Fasten your seat belts! Hold on to your hats! Get ready for a wild romp through the mysteries and wonders of SCIENCE! That's right—SCIENCE! That boring stuff you learn in school. But this is science that is messy, hands-on, fun and really INTERESTING.

In this kit you will learn about the three different types of science (Life Science, Physical Science and Earth Science), you will experiment with activities in various areas of science (Chemistry, Physics, Geology, Magnets, Biology, etc.) and you will learn to use various scientific tools such as Test Tubes, Pipettes, a Magnifying Glass and Petri Dishes. Finally, you will learn basic science skills such as Measuring, Observing, Classifying and others.

Each of the more than 70 activities will be marked by its Type of Science, Area of Science and Science Skill. This kit is great for Science Fair Projects, Science Birthday Parties, School Classes, Science Camps and Rainy Day Activities. Guaranteed hours of fun. Let's get started!

From The Kit:
- Instruction Book
- Large Plastic Storage Bag
- Two Giant Test Tubes with Lids and Holder
- Three Large Test Tubes with Lids and Holder
- White Compartment Mixing Tray
- Color Wheel
- Shaker Cup with Lid
- Blue Measuring Scoop
- Pipette
- Magnifying Glass
- Petri Dish
- Yellow Plastic Loop
- Hex Nut
- Coated Wire
- Iron Filings
- Balloon
- PTC strips
- Straw Glider Template
- Bar Magnet
- Insta-Snow® Powder
- Water Gel™
- Gravity Goo™ Powder
- Garbled Marbles
- Superabsorbent Cubes (Jiggly Jewels)
- True Colors™ Tablets
- pH Indicator (small yellow strips)
- 2 oz Plastic Cups
- Color Changing Paper (1/2 sheet goldenrod paper)
- Non-Newtonian Powder / Quicksand Powder (Corn Starch)
- Superabsorbent Crystals
- Worm Goo
- Worm Activator (Calcium Chloride)
- Energy Beads and Yarn
- Geyser Tube™
- Twister Tube
- Vinegar
- Rubber Band
- Spoon
- Ruler
- Sunscreen
- Sun Glasses
- Egg, one raw and one hard-boiled
- Soda Pop—any kind
- Macaroni or Raisins
- Mentos® Candy roll
- 2 liter bottle of DIET soda
- Straw
- Can of soda, any kind
- Seeds of grass, beans, radishes or any fast growing plant
- Potting Soil (1/2 C)
- Timer
- D Battery
- 1 cup Total Cereal (or any kind claiming to have 80% of minimum daily iron requirement)
- Heavy duty zip lock bag, small size
- Salt & Rock Salt (or Kosher salt, Sea Salt)
- Mixing Tray
- Notebook for writing down observations
- Water
- Paper Towels
- Various Plastic Cups
- 2 one liter plastic bottles, empty
- String
- Opaque Cup
- Small object to bury in quicksand (plastic animal, round ball, etc.)
- Large Bowl
- Glass Cleaner, any brand
- Red Cabbage
- Nail

You Get It:
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⚠️ WARNING:
CHOKING HAZARD-Children under eight yrs. can choke or suffocate on uninflated or broken balloons. Adult supervision required. Keep uninflated balloons from children. Discard broken balloons at once.

⚠️ 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.

⚠️ WARNING:
This product contains small magnets. Swallowed magnets can stick together across intestines causing serious infections and death. Seek immediate medical attention if magnet(s) are swallowed or inhaled.
Activity #1 Fizzing Colors

It seems like magic, but it’s better than that — it’s SCIENCE!

Use chemistry to make water bubble, fizz, and change color, and make a tablet disappear.

Before you begin: True Colors are tub-safe, skin-safe color tablets. However, with high concentrations, they can stain skin and fabric. Since this experiment involves water as well as color, it is important to find a place to do the experiment where it is OK to make a mess, because, hey - messes are fun!

From the kit:
3 test tubes with lids • Test tube rack • True Color coloring tablets

You Get It:
Water • Notebook and pencils so you can draw or write about your discoveries!

Try It!

1. Work with your adult lab assistant to find a safe place to set up your color laboratory. You’ll want to find a place where it’s OK to spill a little.
2. Fill some cups with water and set them aside for a moment.
3. Open the package of True Colors coloring tablets. There are three colors: blue, yellow, and red.
4. Fill each test tube about ¾ full with water, and set them in your test tube rack.
5. Put a blue tablet in one test tube, a red tablet in the second test tube, and a yellow tablet in the third. Screw the lids on tightly so the water doesn’t leak out. What happens? The tablets fizz, bubble, move around, and change the color of the water as they disappear! Leave the colored water in the test tubes for your next experiment.

How does it work?
Your color tablets dissolved. That means that the water pulled them into tiny, tiny pieces and surrounded each little piece so that you can’t see them. Even though you can’t see them any more, you know the pieces of the tablet are still there. How do you know that? Because the water changed color! Scientists would say that you “dissolved the tablet” or “made a color solution.” You have probably made solutions before. Have you every stirred lemonade powder into water? You made a “solution of lemonade!” Wow! You are amazing! Don’t let your adult assistant drink your solutions, though. Remind them that good scientists like you NEVER eat their experiments.

But why does it fizz?
When you put the tablets in water, you created a “chemical reaction.” That means that you made two things turn into two different things. Although it sounds like you did magic, you actually did something cooler than that—you did chemistry! In this case, you used water to change sodium bicarbonate (baking soda) and citric acid (found in citrus fruits and used in cooking) into salts and carbon dioxide. Carbon dioxide is in the air all around you. In fact, it is what you exhale when you breathe. That’s right—you make a chemical reaction with every breath—you are amazing! Since you are making “air” (scientists would say you were making a “gas”) under water, it makes bubbles, which wiggle to the top of the water and escape into the air.

Activity #2 Cross-eyed Colors

Mix the colored solutions that you made in the last experiment without opening the lids. How? Get ready for something really cool!

From The Kit:
The three test tubes with the colored water you made in the last experiment.

You Get it:
Rubber band

Try It!

1. Make sure that the lids are screwed on tightly so that the colored water does not accidentally leak.
2. Hold the blue water test tube up to your eyes and look at the light (or look out of a window if the sun is shining). What do you see?
3. Now hold the yellow water test tube up to your eyes and look at the light.
4. Now for a little color mixing! Put the yellow and blue test tubes together in the shape of an “X” and hold them up to your eyes.

Look at the light. What color do you see? Wow! Write down your discovery in your notebook. If you need help, have your adult assistant write down the name of your color (or draw it with colored pencils or crayons) that you see when you mix yellow and blue.
Activity #3 Color Chemistry 101

Use the three color solutions that you made in your last experiment to make a rainbow of different colors.

From The Kit:
The red, yellow, and blue color solutions in test tubes that you made in previous experiments—or make more!
White plastic mixing tray • Pipette • Color wheel • Test tube rack

You Get It:
• Safe place to experiment • Notebook for recording your discoveries • Cup of water

Before you start: Once again, since this experiment involves water as well as color, it is important to find a place to do the experiment where it is OK to make a mess. You may want to wear a lab coat or apron, just like a real scientist does.

Try It!
1. Set up your color laboratory:
   a. Set your test tube rack on a stable, safe surface.
   b. Carefully unscrew the lids from the test tubes containing your color solutions, and place the test tubes in the rack.
   c. Put the color mixing tray on a table. The color mixing tray is made of plastic and has nine little indentations called “wells” for you to experiment with while mixing colored liquids.
   d. Fill a cup with water and set it on the lab bench.
   e. Set a pipette next to the cup of water. Now you are ready to begin!

2. It is time to practice using the pipette! Scientists use pipettes all of the time to carefully measure different liquids during their experiments. Your adult assistant can help you if you have trouble. Pipettes are very useful, but sometimes it takes a little practice to figure out how to use them. You will first learn how to use it with the cup of water. Here is how:
   a. Pinch the bulb of the pipette with your thumb and fingers, and keep squeezing. This pushes the air out.
   b. While you are pinching the bulb, carefully lower the tip of the pipette into the water.
   c. With the tip of the pipette under water, slowly release your squeeze. What happens? The water is sucked up into the pipette!
   d. Slowly pull the pipette out of the water. What happens? The liquid stays inside!
   e. To remove the liquid from the pipette, squeeze the bulb once more, and the water will squirt out.
   f. Practice using the pipette until you feel comfortable using it. Now you are ready to start your color chemistry experiments!

3. Carefully use your pipette to draw up some liquid from the test tube with the blue-colored water. Squirit it into one of the wells in your color mixing tray. Rinse your pipette in the cup of water. Now use your pipette to draw up some liquid from the test tube containing yellow-colored water. Squirit it into the same well. What happens? You made green!

4. Add a few more drops of blue or yellow liquid into the well. What happens?

5. See how many different colors you can make by combining different amounts of red, yellow, and blue. Wow! You must be a Color Mixologist! Be sure to record your discoveries and observations in your notebook!

When you are finished, don’t dump the colors down the drain. Be sure to read the next experiment to learn how to turn your colored water into solid jelly crystals!

How does it work?
Red, yellow, and blue are called the primary colors. By mixing them, you can make all kinds of different colors. Did you discover which two colors combine to make purple? Look at your color wheel that is included in your kit. Here is a hint: which two colors does purple lie between? Use your color wheel to set up other experiments, or to explain color chemistry to your adult assistant. For example, you could point to orange and explain that orange can be made by mixing the two colors that it lies between: yellow and red. If they don’t believe you, use your pipette and your red and yellow color solutions to show them!
Activity #4 Growing Clear Crystals

From The Kit:
Bag of Superabsorbent crystals • (3) 2 oz cups • Blue scoop

You Get It:
Water

1. Open the bag of superabsorbent crystals and fill one blue scoop with crystals. Pour into one 2oz. cup and fill the cup with water.

2. As they begin to soak up all the water, you’ll notice that the crystals get bigger and bigger, and begin to change from white to a brilliant color. It takes the crystals at least several hours to reach their maximum size, so be patient. In fact, it’s better if you “grow” them overnight.

3. Superabsorbent Crystals are safe to touch and squeeze through your fingers. Since they absorb water, however, they may cause your plumbing system to have nightmares. When you’re finished, throw the crystals (dry or wet) in a trash can and not down the drain!

4. The scientific name for Superabsorbent Crystals is cross-linked polyacrylamide copolymer gel, or a superabsorbent polymer, for short. The crystals were originally developed to help farmers retain water in the soil between waterings. If you look at the polymer with a microscope, you’ll discover that it’s simply a long chain of molecules that absorb water... lots of water! In fact, these tiny crystals soak up to 150 - 300 times their weight in water!

Activity #5 Jelly Crystals

Turn your color solutions into gobs of colorful gooey crystals!

From The Kit:
The color solutions you made in Activity #3 in the mixing tray wells • Bag of Superabsorbent crystals

You Get It:
A notebook and pencil to record your observations

Try It!
1. Once you've filled your mixing tray wells with colors that you love, add a pinch of superabsorbent crystals (5-8 crystals) to each well.

2. Set the mixing tray aside for about an hour or overnight.

3. While you let the crystals soak, look at a couple of crystals that are left over. What do they look like? How do they feel? What color are they? Write about or draw a picture of your observations in your notebook.

4. After at least an hour, check out your crystals. What do you see? How have the crystals changed? Go ahead and touch them. How do they feel?

Wow! The crystals soaked up all of the colored water, and turned into big, squishy jelly blobs that are the same colors as the solutions you made! Write about or draw a picture of your experiment in your notebook!

How does it work?
The Scientific name for your jelly crystals is cross-linked polyacrylamide polymer gel. It’s a big name for a little crystal, isn’t it? Jelly crystals are made of lots of little molecules hooked together to make little nets. Because they are like nets, water can sneak inside through the holes. That is, the crystals “drink” (soak up) water and hold it inside. The polymers that make up jelly crystals belong to a class of molecules called the “superabsorbents.” That means that jelly crystals are thirsty—VERY thirsty! Each jelly crystal can hold up to 300 times its weight in water. If you were a jelly crystal you would be able to drink almost 2000 gallons of water! When the jelly crystals meet water, they start drinking. When they soak up the water, they expand (get larger) and soften. When the water sneaks inside, it takes the dye molecules with it, so the crystals turn the same colors as your amazing solutions! In other words, you added water to make huge, colorful crystals made of goo!

