



NATIONAL
GEOGRAPHIC

AMAZING SCIENCE

ADVENT CALENDAR

INSTRUCTIONS



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.

GET TO KNOW YOUR SCOOPS!



**MEDIUM
SCOOP**
 $\frac{1}{6}$ tsp • 0.6 mL



DON'T THROW IT AWAY...

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



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 scientific method is the cornerstone of modern science. Without this method, we wouldn’t have the scientific knowledge we have today.

DAY 1

FROM THE KIT:

- Red cabbage powder
- Sodium bicarbonate
- 3 plastic cups
- Small scoop
- Big scoop
- Beaker

WHAT TO GET:

- Warm water
- Distilled white vinegar

SAFETY FIRST! Make sure to use your safety goggles.

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

Magic Beaker

WHAT TO DO: Before you perform the trick

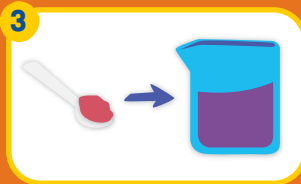


Add 10 mL of vinegar to a plastic cup. This is your acidic solution and "red" cup.



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!



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.



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.



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

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



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



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!



DON'T THROW IT AWAY...

Save all your components for future experiments!

DAY 2

FROM THE KIT:

- Bag of orange polymer powder
- Bouncy ball mold
- Plastic cup

WHAT TO GET:

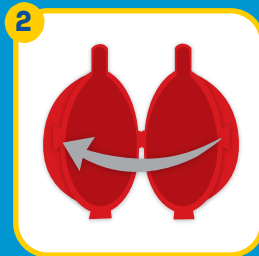
- Cold water
- Paper towel

Make Your Own Bouncy Ball

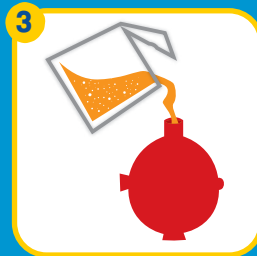
WHAT TO DO:



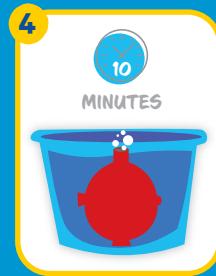
1 Fill the cup $\frac{2}{3}$ full of water.



2 Assemble the ball mold by snapping it together.



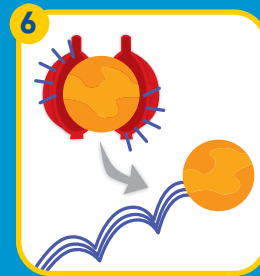
3 Fill the mold with the orange powder.



4 Submerge the powder-filled mold in the water and hold it underwater to allow air to escape. Once the bubbles stop, let go of the mold and fill the cup with water to the brim. Let the mold sit for 10 minutes.



5 Take the mold out of the water and let it sit on a paper towel for 30 minutes to allow the polymers to harden.



6 Carefully open the mold and remove your ball. Make sure the ball is not sticky before bouncing it. **Note:** If your ball sticks to the mold when opening, let the mold sit for a few more minutes and try again.



SERIOUSLY SCIENTIFIC

Polymers are large molecules made up of repeating units. Depending on the type of molecules and how they are attracted, polymers can do amazing things. They can stretch and bend, like polyester, or be stiff and durable like glass.

The polymers in your ball, for instance, relax their bonds when they hit a hard surface. Those bonds quickly snap back into their original shape, sending your ball back into the air.



Make Instant Snow

FROM THE KIT:

- Bag of instant snow powder (*sodium polyacrylate*)
- Beaker
- Big scoop
- Plastic cup

WHAT TO GET:

- Water

SAFETY FIRST! Make sure to use your safety goggles.

CAUTION: The substance may be slippery on certain surfaces; avoid stepping on the snow.

