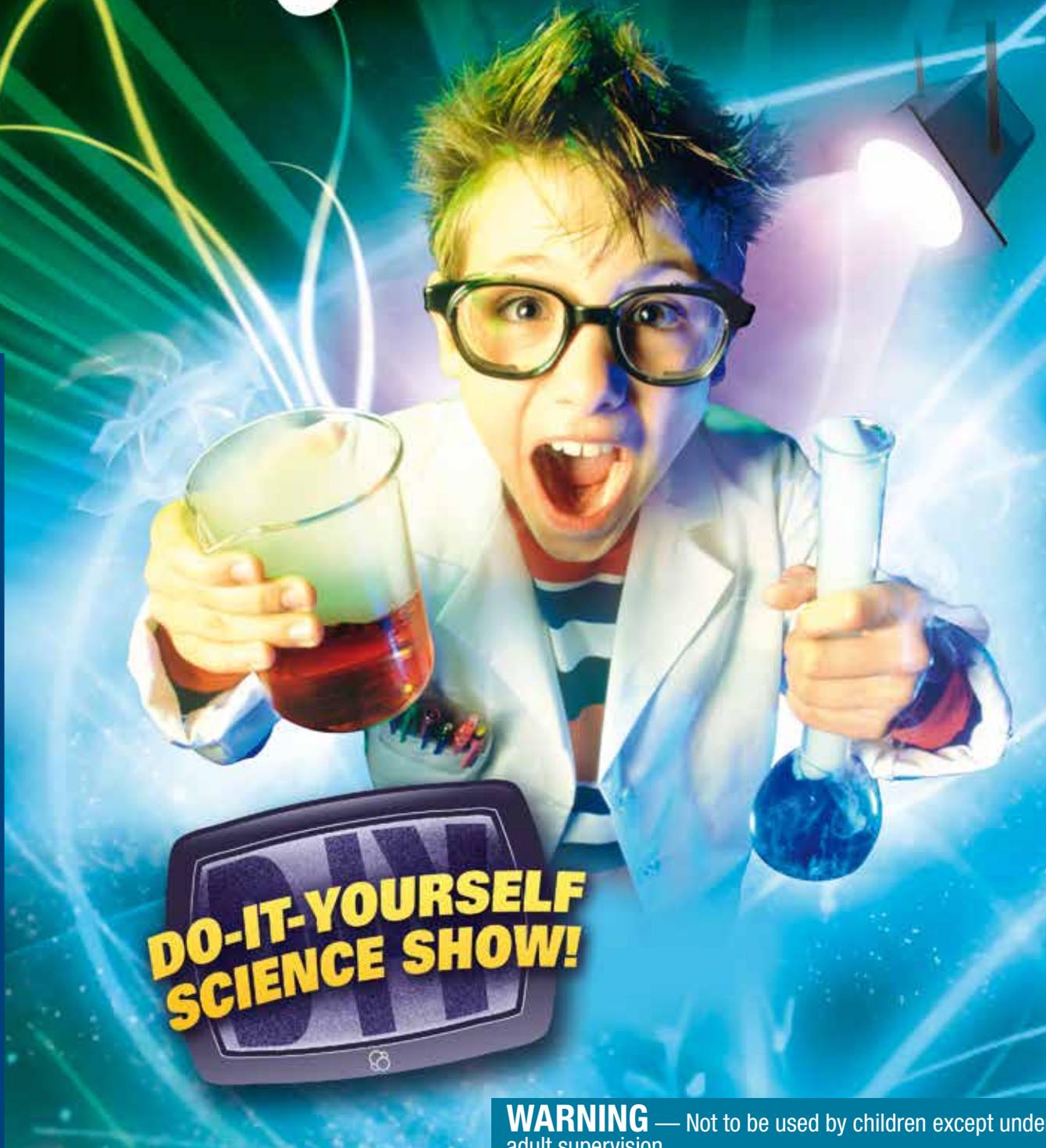


SPECTACULAR SCIENCE



**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!

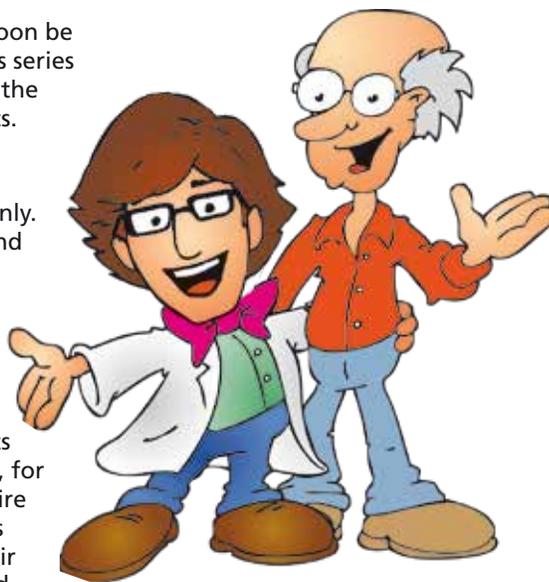
This chemistry activity series is intended for children older than the age of 12 only. In these experiments, your child will be working with chemicals, open flame, and denatured alcohol. Safety is particularly important