Activity #6 Wait Awhile

Put a few of your newly grown crystals on a paper plate and let them sit there for a few days. What happens? The crystals shrink back to their original size! That’s right! You can use them again and again! Just add water to make them grow again. Did the color stay inside? Be sure to record your observations in your notebook!
Some scientists have found that people who find PTC super bitter also find the taste of cigarettes bitter, meaning strong tasters could be less likely to taste it. You are much more likely to find PTC bitter if other members of your family also find it bitter. In fact, the genetic correlation in the explain to them that worldwide, the ability to taste PTC is present in about 70% of humans—though nearly 100% of Native Americans are able can watch which ones sense the icky bitter taste, while others wonder what all the fuss is about. Actually, some will find PTC intensely bitter, you can choose to test one person at a time, but you'll have the most fun by gathering several family members (or friends) together so everybody in half and put it on the top of your tongue, again wet with saliva. If you have the PTC gene, you will know it right away! If not, you'll soon want this lets you learn what paper alone tastes like.

This is a totally cool activity, because it relates to what we inherit in our genes. It turns out that some people can instantly taste the bitterness this lets you learn what paper alone tastes like.

Activity #7 Make A Rainbow Tube

From The Kit:
1 Test tube • Superabsorbent Crystals, from Activity 5 (soaked and colored)

You Get It:
Paper towels • Wax paper

1. Pour the red, blue, and yellow crystals onto separate paper towels. Dry the crystals off as much as possible. Find your empty test tube and cap.
2. Scoop red crystals into the Test tube until it's less than one-third full. Add a middle layer of blue crystals and top the tube off with yellow. Push the crystals together as tightly as you can with your finger.
3. Make sure the yellow crystals are completely overflowing out of the top, and then squish them back into the tube with the cap. Screw the cap on, and you've captured a rainbow in a tube!
4. Keep your test tube closed and watch the colors mix and change. After two or three days, open the tube and pour out all the crystals onto one piece of wax paper. Separate them and count how many new colors you have. Let them dry for two or three days (until they shrink to their original size) if you want. Then, add some more distilled water and you can enjoy them again!

Activity #8 Garbled Marbles

Ask yourself science questions as you sort these mixed-up jelly jewels. After you become an expert in your field, watch them grow to giant jelly sizes!

From The Kit:
Garbled Marbles multi-colored beads • White Color mixing tray

You Get It:
Your notebook and a pencil • Assistant with good eyesight • Water

Some of the most important aspects of science are classification and categorization. That's how scientists make discoveries and learn about the world. From mushrooms to sharks, microbes to molecules, stars to subatomic particles, scientists figure out science secrets by first studying and sorting. They ask questions such as "how are these things alike, and how are they different?" You can do just this as you embark on a study of Garbled Marbles. Ask yourself science questions and see if you can figure out the answers!

Try It!

1. Rinse and dry the white mixing tray.
2. Open the bag of garbled marbles and pour some of them into one of the wells of the color mixing tray.
3. Carefully sort the garbled marbles. Place the different kinds of marbles in different wells in the color mixing tray. How many different colors are there? How many different sizes?
4. Will the differences in the size and color of the garbled marbles effect how big they will get or how fast they will grow? Why do you think that? Write down your guesses in your notebook.
5. Now do the experiment to see if you were right! Fill the wells in the mixing tray with water. Let them sit for a few hours, checking on them from time to time. What did you find out?

The birth of the superabsorbent

Superabsorbent polymers are super cool and fun to play with, but how are they used in the real world? They are used to do what they do best - absorb liquid! They were originally developed in the 1960s to help farmers keep water in the soil around their plants when there wasn't enough rain. The polymers, which surround the roots of plants, soak up water when it is available, and then slowly release it over time so that the plants can have a water supply even when most of the soil is dry. Someone figured out that babies (and their parents) could use a diaper that soaked up and held "water," too. Scientists responded with a safe, water-absorbent polymer that would do the job. Amazing!

Now take one of the Giant Test Tubes and put some of the Garbled Marbles (before grown) into the bottom. Fill it half full of water and watch as the marbles grow.
Activity #9 Warm and Cold Colors
Learn more about chemistry and physics as you explore the effects of heat on chemical reactions while you make more cool colors!

From The Kit:
Two test tubes • Two True Colors color tablets • Test tube rack

You Get It:
Two cups of water, one warm, and one very cold.

Try It!
1. Fill one of the test tubes about three fourths full with warm water and set it in the test tube stand. Fill the other test tube about three fourths full with very cold water, and place it in the test tube rack, too.

2. Drop one True Colors tablet into each test tube.

3. What do you see? The tablet in the warm water is fizzing like crazy and dissolving very fast, while the tablet in the cold water is trying hard just to keep up!

How does it work?
Water is made of tiny molecules that are always moving. When the water is cold, the molecules move very slowly, but when the water is warm, the molecules move much faster! When the water molecules are moving faster, they can pull the tablet apart (dissolve it) much faster, too. That’s one reason why we wash our hands and wash dishes in warm water—not only is it more comfortable, but it helps clean our dishes and hands much faster and more easily. Just don’t forget to use some soap!

Activity #10 Make Insta-Snow®

From The Kit:
Packet of Insta-Snow® Powder • Blue scoop • 2oz cup • Petri Dish • Pipette

You Get It:
Water

1. Place one blue scoop of Insta-Snow® Powder into the bottom of one of the giant test tubes
2. Measure 2 oz. of warm water into the 2 oz. cup
3. Pour the water into the giant test tube and watch what happens.
4. Pour out the “snow” onto a paper towel and feel it. How does it feel? Is it warm or cold?
5. Try to compress the snow into a snowball. Does it work?
6. Let the snow sit for about 15 minutes and then feel it again. Is it warm or cold?
7. Now using the pipette, put one “squirt” of water into the petri dish.
8. Using the blue scoop, slowly drop some of the Insta-Snow® Powder on top of the water.

How does this work?
The official name for the Insta-Snow® Powder is sodium polyacrylate. This chemical is better known as the powder hidden in the lining of baby diapers. However, this version of the powder becomes very fluffy when absorbed into water. Insta-Snow® soaks up water through the process of osmosis (water molecules pass through a barrier from one side of the powder to another) causing the powder to swell.

The mixologists at Steve Spangler Science coined the name Insta-Snow. The official name for this fine, white powder is sodium polyacrylate. This chemical is better known as the superabsorbent polymer found in baby diapers. That’s what makes diapers so absorbent! Insta-Snow is in a classification of chemicals called a polymer. The word polymer simply means long chains of molecules (“poly” means many and “mer” is a unit of molecule). Insta-Snow soaks up water using the process of osmosis (water molecules pass through a barrier from one side to the
other). When water comes in contact with the polymer, it moves from outside the polymer to the inside and causes it to swell. The polymer chains have an elastic quality, but they can stretch only so far and hold just so much water. Otherwise your container of Insta-Snow would grow as big as a house! Hey, that would be so cool!

For the scientists in the audience, there are several different kinds of sodium polyacrylate. When water is added to a diaper, the polymer quickly turns into a gel-like solid. Insta-Snow, on the other hand, becomes very fluffy when water is added. Both polymers look and feel the same before water is added; however, Insta-Snow has a tightly cross-linked network that rapidly unfolds when it comes in contact with water which accounts for its greater ability to swell up into a fluffy material. So, now you know!

### Activity #11 Make A Snowball Any Time of Year

Make a batch of Insta-Snow and put it in the freezer. After several hours, the once fluffy snow will be hard and "crusty" like real snow. Amazing!

### Activity #12 Find The Secret of the Baby Diaper

**From The Kit:**
- Bag of Water Gel

**You Get It:**
- Water • 2 clear cups

You’re about to discover how super absorbent polymers are the thirstiest things you can find!

1. Fill the blue scoop half full with Water Gel Powder. Pour the powder into a clean plastic cup.

2. Fill another plastic cup with approximately 4 ounces of room temperature water. Hold the two cups up for your audience to see. Quickly pour all of the water into the cup containing the Water Gel. Watch what happens. Turn the cup upside down and remove the gel!

### Activity #13 Dry It

1. Place some of the gel on a piece of waxed paper or a clean dinner plate and leave it out the in open to dry out. What happens?

2. Add a little water to the dehydrated gel and watch what happens.

### Activity #14 Salt Anyone?

1. Place some of the gel from the first activity in a cup and add a pinch of salt. In a few seconds, the gel will turn back into a liquid. Stir the mixture. The salt destroys its water-absorbing properties.

### Activity #15 Don’t Get Wet

**You Get It:**
- 2 styrofoam cups

Secretly place 1 teaspoon of the Water Gel into a Styrofoam cup. Invite a friend to hold the cup as you fill it with 4 ounces of water, being careful not to let them see inside the cup! Hold the cup above their head and slowly poke pencils through the cup. Say this, “I have to make sure I don’t remove any of these pencils or you’ll get wet!” Then remove the pencils. Hey what happened? Where did the water go?

**How Does It Work?**
The superabsorbent Water Gel is the same polymer used to absorb liquid in baby diapers! It absorbs water by means of osmosis, the movement of water molecules through a semi-permeable membrane. In other words, the polymer lets only molecules of water pass through its membrane-like structure.
Activity #16 Quicksand
Make your own ooey, gooey quicksand. Be careful where you cross! You can never be sure if you’re standing on solid ground!

From The Kit:
1 Bag of Quicksand Powder (Corn Starch)

You Get It:
Spoon • Pitcher of Water • Small solid objects to “bury” in the quicksand, such as a quarter or a small plastic animal • Mixing Tray

Mix up some Quicksand!
1. Cover the counter with an old newspaper. Making Quicksand can be very messy.
2. Get a pitcher of room temperature water.
3. Pour some of the Quicksand Powder (Corn Starch) into the mixing tray and begin adding the water a little at a time. Mix it up with the spoon or even your hands if you don’t mind making a mess!
4. Keep adding the Quicksand Powder (Corn Starch) and water until you have the consistency of honey.
5. Skim your hand across the top of the glop. Sink your entire hand into the Quicksand and try to pull it up. Weird! Pick it up and squeeze it in your fist. Notice how the consistency changes.

How Does It Work?
Why does the Quicksand act like a solid sometimes and a liquid at other times? Actually, your Quicksand is an example of what is called a Non-Newtonian Fluid—a fluid that defies Sir Isaac Newton’s law of viscosity. All fluids have this property. It is a fluid’s measureable thickness or resistance to flow. Honey and ketchup are liquids that have a strong resistance to flow.

Newton stated that the viscosity (rate of flow) of a fluid can be changed only by altering the fluid’s temperature. Liquids would flow faster if they were warmer and slower when they are cold. A Non-Newtonian fluid has the same dependence on temperature, but its viscosity can also be changed by applying pressure. When you squeeze a handful of Quicksand, its viscosity increases so it acts like a solid for a few seconds. When you release the pressure, the Quicksand behaves just like a liquid again.

Activity #17 Make Real Quicksand
Collect some real sand in a large tube and mix in enough water to create real quicksand. It may take you awhile to get the correct consistency, but you will be able to see how the water separates the grains of sand, creating real quicksand.

Activity #18 Making Slime
Most people consider slime to be in the “yuck” category. You’re about to learn a brand new way to make the world’s best green, gooey, slippery, rubbery, stretchy, sometimes gross but ALWAYS FUN slime. (Remember, you need an adult helper whenever you are handling chemicals).

From The Kit:
Polybag of Mucus Powder (Gravity Goo™ Powder) • Measuring Scoop • True Colors Table

You Get It:
2 Measuring Cups • Water

Try It!
1. Open the packet of True Colors tablets.
2. We are going to make Green Slime so pick out a Yellow and a Blue tablet (yellow and blue mixed together make green).
3. Add the yellow and blue tablets to a cup with 16 oz. of water.
4. Watch the tablets fizz and the water change color from clear to yellow/blue and finally to green.
5. Stir up the water once the fizzing stops to make sure it is consistently green.
6. Stir one blue scoop of Mucus Powder (Gravity Goo™ Powder) into the green water.
7. Stir immediately and without stopping for about 3 minutes. Your liquid will begin to thicken and get “stringy.”
8. After 3 minutes of stirring, begin pouring the liquid back and forth between two cups.
9. Pour for about 5 minutes.
10. Stick your finger in one of the cups and pull out the long, stringy slime.
The Science of Slime

Most liquids, such as water, are made up of small, unconnected molecules bouncing around and tumbling over and into one another. These single, unconnected molecules are called monomers. Monomer liquids flow easily and are seldom gooey or sticky to the touch. In other substances, the monomers are linked together in long chains of molecules known as polymers. These long chains don’t flow easily at all. Like a bowl of cooked spaghetti, they sort of roll over and around one another. Liquid polymers tend to be a lot gooier and flow more slowly than liquid monomers. The Green Goo called polyvinyl alcohol (PVA) you used to make slime is a liquid polymer.

