WINTER SCIENCE

A GUIDE FOR HOME & CLASSROOM

nomad press

TRENDING TOPIC

CONTENTS

Page 1
Introduction

Page 2
4 FANTASTIC Reaction Experiments You Can Do at Home

Page 7
Snow Day Science Projects for Kids!

Page 12
Screen Time? Learning Time!

Page 14
How to Gain STEM Success with Citizen Science in the Classroom!

Page 17
The Science of Bottle Flipping

Introduction

Cold weather means lots of different things—matching up all the gloves, finding the ski poles, venturing out into the snow for winter sports. Or maybe your jive is snuggling up with a good book in front of the fire!

Whatever your kids look forward to the most, there's probably going to be a point at which you'll hear these words coming from your kids: "I'm bored!" One way to combat boredom is by getting some science on.

We've got a slew of STEAM activities and science ideas that are easy to do at home and can serve as the perfect bridge between restlessness and learning. In addition to hands-on projects that get the brain moving, you'll find great websites that offer very cool Citizen Science opportunities.

Ready to dive into winter? Let's go!

4 FANTASTIC Reaction Experiments You Can Do at Home

We all remember making baking soda and vinegar volcanos when we were younger, and unless you grew up to be a science teacher, that is probably the first thing your mind turns to when you think of home science experiments.

Homemade volcanoes are tried and true and really, really fun to watch . . . once. If you want to inspire a love of science in your kids, there are much more visually stunning experiments you can conduct with everyday household items.

Here are four of our favorites that demonstrate the power of SCIENCE and leave your kids absolutely gobsmacked at the same time.

Some of these use materials that can be dangerous—always wear eye and skin protection and follow the safety rules!

#1 Elephant Toothpaste

https://www.youtube.com/watch?v=JSWHRwGaOqs

Hydrogen peroxide (H_2O_2) is a colorless chemical compound that is commonly used as a disinfectant and can be found in most medicine cabinets. It is also very unstable. When mixed with a catalyst, the hydrogen peroxide loses an oxygen molecule and breaks down rapidly into water (H_2O) and oxygen in an exothermic reaction, a reaction that produces heat. Keep in mind that hydrogen peroxide is an irritant and should be handled by an adult.

To get the full effect, simply mix 3 percent hydrogen peroxide, liquid soap, and food coloring in a tall glass or bottle, then quickly add a packet of dry yeast that has been dissolved in some warm water. The yeast is the catalyst, and when it releases the oxygen from the hydrogen peroxide, colorful soap bubbles will fountain up out of the container!

#2 Hot Ice

https://www.youtube.com/watch?v=rM1yu1kDPYY

Have you ever shaken up a hot pack to warm your hands on a cold winter day? That's another exothermic reaction, and one that you can replicate at home. All you need is baking soda and vinegar—that's right, the same ingredients you would use to make a volcano! When you mix baking soda with vinegar, you create sodium acetate and carbon dioxide. (The carbon dioxide is what makes the volcano effect, but because we don't want to make a mess this time, you will want to add the baking soda slowly so it doesn't overflow.)

To make hot ice, you need to first make supercooled, liquid sodium acetate. A supercooled liquid is any liquid that is colder than its freezing point. Sodium acetate freezes, or crystallizes, quite quickly and when it does, it produces a little heat! The resulting "hot ice" is warm to the touch and totally non-toxic.

To start, heat a mixture of baking soda and vinegar over medium heat until most of the liquid has evaporated. As always, an adult should help with using the stove. Pop the liquid in the fridge to cool completely, then put a pinch of baking soda or some leftover sodium acetate crystals on a plate and slowly pour the liquid on top. Boom! Hot ice.

#3 Instant Ice

https://www.youtube.com/watch?v=zVAL5I-WtAQ

The principles of supercooling can also be used to produce “instant ice” from purified water. The effect is similar to the hot ice experiment, only it’s cold! It is also much easier, and doesn’t smell as bad. All you need is a bottle of purified water (popped in the freezer to chill) and some crushed ice. If you cool the purified water to about 17 degrees Fahrenheit, then pour it over the crushed ice, the water will freeze into a slushy tower. Or you can simply shock the bottle with enough force to cause it to freeze on impact. Just don’t let the water get TOO cold, or you will just have a block of ice. If you want detailed instructions, check out this great article from BBC Science. http://www.bbc.co.uk/science/0/23065582

#4 Color-shifting Cranberry Juice

https://www.youtube.com/watch?v=OiYjzg_EvDc

Want a project that takes minimal preparation but is really fun to watch? Cranberries contain a certain chemical that changes color in response to acidity. Try stirring some baking soda into a glass of cranberry juice and see what happens! Any guess why baking soda reduces the acidity of cranberry juice? (The previous experiments should give you a clue.) Now stir some lemon juice or vinegar into the same glass of cranberry juice! The folks over at Kiwico.com have a great video to demonstrate this activity, along with a step by step guide. https://www.kiwico.com/diy/Science-Projects-for-Kids/3/project/Cranberry-Chemistry/2517

Snow Day Science Projects for Kids!

