NATIONAL GEOGRAPHIC

MEGA SCIENCE ADVENT CALENDAR

WARNING:
This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

Experiment Guide

Adult Supervision is Recommended for Experiments Read the instructions and cautions on the containers carefully. Do not ingest any of the chemicals in the kit. 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 of this kit out of reach of young children and pets.

Think Like a Scientist

Are You a Scientist?

If you are the kind of person who likes to know things, then you have the makings of a real scientist, because science is all about knowing stuff about the world around us. In fact, the word *science* comes from the Latin words for "having knowledge."

Pay Attention!

Whenever a chemical reaction occurs, something changes. Observe your experiments carefully to look for all the things that might change:

- Did bubbles form?
- Did the color change?
- Did the solution get hotter or colder?
- Did you smell anything different?
- Did a solution become clearer or cloudier?
- Did solids form from liquids?

Use the Scientific Method

Scientists use a special process called the *scientific method* to figure out how things work. Try this: before conducting an experiment, come up with a question you'd like to answer. Once you have your **question**, **research** your topic, **guess** what will happen, do the **experiment**, **analyze** the results, and **conclude**! (The bold words are essential steps in the scientific method.) The scientific method is the cornerstone of modern science. Without this method, we wouldn't have the scientific knowledge we have today.

STOP **DON'T THROW IT AWAY...**

Be sure save all the materials you receive throughout the calendar for future experiments!

Know Your Tools

A. Paper cup
B. Plastic cup
C. Beaker
D. Test tube
E. Spray bottle
F. Pipette
G. Small scoop (1/16 tsp / 0.3 mL)
H. Dig tool & brush
I. Big scoop (½ tsp / 3 mL)
J. Medium scoop (¼ tsp / 1 mL)

Have an adult carefully cut open bags with powder inside before you begin. When your experiments are complete, roll the bags up and seal them with a rubber band or clip to avoid mess.

DAY 1

Perform these science experiments as a magic trick for friends or parents!

Magic Beaker

FROM THE KIT:
- Red cabbage powder
- Sodium bicarbonate
- Citric acid
- 3 plastic cups
- Small scoop
- Big scoop
- Beaker

WHAT TO GET:
- Warm water

CAUTION: *Adult supervision required for younger children. Red cabbage powder can stain skin and other surfaces.*

WHAT TO DO:

Before you perform the trick

1

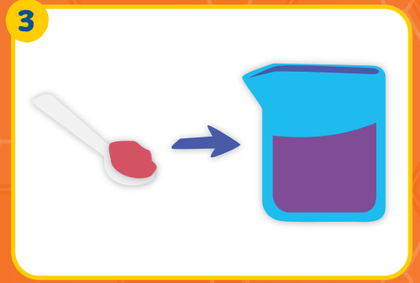
Add 10 mL of warm water and 1 big scoop of citric acid to a plastic cup. Mix until the powder is dissolved. This is your acidic solution and "red" cup.

2

Add 10 mL of warm water and 1 big scoop of sodium bicarbonate to another plastic cup. Mix well until the powder is dissolved. This is your base solution and "blue" cup.

Now amaze your audience!

3



Add 1 small scoop of red cabbage powder to the beaker, then fill with 50 mL of water. Stir the powder until it's completely dissolved. This deep purple liquid is your pH indicator.

4

Put the beaker and plastic cups on a table. Ask your audience, "which two colors make purple?" When they say red and blue, reveal you have a magic beaker that separates colors.

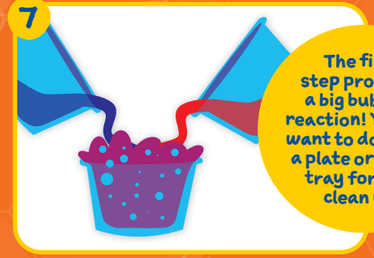
5

Say "red" out loud and pour some indicator into the cup with the citric acid solution. The solution turns red!

6

Say "blue" out loud and pour some indicator into the cup with the sodium bicarbonate solution. The solution turns blue!

7



The final step produces a big bubbling reaction! You may want to do it over a plate or baking tray for easy clean up.

Now, tell the audience you can change the liquid back to purple. Pour the red and blue cups into the empty plastic cup at the same time and . . . *Science Magic!* The liquid changes back to purple with a fizzy reaction!

SERIOUSLY SCIENTIFIC

Do you like the tangy taste of orange juice or lemonade? How about sour gummy worms? That sharp tang comes from an *acid*, and with this experiment you witness the incredible color-changing chemistry of acids and their opposites, *alkalines.*

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. pH stand for "potential hydrogen" and when you take a pH reading you discover how many hydrogen ions are in the sample. The results fall on a scale of 0 to 14, with 0 being the most acidic and 14 being the most alkaline. Completely pure water will register right in the middle at 7 and is considered neutral. Anything below that is acidic and anything above is alkaline.

STOP **DON'T THROW IT AWAY...**
Save all your components for future experiments!

DAY 2
See page 33 to learn about your specimen!

