careful with this step so you don't light the spiral on fire.*

Spiral example

62 Capillary action with celery

WHAT TO GET

- Fresh celery
- Food coloring
- Tall glass or jar

WHAT TO DO

1. Fill the glass half-way with water and add 15-20 drops of food coloring.
2. Cut the bottom end of the celery off and place the stalks in the jar.
3. Observe what happens over the next 24 hours.

THE SCIENCE BEHIND THE EXPERIMENT

Capillary action explains how a liquid can move against the force of gravity as it travels though thin tubes or small holes. Water molecules like to stick to each other (*cohesion*) and to things they touch (*adhesion*), and together these forces are slightly stronger than the force of gravity. That's why the water inside a straw will climb a little higher than the rest of the water.

Capillary action is the ability of a liquid (our colored water) to flow in narrow spaces (thin tubes in the celery) without the help of an outside force, like gravity. Plants and trees couldn't survive without capillary action, which allows vital nutrients to reach the leaves at the top of the tallest tree.

63 Walking water

WHAT TO GET

- Water
- Food coloring
- Half-sheet paper towels
- Odd number of cups (at least three)
- Spoon

WHAT TO DO

1. Place the cups in a row and fill every other one with water.
2. Put a few drops of food coloring in each cup, using a different color per cup.
3. Stir with the spoon, wiping it after each cup to avoid mixing the colors.
4. Fold each paper towel lengthwise until you have a strip about 1inch wide. Then fold that strip in half so that it forms a "V" shape. The V should be just a bit taller than the cups you are using, so cut the paper towels if necessary.
5. Flip the V shape upside down and use one paper towel to connect each pair of adjacent cups.
6. Observe what happens immediately, in one hour, and overnight.

64 Fabric sun prints

WHAT TO GET

- Plain cotton muslin fabric
- Acrylic paints
- Water
- Corrugated cardboard
- Flat objects with interesting shapes
- Small containers
- Wide paint brushes

WHAT TO DO

1. In a small container, dilute some of the paint with water until it looks like colored milk.

2. Cut a square of fabric about 12 x 12 inches (30 x 30 cm) and soak it with tap water.

3. Spread the fabric out on a piece of cardboard, making sure that it is smooth and flat. Then paint it completely with a wide brush.

4. Place objects on top of the fabric in an interesting pattern. Weigh down any lightweight objects like leaves so they don't blow away.

5. Let the fabric sit in the sun until it is completely dry and then remove the objects.

THE SCIENCE BEHIND THE EXPERIMENT

Cotton fabric is made up of tiny tubular structures. As the sun dries the fabric, the water underneath your objects is sucked through the tubes due to capillary action to replace the water that has evaporated. As the water moves, the paint moves with it and out from under the objects.

65 Climbing rainbow

WHAT TO GET

- Washable markers
- Paper towel
- Water
- Tape or magnets
- Small bowl

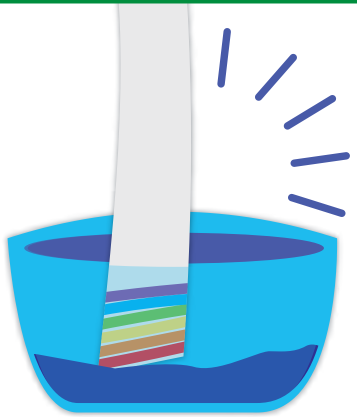
WHAT TO DO

1. Cut or tear a strip of paper towel about 3 x 11 inches (8 x 28 cm).

2. On one end, make heavy stripes of different colors for about an inch. Let the ink dry thoroughly.

3. Add a small amount of water to the bowl.

4. Use tape or magnets to hang your paper towel so that the stripes are just touching the water.



THE SCIENCE BEHIND THE EXPERIMENT

The small fibers in a paper towel have gaps between them which act like straws to allow water to move into the towel through capillary action.

