BEAN IN A BAG

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 7 TO 10 DAYS

What is the effect of sunlight on plant growth? Does a seed in darkness sprout at the same time as a seed in the sunlight? Try this simple experiment to find out.

MATERIALS

- 2 plastic zip-top baggies
- 2 paper towel sheets
- Handful of dry beans (like pinto beans, black beans, navy beans, etc.)

THE STEPS

1. Fold each paper towel so that it fits a baggie.
2. Saturate the paper towels with wa... place one towel into each baggie.
3. Place a few dry beans into each ba... on top of the paper towel and zip ... the bags.
4. Carefully place one baggie in a sun... place where it won't be disturbed. P... the other baggie in a dark closet wi... any sunlight.
5. Check on the beans daily and recor... observations.

CORNSTARCH QUICKSAND

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 30 MINUTES

Do you know how quicksand works? It's easy to sink in but extremely difficult to get out of because it hardens when pressure is applied to it. Make your own quicksand and learn about its unique properties in this super fun and messy science experiment.

Caution: This experiment can get very messy, depending on how much you get into it! When you are done experimenting and playing, throw the cornstarch mixture away in the trash. It will clog the drain if you try to wash it down the sink.

MATERIALS

- Large mixing bowl
- Cornstarch
- Water
- Food coloring
- Slotted spoon, colander, kitchen sieve, funnel, and other kitchen tools

THE STEPS

1. In a mixing bowl, mix 2 parts cornstarch to 1 part water. For example, if you have 1 cup of cornstarch, mix it with ½ cup water.
2. Add a few drops of food coloring, just fo fun. Mix it well.
3. Have fun exploring this mixture. Make a ball of it in your hand and then set it a slotted spoon or flatten it down into colander and see what happens.

Observations What happens to the quicksand when you squeeze it? What happens when you let it go?

Now Try This! Experiment with adding more or less cornstarch to the mixture. How does it change the quicksand's behavior?

The Hows and Whys Cornstarch quicksand is a cool example of a non-Newtonian fluid because it gets more viscous when a force is applied and less viscous when that force is removed. In contrast, Newtonian fluids, like honey, become less viscous when the honey is warm and more viscous when the honey is cold.

CRYSTAL GARDEN

LEVEL OF DIFFICULTY: MEDIUM
FROM BEGINNING TO END: 12 HOURS

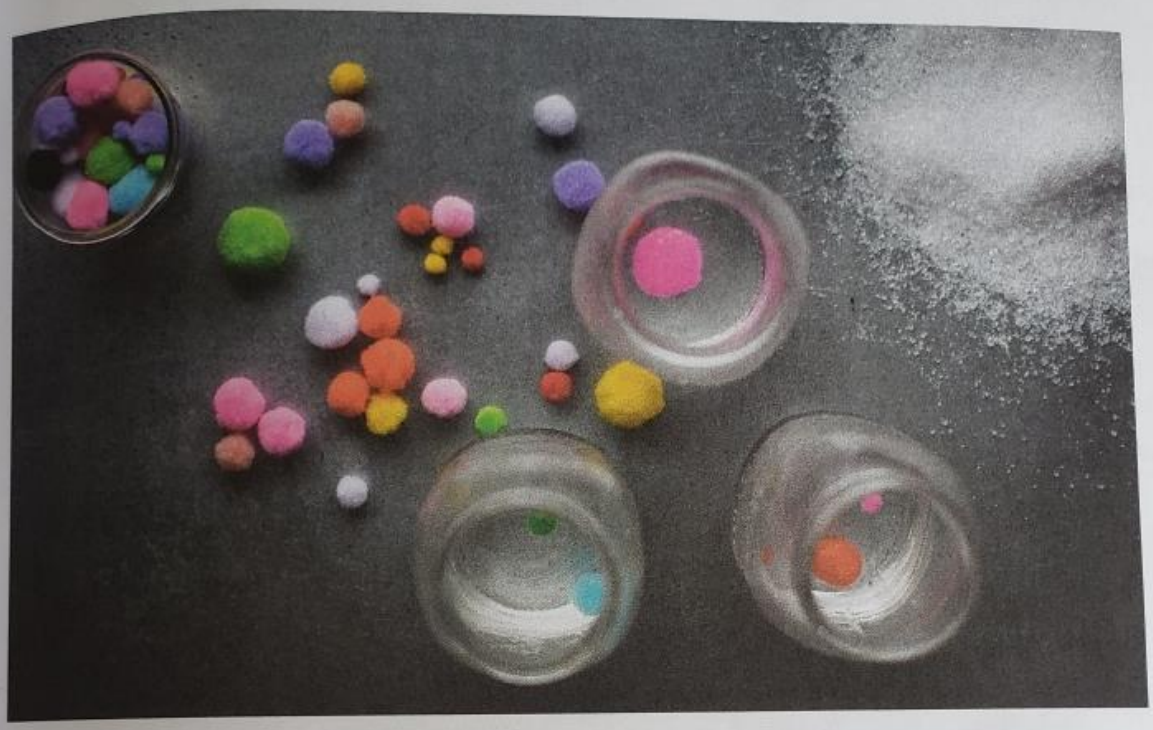
There are numerous examples of crystals that exist in nature, such as diamonds, pyrite, amethyst, and quartz. Have you ever wondered how crystals grow? Find out by growing your own salt crystal garden.

