KIDS' SCIENCE CHALLENGE

ACTIVITY KIT INSTRUCTIONS

The Kids' Science Challenge is presented by the award-winning radio series Pulse of the Planet.

Kids' Science Challenge Activity Kit

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We suggest doing the experiments in this booklet with the help of a parent or teacher.

Flavor Science Activities

Inside your kit are three small bags marked “Control,” “Test Strip 1,” and “Test Strip 2.” Be careful not to open the bags before you’re ready, and don’t mix up the strips!

The Mystery of Taste: Why do pickles taste sour and pretzels taste salty? Why does ice cream taste sweet and lemon peel taste bitter? We taste these flavors thanks to thousands of taste buds on our tongues. Scientists have detected five different kinds of taste buds: sweet, salty, sour, bitter and umami. Never heard of umami (sounds like oo-MOM-ee)? Recently, scientists discovered that umami taste bud “receptors” allow you to enjoy meaty tastes, like hamburgers or bacon.

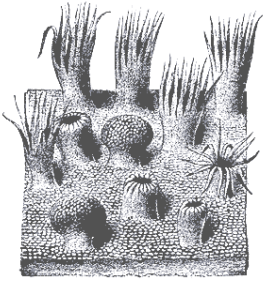
Why do some people love onions and other people hate them? We don’t all taste flavors the same way. And the reason has a lot to do with your parents and grandparents. Are your eyes blue? Is your hair curly? Characteristics like these, including how strongly we taste different flavors, are passed on to us from our parents and grandparents.

In this experiment, you'll test your own sense of taste using "lickable" strips. Scientists use these strips to measure people's ability to taste different flavors. You may be surprised to find the way you taste flavors is very different from the way your family or friends do!

The Experiment

We suggest doing this experiment with a parent or teacher.

In your kit are three small plastic bags, marked "Control," "Test Strip 1," and "Test Strip 2." Before you begin, read all the directions that follow. It's a good idea to wash your hands first, and **don't share your licked strips**. Even though these strips are completely safe to lick, **don't eat or swallow them**.



Magnified Taste Buds

In the chart on the next page, mark whether you or someone else is able to taste the strips. There are 10 strips in each bag. So go test some different tongues, and see what happens! Before you fill in this chart, follow the directions on the next page, so you'll know what to do.

	Can you taste… **Test strip #1** (Thiourea)	Can you taste… **Test strip #2** (Sodium Benzoate)
You	No / Yes	No / Yes (how it tastes: _____)
Friend/family 1	No / Yes	No / Yes (how it tastes: _____)
Friend/family 2	No / Yes	No / Yes (how it tastes: _____)
Friend/family 3	No / Yes	No / Yes (how it tastes: _____)
Friend/family 4	No / Yes	No / Yes (how it tastes: _____)
Friend/family 5	No / Yes	No / Yes (how it tastes: _____)
Friend/family 6	No / Yes	No / Yes (how it tastes: _____)
Friend/family 7	No / Yes	No / Yes (how it tastes: _____)
Friend/family 8	No / Yes	No / Yes (how it tastes: _____)
Friend/family 9	No / Yes	No / Yes (how it tastes: _____)

Note: Each set of taste strips in the plastic bag is on a little pad Each pad has a thicker piece of paper on the bottom and top to protect it. For Test Strip 2 and Control, the color of this protective paper is blue. The protective paper has no taste.

1. Remove a strip from the bag marked “Control.” This is called the control strip.
2. Place the control strip on your tongue. You should taste nothing but paper. If Test Strip #1 or #2 tastes like the control (no taste), then it means you can’t taste that flavor!
3. Now throw the control strip away.
4. Remove a strip from the bag marked “Test Strip 1.”
5. Place it on your tongue. Does this one taste like the control strip, or is it **bitter**? This strip is treated with a chemical called *Thiourea* (thee-OR-ee-yah), which tastes bitter to some people. Was there a taste? Circle “yes” or “no” on the chart.
6. Now throw the strip away.
7. Remove a strip from the bag marked “Test Strip 2.”
8. Place it on your tongue. Is it like the control strip, or does it have a taste? If it does, is it bitter? Sweet? Sour? Salty? Mark your results on the chart. This strip is treated with a chemical called *Sodium Benzoate* (Bends-o-ate). Just like Thioruea, some people can taste it and some can’t. Those people who can taste it may experience a bitter, sweet, sour, or salty sensation.
9. Now throw the strip away.