DAY 3

Make a Glowing Test Tube

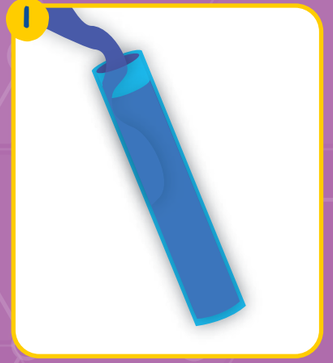
FROM THE KIT:
- Test tube
- Zinc sulfide
- Medium scoop
- Plastic cup

WHAT TO GET:
- Warm water
- Lamp or UV light

SAFETY FIRST! *Make sure to use your safety goggles.*

WHAT TO DO:

1



Fill the test tube with 50 mL of water.

2

Add 1 medium scoop of zinc sulfide to the plastic cup and spread the powder out evenly.

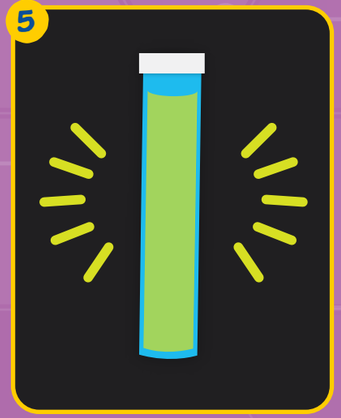
3

Let the powder sit directly under a lamp or UV light for 1–5 minutes. The longer the powder absorbs the light, the longer and brighter it will glow!

4

Add the zinc sulfide to the test tube and stir for 30 seconds.

5



Put the cap on the test tube and look at your test tube in the dark! If the glow-in-the-dark powder settles to the bottom of the test tube, just shake it up!

WHY DID THAT HAPPEN?

In *luminescence*, an energy source kicks an electron out of its normal stable state into a higher-energy excited state; the energized electron gets rid of the extra energy in the form of light so that it can fall back to its normal or *ground* state. In a phenomenon called *phosphorescence* the light energy is stored and continues to be emitted even after the original source of energy is removed.

SERIOUSLY SCIENTIFIC

What is phosphorescence?

Shining a lamp on zinc sulfide provides added energy that excites the chemical's electrons. Because the electrons take a while to relax back to their normal state, the "glow" lasts even after the light is removed. The more energy that's absorbed (that is, the longer you leave the zinc sulfide powder under the light), the longer the glow will last. Once the glow fades, you can "recharge" the solution by putting it back under the light. However, since the water in the test tube will absorb some of the light's energy, it may take a lot longer to get the solution to glow again.

STOP **DON'T THROW IT AWAY...**
Save test tube for future experiments!

DAY 4

Perform these science experiments as a magic trick for friends or parents!

The Beaker Surge

FROM THE KIT:
- Instant snow
- Beaker
- Big scoop
- Plastic cup

WHAT TO GET:
- Water

WHAT TO DO:

1

Fill the beaker with water to just below the rim.

2

Add 2 big scoops of instant snow into the plastic cup.

3

Quickly dump the powder from the plastic cup into the beaker and . . . *Science Magic!* Watch as a snow-like substance begins to form and gradually grow inside the beaker!

WHY DID THAT HAPPEN?

Instant snow (sodium polyacrylate) is super-absorbent material related to table salt. It's made of *polymers*, long chains of molecules, that can absorb up to 800 times their weight in water.

STOP **DON'T THROW IT AWAY...**
Save half your instant snow powder for a future experiment!

Disappearing Water

FROM THE KIT:
- Instant snow
- 3 paper cups
- Plastic cup
- Big scoop

WHAT TO GET:
- Water

DAY 5

WHAT TO DO:

Before you perform the trick

1

Add 1 big scoop of instant snow to one of the paper cups. Remember this cup!

2

Fill the plastic cup with water.

Now amaze your audience!

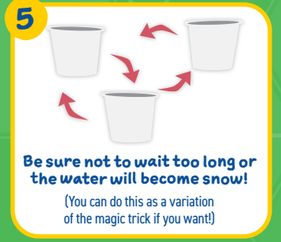
3

Place all the cups on a table. Show your audience the plastic cup of water and say, "it's regular ol' water" and take a sip to prove it. Now ask your audience to remember which paper cup you pour the water into.

4

Pour the water into the cup with the instant snow.

5



Be sure not to wait too long or the water will become snow!
(You can do this as a variation of the magic trick if you want!)

Move the cups around for about 10 seconds, allowing the powder to soak up the water and solidify.

6

Ask your audience which cup has the water in it. Take that cup, turn it upside down and . . . *Science Magic!* Nothing comes out! Now turn over the other cups to show them that there's no water in there either!

DID YOU KNOW?

Sodium polyacrylate is used in things like diapers, surgical sponges, and detergents to absorb water and help keep things clean.

DAY 6
See page 33 to learn about your specimen!

DAY 7
2 experiments

Reveal a Secret Message

FROM THE KIT:
- Citric acid
- 1 piece of pH paper
- Colorless crayon
- Spray bottle
- Medium scoop

WHAT TO GET:
- Warm water

SAFETY FIRST! *Make sure to use your safety goggles.*

WHAT TO DO:

1

Write your name or a secret message on the pH paper with the crayon. ***Tip:*** *It helps to write firmly with the crayon so it will display clearly when revealed.*

2

Pour 1 medium scoop of citric acid into the spray bottle. Fill the bottle about ¾ full of warm water. Replace the cap and shake the bottle until the citric acid is dissolved.

3

Hold the pH paper about 6 inches (15 cm) from the bottle, spray where your message is written, and the pH paper will turn red, revealing your hidden message!