to us, because the incorrect use of chemicals can lead to injury and other health 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

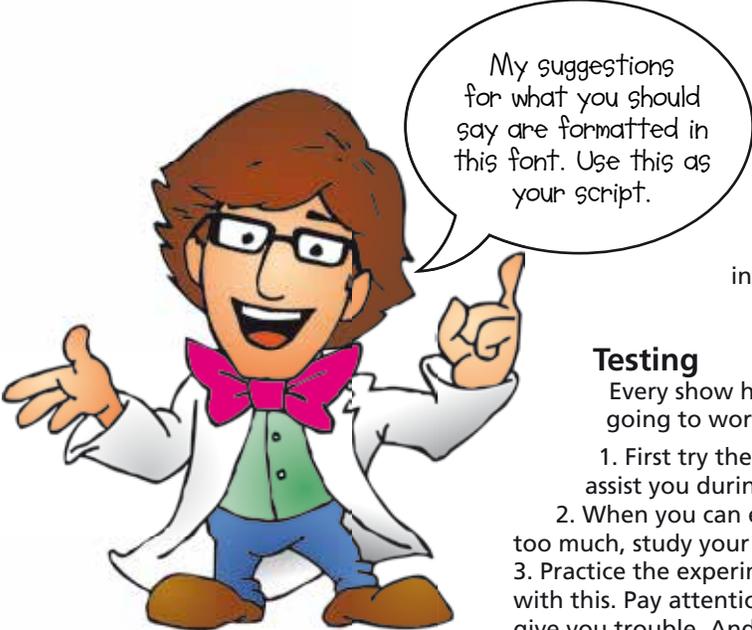
Preparing for your experiment show

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.

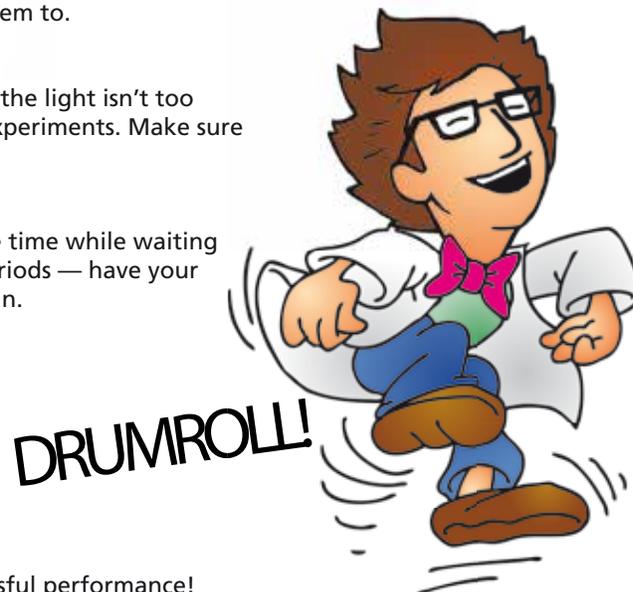
Closing words

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.



