Spooky Science

Steve Spangler's Favorite Halloween Experiments

Written by Steve Spangler

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Halloween is a great time to teach science

I'm not sure if Halloween was better for me as a kid or right now as an adult... but it's no secret that I make the most out of every Halloween. I never remember my parents being invited to an "adult" Halloween party, but now these parties are more popular than ever. When my family and I arrived at a neighbor's Halloween party last year, we were greeted by ghosts and goblins on the driveway who led us through an awesome haunted house on our way into the house. The whole garage had been transformed into a full-blown haunted mansion! Yes, Halloween has changed over the years and this is part of the inspiration behind the experiments in this guide.

As a teacher, I could hardly wait for the first of October to roll around so I could start planning my Halloween Science demos and activities for my students. Every year my Halloween Science unit grew... and so did the storage space I needed to keep everything. It didn't take long to get my fellow teachers hooked on the idea of using this "crazy" time of the year to actually teach some cool science. Every year my fellow teachers and I would add new demos and activities until we were bursting at the seams with a great Halloween Science unit.

These Halloween science activities are teacher-created, kid-tested and guaranteed to produce a room filled with ooohs & ahhhs!

One word of warning... kids have been known to have fun and actually learn something very cool about science while doing these activities. Don't be surprised if your group of ghosts and goblins want to take the stuff home for their own Halloween parties. See what happens when you make learning fun? Happy Halloween!

Steve Spangler

Dictionary of Glowing Things

Luminescence

Luminescence is a general term that describes the process that causes light to shine from a material. Things that "luminesce" usually do so without needing or producing heat, though they may need some sort of material to help activate the process. You might think of luminescence as "self-generated" light.

Fluorescence

This type of luminescence occurs when some form of radiation, such as black (UV) light, causes an object to glow. For example, fluorescent papers and poster boards glow in the daylight. They may seem to glow even brighter under black light (ultraviolet), but in either case, as soon as the light is removed, the glow stops. Fluorescent things do not glow in the dark all by themselves—they require some other form of energy such as ultraviolet light to activate or "excite" them.

Phosphors

A phosphor is a material that gives off visible light when exposed to radiation, like a beam of electrons or ultraviolet light. Fluorescent colors are phosphors—they absorb invisible ultraviolet light and emit visible light in the form of colors you can see.

Phosphorescence

Phosphorescence is just like fluorescence, except that the glow continues even after the light used to activate it is removed. "Phosphorescent" objects glow for a while after having been exposed to black light and continue to glow even after the black light is removed. They are often labeled as glow-in-the-dark materials or products.

Trimboluminescence

In a two-part process, light is produced when objects (such as rocks or sugar crystals) are broken, scratched, or pulled apart. You'll find out more about triboluminescence a little later, when you crack your own Wint-O-Green Lifesaver™ between your teeth!

Black Light Basics

Ultraviolet light is an invisible, natural component of the sun's light, but can also be produced artificially, as it is in the portable black light in your kit. Ultraviolet light is invisible in daylight but can be detected by the fluorescence it creates in certain materials when the lights go off. The particular long wavelength of "black" light causes materials with fluorescent pigments to light up with an awesome glow.

Dictionary of Glowing Things

Black Light Basics

Ultraviolet light generally refers to electromagnetic radiation with wavelengths in the range of 10 to 400 nanometers (nm). This is subdivided into these categories...

- UV-A = 315 to 400 nanometers (nm)
- 315 to 345 nm = used for sun tanning
- 345 to 400 nm = used for "Black light" effects
- UV-B = 280 to 315 nm. Hazardous! Largely responsible for sunburn
- UV-C = 200 to 280 nm. Dangerous! Used to kill germs Vacuum Ultraviolet - 10 to 200 nm

Ensure Correct Wavelength of UV

Never shine the black light (or any light) in your eyes or anyone else's! Shortwave light is harmful to the eyes, but since portable UV lights emit long waves, there is no harm in using the light as directed in this kit.

UV-A is needed by humans for synthesis of vitamin D; however, overexposure to UV-A has been associated with toughening of the skin, suppression of the immune system, and cataract formation.

The photochemical effects of UV radiation can be exacerbated by chemical agents including birth control pills, tetracycline, sulphathizole, cyclamates, antidepressants, coal tar distillates found in antidandruff shampoos, lime oil, and some cosmetics. Protection from UV is provided by clothing, polycarbonate, glass, acrylics, and plastic diffusers used in office lighting. Sunscreen lotions offer limited protection against UV exposure.

Beware of High-Intensity Sources

Make sure that any UV sources used for your activities fall into UV-A, preferably 345 to 400 nm. Lamps sold for entertainment purposes probably fall into this safe area. They should be specifically marked "black light."

The place to watch out is with oddball surplus equipment that might have been designed with germicidal or other purposes in mind!

Avoid UV lamps designed for rock-hunting; many minerals fluoresce under short-wave UV, and rock lamps are designed accordingly (some are interchangeable between long and short wave).

Never use unknown or suspect UV lamps for entertainment.

Even if your light source is safe, play it safe: limit exposure and point the light at your effects, not your patrons!

If you have actors in a scene illuminated with black light, consider giving them sunglasses with UV protection. I'm sure you can figure out a way to work them into the scene... a vampire wearing sunglasses sounds reasonable to me.

Awesome Dry Ice Experiments

Dry Ice

Grocery stores use dry ice to keep food cold during shipping. Some grocery stores and ice cream shops will sell dry ice to the public (especially around Halloween) for approximately $1 per pound. It's a good idea to take a beverage cooler with you along with a pair of gloves to protect your hands. If you are planning to perform a number of dry ice demonstrations, plan to purchase 5 to 10 pounds.

First of all, here's the background information and safety lesson on dry ice. Dry ice is frozen carbon dioxide. Instead of melting like real ice, dry ice turns directly into carbon dioxide gas. Dry ice must be handled with care as it is -110°F (-78°C). It must be handled using gloves or tongs, as it will cause severe burns if it comes in contact with your skin. Never put dry ice into your mouth. When you drop a piece of dry ice in a bucket of water, the gas that you see is a combination of carbon dioxide and water vapor. So, the gas that you see is actually a cloud of tiny water droplets.

Burping, Bubbling, Smoking Water

Use the tongs or gloves to place a piece of dry ice in a glass of warm water. Immediately, the dry ice will turn into carbon dioxide gas and water vapor, forming a really cool cloud! This cloud is perfectly safe for the children to touch and feel as long as they do not put their fingers far enough down into the water to accidentally touch the dry ice.

To create the best effect, be sure to use warm water. Over time, the dry ice will make the water cold and the "smoking" will slow down. Replace the cold water with warm water and you're back in business!

Floating Bubble

You'll notice that when you add dry ice to water, the cloud of carbon dioxide and water does not go up into the air, but instead falls towards the ground. Why? This cloud-like mixture of carbon dioxide and water is heavier than the surrounding air. You'll use this little piece of science trivia to perform the amazing Floating Bubble trick.

A small fish aquarium works well for this activity. Fill the bottom of the aquarium about an inch deep with warm water. Use gloves or the tongs to add a few pieces of dry ice. Of course, the dry ice will begin to smoke, turning into carbon dioxide and water vapor.

Using a bubble wand and a bottle of bubble fluid, blow a few bubbles into the aquarium (it's a little difficult so be patient). To everyone's amazement, a few bubbles will appear to float in mid-air in the aquarium. The bubble is really just floating on a cushion of invisible carbon dioxide gas. Of course, the spooky Halloween story is up to you, but I'm almost certain that the aquarium is the home of a ghost who has been known to play with soap bubbles!

Awesome Dry Ice Experiments

Disappearing Ice

Here's a quick experiment to help children better understand why it's called dry ice. Ask the children, "Why do you think they call this dry ice?" Place a regular ice cube on one plate and a similar sized piece of dry ice on a second plate. Keep both plates out of the reach of the children. "Let's try to guess what is going to happen to the ice cube and the piece of dry ice if we leave it on the plate for one hour." Of course, the children are likely to tell you that both pieces of ice will melt, turning into a puddle of water.

Allow the children to view the plates after one hour and to discover the difference between real ice and dry ice. There should be a puddle of water on the plate where the real ice was, but the dry ice plate will be "dry." Where did the dry ice go? Dry ice is not made from water, it's made from some of the air that we breathe... it's frozen carbon dioxide. The dry ice turns into invisible carbon dioxide gas that disappears into the air. Magic!

Oooh Ahhh Awesome Bubbles

Who would have guessed that you could have this much fun with soapy water and a chunk of dry ice? Fill a tall glass or plastic cylinder with warm water and add a squirt of liquid dish soap like Dawn or Joy. Use gloves or the tongs to place a piece of dry ice into the soapy water. Get ready for a room full of ooohs & ahhhs!

Instead of the dry ice just bubbling in the water to make a cloud, the soap in the water traps the carbon dioxide and water vapor in the form of a bubble. The children will see the bubbles climb out of the cylinder of warm, soapy water and explode with a burst of "smoke" as they crawl over the edge.