WHY DID THAT HAPPEN?

The pH paper is an *indicator* that visually shows the pH value of a liquid. When a liquid's pH value is acidic, the paper will turn a red color. When a liquid's pH value is alkaline, the paper turns blue!

AMAZING FACTS!

There are many strong acids and bases in nature that serve important functions. For example, some insects and animals will use acids and bases as dangerous poisons.

Hide a Secret Message

FROM THE KIT:
- Sodium bicarbonate
- pH paper with revealed message
- Plastic cup
- Sponge
- Medium scoop

WHAT TO GET:
- Water

SAFETY FIRST! *Make sure to use your safety goggles.*

WHAT TO DO:

1

Use the pH paper with the message you revealed earlier. ***Tip:*** *For best results, let the paper dry thoroughly before hiding your message.*

2

Fill the plastic cup ½ full of water. Add 1 medium scoop of sodium bicarbonate and stir well until the sodium bicarbonate is completely dissolved.

3

Dip the sponge in the solution, then dab it across your message. The pH paper will turn from red back to yellow as you neutralize the acid with the base solution. If you continue to dab the yellow parts of the paper, it will eventually turn blue!

WHY DID THAT HAPPEN?

Acids and bases can be used to neutralize one another. When you made the pH paper red, you used an *acidic* solution and lowered the pH level. But by using a small amount of a *basic* solution (like you did with the sodium bicarbonate) you raised the pH level of the paper back toward neutral. If you add too much base, though, the paper will turn blue!

DAY 8
See page 33 to learn about your specimen!

DAY 9
See page 33 to learn about your specimen!

DAY 10

Dissect a Brain

FROM THE KIT:
- Test tube
- Big scoop
- Agar agar powder
- Red coloring
- Brain mold

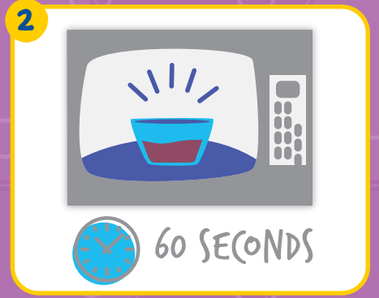
WHAT TO GET:
- Water
- Microwave
- Refrigerator
- Microwavable bowl

CAUTION: *Involves a microwave and hot liquids. Adult supervision required.*

WHAT TO DO:

1

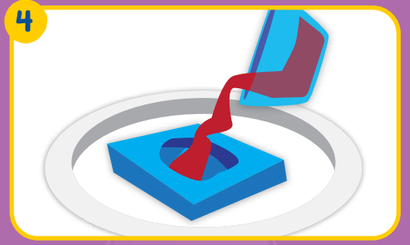
Fill a bowl with 100 mL of water. Add 2 big scoops of agar agar powder and 3 drops of red coloring. Stir well.

2


Have an adult microwave the mixture for 60 seconds. Watch carefully to be sure the mixture does not bubble up and spill out of the bowl.

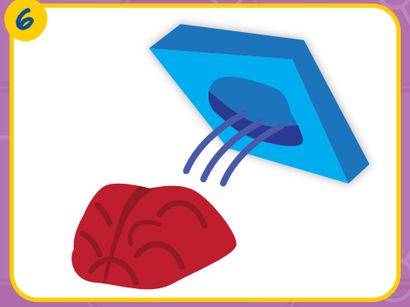
3

Have an adult remove the bowl from the microwave. Let the mixture sit on a heat-proof surface for 5 minutes to settle and cool.

4

Carefully fill the brain mold full with the solution. (You may want to put the mold onto a plate in case some of the solution spills over.)

5


Chill the solution in the refrigerator for 1 hour. The brain is ready when the gel is very firm to the touch.

6

Flip the mold over to remove the brain. You may need to use your fingers to help remove it from the mold.

7

Use your scoop to dissect your brain!

SERIOUSLY SCIENTIFIC

Agar agar is a type of polymer—large molecules made up of repeating units. (Poly is the Greek word for "many" and mer means "unit".) Polymers can be three-dimensional, like a Rubik's Cube; two-dimensional, like a woven placemat; or one-dimensional, like a long string of beads. Depending on the type of molecules and how they are attached, polymers can do amazing things. They can stretch and bend, like polyester, or be stiff and durable, like glass.

GROSS FACTS!

One brain surgeon describes the brain as having the consistency of the soft variety of tofu.

STOP **DON'T THROW IT AWAY...**
Save half of your agar agar powder for a future experiment!

DAY 11

Critter Molding Lab

FROM THE KIT:
- Medium scoop
- Beaker
- Centipede mold
- Agar agar powder
- Orange coloring

WHAT TO GET:
- Microwaveable cup or bowl
- Microwave
- Stirring utensil
- Scissors

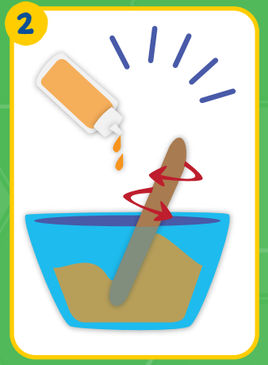
CAUTION: *Involves a microwave and hot liquids. Adult supervision required.*

WHAT TO DO:

1

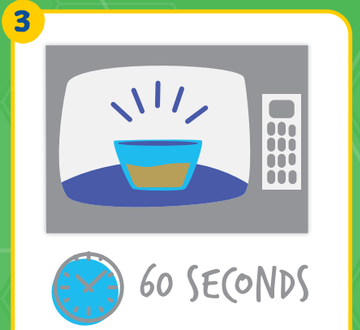
Fill a microwaveable cup or bowl with 60 mL of water. Open your packet of agar agar powder with scissors. Add 1 medium scoop of agar agar powder to the water and stir well. Save the extra agar agar powder to create more bugs later!