THE FOOTLOOSE FLAME



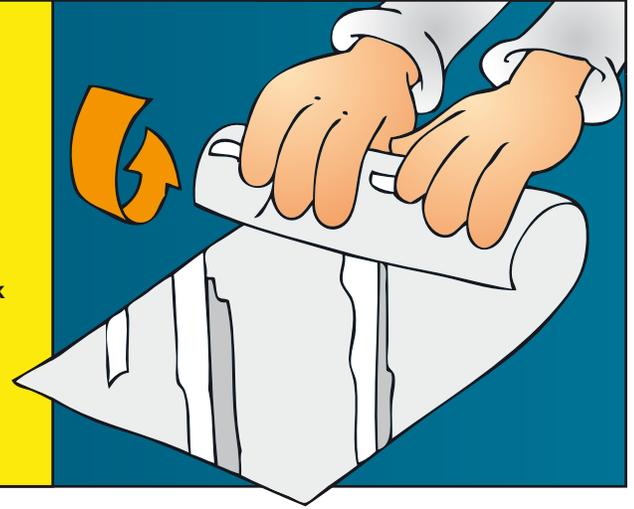
A candle is blown out and relit from 10 cm away. When that happens, you can see the flame make a dash down to the wick.

MATERIALS:

- transparent plastic sheet
- candlestick in a candlestick holder
- stick lighter
- clear tape

BEFORE THE SHOW

Roll the transparent sheet into a short tube (21 cm long). Hold it together with a piece of tape, to keep it from unrolling again. The tube should be just wide enough to fit over the candlestick holder (about 5 cm diameter). Place the roll over the candle and candlestick holder. The top of the candle has to stick up above the tube. Set everything within reach on the experiment table.

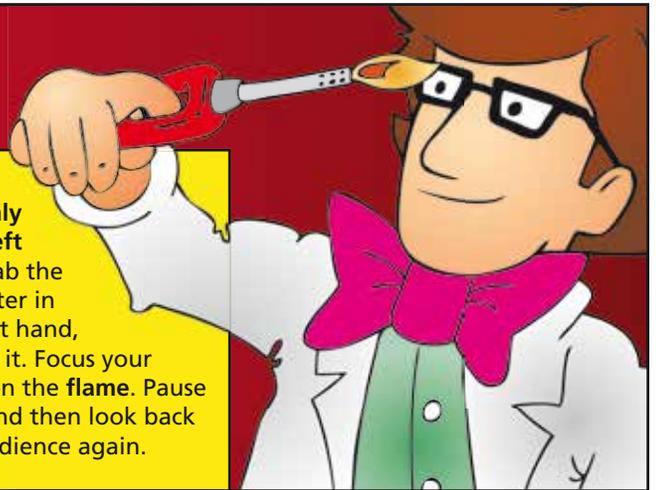


When a candle burns (Light the candle), it looks like the wick is burning. But is it really? (questioning look directed at the audience) That's what we're going to find out now. Absolute silence, please!

PERFORMANCE



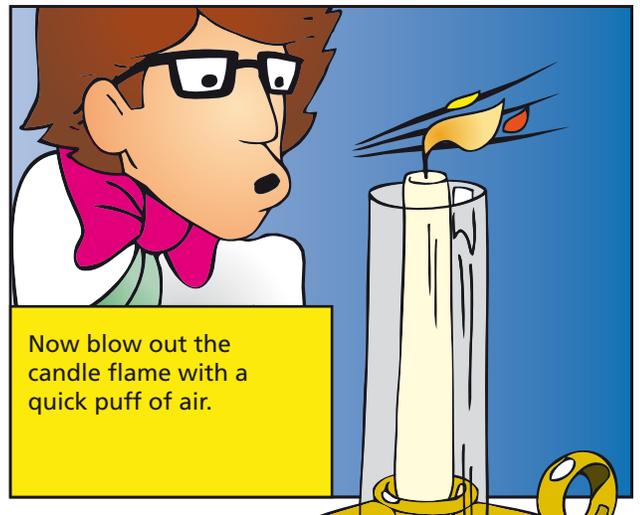
Hold the tube firmly in your left hand, grab the stick lighter in your right hand, and light it. Focus your gaze upon the flame. Pause briefly, and then look back at the audience again.

