Homeschool Science Activity & Video Series

Includes detailed project steps, explanations and key concepts, tips & tricks, and access to instructional videos.

Designed by real scientists for our future generation.

Supercharged Science

www.SuperchargedScience.com

A collection of quick and inexpensive science experiments that work you through electricity, introduce you to chemistry, and present project ideas guaranteed to get your kids excited to do science.

Vol. 5 *Chemistry Issue*

Thank You for purchasing the *Homeschool Science Activity & Video Series.*

I 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 *real* science? The thrill when something you built yourself actually *worked*? Can you recall a teacher that made a difference for you that changed your life?

First, let me thank you for caring enough about your child to be a homeschool parent. As you know, this is a huge commitment. While, you may not always get the credit you deserve, never doubt that it really does make a difference.

This book has free videos that go with it to show you step-by-step how to do each experiment. You can view the videos at: SuperchargedScience.com/savs-chemistry.htm

Access code: ESCI

Go to this page now so you can get a preview of the videos.

"Isn't Chemistry Dangerous?" A lot of folks get nervous around chemistry. You can't always 'see' what's going on (are there toxic gases generated from that reaction?).

Unfortunately, a lot of people have made the generalization that chemicals are dangerous and their effects are bad. In fact, every chemical is potentially harmful if not handled properly. That is why I've prepared a special set of chemistry experiments that include step-by-step demonstrations on how to properly handle the chemicals, use them in the experiment, and dispose of them when you're finished.

Chemistry is predictable, just as dropping a ball from a height always hits the floor. Every time you add 1 teaspoon of baking soda to 1 cup of vinegar, you get the same reaction. It doesn't simply stop working one time and explode the next.

You know what to expect when you do a chemistry experiment, especially if you have a teacher to help you understand what you are doing. And I'm going to walk you through every step of the way so you know exactly what's coming.

A Word About Safety… make sure you work with someone experienced when you're working with new stuff you're unsure about. Just use common sense—If it seems like it could be dangerous, ask for help.

Let's get started! Put on your safety goggles and gloves (yes, those are REQUIRED) and let's go!

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"The future belongs to those that believe in the beauty of their dreams."

~Eleanor Roosevelt

VITAMIN C INDICATOR

Activity

You'd be surprised at where vitamin C pops up in your kitchen - I know I was!

I found it in my broccoli, butternut squash, sweet potatoes, Swiss chard, spinach, carrots, kale, peas, leeks, tomatoes, guava, watermelon, grapefruit, pecans, raspberries, bell peppers, onion, papaya, pineapple, and pistachios!

Let's find out how much of this vitamin is already in your home - are you ready?

Materials

- cornstarch
- distilled or filtered water
- old saucepan (just for chemistry) or chemistry glassware
- disposable stirring stick or spoon
- disposable cups
- iodine
- stove with adult help
- foods to test (you'll be throwing them away when you are done - don't eat them!)

Always wear your safety goggles and gloves.

Experiment

To start with, watch the video for this experiment:

SuperchargedScience.com/savs-chemistry.htm

Access code: ESCI

1. Place two cups of water into your saucepan.
2. Add 1 tablespoon of starch to the water.
3. Bring it to a boil on the stove.
4. Remove from heat and allow to cool to room temperature before doing the next step.
5. Add 10 drops of iodine to the solution.
6. Your indicator is ready to go!
7. Put a sample of orange juice in a disposable cup. Add a couple of drops of indicator to the juice. The lighter the color, the more the vitamin C that's inside the sample.
8. Put a sample of milk in a disposable container. Add a drop or two of the indicator. Did it change color? If the milk turned blue (the color of the indicator), that means that there is *no* vitamin C in your milk.
9. For solids like spinach, add water to the spinach and whirl in a blender. Strain out the solids and test the liquid itself.
10. You can also start with the indicator in a cup and add drops of the juice samples until you get a color change. The more drops it takes to change color, the *less* vitamin C your sample has.

What's Going On?