66 Cotton ball launcher

WHAT TO GET

- 2 empty toilet paper tubes
- 2 thin rubber bands
- 1 short pencil
- Strong tape
- Cotton balls
- Scissors
- Hole punch
- ADULT SUPERVISION

WHAT TO DO

1. Cut one paper tube lengthwise and then reroll it into a tube about half the original diameter. Use tape to hold it in place.

2. Punch two holes on one end of the small tube, about half an inch from the end and on opposite sides of the tube from one another.

3. Carefully push the pencil through the holes so it sticks out on both sides of the tube.

4. On the other tube, cut two slits into one end about ¼ inch (6 mm) long and ½ inch (12 mm) apart. Cut two more slits on the same end of the tube, directly across from the first two.

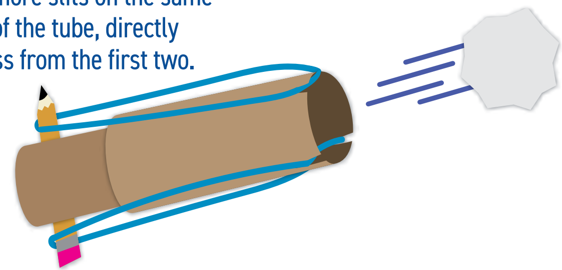
5. Loop a rubber band through the slits so that it hangs on the outside of the tube. Tape the slit to reinforce it. Do the same with the second rubber band.

6. Slide the narrow tube into the larger one, so that the pencil is at the opposite end from the rubber bands.

7. Stretch the rubber bands and loop them around the pencil.

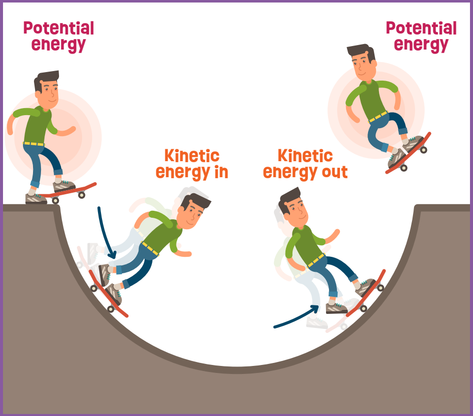
8. Put a cotton ball into the open end of the large tube.

9. Pull the pencil back about two inches and release it.



THE SCIENCE BEHIND THE EXPERIMENT

Energy is defined as the ability to do work. *Potential energy* is the energy an object has at rest, while *kinetic energy* is the energy of motion.



As you draw back on the pencil with the cotton ball loaded, you add potential energy to the system. When you release the pencil, the potential energy becomes kinetic energy, and the cotton ball goes flying. The farther you pull the pencil back, the more potential energy is stored and then released as kinetic energy, and the farther your cotton ball will fly.

67 See kinetic energy

WHAT TO GET

- Ice water
- Hot water
- Room temperature water
- Food coloring
- 3 clear glasses or jars

WHAT TO DO

1. Fill one glass with ice water, one with room temperature water, and the other with hot water. You can use hot tap water, but if you can have an adult heat some water on the stove or in a microwave, that's even better.

2. Put a few drops of food coloring into each glass, and watch how the color spreads.

3. Compare the results immediately after putting the drops in, and then again after one minute and after two minutes.

THE SCIENCE BEHIND THE EXPERIMENT

The molecules in water are always moving and bouncing off each other, filled with kinetic energy. As temperature goes up, they move faster, which spreads the food coloring quickly. As the temperature falls, they move more slowly, so the cold water doesn't change color as fast.

