Science Experiment Guide

by Aurora Lipper

Supercharged Science

www.SuperchargedScience.com

Focusing on wonder, discovery, and exploration.

Thank You for requesting our Science Activity & Experiment Guide. We hope you will find it to be both helpful and insightful in sparking young minds in the field of science!

INTRODUCTION

Do you remember your first experience with electricity? The thrill when something you built yourself actually *worked*? Can you recall a teacher that impressed you beyond words?

First, let us thank you for seeking out a field that is true to your passion, and furthermore, one that serves others.

In this book, we're going to share with you the secrets to learning and doing real science. We'll take you through several different science experiments from a variety of science fields.

Think of this activity book as the "Idea Book", meaning that when you see an experiment you really like, just take it and run (along with all its variations). For example, if you find yourself drawn to crystals, our ideas are just the beginning. Try growing your crystals in different colors, at different temperatures, with and without seeded objects, vary the acidic levels (does vinegar work better than a baking soda solution?) and so forth.

A Word About Safety…

Make sure you work with someone who's been successful before when you're working with new stuff you're unsure about. This goes for heating up liquids, condensing gases, and working with other things that could run away and lead to trouble.

Let's Begin…

TABLE OF CONTENTS

“The future belongs to those that believe in the beauty of their dreams.”
~Eleanor Roosevelt

Air Pressure

There's air surrounding us everywhere, all at the same pressure of 14.7 psi (pounds per square inch). It's the same force you feel on your skin whether you're on the ceiling or the floor, under the bed or in the shower.

An interesting thing happens when you change a pocket of air pressure - things start to move. This difference in pressure that causes movement is what creates winds, tornadoes, airplanes to fly, and some of the experiments we're about to do right now. An important thing to remember is that higher pressure always pushes things around. (Meaning lower pressure does not "pull", but rather that we think of higher pressure as a "push".)

Another interesting phenomenon occurs with fast-moving air particles. When air moves fast, it doesn't have time to push on a nearby surface, like an airplane wing. It just zooms by, barely having time to touch the surface. The air particles are really in a rush. Think of really busy people driving fast in their cars. They are so busy doing other things and driving fast to get somewhere that they don't have time to just sit and relax.

Air pressure works the same way. When the air zooms by a surface (like an airplane wing) like fast cars, the fast air has no time to push on the surface and just sit there, so not as much air weight gets put on the surface. Less weight means less force on the area. (Think of "pressure" as force on a given area or surface.) This causes a less (or lower) pressure region wherever there is faster air movement.

Activity: Magic Water Glass Trick Fill a glass one-third with water. Cover the mouth with an index card and invert (holding the card in place) over a sink. Remove your hand from the card. Voila! Air pressure is pushing on all sides of both the glass and the card (atmospheric pressure). Recall that higher pressure *pushes,* and when you have a difference in pressure, things move. This pressure difference causes storms, winds, and that card to stay in place.

Activity: Fountain Bottle Seal a 2-liter soda water bottle (half-full of water) with a lump of clay wrapped around a long straw, sealing the straw to the mouth of the bottle. Blow hard into the straw.

As you blow air into the bottle, the air pressure increases. This higher pressure pushes on the water, which gets forced up and out the straw.

Activity: Ping Pong Funnel Insert a ping pong ball into a funnel and blow hard. (You can tilt your head back so that the ball end points to the ceiling. Can you blow hard enough so when you invert the funnel, the ball stays inside? Can you pick up a ball from the table?

As you blow into the funnel, the air where the ball sits in the funnel moves faster and generates lower air pressure than the rest of the air surrounding the ball. This means that the pressure under the ball is lower than the surrounding air which is, by comparison, a higher pressure. This higher pressure pushes the ball back into the funnel… no matter how hard you blow or which way you hold the funnel.

Activity: Squished Soda Can Heat an empty soda can (large beer cans actually will work better if you have one) in a skillet with a few tablespoons of water in the can over a hot stove. Have a shallow dish with about ¼ inch of ice water handy (enough water to make a seal with the top of the can). When the can emits steam, grab the can with tongs and quickly invert it into the dish.

CRACK! The air in the can was heated, and things that are hot tend to expand. When you cool it quickly by taking it off the stove onto a cold plate, the air cools down and shrinks, creating a lower pressure inside. Since the surrounding air outside of the can is now higher, it pushes on all sides of the can and crushes it.

Activity: Squished Balloon Blow a balloon up so that it is just a bit larger than the opening of a large jam jar and can't be easily shoved in. Light a small wad of paper towel on fire and drop it into the jar. Place the balloon on top. When the fire goes out, lift the balloon… and the jar goes with it!

The air gets used up by the flame and lower the air pressure inside the jar. The surrounding air outside, now at a higher pressure than inside the jar, pushes the balloon into the jam jar.

Activity: Jumping Paper
Take an empty water or soda bottle and lay it down horizontally on a table. Carefully set a small wadded up ball of paper towel in the mouth of the bottle. (The ball should be about half the size of the opening.) Blow *hard* and try to get the paper to go into the bottle!