Are YOU a taster? What's the science behind it?

Most people can taste bitterness on the Thiourea strip. Test Strip #1. Can you? What about Test Strip #2 - the Sodium Benzoate strip? Did that one taste bitter? Or did it taste different in some way? Just because you can taste the Thiourea strip doesn't mean you can taste Sodium Benzoate.

NOW, try experimenting with your family, or a friend. Run through the same exercise with each person and see what happens!

Do your mom and dad taste the same flavors you do? How about your brother or sister… or a grandparent? Do you see any patterns? Do you see differences in how you taste compared to someone else? Do you share more taste similarities with your family than with friends?

Kids want to know!

- The average person has 10,000 taste buds. Some people have as few as 500 taste buds. How many taste buds do you have?
- If your mother can't taste the Thiourea strip and you can, is that why she likes broccoli, and you don't?
- When flavor chemists create a piece of candy, how do they know everyone is going to like it, if everyone's sense of taste is so different?
- What are some of the world's weirdest flavors? What are the grossest?
- How come you can be full from dinner, but hungry for dessert?

Fun, games and answers!

Want to know the answers to these questions? Check out kidsciencechallenge.com for more online activities and a fun flavor game! And if you want to meet other curious kids like you, find them on imbee.com. Live chats with participating scientists and other kids are on Whyville.net. Find direct links to these sites at kidsciencechallenge.com.

When you've learned about taste and flavor, you're ready to enter the Kids' Science Challenge competition and challenge flavor scientist Joan Harvey!

SETI Activities

Crack the Aliens' Code

Inside your kit, you'll find a CD. Your "Search for Extraterrestrial Intelligence" (SETI) activities can be found there.

Greetings, earthlings. I am an alien life form.

What's an extraterrestrial? It's a creature who lives in outer space, just like in science fiction movies. Do extraterrestrials really exist? So far, we haven't met any. But scientists think that if extraterrestrials ("ETs") really do live in outer space, they may try to contact us. How do you think they could reach us? Through email? Instant messaging? Posting a video to YouTube? Actually, scientists think the most likely way for aliens to communicate with us is through radio signals of different frequencies.

What's a **frequency**? Stars, planets and other objects in space naturally produce radio signals, just like the ones that deliver music to your radio. If you tune your radio to 98.7 megahertz, that's one frequency. If you tune it to 100.3, that's another.

An organization of scientists called the SETI Institute (Search for Extraterrestrial Intelligence) is constantly listening to **100 million** different radio signals coming to us from outer space. They hope someday they'll hear a signal that's a message sent by aliens. SETI scientists use radio telescopes to listen to radio signals, then use high-power computers to study them. When the computers notice a signal that doesn't seem to come from a star or other natural object, they alert the scientists. The scientists then research the signal for signs of communication from aliens.

Radio Telescopes

Noise Annoys

One big challenge for SETI scientists is cutting through all the noise in the galaxy and being able to hear a single radio signal. Imagine 100 million radios blaring music at the same time, while just one radio is broadcasting news. That's what it's like trying to find a signal sent by aliens. So how will we hear a radio signal sent by extraterrestrials through all that noise? SETI scientists believe that aliens could send us messages that form a pattern. So they search for patterns that may be hidden in noise signals from outer space.