For people living in wintry regions, snow days off from school are a fact of life.

Sleds and snow forts are always the first line of defense against snow-day boredom, but when the boots are soaked and the fingers are frozen, that's the time to turn to science projects you can do in the kitchen with items you can find in your cabinet, refrigerator, and recycling bin.

Need some ideas? Here you go!

Non-Newtonian Fluid Fun

Got water? Got cornstarch? That's all you need for some amazing science. Make your own non-Newtonian fluid by combining a little bit of water in about a cup of cornstarch. Add more water, a tiny bit at a time, until the cornstarch is wet. Do some experiments:

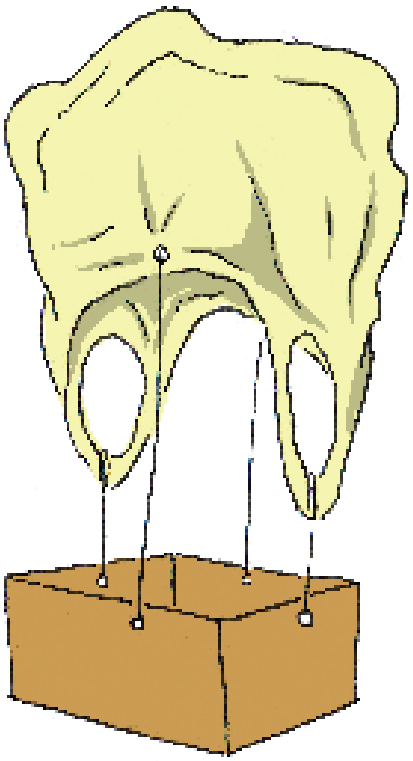
- Squeeze a handful of the stuff.
- Punch the stuff while it's in a container.
- Gently rest your fingers on it.
- Let it lie still in your palm.
- What happens? How is your non-Newtonian fluid different when you squeeze from when you let it lie still?

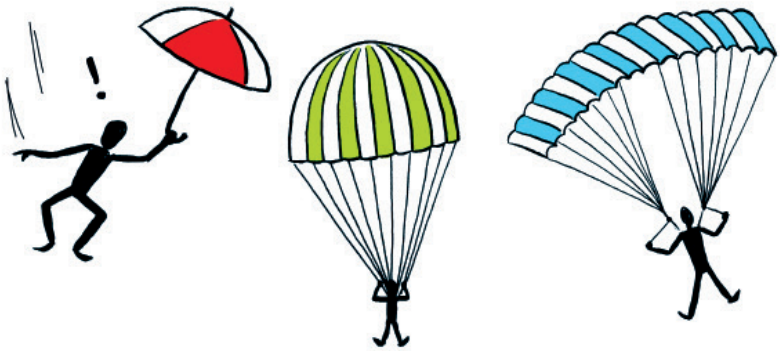
What's happening? The cornstarch molecules are fighting for space with the water molecules, and when you squeeze it or punch it, those cornstarch molecules are trapped together with no space to move. But when you gently ease a finger into the substance, the cornstarch molecules are able to glide gently among the water molecules and make space.

Design a Parachute

A parachute uses wind resistance to slow down objects that are falling through the air. The cloth of the parachute billows out and applies a force called drag to the falling object. That's why when you jump out of a plane, you want to be sure you have a parachute on your back!

Make your own model parachute out of materials from the recycling bin. You need something to create drag and a container to carry the load. Want to test the effectiveness of your parachute? Put an egg into the container and drop your parachute from a high point. Does your egg survive?