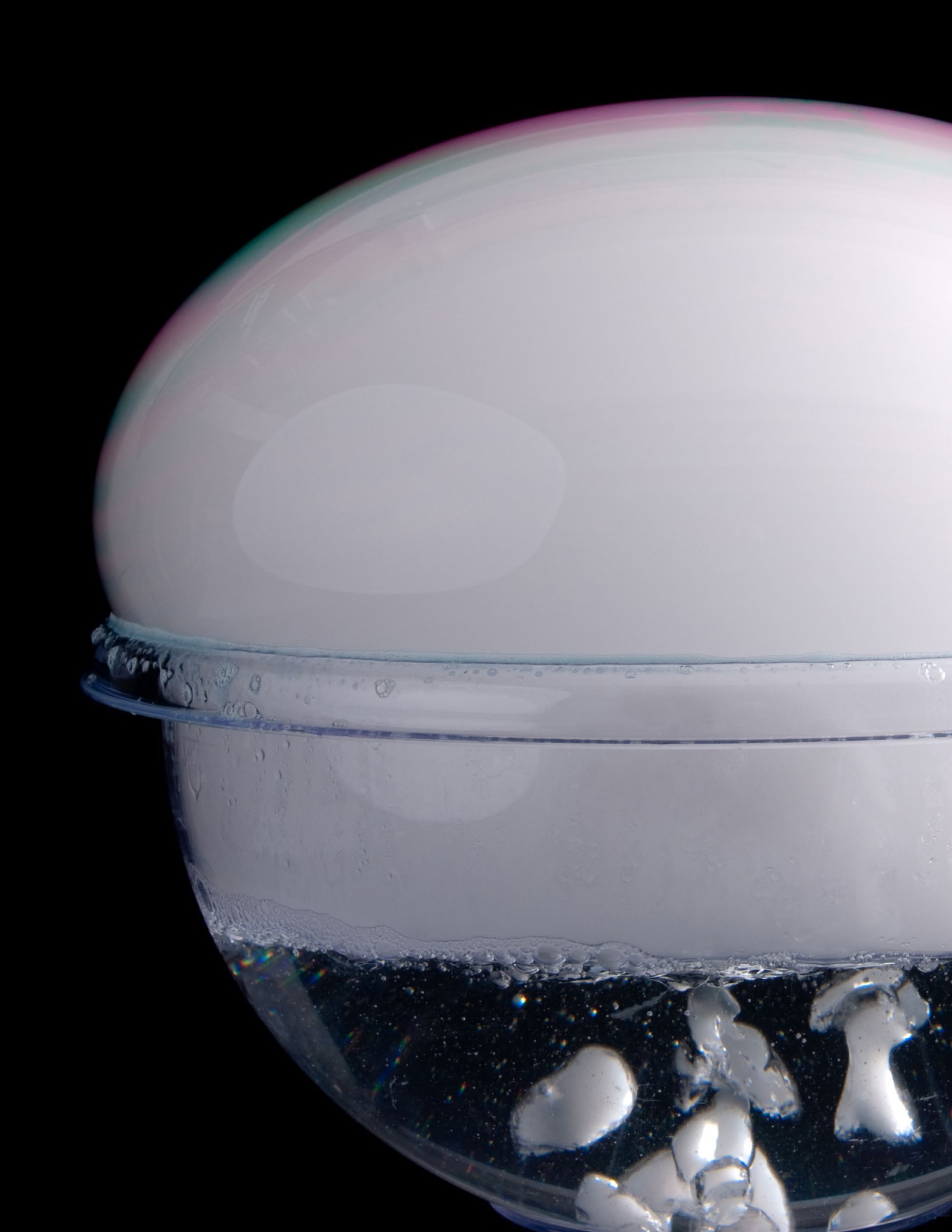
Add some food coloring to the water to make the demonstration more colorful. If you want to give the exploding suds an eerie glow, drop a glowing light stick into the water along with the dry ice. The light stick will give the bursting bubbles an eerie look.

Try a Spooky, Bubbling Bevarage

The next time you have a craving for a sparkling beverage, make your own batch using what you know about dry ice. Fill a bowl or pitcher with apple juice and use gloves or tongs to add a few large pieces of dry ice. While the mixture is bubbling and burping, the apple juice is being carbonated by the dry ice. That is, carbon dioxide gas is mixing with the juice to make a "sparkling" drink. Your local hobby or craft store is sure to have a spooky looking Halloween cauldron that would hold a large batch of apple juice and dry ice. Wait until the dry ice is completely gone before serving the apple juice. It's a spooky carbonated drink.

DRY ICE

CRYSTAL BALL BUBBLE



Great Halloween Science! It's the world's coolest crystal ball. Create a soap film on the rim of the bucket and you'll have what appears to be a crystal ball filled with a cloud-like mixture of water vapor and carbon dioxide. When the giant bubble bursts, the cloud of "smoke" falls to the floor followed by an outburst of ooohs & ahhhs from your audience!

Experiment

Dry Ice Crystal Ball Bubble

What You Need

Large Bucket With a Smooth Rim
Solution of Dish Soap and Water
18" Piece of Cloth
Gloves
Safety Glasses
Dry Ice

Dry Ice

Grocery stores use dry ice to keep food cold during shipping. Some grocery stores and ice cream shops will sell dry ice to the public (especially around Halloween) for approximately $1 per pound. It's a good idea to take a beverage cooler with you along with a pair of gloves to protect your hands. If you are planning to perform a number of dry ice demonstrations, plan to purchase 5 to 10 pounds.

Try It!

1. Select a bucket or container that has a smooth rim and is smaller than 12 inches in diameter.

2. Cut a strip of cloth about 1 inch wide and 18 inches long. An old t-shirt works well. Soak the cloth in a solution of Dawn dish soap or use your favorite recipe for making bubble solution. Make sure that the cloth is completely soaked.

3. Fill the bucket half full with water. Have tongs or gloves ready to transfer the dry ice to the bucket.

4. Place two or three pieces of dry ice into the water so that a good amount of fog is produced.

5. Remove the strip of cloth from the dish soap and carefully pull the strip across the rim. The goal is to create a soap film that covers the top. It also helps to have the rim wet before you start. This may take some practice until you get the technique mastered. Remember that a bubble's worst enemies are dirt, oil, and rough edges. Your patience will pay off in the long run.

Dry Ice Crystal Ball Bubble

Additional Information

If you accidentally get soap in the bucket of water, you'll notice that zillions of bubbles filled with fog will start to emerge from the bucket. This, too, produces a great effect. Place a waterproof flashlight in the bucket along with the dry ice so that the light shines up through the fog. Draw the cloth across the rim to create the soap film lid and turn off the room lights. The crystal bubbles will emit an eerie glow and you'll be able to see the fog churning inside the transparent bubble walls. Take your bows as the class erupts in a chorus of ooohs & ahhhs!

Bob Becker presented this activity during a lecture at the National Hands-on Science Institute (www.nhosi.com) in Denver in 1997. Bob is a chemistry teacher from Kirkwood, Missouri, who constantly searches for new ways to turn students on to the wonders of science.

Notes

Growing Body Parts

Every mad scientist has a large specimen lab jar filled with body parts - a severed hand, a lopped off ear, a big fat nose and a pickled brain - floating in a jar filled with water. The best part of all is that these body parts start off small and get bigger the longer they stay in the water until they reach their maximum size. Each body part starts out about 2 inches in length and grows to human proportions... or a little bigger. Yes, it's the perfect gift for that "special" someone who has everything - give them a "hand," lend them an "ear," get a "brain," and "sniff" out a great idea with this ghoulish Halloween favorite.

Experiment

Growing Body Parts

What You Need

Bag of Growing Body Parts
1-gallon Size Jar
Water
Graph Paper
Sense of Humor

Try It!

1. It's important to gather data as you conduct the experiment in order to make some meaningful conclusions at the end of the experiment - besides growing a jar full of body parts! Start by examining the body parts. One of the easiest ways to take measurements is to place the growing thing on a piece of graph paper and trace around it. Simply count the squares to determine the area and size of the object.

2. Fill the jar with room temperature water. Be careful not to use hot water because it will make the growing thing break up into many tiny pieces. Some people have great results using distilled water (probably because their tap water is so bad!). Most experimenters report that slightly warm water makes the objects grow best and distilled water is a great choice if you have it. Place all of the growing body parts into the water and seal the jar closed.

3. After 24 hours, remove the body parts from the water and carefully dry them off with a paper towel. Take measurements and record your data on your graph paper. It's best to also change the water every day for the first few days.

4. Back to the water they go for another 24 hours. Continue gathering data until the body parts stop growing. How do you know when they're done growing? That's the $64,000 question. We've seen the growing hand get to be the size of an adult hand (or bigger) and the brain grow to the size of a softball, but it really all depends on the water quality and keeping the water at room temperature. Regardless, the body parts should reach their maximum size after 7 days.

5. If the jar is sitting on your desk, be prepared to have to answer lots of questions. When someone says, "What is that?", you can simply respond by saying, "These are the kids that didn't finish their homework last week." Hmmm... I'm sensing a lawsuit on your hands. How about telling them the truth... "It's a jar of growing body parts." Regardless, you'll probably have to schedule a conference with your principal.

Growing Body Parts

How Does it Work?

These growing body parts are made out of two different polymers: a hydrophilic (water-loving) superabsorbent polymer that is responsible for the water absorbing action and a hydrophobic (water-fearing) polymer. The hydrophilic polymer in the object is the superabsorbent, similar to the polymer found in baby diapers (the actual chemical is a little different, but it is a similar superabsorbent polymer). The hydrophobic polymer does not absorb water, but its job is to keep the original shape of the body part when it swells up with water.

Growing Tips and Tricks

Here are a few tips and tricks for growing and keeping your pickled body parts...

- Use distilled water (if the quality of your tap water is poor).
- Make sure the water is at room temperature or slightly warmer. Water that is too hot will cause the body parts to disintegrate.
- Change the water every day for the first few days.
- Make sure your hands are clean when you touch the growing body parts. Dirty hands can cause bacteria to grow in the water.

Disposal

It's safe to throw the body parts away in the trash when you no longer need to stare at creepy body parts in a lab specimen jar.

Notes

Boo

BUBBLES

Bubbles are cool, but bubbles filled with fog are even cooler. Just imagine the cool factor going up tenfold if you could bounce and play with these bubbles. Boo Bubbles are what you get when you fill a bubble with a carbon dioxide cloud using this amazing cloud bubble generator. But we saved the best for last because you'll learn how to roll and bounce the bubbles in your hands. It's the combination of science and performance art!

Experiment

Boo Bubbles

What You Need

Boo Bubble Generator
Pair of Cotton Gloves
9 oz Cup
Dish Soap
Heavy Leather Gloves
Water
Dry Ice

Try This Bubble Receipe

Fill the plastic cup with eight ounces of distilled water. Add 2 tablespoons of the dish soap. Mix the bubble solution gently with a spoon. For crystal-clear bubbles, be sure that you always keep the surface free of foam. For tougher, longer lasting bubbles, you can even add 1 tablespoon glycerin. TIP: Bubble solution improves with age. If you can, leave the mixture in an open container for at least one day before use.

Try It!

1. Fill the bubble generator half full with warm to hot water. Dry ice produces the best fog when you use warm water. NOTE: While warm water is best, DO NOT use BOILING water.

2. Drop a few good sized pieces of dry ice into the jar. Immediately, the fog will roll out of the jar. You'll need some thick gloves to handle the dry ice. The knit gloves used later in the activity do not give enough protection to your hands.

3. Practice covering the top of the jar with the lid to control the flow of fog out of the tube. NOTE: Don't screw the lid onto the jar - just hold it on top of the jar to force more or less fog through the rubber tubing.

4. Fill the plastic cup about three-fourths full with your bubble solution.

5. If the jar is sitting on your desk, be prepared to have to answer lots of questions. When someone says, "What is that?", you can simply respond by saying, "These are the kids that didn't finish their homework last week." Hmmm... I'm sensing a lawsuit on your hands. How about telling them the truth... "It's a jar of growing body parts." Regardless, you'll probably have to schedule a conference with your principal.