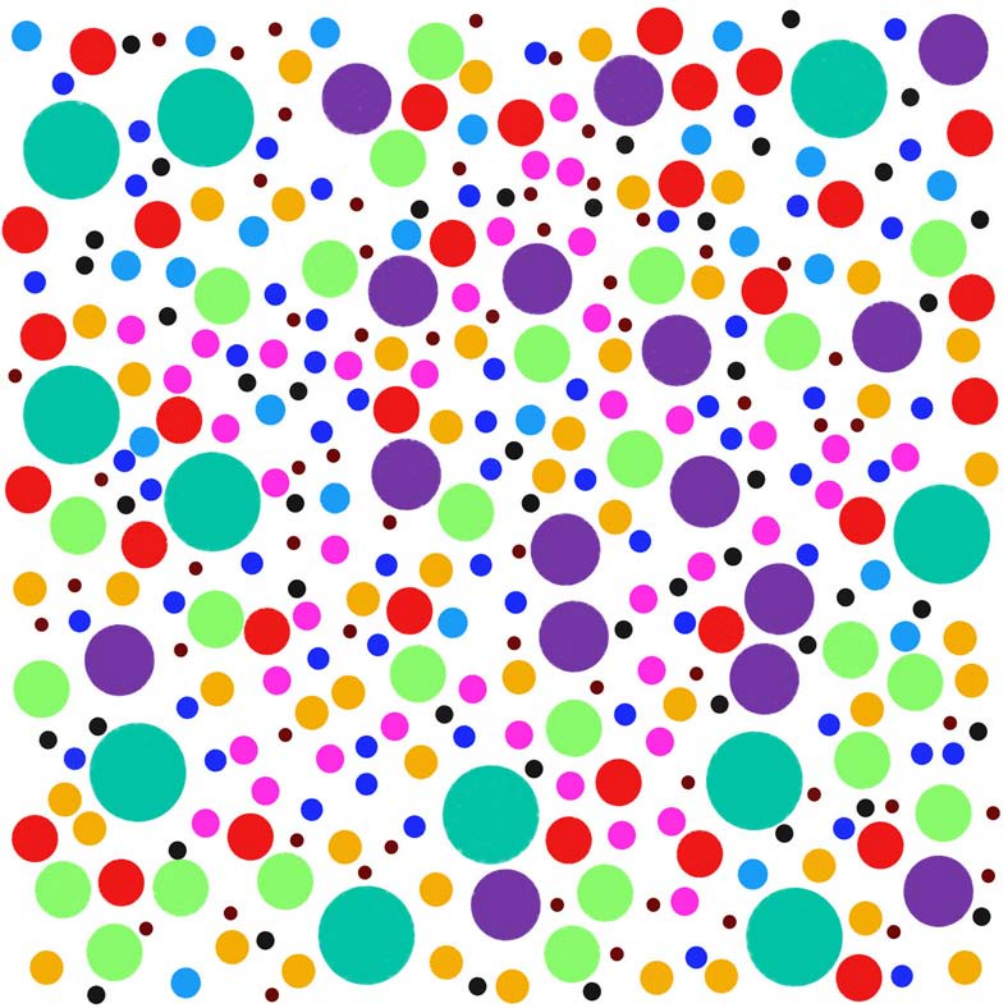
Can you find a pattern on the CD cover?

