

# SPECTACULAR SCIENCE

**DO-IT-YOURSELF  
SCIENCE SHOW!**

**WARNING** — Not to be used by children except under  
adult supervision.

# Important information for parents and adult supervisors

The lights are up and the stage is set! With these experiments, your child will soon be performing exciting tricks before astonished spectators. The experiments in this series have been carefully selected to help your little performer astound and impress the audience with fascinating phenomena from the worlds of chemistry and physics. This creates a fun and entertaining way to put the spotlight on science!

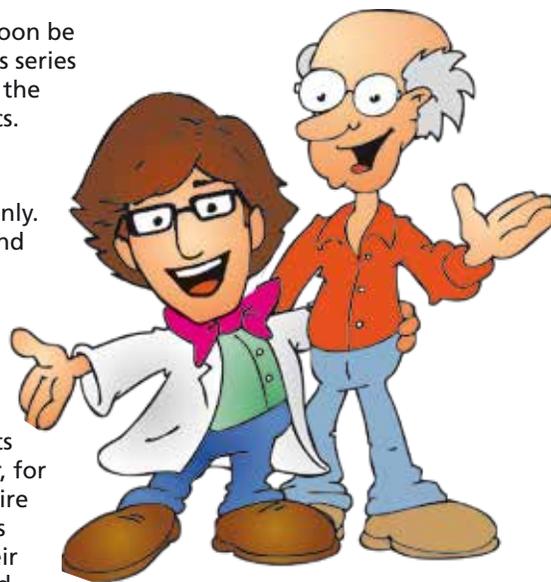
This chemistry activity series is intended for children older than the age of 12 only. In these experiments, your child will be working with chemicals, open flame, and denatured alcohol. Safety is particularly important to us, because the incorrect use of chemicals can lead to injury and other health risks. This series complies with all applicable US consumer product safety regulations, including those for chemistry sets. Moreover, this series complies with the more rigorous European safety standard EN 71-4, in which the safety requirements for chemistry experiments are established, to reduce risks to a minimum. This standard forms the reliable basis of all Thames & Kosmos chemistry experiments and experiment kits. The standard contains requirements for the manufacturer, for example that no particularly hazardous substances can be used. They also require the manufacturer, however, to carefully inform the parents or adult supervisors of the possible hazards and to require them to accompany their children in their new hobby with a helping hand. Therefore, please read and follow the tips and information provided in this activity download.

Perhaps the most important EN 71-4 requirement is the one that obligates the manufacturer to inform parents or guardians about any possible dangers and to encourage them to support their children and stand by their sides ready to help with the experiments. Be your child's "invisible" helping hand, both while practicing the experiments and while putting on the actual show. Even if your child has practiced carefully, the excitement and stage fright of the performance can make everything seem different. That's why every performer needs an assistant! So it's at this point that we turn to you to let you know what this involves. Take a look through this series of downloadable science experiments and pay particular attention to the basic rules for safe experiments, the information about hazardous materials, first aid in case of accidents, and waste disposal.

Since the abilities of children in this age group can vary quite a bit, please also take a look at the safety notes accompanying each experiment and select those experiments within the series that seem safe and appropriate for your child. If the experiments involve working with open flame, lit candles, or denatured alcohol, you will see corresponding symbols printed on the side. Given that denatured alcohol (also known as methylated spirits or rubbing alcohol) and its vapors are highly flammable, it is always important to work carefully with this substance and to close the container immediately after use. Please pay particular attention to the notes on working with denatured alcohol and fire.

Before starting the experiments, discuss the warning notes and safety rules with your child or children. Be absolutely clear about the fact that they must read and follow these instructions, the safety rules, and the first aid information and keep them on hand for reference. Only give the required quantities of household chemicals to your child. The area around where the experiments are to be performed should be free from any obstacles and far from locations where food is stored. It should be well lit and well ventilated, and equipped with a working sink. A sturdy table with a heat-resistant surface should be available.

We wish you dazzling success with the Spectacular Science experiments!



**A great team — the performer and his adult assistant!**



**This symbol indicates that an open flame is part of the experiment.**



**This symbol indicates that an experiment calls for denatured alcohol.**

# Basic rules for safe experiments

All of the experiments described can be performed safely as long as you carefully follow the advice and instructions. In particular, keep the following basic rules in mind.

## Advice for chemical experiments

1. Read the experiment before starting the experiments, follow its instructions, and keep it on hand for reference. Pay particular attention to the quantities indicated and the sequence of individual work steps. Only carry out the experiments described.
2. Keep young children, pets, and any individuals not wearing eye protection away from the experiment area.
3. **Always wear eye protection.** If you wear glasses, you will need safety goggles for people who wear glasses. The safety glasses are particularly important for experiments with open flame, denatured alcohol, and chemicals, which are identified by the adjacent symbol. Wear suitable protective clothing (old smock or old shirt) while working.
4. Keep the experiment materials out of the reach of young children.
5. Clean all equipment after use.
6. Clean your hands after finishing the experiments. If any chemicals get onto your skin by mistake, rinse immediately under running water.
7. Only use the equipment that is specifically recommended for use in each individual experiment.
8. Do not eat, drink, or smoke in the experiment area. Do not use eating, drinking, or other kitchen utensils for your experiments unless specifically told to do so. In that case, wash them thoroughly before returning them to the kitchen for use (in other words, don't just leave them in the kitchen!).
9. **If you are investigating foods or foodstuffs (for example, table salt), transfer the appropriate quantity into one of the measuring cups. Do not return food or foodstuffs to their original container, and do not consume any leftovers. Dispose of them immediately (in the household garbage or down the drain).**
10. Do not bring any chemicals into contact with your eyes or mouth.
11. During experiments with open flame, be sure that there are no flammable objects nearby. Extinguish all flames before leaving the experiment area, even if only briefly. Always be careful not to burn yourself, and avoid reaching above a flame (practice thoroughly before each show).
12. Immediately wipe up any spilled liquids with a paper towel.
13. Always close spirits-filled measuring cups with a lid, so none of the flammable vapors get into the air! The same thing is advisable with vinegar, on account of the odor.
14. Be sure to keep young children, pets, and other onlookers a safe distance away from the stage. Ideally, close off the room where you will be giving your performance after you have set things up.
15. Keep a bucket or box of sand ready in case you have to extinguish any flames. A large blanket can also help to put out a fire. If you can't put out a fire right away, call the fire department immediately.
16. Before starting an experiment, obtain all the required supplemental materials and have them ready for use.