MATERIALS

- Epsom salt
- Clear glass jar
- Hot tap water
- Small pom-pom
- Measuring cups

THE STEPS

1. Measure 1 cup of Epsom salt and plac in the jar.
2. Measure 1 cup of very hot tap water an add it to the salt.
3. Stir the mixture well. It's fine if there is undissolved salt at the bottom of the j
4. Throw in the pom-pom and stir it up.
5. Place the jar in the refrigerator where won't be disturbed and leave it overn
6. In the morning, check to see if the crystals grew. Carefully pour off the excess liquid from the jar to examin the crystals more closely.
7. It's okay to touch the crystals. Just be aware that they are delicate and may crumble.



Observations What do the crystals look like? What does the pom-pom look like?

Now Try This! Try growing crystals with other kinds of household materials to see how the crystals are similar or different. Some ideas to try include baking soda, table salt, sugar, or borax. (You may need to leave the jar in the refrigerator for a longer period for other crystals to form.)

The Hows and Whys More salt dissolves in hot water than in cooler water, creating an unstable supersaturated solution. As the solution cools down, the salt molecules come out of solution and crystallize easily onto any surface they stick to. The pom-pom is in the solution to provide nucleation sites, or uneven surfaces on which the crystals can easily start to grow.

DOES IT RUST?

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 7 DAYS

Why do some items rust and others don't? What causes rust? Answer all of these questions in this fun scientific inquiry.

MATERIALS

- Small paper cups
- Water
- Various metal objects from around the house, like nails, tacks, safety pins, paper clips, bobby pins, coins, and staples

THE STEPS

1. Fill each cup about halfway with water.
2. Drop one metal object into each cup.
3. Check on the cups each day for 7 days and record what you observe.

Observations Which objects got rusty? Were there any surprises?

Now Try This! Repeat this experiment with 2 of every metal object: Place one of them into filtered water and the other into water mixed with salt. Is there a difference in how fast oxidation occurs in salt water versus fresh water?

The Hows and Whys Rust is a reddish brown substance called iron oxide that forms when iron metal comes into contact with oxygen. This chemical reaction is called oxidation. Since there is oxygen in water, it facilitates the rusting process.

EXPLODING BAGGIE

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 15 MINUTES

You might be familiar with making a volcano out of baking soda and vinegar, but what happens if you put these 2 materials into a sealed plastic baggie? Learn about the chemical reaction between baking soda and vinegar while watching the pressure increase. The excitement will make you explode!

Caution: *Be sure to stay a few feet away from the baggie after adding the baking soda and closing the zip-top.*

MATERIALS

- Plastic zip-top baggie
- Vinegar
- Toilet paper
- Baking soda
- Measuring cups and spoons

THE STEPS

1. Be sure to conduct this experiment outside or somewhere else where it's okay if you make a little mess.
2. Measure and pour ½ cup vinegar into the baggie and set it aside.
3. Place 1 tablespoon baking soda on a couple squares of toilet paper. Fold and twist the tissue into a little pouch around the baking soda.
4. Quickly drop the baking soda pouch into the baggie and zip up the top of the baggie.
5. Give the baggie a few shakes, drop it on the ground, and take a few steps back.

Observations What happened to the baggie? What did you notice as baking soda and vinegar reacted together?

Now Try This! Change the variables to see how you can get the best pop from the baggie. Vary the amounts of baking soda and vinegar and the size of the baggie.