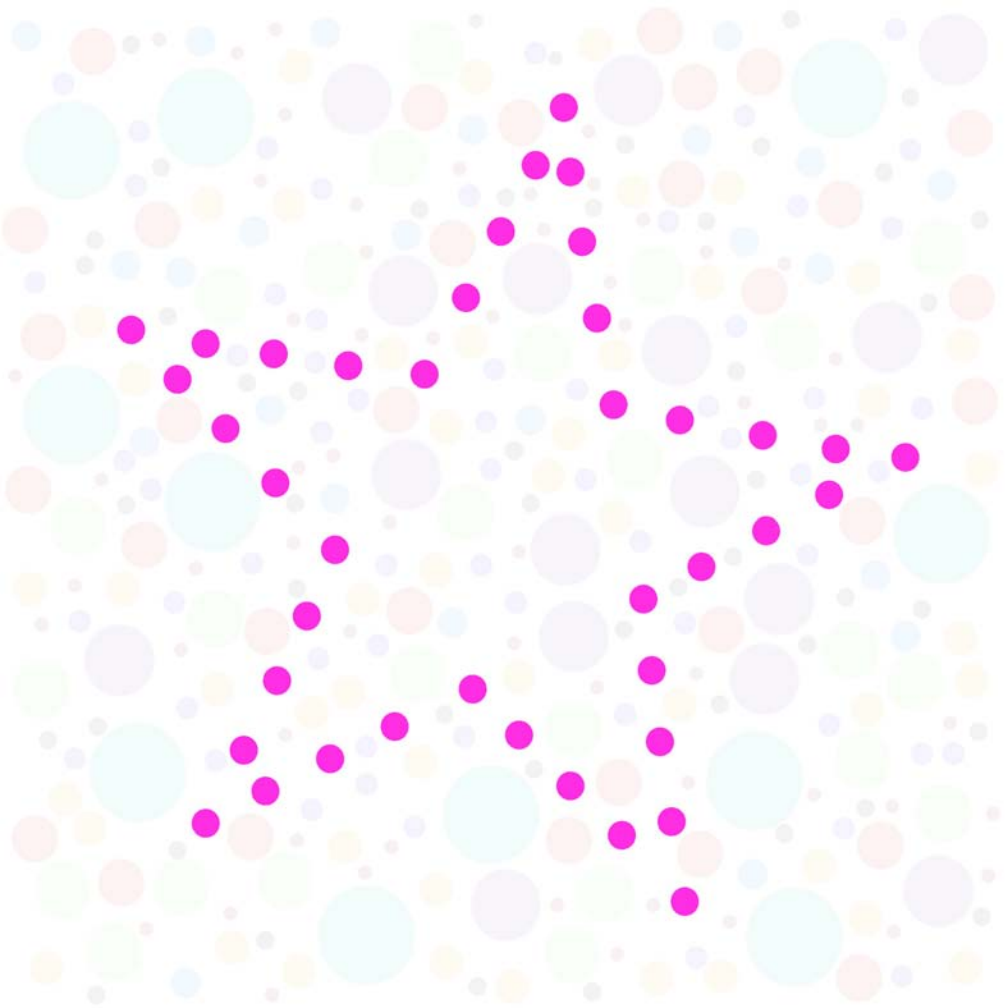
- ❒ See all those colored circles on your CD's cover? It looks like a random collection of dots, right?
- ❒ Now flip it over and look at the back. There is a pattern after all! What shape do those pink dots make?
- ❒ Look at the front again. See it now? That same pattern is there, right in the middle of all that clutter. SETI uses all kinds of signal detection equipment to cut through the radio noise coming from outer space, and to find a clear pattern, just like you did. And that pattern could be a message from extraterrestrials!

Can you crack the alien's secret code?

Okay, let's say we've managed to block out all that random noise and detect a clear signal. What do you think extraterrestrials might say? After all, the aliens probably won't know English or other earth languages.

Planet Mars





Instead, they may send us a series of beeps with a pattern. They might repeat that series of beeps over and over. We can graph these sounds on a piece of paper and try to detect a pattern. Then we can figure out if the pattern is actually a message. It's like cracking an alien's secret code!

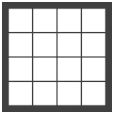
Would you like to give it a try? Well, as luck would have it, we've been able to intercept what may be two "alien messages." Now we need you to crack the code!

We suggest that you decode this message with the help of a parent or teacher. Using a pencil and the graph paper on the next page, work your way across each row, following the directions on the CD.

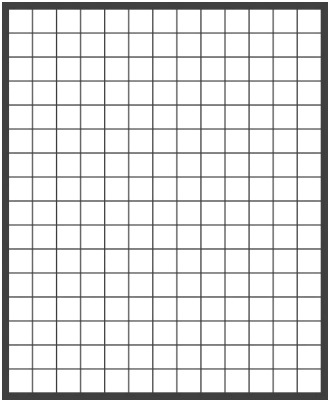
There are two graph paper squares. If you mess up, don't worry! Just erase, and try again.

Pop your CD into a player or computer, and make sure you've got a pencil handy. You'll receive further instructions on the CD. Good luck!

Grid #1



Grid #2



The beeps for each row on the big grid (#2) are on separate tracks on the CD. The first row is track #2 on the CD. So you can find the right track on the CD and start on it again.

Well, what did you come up with? Can you see an image?