68 Marble mover

WHAT TO GET

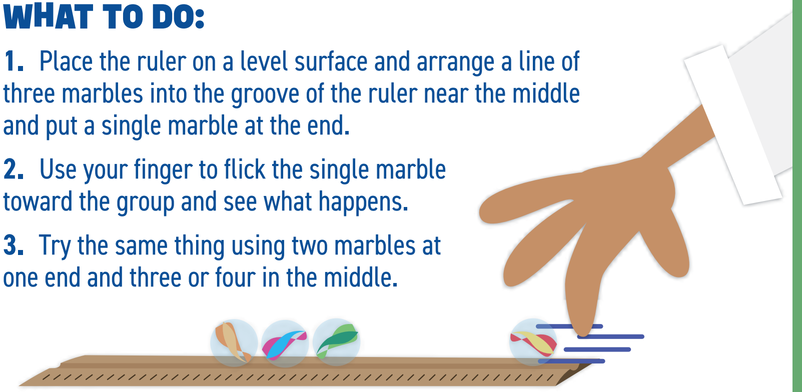
- Wooden or plastic ruler with a groove down the middle
- Marbles

WHAT TO DO:

1. Place the ruler on a level surface and arrange a line of three marbles into the groove of the ruler near the middle and put a single marble at the end.

2. Use your finger to flick the single marble toward the group and see what happens.

3. Try the same thing using two marbles at one end and three or four in the middle.



THE SCIENCE BEHIND THE EXPERIMENT

Energy can be transferred from one object to another. In this experiment, the kinetic energy of the moving marbles is transferred to the motionless marbles. Once that energy is transferred, the marbles that were flicked no longer have kinetic energy, so they stop moving.

69 Agate candy

WHAT TO GET

- Hard candies, assorted colors
- Aluminum foil
- Zipper sandwich bags
- Kitchen mallet or rolling pin
- Oven
- Cookie sheet
- Small bowls and spoons
- ADULT SUPERVISION

WHAT TO DO

1. Have an adult preheat the oven to 300°F (150°C).

2. Fold a 6 inch (15 cm) piece of foil in half and then turn up the edges, forming it into a bean-shaped shallow dish. Be sure the sides are at least ½ inch (12 mm) high.

3. Unwrap the candies and sort them by color. Place the different colors in separate zipper bags and then smash them with a mallet or rolling pin. Try to get the candies crushed finely, with no pieces bigger than a salt crystal. Place each color in a separate bowl.

4. Using a spoon or your hands, fill the molds with the candies, starting with an outer ring of one color and changing colors as you work your way to the middle. Be sure there are no empty spaces or very thin areas. Try for a layer of crushed candy about ⅛ inch (3 mm) thick.

5. Carefully place the molds on the cookie sheet and bake for 3-5 minutes. Bake until the candy is just melted and then remove them from the oven. Watch carefully so the candy does not burn.

6. Let the candy cool completely on the cookie sheet and then carefully remove the foil.

70 Fizzy rocks

WHAT TO GET

- Water
- Baking soda
- Food coloring
- Small toys, coins, or beads
- Vinegar
- Mixing bowl
- Spoon
- Measuring cups
- Plate

WHAT TO DO

1. Put 1 cup (520 g) of baking soda into a bowl. Add a few drops of food coloring and ¼ cup (60 mL) of water to the baking soda.

2. Mix well with a spoon and then your fingers to form a moldable dough. You may need to use more baking soda or more water to get the right consistency, or more food coloring to get a brighter color.

3. Roll your dough around the small items you want to conceal and squeeze the dough tightly to form it into a ball. Place your balls of dough on the plate.

4. Allow the balls to dry overnight until the "rocks" are nice and hard.

5. Put the rocks into a bowl and pour enough vinegar over them to cover the rocks.

THE SCIENCE BEHIND THE EXPERIMENT

Vinegar (an acid) reacts with baking soda (a base) to create carbon dioxide gas. When you pour vinegar onto the rocks, that creates a reaction that causes the fizzy bubbles you see.

71 Homemade puffy paint

WHAT TO GET

- Self-rising flour*
- Salt
- Food coloring
- Sturdy card stock
- Plastic cups
- Spoon
- Measuring spoons
- Paintbrushes
- Microwave oven

WHAT TO DO

1. Combine 1 Tbsp. self-rising flour and 1 Tbsp. salt in a plastic cup.

2. Add a small amount of water and stir until the consistency is a smooth paste, about like stirred yogurt.

3. Add food coloring and mix well.

4. Paint your masterpiece onto the card stock. When you're happy with it, have an adult pop it into the microwave for 30 seconds.