6. The attachment on the end of tube has been included because it is a great holder for the bubble solution when making bubbles. However, the piece is easily removable, and you will find that using the raw tubing creates a completely different effect. Try it both ways and discover the kind of bubbles you prefer!

7. When the bubble reaches the perfect size, gently shake it off of the tubing and it will quickly fall to the ground (it's heavier than a normal bubble because the bubble is filled with carbon dioxide gas and water vapor). When the bubble hits the ground, it bursts and the cloud of fog erupts from the bubble. Very cool!

Boo Bubbles

How Does it Work?

Steve Spangler combined the idea of filling bubbles with dry ice fog with his Bouncing Bubble activity to create a Bouncing Boo Bubble. While blowing bubbles indoors, you might have noticed the occasional bubble that fell to the carpet but didn't pop. Regular bubbles burst when they come in contact with just about anything. Why? A bubble's worst enemies are oil and dirt. Boo Bubbles will bounce off of a surface if it is free of oil or dirt particles. That's why we suggest knit gloves in the experiment below.

Safety Considerations

Dry Ice is terrific for awesome experiments and is a great learning tool. However, remember to be a safe scientist and follow these safety tips:

- Never touch the dry ice with your bare hands. Always use heavy-duty gloves, not the provided cotton gloves in this kit.
- Make sure that children DO NOT handle the dry ice. Leave this part for teachers, parents or adult helpers.
- Remember to never put dry ice in your eyes, ears, nose, or mouth.
- Never screw the lid tightly onto the jar. All of that carbon dioxide needs a way out! Otherwise your jar could become explosive.
- The sides of the container may get very cold as the dry ice releases the gas. Please handle the jar carefully as you continue with your experiment.

Make Your Own Touchable Boo Bubbles!

1. Put on the cotton gloves in your kit.

2. Blow a bubble about the size of a baseball. Bounce the bubble off of your gloves. Try bouncing the bubble off of your shirt or pants. As you'll soon see, some fabrics work better than others. Try bouncing bubbles on a hand towel.

3. Wait for the oohs, ahhs, and applause and take your bow. You are a bubble master!

Notes

Slime

THE REAL RECIPE

It's one of our most asked questions... How do you make real slime? Ask any special effects artist about slime and you're sure to hear the term polyvinyl alcohol (PVA). Combined with a Borax solution, this slime is the best in the world, and for whatever reason, you have voluntarily chosen to make slime in your classroom. It's too late to reconsider because you've already told the kids about it and you know how they can be when you don't deliver on the fun science stuff. Don't despair, however, because every step is outlined for you right here. You'll no doubt add quite a few ideas of your own. Slime is an unforgettable experience that lends itself to any classroom and any age student. As you do the "Year End Review" with them and revisit the incredible lessons and stimulating discussions you carefully planned and executed, they'll remember the day the slime was discovered in the principal's office. Game on!

Experiment

Slime - The Real Recipe

What You Need

Polyvinyl Alcohol
Box of Borax Soap
Plastic Cups
Stirring Stick
Measuring Cups and Spoons
Zipper-lock Bag
Paper Towels

Try It!

1. First you have to make the Borax solution. Measure 1 cup of warm water into a large, plastic cup and add a tablespoon of Borax powder to the water. Stir the solution - don't worry if all the powder dissolves. This Borax solution is the secret linking agent that causes the PVA molecules to turn into slime.

2. Measure 2 ounces of PVA into a plastic cup.

3. Add 1 teaspoon of Borax solution and stir. After several minutes of stirring, all of the PVA should be stuck together in one large clump stuck to the stirring stick. It's just that simple.

4. The slime can be stored in the zipper-lock bag for safe keeping. Clean up is easy if you have water and paper towels for slimy hands and for surfaces that have been "accidentally" slimed. When you're finished, you can just throw the slime and materials into the trash. Or, you could toss the slime back into the zipper-lock bag. It's reusable!

Slime - The Real Recipe

How Does it Work?

Because you mixed two liquids together, there's a good chance that slime is a colloid, and it is! But, there's more to it than that and your kids need to understand how the molecules behave in order to grasp it all.

For starters, most liquids, such as water, are made up of small, unconnected molecules bouncing around and tumbling over and into one another. Single 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 identical, repetitive segments that form long chains of molecules known as polymers. These long chains don't flow over and across one another very easily. Like a bowl of cooked spaghetti, they sort of roll over and around one another but they're not linked to each other. Liquid polymers tend to be gooier and flow more slowly than liquid monomers. The PVA used in this activity is a liquid polymer.

You might use this analogy to help the kids understand what happened. Picture 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. If you reach in and grab one chain and pull it out, that's what you get: one chain. Suppose you stir a whole bunch of tiny magnets into the box of chains. The magnets randomly connect the chains together in many locations, making a single large blob of chains. Now if you reach in and grab one chain, you'd lift out the entire pile.

Adding Borax solution to the PVA does pretty much the same thing (only it's a chemical, not a magnetic connection). 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. In the chemical reaction that the kids made, they got a slow-moving, glistening mass that's known as a hydrogen-bonded, cross-linked polymer gel. Slime is way easier to say.

In an effort to understand the world around them, scientists design models of what they can't see in order to understand and explain what they can see. The idea is to figure out how various molecules inside materials are arranged to produce the observable results. In general, molecules can be "seen" only with some serious electronic help and these images serve only to assist with the inferences of the model. If your kids understand how this inference modeling works, then they're way ahead of the game in their understanding of molecules.

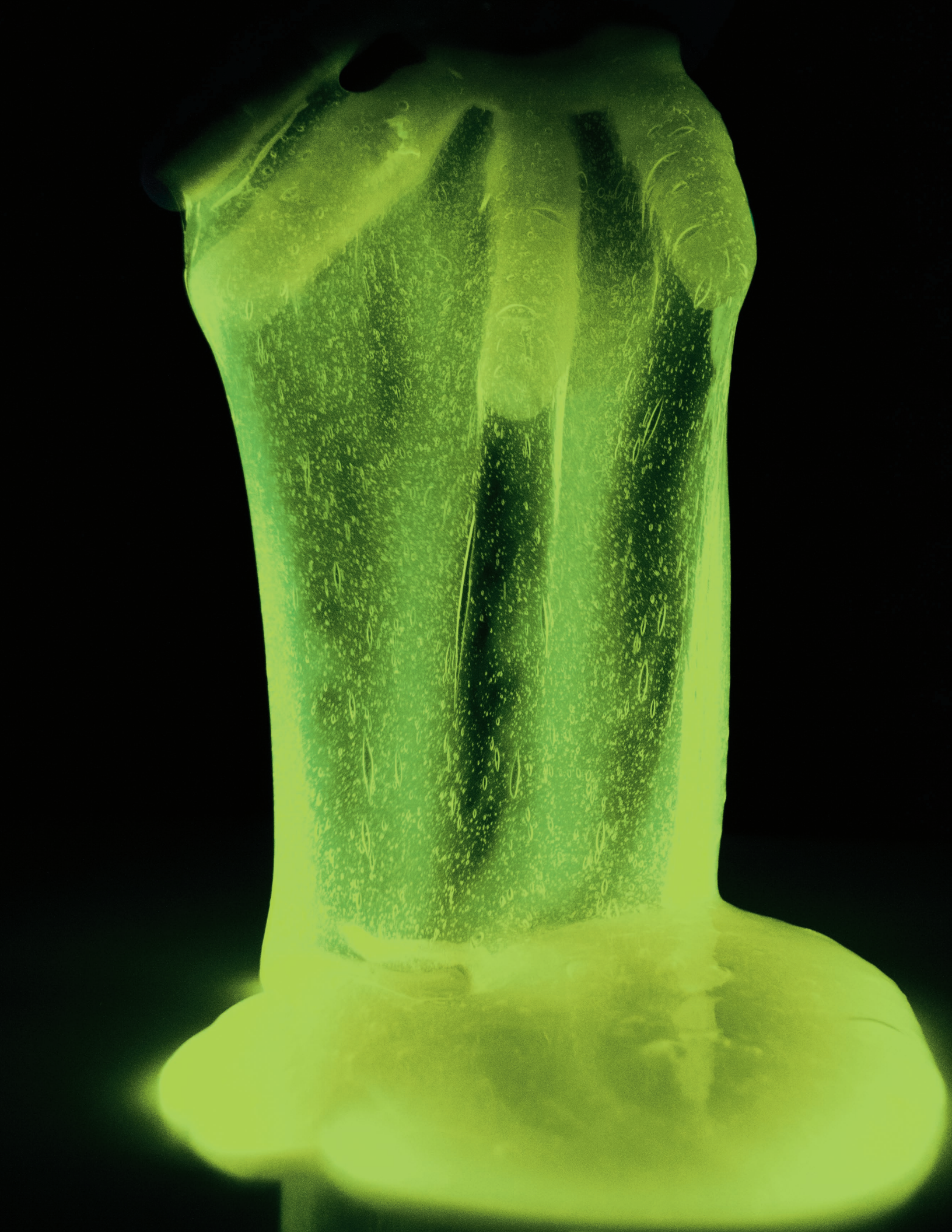
Additional Information

What is PVA (polyvinyl alcohol) used for anyway? PVA is used by the plastics industry to form surface coatings and to make surface films resistant to gasoline. It's used to make artificial sponges, hoses and printing inks. Also, if you look at the ingredients of contact lens wetting solutions, you may find this stuff as a lubricant and a cleanser. The PVA solution in this slime contains coloring and a special disinfectant to help resist pesky germs on those not-so-clean hands.

The Borax solution is used in the wood industry to protect against fungus and to make new wood look old. It's also used to solder metals, to glaze and enamel pottery, to whiten your wash and serves as an excellent soap in the medical industry. The students can add more Borax to achieve a firmer slime but there is a point of diminishing returns before the slime breaks down because of too much Borax and turns back into a liquid.

Notes

Atomic SHAKER SLIME



The best slime is made when it's shaken... not stirred! You're about to learn a brand new way to make the world's best, gooey, slippery, rubbery, stretchy, sometimes gross, but always fun, slime. Uncover the real secrets to making a perfect batch of slime and the science that makes slime what it is... a non-Newtonian fluid. Atomic Slime is formulated with a special coloring agent that fluoresces under black light. The eerie, greenish-yellow glow makes this slime irresistible.