Why is this so impossible? You're trying to force more air into the bottle, but there's no room for the air already inside to go except back out the mouth of the bottle, taking the paper ball with it.

Activity: Kissing Balloons
Blow up two balloons. Attach a piece of string to each balloon. Have each hand hold one string so that the balloons are at nose-level, 6" apart. Blow hard between the balloons and watch them move!

The air pressure is lowered as you blow between the balloons (think of the air molecules as ping pong balls … they balls don't have enough time to touch the balloon surface as they zoom by). The air surrounding the balls that's not really moving is now at a higher pressure, and pushes the balloons together.

AERODYNAMICS

Every flying thing, whether it's an airplane, spacecraft, soccer ball, or flying kid, experiences four aerodynamic primary forces: lift, weight, thrust and drag. An airplane uses a propeller or jet engine to generate thrust. The wings to create lift. The smooth, pencil-thin shape minimizes drag. And the molecules that make up the airplane attributes to the weight.

Let's find out what are all the parts of an airplane for. You'll need to get a cheap balsa wood airplane for this next part - check out your local drug store or toy store. I've even found them in grocery stores for about $2.

Take the balsa wood airplane and try to fly just the body (no wings or fins). It flips all over the place. Try flying just the large wing (no body). Somersaults! Now slide the large wing into the body and fly (fewer somersaults, but still sickening to fly in!). Now add a horizontal stabilizer (elevator) tail, and when you throw it, add a slight curve so the plane "fishtails" in the air (like a car)… but did you notice that there are no more somersaults? Add the vertical tail (rudder) and see how it now steers straight no matter how to curve-throw it.

Sneaky Tip: if you remove the metal clip on the nose beforehand, you can add it last to really see what it's for… notice where most of the weight is without the clip?

Activity: Helicopters Cut out a paper rectangle 5 by 2 inches. Cut lengthwise down the strip, stopping about an inch before the end. Tape this uncut inch to the end tip of a popsicle stick. Fold the "bunny-ear" flaps down in opposite directions. Throw off a balcony and watch it whirl and gyrate!

Optional: You can notch the end of the popsicle stick to make a sling-shot helicopter. Make a quick slingshot launcher by looping a rubber band to another popsicle stick end.

Activity: Butterflying Cups Tape two Dixie paper cups together, bottom-to-bottom. Chain together six rubber bands. Loop one end of the rubber band chain over your thumb and hold your arm out horizontally straight, palm up.

Drape the remainder of the chain along your arm. Place the taped butterfly cups at the free end (near your shoulder) and slowly wind the rubber bands around the middle section of the cups.

When you wind near the end, stop, stretch the chain back toward your elbow, make sure the rubber band comes from the underside of the cups and release. The cups should rotate quickly and take air, then gracefully descend down for a light landing. Try making one with four cups.

Activity: Hot Air Balloons Shake out a garbage bag to its maximum capacity. Tape (use duct or masking tape) the open end almost-closed… you still want a small hole the size of the hair dryer nozzle. Use the hair dryer to inflate the bag and heat the air inside (make sure you don't melt the bag).

When the air is at its warmest, release your hold on the bag while you switch off the hair dryer. It should float up to the ceiling and stay there for a while.

This experiment works best on cold mornings. The greater the temperature difference between the bag's air and the surrounding air, the longer it will float.

Activity: Parachutes Attach a piece of floss or thin string to the four corners of a tissue. Attach a stick, a small wad of stones wrapped in another tissue, a pinecone, etc. to the centers of the string. Practice dropping these from the balcony and see which falls slowest with which load.

Activity: Ring Thing Cut an index card into thirds lengthwise. Loop one strip into a circle and tape ends together. Place two remaining strips together end-to-end and tape, then loop into large circle and tape in place. Place a piece of tape across one end of a straw and gently secure one ring to the tape. Repeat on the other end with remaining ring. Make sure the two rings are concentric (you can see through both like a telescope). Throw it small-end-first!

Activity: Free Form Machines Make an obstacle course with some or all the following different challenges:

- Hit a target balloon (arm the machines with opened paper clips)
- Go over and under a suspended length of string
- Make it through a hula hoop suspended vertically or horizontally
- Dangle large paper airplanes (made from 11x17" paper, or two 8.5x11" papers taped together to make an 11x17") from the ceiling for a 'dogfight' to earn points if you tag one
- Shoot through the basketball hoop, and dive into a basket.

Tips for Successful Learning

Learn from someone who has already done it successfully before, and ask them how long they waited before seeing results.

When making household repairs, servicing the family car or other domestic equipment, include your child. Natural scientific and mechanical skills can be discovered and developed in this way, and many scientific principles can be demonstrated in firsthand and practical ways.

"The definition of insanity: doing the same thing over and over again and expecting different results."
~Albert Einstein

ROLLER COASTER PHYSICS

The reason why things bounce, fly, zoom, and splat are described by the Laws of Physical Motion most kids learn in their high school physics class. But you don't have to wait until your kid hits puberty to have fun with physics – you can start right now. Kids across the globe use the law of gravitation everyday to put the zing in their games, from basketball games to skateboarding. Let's find out how they do it.