** To make self-rising flour, combine ½ cup (60 g) all-purpose flour, ¾ tsp. baking powder, and ⅛ tsp. salt*

THE SCIENCE BEHIND THE EXPERIMENT

The baking powder in the self-rising flour produces carbon dioxide bubbles when combined with water and heat. The bubbles rise to the surface of the paint, but not all of them can escape before the paint becomes solid.

72 Bouncing snowballs

WHAT TO GET

- 1 cup liquid starch
- 1 cup school glue
- Small amount of warm tap water
- Large bowl or container NOT used for food

WHAT TO DO

1. Add half of the liquid starch to the container and combine it with half of the school glue. Stir them together with a wooden spoon. Once it starts to firm up add the rest the of liquid starch and glue slowly and keep mixing until it becomes a big glob.

2. Once this happens take it out of the container and put it under warm running water in your sink. Knead it as it's under the water so it starts to firm up. Then it's ready to play!

THE SCIENCE BEHIND THE EXPERIMENT

As with the #56 Classic Slime experiment, the long chains of molecules (*polymers*) in the school glue and liquid starch link together as you stir and knead under the warm running water to create a non-Newtonian fluid.

73 Crystal clear slime

WHAT TO GET

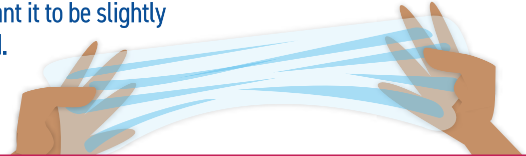
- Clear school glue
- Buffered saline solution
- Baking soda
- Water
- Bowls
- Spoons

WHAT TO DO

1. Add 100 mL of glue to a bowl, sprinkle with ¼ teaspoon baking soda and mix well. Carefully add a few drops of buffered saline and mix well. Add a few more drops and mix well. You should notice it start to pull together immediately.

2. Once it starts to pull together and get stringy, add some saline to your hands and lift it out. Start working it with your hands. It will start out really sticky, but after a few minutes of kneading the stickiness will go away. If after 5 minutes it is still very sticky, add a couple of drops of saline and work it in. You do want it to be slightly sticky still at the end.

3. Place in an airtight container and let it sit for 3 to 7 days. After the rest period the bubbles will have risen to the top. Pull off the bubble layer leaving only the clear slime. Do not mix the bubble layer back in as it will cause your slime to get cloudy again. Instead pop it like bubble wrap!



74 Play dough bubble bath

WHAT TO GET

- ¼ cup (60 mL) bubble bath
- ½ - ¾ cup (60-90 g) corn starch
- 1 tsp coconut oil
- Essential oil (optional)
- Coloring (optional)
- Large bowl or container

WHAT TO DO

1. Melt coconut oil in the microwave or over the stove and add to the bowl with bubble bath, essential oil, and coloring.

2. Next add ½ cup (60 g) cornstarch to the bowl and mix together with your hands. If it doesn't pull like a dough add a little more cornstarch until it comes together.

3. Knead your dough until it is a solid ball.

4. Store in an airtight container for up to a week.

5. To play with in the bath simply break off a tablespoon sized ball and let your child run under the bath water to create a fun bathtime experiment!

THE SCIENCE BEHIND THE EXPERIMENT

In several experiments, you have used cornstarch as a thickening agent to create a non-Newtonian fluid. Cornstarch is made from corn through a wet milling process that separates the proteins, fibers, oils, and starch. The dried starch turns out to be useful in producing many different things such as food products, baby powder, paper, and adhesives.

75 Rock candy science

WHAT TO GET

- 2-3 cups sugar
- 1 cup of water
- Food grade coloring (optional)
- Skewers for rock candy to grow on
- Canning jar
- Saucepan
- Clothespin
- ADULT SUPERVISION

WHAT TO DO

1. Combine equal parts of sugar and water in a saucepan and heat until all of the sugar is dissolved.

2. Slowly add more sugar and mix, continuing to add and mix until the sugar will no longer dissolver in the water.

3. The water should start to look a little cloudy. That is when you know that no more sugar is dissolving and the perfect sugar-saturation has been reached. The ratio of sugar to water should be roughly 3:1.