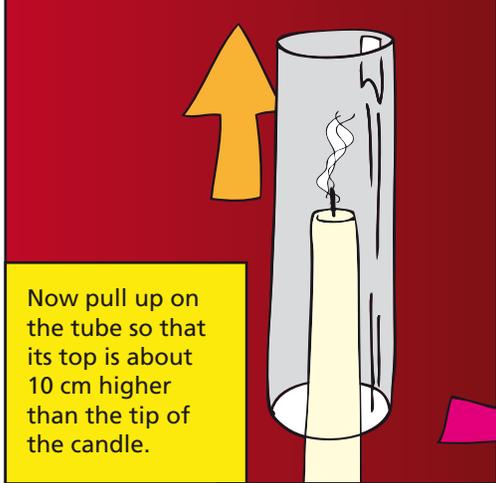


This is going to happen pretty quickly, so don't forget to clap! (Smile and look at the flame again.)



Now blow out the candle flame with a quick puff of air.

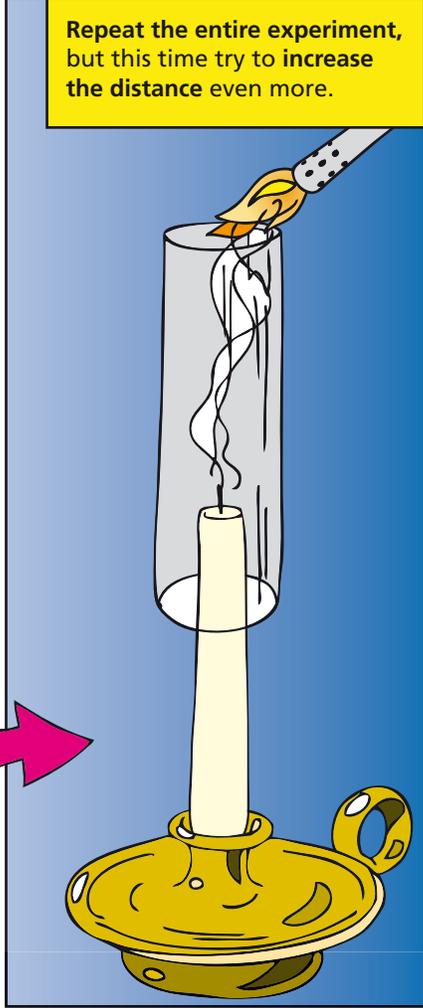




Now pull up on the tube so that its top is about 10 cm higher than the tip of the candle.



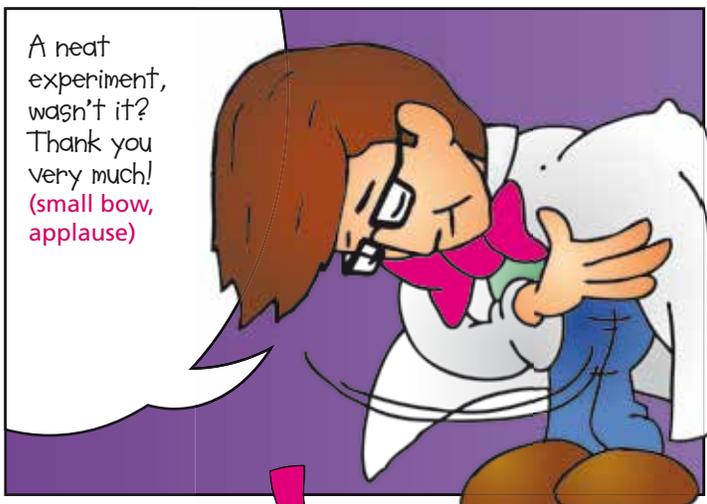
Wait a little for the white smoke from the candle to rise upward. Then, hold the stick lighter flame in the smoke: The flame will race down and light the candle!



Repeat the entire experiment, but this time try to increase the distance even more.



Crazy! (Act really pleased!) But maybe I can do it even better.



A neat experiment, wasn't it? Thank you very much! (small bow, applause)

A few more tips:

- For this show experiment, you should dim the light a little.
- The experiment won't work the first time you try it. But after a little while, you will get a feel for when and where to light the smoke.
- Be sure that the candle burns at least long enough for a small pool of wax to form around the wick. It usually works best after the first light.
- First try it from a short distance away and then increase the distance.



When a candle is lit, it isn't actually the wick that's burning, but the vaporized wax. And this vapor can also be lit from a distance. Thanks a lot! (Blow out the candle.)

Next, you will learn a lot of ways to put out a candle. You don't have to perform them all, but in this case you are allowed to deviate from the general rule against presenting more than five experiments in a row.