Also pay attention to the notes accompanying each experiment, because they point out specific dangers and tell you how to avoid them. If they make reference to hazardous materials, the hazard symbol will also be shown, and reference will be made to the information about hazardous materials.

## Instructions for handling denatured alcohol and fire

You will always find these symbols next to an experiment's heading when you will be working with fire, open flame, or denatured alcohol.

Be very alert during experiments with open flame, including when you are working with candles. That particularly applies to experiments with **denatured alcohol (methylated spirits)**, because it is **highly flammable**. Keep the supply bottle far from the flames, only decant the amount required for the experiment, and close the bottle again right away. Immediately wipe up any spilled denatured alcohol. Let the cloth dry outside and avoid inhaling the vapors. Also, be careful when **lighting denatured alcohol**: Do not hold the stick lighter directly in the liquid. You only need to hold it a **little above** the spirits in order to ignite them. Denatured alcohol is highly flammable, and strictly speaking you are lighting the vapors that are rising up from it. It is particularly important with these experiments for an adult assistant to stand by your side to help and support you. You can actively involve your assistant in the show and instruct him to perform specific steps. Never leave an open flame unattended, and always extinguish it at the end of the experiments. **At the start of the show, tell your audience** that no smoking is allowed during the performance.

# Your own science show

## Setting your stage

Now we want to give you some suggestions for preparing the stage for your science show in a safe and entertaining manner. For your experiment table, a sturdy old table with a washable surface that is heat resistant, would be best. Given the proximity of foodstuffs, the kitchen is not an appropriate place for chemistry experiments. Since you will need some space for your performances, your experiment table should be free of any unnecessary objects, such as tablecloths, curtains, or other flammable items. Your table should only have those things on it that you will need before and during a portion of the show. For show portions using flames, the table should be covered with aluminum foil. That will provide protection against flying sparks or in case something tips over. In addition, the reflection on the foil looks “magical” and magnifies the light of the flames!

It is important for your table to be sufficiently well lit, so you can stand in the spotlight and your audience can see everything properly. The room where you give your performances should have a floor that can take a little abuse (ideally a tile floor), and it should be well ventilated, since some of the experiments will feature a little smoke or smoldering.

You will often require water while preparing for a show, so it's a good idea to equip your workplace with a watering can or large pitcher filled with water.

It is also handy to have a small table or storage box next to your work table on which you can place used materials. You can also keep a roll of paper towels there for wiping up spills, or maybe even a tissue box decorated for the show.

For any dry trash produced during the show, you can decorate a large, clean aluminum can with foil and place it on your performance table.

To keep onlookers away from your lab materials before and after the show, you should close off the room that holds your stage. That way, you can be sure that everything remains the way you tested it.

## Your master of ceremonies costume

When experimenting, wear old clothes with an old white smock or shirt pulled over them. Loose-sleeved pullovers, scarves, bandannas, or long chains, all of which could fall into the experimental setup or even into a flame, are awkward and would just get in the way while you perform your experiments. If you have long hair, tie it up with a hair band. And don't forget: During your preparations as well as during the show, always wear safety glasses!



## Before, during, and after your show

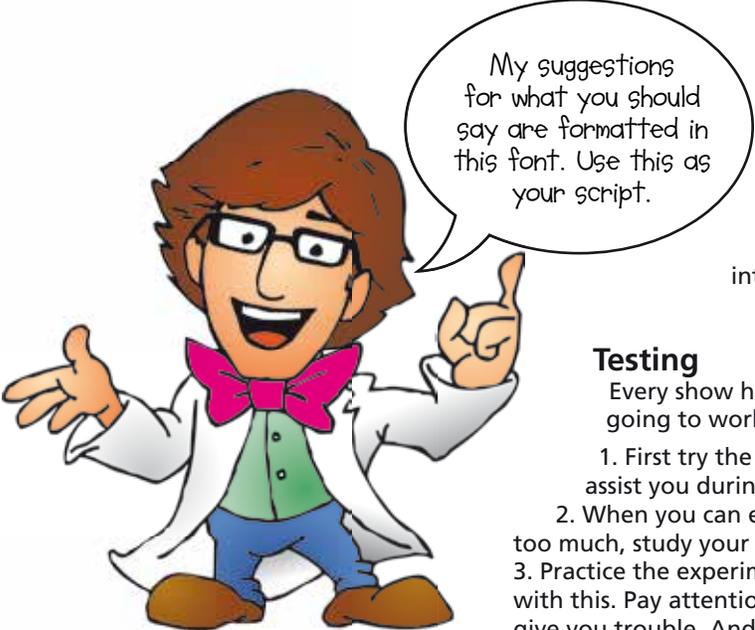
### Preparing for your experiment show

To turn the experiments in this series into real show experiments, they will need something really special: **you!** You are the one who will be presenting the experiments to your audience. You are the star of your science show!

But don't worry, it won't be too difficult. The experiments alone are impressive enough, and you will just have to slip into the role of a star performer in order to guarantee yourself some applause.

There are just a few things you have to pay attention to:

- **Perform the experiments only after you have mastered them.**
- You should **practice every show at least once from beginning to end**. This is the only way to be sure, for example, that materials from one experiment don't get in the way of another. Get used to clearing away the used material at the end of each experiment, so it doesn't get in your way during the next one.
  - **Consider beforehand what you want to say during the experiments.** In this handout, you will find scripts for each experiment that will help you find the right words for your show. Or maybe you can think of something much better!
    - **Don't make your show too long.** You should not perform more than five experiments in one show. After all, you won't just be performing experiments, you will be entertaining your audience. That requires some concentration, and it can be pretty tiring. So don't try to do too much. You will find suggestions for thematically complete show portions in this manual. You can also combine your own favorite experiments into your own show if you like.



My suggestions for what you should say are formatted in this font. Use this as your script.

### Testing

Every show has to be tested. After all, you have to be sure that everything is going to work well in front of the audience. This is the best way to do it:

1. First try the experiment without presenting it. Recruit an adult helper to assist you during the show as well.
2. When you can execute the experiment itself without having to think about it too much, study your lines. You can also think up your own lines, of course.
3. Practice the experiment while speaking your lines. Have an adult assistant help you with this. Pay attention to how long it takes and whether there are any parts that give you trouble. And if, despite your preparations, you do forget your lines during the show, your assistant will be ready to help with this instruction sheet.