2



Add 5 drops of orange coloring to the mixture. Stir well.

3



Have an adult microwave the mixture for 60 seconds. Watch carefully to be sure the mixture does not bubble up and spill out of the bowl.

4

Have an adult remove the bowl from the microwave and set it on a heatproof surface. Let the mixture sit for 5 minutes to settle and cool.

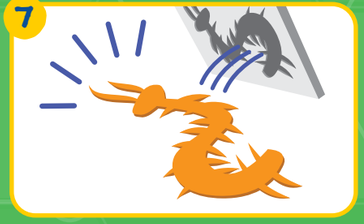
5

Have an adult carefully fill the bug mold with the hot solution. (You might want to put the mold onto a plate in case some of the solution spills over.)

6

Chill the solution in the refrigerator for 1 hour. The bugs are ready when the gel is very firm to the touch.

7



Flip the mold over to remove the centipede. You may need to use your fingers to help remove it from the mold.

DID YOU KNOW?

Agar agar is a gelatinous substance that is derived from the cell walls of red seaweed. According to Japanese legend, agar agar was discovered by an innkeeper who found that some seaweed soup had gelled after being discarded outside on a cold winter's night.

DAY 12

Rainbow in a Test Tube

FROM THE KIT:

- Test tube
- 3 plastic cups
- Beaker
- Medium scoop
- Color tablets (1 red, 1 blue, and 1 yellow)
- Jelly crystals

WHAT TO GET:

- Warm water
- Paper towels

When you are done with the jelly crystals, they can be safely thrown in the trash. Do not put them down the sink.

*This experiment takes longer than the others. **Total time is up to 24 hours.***

WHAT TO DO:

1

Measure 30 mL of water with the beaker and add it to a plastic cup. Repeat with the other two cups until you have three vessels of water.

2

Add one color tablet to each vessel of water and let the color fully dissolve (10 minutes).

3

Add 1 medium scoop of jelly crystals to each water-filled vessel. Allow the crystals to sit until they soak up all the water. This can take up to 24 hours.

4

Scoop out your colored jelly crystals from each cup and put them on a paper towel to absorb any extra liquid. Don't let the three colors of jelly crystals touch yet!

5

Choose your first jelly crystal color and drop some into the test tube until it is ⅓ full.

6

Add the same amount of your second color to the test tube.

7

Add your third color, making sure the crystals slightly overflow the tube.

8

Squish the crystals down with the cap of the test tube and close it tightly.

9

Turn the test tube upside down. The crystals will sink into each other. After a few minutes, you'll notice the colors begin to mix. The primary colors (red, yellow, blue) mix together to form secondary colors (orange, purple, green). If you wait a few days, the colors will fully mix together to form a rainbow!

AMAZING FACTS!

Because super-absorbent polymers can absorb and trap so much water, they are used in diapers, hair gel, surgical sponges, and detergents. Florists and plant nurseries also add them to soil to act as a long-lasting water reservoir. The water is trapped in gel instead of running through the soil, and when the plant's roots need water, they suck it out of the gel. The really cool thing is that the next time the plant is watered, the process starts all over again, since the crystals can be used over and over.

DAY 13
See page 34 to learn about your specimen!

DAY 14
2 experiments

Atomic Fizz

FROM THE KIT:

- Test tube
- Citric acid
- Sodium bicarbonate
- Phenol red
- Pipette
- Big scoop
- 2 plastic cups

WHAT TO GET:

- Water

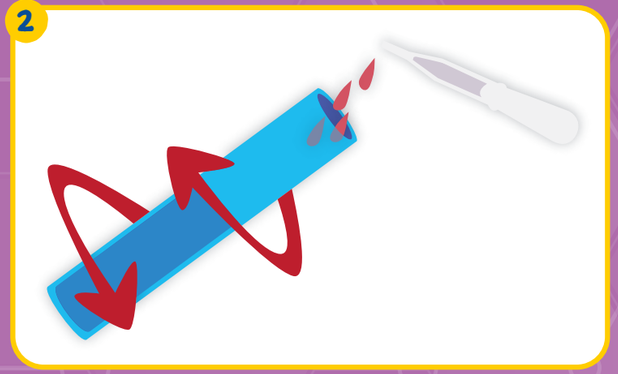
CAUTION: *Phenol red can stain clothing, skin and other surfaces. Please handle with care.*
SAFETY FIRST! *Make sure to use your safety goggles.*

WHAT TO DO:

1

Make a basic solution. Measure 50 mL of water with your test tube and pour it into the first plastic cup. Add 1 big scoop of sodium bicarbonate into the water and stir until the powder is dissolved.

2



Make a pH indicator solution. Measure 20 mL of water in your test tube. Using your pipette, add 5 drops of phenol red into the water and swirl the test tube until the solution is mixed.