Experiment

Atomic Shaker Slime

What You Need

Atomic Goo Solution
Cross-linker Solution
Shaker Slime Cups
Black Light
Paper Towel
Zipper-lock Bag

Try It!

1. Measure 2 ounces (60 mL) of the Atomic Goo solution into a plastic cup. You'll see markings on the side of the cup to indicate ounces. Fill the cup to the "2" line.

2. Add 1 tablespoon (15 mL) of the Cross-Linker solution to the Atomic Goo in the cup.

3. The last step is the most important one. It's time to shake. Wait! Don't shake anything until you seal the shaker cup with a lid. Go ahead... shake! Don't stop shaking for at least 1 minute. Take a rest if you need to, but you need lots of shaking. 3-2-1... stop. Fix your eyes on the liquid in the cup. What? It's not a liquid anymore? The Atomic Goo changed into a big ball of slime.

Bonus Idea

As an added bonus, shine the mini black light onto the blob of Atomic Slime and look at that eerie greenish-yellow glow! You can also prepare the mixture under a strong black light (like the ones found at Halloween). The mixture will have a radioactive glow that is guaranteed to produce a room filled with oohs & ahhhs!

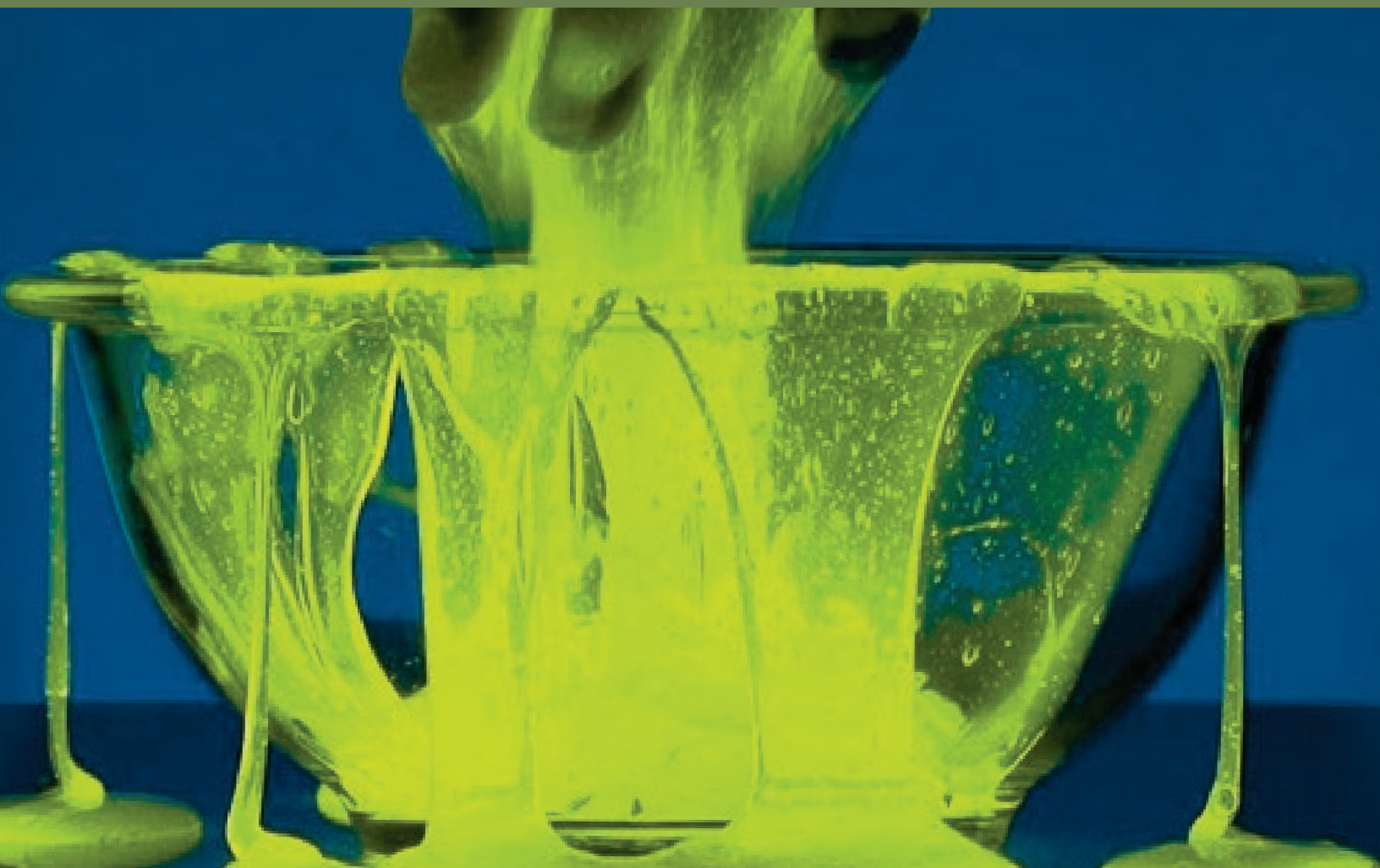
Atomic Shaker Slime

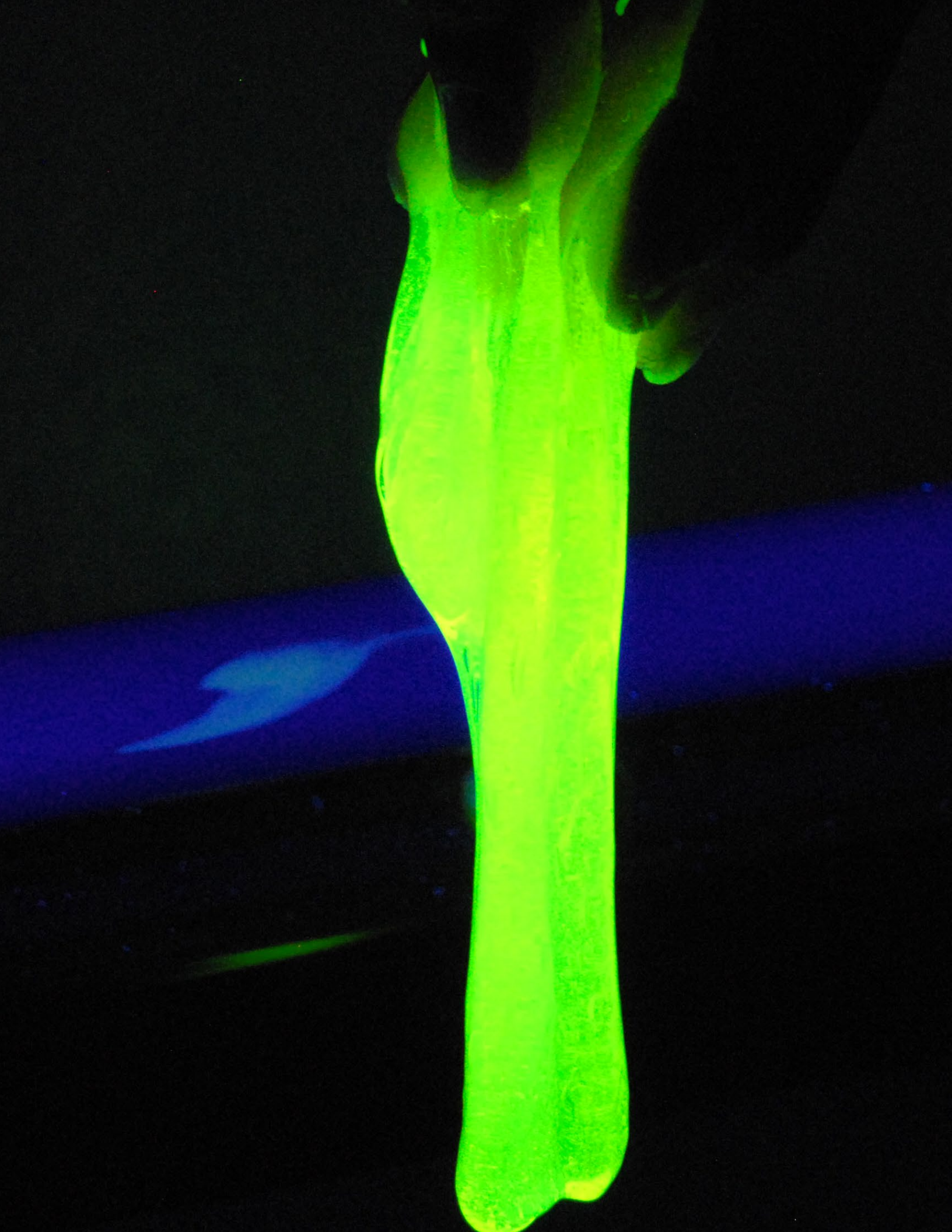
How Does it Work?

The Atomic Goo solution is specially formulated with a unique dye that fluoresces under black light. Fluorescent things do not glow in the dark all by themselves—they require some other form of energy such as ultraviolet light to activate or "excite" them. Fluorescence is a type of luminescence that occurs when some form of radiation, such as black (ultraviolet) light, causes an object to glow. Liquids colored with Atomic Glow appear to "glow" in the daylight, but they seem to glow even brighter under black light. As soon as the light is removed, the glow stops.