### Stage fright

Sometimes people can get a little nervous before a performance, or maybe even quite anxious. They might be afraid that something will go wrong, that they might forget their lines or that the audience just won't enjoy the show. This kind of feeling of anxiety is known as stage fright. Almost all experienced performers, actors, and musicians get it before a performance, even if they have stood on the stage hundreds of times before. There is no prescription for it. But there's nothing wrong with it. On the contrary, stage fright often motivates people to put on a particularly good show, and it's just part of the process.

But here are a few tips you can use to calm your stage fright a little:

- Before the show, find a quiet place where you can be alone one last time.
- Think about the fact that nobody except you knows what you have planned. No body knows what you will say, either. So nobody will notice if you don't say your lines exactly as you planned!

## The elements of the show

In professional shows, people often use music to introduce the show, and they may use other light and sound effects as well. With the help of your assistant, you can do it too. Here are some ideas.

### Drum roll

A drum roll is often used to build tension. Instead of an actual drum roll, you can simply ask your audience to beat on their thighs with their hands or to stamp their feet. That's fun for everyone and works just as well to build tension. The audience will catch on more quickly if you also do it yourself when you ask them to.

### Light

Some show elements really only make a good impression when the light isn't too bright. You will find instructions to that effect in some of the experiments. Make sure that your assistant can dim the lights when you ask him to.

### Music

With some of the show experiments, you will have to kill a little time while waiting for something to happen. You can use music to bridge those periods — have your assistant be ready to start it at your signal, and then stop it again.

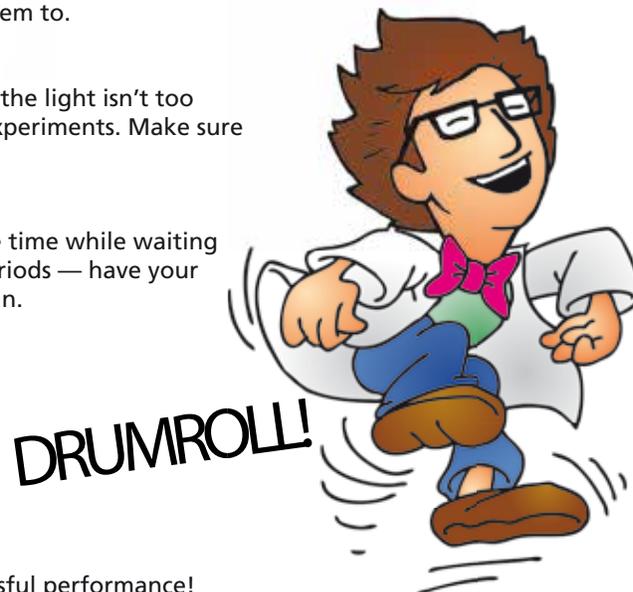
### Closing words

You can use the same closing words for every show. Then take a deep bow! And wait for the calls for an encore. Then, with your prepared encore experiments, you'll be digging deep into your box of chemistry tricks again.

### After the show

First of all, enjoy the applause and accept praise for your successful performance! Bow to your fans, and if you like you can hand out home-made autograph cards (with your photo). But when the audience finally leaves the room, there will still be a few things to do: air out the room thoroughly. Once the experimental material has cooled off, you can start cleaning up. Dispose of residues and wash all the parts. It's easier to clean up fresh dirt than dried-on dirt. Usually, lukewarm tap water and dish washing liquid will work. Carbonized or sooty residues can be scraped off and cleaned with a little scouring powder. Dry everything with paper towels, which you can then toss into the trash. Then return everything to its place and put it someplace out of the reach of young children (for example, lock it away in a closet). Finally, don't forget to wash your hands!

**!** No matter how nervous you might be, take your time when handling the lighter, open flames, and chemicals, and don't rush yourself! The show will come off even better that way, because the audience's anticipation will rise as they wait.



# ENCORE



When a show goes particularly well, the audience will want to have an encore. Of course, you will need to have something prepared for that. On the following pages, you will find a few experiments that work especially nicely as encores. You might want to practice one of them for your show. Just in case, you can always tell the audience this line at the end of the show: "Now is the perfect moment to yell 'Encore!' I have one all ready for you" (big smile)

## THE PHAROAH'S SNAKES



All you need is a little fire to make mystical black snakes emerge from baking soda and sugar.

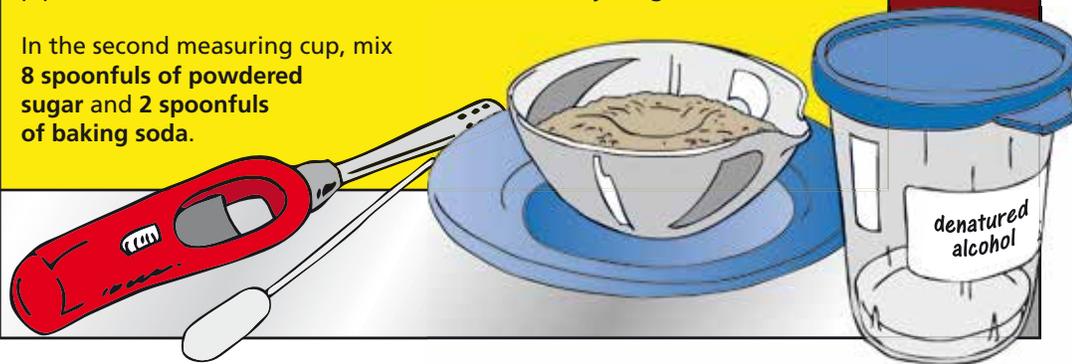
### MATERIALS:

- porcelain bowl (on fire-resistant surface)
- 2 measuring cups
- lid
- pipette
- powdered sugar
- baking soda
- denatured alcohol
- sand
- stick lighter