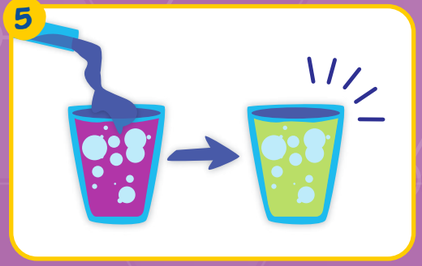
3

Pour both the basic and indicator solutions into the second plastic cup. The solution turns pink, indicating a high pH level.

4

Make an acidic solution. Wash your test tube with water and dry. Add 20 mL of water to the clean test tube. Add 1 big scoop of citric acid to the water and stir until the crystals are dissolved.

5



Now, pour the acidic solution from the test tube into the plastic cup of pink solution. The solution fizzes and changes color from pink to atomic yellow!

WHY DID THAT HAPPEN?

Phenol red is an indicator that turns pink in solutions that are basic (like sodium bicarbonate) and yellow in solutions that are acidic (like citric acid). When sodium bicarbonate and citric acid dissolve in water and meet up, they create a chemical reaction that forms carbon dioxide gas.

SERIOUSLY SCIENTIFIC

What's a Chemical Reaction?

In a chemical reaction, molecules crash into each other with enough energy to break the original bonds between atoms and form new bonds, which creates new molecules. The starting materials (the *reactants*) change into (*yield*) new chemical substances (*products*). In this experiment, the reaction created carbon dioxide gas as a product, which made the solution fizz.

Drop by Drop

FROM THE KIT:

- Test tube
- Citric acid
- Sodium bicarbonate
- Phenol red
- Pipette
- Medium scoop
- Plastic cup

WHAT TO GET:

- Water

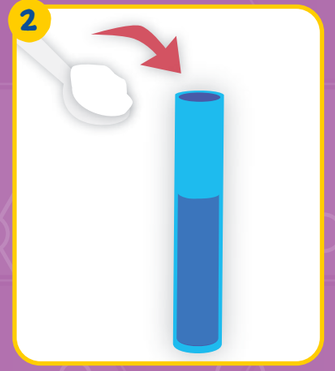
NOTE: *If your water does not turn pink or red when phenol red is added in Step 2, let the cup sit on the kitchen counter for a few hours and the solution will change color.*
CAUTION: *Phenol red can stain clothing, skin and other surfaces. Please handle with care.*

WHAT TO DO:

1

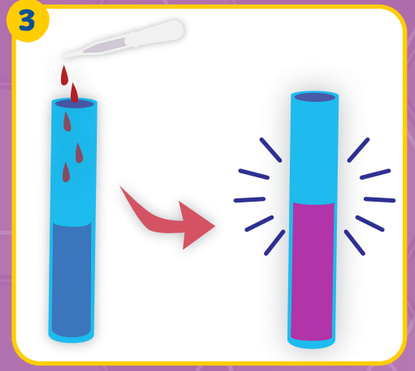
Make an acidic solution. Using the test tube, measure 30 mL of water and pour it into the cup. Add 1 medium scoop of citric acid to the water and stir until the crystals are dissolved.

2



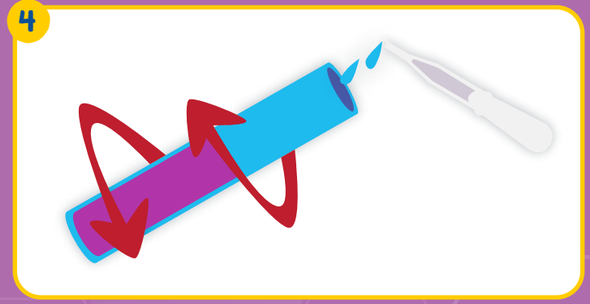
Make an indicator solution. Measure 30 mL of water in the test tube. Add 1 medium scoop of sodium bicarbonate and stir until the powder is dissolved.

3



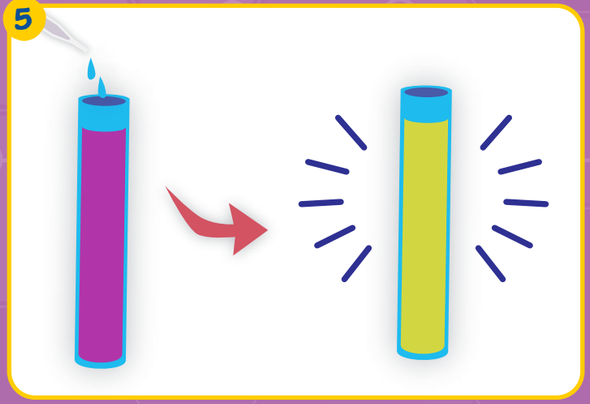
Using your pipette, add 5 drops of phenol red to the test tube. The solution changes to pink, as the phenol red detects a high pH level.

4



Fill your pipette with the acidic solution from the cup then add drops to the test tube—4 or 5 at a time. Keep count of the drops and swirl the test tube to see how the color changes.

5



Keep adding drops and swirling the test tube until the solution changes color. How many drops did it take to turn the solution from basic to acidic?

COUNT THE DROPS!

Color	Number of Drops
PINK (Alkaline)	
ORANGE (Slightly Acidic)	
YELLOW (Acidic)	

DAY 15
3 experiments

Perform these science experiments as a magic trick for friends or parents!