The Hows and Whys When baking soda and vinegar are mixed, they react to produce carbon dioxide gas. As more and more carbon dioxide fills up the baggie, the pressure inside increases. Once the pressure is so high that the baggie can't contain it any longer, the baggie pops!

FISHING FOR ICE

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 20 MINUTES

If you live in a snowy place in the winter, you may have noticed that people often sprinkle salt on the ice on their steps, porches, and driveways. Do you know what happens to ice when it is mixed with salt? Find out by going fishing for ice with a string. You never know what you'll catch!

MATERIALS

- Cup of water
- Ice cubes
- String or yarn
- Table salt

THE STEPS

1. Place a few ice cubes into a cup of water.
2. Lay the string over the top of the ice cubes, trying to get it to touch each one.
3. Sprinkle some salt onto the top of the ice cubes and string.
4. Wait 1 minute. Gently pull the string out of the cup and see what you've caught!

Observations How many ice cubes can you freeze to the string at once?

Now Try This! What happens if you use other kinds of salt to go fishing for ice? Some ideas include Epsom salt, baking soda, and rock salt.

The Hows and Whys When salt is added to ice water, it decreases the freezing point. Pure water freezes at 32 degrees Fahrenheit, but the addition of salt decreases the freezing point by several degrees because salt molecules get in the way of water molecules freezing together. This means that the salt makes the ice melt. You can see how the salt melts little tunnels into the ice cubes.

However, since we are using only a tiny bit of salt in this experiment, the water around the ice quickly freezes again, freezing the string to the ice along with it. For a few moments, the ice sticks to the string.

FIZZY ROCKET

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 30 MINUTES

Can you launch your own rocket using a common chemical reaction? Learn about pressure and watch what happens when the pressure overcomes the strength of a container.

Caution: *Be sure you stand a few feet back from the rockets so you don't get hit when they launch! Do this experiment outside where it's fine to make a little bit of a mess.*

MATERIALS

- M&M's Minis candy in the pop-top tube (If you can't find one of these, any small bottle with a lid that snaps on will work. Some vitamin bottles have this; the old 35mm film canisters work the best.)
- Scissors
- Alka-Seltzer tablet
- Water

THE STEPS

1. Head outside where it's fine to make a little mess.
2. Use scissors to cut the small piece of plastic holding the lid to the tube so th the lid comes off freely.
3. Place an Alka-Seltzer tablet in the cani
4. Fill the tube up about ¾ full with wate and pop the lid on. Set the rocket on t ground upside down (on its lid) and st back a few feet.
5. Watch and wait for the rocket to laun

Observations What happened when the rocket launched? What did you notice before it launched?

Now Try This! Vary the amount of water and the size of the Alka-Seltzer tablet you add to the canister. Does it make a difference in how quickly or how high it launches? How does water temperature affect the rocket?

The Hows and Whys The key to launching this rocket is the chemical reaction that happens when Alka-Seltzer tablets dissolve in water. These tablets are made from a dry acid (citric acid) and a dry base (sodium bicarbonate) that react to form carbon dioxide gas when they dissolve in water. As more and more carbon dioxide is produced, the pressure inside the canister builds until at last the canister is launched off the top!

FLOATING COMPASS

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 10 MINUTES
OTHER CATEGORIES: SCIENCE

Which way is the North Magnetic Pole? Use a magnet and a few household supplies to quickly and easily figure out exactly which direction is north.

MATERIALS

- Bar magnet, with north and south clearly indicated
- Tape
- Small plastic storage container with a flat bottom
- Large bowl full of water

THE STEPS

1. Tape the magnet inside the bottom of a small plastic storage container.
2. Place the plastic container into a large bowl full of water so that it floats.
3. Wait a few minutes for the small bowl to be still.

Observations Which way is north? Spin the small bowl and see if the magnet settles the same way.

Now Try This! Magnetize a needle by stroking the needle 20 times in the same direction with one end of the bar magnet. Cut out a small circle of paper and thread the needle through it, as you would a needle through cloth. Don't run the needle all the way through, but leave the needle halfway through the paper with the needle lying flat on the surface. Float the paper in a bowl full of water so that the ends of the needle are on top of the paper and see which direction the needle ends up pointing.

The Hows and Whys No matter how you move the small plastic container, it will always settle with the magnet pointing to the north. This is because Earth has a magnetic field that pulls on the bar magnet and aligns it facing north-south.