### BEFORE THE SHOW

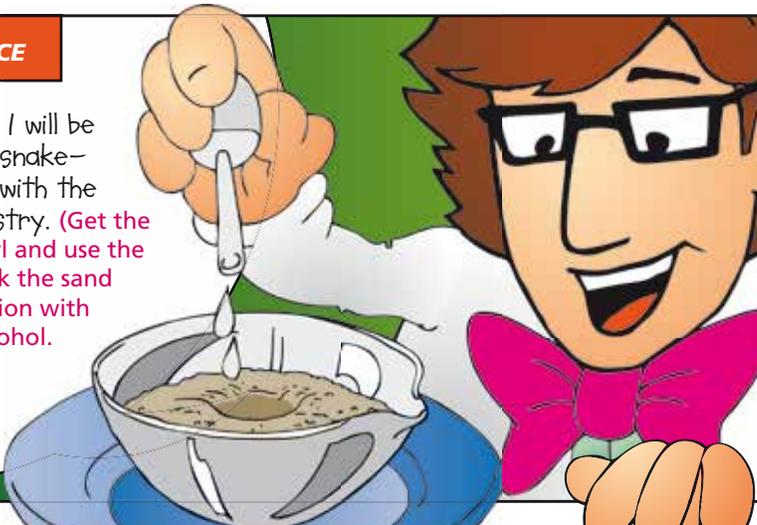
Set the **porcelain bowl** on the table. Fill the bowl halfway with **sand**. Make a depression in the middle of the sand. Add a little **denatured alcohol** to the labeled measuring cup (you only need 1-2 pipettes' worth) and close it with the lid. Place everything within reach.

In the second measuring cup, mix **8 spoonfuls of powdered sugar** and **2 spoonfuls of baking soda**.

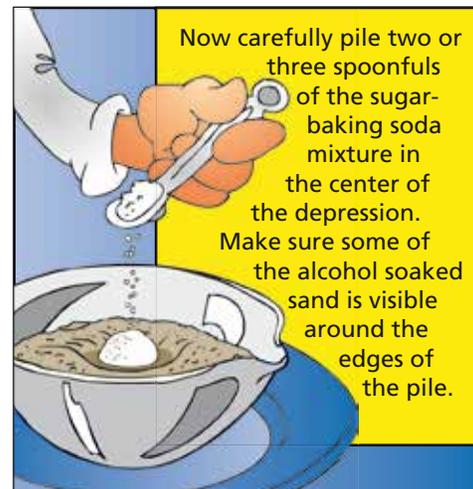


### PERFORMANCE

For my finale, I will be performing a snake-charming act with the help of chemistry. (Get the porcelain bowl and use the pipette to soak the sand in the depression with denatured alcohol. One pipettes' worth should be enough.)

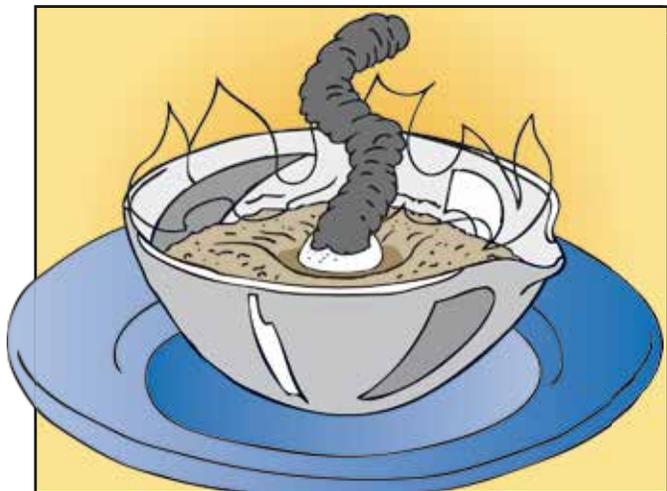


Now carefully pile two or three spoonfuls of the sugar-baking soda mixture in the center of the depression. Make sure some of the alcohol soaked sand is visible around the edges of the pile.



Now, light the denatured alcohol. Wait a few minutes. After a little while, black snakes will start to emerge out of the pile.

ATTENTION!



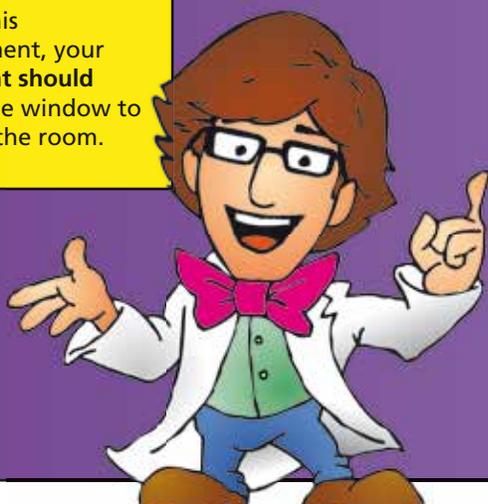
Where are the snakes coming from? For one thing, the sugar is burning. That's what makes the snakes black: carbon! For another, the baking soda, which puffs the carbon snakes full of air, making them grow longer and longer!



Thanks a lot!  
(Deep bow, applause!  
Wait for the flame to go out!)



After this experiment, your assistant should open the window to air out the room.



**CAUTION!** The porcelain bowl will get very hot. Let it cool off first before touching it again!



Denatured alcohol is highly flammable.

# RED CABBAGE - BLUE CABBAGE



A magical change of color: red cabbage juice is turned into blue cabbage juice.

## MATERIALS:

- sodium bicarbonate (baking soda)
- measuring spoon
- measuring cup with lid
- pipette
- homemade red cabbage juice
- household vinegar
- glass
- white paper

## MAKING THE RED CABBAGE JUICE: LET A GROWNUP HELP YOU WITH THIS!

To make red cabbage juice, finely chop some fresh red cabbage (like for coleslaw) and boil the pieces for a few minutes in a little water (not too much).



When the water has turned noticeably red, let it cool and pour off the juice through a fine sieve. By the way, you can freeze small portions of the red cabbage juice in labeled baggies.



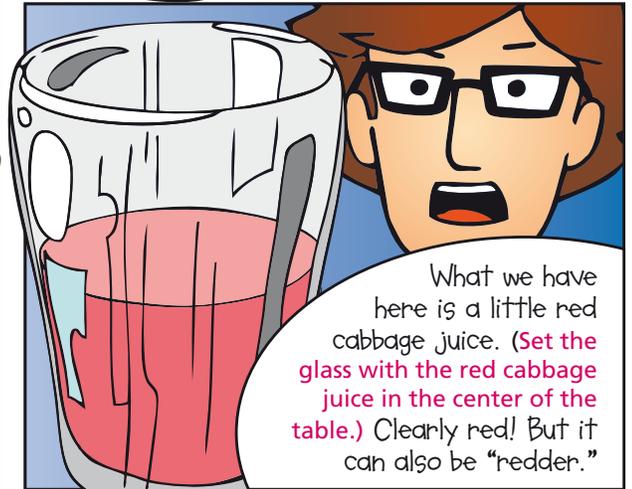
## BEFORE THE SHOW

Fill the glass about 2/3 of the way with red cabbage juice. Fill the measuring cup halfway with vinegar and put the lid on.