PVA is used by the plastics industry to form surface coatings and to make surface films resistant to gasoline. It’s also used to make artificial sponges, hoses, and printing inks. If you check out the ingredients of contact lens wetting solutions, you may find PVA used as a lubricant and a cleanser. The PVA solution in this kit contains coloring and a special disinfectant to help resist pesky germs on those not-so-clean hands.

The Cross-Linker Solution is called sodium tetraborate. The common household name for this chemical is Borax. Your parents or grandparents will recognize the name Borax as a unique brand of powdered soap used to whiten linen and to really clean your hands. The Borax or sodium tetraborate molecules act to “cross-link” the long strands of PVA molecules. Just imagine a box full of tiny, steel chains that slip and slide easily across one another. Each chain is made up of hundreds of individual links but one chain is not connected to another chain. Borax loves to connect with water and billions of Borax molecules randomly link trillions of water molecules found anywhere on the chains of PVA. Now when you pull out one PVA chain, all the rest come with it in a blob.

<table>
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<tr>
<th>Type of Science: PHYSICAL</th>
<th>Area of Science: CHEMISTRY</th>
<th>Skills: MEASURE, OBSERVE</th>
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Activity #41 Tornado In A Bottle

You Get It:

- Water • Notebook • Pencil • Timer (optional) • 2 empty 1 liter soda bottles

Slime Time

1. Hold the end of the top bottle and swirl it in a circular motion. The motion of the bottles will cause the water to rotate until a vortex develops. As the force of gravity acts on the water in the upper bottle, the water easily flows through the hole in the Twister Tube™. Notice that the water won’t leak out.

2. Place the connected bottles on a flat surface with the empty bottle on the bottom and the bottle with water on the top. What happens?

3. Follow-up Questions:

   - If the water won’t flow at all, check to make sure the bottle is airtight at the bottom. Use tape or a plastic cap.
   - If the water flows but not the air, try adding a few drops of dishwashing liquid to make water a little less slippery.
   - If the water flows, but not the air, try swirlng the water in the bottle forcefully and then letting go. The air flow will continue until the water pressure is equalized across the bottle.

4. Make a Bubbling Twister:

   - Use food coloring to make a colorful cyclone.
   - Put more or less water in the top bottle. Does it affect the twister?

   - Who would have ever thought that you could blow bubbles with slime?

   - Some great slime stretches if you make slime with this kit. When you put slime on the end of a drinking straw, you can blow bubbles of slime. Just slowly blow air into the straw. If you blow too fast, you’ll get a bubble too big to blow through the straw. A bubble about the size of a quarter is just right.

   - You can keep your slime in a zipper-lock bag until you’re ready to play again. Dirt and bacteria on your hands will destroy the slime over time – that’s normal. Hey, you’re a slime master… just mix-up a new batch. Use warm water and paper towels for slimy hands and surfaces that have been “accidentally” slimed. Leftover slime can simply be thrown in the trash.

   - Try It!

   - Water • Notebook • Pencil • Timer (optional) • 2 empty 1 liter soda bottles

   - Get a drinking straw

   - Measure everyone’s piece of slime and make the adult helper come up with a prize for the longest piece. Hey, there are benefits to being a kid.
Activity #21 Nose Hang
The title says it all - it’s the nose hang activity.

You Get It:
Slime, from Activity 18 • A few friends (everyone must have a nose) • Ruler • An adult helper acting as judge

Slime Time
Tell your friends to stick a clump of slime on the end of their noses. Don’t get any funny ideas! Stretch the slime off the end of each nose, and measure the hanging slime. The longest slime gets the prize! Again, it’s the duty of the adult helper to cough up the prize.

Activity #22 Making Worms
Now is your chance to create a bowl full of worms! Just add a little Worm Activator to some blue Worm Goo, stand back and watch the worms wriggle and squirm, along with your friends and family! Fishing, anyone? Oh, did anyone mention that this is an excellent way to learn a little chemistry at the same time? Awesome!

From The Kit:
Blue Worm Goo • Worm Activator (Calcium Chloride)

You Get It:
Warm water • Food Coloring • Measuring cup • Bowl • Spoon • Paper Towel • Mixing Tray

Let’s Try It
1. Let’s start by making the Worm Activator solution. Measure 1 cup of warm water into the tray. Pour all of the Worm Activator (calcium chloride) into the water and stir with a spoon until fully dissolved.
2. Take off the cap to the Worm Goo solution and remove the seal. Replace the cap and you’re ready to start making worms.
3. Squirt a small stream of the Worm Goo into the Activator solution. Notice how the Worm Goo immediately turns into a long, stringy worm.
   Go ahead... you know you want to... touch it!
4. Carefully pull the worm out of the Activator solution to see what you made. Don’t worry if the worm breaks... just dip the gooey end back into the Activator solution to seal it up. Now that’s science magic.

Worm Activator (Calcium Chloride)
“Worm Activator” is Be Amazing’s name for the chemical Calcium Chloride (CaCl2). We package this as a course white powder or in granular form. It is used in several kits, including Insta-Worms (#5835), Test Tube Adventures (#4420), Glow Chemistry (#4465), and Big Bag of Science (#4120).

It needs to be stored in a tightly closed container, in a cool dry, ventilated area. This is because it is a hygroscopic substance – Calcium Chloride will absorb water from the air and form a solution.

Sometimes this happens even though it is packaged dry in a sealed poly bag. But is does not change either the use or strength of the Calcium Chloride. If it is already in liquid form, dissolve it all in one cup of warm water. Even if it has hardened somewhat, simply add it to one cup of warm water and stir until dissolved.

Then follow the next directions for making Worms.

Activity #23 Wacky Worm Wonders
Tiny Worms - Squirt a thin stream of Worm Goo to make web-like worms.
Worm Eggs - Drip single drops of Worm Goo into the Activator solution.
Hard Worms - The longer the worms stay in the Activator solution, the harder the texture of the worm.
Wear-a-Worm - Turn your favorite worm into a necklace to totally gross out your friends!
Dehydrated Worms - Allow a worm to sit out on a dinner plate for several days. Notice how the worm begins to dehydrate. Eventually the worm will completely shrivel up and become a long, thin thread. As you might have guessed, the water in the middle of the worm evaporates leaving only the thin worm skeleton.
Don't worry... carefully place the worm in a bowl of water and watch it rehydrate.
Intestines - Some people like to make thick worms by squeezing a large stream of Worm Goo into the Activator solution. Notice how the worm has a liquid center! Just you wait and see... someone will yell out, "Hey, you made intestines!"

How Does It Work?
When you make Insta-Worms™, you’re learning about the science of polymers. We call this liquid Worm Goo, but the real name of this liquid is sodium alginate. Sodium alginate is a long chain of molecules called a polymer. Specifically, sodium alginate a polysaccharide isolated from seaweed. Polymers are large molecules made by linking together hundreds of glucose (sugar) molecules. Alginate commonly used as a thickener for foods such as ice cream and fruit pies. Now that you know this chemistry secret, take a look at food labels the next time you’re at t food store to find out which other foods contain sodium alginate. Alginate compounds are also used for dental impression materials and wound dressings to name a

When You’re Finished
Pour the Worm Activator solution into a container to keep it for future worm making... unless you already used up all of the Worm Goo. When you’re finished making worms, it is safe to pour the Activator solution down the drain. Worms can be thrown away in the trash when you are finished with your weird, wacky, worm wonders.
Activity #24 Gravity Goo

Everyone knows that water can’t flow uphill. Not so fast… When a small amount of Gravity Goo powder is mixed with water, it dissolves forming a thick, slippery, gooey, mucous-like gel. Oh, the visual imagery! When the goo is poured back and forth between two containers, it mysteriously siphons from the higher held container to the lower one. Maybe water can flow uphill. You have to play with this stuff to believe it.

From The Kit:
Gravity Goo Powder • True Colors Color Mixing tablets • Clear Spheres (taken from Garbled Marbles) • Garbled Marbles
• Blue measuring scoop • Giant Test Tubes

You Get It:
Adult helper – This is a science essential. Adults and safety go hand-in-hand
Water - You’ll be experimenting with lots of water-loving polymers
Paper towels – hey, you have to clean up after yourself!

What is Gravity Goo?
• Gravity Goo is a unique polymer.
• Gravity Goo combines the sponge-like properties of polyacrylamide polymers and the molecular linking properties of acrylic co-polymers. Those are basically big words that mean that your Gravity Goo is going to soak up lots of water and you’ll find that it is highly attracted to itself.

Self-Siphoning Goo

From The Kit:
Gravity Goo Powder • Two Giant Test Tubes • Scoop • Water

Let’s Try It!

1. Fill one Test Tube with almost full of room-temperature water.

2. Fill the other Test Tube with one blue scoop of Gravity Goo powder.

3. Now, quickly pour the water from its Test Tube into the Test Tube with the powder.

4. Keep pouring the liquid back and forth, from Test Tube to Test Tube. For the first 2-3 minutes you will need to carefully pour the liquid very quickly from Test Tube to Test Tube, in order to avoid any clumping. NOTE: If clumping does occur, or powder material is stuck to the bottom of a Test Tube, gently stir the mixture to loosen the polymer from the Test Tube. If clumps are still present after stirring, let the mixture sit for 24 hours to allow the lumps to dissipate.

5. After 2-3 minutes of pouring, the liquid should start to form “strings” of goo as you pour it back and forth.

6. After the formation of the “strings” pour the liquid back and forth more slowly for an additional 5 minutes.

7. Now, after the excitement has started to build… you need to be patient for 30-40 more minutes while the liquid sits. We know, it’s hard to wait, but trust us, the result will be worth it! NOTE: Make sure to let the liquid sit all in one Test Tube. If it is separated between the two Test Tubes you will end up with two separate sets of Gravity Goo.

8. After your concoction has settled for 30-40 minutes you are ready for the coolest anti-gravity experiment you’ve ever seen! Just start pouring the liquid between the two Test Tubes again...

9. After just a few pours back and forth, you will start to notice a very strange occurrence. Once you start to pour the liquid you just can’t stop it as the liquid crawls up and over the sides of the cup in a “self-siphoning” action. Make sure that you keep the Test Tube you are pouring from higher than the Test Tube you are pouring into.

10. As the Gravity Goo continues to flow, you will find that you hardly need to pour the liquid at all… it will climb up and out of the Test Tube on its own! It’s like the giant blob that takes over the city.

11. When you are finished playing with your Gravity Goo, dispose of it in a trash can. Don’t pour it down the drain unless you want some very strange occurrences in your plumbing!
How Does it Work?
Gravity Goo is a unique type of polymer. When added to water, it acts both like a sponge to suck up the water and also links the molecules in a long chain. Gravity Goo is a combination of polyacrylamide and acrylic co-polymers. Think of Gravity Goo as a combination of a superabsorbent polymer which absorbs tons of water, and Slime, which bonds into long chains of molecules.

In order to illustrate the molecular structure of Gravity Goo, it might be helpful to picture a bowl of spaghetti all tangled up. The spaghetti-like structure causes the polymer to thicken water and provides a strong elastic effect. Although extremely elastic, the Gravity Goo remains fluid like pancake syrup. The straight chain format of the Gravity Goo molecule with no side chains to attach to other molecule strands allows the separate chains to slide past each other and stay fluid.

Suspended Spheres
If you are looking for the ooey, gooiest experience, with the highest level of YUCK... this is the experiment for you!