WHAT TO DO:

1



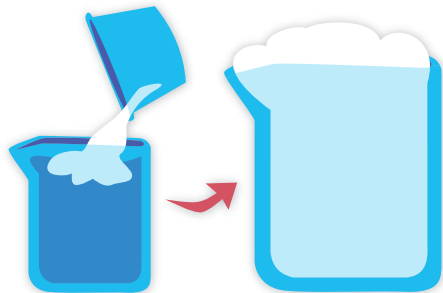
Fill the beaker with water to just below the rim.

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 is made of sodium polyacrylate, a 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.



DID YOU KNOW?

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

STOP

DON'T THROW IT AWAY...

Save all your components for future experiments!

DAY 4

FROM THE KIT:

- 3 paper cups
- Bag of instant snow powder (*sodium polyacrylate*)
- Beaker
- Big scoop
- Plastic cup

WHAT TO GET:

- Water

SAFETY FIRST! Make sure to use your safety goggles.

The Disappearing Water Trick

WHAT TO DO: Before you perform the trick



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



Fill the plastic cup with water.

Now amaze your audience!



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.



Pour the water into the cup with the instant snow.



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.



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!

DAY 5

T. rex

The name *Tyrannosaurus rex* translates to “tyrant lizard king,” which is fitting because it was one of the most formidable predators during the Late Cretaceous Period.



DAY 6

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.”



DAY 7

FROM THE KIT:

- 1 piece of pH paper
- Colorless crayon
- Spray bottle
- Medium scoop

WHAT TO GET:

- Distilled white vinegar



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!

Reveal a Secret Message

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



Remove the cap from the spray bottle. Slowly pour distilled white vinegar into the bottle, filling it 3/4 full. Screw the cap back on the bottle.

3



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

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 9

FROM THE KIT:

- Hydrophobic sand
- Plastic cup
- Big scoop

WHAT TO GET:

- Water
- Paper towels

The Magic Spoon

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 jar.

3



Slowly lower the spoonful of sand into the water, being careful not to spill any. Now lift the spoon 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!

DAY 10

Jade



Jade has been used by different cultures around the world, for thousands of years, to make beautiful sculptures, jewelry, tools, and weapons.

DAY 11

Stegosaurus

Stegosaurus is one of the most recognizable of all dinosaurs because of the row of large, bony plates running down its back. Because these plates were hollow and filled with blood vessels, scientists believe that they helped the animal regulate its body temperature.



DAY 12

Unakite

A form of granite, unakite gets its unique coloring from bits of other minerals like clear quartz, pink feldspar, and green epidote. Its name comes from the place where it was discovered: the Unakas Mountains, part of the Appalachian range in the southern United States. Because of its interesting blend of colors, it's often used as a decorative stone on buildings. In fact, slabs of unakite trim the front steps of the Smithsonian National Museum of Natural History in Washington, D.C.



Critter Molding Lab

FROM THE KIT:

- Medium scoop
- Beaker
- Centipede mold
- Agar agar powder
- Yellow 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:

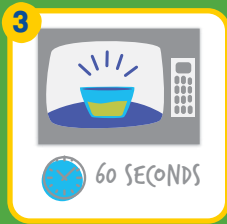


1 Add 1 medium scoop of agar agar powder to the water and stir well. Save the extra agar agar powder to create more centipedes later!

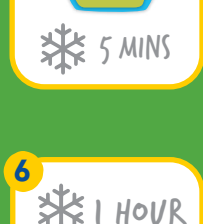
Fill a microwaveable cup or bowl with 60 mL of water. Open your packet of agar agar powder with scissors.



2 Add 5 drops of yellow 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.



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



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.)



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



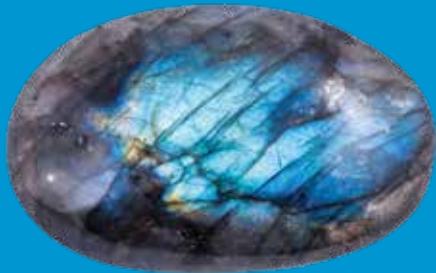
DID YOU KNOW?