Vitamin C is essential for humans and some animals (mostly primates), protecting the body from oxidative stress (involved in many diseases) and helping heal wounds. When humans don't get enough vitamin C, they get sick with scurvy (bleeding from all mucus membranes, brown spots on the skin...), which is actually how scientists discovered vitamin C in the first place.

Plants and most animals actually make their own vitamin C by converting glucose (sugar).

Latest research (2008) discovered that the red blood cells in humans and primates more efficiently use vitamin C already in the body by recycling DHA. The neat part about this discovery is that *only* humans and some primates have this ability - plants and most other animals do not.

Questions to Ask

1. Which has more vitamin C: fresh orange juice or store-bought orange juice?
2. Do dark green leafy vegetables like kale and spinach have more or less vitamin C than orange juice?
3. Which fruits that you love to eat have the most vitamin C?
4. Does the vitamin C level change depending on how old the food is?
5. Which has more vitamin C: cooked spinach or raw?

What is stuff made of?

If you had a really high-powered microscope and you looked really close at an apple to figure out what it was made out of, you'd see tiny, fuzzy little dots that have forces pulling on them. Those forces are what keep the apple in its shape so it doesn't fly apart. The forces also connects the little dots together to make **molecules**.

The fuzzy little dots are called **atoms**. Have you ever heard of oxygen or hydrogen? Those are atoms!

The definition of an **atom is: the smallest part of stable matter**. There are things smaller than an atom, but they are unstable.

Atoms are very stable and can be around for long, long, long periods of time. Atoms rarely hang out on their own though. They really are friendly and love to hang out together in groups.

These groups of atoms are called molecules. A molecule can be made of anywhere from two atoms to millions of atoms. Together these atoms make absolutely everything.

So if hydrogen and oxygen are two kinds of atoms, then a molecule is when hydrogen and water atoms combine to make water. Water is the molecule.

All matter is made of atoms. Shoes, air, watermelons, milk, wombats, you, everything is made of atoms. Hundreds, and billions, and zillions of atoms make up everything.

When you fly your kite, it's the air atoms (nitrogen and oxygen mostly) moving against the kite that keep it up. When you float in a boat, it's water atoms (hydrogen and oxygen) under your boat holding it up.

Supercooling Liquids

Activity

Did you know that supercooled liquids need to heat up in order to freeze into a solid?

Supercooling a liquid is a really neat way of keeping the liquid a liquid below the freezing temperature.

Normally, when you decrease the temperature of water below 32°F, it turns into ice. But if you do it gently and slowly enough, it will stay a liquid, albeit a really *cold* one!

We're going to do *two* experiments so you can really get the hang of this idea. Are you ready?

Materials

- water
- glass
- bowl
- ice
- salt
- two reusable hand warmers (the kind with sodium acetate inside
- disposable aluminum pie plate
- safety goggles
- disposable rubber gloves (you don't want to touch sodium acetate with your hands)

Experiment #1: Instant Ice

To start with, watch the first video for this experiment at:

SuperchargedScience.com/savs-chemistry.htm

Access code: ESCI

1. Fill a glass halfway with water.
2. Fill a bowl with ice.
3. Put the glass of water inside the bowl, making sure that the level of ice is higher than the water.
4. Sprinkle salt around on the ice (no ice in the glass of water!)
5. Let sit for 15 minutes.
6. After 15 minutes, *CAREFULLY* remove the glass of water (don't disturb it) from the ice and set gently on the table.
7. Add a piece of ice (without salt—get a fresh piece from the freezer) to the cup—just drop it in.
8. You'll see the crystals instantly form!

What's Going On?

In nature, you'll find supercooled water drops in freezing rain and also inside cumulus clouds. Pilots that fly through these clouds need to pay careful attention, as ice can instantly form on the instrument ports causing the instruments to fail.

More dangerous is when it forms on the wings, changing the shape of the wing and causing the wing to stop producing lift. Most planes have de-icing capabilities, but the pilot still needs to turn it on.

We supercooled the water, and then triggered the crystallization (freezing) process by adding in the ice. While we're only going to supercool it a couple of degrees, scientists can actually supercool liquid water to below -43°F!