From The Kit:
Gravity Goo Powder • Two Plastic Test Tubes • Scoop • Clear Spheres (taken from Garbled Marbles)

You Get It:
Water • Cup

Let’s Try It!
1. Fill a plastic cup three-fourths full with water.
2. Pull out 10-15 Clear Spheres taken from the Garbled Marbles and place them in the water.
3. Let the spheres grow for 1-2 hours. Notice the changes that occur in the shape and size of the spheres as they grow. These superabsorbent spheres are going to soak up lots of water!
4. Once the spheres have had time to grow (but aren’t yet fully grown) follow the instructions for preparing the Gravity Goo from the first section or the “Colorful Gravity Goo” section of these instructions, adding the spheres to the plain or colored water before pouring the water into the powder.
5. Now, when your Gravity Goo is mixed, you will find that the spheres climb out of the Test Tube right with the goo! We know you want to say it... it kind of reminds you of boogers and snot. It’s okay, we think so too.

Garbled Goo
Our Garbled Marbles seem to really like that Gravity Goo...they will grab right on and illustrate the “anti-gravity” movement of the goo better than anything we’ve seen.

From The Kit:
Gravity Goo Powder • Two Giant Test Tubes • Scoop • Garbled Marbles (from Activity #8)

You Get It:
Water

Let’s Try It!
1. Let the Garbled Marbles in the first test tube grow for about an hour. Notice that they don’t get as large as your Clear Spheres, but the colors are so bright!
2. Once the Garbled Marbles have had time to grow (but aren’t yet fully grown) follow the instructions for preparing Gravity Goo from the first section of this hand-out, adding the Garbled Marbles to the plain water before pouring the water into the powder. For best results, use plain water, not colored water.
3. Now, when your Gravity Goo is mixed, you will find that the Garbled Marbles climb out of the Test Tube right with the goo and demonstrate the amazing motion of the goo!
4. Let the Garbled Marbles in the second test tube grow for about 3-4 hours. Are they larger than the ones already sitting in your Gravity Goo? Add some of these to the Gravity Goo and compare them to the others.
5. Your colorful creation probably looks something like confetti...floating in a pool of goo.
How Does it Work? Clear Spheres and Garbled Marbles are a special kind of superabsorbent polymer that soak up LOTS of water. In fact, these special polymers can absorb up to 300 times their weight in water! When you add the spheres or marbles to your Gravity Goo powder, they soak up some of the water that you mixed in with the Gravity Goo powder. Once these little balls have absorbed the water, the Gravity Goo grabs onto them and takes them for a ride as you pour the goo back and forth. The polymers are a great way to illustrate the movement of the Gravity Goo.

Activity #25 Energy Bead Bracelet
Explore the science of ultraviolet light with amazing white beads that change colors in the sunlight! Make your own Energy Bead Bracelet, then take it outside in the sunlight to change it into a rainbow of color.

From The Kit:
Energy Beads • Yarn

You Get It:
Sunscreen • Sunglasses • String an Energy Bead Bracelet

Let's Try It!

1. Thread one end of the yarn through enough Energy Beads to fit around your wrist. (Make it be enough to slip on and off your wrist to do the experiments). Tie the two ends of the yarn together.

2. Choose a sunny day and take your bracelet for a walk in the sunshine and see what happens. How long does it take for the beads to change color?

3. Take your bracelet back inside and notice how long it takes the beads to change back to white.

Activity #26 Test Your Sunscreen
Let's Try It!

1. Take a few of the beads and cover them with a thick coat of sunscreen. (Use sunscreen that is SPF 15 or greater and make sure that it wasn’t purchased more than a year ago.)

2. Place the beads on a paper plate and leave them outside on a sunny day. What happens? Did the beads change color or did the sunscreen protect them from the ultraviolet light? Is your sunscreen effective in keeping out harmful sun rays?

Activity #27 Make an Energy Bead Mosaic
Let's Try It!

1. Make a design with your Energy Beads on a piece of wood or poster board. Glue the beads in place.

2. Take the mosaic outside and leave it in the sunlight. Watch the colorful pattern develop when exposed to sunlight.

How does it Work?
The word “light” is a generic word, often used to describe the opposite of “dark.” However, there are many forms of light energy. Each type of light energy is made up of different lengths of light waves. The light waves we can see allow us to see colors in the world around us. The Energy Beads allow us to “see” a type of light that is normally invisible. This type of light is called ultraviolet light. When the light comes in contact with the beads, a chemical reaction occurs and you see color.

Activity #28 Energy Beads and Clouds
Take your energy beads outside on a cloudy day and see if they still change color. If they do, you’ll see why doctors recommend wearing sunscreen even on cloudy days.
Activity #29 Glass Protection

Place several beads in a glass jar and expose them to direct sunlight. Do the beads change color? Test a variety of glass and plastic containers to determine which materials block out ultraviolet light.

Activity #30 Check your Sunglasses

Arrange your Energy Beads out in the sun so that they are completely shaded by your sunglasses. Do the beads change color? All sunglasses should be 100% UV protected in order to protect your eyes from the sun’s damage.

Activity #31 Nut In The Bottle

Get ready to perform a few impossible feats of science magic thanks to that master science magician, Sir Isaac Newton.

From The Kit:
Hex nut • Yellow plastic ring

You Get It:
Card • Empty soda bottle

Let’s Try It!

Part 1

1. Place the card on top of the bottle, and place the hex nut on top of the card.
2. Challenge your friends to find a way to get the hex nut in the cup without lifting the card. Part of the fun of this experiment is to watch your friends trying to figure it out. Give them time to test out all of their suggestions.
3. When your friends have finally exhausted all of their ideas, flick the card with your forefinger so that the card slides out from underneath the hex nut. Watch the expression on your friends’ faces as the nut drops into the bottle.

Part 2

1. Balance the ring on the mouth of the empty bottle; then place the nut on top of the ring so it rests directly over the bottle opening. Check out the illustration.
2. There’s a way to hit the ring so the nut can drop through the mouth of the bottle and fall to the bottom, though it may seem impossible.
3. Consider possibilities and think of ways you can hit the ring to move it to the side and let the nut drop straight down. Remember that the plastic flexes just a little when you hit it causing the nut to move upwards.
4. Give up? Try this… The best way to get the nut to drop is to hit the ring from the inside. Point your index finger and insert it inside the ring. Quickly move it to one side. It may take a bit of practice to get the nut to drop into the bottle but once you get it, you’ll love the sound.

How Does It Work?

Again, a cool guy named Newton that says an object at rest wants to remain at rest unless something smacks it (OK, maybe those aren’t his exact words). The tendency of an object to stay where it is known as inertia. If the nut is to fall into the bottle, it must remain where it is while the ring is cruising to the side. Then the nut can fall straight into the bottle when the ring is out of the way. By hitting the ring from the inside, you cause it to bend in such a way that it pushes up and out on the nut, moving it away from the bottle opening.

It’s the same story for flicking the card out of the way. If you flick it just right, the card goes flying sideways, the hex nut remains in place for a split second and gravity does the rest. That Newton guy was pretty darn smart!
Activity #32 Spinning Eggs

Use your knowledge of inertia to determine if an egg is raw or hard-boiled… without cracking the shell!

You Get It:
Two identical looking eggs – one is raw and the other is hard-boiled

Let’s Try It!

1. Place one fresh and one boiled egg on a table or desk and ask your friends to guess which one is which. Go ahead… hold them, give them both a little shake. When your friends give you their final answer, ask them how they know and mark the eggs accordingly.

2. Here’s how you’ll know… Spin the eggs! The hard-boiled egg will spin like crazy and the fresh egg will be rather sluggish.

3. Get both eggs spinning and then place a finger on each one for a second. Remove your fingers. The hard-boiled egg will remain motionless and the fresh egg will resume spinning. After identifying which egg is which, crack them open in the bowl to prove your point.

How Does It Work?
Inertia is the tendency of objects to keep on doing whatever they’re doing. A dump truck full of gravel has lots of inertia because it’s hard to get it moving, and once it’s moving, it’s hard to stop. A pea has very little inertia because you can move it with the flick of a finger and stop it without much trouble. What you’re dealing with in this activity is called rotational inertia. This is basically the same concept, except that it refers to how hard it is to get something rotating or to stop it from rotating.

When you spin a hard-boiled egg, all the innards stay in place. When you spin a fresh egg, the liquid inside moves to the edge, making the egg much harder to spin. When you briefly place your finger on each egg, the liquid in the fresh egg keeps rotating inside, so there’s still rotational motion after you let go.
Activity #33 What Is Carbonation - The Story of Soda Pop

If you want to know where it all began, you have to go back more than 2000 years and have a talk with Hippocrates, the Father of Medicine. Hippocrates was convinced about the positive value of mineral springs that bubbled up from the ground. As a consequence, both Greek and Roman cultures took bubbling baths (ever wonder how bubble baths were invented?) and used the waters for relaxation, but no one thought to drink the effervescent waters in order to promote good health.

In America, a natural spring was discovered bubbling up from between the rocks in upstate New York. Whoever first tried drinking the water may have been responsible for starting the soft drink industry that now supplies just less than 53 gallons of soda a year to every woman, man, and child in the United States! By the 1830’s, myths and legends sprang up all over the region, telling of miraculous cures and improved digestion.

Soon after, curious physicians and scientists began studying the fizzy water. They discovered that it naturally contained a gas called carbon dioxide. To improve the water, pharmacists added herbs and flavors and created drinks like root beer, ginger ale, and sarsaparilla. They opened “soda fountains,” mostly in the summer when people would come from miles around to enjoy their healthful drinks.

In 1892, an inventor finally came up with an idea for what was called the “Crown Cap.” This allowed the fizzy drinks to be bottled and capped, so that all those bubbles stayed trapped in the bottles. Soon, people were taking their soft drinks home, and many of the pharmacists began bottling their drinks, because their business was slow at the soda fountain. Still, it was a few more years before people were carting home trunk loads of soda. In the 1920s, the “Hom Pak” made it possible to easily carry a six-pack, so people could buy plenty of drinks, all at once, and by then, they could also buy a car to carry it all home. Trucks replaced horse-drawn delivery carts, and by the late 1920s, the soft drink industry was in full swing.

In the 1930s, modern machinery made it possible to bottle many thousands of sodas at the same. Even during the great Depression and World War II, when sugar was rationed, people still continued to drink soda pop. After the war, soft drink companies added new flavors and diet drinks, increasing their market. In 2001, this market includes over 450 different brands, bottled in plants that produce more than 2,000 cans of soft drinks per minute on one production line. (And that doesn’t even count plastic soda bottles!)

What is Carbonation? Have you ever wondered what makes soft drinks fizz?

You Get It:
Clear plastic cups • 2-liter bottle of soda (any kind) • Notebook

Try IT!
1. Pour a glass of soda and observe it. Notice as many things as you can about the soda and write them down in your notebook.

2. Attempt to explain each thing you observe.

Beyond the Fizz

While this activity sounds simple, it should help you to explain everyday phenomena in scientific terms. The foam that forms on top of a glass of soda is composed of a gas, which is also responsible for all of the bubbles you see in the glass. These bubbles always rise to the top. This is due to the fact that gases are always less dense than liquids, because their individual molecules are much farther apart. Notice what happens to the bubbles after they reach the top of the glass.

Soda is an example of a carbonated beverage, which means that carbon dioxide is pumped into the cans or bottles at the bottling plant. The containers are then immediately sealed, causing the carbon dioxide to be held inside, under high pressure. Once a can or bottle of soda is opened, however, the pressure is greatly reduced, which causes the carbon dioxide to begin diffusing into the atmosphere. Once all of the carbon dioxide in the soda has come out of solution, the soda becomes flat, having lost its fizz.

Then you burp. BURP!

What is this deep rumble exploding rudely from your mouth when you least expect it? Before you can trap it with your lips or hand the rebellious air has already escaped, requiring an even louder “excuse me!” to cover your embarrassment. How could such a shocking thing happen while you so innocently slurped your soda?

That “burp” or “belch,” as some people call it, is caused by a little ball of gas. As soon as the gas forms in your stomach, (usually caused by swallowing air when you eat or drink) it’s on its way up and out, moving up through the stomach and the esophagus (pronounced eh-soff-uh-guss) until it escapes. The esophagus is the small tube that connects your stomach with your throat and mouth.
Soda pop seems to cause burping even more than gulping air when you eat, because it contains extra gas. The gas that makes the soda bubbly is called carbon dioxide (kar-bon di-ahk-side). Since burping is only a little irritating to others and not harmful to the body, you can have a lot of fun with it. Babies, however, may have a little more trouble than you do, because when gas is trapped in a baby’s stomach it can be very uncomfortable. This is why mothers tap lightly on their babies’ backs after they eat to get them to burp.