4. Add coloring if desired, and then continue to heat the water until it comes to a simmer. Remove the sugar-water from the heat and allow it to cool all the way.

5. Sprinkle sugar on a paper plate, dip skewers in water and roll them in the sugar. Allow the skewers to dry all the way.

6. Once cooled, pour your sugar water in the canning jars.

7. Attach the skewers to the clothespins making a "T" and suspend your skewers in the sugar water making sure they do not touch the bottom of sides of the jar.

8. Watch your crystals grow every day for one week.

76 Sugar cube absorption

WHAT TO GET

- Sugar cubes
- Plate
- Water
- Food coloring
- Aluminum foil
- Food plastic wrap
- Paper

WHAT TO DO

1. Add a few drops of food coloring to a little water and pour it onto the plate.

2. Stack up several sugar cubes and watch them absorb the color.

3. Add a small foil sheet on top of one sugar cube and stack some more on top.

4. Try the same with food plastic wrap, paper or tissue.

SCIENTISTS ASK QUESTIONS

- How many sugar cubes can you stack before they stop absorbing color?
- What stops the water from reaching the top cubes best? Aluminum foil? Plastic wrap? Paper?
- Which falls down first?

THE SCIENCE BEHIND THE EXPERIMENT

The tiny spaces between the sugar crystals allow the water to rise through the cubes by way of capillary action. The water molecules stick to one another and the sugar crystals they touch, and thanks to the food coloring, you're able to see just how high the water rises!

77 Making secondary color orange

WHAT TO GET

- Red and yellow food coloring
- Water
- 2 glasses or clear plastic cups
- Spoon or stir stick for mixing

WHAT TO DO

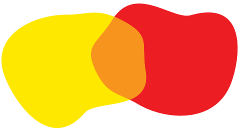
1. Fill one glass or cup ⅓ full with water and add 2-4 drops of red coloring. Mix well.

2. Fill your second glass or cup ⅓ full with water and add 2-4 drops of yellow coloring. Mix well.

3. Now slowly pour some of your red colored water into your yellow colored water and watch what happens to the color.

4. You've just taken two primary colors and made a secondary color!

5. What happens when you add more red colored water to the yellow colored water? Does the orange color appear a darker orange?



STOP

Keep your secondary color cups once they're mixed, you'll need them for later experiments!

78 Making secondary color green

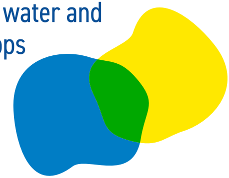
WHAT TO GET

- Blue and yellow food coloring
- Water
- 2 glasses or clear plastic cups
- Spoon or stir stick for mixing

WHAT TO DO

1. Fill one glass or cup ⅓ full with water and add 2-4 drops of blue coloring. Mix well.

2. Fill your second glass or cup ⅓ full with water and add 2-4 drops of yellow coloring. Mix well.



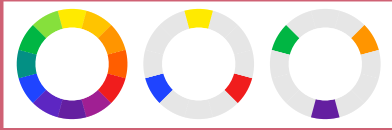
3. Now slowly pour some of your blue colored water into your yellow colored water and watch what happens to the color.

4. You've just taken two primary colors and made a secondary color!

5. What happens when you add more blue colored water to the yellow colored water? Does the green color appear a darker green?

THE SCIENCE BEHIND THE EXPERIMENT

Secondary colors are made by mixing two *primary colors* (which are red, blue, and yellow). By mixing one of these three colors with another, you can make green, purple, and orange.