Additional Information

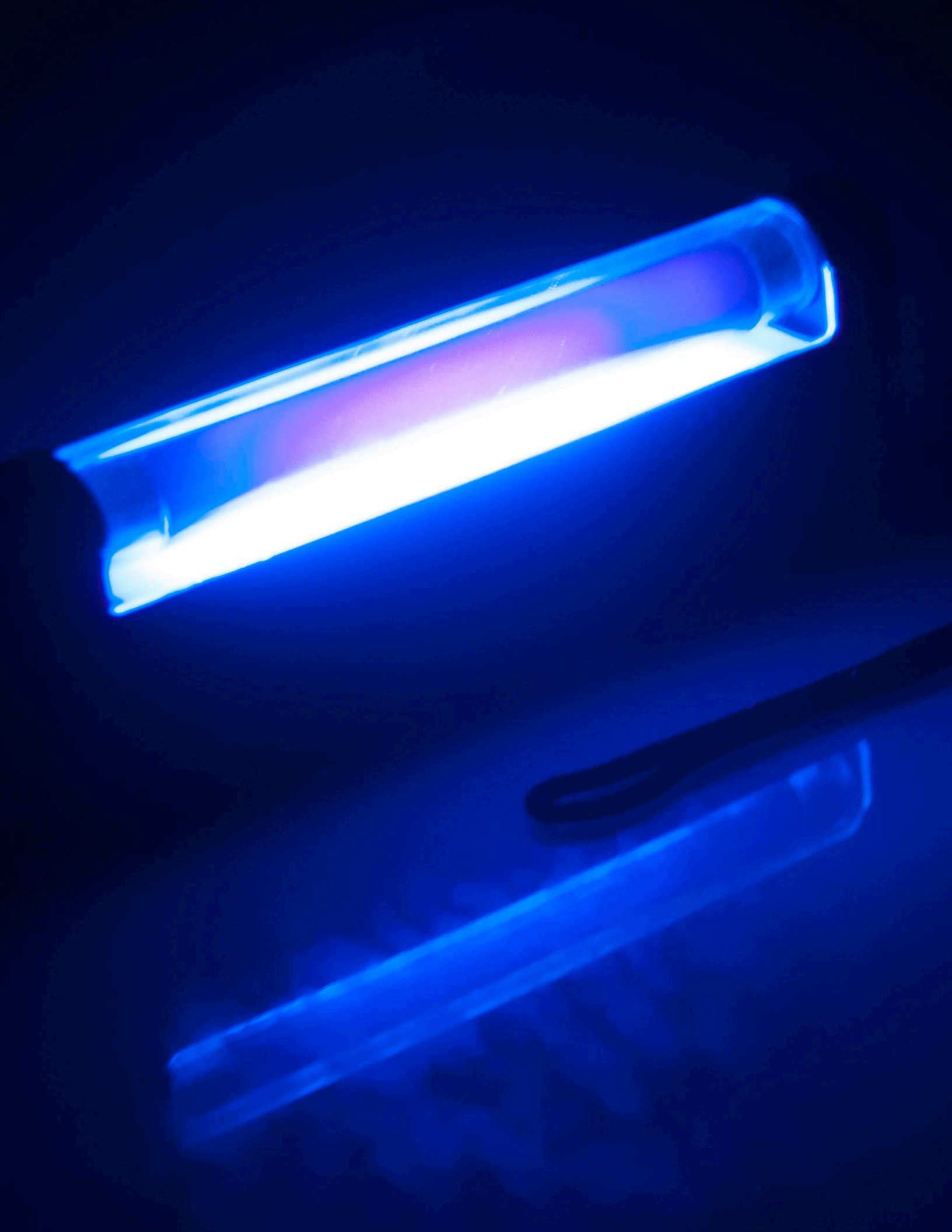
Slime stretches in a most unusual way. If you try to stretch slime quickly, it will literally break in half. If you stretch the slime slowly, however, it will get longer and longer and longer. Why? Scientists consider slime to be a "Non-Newtonian Fluid," which means that it behaves like both a solid and a liquid at the same time. When you apply pressure, it turns into a solid (so to speak) and breaks apart. When you let slime flow like a liquid, it stretches with no problem. Store the slime blob in a zipper-lock bag when you're finished.





Notes

In Search of PHOSPHORS



Experiment

In Search of Phosphors

What You Need

Portable Black Light
Dark Room or House
Everyday Objects
Paper
Pen

Try It!

1. Push the button on your black light to switch it on. Keep your thumb lightly on the button so you don't lose it in the dark!

2. Turn off the lights and darken the room or house.

3. Using your black light as a search tool, carefully search the room for objects that shine in the ultraviolet light. You may find clothes, rocks, credit cards, skin, food, laundry detergent, crayons, high lighters, toys or other everyday objects that give off an eerie glow.

4. Keep a record of all of the things that glow in the ultraviolet light.

What Else Glows Under Black Light?

- Fluorescent (day-glow) tempera paint
- Fluorescent (day-glow) poster paint - Try the art supply section of a stationery store.
- Leftover fluorescent paint, mixed with water, or the water used to wash paint brushes used for fluorescent paint
- Fluorescent (day-glow) spray paint - Blue is particularly tough to find. Try Tru-Value hardware stores.
- RIT brand fabric whitener and brightener - Glows blue-white. Available in liquid or powder form.
- Woolite - Glows greenish-white.
- Era brand laundry detergent
- Just about any brand of laundry detergent - Try out whatever you have in the house! Tonic water - Glows blue due to quinine content. Drinkable!
- Cat urine - Glows greenish-yellow. Not particularly drinkable.
- Ink from fluorescent high lighters - Try out just about any bright color. Many of these inks are water-soluble, so you can crack open a high lighter and drop the ink (usually contained in an absorbent felt pad) into fountains, toilet reservoirs, and other areas where glowing water is desired.
- Vaseline glass
- Uniball Uni-gel pens - Only certain colors glow. Try pink and orange.
- Most kinds of fishing line and weedwhacker line - If you want it invisible under black light, try before you buy!

In Search of Phosphors

How Does it Work?

The first thing most people notice when you switch on a black light is that some of their clothing glows. This is because most laundry detergents contain phosphors to make whites appear brighter in sunlight. Natural sunlight contains ultraviolet rays that make the laundered whites glow "brighter than white!" Dark clothes don't glow because the dark pigments absorb the ultraviolet light.

Walking around a darkened house with your black light leads you to an amazing discovery: phosphors are all over the place! A phosphor is a substance that radiates visible light after being energized by visible light, invisible ultraviolet light or electrons. There are lots of natural phosphors, even in your teeth and fingernails, for example.

Black Lights at Work

In addition to making people and fluorescent posters look cool, black lights have some practical applications. Most of these uses, as well as dozens of others, follow a common theme—the black lights make the invisible visible or isolate one specific substance from everything around it. When you think about it, there are dozens of situations where you could put this phenomenon to work. The applications are potentially endless!

- Appraisers use them to uncover antique forgeries. Many paints and stains used today contain phosphors that will glow under a black light, while antique paints do not contain phosphors.

- Repairmen use them to find invisible leaks in machinery -- they inject a little fluorescent dye into the fuel supply and illuminate it with a black light. For example, they might detect an invisible air conditioner leak by adding fluorescent dye to the refrigerant.

- Law enforcement officers use them to identify counterfeit money. The United States and many other countries include an invisible fluorescent strip in their larger bills that only shows up under a black light.

- Amusement parks and clubs use them to identify invisible fluorescent hand stamps for readmission.

- Forensic scientists use them to analyze crime scenes. To pick out fingerprints, for example, they often dust with fluorescent dye under a black light. This makes it easier to pick the fingerprints out from surrounding dirt. Black lights can also identify semen, blood and other bodily fluids that naturally fluoresce.

- You can even identify hidden pet stains with a black light before you clean the carpet!

Notes

Freeze
YOUR SHADOW

Experiment

Freeze Your Shadow

What You Need

Phosphorescent Paper
Thick Magazine
Bright Light
Dark Room
Clock or Watch

Write With Light

1. Place the phosphorescent paper on the table and use the black light to "write" with light. Put the light right up against the paper just as if you were drawing with a pen - turn it on and draw a few squiggles.

2. Try to write "WOW" as fast as you can. Turn it upside down and it says "MOM!"

Try It!

1. Find the middle of the thick magazine and open it up. Put the phosphorescent plastic paper between the pages. Close the magazine and leave the paper undisturbed for at least five minutes.

2. Dim the lights (not too dark—you'll need to be able to see what you're doing).

3. Place the magazine containing your phosphorescent paper on a table in front of you. Arrange the light source (desk or table lamp) so that its light will shine directly down on the magazine, but don't turn it on.

4. Slip the phosphorescent paper out of the magazine (shiny, yellow-side up) and put it on top.

5. Spreading your fingers apart, place your hand on the paper.

6. Turn on the light source. Be careful not to move the lamp or your hand for the next 60 seconds.

7. After 60 seconds, turn off the light source and lift your hand. You should clearly see the shadow of your hand remaining on the phosphorescent paper. It will look something like an x-ray, which you'll learn more about in a minute.

Freeze Your Shadow

How Does it Work?

The phosphorescent paper actually contains a thin layer of luminous zinc sulfide. By keeping the phosphorescent paper in the magazine for five minutes before starting the experiment, you allowed any light-exposed areas of the paper to become de-energized and preexisting shadows to fade away. When you place your hand on top of the paper under the bright light, your hand interrupts the energizing source, thereby making a shadow. At every point where the light is able to energize the phosphorescent paper, the electrons of the zinc sulfide molecules become excited and move into higher atomic fields. When you switch off the light and lift your hand, you can clearly see the energized areas.

A fluoroscope (an x-ray machine that has a glowing screen instead of film) works in much the same way. Instead of using visible light to energize the zinc sulfide, the fluoroscope uses x- rays—a much more powerful form of radiation. The x-rays are powerful enough to penetrate our skin and be absorbed by our bones. That's why we see the image of our bones instead of our whole hand. To get x-ray film, doctors simply replace the phosphorescent screen with photographic film. The x-rays affect the film the same way that visible light affects phosphorescent paper.

Notes

Glow

POWDER

When the lights go off, most people think it's time for bed. Oh no... the after-dark scientist knows that ONLY when the lights go off, can you see the eerie green glow.

Experiment

Glow Powder

What You Need

Glow Powder (Zinc Sulfide)
Measuring Scoop
Baby Soda Bottle Test Tube
Portable Black Light
Bright Light
Dark Room

Try It!

1. Carefully open the bag of Glow Powder. Measure out 1/2 blue scoop of powder and pour it into the clean test tube. Tightly seal the test tube with the cap.

2. Hold the test tube of Glow Powder on its side (or lay it horizontally on a table) and expose it to bright light for about 30 seconds. Try to hold it steady and don't shake it. Get ready to turn off the lights...

3. Okay, turn off the lights (or quickly take the test tube into a dark closet). What do you see? An eerie green glow? Wow—you've just made a homemade glow stick!

4. Gently roll the test tube so that the exposed top layer of powder mixes in with the powder on the bottom. Continue to twist and turn the test tube to see how the glowing powder moves and changes.

5. Shine the portable black light on the test tube for 3 seconds. Is the glow brighter or dimmer than it was when you held the test tube in the dark?

Glow Powder

How Does it Work?

All glow-in-the-dark products contain phosphors. As mentioned previously, a phosphor is a substance that radiates visible light after being energized. To make a plastic toy glow-in-the- dark, you need a phosphor that is energized by normal light and has a very long persistence (ability to hold that energy and to illuminate the toy for a period of time). The zinc sulfide in your kit has these properties. The secret is out! Zinc sulfide is one of the non-toxic chemicals used to make all of those glow-in-the-dark toys, posters, wall plates, stickers and —you name it!