If you feel a burp coming on in an inappropriate place, cover your mouth and burp quietly. After all, not everyone may be as excited as you are about your taste in music!

**Fizz? Bubble? Pop!**

Many years ago, carbonated beverages were made by mixing sugar water and flavoring with citric acid and baking soda. The chemical reaction created lots of bubbles and tasted pretty good. In this experiment, you’ll experiment with citric acid and baking soda to make a bubbling potion… but it’s not to drink.

This experiment requires adult supervision. While the ingredients in this experiment are not toxic, it’s best not to taste or drink your experiment… because it doesn’t taste good!

**You Get It:**
Tall glass (a 12 -16 ounce cup works well) • Citric acid (powder) • Baking soda (powder) • Measuring spoons • Spoon • Water

**Try IT!**
1. Fill the glass ¾ full with water.
2. Use the measuring spoons to measure ¼ teaspoon of baking soda into the water. Stir the water to dissolve the baking soda.
4. Now it time to experiment by adding another ¼ teaspoon of citric acid and another ¼ teaspoon of baking soda. Add a few more scoops of baking soda to see how this affects the bubbling. Add another few scoops of citric acid to make the liquid bubble even more.
5. When you’re finished playing (experimenting!), it’s safe to pour the mixture down the drain.

**Beyond the Fizz**

Back in the 1950's and 1960's, people purchased fizzy drink tablets to add to water to make a version of soda pop. The fizzy drink tablets contained citric acid, baking soda, flavoring and some sort of artificial sweetener. When the tablet was placed in water, carbon dioxide gas was released, producing a fizzy carbonated beverage.

The fizziness is due to carbon dioxide (CO2) gas that is produced by the chemical reaction that occurs when baking soda (sodium bicarbonate) meets citric acid. They have a scintillating relationship!

The chemical reaction is as follows:  
\[
\text{H}_3\text{C}_6\text{H}_5\text{O}_7(aq) + 3\text{NaHCO}_3(aq) \rightarrow \text{Na}_3\text{C}_6\text{H}_5\text{O}_7(aq) + 3\text{H}_2\text{O}(l) + 3\text{CO}_2(g)
\]

The sodium bicarbonate and sodium citrate are also used in other products in place of baking soda. However, when this reaction takes place in your stomach, it goes in a different direction.

This same reaction is used for a number of other commercially available products, such as Alka-Seltzer™ antacid tablets and Kool-Aid Slushies™ to name a few.

**Activity #34 Dancing Macaroni**

It’s a simple experiment using soda and uncooked Macaroni, but it’s a great way to see how carbon dioxide behaves on the surface of an object.

**You Get It:**
Clear glass • Clear soda • Macaroni or raisins (golden)

**Try IT!**
1. Fill the glass with soda.
2. Drop 10-15 pieces of Macaroni or raisins into the soda.
3. Focus all of your attention on those pieces of pasta. Look at them with your Magnifying Glass from the kit. Something is happening on the surface of the pasta. Wake the kids, phone the neighbors... the pasta is dancing, I think? They're floating, they're bobbing up and down, they're dancing! OK, maybe it has something to do with those bubbles attached to the surface of the Macaroni.

Beyond the Fizz
As you have learned by now, the soda is full of carbon dioxide gas. The gas attaches itself to the small pits and imperfections on the surface of the Macaroni. These pits are called nucleation sites. Think of the bubbles as tiny life vests that make the little pieces of pasta buoyant (want to float). At some point the bubbles are buoyant enough to make the piece of Macaroni rise. They float to the surface, “pass gas,” (okay, the bubbles pop) and sink to the bottom again to gather more bubbles.

Scientifically speaking, these bubbles will increase the volume of the pasta substantially, but contribute very little to its mass. As a result, the overall density of the pasta is lowered, causing it to be carried upward by the more dense fluid surrounding it. Just memorize the previous two sentences and say them out loud at every social event you attend. People will be so impressed.

You can see the same thing happening with a set of inflated Water Wings™ or an inner tube. The volume of the Water Wings increases the person's volume considerably. However, the mass of the Water Wings is very small. The overall effect is to lower the density of the Water-Wings-person combo to less than that of water, so that the person can float. Deflating (don’t try this with someone who can’t swim!) the Water Wings would reverse the process and cause the person to sink.

Note: Raisins also work

| Type of Science: PHYSICAL, LIFE | Area of Science: CHEMISTRY, BIOLOGY | Skills: OBSERVE, CLASSIFY |

Activity #35 The Soda Geyser Eruption
It’s been called the “vinegar and baking soda” reaction for a new generation. Words cannot begin to describe the awesome eruption that is created from adding MENTOS® candies to a 2-liter bottle of soda. The eruption is enormous... and so is the learning if you consider the chemistry.

You Get It:
A roll or box of MENTOS® Mints • Large plastic test tube • 2-liter bottle of diet soda (Either diet or regular soda will work for this experiment, but diet soda is less sticky when you’re cleaning it up, and it will usually create a bigger blast.)

Try IT!
1. This activity is probably best done outside in the middle of an abandoned field or on a huge lawn.
2. Carefully open the bottle of soda. Position the bottle on the ground so that it will not tip over.
3. Fill the test tube with seven MENTOS®.
4. The goal is to drop all of the MENTOS® into the bottle of soda at the same time (which is trickier than it looks). One method for doing this is to place your finger over the top of the test tube and hold the tube directly over the mouth of the bottle so that all of the candies drop into the bottle at the same time. You can also use a small card in place of your finger.
5. Don’t drop them into the bottle just yet! Warn the spectators to stand back. Okay, you’re going to drop all of the MENTOS® into the bottle at the same time and then get truckin’ (move out of the way... so long... bye-bye... hasta la vista!)

Beyond the Fizz
Soda pop is basically sugar (or diet sweetener), flavoring, water and preservatives. The thing that makes soda bubbly is invisible carbon dioxide gas, which is pumped into bottles at the bottling factory using tons of pressure. Until you open the bottle and pour a glass of soda, the gas mostly stays suspended in the liquid and cannot expand to form more bubbles, which gases naturally do. But there's more...

If you shake the bottle and then open it, the gas is released from the protective hold of the water molecules and escapes with a whoosh, taking some of the soda along with it. What other ways can you cause the gas to escape? Just drop something into a glass of soda and notice how bubbles immediately form on the surface of the object. For example, adding salt to soda causes it to foam up because thousands of little bubbles form on the surface of each grain of salt.
The MENTOS® Secret
The reason why MENTOS® work so well is two fold: Tiny pits on the surface of the candy and the weight of the candy. Each MENTOS® candy has thousands of tiny pits all over the surface. These tiny pits are called nucleation sites - perfect places for carbon dioxide bubbles to form. As soon as the MENTOS® hit the soda, bubbles form all over the surface of the candy. Couple this with the fact that the MENTOS® candies are heavy and sink to the bottom of the bottle and you've got a double-whammy. When all this gas is released, it literally pushes all of the liquid up and out of the bottle in an incredible soda blast.

Use the magnifying glass to look closely at the surface of a single piece of MENTOS® candy. Can you see the tiny pits on the surface of the candy? Those tiny pits are the key to all of the soda geysers you're going to make with the kit... and at every party you attend!

The Geyser – Unwrapped
Here's an interesting piece of trivia... The MENTOS® Geyser never actually started out using MENTOS® candies. This science experiment was popular among chemistry teachers back in the 1980s using a roll of Wintergreen Lifesavers and a pipe cleaner. Teachers threaded the roll of Wintergreen Lifesavers onto a pipe cleaner as an easy way to drop all of the Lifesavers into the soda at the same time. Within seconds of dropping the candies into the soda, a huge geyser would erupt from the bottle.

MENTOS® came into the picture when the maker of Wintergreen Lifesavers changed the size of the candy making them too big to easily fit into a two liter bottle of soda. So, some very clever science teachers discovered that MENTOS® worked even better. Lee Marek is a very cool chemistry teacher who first taught Steve Spangler (the creator of this kit) about using MENTOS®.

So, what does the maker of MENTOS® have to say about all of this?

Imagine that you’re a candy maker and one day you learn that your candy is the key ingredient for a very cool science experiment. What would you say? AWESOME! That's exactly what the maker of MENTOS® (Perfetti Van Melle) had to say. Steve Spangler (the creator of this kit and the inventor of the Geyser Tube™) worked closely with the people who make MENTOS® to make this kit and the other MENTOS®- powered toys he invented. MENTOS® is a registered trademark of Perfetti Van Melle B.V. The candy is made in Holland.

Activity #36 Geyser Tube™
The Geyser Tube makes it easy to launch the perfect soda geyser everytime.

From The Kit:
Geyser Tube with the pin and string

You Get It:
MENTOS® Mints • 2-liter bottle of diet soda

Try IT!
1. You’ll need a 2-liter bottle of diet soda (diet doesn’t make a sticky mess) and an outdoor location for your geyser. Select a flat surface on the lawn or driveway to place the bottle.

2. Start by tying one end of the string to the trigger pin (the string might already be attached to the pin).

3. Open the bottle of soda and attach the Geyser Tube. Put the trigger pin into the hole at the base of the Geyser Tube.

4. Twist off the top cap on the Geyser Tube and drop 7 MENTOS® candies into the tube. The trigger pin will keep the candy from falling into the soda... before you’re ready. Replace the twist-on cap.

5. Warn everyone to stand back. Countdown... 3-2-1... and pull the trigger. The MENTOS® will drop and the soda will go flying into the air!

6. Pour out the remaining soda and take a look at the MENTOS®. You can see where the soda has eaten away at the surface of the candy. No need to waste the candy... they still taste great.

Take the Taste Test
You’ll notice that there is still some soda left in the bottom of the bottle. Twist off the Geyser Tube and taste the soda. Beside tasting minty fresh, you’ll probably notice that all of the bubbles of carbon dioxide are gone. The soda is flat. Very interesting!

Beyond the Fizz
What made the soda shoot up so much higher? You already know why the soda erupts (if you forgot, re-read the explanation part of the previous experiment called The Original Geyser Eruption). Look closely at the cap on top of the Geyser Tube. Do you notice the small hole in the top? That’s the secret! The smaller hole caused the soda to build up more pressure and the result was a 20 to 30 foot soda geyser.
You may have also noticed the clear plastic sleeve that slides back and forth on the Geyser Tube. When you pull the pin, the sleeve drops down to cover the two holes at the bottom of the Geyser Tube where the pin used to be. Without the sleeve, lots of soda shoots out from the two holes and keeps the geyser from going higher. Steve Spangler worked on many ways to keep the soda from shooting out of the holes and the sleeve method is the one he liked the best (and so did the attorneys who filed the patent for the Geyser Tube).

Activity #37 Recycled Mentos®
Thanks to the invention of the Geyser Tube, you can reuse the MENTOS® for a second launch, but you can’t wait too long before launching a second geyser.

You Get It:
The set-up from the last experiment (used bottle of soda with the Geyser Tube attached) • New 2-liter bottle of diet soda

Try IT!
1. This works best if you try it right after you launch a geyser. You’ll notice that there’s still a little soda left in the bottle. Turn the bottle upside down (with the Geyser Tube still attached) and empty it all out of the soda.

2. While you’re emptying the soda, the used MENTOS® will fall back into the Geyser Tube. You might have to shake the bottle a little, but the MENTOS® will all line up back in the Geyser Tube.

3. Put the trigger pin through the holes and turn the bottle right side up.

4. Remove the Geyser Tube from the old bottle and attach it to the new 2-liter bottle of soda (with the used MENTOS® already loaded). Be careful not to accidentally pull the pin before you’re ready to launch.

5. When you’re ready to go, pull the pin and keep your eyes on the geyser. Did it go as high or higher than the previous one?

Beyond the Fizz
You probably noticed that the MENTOS® looked almost new when you reloaded them into the Geyser Tube after the first launch. The soda dissolved some of the surface of the MENTOS® during the first launch, but there are still millions of tiny pits (called nucleation sites) all over the surface of the candy. When you drop the MENTOS® into the soda for the second time, the bubbles form all over the surface of the candy and expand to push the soda up and out of the bottle.