Let's take a look at the first law of motion. When you place a ball on the floor, it stays put. A science textbook will tell you this: An object at rest tends to stay at rest unless acted upon by an external force. Your foot is the external force—kick it!

What about when the ball whacks into something? Checking back in with the science textbook: An object in motion tends to stay in motion unless acted upon by an external force. After you kicked the ball (external force), it flies through the air until it smacks into something.

But there are two other forces acting on the ball that you can't see. One force is air resistance. The ball is hitting the air molecules when it flies through the air, which slows it down. The other force is gravitational. Gravity is inherent in anything that has mass (including you!), but you need something the size of a planet before you can begin to see the effects it has on other objects. If you tossed your ball in space (away from any nearby gravitational pulls like black holes or galaxies), it would continue in a straight line forever. There aren't any molecules for it to collide with, and no gravitational effects to pull it off-course.

There is one more idea that you'll need to understand… acceleration. A ball at rest has a position you can chart on a map (latitude, longitude, and altitude), but no velocity or acceleration. It's not moving. When you decide to stir things up and kick the ball, that's when it gets interesting. The second your toe touches the ball, things start to change. Velocity is the change in position. If you kick the ball ten feet, and it takes five seconds to go the distance, the average speed of the ball is 2 feet per second (about 1.4 MPH).

The trickier part of this scenario has to do with acceleration, which is the change of velocity. When you drive on the freeway at a constant 65 MPH, your acceleration is zero. Your speed does not change, so you have no acceleration. Your position is constantly changing, but you have constant speed. When you get on the freeway, your speed changes from zero to 65 MPH in ten seconds. Your acceleration is greatest when your foot first hits the gas – when your speed changes the most.

There's an interesting effect that happens when you travel in a curve. You can feel the effect of a different type of acceleration when you suddenly turn your car to the right – you will feel a *push* to the left. If you are going fast enough and you take the turn hard enough, you can get slammed against the door. So - who pushed you?

Think back to the first law of motion. An object in motion tends to stay in motion unless acted upon by an external force. This is the amazing part – the *car* is the external force. Your body was the object in motion, wanting to stay in motion in a straight line. The car turns, and your body still tries to maintain its straight path, but the car itself gets in the way. When you slam into the car door, the car is turning itself into your path, forcing you to change direction.

This effect is true when you travel in a car or in a roller coaster. It's the reason the water stays in the bucket when you swing it over your head. Physical motion is everywhere, challenging toddlers learning to walk as well as Olympic downhill skiers to go the distance.

Bucket Splash Fill a bucket half-full with water. Grasp the handle and swing it over your head in a circle in the vertical direction. Try spinning around while holding the handle out in front of your chest to swing it in the horizontal plane. Vary your spin speed to find the minimum!

Activity: Roller Coaster Physics This is the best way to learn about physics. All you need is a handful of marbles, several pieces of ¾" foam pipe insulation, a few rolls of masking tape, and a crowd of participants.

To make the roller coasters, you'll need foam pipe insulation, which is sold by the six-foot increments at the hardware store. You'll be slicing them in half lengthwise, so each piece makes twelve feet of track.

Pipe insulation comes in all sizes, so bring your marbles when you select the size. The ¾" size fits most marbles, but if you're using ball bearings or shooter marbles, try it out at the store. (At the very least you'll get smiles and interest from the hardware store sales people.)

Slit most of the track lengthwise (the hard way) with scissors. You'll find it is already sliced on one side, so this makes your task easier. Leave a few pieces uncut to become "tunnels" for later roller coasters.

The next step is to join your track together before adding all the features like loops and curves. Join two tracks together in butt-joint fashion and press a piece of masking tape lengthwise along both the inside and the underside of the track. A third piece of tape should go around the entire joint circumferentially. Make this connection as smooth as possible, as your high-speed marble roller coaster will tend to fly off the track at the slightest bump.

You can create all kinds of roller coaster maneuvers:

- Loops
- Camel-Backs (think humps)
- Whirly-Birds (take a loop and make it horizontal)
- Corkscrew (spread a basic loop apart)
- Jump Track
- Pretzel (tie a loose knot)

Troubleshooting If your marble is flying off the track, look very carefully for where it flies off:

o Does the track change position with the weight of the marble, making it fly off course? Make the track more rigid by taping it to a surface.

o Is the marble jumping over the track wall? Increase your bank angle (the amount of twist the track makes along its length).

o When all else fails, make it a tunnel section by taping another piece on top the main track. Spiral-wrap the tape along the length of both pieces to secure them together.

BUBBLOLOGY

If you pour a few droplets of water onto a sweater or fabric, you'll notice the water will just sit there on the surface in a ball (or oval, if the drop is large enough). If you touch the ball of water with a soapy finger, the ball disappears into the fibers of the fabric! What happened?