79 Making secondary color violet

WHAT TO GET

- Red and blue food coloring
- Water
- 2 glasses or clear plastic cups
- Spoon or stir stick for mixing

WHAT TO DO

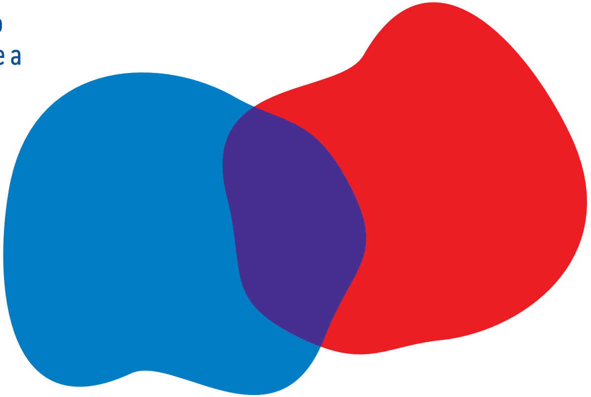
1. Fill one glass or cup ⅓ full with water and add 2-4 drops of red coloring. Mix well.

2. Fill your second glass or cup ⅓ full with water and add 2-4 drops of blue coloring. Mix well.

3. Now slowly pour some of your blue colored water into your red colored water and watch what happens to the color.

4. You've just taken two primary colors and made a secondary color!

5. What happens when you add more blue colored water to the red colored water? Does the violet color appear a darker violet?



80 Making tertiary color red-violet

WHAT TO GET

- Red food coloring
- Violet colored water from secondary color experiment
- Water
- Glass or plastic clear cup
- Spoon or stir stick for mixing

WHAT TO DO

1. Fill your glass or cup ⅓ full with water and add 2-4 drops of red coloring. Mix well.

2. Grab your glass of violet colored water you made in the secondary color experiment.

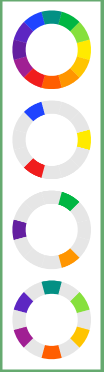
3. Now slowly pour some of your violet colored water into your red colored water and watch what happens to the color.

4. You've just taken a primary color and a secondary color and made a tertiary color!

5. This color is called red-violet.

THE SCIENCE BEHIND THE EXPERIMENT

Tertiary colors are made by mixing primary colors (red, blue, and yellow) with secondary colors (green, orange, purple). They are also sometimes called "intermediate" colors and include blue-green, yellow-orange, and many others.



81 Making tertiary color red-orange

WHAT TO GET

- Red food coloring
- Orange colored water from secondary color experiment
- Water
- Glass or plastic clear cup
- Spoon or stir stick for mixing

WHAT TO DO

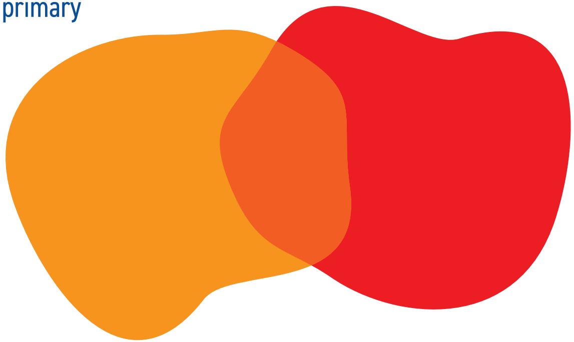
1. Fill your glass or cup ⅓ full with water and add 2-4 drops of red coloring. Mix well.

2. Grab your glass of orange colored water you made in the secondary color experiment.

3. Now slowly pour some of your orange colored water into your red colored water and watch what happens to the color.

4. You've just taken a primary color and a secondary color and made a tertiary color!

5. This color is called red-orange.



82 Making tertiary color yellow-orange

WHAT TO GET

- Yellow food coloring
- Orange colored water from secondary color experiment
- Water
- Glass or plastic clear cup
- Spoon or stir stick for mixing