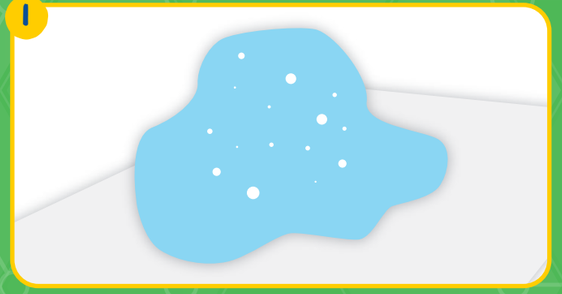
The Incredible Water Ball

FROM THE KIT:
- Hydrophobic sand
- Pipette
- Plastic cup

WHAT TO GET:
- Water
- Plate or paper towel

WHAT TO DO:

1

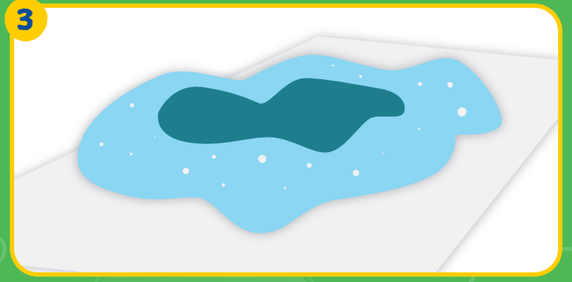


Make a pile of hydrophobic sand. You can make the pile of sand on top of a plate or paper towel for easy clean-up.

2

Add some water to the cup.

3



Create a wide crater in the sand with your fingertip.

4

Use the pipette to slowly drop water into the crater. A water bead will soon form that rolls around the sand but doesn't get absorbed!

5

Slowly add more water droplets into the crater and . . . *Science Magic!* The bead of water will grow and grow into an incredible water ball!

THE SCIENCE BEHIND THE MAGIC

The word hydrophobic is a combination of the Greek words *hydro* (water) and *phobic* (fear). Things that are hydrophobic are "afraid" of water--that is, they are repelled by water. This magical blue sand itself isn't hydrophobic, but it's been coated with a hydrophobic oil that water molecules are unable to bond with. The water-fearing grains of the sand cluster together to keep from getting wet.

The Magic Spoon

FROM THE KIT:
- Hydrophobic sand
- Plastic cup
- Big scoop

WHAT TO GET:
- Water
- Paper towels

CAUTION: *Adult supervision required for younger children. This sand can stain skin and other surfaces.*
CAUTION: *Don't pour hydrophobic sand into a sink as it can clog drains. See the next experiment for clean-up instructions.*

WHAT TO DO:

1

Pour some water into the cup, making sure to leave enough room for the sand.

2

Take a big scoop of hydrophobic sand from the bag.

3

Slowly lower the scoopful of sand into the water, being careful not to spill any. Now lift the scoop out of the water and . . . *Science Magic!* The sand is dry!

TRY THIS! *Pour some hydrophobic sand into a bowl of water and build underwater structures!*

BONUS EXPERIMENT:

Reusable Sand!

(Hydrophobic Sand Clean-Up)

FROM THE KIT:
- Hydrophobic sand left over in a cup of water
- Big scoop

WHAT TO GET:
- Paper towels

WHAT TO DO:

1

To safely get the sand out of the water, first strain the water by holding the big scoop up to the edge of the cup and slowly pouring out the water—making sure to not let any sand get into the sink.

2

Pour the sand from the cup onto a paper towel, which will absorb any leftover water.

3

Pour the sand directly from the paper towel back into the bag it came in. Voilà! You can now experiment with your hydrophobic sand over and over again!

DAY 16

See page 34 to learn about your specimen!

DAY 17

Pop Crystal Fireworks

FROM THE KIT:

- Pop crystals
- Beaker
- Big scoop

WHAT TO GET:

- Water
- Microwave-safe measuring cup

SAFETY FIRST! *Make sure to use your safety goggles.*
CAUTION: *Adult supervision required. This experiment can get messy. We recommend putting newspaper down in your experiment area for easy cleanup.*

WHAT TO DO:

1

Measure out 100 mL of water into a microwave-safe measuring cup.

2

Have an adult microwave the water for 30 seconds and then pour the hot water into your beaker. ***Note:*** *the hotter the water, the better the crystals will pop!*

3

Fill the big scoop with pop crystals and lower it slowly into the hot water. Stand back! These crystals jump when they pop.

TRY THIS!

Pop crystals only pop when the sugar coating dissolves. See what happens when you try to dissolve them in different liquids. Compare how quickly they dissolve in water, vegetable oil, dish soap, pancake syrup—whatever you want! Did they dissolve faster in thicker liquids or in thinner ones? How long did the crystals have to soak before they began to pop?

WHAT'S POPPIN'?

Pop crystals contain pressurized carbon dioxide, held inside a hard sugar coating. The hot water dissolves the sugar very quickly, releasing the carbon dioxide almost instantly. The quick release causes the crystal pieces to jump as they pop.

SERIOUSLY SCIENTIFIC

How do fireworks get their colors?

Fireworks are just great big chemical reactions. The color of the sparks depends on the chemicals involved. Reds come from lithium salts, oranges from calcium salts, and yellows from sodium compounds. Some colors come from burning metals, like magnesium or aluminum (bright white sparks), iron (gold sparks), or copper (blues and greens).