Soap makes water "wetter" by breaking down the water's surface tension by about two-thirds. The force that keeps the water droplet in a sphere shape is called *surface tension*. It's the reason you can fill a cup of water past the brim without it spilling over. Water becomes "wetter" because without soap, it can't get into the fibers of your clothes to get them clean. That's why you need soap in the washing machine.

Soap also makes water stretchy. If you've ever tried making bubbles with your mouth just using spit, you know that you can't get the larger, fist-sized spit-bubbles to form completely and detach to float away in the air. Water by itself has too much surface tension, too many forces holding the molecules together. When you add soap to it, they relax a bit and stretch out. Soap makes water stretch and form into a bubble.

The soap molecule looks a lot like a snake – it's a long chain that has two very different ends. The head of the snake loves water, and the tail end loves dirt. When the soap molecule find a dirt particle, it will wrap its tail around the dirt and hold it there.

Activity: Best Bubble Solution Gently mix together 12 cups cold water in a shallow tub with one cup green Dawn (or clear Ivory) dish soap.

If it's a hot dry day, add a few tablespoons of glycerin. (Glycerin can be found at the drug store.)

You can add all sorts of things to find the perfect soap solution: lemon juice, corn syrup, maple syrup, glycerin… to name a few. Each will add its own properties to the bubble solution.

The absolute best time to make gigantic bubbles is on an overcast day, right after it rains. Bubbles have a thin cell wall that evaporates quickly in direct sun, especially on a low-humidity day. The glycerin adds moisture and deters this rapid thinning of the bubble's cell wall.

Activity: Zillions of Tiny Bubbles can be made with strawberry baskets. Simply dip the basket into the bubble solution and twirl around. You can also use plastic six-pack soda can holders.

Activity: Trumpet Bubbles are created by using a modified a water bottle. Cut off the bottom of the bottle, dip the large end in the soap solution, put the small end to your lips and blow. You can separate the bubble away from the trumpet by rolling the large end up and away from your bubble.

Activity: Bubble Castles are built with a straw and a plate. First, spread bubble solution all over a smooth surface (such as a clean cookie sheet, plate, or table top).

Dip one end of a straw in the bubble solution and blow bubbles all over the surface. Make larger domes with smaller ones inside. Notice the bubble changes shape and size when it connects with another.

Activity: Stretch and Squish! Get one hand-sized bubble in each hand. Slap them together (so they join, not pop!). What if you join them together s l o w l y?

Activity: Light Show is one of the favorites when I teach this class. Find a BIG flashlight and stand it on end (or use a thin one with three clothespins).

Rub soap solution all other the bottom of an uncolored plastic lid (like from a coffee can). Balance the lid, soapy side up, on the flashlight (or on the spring-type clothespins).

Blow a hemisphere bubble on top of the lid. Find a dark room, turn on the flashlight, and blow gently along the side of the bubble and watch the colors swirl.

Activity: Weird Shapes are the simplest way to show how soap makes water stretchy. Dip a rubber band completely in the soap solution and pull it up. Stretch the rubber

band using your fingers. Twist and tweak into all sorts of shapes. Note that the bubble always finds a way of filling the shape with the minimum amount of surface area.

Activity: Moebius Bubble Make one by cutting open a thick rubber band or ½" thick ribbon, give one end a half-twist, and reattach it together.

Activity: Polygon Shapes allow you to make square and tetrahedral bubbles. Create different 3D shapes by bending pipe cleaners made into cubes, tetrahedrons, or whatever you wish.

You can also use straws threaded onto string made into 3D triangular shapes. Notice how the film always finds its minimum surface area. Can you make square bubbles? *(Hint: Yes!)*

Activity: Gigantic Bubbles Using the straws and string, thread two straws on three feet of string and tie off. Grasp one straw in each hand and dip in soap solution. Use a gentle wind as you walk to make BIG bubbles. Find air thermals (warm pockets of air) to take your bubbles up, up, UP!

Kid-In-A-Bubble In a child's plastic swimming pool, pour your best bubble solution. Lay a hula hoop down, making sure there is enough bubble solution to just cover the hoop.

Have your child stand in the pool (use a stool if you don't want to get your feet wet), and lift the hoop! For a more permanent project, use an old car tire sliced in half lengthwise (the hard way) to hold the bubble solution.

"I have not failed. I have just found 10,000 ways that won't work."

~Thomas Edison

CRYSTAL FARMING

Crystals are formed with atoms line up in patterns and solidify. There are crystals everywhere – in the form of salt, sugar, sand, diamonds, quartz… and more!

When making crystals, there is a very special kind of solution to make. It's called a "super saturated solid solution". What does that mean? Here's an example: If you constantly add salt by the spoonful to a cup of water, you'll reach a point where the salt doesn't disappear (dissolve) anymore and forms a lump at the bottom of the glass.

The point at which it begins to form a lump is just past the point of being a saturated solution. If you heat up the saltwater, the lump disappears. You can now add more and more salt, until it can't take anymore salt (you'll see another lump starting to form at the bottom). This is now a super saturated solid solution. Mix in a bit of water to make the lump disappear. Your solution is ready for making crystals. But how?