Notes

Glow-in-the-Dark

PUTTY

Experiment

Glow-in-the-Dark Putty

What You Need

Glow Powder
Sodium Tetraborate (Borax) Powder
Blue Scoop
Bottle of White Glue
Plastic Cups
Stirring Stick
Spoon
Plastic Zipper-Lock Bag
Bright Light
Dark Room
Water

Try It!

1. Empty half of the bottle of glue (1 ounce) into a plastic cup. Thin out the glue with 2 blue scoops of water and mix it well with the stirring stick.

2. Add 1/2 blue scoop of zinc sulfide powder to the glue. Use the stirring stick to mix the powder and thinned glue together.

3. Fill a second plastic cup 3/4 full with warm water. Pour all of the sodium tetraborate powder into the water and stir it with a spoon. The powder might not completely dissolve and that's okay. This will be your activator solution.

4. Add one blue scoop of the activator solution to the glue mixture in the cup. Use the stirring stick to mix the liquids together. Don't stop stirring for at least 2 minutes. You'll know that you're finished when the liquid has turned into thick, gooey putty. If your putty is too runny, add just a little bit more activator liquid (sodium tetraborate).

5. The chemicals that you've used to make this glowing goo are not dangerous to your health or to touch, but remember never to put the putty-like stuff (or anything in this kit) in your mouth. Also, be careful not to get the goo on carpet, clothes, your hair, or someone else's hair!

6. Reach inside the cup and pull out the gooey stuff. When you're finished playing, return it to the cup or keep it in a zipper-lock bag for later.

7. When you're ready, hold the gooey putty up to the bright light to charge up the luminous zinc sulfide. You know the routine—dim the lights and get ready for lots of ooohs and ahhhs!

Glow-in-the-Dark Putty

How Does it Work?

Let's start with the glowing part of the activity. When you added the zinc sulfide powder, you did exactly what the toy scientists do at the factory where they make glowing slime or glowing gooey putty. Zinc sulfide is the secret!

White glue is actually included in a group of chemicals called polymers. In simplest terms, a polymer is a long chain of molecules. Pretend that a piece of spaghetti represents (for our example) a long chain of molecules (a polymer). If the long molecules slide past each other easily, then the substance acts like a liquid because the molecules flow. If the molecules stick together at a few places along the strand of spaghetti, then the substance behaves like a rubbery solid called an elastomer. The activator liquid in this activity (sodium tetraborate) is the chemical that is responsible for hooking the molecules together to form the gooey putty.

There's enough chemical in your kit to make another batch of glow-in-the-dark putty. You might want to experiment by making a batch of putty that contains a little more or a little less zinc sulfide powder. Expose all of the putty to the same source of bright light and then turn out the lights. Which formula created more glow?

When you're finished playing with your special mixture, seal in a zipper-lock bag or just throw it away in the trash. Wash your hands with soap and water.

Notes

The ART OF GLOW


MOTO

Experiment

The Art of Glow

What You Need

Glow Powder
Blue Scoop
Bottle of White Glue
Plastic Cups
Stirring Stick
Spoon
Piece of Black Paper
Paintbrush
Bright Light
Dark Room
Friends

Try It!

1. Get a piece of black construction paper and grab the glue.

2. You may have to thin the glue a little with water to get more control. Add the water slowly and make sure that you stir the mixture well with the stirring stick.

3. Dip the stirring stick (or paintbrush) into the glue and write your name or draw a picture on the black construction paper.

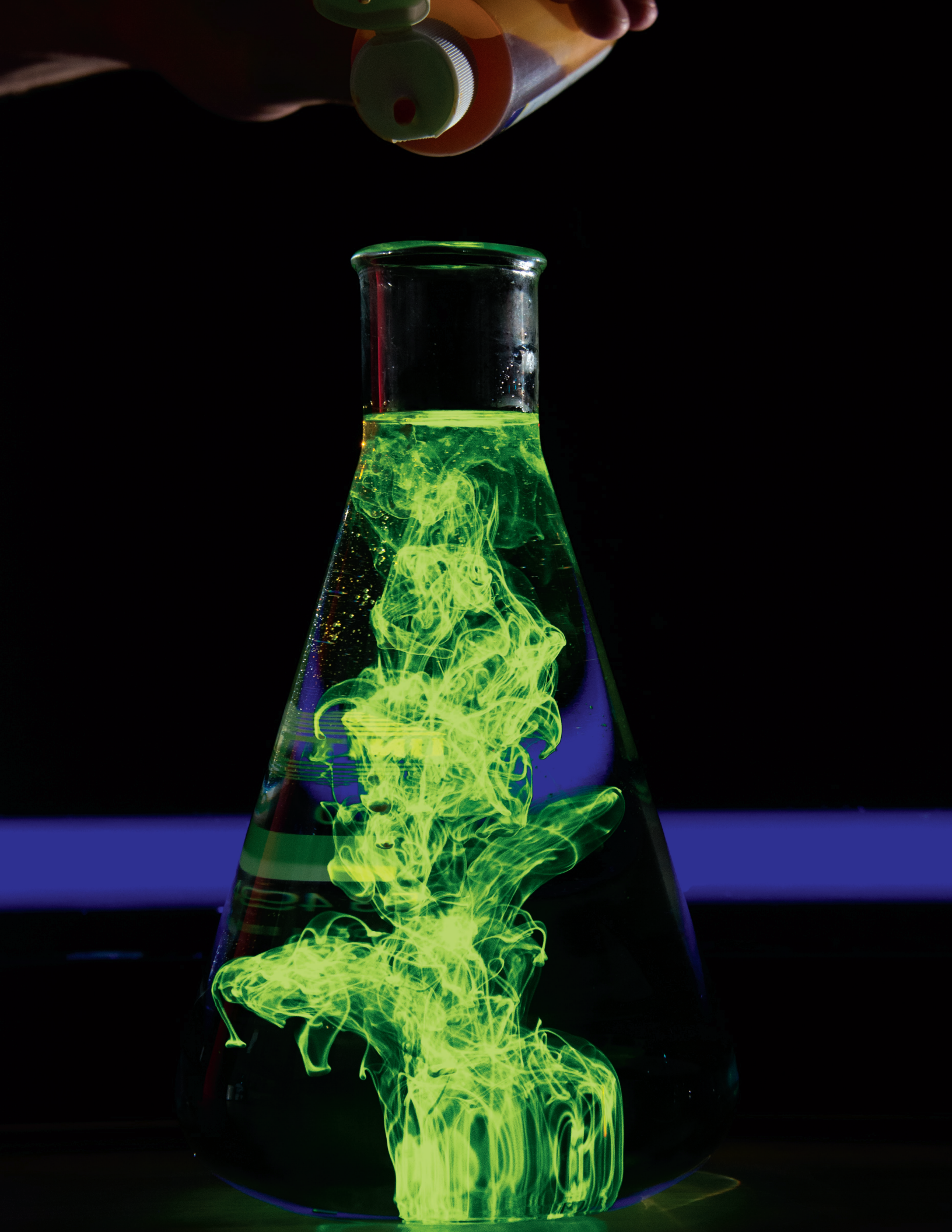
4. Dip the blue scoop into the zinc sulfide powder and sprinkle it on top of the glue.

5. Allow the glue to dry and pour the excess zinc sulfide back into the bag.

6. When you're ready, hold your "painting" up to the bright desk light to charge up the zinc sulfide, as you did when you made the glow-in-the-dark putty. Call your friends into your glow-in-the-dark art gallery and shut off the lights. You can bet that most famous artists have never thought of this one!

Notes

Atomic
GLOW



Atomic Glow™ is the secret coloring ingredient used to give a liquid that greenish-yellow, almost radioactive glow. Just a few drops of Atomic Glow will turn an ordinary beaker of water into something that looks like a mad scientist concoction. But the coolest part comes when you flip on a black light (ultraviolet light), and the liquid lights up with an eerie green glow.

Experiment

Atomic Glow

What You Need

Atomic Glow Coloring
Water-Soluble Materials
Black Light
Glass Container
Dry Ice

Getting Started

Atomic Glow is safe and fun to add to almost any water-soluble material to create an eerie green color. Like food coloring, however, Atomic Glow coloring will stain your hands, clothes and fabrics in its concentrated form. Just a few drops of Atomic Glow are needed to color almost anything. DO NOT use Atomic Glow to color food or drink. Keep the Atomic Glow out of your eyes and mouth.

Try It!

Eerie Green Liquid

Just add a few drops of Atomic Glow to a glass of water and stir. Under normal light, the liquid will appear greenish-yellow with a slight "glow." Shine the black light onto the liquid to make it really glow.

Mad Scientist Bubbling Concoctions

Atomic Glow looks best under a large black light like those sold in stores at Halloween. Use a few drops of Atomic Glow to color several containers of water (glass beakers, flasks or other clear, mad-scientist-looking containers). Turn on the black light and the water will glow! Add a small piece of dry ice (adult supervision required) to each container and you'll have the coolest glowing, bubbling, smoking liquid you've ever seen. Guaranteed to create a room filled with ooohs and ahhhs!

Atomic Slime

Add a few drops of Atomic Glow to your favorite slime recipe to create the coolest looking slime ever. Atomic Glow is a great coloring additive for our Clear Slime or it can be used with our classic Green Slime. Atomic Slime looks best under a large black light (fluorescent bulb style).

Atomic Putty

Atomic Glow coloring can be used to color slime made from mixing Elmer's Glue and a Borax solution. But something quite strange will happen. Atomic Glow will not change the color of Elmer's Glue until the Borax solution is added. This produces an almost color- changing slime effect!