Don't mix up the idea of supercooling with "freezing point depression." Supercooling is when you keep the solution a liquid below the freezing temperature (where it normally turns into a solid) *without* adding anything to the solution. "Freezing point depression" is when you lay salt on the roads to melt the snow - you are lowering the freezing point by adding something, so the solution has a lower freezing point than the pure solvent.

Experiment #2:
Hot Ice Sculptures

After you've finished #1, it's time to watch the second video (right below the first one).

1. Always wear gloves and goggles when handling sodium acetate!

2. Flex the disc in one of the hand warmers to trigger the crystallization process. Did you notice how *HOT* the warmer gets when it goes from a liquid to a solid?

3. After the warmer has cooled down, cut open the solid pack and remove a small crystal and place it on your disposable pie plate.

4. Open the second warmer (this one is still in its liquid state) by snipping a corner with scissors.

5. Slowly trickle a steady stream of the liquid directly onto the crystal in the pie tin. You'll find it instantly forms into a solid.

6. Continue to grow the stalagmite using the rest of the liquid!

What's Going On?

To supercool a liquid, you slowly and carefully bring down the temperature to below the normal freezing point and it's still a liquid. We did this in our previous *Instant Ice* experiment.

Since the temperature is now *below* the freezing point, if you disturb the solution, it will need to heat up in order to go back up to the freezing point and to turn into a solid.

When this happens, the solution gives off heat as it freezes. So instead of cold ice, you have hot ice. Weird, isn't it?

Sodium acetate is a colorless salt used making rubber, dying clothing, and neutralizing sulfuric acid (the acid found in car batteries) spills. It's also commonly available in heating packs, since the liquid -solid process is completely reversible - you can melt the solid back into a liquid and do this experiment over and over again!

The crystals melt at 136°F (58°C), so you can wrap the used warmer in boiling water (wrap it in a towel first so you don't melt the bag) for about 10 minutes to liquefy the crystals. For crystals outside the bag (like your icicle), place the icicle in the foil pan over a heat source to gently melt it into a liquid state.

You have seen sodium acetate before - when you combine baking soda and vinegar in a cup, the white stuff at the bottom of the cup left over from the reaction is sodium acetate. (No white stuff? Then it's suspended in solution with the water. If you heat the solution and boil off all the water, you'll find white crystals in the bottom of your pan.) The bubbles released from the baking soda-vinegar reaction are carbon dioxide.

Fruit Battery

Activity

This experiment shows how a battery works using electrochemistry.

The electrons inside the copper are going to react with the acid in the lemon juice to make a flow of current you can detect with a digital multimeter.

Materials

- one zinc strip or galvanized nail
- one copper strip or shiny penny
- two alligator wires
- digital multimeter or LED (1.7V or less)
- one fresh large lemon, orange, grapefruit, potato, or apple

Always wear your safety goggles and gloves.

Experiment

To start with, watch the video for this experiment:

SuperchargedScience.com/savs-chemistry.htm

Access code: ESCI

1. Roll and squish the lemon around in your hand so you break up the membranes inside, without breaking the skin. If you're using non-membrane foods, such as an apple or potato, you are all ready to go (you don't have to squish it).

2. Insert the copper and zinc strips into the lemon, making sure they do not contact each other inside. Put them about an inch apart.

3. Clip one test wire from the digital multimeter to each metal strip using alligator wires.

4. Read and record your results.

5. What happens when you gently squeeze the lemon? Does the voltage vary over time?

What's Going On?

The copper electrons are chemically reacting with the lemon juice, which is a weak acid, to form copper ions (cathode, or positive electrode) and bubbles of hydrogen.

These copper ions interact with the zinc electrode (negative electrode, or anode) to form zinc ions.

The difference in electrical charge (potential) on these two strips causes a voltage.

The basic idea of electrochemistry is that charged atoms (ions) can be electrically directed from one place to the other. If we have a glass of water and dump in a handful of salt, the NaCl (salt) molecule dissociates into the ions Na+ and Cl-.

When we plunk in one positive electrode and one negative electrode and crank up the power, we find that opposites attract: Na+ zooms over to the negative electrode and Cl- zips over to the positive. The ions are attracted (directed) to the opposite electrode and there is current in the solution.