How Many Times Can You Use the MENTOS®?
Good question. Most soda geyserologists agree that two times is about the limit. After the second time, the soda eats away (dissolves) the surface of the MENTOS® and all of the tiny pits disappear. Don’t waste the third bottle of soda unless you are the kind of scientists who needs to prove it for yourself!

Do You Have to Use Diet Soda?
It doesn’t take long for the young geyserologist to ask the all-important question: Is diet soda the only kind that works? The simple answer is NO, but there’s more to the story (as you might imagine). Diet soda just plain works better than regular soda. Here’s what we know from launching thousands of soda geysers with MENTOS®…

1. Diet soda is the choice of most experimenters because it’s not sticky. Remember, diet soda does not contain sugar. Instead, most diet soda contains Aspartame™, Saccharin™, or Sucralose™.

2. Geysers are bigger with diet soda than regular soda. Give it a try and you’ll see. While no one really knows why this is true, some scientists speculate that it has something to do with the way the sugar in the soda holds the molecules together.

How High Will the Soda Geyser Go?
What’s the record for the biggest soda geyser? Steve Spangler's official record (just dropping MENTOS® into the bottle without using the Geyser Tube) is about 18 feet. He used seven MENTOS® in a plastic test tube and dropped them into a bottle of Diet Coke, which was at room temperature (about 70°F).

The official record for the Geyser Tube is about 30 feet using seven MENTOS® and a bottle of Diet Coke at room temperature. Remember that the cap on the top of the Geyser Tube helps the soda to build up more pressure when it’s trying to escape from the bottle and this results in a higher shooting geyser.
Activity #38 Soda Can Shake Up
This little after-dinner science gem is guaranteed to put panic in the eyes of all your dinner guests and send them running from the table.

You Get It:
Cans of unopened soda. It’s best to practice with clear liquids! (Try club soda, but do not use diet soda)

Try IT!

1. Vigorously shake a sealed can of soda.

2. Invite a dinner guest to immediately open the can!
   Of course, most sane people will refuse the offer.

3. With a little science know-how, you’ll be able to open the can without spraying your audience. The secret is to use your fingerto snap the side of the can.

Beyond the Fizz
Let’s start by explaining why the can explodes in the first place. Carbonated beverages contain dissolved carbon dioxide gas. The way to get gas to dissolve in liquid is to pressurize the mixture, meaning that the pressure inside a soda can is greater than the pressure outside the can. This is why you see little bubbles spray out when you open a soda can—breaking the seal depressurizes the mixture, causing the gas to come out of solution, starting with the gas closest to the top (that’s where the pressure decrease starts). Because gas is lighter than liquid, as soon as it comes out of solution, it rises to escape the can. When it escapes, it carries with it a small amount of liquid from the very top of the can because that liquid is blocking its path.

Shaking the unopened can of soda causes bubbles of carbon dioxide to line the inside walls of the can. When you open the can—woosh—the pressure in the can goes down and the volume of each bubble goes up (Boyle’s Law). The quickly expanding bubbles force the liquid that rests above it out of the can. Most people have learned to tap the top of the can before opening it. No one can really explain why. Mom said, “It keeps the can from exploding!” True or false? It depends on where you tap the can. Believe it or not, tapping the top of the can does nothing! However, tapping the side of the can knocks bubbles off the bottom and sides of the can, at which point they rise to the top. The trick is to dislodge the bubbles from the side walls and bottom of the can so they can float to the top of the can (because gas is lighter than liquid) and there is only a small amount of liquid blocking their escape when you open the can. Remember, SNAP the SIDE instead of tapping the top.

Another option is to simply wait a few minutes to open the can so that the gas has some time to re-dissolve in the liquid. But if you’re too thirsty to wait, start snapping and hope that those darn little bubbles rise to the occasion and join that big bubble right under the lid.

Now go out and amaze your friends—and scare the waitress at Denny’s.

By the way—avoid diet sodas for this experiment! Why? No one really knows, but it is generally accepted that the snapping action does very little to dislodge the bubbles from the sides of the can. Due to the presence of the artificial sweetener, soda canologists theorize that the bubbles hold on tightly to the inside walls of the can. (Sounds good, but who knows?)

WARNING: If you decide to perform this experiment, you are responsible for everyone’s cleaning bill if the experiment doesn’t go exactly as planned. It’s best to practice this outdoors. If you drink each can of soda you open, you can use your own body to demonstrate another fascinating concept - the solubility of gases. This, too, is a real crowd-pleaser.
Activity #39 The Rock Salt Secret

Is there anything that works in place of MENTOS®? This is the question one of the Discovery Channel consultants from MythBusters asked Steve Spangler as they were researching a challenge for the show. Rock salt works... but it's a little tricky.

From The Kit:
Two Giant Test Tubes and Holder
Magnifying glass

You Get It:
2 liter bottle of soda
Rock Salt (or Kosher or sea salt)
Table Salt

Note: It’s best to conduct this experiment over a sink... because it’s probably going to overflow.

Try IT!
1. Fill the glass ¾ full with soda. Remember, it’s best to do this experiment over the sink.
2. Add 4 or 5 pieces of rock salt to the soda and watch what happens. Add a few more pieces and look closely at the pieces of rock salt sitting on the bottom of the glass. Notice the bubbles forming on the pieces of rock salt.
3. Use the magnifying glass to look closely at the surface of the rock salt. See any pits or rough spots on the surface of the crystal? Of course you do!
4. You might want to pour yourself a new glass of soda depending on how much carbon dioxide bubbled away using the rock salt. Add a teaspoon of plain salt to the glass of soda and observe what happens. More bubbling? Lots more bubbling! Why?

Salt Geyser
1. Fill the test tube half full with salt – either rock salt or plain salt - you choose.
2. Open the bottle of soda and prepare the launching site. Remember, this is an outdoor activity!
3. Unlike using MENTOS®, there’s no easy way to use your finger to keep the salt from falling into the soda too early. Try covering the top of the test tube with the piece of cardboard from your kit and turning the whole thing upside down over the bottle of opened soda. Line up the test tube so that the rock salt falls into the soda when the paper is pulled away.

Yell, “Fire in the hole!” and pull the paper way. The rock salt will drop and you should probably run. So, did rock salt work?

Beyond the Fizz

If you captured this reaction on video, it would be a good idea to rewind and watch the reaction. You’ll notice that the soda bubbles and fizz when the salt is added. Remember how carbon dioxide molecules cling to nucleation sites (the pits on the surface of the MENTOS®)? The salt particles provide many more sites that the carbon dioxide molecules can adhere to. As a result, many carbon dioxide molecules quickly come out of solution, and the soda gets pushed out of the bottle.

You probably noticed that the plain salt reacted faster than the rock salt. That’s because there is more surface area or space for the carbon dioxide bubbles to form on the surface of the salt crystals.

When you added the rock salt to the soda, you probably noticed small bubbles forming on the surface of the salt crystal. When you looked closely at the salt crystals with your magnifying glass, you saw lots of pits and rough spots on the edges of the salt crystals. You guessed it... these pits and holes are called nucleation sites. It’s all about nucleation sites! Try adding sand, sugar, or other materials to your soda to see if they cause increased fizzing.

Hey, some people even add a shake or two of salt to their soda before drinking it to remove some of the carbonation.
Activity #40 Polymer Plants

Use your superabsorbent crystals (taken from Activity #4) to do real-world agricultural science!

Weather Wonder: Drought

Besides looking just like big chunks of ice, what do Super-absorbent polymer crystals have to do with stormy weather, or the lack of it? It turns out that polymer crystals can play a significant role in retaining water in the soil during times of drought. A drought is a prolonged, abnormally dry period when there is not enough water. In the last few years, parts of the earth have recorded the most severe drought conditions ever known. Droughts may not seem as dramatic as hurricanes, ice storms, or tsunamis, but severe drought conditions can cause incredible levels of destruction and devastation, since plants, animals, and people can’t live in an area without water. What can be done? Polymer Ice to the rescue! You can perform just such an experiment with the Polymer Ice that you grew in the last activity!

From The Kit:
Super-absorbent Crystals (use some of the hydrated crystals from the previous experiment, or grow some more) • Giant Test Tubes • Holder

You Get It:
Potting soil • Seeds from a fast-starting plant, such as grass seed, radish, or beans

Try It!

1. Use the hydrated Polymer Superabsorbent crystals from Activity #4.

2. Add equal amounts of Polymer Superabsorbent crystals and potting soil until the Giant Test Tube is about ¼ full.
   The potting soil and polymer crystals should be well mixed.

3. Plant some of the fast-starting plant seeds in the soil/polymer mixture.
   Use the seed packet instructions to determine the depth that the seeds should be planted.

4. Screw the Giant Test Tube jar lid on tightly, place in the Test Tube Holder where it can get enough sunlight, and then........wait. Keep a daily watch on your jar. What do you see? Record the progress and any observations you have in your notebook. This is exactly what people from countries all over the world do during drought conditions to conserve water and save their crops.

Science Secrets
So how can the environmentally safe, super-absorbent polymers help stop drought? They can save irrigation costs and prevent the stress that drought causes to plants. They reduce water consumption up to 80% for lawns, golf courses, vegetable gardens, and even houseplants. When mixed with soil, super-absorbent polymer crystals absorb the moisture and nutrients from the soil and retain excess water for long periods of time, keeping the water near the plants, rather than allowing it to sink into the ground, creep away to lower-lying areas, or be evaporated by extreme temperatures. The roots of plants penetrate the crystal’s membrane, soaking up the nutrients and extra moisture whenever the plant requires it.

Other things to try:
Try growing the same seeds that you planted in the soil/polymer mixture in just plain soil and compare the growth at 2-day intervals for 1 to 2 weeks. Record your findings in your notebook. Growing a polymer plant makes a great science fair project!

Will the fast-starting seeds grow in a cup of polymer crystals without soil? Try it and see!
Activity #41 Tornado In A Bottle

From The Kit:
Twister Tube™

You Get It:
Water • Notebook • Pencil • Timer (optional) • 2 empty 1 liter soda bottles

Try It!

1. Make your first vortex using the two plastic bottles. Fill one bottle 2/3 full with water and screw on the Twister Tube™, just as you would a plastic cap.
2. Attach the second bottle to the other end of the Twister Tube™. Make sure that the bottles are screwed securely to the tube so the water won’t leak out.
3. Place the connected bottles on a flat surface with the empty bottle on the bottom and the bottle with water on the top. What happens? Nothing for a minute? Read on and you’ll find out why.
4. Hold the end of the top bottle and swirl it in a circular motion. The motion of the bottles will cause the water to rotate until a vortex develops. It’s a tornado in a bottle!

Stormy Science Secrets
As the force of gravity acts on the water in the upper bottle, the water easily flows through the hole in the Twister Tube™. Notice that the water avoids the center of the vortex and that the air from the bottom bottle is able to flow upward through the vortex into the top bottle.

Why didn’t the water flow into the bottom bottle when you first set up the tornado? Here’s why: Even though the lower bottle appears empty, it’s really filled with air. Since air occupies all the space in the lower bottle, the water cannot flow from the top bottle into the bottom bottle unless the air gets out of the way. Air takes up space! Squeezing the upper bottle helps a little, as it increases the pressure in the upper bottle, sending some of the water down to the lower bottle. Letting go creates a difference in pressure again, and you get a glug glug sound as some air shoots to the top bottle. When the pressure is equal again, the water and air stop flowing. The action of swirling the water in the bottle causes a vortex (your tornado) to form. The swirling vortex forms a tunnel in the center of the bottle, causing air molecules to rush straight through from the bottom bottle to the top, while at the same time water flows to the bottom bottle along the edges.

Follow-up Questions:
What stops the water from flowing to the bottom bottle? (Air! It takes up space and creates enough pressure that the water is stuck until you do something to move the air.)

Activity #42 Other Things to Try

Change the size: Try using larger bottles and see if the twister tube still works. 2 liter soda bottles fit well with the twister tube, and can hold a lot of water.

Change the amount of water: Put more or less water in the top bottle. Does it affect the twister?

Color the water: Use food coloring to make a colorful cyclone.

Make a Glitter Twister: Sprinkle a little colored glitter in the water to make a vortex that is bespangled by twinkling sparkles. Don’t limit your creativity to glitter alone. You will find a large variety of brightly colored confetti and mylar sprinkles at your local craft or hobby store.