FLUFFY SOAP

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 20 MINUTES
OTHER CATEGORIES: MATH

Does a bar of soap sink or float? What happens when you cook soap in the microwave? Does all soap behave the same way? Discover the properties of bar soap and compare how various brands differ in this simple and surprising science experiment.

Caution: *The soap will be hot when it comes out of the microwave, so be careful not to touch it right away. If at any point you smell something burning in the microwave, turn it off immediately.*

MATERIALS

- Bowl of water
- Bar of Ivory soap
- Several bars of soap of other brands (like Irish Spring, Lever 2000, Olay, Dial, or others)
- Microwave-safe plate

THE STEPS

1. Place the bar of Ivory soap into the bo of water to see if it sinks or floats. Rec your observations.
2. Test out the other bars of soap one by to discover if they sink or float.
3. Place the bar of Ivory soap on a microwave-safe dish. Cook it in the microwave for 1 minute, watching it through the door of the microwave. What happens?
4. Place the other bars of soap one by on the microwave for 1 minute. (Rememb If you smell any burning soap, turn of the microwave immediately.) Record observations of each brand.

Observations Is there a relationship between the density of a bar of soap and how it behaves when it is cooked in the microwave?

Now Try This! Weigh the bar of soap before and after it is cooked in the microwave. Does the weight change? Why?

The Hows and Whys Ivory soap is made by whipping a whole bunch of air into the mixture. Little air pockets get trapped in the soap, making it light and fluffy. The air pockets make the soap less dense than water, so the soap floats.

When Ivory soap is cooked in the microwave, it expands like a soap soufflé. This happens because water molecules stuck in the air pockets heat up and turn into water vapor. The water vapor escapes from the soap mixture, making it puff up and expand as it goes.

Other brands of soap have varying degrees of air whipped into them. How are they similar to/different from Ivory brand soap?

ICE CREAM IN A BAG

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 30 MINUTES
OTHER CATEGORIES: MATH

What happens when salt is added to ice? How does the temperature change? Find out and measure the change for yourself, plus get rewarded with a delicious frosty treat for all your hard work.

MATERIALS

- 2 large mixing bowls
- Measuring cups and spoons
- 20 cups ice (divided)
- 2 cups water (divided)
- 6 tablespoons salt
- Thermometer
- Small plastic zip-top baggie
- ½ cup milk
- 1 tablespoon sugar
- ¼ teaspoon vanilla
- Gallon-size plastic zip-top baggie
- Spoon

THE STEPS

1. In one mixing bowl, mix 10 cups of ice and 1 cup of water.
2. In the other mixing bowl, mix 10 cups of ice, 1 cup of water, and the salt.
3. Wait a few minutes, then use a thermometer to measure the temperature of each bowl. Which mixture is colder?
4. Add the milk, sugar, and vanilla to the small baggie. Squeeze the air out and seal it up tightly.
5. Dump the salty ice mixture from the second bowl into the large baggie.
6. Place the small baggie inside the large baggie with the ice mixture and seal it.
7. Shake up the baggies for 5 to 10 minutes, or until the milk mixture turns into a soft solid.
8. Open up the large baggie and remove the small baggie. Rinse it under cold water, paying special attention to rinse off the zippered top of the baggie.
9. Open the bag, grab a spoon, and enjoy your sweet treat!

Observations What is the temperature of the salty ice mixture? How does the milk mixture freeze into ice cream so quickly?

Now Try This! Instead of mixing up the small baggie in the salty ice mixture, try placing it directly in the freezer. How is it the same? How is it different?

The Hows and Whys To make any variety of homemade ice cream, milk needs to be partially frozen. Most freezers are set at −10 degrees Fahrenheit, so putting milk directly in the freezer and leaving it there makes the milk freeze solid, which makes the texture chunky and icy instead of smooth and creamy. Water freezes at 32 degrees Fahrenheit, but because milk contains proteins and fat, it freezes at a lower temperature. This means that trying to freeze milk with ice cubes won't work. When salt is added to ice, it lowers the freezing point of the ice, making it melt. This leaves a salty ice mixture that is much colder than 32 degrees Fahrenheit. The temperature of the salty mixture is close to 0 degrees Fahrenheit! (You can verify this with a thermometer.) This temperature is cold enough to freeze milk into homemade ice cream in less than 10 minutes without freezing it solid.