If you add something for the crystals to cling to, like a rock or a stick, crystals can now grow. If you "seed" the object (coat it with the stuff you formed the solution with, like salt or sugar), they will start forming faster.

TIP: If you keep the solution in a warm place, crystals will grow faster.

If you have too much salt (or other solid) mixed in, your solution will crystallize all at the same time and you'll get a huge rock that you can't pull out of the jar. If you have too little salt, then you'll wait forever for crystals to grow. Finding the right amount to mix in takes time and patience.

Activity: Geodes A geode is a crystallized mineral deposit, and are usually very dull and ordinary-looking on the outside, until you crack them open!

An eggshell is going to be used to simulate a gas bubble found in flowing lava. By dissolving alum in water (real life uses minerals dissolved in ground water) and placing it into your eggshell (in

real life, it's a gas bubble pocket), you will be left with a geode. (Note: these crystals are not for eating, just looking.)

Make sure your eggshells are clean. Fill a small cup with warm water and dissolve as much alum in the water as you can to make a saturated solution (meaning that if you add any more alum, it will only fall to the bottom and not dissolve).

Fill the eggshells with the solution and set aside. Observe as the solution evaporates over the next few days.

When the solution has completely evaporated, you will have a homemade geode. If no crystals formed, then you had too much water and not enough alum in your solution.

Activity: Gemstones Fill a clean glass jar with saturated solution made above and leave it for two days. Strain it and save the water for later. Keep the crystals!

Activity: String Crystals
Fill another glass jar with spare saturated solution, and suspend a crystal (from experiment above) with string from the jar lid. Lower it into the solution and wait several days. (Seed the string for quicker growth.)

Activity: Rock Candy
We're going to take advantage of the process of crystallization to make candy. You are going to make a super saturated solution of sugar and use it to grow your own homemade sugar candy crystals.

A super saturated solution is one that has as much sugar dissolved in the water as possible. (If we didn't heat the water, we'd wind up with only a saturated solution.)

Boil three cups of water in a large pot on the stove. Add eight cups of sugar, one cup at a time, slowly stirring as you go.

The liquid should be thick and yellowish. Turn off the heat and let it sit for four hours (until the temp. is below 120 degrees F).

Pour the sugar water solution into clean glass jars and add a couple drops of food coloring (for colored crystals). Tie a string to a skewer, resting the skewer horizontally across the jar mouth.

Activity: Salt Stalactites
Make a saturated solution from warm water and Epsom salts. (Add enough salt so that if you add more, it will not dissolve further.)

Fill two empty glass jars with the salt solution. Space the jars a foot apart on a layer of foil or on a cookie sheet.

Suspend a piece of yarn or string from one jar to the other. Wait impatiently for about three days. A stalactite should form from the middle of the string!

Educational Gift Ideas

Today, a whole range of educationally approved toys and games are are available. Consider these items: giving a subscription to a scientific magazine (Scientific American, Popular Science, Popular Mechanics, MAKE Magazine), an easy-to-assemble crystal radio, a general science kit, binoculars (Orion's 10x50 UltraViews are outstanding), an aquarium or terrarium (I use a pickle jar myself), a chemistry set, a model airplane, a biography of an inventor (Tesla, Einstein, or Edison), a microscope (Observer IV by GreatScopes is excellent), a telescope (my personal Orion SkyView Pro telescope is incredible for the price) and definitely a magnifying glass—and chances are, you already have one hiding somewhere in your home!

VOLCANO ERUPTIONS

If you've ever wondered what makes the Earth burp and spit magma, you're in the right place. This article is for those who want to shake up volcanoes using chemical reactions and air pressure.

The first thing to do is to mix up your own volcano dough. You can choose from the following two mixtures. The Standard Volcano dough is akin to "play dough", and the Earthy Volcano dough looks more like the real thing.

Either way, you'll need a few days on the shelf or a half hour in a low temperature oven to bake it dry. You can alternatively use a slab of clay if you have one large enough.

Activity: Standard Volcano Dough Mix together 6 cups flour, 2 cups salt, ½ cup vegetable oil, and 2 cups of warm water. The resulting mixture should be firm but smooth. Stand the water or soda bottle in the roasting pan and mold the dough around it into a volcano shape.

Activity: Earthy Volcano Dough Mix 2 ½ cups flour, 2 ½ dirt, 1 cup sand, 1 ½ cups salt and water. You mix all the dry ingredients together and then add water by the cup until the mixture sticks together.

Build the volcano around an empty water bottle on a disposable turkey-style roasting pan. It will dry in two days if you have the time, but why wait? You can erupt when wet if the mixture is stiff enough! (And if it's not, add more flour until it is.)

Activity: Soda Volcanoes Fill the bottle most of the way full with warm water and a bit of red food color. Add a splash of liquid soap and ¼ cup baking soda. Stir gently. When ready, add vinegar in a steady stream and watch that lava flow!

Activity: Air Pressure Sulfur Volcanoes Wrap the dough around the tubing into an ice-cream-cone-shape and slap the ice-cream-end down into your roasting pan tray. Push and pull the tube from the bottom until the other end of the tube is just below the volcano tip.