Atomic Glow

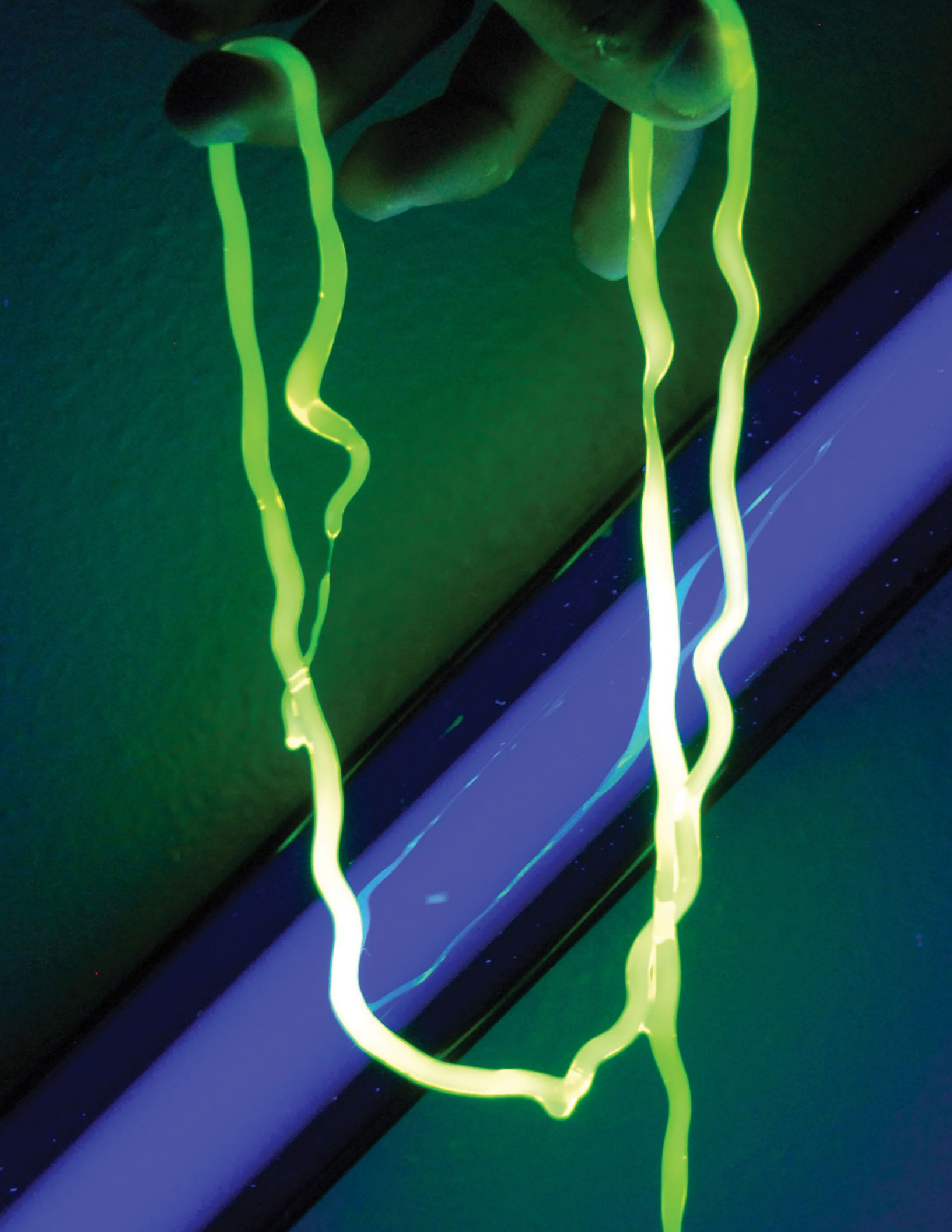
How Does it Work?

Atomic Glow is a coloring agent that fluoresces under black light. Unlike Glow Powder, Atomic Glow does not glow in the dark, but instead requires ultraviolet light to glow. Fluorescent things do not glow in the dark all by themselves - they require some other form of energy such as ultraviolet light to activate or "excite" them.

Liquids colored with Atomic Glow appear to "glow" in the daylight, but they seem to glow even brighter under black light. As soon as the light is removed, the glow stops.

Notes

Atomic
WORMS



Experiment

Atomic Worms

What You Need

Atomic Worm Goo Solution
Worm Activator
Measuring Scoop
Black Light
Paper Towel
Clear Plastic Cups

Try It!

1. Fill a plastic cup 3/4 full with water... roughly 180mL (6 ounces).

2. Measure one scoop of Worm Activator powder into the water. A level scoop equals one teaspoon. Stir the mixture with a spoon until all of the powder dissolves.

3. If you have a large black light, turn it on and face it toward the Worm Activator solution in the plastic cup, or hold the mini black light in one hand and, with it turned on, face it toward the cup. Turn the Worm Goo bottle upside down and squeeze a small, steady stream of the Atomic Goo into the Activator solution (move your hand around in a circular motion as you're squeezing the goo). It's like squeezing honey onto a biscuit. Be careful not to let the top of the bottle touch the Activator solution because you don't want to contaminate the entire bottle.

4. Set the bottle of Atomic Goo to the side because it is time for the big dig. Put your index finger down into the water and fish around. When you find something, slowly pull it out. That's right... it's an instant worm!

5. You can't stop at just one, so go ahead and squeeze another Atomic Worm. When you're finished, you can pour the water mixture in the cup down the drain.worm!

Wacky Worm Wonders... Different Ways to Experiment with Worm Goo

- Squirt a thin stream of Worm Goo to make web-like worms.
- Drip single drops of Worm Goo into the Activator solution to make perfect worm eggs.
- The longer the worms stay in the Activator solution, the harder the texture of the worm.
- Turn your favorite worm into a necklace to totally gross out your friends!
- 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.
- 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!"

Atomic Worms

How Does it Work?

When you make Atomic Insta-WormsTM, you're learning about the science of polymers. The creative young scientists at Steve Spangler Science coined the name Worm Goo, but the real name of this liquid is sodium alginate. Sodium alginate is a chain of molecules called a polymer. Specifically, sodium alginate is a polysaccharide isolated from seaweed. Polymers are large molecules made up by linking many smaller molecules together. Polysaccharides, such as starch and alginate, are made by linking together hundreds of glucose (sugar) molecules. Alginate is 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 the grocery 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 few.

The sodium alginate (Worm Goo) immediately changes from a liquid to a solid the moment it touches the Worm Activator solution. The Worm Activator solution contains calcium ions which serve to link the long polymer chains together. Scientists call this "cross-linking." For the scientists in the audience, here's a more detailed description of what happens: a polymer strand is formed when the sodium alginate solution is added to a calcium chloride solution. This occurs because the Ca++ ions replace the Na+ ions and serve as a cross-linking agent to bond two alginate chains together. The resulting cross-linked polymer is insoluble in calcium chloride solution and this results in the formation of the polymer strand. See, now you know!

Did You Know...

The Worm Activator chemical is called calcium chloride... one of the main ingredients in pickle juice. Are you thinking what we're thinking? Pour some pickle juice into a cup and squirt in a little Atomic Worm Goo. Voila! You get a worm... but don't eat it.

Notes

Glowing
TONIC WATER

Experiment

Glowing Tonic Water

What You Need

Black Light
Bottle of Tonic Water
Clear Drinking Glass
Dark Room
White Sheet or Poster Board

Try It!

1. Open the tonic water and pour some into a large, clear drinking glass.
2. Place a white sheet or poster board behind the glass to create a white background.
3. Turn off all the lights and completely darken the room. Turn on the black light and shine it on the tonic water. Hey, what happened? The water is glowing blue!

How Does it Work?

The black light in your kit gives off UV light. This ultraviolet light is a higher energy light than visible light and the human eye is not able to see it well. So, if ultraviolet light is virtually invisible, how can the tonic water glow so brightly? The tonic water's color under the UV black light is fluorescent-blue because it contains quinine, a substance that changes when it absorbs UV light. When the black light shines on the tonic water, the tonic water absorbs the light and excites the electrons. Since the electrons naturally want to return to their original relaxed state (who wouldn't?), they give off energy that has a wavelength in the blue part of the visible spectrum. That's why the tonic water has an eerie blue glow in the presence of ultraviolet light!

Experiment

Mentos and Tonic Fountain

What You Need

Roll or Box of Mentos® (Candy Mints)
2-liter Bottle of Tonic Water
Large Black Light

Try It!

Words cannot begin to describe the awesome eruption that is created from adding MENTOS candies to a 2-liter bottle of soda, especially when you add a black light and a bottle of tonic water. The eruption is enormous... and so is the learning if you consider the chemistry.

1. This activity is probably best done outside in the middle of an abandoned field, or better yet, on a huge lawn. But, the key is to do the activity at night so that the eruption really glows.

2. Place the large black light behind the bottle of tonic water, so that it shines onto the bottle and above the bottle to catch the eruption.

3. Carefully open the bottle of tonic water.

4. Unwrap the whole roll of MENTOS. The goal is to drop all of the MENTOS into the bottle of tonic water at the same time (which is trickier than it looks). One method for doing this is to roll a piece of paper into a tube just big enough to hold the loose MENTOS. You'll want to be able to position the tube directly over the mouth of the bottle so that all of the candies drop into the bottle at the same time.

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!)

6. It's just like fireworks on the 4th of July. The spectators erupt, of course, in a chorus of ooohs and ahhhs. The eruption glows a vibrant blue because of the black light behind it! Now that's an amazing geyser!

Notes

Spinning PENNY

Warning: The Spinning Penny Trick is known to be addicting. Once you start, it's almost impossible to stop. Centripetal force may get the best of you. Proceed with caution!

Experiment

Spinning Penny

What You Need

Clear Balloon
Penny

Try It!

1. Squeeze a penny through the mouth of one of the clear balloons. Make sure that the penny goes all the way into the balloon so that there is no danger of it being sucked out while blowing up the balloon.

2. Blow up the balloon. When properly inflated, the balloon will be almost clear in the middle and cloudy at the area near the neck and at the end opposite the neck. The cloudiness at the ends is un-stretched latex, which provides stress relief. If the balloon is completely clear all over, it is over-inflated. Tie off the balloon and you're ready to go.

3. Grip the balloon at the stem end as you would a bowling ball. The neck of the balloon will be in your palm and your fingers and thumb will extend down the sides of the balloon.

4. While holding the balloon, palm down, swirl it in a circular motion. The penny may bounce around at first, but it will soon begin to roll around the inside of the balloon. The best orbit or path for the coin is one parallel to the floor. Once the coin begins spinning, use your other hand to stabilize the balloon. Your penny should continue to spin for 30 seconds or more.

Spinning Penny

How Does it Work?

Use this demonstration to pique curiosity about centripetal forces. Centripetal force is the inward force on a body that causes it to move in a circular path. The old concept of "centrifugal force" (an outward or center-fleeing force) has been largely replaced by a more modernistic understanding of "centripetal force" (an inward or center-seeking force). When we attach a ball to a string and swing it in a circular path, we feel the forces of the ball pulling on the string and that of the string pulling on our hand. That effect is probably responsible for the misconception of a centrifugal, or center-fleeing force.

Scientists have now proven that only centripetal forces are responsible for the effects we experience with the ball and string. Let's consider the experiment where one swings a tethered ball in a circular motion around one's head. If we were to let go of the string, and if center-fleeing forces (centrifugal) were in effect, the ball would fly off radially from the point of release. But, it doesn't do that! Instead, it flies off tangentially, in the direction of the velocity it had at the moment it was released.