Make a Bubbling Twister: Try adding a few drops of dish detergent to the water in the soda bottles and watch as a bubbling twister appears. See how water and air exchange places in the bottles.

Can the water whirl both ways?: Try it and see. First swirl the bottle in a clockwise, then counter clockwise direction. What did you find out?

The Power of Air Weather Wonder: Wind
Air is strong enough to hold up airplanes and push boats forward, but is light enough to gently allow birds to fly. It cools your house in the summer, allows you to smell flowers in the spring, and makes your kite soar. Air can also trigger avalanches, topple trees, and knock down buildings. Air is one of the most important elements of stormy weather. What makes it so powerful? Air has some secret qualities that may make you laugh because they are so simple, but these simple properties give air its awesome power.
Its secret qualities are: Air occupies space • Air has weight • Air can exert pressure
Activity #43 Tsunami At Home

Sometimes an early tsunami warning can come from animals. Animals may be able to sense “Rayleigh waves” which are associated with earthquakes and other seismic energy. They may also just be able to hear an approaching wave. Whatever the reason, there have been many instances of animals suddenly moving inland, and toward higher ground before a tsunami strikes.

From The Kit:
Pipette

You Get It:
Large bowl or pan • water

Try It!
Before you begin: Have your adult assistant help you find a good place to do this experiment. Just like in a real tsunami, there may be some splashing water!

1. Fill the large bowl or pan with water, and set it in a place that won’t be damaged by some splashing water. Ask your adult assistant for help if needed.

2. Pinch the pipette bulb, lower the tip of the pipette into the water, and slowly release the pressure on the pipette bulb to make the pipette fill part way with water.

3. Wait until the surface of the water has become still again. You will be watching what happens to the surface of the water when you use the pipette to allow a single drop of water to fall into the bowl. You will need to look quickly—it will happen fast.

4. Hold the pipette over the center of the bowl and gently squeeze the bulb to release one drop of water. What happens to the surface of the water when the drop hits it?

Stormy Science Secrets
Did you see circular ripples of water move quickly from the center of the bowl to the outside? The same thing happens during a tsunami, but on a much, much larger scale. Water moves away from the source of the disturbance in all directions. The strength of a tsunami depends on how much water was disturbed, and how close the disruption was to land. The Indian Ocean tsunami of 2004 was caused by the second greatest earthquake in recorded history (9.0 on the Richter’s scale) and was the deadliest tsunami that has ever been recorded. As a result of this tsunami (the initial wave was 108 feet high!) different organizations around the world have called for a tsunami monitoring system. Scientists are working on ways to better predict tsunamis before they hit land. Maybe when you grow up you’ll invent the best form of tsunami prediction yet!

Activity #44 Be A Chemical Detective

It all starts with a chemical reaction. You can usually spot a chemical reaction when you see a liquid bubble, change color, change temperature or if a new substance is created (that’s called a precipitate) when two or more substances are mixed together.

You’re about to learn how scientists organize substances into groups called acids and bases. Think of acids and bases as opposites - acids and bases are on opposite sides of a teeter-totter. Scientists can tell if a substance is an acid or a base by means of an indicator. An indicator is typically a chemical that changes color if it comes in contact with an acid or a base.

Making your Own Indicator

Did you know you can make your own pH Indicator from something you find in the produce section of the grocery store? Well, you can. The vegetable you need in order to make your own indicator is something as familiar as Red Cabbage! Yes, you can use red cabbage leaves to make your own indicator. This is how it’s done:

1. Pick out a nice firm small red cabbage and take it home. (Be sure to pay for it!)

2. Have your adult helper cut the red cabbage into about 4 pieces.

3. CAREFULLY, again using the adult helper, put one of the pieces of red cabbage into a small pot filled with water and put the lid on it.
4. Put the pot on the stove and turn on the heat. Watch for the water in the pot to boil and when it does, turn the heat down to Low and let it simmer for about 15 minutes.

5. Take the pan off the stove and let everything cool for about 30 minutes.

6. Now look at the water in the pot. What color is it? It’s a purple color and will now have some special properties that it didn’t have before. It is now an indicator called Red Cabbage Indicator.

**Activity #45 Test For A Liquid Acid**
The Red Cabbage Indicator will change color depending on whether a substance it mixes with is an acid or a base. To test your Red Cabbage Indicator, pour some into one of the Giant Test Tubes (fill it about ½ full). Then find some orange juice from the refrigerator and using the pipette from the kit, fill the pipette with orange juice and then squeeze it into the Giant Test Tube with the Red Cabbage Indicator in it. What happens? The color changes because the orange juice is slightly acid and makes the indicator change colors.

**Activity #46 Test For A Liquid Base**
Now do the same thing to test for a base. Put some of the Red Cabbage Indicator into another Giant Test Tube (1/2 full). Make a soap solution of one squirt of dishwashing soap into ¼ C. water. Stir it up. Now fill another pipette with the soap solution and squirt it into the Red Cabbage Indicator. What happens this time? The soap solution is a weak base and makes the indicator change into a different color.

**Activity #47 Magnets**
The best way to get a feeling for magnetism is to gather things around the house you think might be magnetic. Gather smaller metal objects like screws, nuts, nails, keys, rings and coins. Find some copper, brass and aluminum items as well. One at a time, bring them near your ceramic plate. You’ll notice that items containing iron are the most common magnetic materials and that wood, plastic and paper are non-magnetic.

**From the Kit:**
Wire • Magnet

**You Get It:**
D Battery • Nail

An Electromagnet is produced whenever electricity flows through a conductor like copper wire. If the conductor is coiled, the electromagnet’s field is stronger and it gains strength when the coils are wrapped around a magnetic core like iron. But it will only be a temporary magnet, active as long as electricity is flowing.

1. Take the nail and wire

2. Pull out about 3” of the wire and then begin wrapping the remaining wire tightly around the nail from the head to the point always in the same direction. Coil it carefully, leaving almost no spaces between coils. When the wrapping is complete, leave about another 3” at the end.

3. Strip about ¼” off of each end of the wire. The coiled conductor is ready to turn your nail into a magnet. All it needs is flowing current. Attach one end of the wire to the negative (flat) end of the battery using tape to hold it in place.

4. Stand the battery up on the flat end. Hold the other end of the wire against the positive end (with a “button” sticking out) and your electromagnet is operating.

5. You can now test your magnetized nail for strength by trying to use it to pick up a paper clip. Make a “daisy chain” of paper clips and see how many your magnet can hold. Disconnect one of the wires from the battery and watch what happens to the paper clips.
Activity #48 Eating Nails For Breakfast

From the Kit:
Bar magnet

You Get It:
Heavy duty sandwich size zip lock bag • 1/2 cup Total® cereal

Place a good-sized handful of iron-containing cereal, like Total®, into a strong, re-closable plastic bag, and crush up all the flakes. Transfer the crushed flakes to the second bag, add enough water to make a cereal "soup," and seal the bag. Let it sit for a few minutes. It should look like the soggy cereal you leave behind in your breakfast bowl. Hold the bag with the soggy cereal in one hand and move your magnet slowly back and forth across the part of the bag where the most cereal is. It may take you a few minutes to get it just right. Can you see what's following behind the magnet -- tiny iron filings! This is the government recommended amount of iron we should have in our daily diet! You're really eating iron for breakfast!

Activity #49 Separating Particles

In a sealable sandwich baggie, add a teaspoon of salt, and about the same amount of iron filings from your kit. Seal it tight and shake to mix together. Then take out your ceramic magnet and see if you can separate magnetic from non-magnetic materials. You can use any safe granular substance like cornstarch, sugar or even sand in place of the salt. Doctors sometimes use this concept with powerful magnets to remove tiny metal chards that have gotten into a worker's eye. Important: always keep your iron filings in a vial, baggy or covered Petri dish, so you can keep the surface of your magnet clean. Once these pesky filings get on, they are hard to pull off!

Activity #50 Tiny Magnet Arrows

By now you have noticed that whenever the iron filings come near a magnet, they like to line up in certain ways. Put a piece of white paper under your sealed baggy of iron filings. Move the magnet under the paper and see if you can see the circular patterns being formed by these little pieces of magnetic material.

This shows you the force lines of a magnetic field. Look at the arc of compasses below, and notice the changing direction of the magnetic field from one end of your ceramic bar magnet to the other (see Figure 1). The orientation of each of these tiny slivers of iron acts almost like thousands of little arrows, launched from thousands of tiny archers all shooting in the same direction.

Figure 1
Activity #51 Straw Glider

For the Straw Glider, you will need the enclosed Straw Glider template and a drinking straw.

1. Start by cutting out the two pieces from your paper
2. Form two rings by taping the ends of the paper together.
3. Tape one paper ring to each side of your straw. To launch your Straw Glider, gently throw with the little ring forward. It will glide for quite a distance!

Activity #52 Making A Ballon Rocket

For the Ballon Rocket, you will need the enclosed balloon. You will also need a drinking straw, a long piece of string, yarn or fishing line.

1. Start by tying one end of your string to something solid (a stair rail, door knob, chair, or table leg).
2. Feed the other end of the string through the straw. Then pull the string tight and tie it off on a chair.
3. Blow up your balloon, but don’t tie it.
4. While pinching off the end of the balloon, tape the balloon to the straw.

To launch your Balloon Rocket, let go of the end of the balloon. It should shoot across the string. If it doesn’t, you may have put the balloon on backwards. Try again!

Activity #53 Why You May Hate Vegetables

Can YOU Taste It?
This is a totally cool activity, because it relates to what we inherit in our genes. It turns out that some people can instantly taste the bitterness of a substance called PTC, while others cannot taste it at all.

First, test yourself. Cut out a small strip of regular, white coffee filter paper and put it on your tongue. Keep it in your mouth for about five seconds. This lets you learn what paper alone tastes like.

Now rinse out your mouth or take a small drink of water to clear out any after taste. Take out your packet of PTC strips. Cut one of the PTC strips in half and put it on the top of your tongue, again wet with saliva. If you have the PTC gene, you will know it right away! If not, you’ll soon want to find someone who does taste it.

You can choose to test one person at a time, but you’ll have the most fun by gathering several family members (or friends) together so everybody can watch which ones sense the icky bitter taste, while others wonder what all the fuss is about. Actually, some will find PTC intensely bitter, others just somewhat bitter, while others will taste nothing.

Explain to them that worldwide, the ability to taste PTC is present in about 70% of humans – though nearly 100% of Native Americans are able to taste it. You are much more likely to find PTC bitter if other members of your family also find it bitter. In fact, the genetic correlation in the past was so strong that it was used in paternity tests before we had DNA matching.

Some scientists have found that people who find PTC super bitter also find the taste of cigarettes bitter, meaning strong tasters could be less likely to smoke. Maybe having the PTC gene will even give us an excuse to tell our parents that broccoli is just too bitter to eat!
Activity #4 Growing Clear Crystals

1. Open the bag of superabsorbent crystals and fill one blue scoop with crystals. Pour into one 2oz. cup and fill the cup with water.
2. Set the mixing tray aside for about an hour or overnight.
3. After at least an hour, check out your crystals. What do you see? How have the crystals changed? Go ahead and touch them. How do they feel?
4. While you let the crystals soak, look at a couple of crystals that are left over. What do they look like? How do they feel?

Activity #5 Jelly Crystals

1. Once you've filled your mixing tray wells with colors that you love, add a pinch of superabsorbent crystals (5-8 crystals) to each well.
2. Put a few of your newly grown crystals on a paper plate and let them sit there for a few days. What happens? The crystals shrink back to their original size! That's right! You can use them again and again! Just add water to make them grow again. Did the color stay inside?
3. Try growing grass, radishes, or whatever you desire to learn how plants develop and the roots search for water and nutrients.
4. The swirling motion of the soap and water will make a twisting, turning vortex. It's your very own pet tornado!
5. The crystals “drink” (soak up) water and hold it inside. The polymers that make up jelly crystals belong to a class of molecules called hydrogels. Because they are like nets, water can sneak inside through the holes.
6. The crystals soak up all of the colored water, and turn into big, squishy jelly blobs that are the same colors as the solutions you made!
7. Seal with a cap and watch the Styrofoam beads jockey for position in the bottle.
8. Use the test tube to hide a secret message or as a way to store information that will be opened some time in the future.