LEVITATING PING-PONG BALL

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 15 MINUTES
OTHER CATEGORIES: SCIENCE

Can you make a ping-pong ball magically levitate in the air? Use just a few simple supplies to complete this cool science trick and learn all about air pressure.

MATERIALS

- Cone-shaped paper cup
- Scissors
- Bendable drinking straw
- Tape
- Ping-pong ball

THE STEPS

1. Use scissors to cut the tip off of a cone-shaped paper cup.
2. Insert the short end of a bendable drinking straw into the hole from the bottom of the cup.
3. Securely tape the straw and the cup together. Bend the straw 90 degrees so you can hold it horizontally and keep the cup upright.
4. Place a ping-pong ball into the cone. Blow into the long end of the straw and watch what happens!

Observations What happens when you bl air into the straw? How hard do you have blow to get the ball to levitate?

Now Try This! What happens if you use a longer or a wider straw?

The Hows and Whys Bernoulli's principle states that if air speeds up, the pressure is lowered. The air that you are blowing around the sides of the ping-pong ball is moving quickly, which means it's at a lower pressure than the surrounding, stationary air. Gravity pulls the ping-pong ball downward while the air blowing from below the ping-pong ball forces it upward. When all the forces acting on the ping-pong ball are balanced, it hovers in midair.

MINI LIGHTNING SPARK

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 20 MINUTES

Do you know how lightning is formed and what it is made of? In this science experiment, you will create your own small lightning spark to see how real lightning works. This may work best in a darkened room.

MATERIALS

- Aluminum pie tin
- Push pin or thumbtack
- Pencil with an eraser
- Foam plate
- Wool blanket

THE STEPS

1. Push a thumbtack through the center the pie tin so the point is sticking out back of the tin.
2. Push the pencil eraser through the poi end of the thumbtack to create a hand for the pie tin.
3. Rub the foam plate vigorously for abou 1 minute with wool or on your hair.
4. Touch the aluminum plate to the foam plate.

Observations What did you see when the aluminum plate touched the foam plate?

Now Try This! What other metal objects could you use to make the charge jump from the foam plate?

The Hows and Whys Rubbing the foam plate with wool gives it a static charge by transferring electrons from the wool to the foam plate. When you hold the pie tin near it, the charge jumps from the plate to the tin. You should see a tiny flash as the charge travels through the air.

Lightning works in a similar way. Within a thundercloud, millions of frozen raindrops bump into one another. This friction creates an electrical charge that builds up until the bottom of the thundercloud develops a negative charge, creating a positive charge on the ground below. The charge coming up from the ground eventually connects with the charge in the clouds and a lightning bolt strikes.

NAKED EGG

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 24 HOURS

What happens to an egg when it is soaked in vinegar? In this experiment, you will learn about the reaction between an acid and a base, plus you'll get to create something you've probably never seen before.

Caution: *Always wash your hands with soap and water after you handle raw eggs.*

MATERIALS

- 3 cups or jars
- White vinegar
- Food coloring
- 3 whole eggs

THE STEPS

Fill the cups or jars with enough vinegar to cover an egg.

Add a few drops of food coloring to each cup of vinegar and mix them in.

Carefully add an egg to each cup.

4. Place the cups in the refrigerator and leave them overnight. Check on them every few hours to see how they are changing.

Observations What did you notice about the eggs as they soaked in vinegar? What do they look like after 24 hours? What do they feel like?

Now Try This! Fill up 3 new cups with different clear liquids. Some ideas to try include corn syrup, honey, hand soap, soda, salt water, and soapy water. Place an egg into a different liquid each night in the refrigerator and see what happens.

The Hows and Whys The eggshell dissolves because vinegar is an acid and the eggshell is made of a base called calcium carbonate. The vinegar breaks apart the solid calcium carbonate crystals that make up the eggshell into their calcium and carbonate parts. The calcium floats free, while the carbonate reacts to make carbon dioxide (these are the tiny air bubbles on the surface of the eggshell).

PENCIL SUNDIAL

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 8 HOURS
OTHER CATEGORIES: SCIENCE, TECHNOLOGY

Can you construct a clock that will tell time using shadows? Ancient Egyptians were doing this more than 4,500 years ago! Grab a few simple supplies, and make your own sundial.