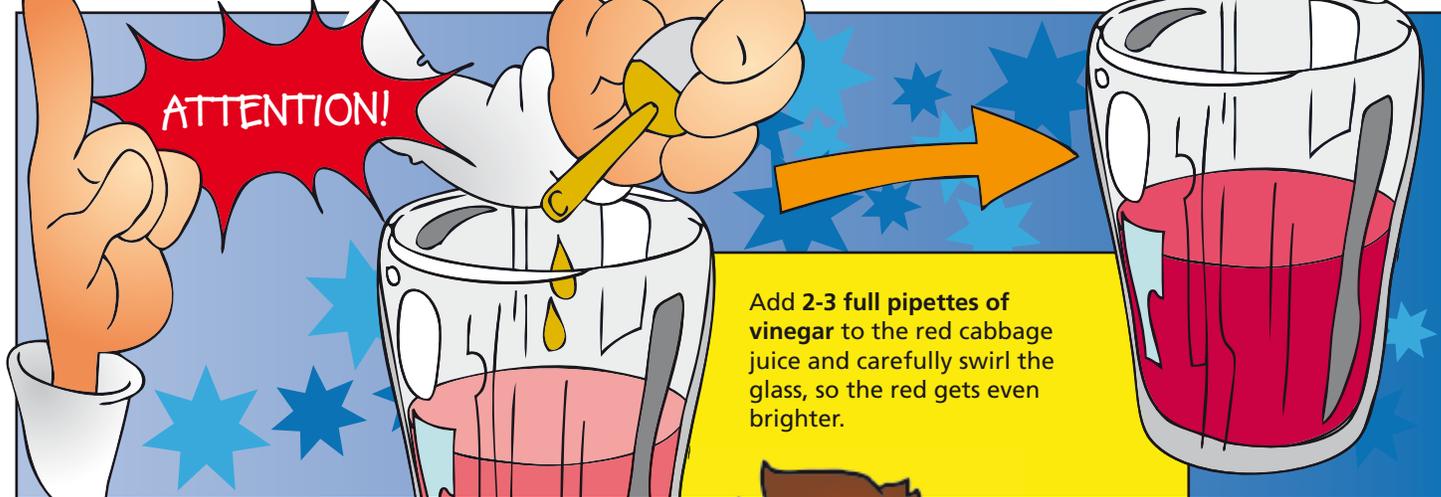


## PERFORMANCE

Red is red and blue is blue. But why is red cabbage sometimes blue or purple? And why does it sometimes change color when you cook it or make it into coleslaw? I will be answering these questions in the next experiment!



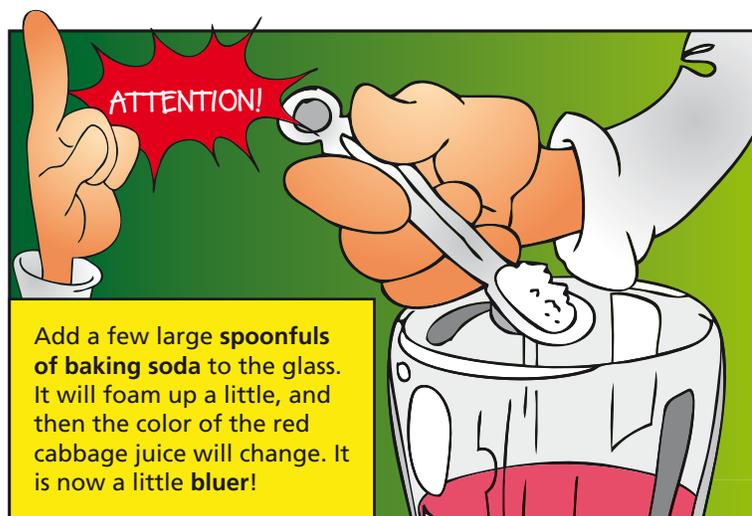
What we have here is a little red cabbage juice. (Set the glass with the red cabbage juice in the center of the table.) Clearly red! But it can also be "redder."



Add 2-3 full pipettes of vinegar to the red cabbage juice and carefully swirl the glass, so the red gets even brighter.



But I will now transform this red cabbage juice into blue cabbage juice.



Add a few large spoonfuls of baking soda to the glass. It will foam up a little, and then the color of the red cabbage juice will change. It is now a little bluer!



The blue cabbage juice is ready!

In reality, blue cabbage and red cabbage are exactly the same thing. The dye in the cabbage is called an indicator: When you add an acid to it, such as the vinegar, it turns red. Its reaction to a base or alkali, such as baking soda or soap, is to turn blue. So it all depends on how you prepare it. Thanks a lot! (bow, applause)



**CAUTION!** Dispose of the liquid. It is not suitable for consumption!



**TIP**

- If the red cabbage juice doesn't turn blue right away, add a few more spoonfuls of baking soda and stir with the spoon.
- The different colors are easier to see against a light background. It sometimes helps to hold a piece of white paper behind the glass.

# THE FIRE ORANGE

A little jet of flame is shot out of an orange peel.