Using your fingers, shape the inside top of the volcano to resemble a small Dixie cup. Your solution needs a chamber to mix and grow in before overflowing down the mountain.

The tube goes at the bottom of the clay-cup

space. Be sure the volcano is SEALED to the cookie sheet at the bottom. You won't want the solution running out of the bottom of the volcano instead of popping up out the top!

Activity: Make your chemical reactants.

Solution 1: In one bucket, fill halfway with warm water and add one to two cups baking soda. Add one cup of liquid dish soap and stir very gently so you don't make too many bubbles.

Solution 2: In a different bucket, fill halfway with water and place one cup of aluminum sulfate (find this at the gardening section of the hardware store). Add red food coloring and stir.

Putting it all together: Practice your breathing: count ONE (and pour in Solution 1), TWO (inhale air only!), and THREE (pour in Solution 2 as you put your lips to the tube and puff as hard as you can!). Lava should not only flow but burp and spit all over the place!

Cool Volcano Facts

The largest volcano in the world is Mauna Loa. It has a volume of about 40,000 cubic kilometers, and an above-sea level area of 5125 square kilometers.

Most people consider Kilauea in Hawai'i to be the most active. It has erupted more than 50 times since the late 1700's when westerners arrived. A few claim that Piton de La Fournaise on Reunion Island in the Indian ocean is the most active.

Volcanoes are used to make electricity by heating water! It's called geothermal energy and the countries currently using this technology include: the USA, Iceland, Japan, Guatemala, New Zealand. Geothermal energy is usually considered a "clean and renewable" resource, but it's not always the case, as smelly chemical compounds are constantly released into the atmosphere by a geothermal plant.

"A new idea must not be judged by its immediate results."

~Nikola Tesla

An Interview With A Successful Science Teacher

Aurora Lipper, mechanical engineer, university instructor, rocket scientist, airplane pilot, astronomer, and director of Supercharged Science, a science education company, shares her story.

"Tell us a bit about yourself."

"I attended Cal Poly State University in San Luis Obispo, California, where I obtained a Bachelor's Degree in Mechanical Engineering (with a minor in Mathematics and senior project in Rocket Science) in June 1996. While in California, I received an Air Force sponsorship to pursue further studies in a Master's program with Edward Air Force Base in Dryden, California. I was also a student pilot and shortly thereafter received my private pilot license."

"In June 1997, I completed a Master's Degree in Mechanical Engineering at Cal Poly State University, with a thesis in flow patterns of F -15 engines and with 4.0 GPA and was awarded Graduation with Distinction."

"In Fall 1997, I became one of the youngest instructors in the engineering department at Cal Poly State University, where I taught lectures in Statics, Dynamics, Engineering Systems, and labs in Fluid Mechanics, Vibrations, and Engineering Design."

"What kind of teacher were you in college?"

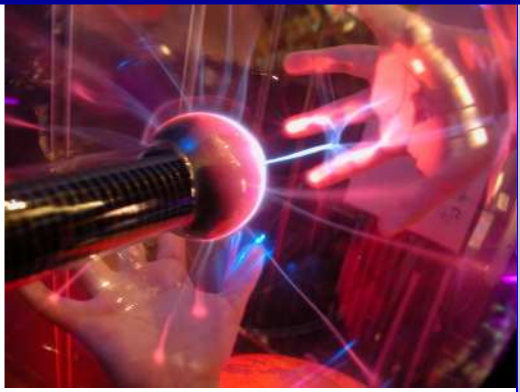
"A student once told me this: *"I can get an A in your class, or an A in all my other classes.."* and they picked mine! Although my classes were filled with textbook problems and mathematical formulas, they had a very unique feel to them. I worked hard to set up the learning environment so learning felt *good,* which is no small task with college-age students. I also worked very hard at setting up the lecture into small, bite-sized pieces anyone could grasp by relating it to what they already knew. For example, I would explain supersonic flow by relating it to something they deal with everyday… like freeway traffic. Einstein himself said that if you couldn't explain something in simple terms, you did not truly understand it at all."

"I am a big believer in getting outside of the classroom and into the environment. My sophomore level Dynamics class went to Six Flags Magic Mountain for their exam and analyzed roller coasters and other rides with homemade accelerometers, height meters, and g-force indicators they crafted themselves. The point was to get the students out of the classroom and into real life situations. And I am happy to report most my students did stellar on common final exams ("common final" refers to the idea that if there are multiple classes taught by different instructors, the same exam is given to all students).

"How did you get into teaching kids?"

"Thinking I was going to teach university classes for the rest of my life, I needed to obtain a Ph.D.. I began my doctorate studies at Stanford University in the High Temperature Gas Dynamics Lab (Combustion) and spent my free time at the local children's museum in the San Francisco Bay Area.

"After six months, I realized that studying in a dark corner about a subject no one really cared about (Simultaneous Laser Spectroscopy and Schlieren Photography of Hypersonic Combustion Fluid Flow... See? Not all that interesting.) for the next seven years was not the fastest track to making



the biggest impact on young minds.