HOW TO PUT OUT A CANDLE PART 1



A tealight candle burns inside a glass lantern. The glass lantern is covered with a saucer. The candle soon goes out.

MATERIALS:

- tealight candle
- stick lighter
- glass lantern (candle holder vase)
- old saucer

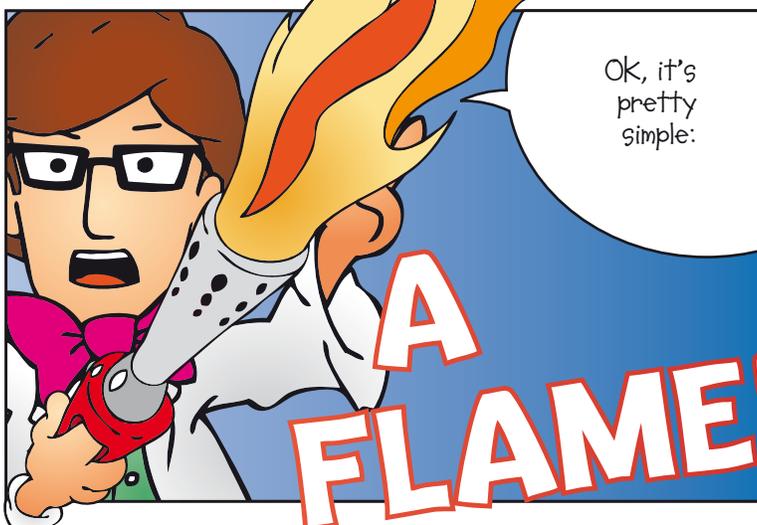
BEFORE THE SHOW

Place the candle in the glass lantern, and set it within reach on the table.



PERFORMANCE

There are lots of ways to put out a fire. But there's one thing you always need if you want to extinguish a flame. Does anyone know what it is? (Address the question to the audience. Pause briefly.)



Ok, it's pretty simple:

Light the candle.



This is one way to do it.



FLICKER FLICKER



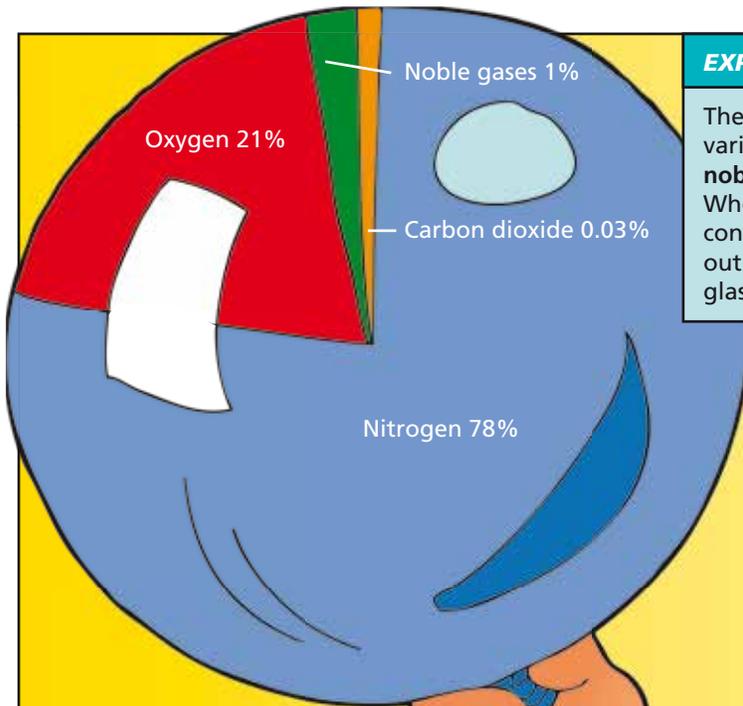
Exactly! When the flame burns, it produces carbon dioxide. In the process, the oxygen that the flame needs to burn is used up inside the glass, until the flame eventually goes out.



Lay the saucer over the glass lantern to form a relatively airtight seal. After a little while, the flame will get smaller and then finally go out.

EXPLANATION

The air — for example, the air in this balloon — is a mixture of various gases, such as **nitrogen** (the main ingredient), **oxygen**, **noble gases** (e.g. helium, neon, argon) and **carbon dioxide**. When a candle's wax burns, oxygen is consumed and converted to carbon dioxide. The result is that the candle goes out after a little while, because the remaining gases in the glass won't support combustion.