DAY 18
See page 34 to learn about your specimen!

DAY 19
See page 34 to learn about your specimen!

DAY 20
See page 35 to learn about your specimen!

DAY 21
See page 35 to learn about your specimen!

DAY 22

Perform this science experiment as a magic trick for friends or parents!

Make Coins Float on Water

Then Make Them Sink!

FROM THE KIT:
- Copper coins
- Plastic cup

WHAT TO GET:
- Water
- Dish soap
- Paperclip

WHAT TO DO:

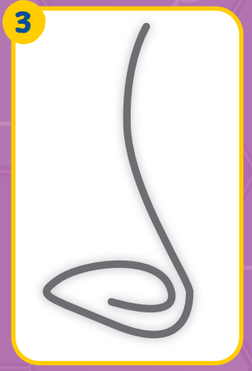
1

Fill the plastic cup ¾ full of water.

2

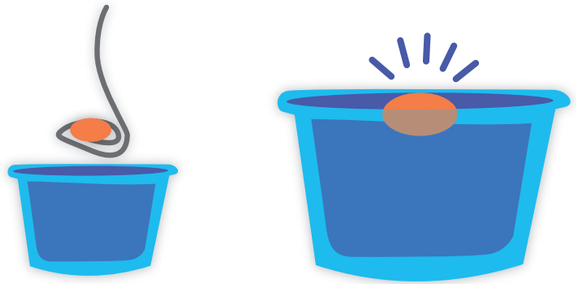
Drop one of your copper coins into the water to show your audience it is made of real metal and will sink to the bottom of the cup.

3



Now, unfold your paperclip to create a cradle for the coin like you see in the image here.

4



Place a coin on the paperclip and slowly lower it on to the surface of the water. Make sure the coin is level with the water. If you've been careful, as you drop the paperclip below the surface of the water, you'll see . . . *Science Magic!* The coin floats!

5

Once you get the coins to float on the water, you can make them instantly sink by breaking the surface tension! Do this by putting some dish soap on your fingertip and touching the water.

THE SCIENCE BEHIND THE MAGIC

Water molecules want to stick together and are pulled in equal directions by all the water molecules surrounding them. But the molecules on the surface are only pulled down and to the side since there's nothing but air above. Just like a tug-of-war when one side is stronger than the other, the effect is to pull those surface molecules inward and move them closer together, forming a tight surface. If the connections between molecules at the surface aren't broken, water can support objects that would otherwise sink!

INCREDIBLE INSECTS!

The surface tension of water makes it possible for insects to walk on water. Water striders have a hydrophobic quality, with legs that are coated in a layer of waxy hairs, making them water repellent.

DAY 23

Make a Colorful Crystal Tree

FROM THE KIT:
- Washable markers
- Tree base
- Crystal growing liquid
- Paper tree

WHAT TO GET:
- Scissors

This experiment takes longer than the others. Total time is up to 8 hours.

SAFETY FIRST! *Make sure to use your safety goggles and experiment tray.*

WHAT TO DO:

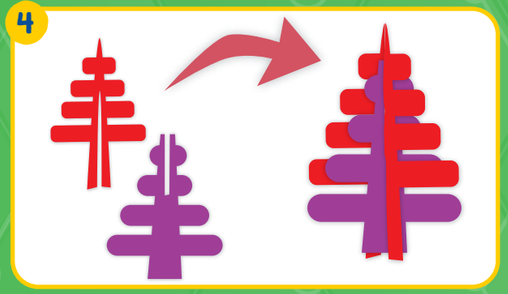
1. Pick a safe location for your tree to grow, where it won't be touched or disturbed. The crystals on your tree will be fragile and may fall if moved.

2. 

Using the markers included in the kit, color your tree any way you want.

3. 

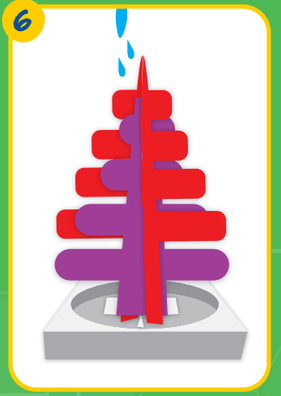
Separate the tips to spread out the branches as desired.

4. 

Assemble your tree by sliding the part with the slot on the bottom over the part with the slot on the top.

5. 

Place the assembled tree into the center of the base. Place your tree in the safe location.

6. 

Open the bottle of crystal growing liquid and pour a small amount over the very top of the tree. This will ensure the top of the tree grows crystals.

7. 

Pour the remaining liquid into the base.

8. In just 30 minutes, crystals will begin to form on your tree. In 6–8 hours, your crystal tree will have fully bloomed!

TRY THIS! *When the crystals fall off the tree, put them back in the base and add a little bit of water to regrow the tree!*

WHY DID THAT HAPPEN?

The growing solution for your crystal garden contains "bluing," which is a suspension of microscopic particles of a blue powder that give the *unit cells*, the smallest building blocks of a crystal, something to attach to, allowing the crystals to grow.

SERIOUSLY SCIENTIFIC

Crystals and evaporation

In nature, crystals often grow when water evaporates from a solution, leaving the minerals behind. That's the principle at work in this experiment. The crystal growing solution contains ammonia, which speeds up the evaporation process, letting your crystals grow in a matter of hours.

DAY 24

Shiver Me Timbers!