Kids want to know!

- Have we ever received a message from extraterrestrials?
- Have we ever sent a message to them? How did we do it?
- How long might it take for a message from outer space to get to earth? Hint: the nearest star to our planet is more than four light years away. What's a light year?
- Earth is just one planet circling the sun, which is a star. How many other stars are there in our galaxy?
- What are some of the other ways that SETI scientists are searching for life in space?

Fun, games and answers!

Want to know the answers to these questions? Check out kidsciencechallenge.com for more online activities, and a fun SETI game! And if you want to meet other curious kids like you, find them on imbee.com. Live chats with participating scientists and other kids are on Whyville.net. Find direct links to these sites at kidsciencechallenge.com.

When you've learned more about the search for extraterrestrials, you're ready to enter the competition and challenge the SETI team!

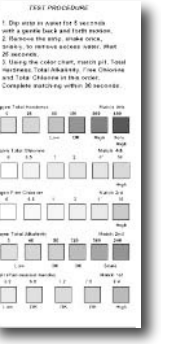
Water Quality Activities

Inside your kit, you'll find four water test strips and a color chart. Test your water with these fun supplies.

What's in your water? — How is bottled water different from tap water? Is rain water the same as water in a swimming pool? How does ocean water compare to lake water? Water can contain lots of different ingredients that affect how safe and healthy it is to drink. With the strips in this package, you can test up to four different water samples. These tests will reveal the quality of your water by showing how much it contains of certain chemicals. You'll learn if your water is acidic or not, if it has chlorine, and if your water is "hard."

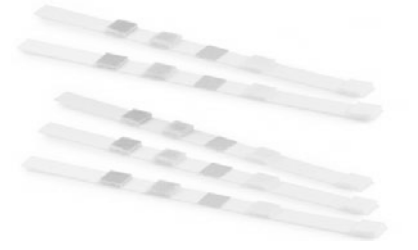
Okay, let's test some water! If you have trouble following along, ask your mom, dad or teacher for help. And remember, these are water test strips, **not** taste strips. **So don't lick them**!

The Experiment



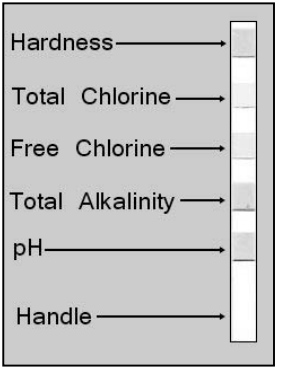
With the test strips in this kit, you can test up to four different water samples! Start off by testing your tap water. Then try a few other sources. Your kit includes a color chart like the one on the right. Use it to test your water according to the directions.

Here are a few ideas for different kinds of water to test, and remember, use just one strip in each water sample.



- ❒ Tap water
- ❒ Bottled water
- ❒ Rain water
- ❒ Pool water
- ❒ Ocean water
- ❒ Lake or pond water
- ❒ Stream or river water

Here's how to test it…



1. Remove a strip from the bag and dip the whole strip into the water for **five seconds**. Move it back and forth gently.
2. Hold the strip flat for **25 seconds**. Don't shake extra water off of it.
3. Compare your strip to the chart, and quickly find the color that most closely matches your test pads for each test. Compare them in this order:
   - Hardness
   - Total Chlorine
   - Free Chlorine
   - Alkalinity
   - pH
4. Find the number above each matching color on the chart. Then record your results on the data table on the next page.

Water Source	Hardness	Total Chlorine	Free Chlorine	Alkalinity	pH
tap water					

Take a look at the following information, then see if you can answer any of the questions on page 20.

Hardness: How can *water* be hard? Well, 9 out of 10 homes in America have **hard water**. When the earth's fresh water flows through soil and around rocks, minerals like limestone (calcium carbonate) can dissolve in water, turning it into "**hard water**." Hard water means water that contains minerals like calcium and magnesium. Is this dangerous to humans? No! But hard water is not great for *other* things in your home, like water pipes or your washing machine. Minerals in the water can plug up pipes and faucets, slowing down the water flow. If your tests show you have hard water, can you see any effects on the plumbing in your house? The levels for hardness should be between 0 and 120

ppm (parts per million). The measurement 'ppm' shows how much of an element is found in water.