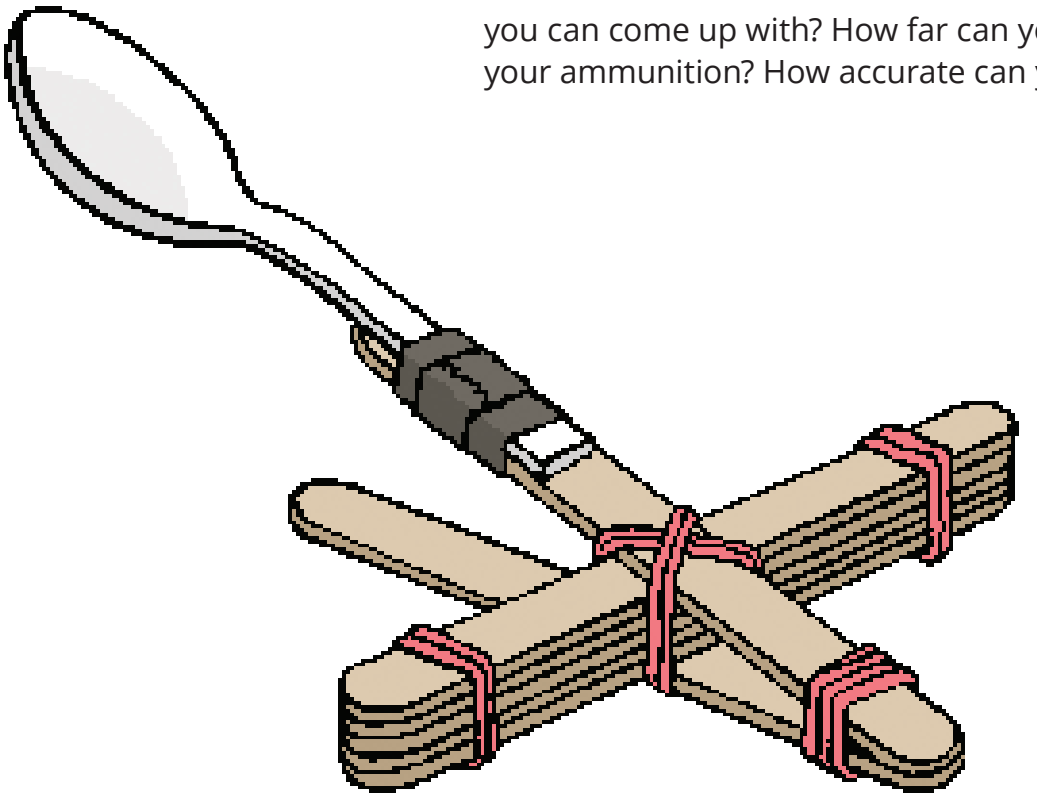




Create a Catapult

What have you got in your recycling bin or toy room that you can use to create a catapult? A catapult uses a simple machine called a lever to launch ammunition at a target. You need a fulcrum, which is the base on which the lever rests, and a lever, which is the straight piece that holds the ammunition until the lever is released and the ammunition flies!

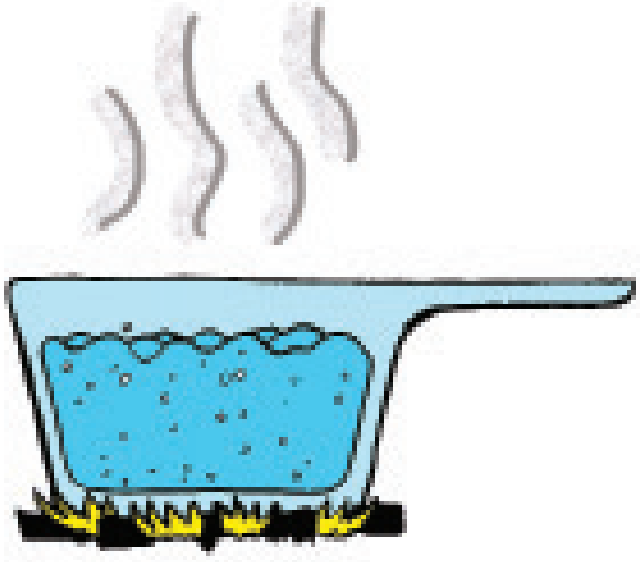
Some ideas for materials are a round oatmeal container, elastic bands, plastic forks and spoons, and mini marshmallows. What's the best design you can come up with? How far can you launch your ammunition? How accurate can you be?

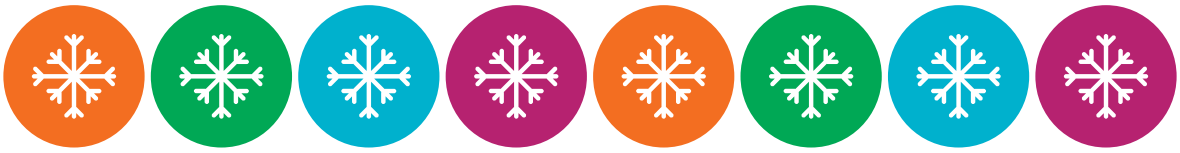


Watch Boiling Water Turn to Ice!