Electrochemistry studies chemical reactions that generate a voltage and vice versa (when a voltage drives a chemical reaction), called oxidation and reduction (redox) reactions. When electrons are transferred between molecules, it's a redox process.

Fruit batteries use electrolytes (solution containing free ions, like salt water or lemon juice) to generate a voltage.

Think of electrolytes as a material that dissolves in water to make a solution that conducts electricity.

Fruit batteries also need electrodes made of conductive material, like metal. Metals are conductors not because electricity passes through them, but because they contain electrons that can move.

Think of the metal wire like a hose full of water. The water can move through the hose. An insulator would be like a hose full of cement - no charge can move through it.

You need two different metals in this experiment that are close, but not touching inside the solution. If the two metals are the same, the chemical reaction doesn't start and no ions flow and no voltage is generated - nothing happens.

Going Further

1. You can try potatoes, apples, or any other fruit or vegetable containing acid or other electrolytes.
2. You can use a galvanized nail and a shiny copper penny (preferably minted before 1982) for alternate electrodes, although they don't have as much surface area as the strips and will give a smaller voltage.
3. If you want to light a light bulb, try using a low-voltage LED (1.7V or lower) in place of the multimeter. You can also power a digital display if you have one you can rip out of an old clock.
4. You can connect several lemons together by connecting the copper strip of lemon #1 to the zinc strip of lemon #2, and the copper strip of #2 to the zinc of #3, etc. For comparison, you'll need about 557 lemons to light a standard flashlight bulb.

What is Electrochemistry?

If you guessed that this has to do with electricity and chemistry, you're right! But you might wonder how they work together.

Back in 1800, William Nicholson and Johann Ritter were the first ones to split water into hydrogen and oxygen using electrolysis.

They added energy in the form of an electric current into a cup of water and captured the bubbles forming into two separate cups, one for hydrogen and other for oxygen.

Soon afterward, Ritter went on to figure out electroplating, which is depositing one metal onto another using electricity.

Iodine Clock Reaction

Activity

First discovered in 1886 by Hans Heinrich Landolt, the iodine clock reaction is one of the best classical chemical kinetics experiments. Here's what to expect: Two clear solutions are mixed. At first there is no visible reaction, but after a short time, the liquid suddenly turns dark blue.

Materials

Find the chemicals at HomeTrainingTools.com

- two test tubes
- packing peanut
- sodium thiosulfate
- potassium iodide
- disposable droppers
- hydrogen peroxide
- distilled white vinegar
- distilled water
- four disposable cups
- popsicle sticks
- clock or stopwatch
- measuring spoons
- measuring cups
- goggles and gloves

Always wear your safety goggles and gloves.

Experiment

To start with, watch the video for this experiment:

SuperchargedScience.com/savs-chemistry.htm

Access code: ESCI

1. Put on your safety goggles and gloves. You do not want to come in contact with sodium thiosulfate or potassium iodide.

2. This is a very sensitive experiment. If you're using glassware, rinse everything out very thoroughly with water three times, to ensure that nothing is contaminated before the experiment so you can get a clean start. If you're using disposable cups, you're all set.

3. You can use droppers or measuring spoons (dedicated just to chemistry, not used for cooking) to measure your chemicals. For droppers, make sure you're using one dropper per chemical, and leave the dropper in the chemical when not in use to decrease the chances of cross-contamination.

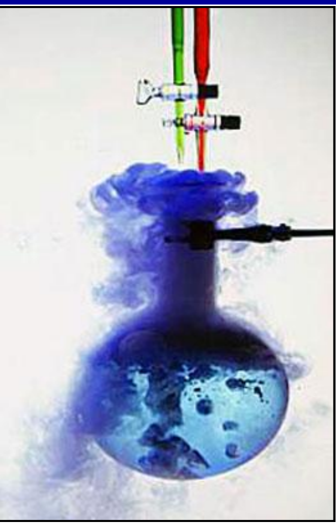
4. Measure out 1 cup of distilled water and pour it into your first cup. Add ½ teaspoon sodium thiosulfate and stir until all the crystals are dissolved. Touch the cup (with your glove) to feel the temperature change. Is it hotter or colder?