WHAT TO DO

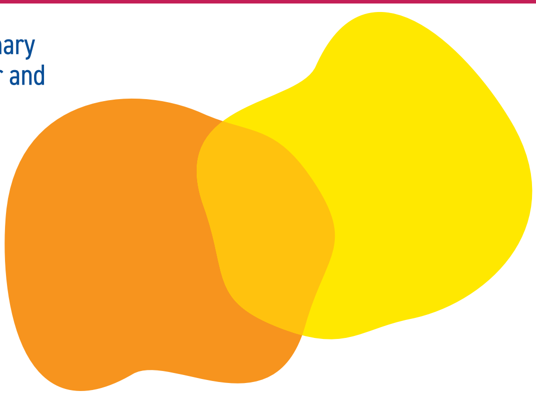
1. Fill your glass or cup ⅓ full with water and add 2-4 drops of yellow coloring. Mix well.

2. Grab your glass of orange colored water you made in the secondary color experiment.

3. Now slowly pour some of your orange colored water into your yellow colored water and watch what happens to the color.

4. You've just taken a primary color and a secondary color and made a tertiary color!

5. This color is called yellow-orange.



83 Making tertiary color blue-violet

WHAT TO GET

- Blue food coloring
- Violet colored water from secondary color experiment
- Water
- Glass or plastic clear cup
- Spoon or stir stick for mixing

WHAT TO DO

1. Fill your glass or cup ⅓ full with water and add 2-4 drops of blue coloring. Mix well.

2. Grab your glass of violet colored water you made in the secondary color experiment.

3. Now slowly pour some of your violet colored water into your blue colored water and watch what happens to the color.

4. You've just taken a primary color and a secondary color and made a tertiary color!

5. This color is called blue-violet.

84 Making tertiary color blue-green

WHAT TO GET

- Blue food coloring
- Green colored water from secondary color experiment
- Water
- Glass or plastic clear cup
- Spoon or stir stick for mixing

WHAT TO DO

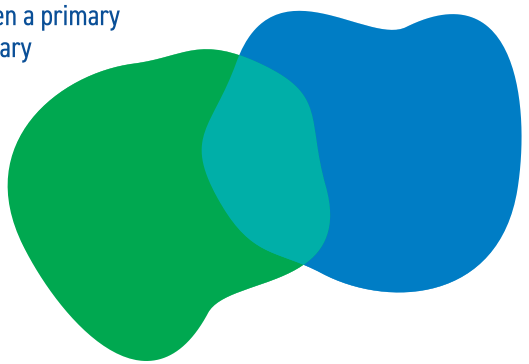
1. Fill your glass or cup ⅓ full with water and add 2-4 drops of blue coloring. Mix well.

2. Grab your glass of green colored water you made in the secondary color experiment.

3. Now slowly pour some of your green colored water into your blue colored water and watch what happens to the color.

4. You've just taken a primary color and a secondary color and made a tertiary color!

5. This color is called blue-green.



85 Making tertiary color yellow-green

WHAT TO GET

- Yellow food coloring
- Green colored water from secondary color experiment
- Water
- Glass or plastic clear cup
- Spoon or stir stick for mixing

WHAT TO DO

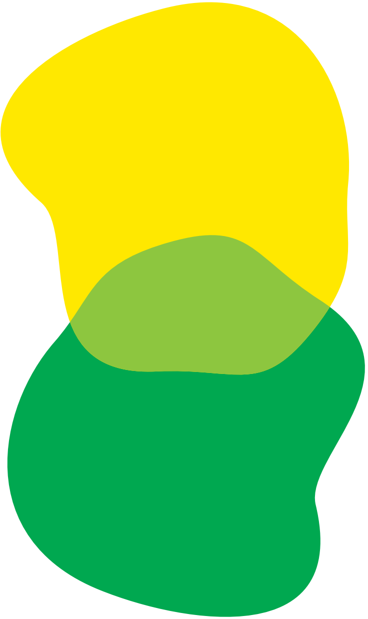
1. Fill your glass or cup ⅓ full with water and add 2-4 drops of yellow coloring. Mix well.