Is it freezing outside? While the frigid weather might drive you back in from sledding, it's great for this activity. Bring a cup full of boiling water outside (use oven mitts to keep your hands safe!) and toss it into the air. What happens? Now try the same thing with a cup of cold water? What's different?

This effect was discovered by a 13-year-old named Erasto Mpemba, who used to make ice cream along with his classmates. He realized that the hot ice cream mixture froze faster when it was put in the freezer without being given time to cool. This is now called the Mpemba effect, and scientists are still trying to figure out why it happens! What do you think?





Screen Time? Learning Time!

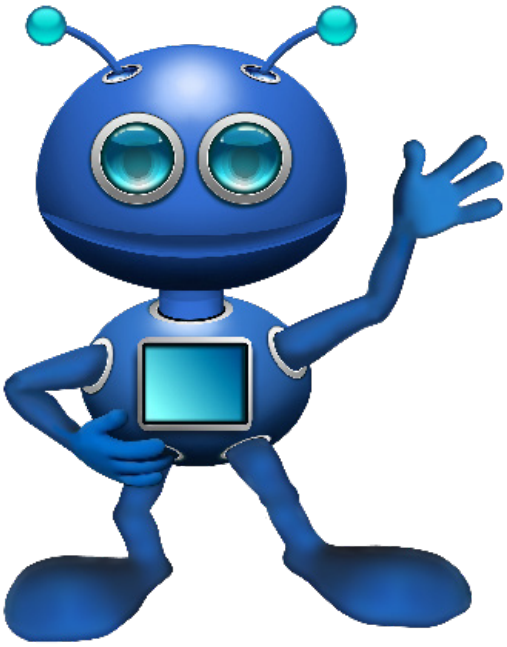
Let's face it—school holidays can pose a challenge for some households. That's a long time to be at home, and add nasty weather on top of those weeks and things might just get tense.

Spending day upon day with loved ones is a wonderful thing, but sometimes everyone needs a break from all that togetherness. One way kids tend to take breaks is to spend some time on the screen. Everyone has a favorite holiday movie, but even that can get tedious after the seventh showing.

How about some quality internet time? Every family has its own guidelines in terms of internet use and kids and technology, and these guidelines grow more important every day, as the online world becomes fuzzier in terms of real news and fake news, and more opportunities pop up for kids to see or read things that might prove regrettable. But at the same time, websites that offer a quality educational experience are growing, too. There's plenty of inspiration to be found during screen time, if you know where to look.

Try some of these sites with your kids when you notice that familiar refrain floating through the house: “I’m bored!” The projects, experiments, and discussions that might result will be exciting for both you and your kids.

- **Wonderopolis:** Questions! Answered! wonderopolis.org
- **TedEd:** Free lessons on just about anything. ed.ted.com
- **Out of Eden:** Follow Paul Salopek as he takes seven years to walk across the world. outofedenwalk.nationalgeographic.com
- **Instructables:** Lots of ideas for stuff to make—welcome to the makerspace movement! instructables.com



How to Gain STEM Success with Citizen Science in the Classroom!

In this digital age, regular people of all ages have lots of chances to be scientists. Because there is so much data in the world to observe and record, and so little time in which to do it, research facilities such as NASA, the National Wildlife Federation, and the Planetary Society are teaming up with the whole rest of the world to find alien life, track the migration habits of monarch butterflies, and map the meteors hitting the moon's dark side, among other great projects!

Know where citizen science makes an even bigger impact? Classrooms! Homeschools! Kitchen tables! Anywhere kids gather! Students get the chance to be a part of a real mission. They not only learn the science behind the project, they also get real-life exposure to the patience and determination needed to be a scientist.

They also get the satisfaction of being part of a knowledgeable team of people. They get to observe the scientific process and realize that success is often measured in tiny increments, with lots of backward steps.