HOW TO PUT OUT A CANDLE PART 2



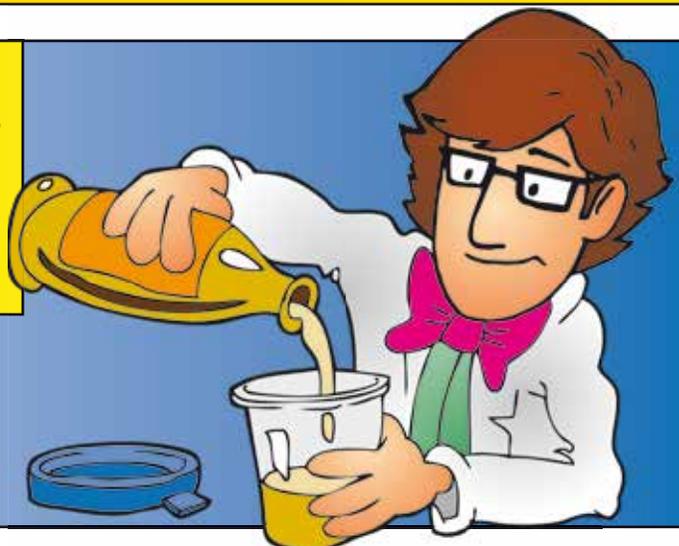
Another way to put out a tealight candle.

MATERIALS:

- tealight candle
- sodium bicarbonate (baking soda)
- measuring spoon
- pipette
- measuring cup with lid
- glass lantern (candle holder) from the previous experiment
- household vinegar
- stick lighter

BEFORE THE SHOW

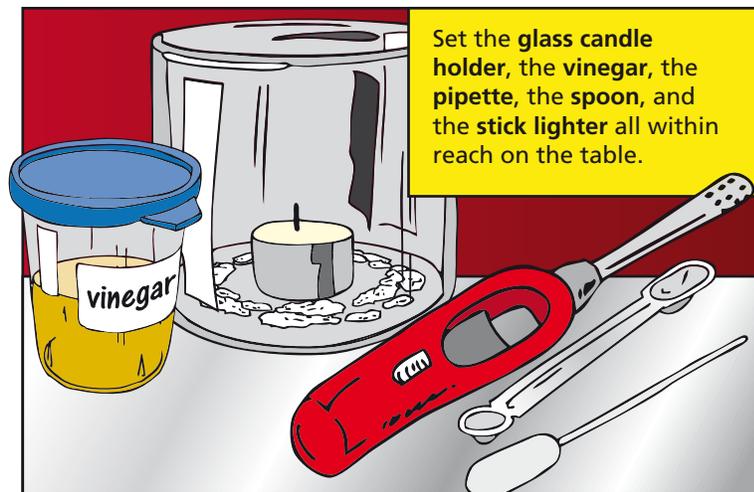
Pour some household vinegar (about 2 centimeters deep) into the labeled measuring cup, and close the cup with the lid.



Set the candle in the glass lantern and use the spoon to spread some baking soda (about 5 large spoonfuls full) all around the candle.

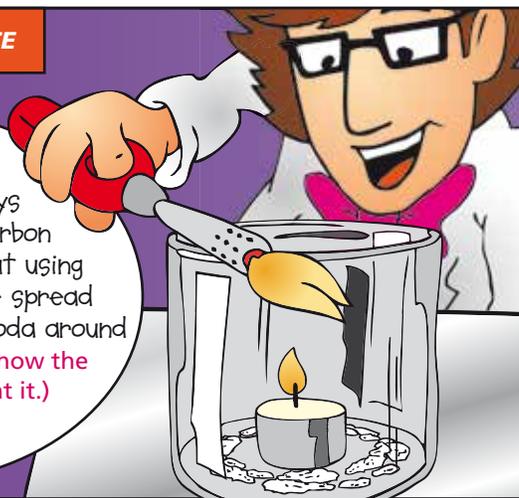


Set the glass candle holder, the vinegar, the pipette, the spoon, and the stick lighter all within reach on the table.