In the example of the ball and string, it is the string that supplies the inward force while in the case of the penny in the balloon, it is the balloon that imposes an inward force on the penny, thereby keeping it traveling in a circular path.

Additional Information

Compare the motion of the penny in the balloon with that of the planets around the sun. See if your kids can figure out that gravity takes the place of the string and balloon in providing an inward force on the planets.

Compare the behavior of a gyroscope to that of the penny spinning in the balloon. A gyroscope is essentially a spinning mass, and so is the penny. Once the disk (mass) of the gyroscope starts spinning, it resists tipping on its axis of rotation. A child's spinning "top" is a good example of a gyroscope to which we can easily relate. Just as the "top" resists tipping over while it's spinning, so does the penny. The gyroscopic action of the penny provides stability to its orbit within the balloon.

Notes

Screaming

BALLOON

What would Halloween be without spooky sounds? Here's an easy-to-do experiment using only a balloon and a hex nut from the hardware store. Be sure to buy enough supplies for all of your Halloween party guests because everyone is going to want a screaming balloon!

Experiment

Screaming Balloon

What You Need

Latex Balloons
1/4" Hex Nuts

Try It!

1. Squeeze the hex nut through the mouth of the balloon. Make sure that the hex nut goes all the way into the balloon so that there is no danger of it being sucked out while blowing up the balloon.

2. Blow up the balloon, but be careful not to over-inflate the balloon as it will easily burst. Tie off the balloon and you're ready to go.

3. Grip the balloon at the stem end as you would a bowling ball. The neck of the balloon will be in your palm and your fingers and thumb will extend down the sides of the balloon.

4. While holding the balloon, palm down, swirl it in a circular motion. The hex nut may bounce around at first, but it will soon begin to roll around the inside of the balloon. What is that sound? Could the balloon be screaming? Once the hex nut begins to spin, use your other hand to stabilize the balloon. Your hex nut should continue to spin for 10 seconds or more.

Screaming Balloon

How Does it Work?

This is actually a 2-for-1 experiment – you're learning about the science of inertia and sound. The hex nut circles inside the balloon due to centripetal force. Centripetal force is the inward force on a body that causes it to move in a circular path. The old concept of "centrifugal force" (an outward or center-fleeing force) has been largely replaced by a more modernistic understanding of "centripetal force" (an inward or center-seeking force).

The sound is made by the sides of the hex nut vibrating against the inside wall of the balloon. To prove this, repeat the experiment using a penny in place of the hex nut. While the penny spins beautifully inside the balloon, the "spooky" sound is gone. Experiment with different sizes of hex nuts or any other circular object whose edges might vibrate against the balloon and create a spooky sound.

The Screaming Balloon makes for a great Halloween party give-away or a fun science experiment for teachers to do in class.

Notes

Twirling SOUNDS

At first glance, it looks like your ordinary plastic tube. Hold one end of the tube and twirl the other end in a circle over your head. It's music to your ears!

Experiment

Twirling Sounds

What You Need

Sound Hose

Try It!

1. Hold one end of the tube and twirl the other end in a circle above your head.

2. Spin the tube faster and notice how the pitch of the note goes up. Fast twirling creates high pitched notes and slower twirling creates lower notes. Amazing!

Twirling Sounds

How Does it Work?

Imagine that the tube is filled with tiny pebbles. Twirling the tube overhead would shoot the rocks out of the tube. The same thing happens with the molecules of air. As you twirl the tube, air molecules are launched out of the other end. The faster the twirl, the faster the molecules come flying out the other end.

Not all plastic tubes sing. The tube must be corrugated on the inside. Why? The aerodynamics researchers in Japan put a whirly in a wind tunnel and used very tiny hot wire anemometers to measure the airflow near the corrugations. As the air flows first over one ridge then over a second it tumbles into a vortex. The faster the air flows through the tube the higher the frequency of the sound produced by the vortex. When the frequency of the vortex matches one of the natural resonant frequencies of the tube it is amplified.

Notice how the inside of your vacuum cleaner hose is NOT corrugated! Otherwise, your vacuum cleaner would play music (maybe a poor choice of words) whenever you cleaned the house.

In Search of More Tubes... While the toy store "Twirly" is fun, you'll soon want to experiment with different sized tubes (long, short, fat, skinny) to see how the size and shape change the sound.

Additional Information

Information for this article was gathered from a great website presented by Paul Doherty from the Exploratorium. For much greater detail on the Singing Tube, visit http://isaac.exploratorium.edu/ ~pauld/activities/AAAS/aaas2001.html.

Notes

Singing TUBES

The Singing Tube is a great science demonstration used to teach students about sound waves as the piece of metal pipe is made to magically sing. Since this demonstration requires the use of fire (a propane torch), it must be done by an adult... with a child-like enthusiasm for making science fun.

Experiment

Singing Tubes

What You Need

24" Piece of Metal Pipe
4" Square Piece of Metal Mesh
Propane Torch
Stick

Try It!

The screen mesh looks like a small piece of screen, but it's made of much thicker metal in order to withstand extreme heat from the torch. If you repeat the demonstration many times, you may need a pair of gloves to protect your hand from the heat. Generally the outside of the tube does not get hot enough to require you to use gloves. WARNING: This experiment requires adult supervision!

1. The first step is to fold the piece of heavy wire screen mesh several times to make it just small enough to fit in the metal tube. Use a stick to position the screen about 4 inches from the end of the tube.

2. Use a propane torch to heat the piece of screen for approximately 10 seconds. If you could see the screen (but you can't), it should be red hot from the torch.

3. Remove the tube from the flame and hold it vertically. The tube should begin to "sing." Reheat the screen when the sound stops.

4. What happens to the sound when you cover the top of the tube with your hand?

5. What happens to the sound when you hold the tube in the horizontal position?

6. Does changing the size of the tube change the sound? How? (It's worthwhile to make several tubes of different sizes to hear the changes in pitch).

Singing Tubes

How Does it Work?

The scientific secret behind this demo is as simple as the fact that hot air rises. Okay, the full explanation is a little more complex, but not much. When the screen gets hot, the air molecules surrounding the screen rise. This rising hot air begins to oscillate in the tube and produces the sound. As the screen cools down, the air stops flowing through the tube and the sound stops. Changing the size of the tube also changes the pitch. Covering the top of the tube with your hand stops the flow of air and the sound stops. The same holds true when you turn the tube horizontally – the air can no longer flow through the tube. It's fun to tip the tube over and pretend to pour the sound onto the floor or into a cup. Pretend to pour the sound back into the tube as you return it to the vertical position.

Doug Hodous from Littleton, Colorado, made a set of Singing Tubes that covered an entire octave (C to C). Instead of playing the bells during the holidays, the science department entertained the staff with songs on their Singing Tubes (I'll bet the punch at the holiday party was spiked!).

Notes

Spooky Sounds

SCREAMING CUP

You've never heard a sound quite like this coming out of an ordinary cup! It's the perfect sound effect to carry door- to-door on your Trick-or-Treat adventure. If you like this, you'll love to make a thunder-like sound with the Thunder Tube.

Experiment

Spooky Sounds Screaming Cup

What You Need

Plastic Cup
24" Piece of String
Water

Try It!

1. Start by poking a hole in the bottom of the cup just large enough to thread the piece of string.

2. Thread the string through the hole and tie a knot or two at the end of the string to hold the string in place.

3. Wet the string... or coat the string with violin rosin.

4. Holding the cup in one hand, pinch the string between your thumb and forefinger. Squeeze tight on the string as you slide your thumb and forefinger down the string. With practice and a little patience, the string will "stick and slide" between your fingers causing a "screaming" sound. Oh, you'll know when you've got it down to a science!

5. Try differently shaped cups and determine what this change does to the sound.

Spooky Sounds Screaming Cup

How Does it Work?

Sound is transmitted through the air by vibrations. As your fingers slide across the string, vibrations occur in the string. The violin rosin makes the string more sticky and increases the "stick and slide" effect. The vibrations caused by "stick and slide" cause the cup to vibrate, which results in the amplification of sound. In other words, the cup produces an incredibly eerie scream!

Notes

Singing GLASSES

Experiment

Singing Glasses

What You Need

Wine Glasses
Water

Try It!

1. Fill the glass about half-full with water. Dip your pointer finger into the water (or vinegar) to clean it. Use a napkin to wipe off any dirt or oil on your finger. Clean is good.

2. You'll need a little moisture to help, so dip your finger into the water again. Set your clean, moist finger on the rim of the glass, press down slightly, and rub it all the way around the rim without stopping. Keep going in a circular motion along the lip of the glass while maintaining the pressure and, in almost no time, you'll have displayed a newfound musical talent.

3. Several things have to be just right for a tone to be produced: pressure, moisture, glass type, etc. Keep trying because it's worth it. Once you get there, it's hard to stop.

Singing Glasses

How Does it Work?

You are demonstrating the principle of "stick and slide." As you rub your finger on the rim, your finger first sticks to the glass and then slides. This stick and slide action occurs in very short lengths and produces a vibration inside the glass which, in turn, produces a sound. Vinegar helps to clean dirt and oil from your finger. A clean finger improves the stick and slide action. As soon as the first few vibrations are produced, the glass resonates. That means you're causing the crystals in the glass to vibrate together and create one clear tone. You can change the pitch (highness or lowness of the sound) by adding to or subtracting from the amount of water in the glass. The volume (loud or quiet) can be changed only a little bit by increasing or decreasing the pressure from your finger. Just think about the "jam session" you'll have with your dinner guests!

Notes

About Steve Spangler

With more than 1,500 television appearances and multiple Emmy awards to his credit, Steve is also a regular guest on the Ellen DeGeneres Show where she dubbed him America's Science Teacher. Steve's catalog of videos featured on YouTube, Facebook, Instagram and now TikTok have more than 1 billion views, and his books and online experiments are widely used by parents and educators to increase student engagement and inspire young scientists to learn more about STEM-based careers.

But Steve Spangler feels most at home when he's on stage sharing insights and creating those amazing experiences audiences remember for a lifetime. Steve brings over 25 years of experience (4,500+ presentations) to the platform every time he speaks. In July 2010, members of the National Speakers Association inducted Steve into the prestigious Speaker Hall of Fame. He is among an elite group of only 224 professional speakers in the world to receive this honor.

Whether you're looking for an amazing keynote speaker to kick-off your event, teacher training and professional development opportunities to help you become a more effective STEM educator, or personalized consulting and coaching, Steve Spangler can help you create your own transformational experiences in business and education.

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