5. Measure out 1 cup of distilled water into a new container. Drop in the starch packing peanut and stir it around until it dissolves. Packing peanuts can be made of cornstarch (as yours is, which is why it "melts" in water) or polystyrene (which melts in acetone, not water).

6. Into a third cup, measure out 1 cup of hydrogen peroxide.

7. Into the fourth cup, measure out 1 cup of distilled white vinegar.

8. Fill your test tube with three parts starch



(packing peanut) solution.

9. Add two parts distilled vinegar and two parts potassium iodide. (Make sure you don't cross-contaminate your chemicals — use clean measuring equipment each time.) Your solution should be clear.

10. In another test tube, measure out three parts starch solution.

11. Add two parts hydrogen peroxide and two parts sodium thiosulfate solution. If the solution in the test tube is clear, you're ready to move on to the next step.

12. Your next step is to pour one solution into the other and cap it, rocking it gently to mix the solution. While you're doing this, have someone clock the time from when the two solutions touch to when you see a major change.

What's Going On?

There are actually two reactions going on at the same time. When you combined the two solutions, the hydrogen peroxide (H_2O_2) combines with the iodide ions (I) to create triiodide (I_3) and water (H_2O).

The sodium thiosulfate ($S_2O_3^2$) grabs the triiodide to form iodine, which is clear. But the sodium thiosulfate eventually runs out, allowing the triiodide to accumulate (indicated by the solution changing color).

The time you measure is actually the time it takes to produce slightly more iodide ions than the sodium thiosulfate can wipe out.

By accelerating the first reaction, you can shorten the time it takes the solution to change color.

There are a few ways to do this: You can decrease the pH (increasing H+ concentration), or increase the iodide or hydrogen peroxide. To lengthen the time delay, add more sodium thiosulfate.

In the first (slow) reaction, the triiodide ion is produced:

$H_2O_2 + 3\ I^- + 2\ H^+ \longrightarrow$

$I_3^- + 2\ H_2O$

In the second (fast) reaction, triiodide is reconverted to iodide by the thiosulfate:

$I_3^- + 2\ S_2O_3^{2-} \longrightarrow 3\ I^- + S_4O_6^{2-}$

After some time the solution always changes color to a very dark blue, almost black (the solution changes color due to the triiodide-starch complex).

Usually, this reaction uses a solution of hydrogen peroxide with sulfuric acid, but you can substitute a weaker (and safer) acid that works just as well: acetic acid (distilled white vinegar).

The second solution contains potassium iodide, sodium thiosulfate (crystals), and starch (we're using a starch packing peanut, but you can also use plain old cornstarch).

When you combine one with the other to get the overall reaction, but remember that there are *two* reactions going on at the same time.

The next experiment to try after this one is the oscillating clock experiment, in which the solution repeatedly changes back and forth, all by itself.

Borax Crystals

Activity

Can we really make crystals out of soap? You bet! These crystals grow really fast, provided your solution is properly saturated. In only 12 hours, you should have sizable crystals sprouting up.

You can do this experiment with either skewers, string, or pipe cleaners. The advantage of using pipe cleaners is that you can twist the pipe cleaners together into interesting shapes, such as a snowflake or other design. (Make sure the shape fits inside your jar.)

Materials

- pipe cleaners (or string or skewer)
- cleaned out pickle, jam, or mayo jar
- water
- borax (*AKA sodium tetraborate)*
- adult help, stove, pan, and stirring spoon

Always wear your safety goggles and gloves.

Experiment

To start with, watch the video for this experiment at:

SuperchargedScience.com/savs-chemistry.htm

Access code: ESCI

1. Cut a length of string and tie it to your pipe cleaner shape; tie the other end around a pencil or wooden skewer. You want the shape suspended in the jar, not touching the bottom or sides.

2. Bring enough water to fill the jar (at least 2 cups) to a boil on the stove (food coloring is fun, but entirely optional).