Chlorine: Chlorine is an element that is found most commonly in salt (sodium chloride). Other chlorine compounds are made in a laboratory. They're added to drinking water and swimming pool water to clean and purify them. Chlorine kills dangerous germs, but if too much chlorine is added to water, it can bother your eyes and nose. In much larger amounts, chlorine can be dangerous to your health. There are **two types of chlorine** we can measure: "free chlorine" and "total chlorine." If there's chlorine in your water, it most likely has been added in your local town water treatment plant. Its levels are probably safe. The levels for both types of chlorine should measure below 4 ppm (parts per million).

What do the numbers mean?
The following are considered to be safe levels:
Hardness should be 0 - 120 **ppm** (parts per million).
Total and free chlorine should be below 4 ppm.
pH should be between 6.5 and 8.5.
Alkalinity should be 0 - 120 ppm.

Alkalinity: Measuring alkalinity can tell us how many minerals are dissolved in the water. Alkaline water can help get rid of acids. If stream water becomes too acidic because of acid rain or pollution, fish can die. Alkalinity can remove some of those acids and keep the stream healthy. But if the water you bathe in is *too* alkaline, you may wind up with dry skin. How does *your* water check out?

pH: The measurement of pH tells us whether water is **acidic** (think lemons or vinegar) or **basic** (think baking soda or ammonia). On the pH scale of 1 to 14, the lowest numbers are the most acidic. and the highest numbers are the most basic. (Lemons are in the range of 0 to 3.) The middle of this scale (7) is neutral, and that's where you'll find liquids like milk and pure water. What does all this mean for you? If your water is very acidic, it can eat away at pipes and release metals into your water. Some metals, like lead, can be dangerous. Since you may not see the effects of water that's out of balance, tests like these are important to show if you have a problem.

Kids want to know!

- How did the test colors compare with the colors on the chart?
- Did you find a difference between tap water and bottled water? How are they different? Can these tests show you which water is better?
- Do you use water from a well or water supplied by your town? How do you think that affects the test results?
- How are water sources like rain or the ocean different from drinking water? Why do you think they're different?

Fun, games and answers!

Want to know the answers to these questions? Check out kidsciencechallenge.com for more online activities, and a fun water quality game! And if you want to meet other curious kids like you, find them on imbee.com. Live chats with participating scientists and other kids are on Whyville.net. Find direct links to these sites at kidsciencechallenge.com.

When you've learned about water, enter the competition and challenge water scientist, Adina Paytan!

Skateboard Activities

Inside your kit, you'll find a mini-skateboard you can ride with your fingers! Get stoked to discover the science behind skateboarding with your fingerboard. Start your ride with an awesome "Ollie!"

Do the "Ollie" — The Ollie is the basic building block of most skateboard tricks. It's named after Allan "Ollie" Gelfand, who figured out that by stamping down on the tail of his skateboard while he was in motion, he could leap into the air. You can do the same trick with your fingerboard. But first, here's how you would do an Ollie on a full-size skateboard. While speeding up on a flat surface, push your back foot down on the tail of your board, forcing the front up. With the board now in the air, slide your front foot forward, pulling the board higher. With the board completely in the air, push your front foot down, raising the rear wheels and leveling out the board. You and your skateboard will glide through the air as if by magic… until gravity pulls you down! It will look like the board is attached to your feet.

What's the greatest height a skateboarder has Ollied from a flat surface? So far, the world record is an awesome 44.5 inches!

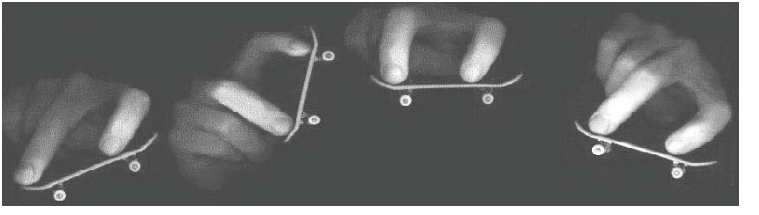
Most skateboard tricks begin with an Ollie.