Activity #6 Sands of Time

1. Fill the test tube 3/4 full with sand and place a marble on top of the sand. Seal the tube and try to find a way to move the marble from one end of the bottle to the other as quickly as possible. Make two or three and challenge your friends.
2. Place a few of your newly grown crystals on a paper plate and let them sit there for a few days. What happens? The crystals shrink back to their original size! That's right! You can use them again and again! Just add water to make them grow again. Did the color stay inside?
3. Try growing grass, radishes, or whatever you desire to learn how plants develop and the roots search for water and nutrients.
4. The swirling motion of the soap and water will make a twisting, turning vortex. It's your very own pet tornado!
5. The crystals “drink” (soak up) water and hold it inside. The polymers that make up jelly crystals belong to a class of molecules called hydrogels. Because they are like nets, water can sneak inside through the holes.
6. The crystals soak up all of the colored water, and turn into big, squishy jelly blobs that are the same colors as the solutions you made!
7. Seal with a cap and watch the Styrofoam beads jockey for position in the bottle.
8. Use the test tube to hide a secret message or as a way to store information that will be opened some time in the future.

Activity #7 Time Capsule

1. Fill the test tube 3/4 full with water and add a few drops of liquid soap. Seal the bottle with a cap and start twisting.
2. The swirling motion of the soap and water will make a twisting, turning vortex. It’s your very own pet tornado!
3. The crystals “drink” (soak up) water and hold it inside. The polymers that make up jelly crystals belong to a class of molecules called hydrogels. Because they are like nets, water can sneak inside through the holes.
4. The crystals soak up all of the colored water, and turn into big, squishy jelly blobs that are the same colors as the solutions you made!
5. Seal with a cap and watch the Styrofoam beads jockey for position in the bottle.
6. Use the test tube to hide a secret message or as a way to store information that will be opened some time in the future.

Activity #8 Dancing Beads

1. Fill the test tube 3/4 full with sand and place a marble on top of the sand. Seal the tube and try to find a way to move the marble from one end of the bottle to the other as quickly as possible. Make two or three and challenge your friends.
2. Place a few of your newly grown crystals on a paper plate and let them sit there for a few days. What happens? The crystals shrink back to their original size! That's right! You can use them again and again! Just add water to make them grow again. Did the color stay inside?
3. Try growing grass, radishes, or whatever you desire to learn how plants develop and the roots search for water and nutrients.
4. The swirling motion of the soap and water will make a twisting, turning vortex. It’s your very own pet tornado!
5. The crystals “drink” (soak up) water and hold it inside. The polymers that make up jelly crystals belong to a class of molecules called hydrogels. Because they are like nets, water can sneak inside through the holes.
6. The crystals soak up all of the colored water, and turn into big, squishy jelly blobs that are the same colors as the solutions you made!
7. Seal with a cap and watch the Styrofoam beads jockey for position in the bottle.
8. Use the test tube to hide a secret message or as a way to store information that will be opened some time in the future.

Activity #9 The Marble Challenge

1. Fill the test tube 3/4 full with sand and place a marble on top of the sand. Seal the tube and try to find a way to move the marble from one end of the bottle to the other as quickly as possible. Make two or three and challenge your friends.
2. Place a few of your newly grown crystals on a paper plate and let them sit there for a few days. What happens? The crystals shrink back to their original size! That's right! You can use them again and again! Just add water to make them grow again. Did the color stay inside?
3. Try growing grass, radishes, or whatever you desire to learn how plants develop and the roots search for water and nutrients.
4. The swirling motion of the soap and water will make a twisting, turning vortex. It’s your very own pet tornado!
5. The crystals “drink” (soak up) water and hold it inside. The polymers that make up jelly crystals belong to a class of molecules called hydrogels. Because they are like nets, water can sneak inside through the holes.
6. The crystals soak up all of the colored water, and turn into big, squishy jelly blobs that are the same colors as the solutions you made!
7. Seal with a cap and watch the Styrofoam beads jockey for position in the bottle.
8. Use the test tube to hide a secret message or as a way to store information that will be opened some time in the future.
Activity #62 Flower Holder
Fill the test tube half full with water and use it as a flower vase. (It will stand up if you put it into the lid.)

Activity #63 Rain Gauge
Use a permanent pen and a ruler to mark off half inch increments on the test tube. Put the tube in an open area outdoor to collect and measure rainfall.

Activity #64 Message in a Bottle
Place a message in the test tube and seal it with a cap to make it water tight. Float the message in a bottle to a friend... across the pool!

Activity #65 Pop Goes The Weasel
Find a cork that fits snugly in to the opening of the test tube. Fill the bottle 1/4 full with water. Divide an Alka-Seltzer tablet into quarters and drop one section into the tube. Quickly seal the test tube with the cork and point the corked end away from anything living. Pow! The cork goes sailing.

Activity #66 Travel Containers
Fill the test tubes with your favorite soap, shampoo, conditioner, hair gel, hand lotion, sun screen, or whatever else makes you happy for your next vacation.

Activity #67 Glitter Wand
Fill the test tube 3/4 with cooking oil and add an assortment of colored beads, glitter, and Mylar confetti. Top the tube off with cooking oil and seal with a cap. Tip the tube back and forth to make your glitter wand sparkle.

Activity #68 Magnifying Glass
Fill the test tube to the very top with water and seal it with a cap. Hold the test tube up against newspaper print to magnify the letters. The water magnifies the message.

Activity #69 Rhythm Tube
Fill the test tube with an assortment of beads, pebbles, nuts, bolts... you name it. Seal with a cap and start shaking. Experiment with different materials as each will make its own unique sound.

Activity #70 Color Mixing With Your Eyes
Fill three test tubes almost to the top with water. Add two drops of blue food coloring to one test tube and seal it with a cap. Do the same thing with the other two using yellow and red food coloring. Hold each test tube up to your eyes near the light to observe the color. Now, cross the yellow and blue tubes in front of your eyes, looking through both of them at the same time. What color do you see? Green! Cross the red and blue tubes in a similar fashion to make purple. What color does red and yellow make?
Activity #1 Fizzing Colors

It seems like magic, but it's better than that - it's SCIENCE!

Use chemistry to make water bubble, fizz, and change color, and make a tablet disappear.

Before you begin: True Colors are tub-safe, skin-safe color tablets. However, with high concentrations, they can stain skin and fabric.

Since this experiment involves water as well as color, it is important to find a place to do the experiment where it is OK to make a mess, because, hey - messes are fun!

From the kit:

3 test tubes with lids • Test tube rack • True Color coloring tablets

You Get It:

Water • Notebook and pencils so you can draw or write about your discoveries!

Try It!

1. Work with your adult lab assistant to find a safe place to set up your color laboratory. You'll want to find a place where it's OK to spill a little.

2. Fill some cups with water and set them aside for a moment.

3. Open the package of True Colors coloring tablets. There are three colors: blue, yellow, and red.

4. Fill each test tube about ¾ full with water, and set them in your test tube rack.

5. Put a blue tablet in one test tube, a red tablet in the second test tube, and a yellow tablet in the third. Screw the lids on tightly so the water doesn't leak out. What happens? The tablets fizz, bubble, move around, and change the color of the water as they disappear! Leave the colored water in the test tubes for your next experiment.

How does it work?

Your color tablets dissolved. That means that the water pulled them into tiny, tiny pieces and surrounded each little piece so that you can't see them. Even though you can't see them any more, you know the pieces of the tablet are still there. How do you know that? Because the water changed color! Scientists would say that you "dissolved the tablet" or "made a color solution." You have probably made solutions before. Have you every stirred lemonade powder into water? You made a "solution of lemonade!" Wow! You are amazing! Don't let your adult assistant drink your solutions, though. Remind them that good scientists like you NEVER eat their experiments.

But why does it fizz?

When you put the tablets in water, you created a "chemical reaction." That means that you made two things turn into two different things. Although it sounds like you did magic, you actually did something cooler than that—you did chemistry! In this case, you used water to change sodium bicarbonate (baking soda) and citric acid (found in citrus fruits and used in cooking) into salts and carbon dioxide. Carbon dioxide is in the air all around you. In fact, it is what you exhale when you breathe. That's right—you make a chemical reaction with every breath—you are amazing! Since you are making "air" (scientists would say you were making a "gas") under water, it makes bubbles, which wiggle to the top of the water and escape into the air.

Type of Science: PHYSICAL Area of Science: CHEMISTRY Skills: MEASURE, OBSERVE

Activity #2 Cross-eyed Colors

Mix the colored solutions that you made in the last experiment without opening the lids. How? Get ready for something really cool!

From The Kit:

The three test tubes with the colored water you made in the last experiment.

You Get it:

Rubber band

Try It!

1. Make sure that the lids are screwed on tightly so that the colored water does not accidentally leak.

2. Hold the blue water test tube up to your eyes and look at the light (or look out of a window if the sun is shining). What do you see?

3. Now hold the yellow water test tube up to your eyes and look at the light.

4. Now for a little color mixing! Put the yellow and blue test tubes together in the shape of an "X" and hod them up to your eyes. Look at the light. What color do you see? Wow! Write down your discovery in your notebook. If you need help, have your adult assistant write down the name of your color (or draw it with colored pencils or crayons) that you see when you mix yellow and blue.

NOTES:
Fasten your seat belts! Hold on to your hats! Get ready for a wild romp through the mysteries and wonders of SCIENCE!

That's right—SCIENCE! That boring stuff you learn in school. But this is science that is messy, hands-on, fun and really INTERESTING.

In this kit you will learn about the three different types of science (Life Science, Physical Science and Earth Science), you will experiment with activities in various areas of science (Chemistry, Physics, Geology, Magnets, Biology, etc.) and you will learn to use various scientific tools such as Test Tubes, Pipettes, a Magnifying Glass and Petri Dishes. Finally, you will learn basic science skills such as Measuring, Observing, Classifying and others.

Each of the more than 70 activities will be marked by its Type of Science, Area of Science and Science Skill. This kit is great for Science Fair Projects, Science Birthday Parties, School Classes, Science Camps and Rainy Day Activities. Guaranteed hours of fun. Let's get started!

From The Kit:

- Item #4120 Ages 8 and up
- Big Bag Of Science

• Insta-Snow® Powder
• Water Gel™
• Gravity Goo™ Powder
• Garbled Marbles
• Superabsorbent Cubes (Jiggly Jewels)
• True Colors™ Tablets
• pH Indicator (small yellow strips)
• 2 oz Plastic Cups
• Color Changing Paper (1/2 sheet goldenrod paper)
• Non-Newtonian Powder / Quicksand Powder (Corn Starch)
• Superabsorbent Crystals
• Worm Goo
• Worm Activator (Calcium Chloride)
• Energy Beads and Yarn
• Geyser Tube™
• Twister Tube
• Magnifying Glass
• Petri Dish
• Yellow Plastic Loop
• Hex Nut
• Coated Wire
• Iron Filings
• Balloon
• PTC strips
• Straw Glider Template
• Bar Magnet
• Instruction Book
• Large Plastic Storage Bag
• Two Giant Test Tubes with Lids and Holder
• Three Large Test Tubes with Lids and Holder
• White Compartment Mixing Tray
• Color Wheel
• Shaker Cup with Lid
• Blue Measuring Scoop
• Pipette

• Can of soda, any kind
• Seeds of grass, beans, radishes or any fast growing plant
• Potting Soil (1/2 C)
• Timer
• D Battery
• 1 cup Total Cereal (or any kind claiming to have 80% of minimum daily iron requirement)
• Heavy duty zip lock bag, small size
• Salt & Rock Salt (or Kosher salt, Sea Salt)
• Mixing Tray
• Vinegar
• Rubber Band
• Spoon
• Ruler
• Sunscreen
• Sun Glasses
• Egg, one raw and one hard-boiled
• Soda Pop—any kind
• Macaroni or Raisins
• Mentos® Candy roll
• 2 liter bottle of DIET soda
• Straw
• Notebook for writing down observations
• Water
• Paper Towels
• Various Plastic Cups
• 2 one liter plastic bottles, empty
• String
• Opaque Cup
• Small object to bury in quicksand (plastic animal, round ball, etc.)
• Large Bowl
• Glass Cleaner, any brand
• Red Cabbage
• Nail

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