3. Add 1 cup of borax (aka sodium tetraborate or sodium borate) to the solution, stirring to dissolve.

4. If there are no bits settling to the bottom, add another spoonful and stir until you cannot dissolve any more borax into the solution. When you see bits of borax at the bottom, you're ready. You have made a supersaturated solution. Make sure your solution is saturated, or your crystals will not grow.

5. Wait until your solution has cooled to about 130°F . It's hot to the touch, but not so hot that you yank your hand away.

6. Pour the solution (just the liquid, not the solid bits) into the jar with the shape. Put the jar in a place where the crystals can grow undisturbed overnight, or even for a few days. Warmer locations (such as upstairs or on top shelves) are best.

DO NOT EAT!!! Keep these crystals out of reach of small kids, as they look a lot like the Rock Candy Crystals, but remember, they are made out of laundry soap!

What's Going On?

The magic behind this experiment is the way we mix up the solution as well as providing a place for the crystals to grow.

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

If you have too much borax 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 borax, then you'll have to wait forever for crystals to grow.

Finding the right amount takes time and patience, which makes this a perfect experiment to help your young scientists learn about diligence and perseverance.

Encourage them to observe that happened and to try again when they feel frustrated or want to give up. Most folks jump ship at this point, but that's what separates the real scientists from those who just dabble and never get anywhere.

Science takes time and patience to cultivate, and you want your kids to learn the joy of succeeding when they push through. Scientists learn the most when they make mistakes, and your kids will too.

Don't be afraid to let them experience emotions like frustration or overwhelm, so they know how to deal with it when it arises in real life. The real secret is not to take it personally, and know that science doesn't always work the first time… or second, or third.

Remind them to keep their eye on the goal and to try again. Your kids will be truly rewarded when they feel the excitement and victory after working on a hard project and seeing their results (in this case, a beautiful crystal).

Some scientists actually look forward to (and expect) their experiments *not to* work, so they can learn something new!

What IS Science?

Science is more than a classroom… it's actually pretty difficult to define. Science is not about what we know, but rather about how we face what we *don't* know.

It's not a textbook of principles, set of rules, or collection of factoids. It's a process, a *thing* you do.

Science is what happens when you ask questions, get back answers, and try to figure out and make sense of it all. There are many different ways to do this, the *Scientific Method* is only one of the ways of sorting and sifting through the information as you go along.

Believe it or not, there's a straightforward method to doing science. You can't just sit around and argue about how things work, but you actually have to do experiments and be able to measure your results.

And other people have to be able to get those same results on their own, too!

Learn more about how to do real science with the e-Science Online Program: www.SuperchargedScience.com

Teaching Science Right

Hopefully these activities have given you a small taste of how science can be totally cool AND educational.

But teaching homeschool science isn't always easy.

You see, there's a lot more to it than most traditional science books and programs accomplish. If your kid doesn't remember the science they learned last year, you have a problem.

What do kids really need to know when it comes to science?

Kids who have a solid science and technology background are better equipped to go to college, and will have many more choices once they get out into the real world.

Learning science isn't just a matter of memorizing facts and theories. On the contrary, it's developing a deep curiosity about the world around us, AND having a set of tools that lets kids explore that curiosity to answer their questions.

Teaching science in this kind of way isn't just a matter of putting together a textbook with a few science experiments and kits.

Science education is a three-step process (and I mean teaching science in a way that your kids will really understand and remember). Here are the steps:

1. Get kids genuinely interested and excited about a topic.
2. Give them hands-on activities and experiments to make the topic meaningful.
3. Teach the supporting academics and theory.

Most science books and programs just focus on the third step and may throw in some experiments as an afterthought. This just isn't how kids learn.

There is a better way. When you provide your kids with these three keys (in order), you can give your kids the kind of science education that not only excites them, but that they remember for many years to come.

Don't let this happen to you… you buy science books that were never really used and now your kids are filling out college applications and realizing they're missing a piece of their education—a REALLY big piece. Now *that's* a setback.

So what do you do?

First, don't worry. It's not something that takes years and years to do. It just takes commitment.