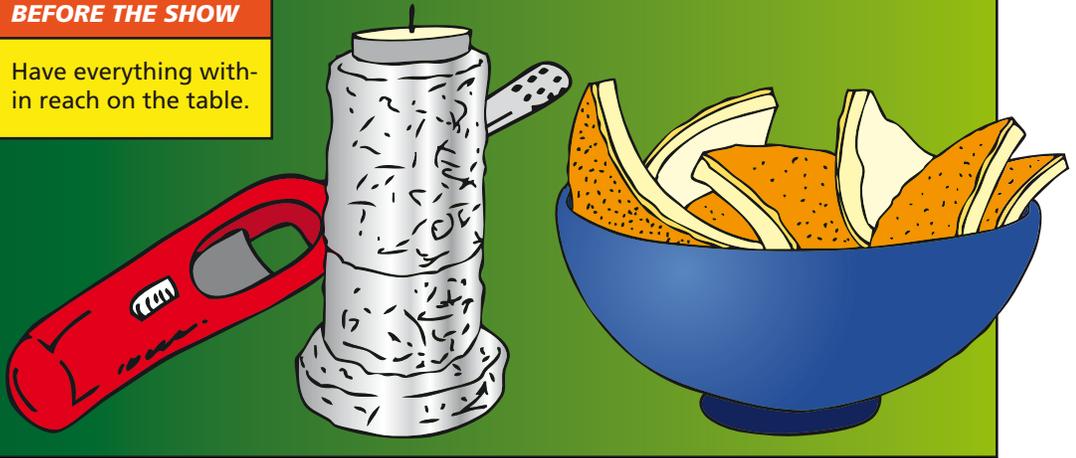


## MATERIALS:

- tall tealight candle stand with tealight candle
- fresh, firm pieces of orange peel
- small bowl
- stick lighter

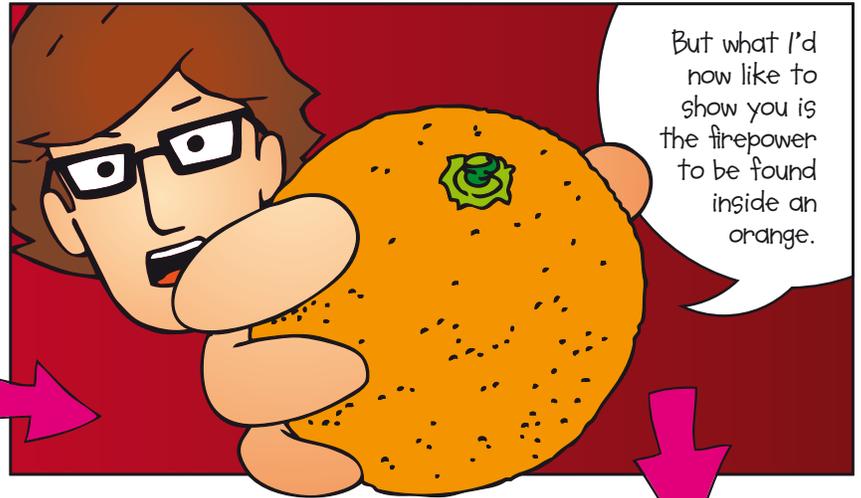
## BEFORE THE SHOW

Have everything within reach on the table.



## PERFORMANCE

Even harmless fruit can be dangerous. As you know, an apple can fall from a tree and hit your head.



Light the candle and take the orange peel in your hand.





And now, a drum roll please!

**DRUM ROLLLL!**



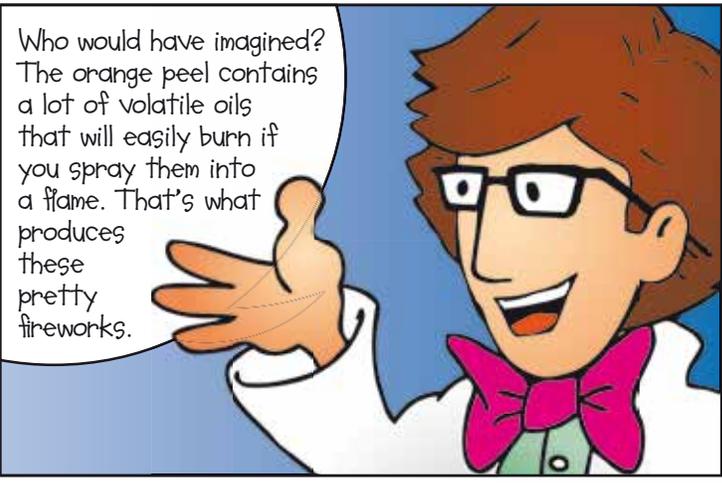
**ATTENTION!**

Now **squeeze the orange peel** forcefully between your fingers, so liquid squirts out into the candle flame. It will create a little **flash of flame**. Repeat a few more times.

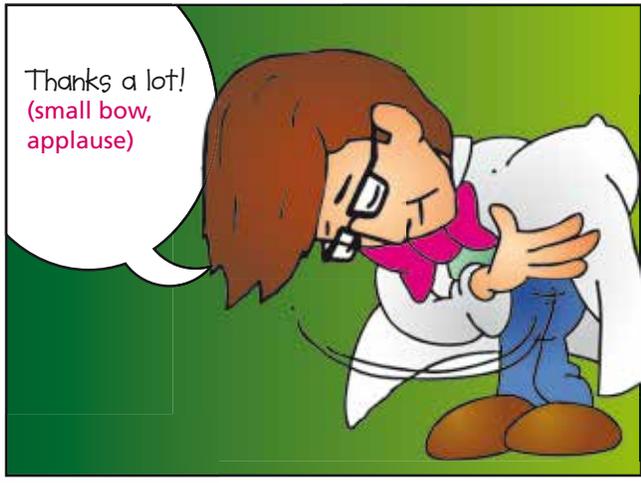


**PFFFFTTTTT**

**HSSSS**



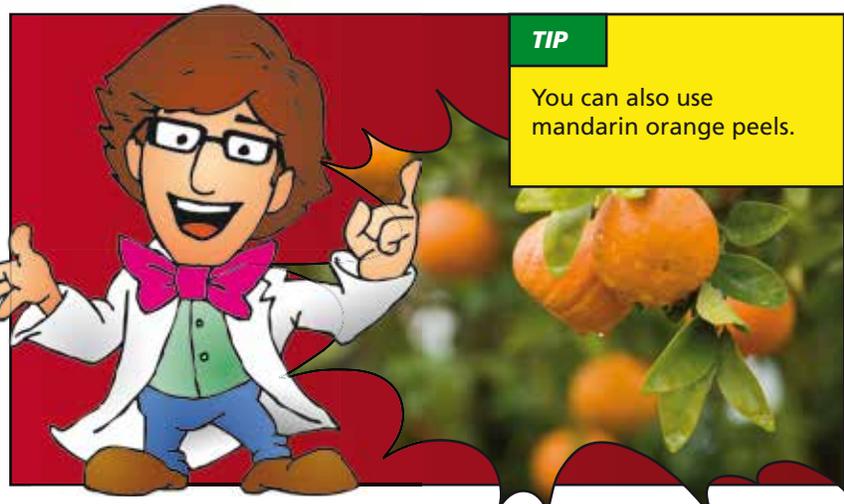
Who would have imagined? The orange peel contains a lot of volatile oils that will easily burn if you spray them into a flame. That's what produces these pretty fireworks.