"I returned to the university and taught for several years as an instructor while creating my own unique set of physical science lessons. Then I had a radical idea: what if I packaged my university classes into something school kids could learn?

"Teaching elementary schools about supersonic combustion did not seem like a good idea at first. But after awhile, I realized how much physical science was really needed in all levels of public schools, and was able to create an amazing program that inspired thousands of kids to experiment with science on their own.

"What are you working on now?"

"I enjoyed some wonderful experiences with kids and parents when I created Camp Kinetic, a summer science camp for 7-12 year olds in my local area. I first planned to offer camp for 48 kids, but soon had to add enough space to accommodate over 200. We now teach this camp to thousands of kids across the country.

"I have now taken the opportunity to have a wider range of students as I dedicate my work to educating and inspiring families and teachers through my science education business, Supercharged Science. My company evolved as an expression of a value I am committed to in my life and want to offer others: envisioning, empowering, and taking massive action.

"Many parents and teachers have learned the teaching strategies needed for self-motivated learning through my intensive workshops and seminars. I share a unique perspective on overcoming the stressful and overwhelming tasks of teaching science in a meaningful and impactful way through my experiences as an instructor, speaker, and rocket scientist."

An Interview With A Successful Science Teacher… continued

"What traits do you think can help someone succeed at their science education?"

"Determination, resilience, and acuity. Most people give up just before what they are trying to do actually works. Edison tried thousands of times before he got that light bulb to work, and every "failure" was recorded as a success... he knew which elements burned and for how long (or exploded), just in case he'd need it in the future (which he did!).

"As for acuity - know what you are getting. Observe your results carefully. Why did the roller coaster fly off the track? Too fast or too slow? Asking better questions gets better results. Just saying 'It didn't work!' does not get you anywhere."

"It doesn't matter how beautiful your theory is, it doesn't matter how smart you are. If it doesn't agree with experiment, it's not right. "

~Richard Feynman

"How does someone do a great science experiment?"

"I figure there are three basic steps to doing great science experiments: first, figure out what you want to do. Have a clear vision about what you want to test or try out. Second, have a plan for doing it. Design the experiment, map it out so you know what to do. Third: measure your success. Lots of people, scientist or not, skip this vital step.

"Think of yourself in an airplane. Before you leave the ground, you know exactly where you are headed (this is your vision). You made sure you have enough fuel, and you didn't forget your passengers (you mapped out a plan). Did you know an airplane is off-course 95% of the time? The airplane course-corrects to keep it headed in the right direction... it doesn't check once in awhile - it's an ongoing process (measuring success)."

"Who would a student contact if they want to do science experiments?"

"One of the most difficult aspects of a science experiment is becoming overwhelmed by the magnitude of variables (things you can vary in each experiment). Another is not knowing where to find materials.

"Get in touch with your local college or

universities. There is usually someone in the physics or engineering department who either has kids or likes kids, and are willing to help you find new resources for your child. Your local community section in the newspaper can be a resource area as well."

"The Supercharged Science website is a great place to get started. By downloading the free resources, you can get science experiment information delivered to you - experiments you can do right now at home with the things you have Most experiments require local grocery store items."

"What do you recommend for a parent with no science skills looking for ways to help their child?"

"Remember that your job is not to know everything. Your job is to play with the kids. This means going to the library together with your child, getting science experiment books, and making time to just be with your child.

"When they ask you, *"What's happening?"* when they rub a balloon on their hair and stick it to the wall, you should turn right

around and say, "Gosh. I'm not sure. It looks like that balloon just stuck there. Did you glue it?"

"What additional tips would you be willing to offer someone interested in expanding their classroom curriculum?"

"If you truly want to be successful in your science classroom, you can start by creating a vision of what you want. Is it a mad scientist lab with beakers of colored substances constantly burping and bubbling? Is it a student-run interactive robotics lab, where they run it part time as a hands-on museum open to the public? What do you really want to create?

"Get creative by visiting local colleges with your ideas and requests. Put an ad online or in the university paper looking for energetic physics students to help you build an astronomy lab on the roof or design an interactive slime lab that refills itself. Visit the library and fill your card with as many resources as you can. Totally immerse yourself in the process, and you will be amazed and dazzled by the results."

WHAT'S NEXT?

There you have it—many different science ideas to help focus your child on **wonder, discovery, and exploration.**

If you're searching for even *more* science for your child, know that you can provide an outstanding science education more quickly, easily, and inexpensively than you think.

Many families are very frustrated with current quality of science education available because the science experiments on the market are poorly designed, expensive to refill, difficult to implement, and are limited in their capacity to ensure understanding.