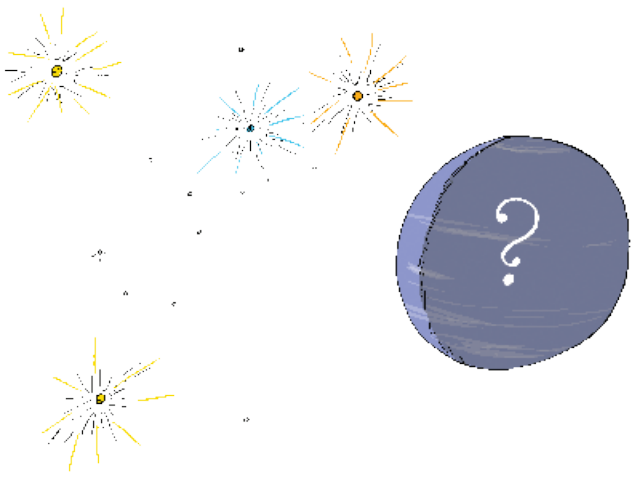
And they get to see things they otherwise wouldn't if they weren't looking! Stardust, new planets, tiny turtles, humpback whales, and Mars!

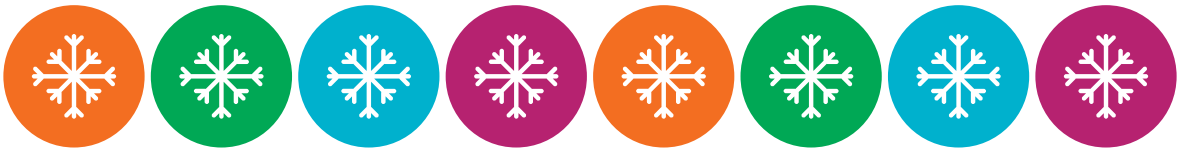
Turn screen time into learning time and check out these sites to get started on science citizenship!

- Are you interested in birds? You can take part in citizen science projects that involve counting, categorizing, and tracking bird nests at the Cornell Lab of Ornithology.

- For ideas on science projects that involve frogs, insects, and other wildlife, check out the National Wildlife Federation.

- Zooniverse is a terrific website to explore to find ways to contribute to scientific exploration. For older kids and adults, there are projects in the arts, history, and language. It's also just a great place to poke around to see the kinds of projects people are interested in!





- Do you know about light pollution? Yes, in addition to water and air pollution, we're also concerned about too much light getting into the sky. Why? Because the more light that seeps up from here on Earth, the less clear the stars, planets, and galaxies will appear. Join the team at Globe at Night to help track this problem.

- NASA has a great opportunity for kids who have their heads in their clouds. Citizen scientists working with S'COOL (Students' Cloud Observations On-Line) report their observations on the clouds to help NASA gain a better understanding of our atmosphere. You can also check out their other Citizen Science opportunities.

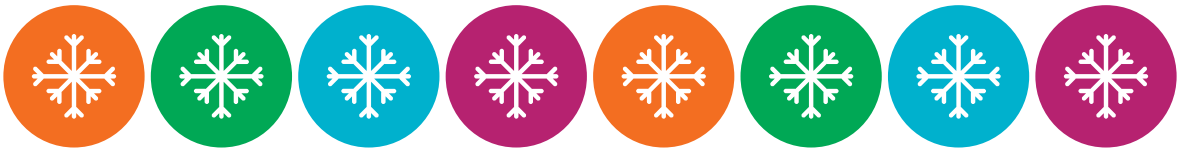
- **If you're interested in looking at some new real estate, try Planet Hunters**, because there's more to be found!

Still need more ideas?
You can find a full database of citizen science projects at Scientific America
www.scientificamerican.com/citizen-science

The Science of Bottle Flipping

Remember this fad? For a while, every household in America echoed with that specific "Ka-chunck" as kids tried to get a bottle to flip over and land upright. While adults might be immune to the charms of bottle flipping, kids understand the pure sense of accomplishment that comes from perfecting this incredibly difficult skill.

Why is it so hard? Science.



You know how to achieve the perfect flip the bottle has to be a certain shape? You know how you can't have too much or too little water inside the bottle? Bottle flipping comes down to physics—having the right amount of water in a bottle that's given just enough force when tossed into the air.

When you release the bottle and put it into a spin, you're applying angular momentum to the water bottle. Angular momentum is the force that keeps the bottle spinning, just like regular momentum is the force that keeps a ball rolling until something, such as friction or a person, stops it.

But the water in the bottle is much heavier than the bottle itself—it has more mass. The water slows the angular momentum of the bottom of the bottle down. And when the water is pooled in the bottom of the bottle, gravity supplies another force, pulling the water, and therefore the bottle, to the ground and stopping the angular momentum completely.

So kids, you might think you're just flipping bottles and annoying the adults around you, but you're really exploring the physics of angular momentum, fluid dynamics, and gravity.

Which is flippin' awesome.