MATERIALS

- New, unsharpened pencil
- Tape
- Paper plate
- Markers
- Book or full water bottle

THE STEPS

1. Do this experiment on a clear, sunny day. If clouds move in, you may have to try making your sundial a different day.
2. Tape the pencil standing up on its unsharpened, flat end to the center of a paper plate.
3. Find a sunny place outside. Set the paper plate down and trace the pencil's shadow on the paper plate with a marker. Mark the time next to the shadow.
4. Make sure the paper plate and pencil stay in the same position throughout this activity. Place something heavy (like a book or a full water bottle) on part of the paper plate to keep it in place.
5. Each hour on the hour, trace and label the pencil's shadow.
6. Try to get at least 8 shadows traced in a row. The more shadows you capture, the better your sundial will be.

Observations Did the pencil's shadow change its size throughout the day? Why?

Now Try This! Make a human sundial using your own shadow and sidewalk chalk on a large section of asphalt. Head to a driveway, a parking lot, or a playground to trace and measure your shadow each hour, making sure to mark where your feet go so you can stand in the same place each time.

The Hows and Whys As the Earth rotates eastward on its axis, the apparent position of the sun in the sky changes. This makes shadows move across the surface of the Earth.


DID-SQUEOKS

PULLEY SYSTEM

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 30 MINUTES

Can you engineer a pulley that can lift a heavy load? Learn how this simple machine works to lift and lower objects and experiment to see how much weight it can move.

MATERIALS

- 2 cardboard tubes from paper towel rolls
- Scissors
- Long pencil
- Empty spool of ribbon
- Masking tape
- Small paper cup
- Yarn
- Small objects, like cereal, plastic toys, or paper clips

THE STEPS

1. Carefully use scissors to poke a hole big enough for a pencil to fit through in a cardboard tube, about 2 inches from the end. Poke another hole directly opposite the first hole. Do the same with the other tube.
2. Fit the pencil through the center hole of the empty spool of ribbon.
3. Insert one end of the pencil through the holes in one cardboard tube and the other end of the pencil through the holes in the other cardboard tube so that about an inch of pencil hangs out each side.
4. Tape the cardboard tubes upright to a flat surface with the pencil at the top.
5. Use scissors to poke 2 holes opposite each other just below the rim of the cup.

6. Thread a piece of yarn through the holes and tie it together to give the cup a short bucket handle.

7. Cut another piece of yarn about 3 feet long and attach one end to the handle. Thread the other end over the ribbon spool pulley.

8. Load up the cup with some lightweight objects. Pull the end of the yarn to lift the cup using your pulley system.

Observations How much weight can your pulley system lift? Are there any adjustments you need to make so that the system is more sturdy?

Now Try This! Can you add more pulleys to your system? Does adding more pulleys affect how much weight the system can move?

The Hows and Whys A pulley is a simple machine that uses grooved wheels and a rope to raise, lower, or move a load. Using a pulley reverses the direction of the lifting force, making it easier to move a load. With a pulley, you can pull the yarn down to move the load up!

SCATTERED PEPPER

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 10 MINUTES

What happens when dish soap is dripped into water? Why? Create the illusion that pepper is fleeing from a drop of soap in this fun and easy science experiment.

MATERIALS

- Baking dish, baking pan, deep plate, or wide bowl that is at least ½ inch deep
- Water
- Black pepper
- Liquid dish soap

THE STEPS

1. Pour enough water into a dish so that it is about ½ inch deep.
2. Sprinkle pepper onto the water.
3. Squeeze a drop of liquid dish soap into the center of the plate.

Observations What happens when dish soap is dripped into the water?

Now Try This! Repeat this experiment using salt water instead of tap water. How are the results the same or different?

The Hows and Whys The molecules on the surface of a liquid bond tightly together to form a little dome. This is called surface tension. Pepper is light enough to float on water's surface without breaking the surface tension. However, when soap is dripped into the water, all the soap molecules bond with water molecules, which breaks the surface tension. The dome pops and all the surface water molecules spread out, taking the pepper with them.

SOUND WAVES EXPERIMENT

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 10 MINUTES

Can you hear vibrations? Learn how sound travels by doing this really cool sound waves experiment and making your very own gong with a kitchen spoon.

MATERIALS

- Metal spoon
- 4 feet of string or yarn
- Ruler

THE STEPS

1. Tie the handle of the spoon to the middle of the string.
2. Wrap each end of the string a few times around your index fingers.
3. Hold your fingers up close to your ears and let the spoon hang free at your waist.
4. Have a friend hit the spoon with the ruler.