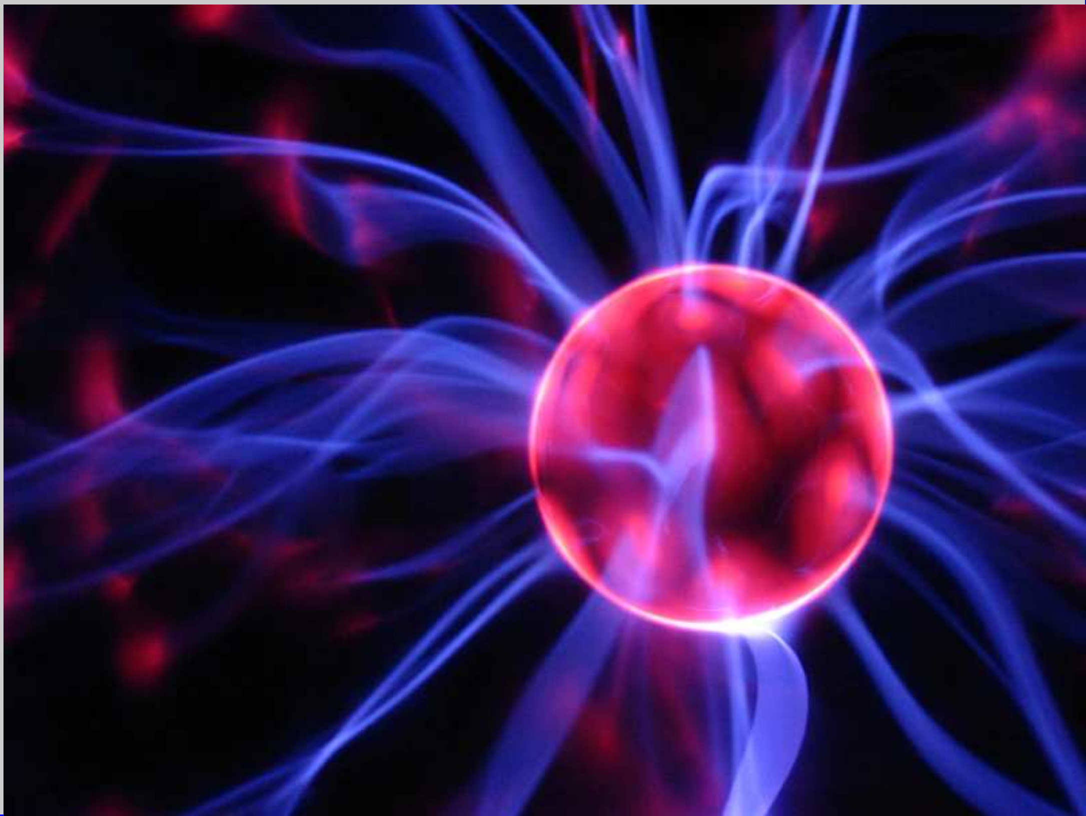
Some of the areas that parents are concerned about are that they have a child who is thirsty to learn more science, but they have no idea where to fulfill this need.

Many parents feel embarrassed or unable to respond when their child asks questions about science they simply can't answer. Other parents don't have a clear, big-picture perspective of how science works. Many families really don't have the budget to keep buying "science activities" which are hard to understand, have directions that are difficult to follow, and contain materials that are impossible to get refills for further study.

Most science kits and books do not accurately represent what it is really like to be a scientist or engineer. Perhaps the greatest concern of all is that their child will get turned off to science at an early stage because of frustrating experiences like these.

Imagine a child who can't sleep at night because they are so excited about the next day's activities... and those activities spark more ideas! Imagine having the peace of mind in knowing your child is learning even without your help, because you ignited your child's interest in a way that may last their entire life.

This same child will patiently explain everything to you and doesn't expect you to know all the answers. Imagine having a child who is turned on by life and tries to fix the broken



things in your house. This same child will turn toilet paper tubes into working radios, Tupperware containers into laser light shows, and launch soda bottles a hundred feet in the air as rockets. using stuff from around the house.

For years, the bridge between the adult scientist-career world and the child science-education world has had no bridge. Science museums and books are being created to fill the gap, but it simply isn't enough to visit a museum once a year nor to buy books when you have no one to ask questions to. For many years, there has been a wall between those who understand and utilize the wonders of science and the rest of the world who buy groceries and frequent family soccer games.

The key steps to success in sparking a child's interest in science in a lasting way are to first get your hands on the right information. Everyone sells a science book full of experiments, but you will have questions that go unanswered, science ideas that still don't make sense, and you won't be able to find the materials you need.

Or worse, you buy science books for your kids, and years later find them on a dusty shelf while your now-high-school-age-kids are filling out college applications and unsure which career path to choose - now that's a *set-back.*

You need to get your hands on the right information and deliver it in the right way at the right time to your child. We have a science program filled with well-written experiments that require parts from local stores, shopping lists for easy assembly, science articles and resources plus unlimited support as long as you need it.

Since 1996, Aurora Lipper (founder and owner of Supercharged Science) has been sparking the minds of young scientists in elementary schools through university level. What we offer is a wide variety of products and services that will put you on track to getting interested in learning science in an

outstanding and lasting way.

The next step is to check out our Science Mastery Program, which will give you everything you need to create an outstanding science education program that will dazzle your child and set them thinking. (All you need to do is add the kids.)

Visit our website to find out more:

www.SuperchargedScience.com