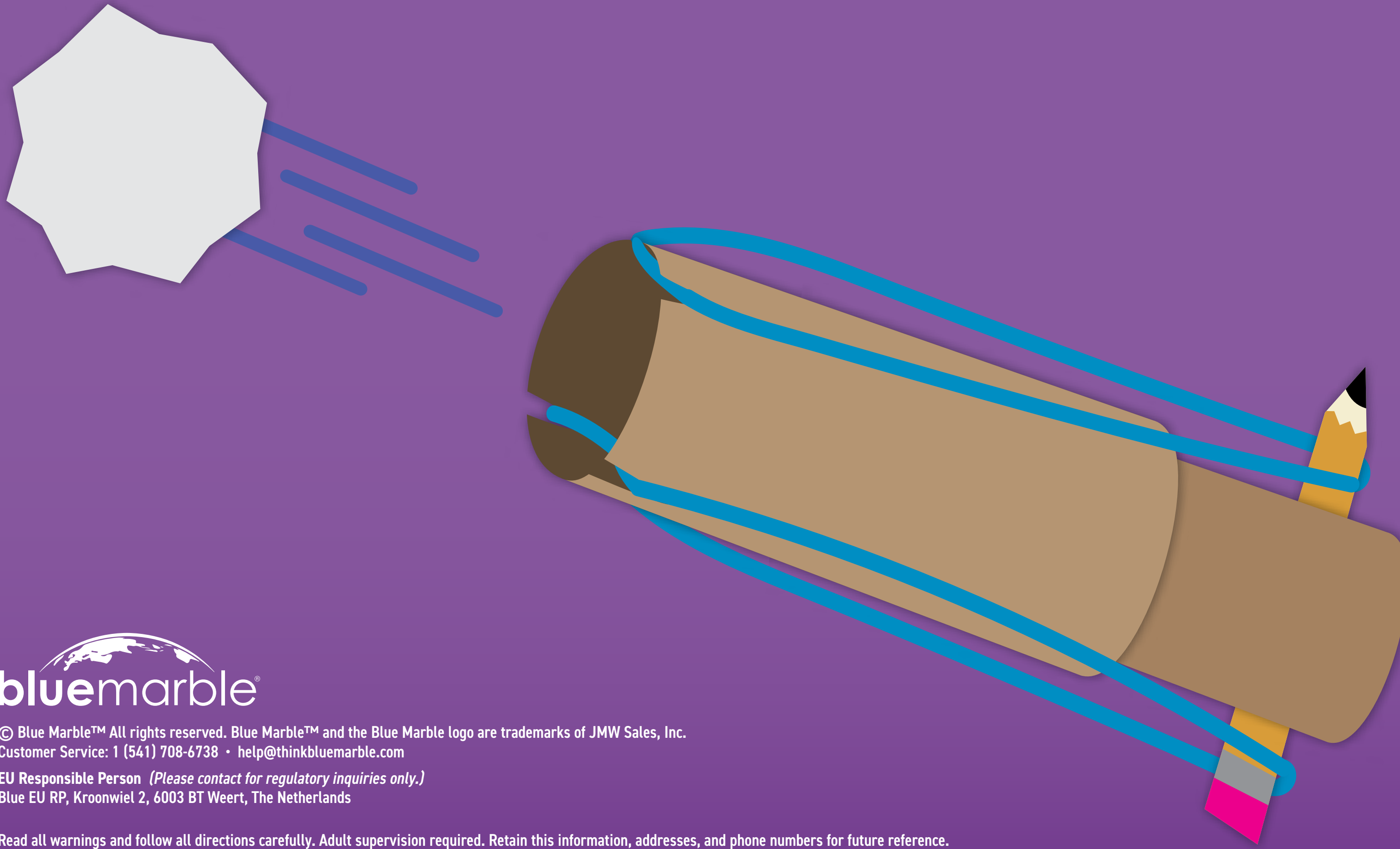
2. Grab your glass of green colored water you made in the secondary color experiment.

3. Now slowly pour some of your green colored water into your yellow colored water and watch what happens to the color.

4. You've just taken a primary color and a secondary color and made a tertiary color!

5. This color is called yellow-green.





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