Take your fingers for a wild ride!

Now it's time to try an Ollie with your fingers. A fingerboard Ollie takes some practice and patience, but just keep trying. And while you're learning, you can also conduct some fun science experiments with your fingerboard.

And be sure to watch a video of a fingerboard Ollie in action on our web site, kidsciencechallenge.com!

1. Place your middle finger on the tail of the fingerboard, just behind the rear wheels (just pick an end if you can't tell which is the tail). You can place a second finger there, too, if it feels more natural.
2. Place your index (pointer) finger between the front wheels and the middle of the board.
3. Roll the board on a tabletop and quickly tap your middle finger down on the tail.
4. As the front end lifts up, slide your other finger to the front of the board. Release the rear finger and push down lightly on the front.
5. If you don't get it right away, check out the video, and just keep practicing!



Once you've mastered the Ollie, you can try your fingers at lots of eye-popping skateboard tricks!

What's the science behind an Ollie? The energy you use to slap down on the rear of the fingerboard launches the board into the air. When the board is in the air, your front finger pushes down on the nose of the board, causing it to rotate about its center. It hangs in mid-air, briefly before it lands, pulled down by gravity. For a more complete explanation of the physics of the Ollie, visit http://tinyurl.com/6jmefl

There are several things that affect the motion of skateboards and fingerboards. **Gravity** pulls a skateboarder down a ramp. **Friction** between the skateboard and the ground slows and stops the skateboard, unless other forces (like the skateboarder pushing off) overcome the friction.

Gravity is the force that pulls two objects towards each other. A massive object, like our planet earth, has a strong gravitational pull. In fact, gravity keeps us on the ground.

Friction is the force between two surfaces that slows moving objects.

To learn more, visit http://www.exploratorium.edu/skateboarding/

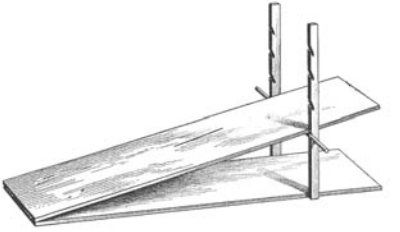
Fast, Faster, Fastest!

Did you ever wonder what makes one skateboard go faster than another? How do you design a really fast board? Will you go farther on a board if you're lighter or heavier?

Let's find out!

- ❒ Build a small ramp using a book or a piece of wood. Place your fingerboard at the top and release it.
- ❒ Measure the distance it traveled. Now tape a coin to the board and repeat the experiment.
- ❒ Did the fingerboard travel a longer distance or a shorter distance with the weight attached?

Want to try another experiment?



Clipart courtesy FCIT
http://etc.usf.edu/clipart

- ❒ Place your inclined plane near the edge of a table so that the bottom of it is about one foot from the edge.
- ❒ Place your fingerboard at the top and release it.
- ❒ After it rolls down the ramp and across the table, it will fly through the air and land on the floor.
- ❒ Measure how far it lands from the edge of the table.
- ❒ Now tape a weight to the board and repeat the experiment.

How did this experiment differ from the first one? How is movement through the air different from movement across a solid surface?

Kids want to know!

- Some skateboard wheels are hard and others softer. How does hardness affect speed and distance?
- What's the best way to ride an Ollie? Stand tall? Crouch?
- What makes one skateboard perform an Ollie better than another one?
- What role does friction play in an Ollie? And gravity?
- Why are some skateboards faster than others?

Fun, games and answers!

Want to know the answers to these questions? Check out kidsciencechallenge.com for more online activities, and a fun skateboard game! And if you want to meet other curious kids like you, find them on imbee.com. Live chats with participating scientists and other kids are on Whyville.net. Find direct links to these sites at kidsciencechallenge.com.

When you've learned about skateboards, you're ready to enter the competition and challenge engineers Michael Bream and Paul Schmitt!

Remember. If you go skateboarding, **wear pads and a helmet**!

The Kids' Science Challenge is made possible by the National Science Foundation.