Thanks a lot!  
*(small bow, applause)*



Don't forget to **blow out the candle!**



**TIP**  
You can also use mandarin orange peels.

# SOLID LIQUID "MILK"

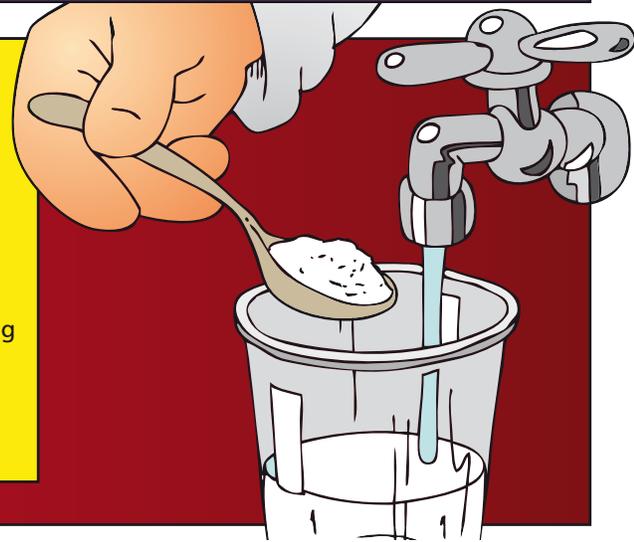
You will be experimenting with a milk-like fluid. The fluid will behave very strangely though: Sometimes it's solid, and sometimes it's liquid.

## MATERIALS:

- measuring cup
- marble
- cornstarch (no flour)
- water
- teaspoon
- tablespoon
- plastic bowl
- hammer
- saucer

## BEFORE THE SHOW

The fluid (your "milk") is actually a **cornstarch solution** that you will have to mix up yourself. First measure **two heaping teaspoons of cornstarch** into the **measuring cup**, and add a little **water** to it straight from the tap. Stir well. Now keep adding water and cornstarch by turns, until the measuring cup is not quite half full.



At the end, the solution should be hard to stir if you try stirring it quickly. But if you carefully tip the cup a little, the solution will act like a liquid. Stir up another batch of starch mixture in the **plastic bowl** with the **tablespoon**. The bowl should be about 2/3 full. Set everything within reach on the experiment table.

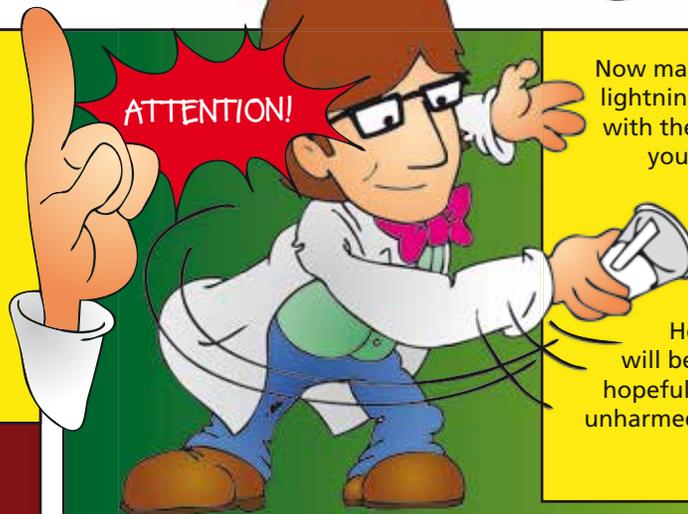


## PERFORMANCE

Solid is solid and liquid is liquid. Not to me! (**hearty smile**) I have here (**Pick up the measuring cup**) a very special fluid.

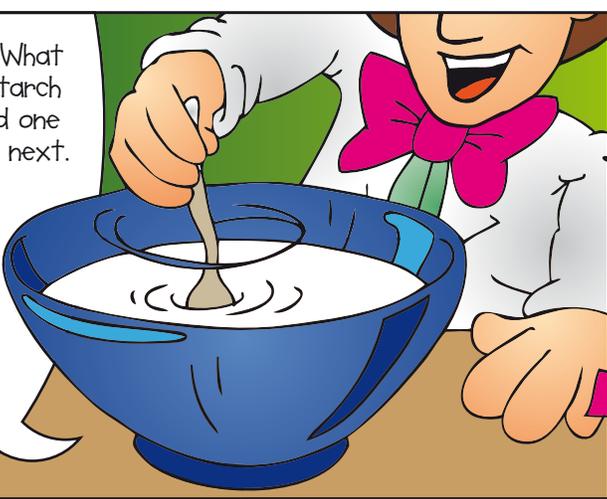


Stir a little with the **teaspoon** again, then set the spoon aside on the saucer. Lightly **swirl** the **measuring cup** so people can see that there is a liquid in it.

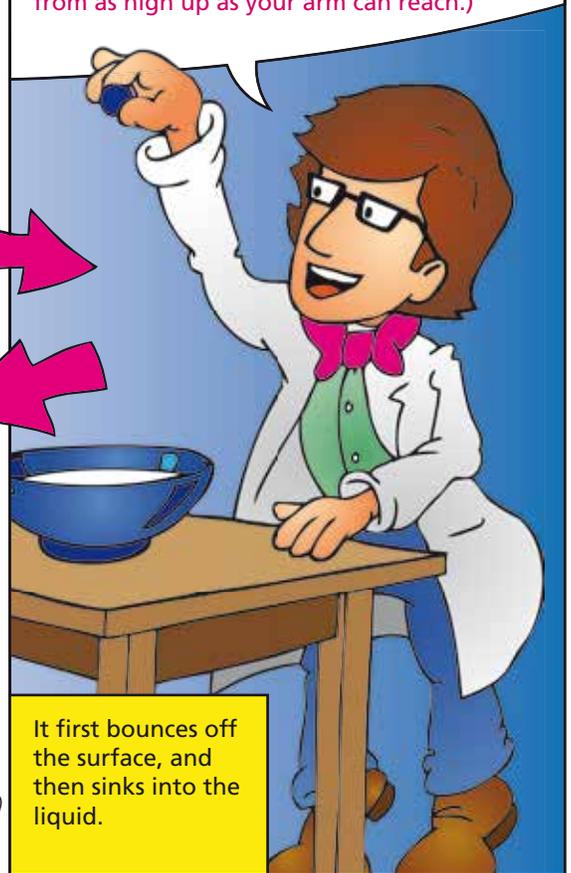


Now make a lightning-fast move with the cup, as if you wanted to splash the liquid onto an audience member. He, of course, will be startled, but hopefully otherwise unharmed.