What if you don't have time? What I'm about to describe can take a bit of time as a parent, but it doesn't have to. There is a way to shortcut the process and get the same results! But I'll tell you more about that later.

Putting It Into Action

Step one: Get kids genuinely interested and excited about a topic.

Start by deciding what topic you want your kids to learn. Then, you're going to get them really interested in it.

For example, suppose I want my 10-year old son to learn about aerodynamics. I'll arrange for him to go up in a small plane with a friend who is a pilot. This is the kind of experience that will really excite him.

Step two: Give them hands-on activities and experiments to make the topic meaningful.

This is where I take that excitement and let him explore it. I have him ask my friend for other chances to go flying. I'll also have my friend show him how he plans for a flight. My son will learn about navigation, figuring out how much fuel is needed for the flight, how the weight the plane carries affects the aerodynamics of it, and so much more.

I'll use pilot training videos to help us figure this out (short of a live demo, video is incredibly powerful for learning).

My son is incredibly excited at this point about anything that has to do with airplanes and flying. He's sure he wants to be a pilot someday and is already wanting flying lessons (he's only 10 now).

Step three: Teach the supporting academics and theory.

Now it's time to introduce academics. Honestly, I have my pick of so many topics, because flying includes so many different fields. I mean he's using angles and math in flight planning, mechanics and energy in how the engine works, electricity in all the equipment on board the plane, and of course, aerodynamics in keeping the plane in the air (to name just a few).

I'm going to use this as the foundation to teach the academic side of all the topics that are appropriate.

We start with aerodynamics. He learns about lift and drag, makes his own balsa-wood gliders and experiments by changing different parts. He calculates how big the wings need to be to carry more weight and then tries his model with bigger wings. (By the way, I got a video on model planes so I could understand this well enough to work with him on it).

Then we move on to the geometry used in navigation. Instead of drawing angles on a blank sheet of paper, our workspace is made of airplane maps.

We're actually planning part of the next flight my son and my pilot buddy will take. Suddenly angles are a lot more interesting. In fact, it turns out that we need a bit of trigonometry to figure out some things.

Of course, a 10-year old can't do trigonometry, right? Wrong! He has no idea that it's usually for high school and learns about cosines and tangents.

Throughout this, I'm giving him chances to get together with my pilot friend, share what he's learned, and even use it on real flights. How cool is that to a kid?!

You get the idea. The key is to focus on building interest and excitement first, then the academics are easy to get a kid to learn.

Try starting with the academics and...well, we've all had the experience of trying to get kids do something they don't really want to do.

The Shortcut

Okay, so this might sound like it's time-intensive. If you're thinking "I just don't have the time to do this!" or maybe "I just don't understand science well enough myself to teach it to my kid." If this is you, you're not alone.

The good news is, you don't have to. The shortcut is to find someone who already specializes in the area you want your kids to learn about and expose them to the excitement that persons gets from the field.

Then, instead of you being the one to take them through the hands-on part and the academics, use a solid video-based homeschool science

program or curriculum (live videos, not cartoons).

This will provide them with both the hands-on experiments and the academic background they need. If you use a program that is self-guided (that is, it guides your kinds through it step-by-step), you don't need to be involved unless you want to be.

I'm partial to the "e-Science" program from SuperchargedScience.com (after all, I'm in it), but honestly, as long as a program uses these components and matches your educational goals, it should be fine.

Your next Step should be to take a look at how you're teaching science now and simply ask "Is my kid getting the results I want from his or her science education?"

After this, consider how you can implement the three key steps we just talked about. Either go through the steps yourself, or use a program that does this for you.

If you want to learn more about how to teach science this way, we regularly give free online tele-seminars for parents. To learn more about them, visit:

SuperchargedScience.com/freeteleclass.htm

My hope is that you have some new tools in your homeschool parent toolbox to give your kids the best start you can in life.

Again, I want to thank you for taking the kind of interest in your child that it takes to homeschool. I know it's like a wild roller coaster ride some days, but I also know it's worth it. Have no doubt that the caring and attention you give to your child's education today will pay off many fold in the future.

My best wishes to you and your family.

Warmly,

Aurora