Is That Gold?

FROM THE KIT:
- Gold dig brick
- Dig tool & brush

WHAT TO GET:
- Water
- Paper plate or newspaper

WHAT TO DO:

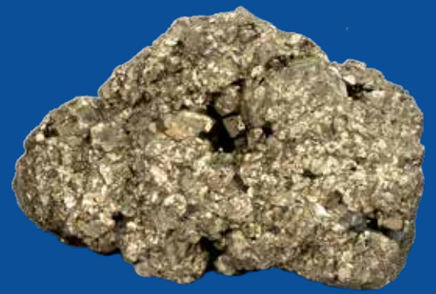
1. Prepare your work station. This science dig can get messy, so place your dig brick on a sturdy paper plate or a newspaper. If the weather is nice, do your excavation outside.
2. The specimen is buried INSIDE your digging brick. Dig into the brick with the tools provided. If the digging brick is too hard, soften it by adding some water. Just pour a little onto the brick and let it soak in.
3. When you find the specimen, make sure to excavate all the way around it. Patience is key, so as not to damage the fragile specimen. ***Note:*** *Do not try to pry out a specimen that is only partially excavated or it may break.*
4. Rinse your specimen in water to remove any remaining dirt.

SERIOUSLY SCIENTIFIC

Fool's Gold (aka Pyrite)

The shiny yellow/gold color of pyrite crystals often led people to believe they had found gold, and so it was nicknamed "fool's gold." In fact, most pyrite deposits do contain some gold, so those fools may have been on the right track.

Pyrite gets its name from the Greek word for "fire," because it could create sparks when struck against steel. It is found worldwide in many different kinds of rock. Pyrite forms glistening crystals in a variety of shapes, including perfect cubes.



DAY 2

Rose Quartz

Unlike most varieties of quartz, the unusual pink stone only rarely displays well-formed crystals. Mineralogists do not completely understand the source of rose quartz's highly prized pink color, but many believe it comes from iron, titanium, and manganese impurities within the stone.

DAY 8

Carnelian

Carnelian is a kind of chalcedony, a type of quartz made up of microcrystals, and is considered a semi-precious stone. The concentration of iron oxide in a carnelian specimen gives the stone its hue, and the colors of carnelian can range from pinkish-orange to a dark, brick red. Carnelian was used frequently in Roman times in signet rings used to seal important documents with wax.

DAY 6

Tiger's Eye

Tiger's eye is a lustrous gemstone that occurs mainly in South Africa and East Asia. When polished, tiger's eye displays distinctive bands of color that give the effect of waves of brown, yellow, and gold as the light catches different parts of the stone. It is a member of the quartz family and has a hardness of 7.0 on the Mohs scale, about the same as hardened steel.

DAY 9

Clam

Clam fossils are easily recognized because they look almost exactly like present-day clams. They are bivalves—meaning they have an upper and lower shell—and the two shells are hinged together so the animal can open them to feed and close them for protection. In clams, the two shells are symmetrical (they mirror one another), while in brachiopods, the upper and lower shells are different.

DAY 13

Chevron Amethyst

This stone gets it gets its name from the Greek word *amethustos*, which means "not drunken." Many people believe that wearing amethysts offers protection from intoxication, and drinking vessels were often carved from amethyst. The ancient Egyptians saw amethyst as a stone of the intellect and wisdom.

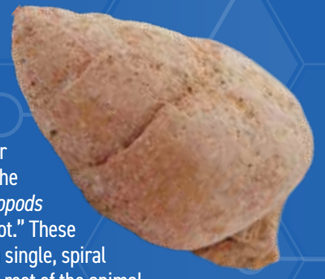
DAY 16

Snowflake Obsidian

The regular type of obsidian is a volcanic glass formed when certain types of lava cool so rapidly that crystals cannot form. When the lava cools more slowly, crystals can form and give the rock a textured appearance. The crystals that speckle the surface of snowflake obsidian are called *spherulites* and they are formed from the mineral cristobalite, a type of quartz.

DAY 18

Pink Gastropod



Because these relatives of the modern snail crawl around on their bellies using their muscular foot, the ancient Greeks named them *gastropods* which literally means "stomach foot." These mollusks are usually enclosed in a single, spiral shell that protects the foot and the rest of the animal. There are over 35,000 living species of gastropods and 15,000 species found in the fossil record.

DAY 19

Dalmatian Jasper

Jasper is a hard, opaque gemstone with very special characteristics. A variety of calcedony—a type of quartz made up of microcrystals—jasper is very smooth and does not flake when cut, and it can be polished to a high luster. What makes jasper even more appealing is the fact that other minerals and even organic material can make up as much as 20% of a piece of jasper.

DAY 20

Hematite

Hematite is a form of iron oxide that is typically steel gray in appearance. Before it is polished it will often create a rust-red streak when rubbed on another surface. Its name comes from the Greek word for "blood" for its blood-red colored streak. Using an infrared spectrometer, NASA's Mars Global Surveyor located two deposits of hematite on the red planet.

DAY 21

Geode

Perhaps the most fascinating of all rock formations, geodes are hollow rocks in which beautiful crystals have formed. These round rocks get their name from the Greek word for "shape of the earth." They may look plain on the outside, but you can never know what glorious beauty waits within a geode until you crack it open.

Keep all your specimens together in the storage pouch!

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