Nothing happens! What we have here is starch solution. It is solid one moment, liquid the next. I have some more of it in this bowl. (Move the bowl to the center of the table.) As you can see, I can easily stir it. (Stir the mixture.)



But if I let this marble (Show the marble) plop in from way up here, this is what happens: (Drop the marble into the bowl from as high up as your arm can reach.)



The greater the force acting on this liquid, the more solid it gets. Strange, isn't it?

Let's see what happens if I hit it with a hammer. Please take cover!

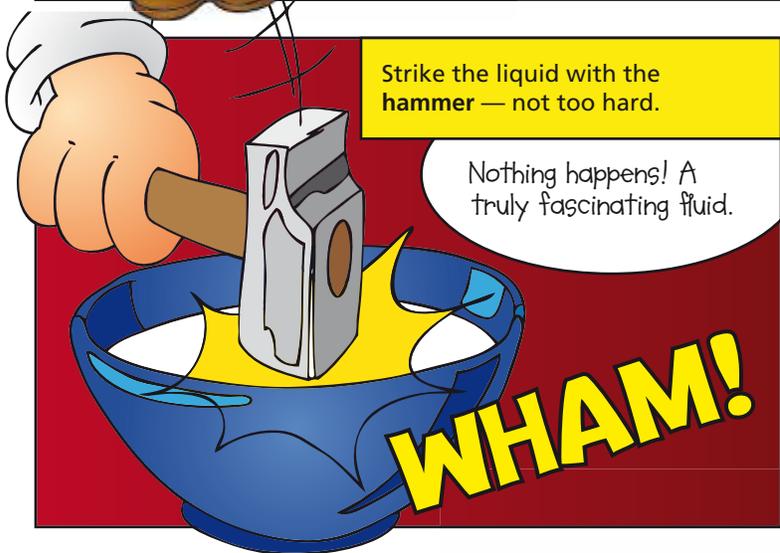
ATTENTION!



Strike the liquid with the hammer — not too hard.

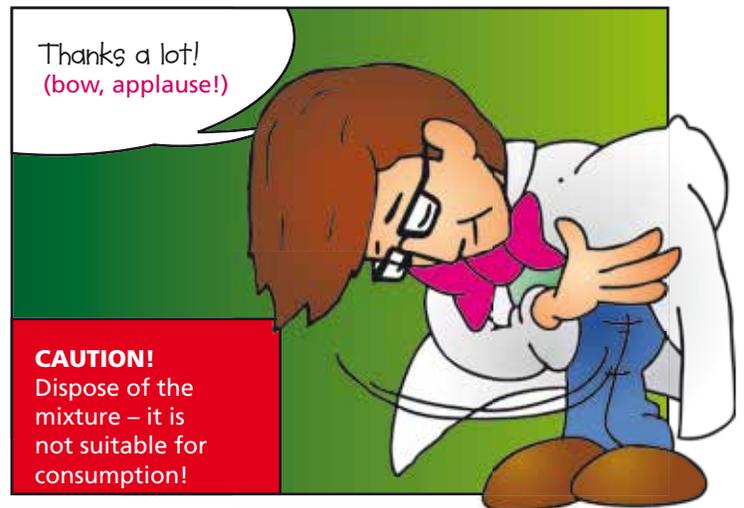
Nothing happens! A truly fascinating fluid.

WHAM!



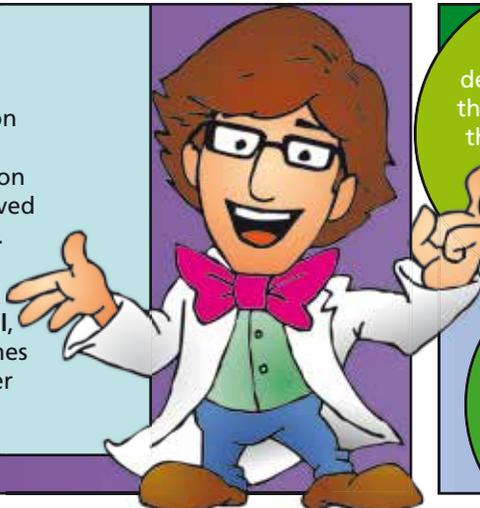
Thanks a lot! (bow, applause!)

CAUTION! Dispose of the mixture — it is not suitable for consumption!



## EXPLANATION

**Cornstarch** consists of very long particles. They mesh in the solution when they are pushed **quickly** against each other, and the solution **hardens**. If the solution is just moved slowly though, it acts like a liquid. This type of substance is called a **dilatant material**. The opposite of this is called a **thixotropic material**, which is normally thick but becomes thinner or runnier when put under stress or agitated.



You should definitely practice the step of spilling the mixture onto the audience! Preferably outside!

If you're still afraid that some of it might spill, do not pretend to pour it on the audience — do it in a different direction.

## A few more tips:

It is also interesting to try sticking your finger quickly into the mixture to feel how hard it is. If you just push your finger in slowly, it will sink into the starch mixture without any resistance.



# SCIENCE at HOME

Free, Downloadable Instructions for  
Science Activities You Can Do at Home!

**We hope you enjoyed this activity—and learned something cool while you did it!**

Thames & Kosmos was founded in 2001 with the mission of improving informal science education outside of the classroom. T&K's mission has since expanded from its STEM roots to encompass other educational branches, including arts and crafts and games and magic. T&K places an emphasis on teaching concepts and skills through tactile processes. Our vision is to give all children access to real, physical activities and projects that teach them how things work.

If you liked this experiment, we encourage you to check out our other free and downloadable educational resources that will keep your mind sharp and provide an afternoon of fun. From science experiments to coloring pages to word searches, we've got a little something for everyone. Scan the QR code to see!

Scan for more!



We want to hear about your experience with this activity! Share your pictures, videos, and comments on social media and tag **@thamesandkosmos**.



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