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 14

Labradorite



Labradorite often sparkles with iridescent colors—a phenomenon known as *labradorescence*. The colors arise when light reflects off of facets within the stone, not just on the surface.

DAY 15

Shark

Great white sharks are apex predators, living all over the world in cooler ocean waters, often near coastlines. They can have up to 300 extremely sharp teeth arranged in several rows and can locate prey up to two miles away based on scent alone.



DAY 16

Rose Quartz

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



DAY 17

Glow-in-the-dark Super Bouncy Ball



DID YOU KNOW?

Some marine organisms can glow in the dark through a process called *bioluminescence*. The bioluminescent glow produced by these organisms occurs when a special molecule called luciferin reacts with oxygen.

TO MAKE YOUR BALL GLOW

Set it under a lamp or in sunlight for 1-5 minutes. Then, take your ball into a dark room and enjoy! If the glow dies down, just hold it under a lamp again to recharge!



DAY 18

Gray Agate

Like jasper, agate is a variety of *chalcedony*, a type of quartz made up of microcrystals. However, while jasper is *opaque* (no light passes through), agates are *translucent* (light passes through them). When sliced and polished, agates reveal beautiful bands of various colors, created as layers of minerals were deposited over time into cavities within other rock formations.



DAY 19

Aventurine

Aventurine, one of the many varieties of quartz, usually occurs as a green stone, though some blue, gray, orange, or brown specimens can be found. Small flakes of mica or hematite can make aventurine sparkle and glisten—an effect called *aventurescence*. Aventurine has often been considered a good luck stone.



FROM THE KIT:

- Copper coins
- Plastic cup

WHAT TO GET:

- Water
- Dish soap
- Paperclip

Make Coins Float On Water

WHAT TO DO:



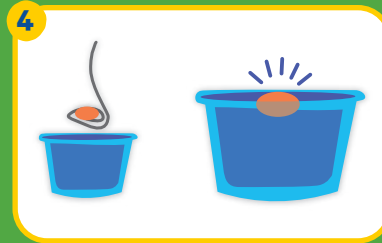
1 Fill the plastic cup 3/4 full of water.



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 above.



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.



WHY DID THAT HAPPEN?

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 21

Jasper

Jasper is a hard, opaque gemstone with very special characteristics. It is very smooth and does not flake when cut, and it can be polished to a high luster.

In addition to its other beautiful properties, jasper can also contain flecks of other minerals (and even organic material), sometimes as much as 20%. These impurities produce stones in a rainbow of colors, often with rings, bands, or even spots that make each piece unique. In fact, the name jasper comes from a Greek word meaning "spotted stone."

Some ancient civilizations believed that jasper could drive away evil spirits and protect against snake and spider bites. Several Native American tribes thought that it could bring rain. Today, many people wear or carry jasper to bring about tranquility, alleviate stress, and reduce negative energy.



DAY 22

Pterosaur

Pterosaur is technically a reptile and a cousin to dinosaurs. It is believed to be the first animal to evolve the ability to fly, after insects.



DAY 23

Chevron Amethyst

This stone gets its name from the Greek word *amethystos*, 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.



FROM THE KIT:

- Gold dig brick
- Dig tool & brush

WHAT TO GET:

- Water
- Paper plate or newspaper

Is That Gold?

WHAT TO DO:



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.



The specimens are 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.



When you find a specimen, make sure to excavate all the way around it. Patience is key, so as not to damage the fragile specimens. **Note:** Do not try to pry out a specimen that is only partially excavated or it may break.



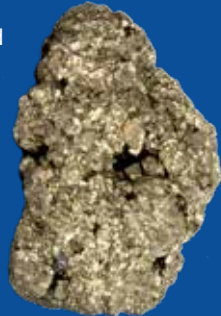
Rinse your specimens in water to remove any remaining dirt.



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.





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