Observations What can you hear when your friend hits the spoon with the ruler? Does it sound different when the string is held close versus holding the string far away from your ears? How long does the sound echo?

Now Try This! Try attaching different sizes of spoons and forks to the string to see how they each sound when hit with a ruler.

The Hows and Whys Sound is simply vibrations that travel through the air or through another medium. In this experiment, hitting the spoon with a ruler makes the spoon vibrate. Those vibrations travel up through the string into your ears, which your brain interprets as sound.

TORNADO IN A BOTTLE

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 20 MINUTES
OTHER CATEGORIES: ENGINEERING

Can you capture a tornado in a bottle? Grab a few quick supplies and get spinning.

MATERIALS

- Two 2-liter plastic bottles
- Water
- Small plastic beads or small wadded up pieces of paper
- Metal washer
- Duct tape

THE STEPS

1. Fill one bottle about ¾ full of water. Add some beads to the bottle. (This will make the tornado easier to see.)
2. Place a metal washer on the lip of the bottle.
3. Position the empty bottle upside down so its mouth is on top of the washer.
4. Use duct tape to secure the bottles together.
5. Flip the bottles over, so that the e one is on the bottom, and observe what happens.
6. When all the water has drained fro the top bottle into the bottom bott them over again. This time, swirl t bottles in a circular motion and obs what happens.

Observations Which method empties water from the bottle the fastest?

Now Try This! Experiment to discover t quickest way to transfer all the water fr one bottle to another. Shake, squeeze, p or let it sit to find out which method wo the best.

The Hows and Whys When you swirl the bottles, it creates a vortex that makes it easier for air to come in and for water to flow out. Without a vortex the air and water have to take turns flowing through the mouth of the bottle and may even come to pressure equilibrium—where nothing moves

UNLEAKABLE BAGGIE

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 15 MINUTES

If you poke sharp pencils through a baggie full of water, what do you think will happen? Find out by trying it yourself, preferably over the head of an adult! In this fun and easy science experiment, you will learn about polymers and see them in action.

MATERIALS

- Plastic zip-top baggie
- Water
- Several sharpened pencils

THE STEPS

1. Fill up the baggie about ¾ of the way with water. Squeeze out the air and make sure the top is zipped up tight.
2. Hold the baggie in one hand and use your other hand to stab a sharp pencil all the way through the baggie and out the other side.
3. Continue to impale the baggie with as many pencils as you have.

Observations Did any water spill?

Now Try This! What happens if you try this experiment using a plastic grocery bag? How about a water balloon?

The Hows and Whys Plastic storage bags are made of a polymer called low-density polyethylene. When the pencil pierces the plastic, the sharp end of the pencil squeezes through the chains of the polymer without breaking them. These chains are very flexible and actually move over to form a seal around the edge of the pencil so that no water is spilled from the baggie.

UN

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 15

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science experiment, y
polymers and see the

MATERIALS

- Plastic zip-top bagg
- Water
- Several sharpened p

THE STEPS

1. Fill up the baggie
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2. Hold the baggie i
your other hand
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other side.

3. Continue to imp
many pencils as

WIND-POWERED CAR

LEVEL OF DIFFICULTY: EASY
FROM BEGINNING TO END: 45 MINUTES
OTHER CATEGORIES: ENGINEERING, MATH

Can you design and build a sail to attach to a toy car that will make the car move, powered only by the wind? Have a race with a friend to see whose car goes the farthest.

MATERIALS

- Craft supplies, such as paper, craft sticks, index cards, wooden skewers, plastic bags, and string
- Scissors
- Tape
- Toy car
- Fan or blow dryer
- Tape measure

THE STEPS

1. Construct a sail for a toy car using scissors and any craft supplies you have available at home.
2. Attach the sail to the car with tape.
3. Test out the sail by blowing air into it using a fan or a blow dryer. If you don't have access to either of these tools, you can just use your breath to blow into the sail.
4. Set up the wind-powered car directly in front of the source of the wind. Lay the tape measure out on the ground and tape it down so it doesn't get blown away.
5. Turn on the fan or blow dryer and see how far your car travels.

Observations What kinds of sail designs enable the toy car to travel the farthest? How can you modify your design to make it better?

Now Try This! Add a little bit of weight to the toy car by taping coins to it. How does this affect how far it travels?

The Hows and Whys Air is made up of particles, just like a liquid is. The faster the air moves, the faster those particles move. The sail captures the fast-moving air, pushing the car forward.