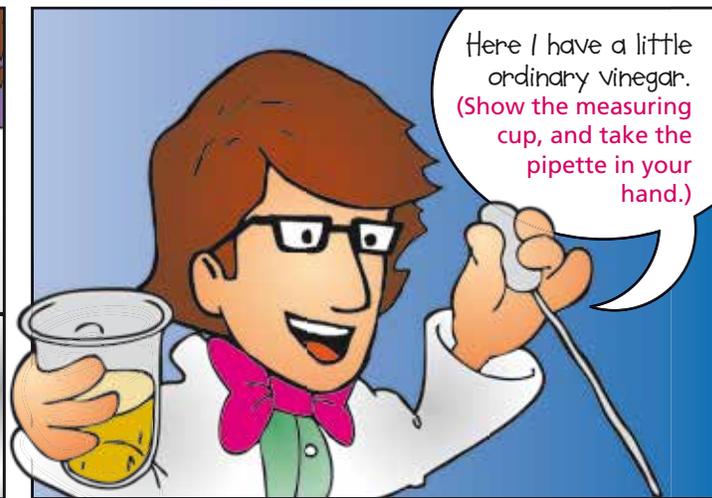


PERFORMANCE

But there are also other ways to produce carbon dioxide without using a flame. I have spread some baking soda around this candle. (Show the candle and light it.)



Here I have a little ordinary vinegar. (Show the measuring cup, and take the pipette in your hand.)

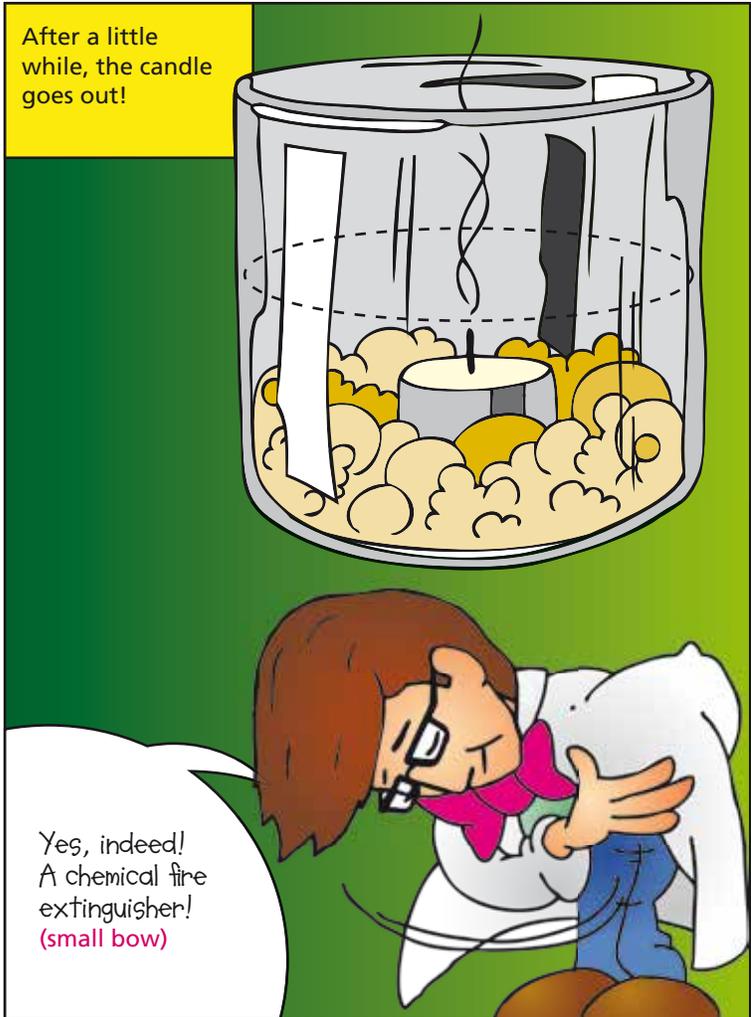




Now, drip about 2 full pipettes of vinegar onto the baking soda in the glass. As you do this, do **not** hold the pipette or your hand over the flame.



A drum roll! (Invite the audience to do a drum roll.)



After a little while, the candle goes out!

Yes, indeed! A chemical fire extinguisher! (small bow)

EXPLANATION
The reaction of baking soda with vinegar produces carbon dioxide, which pushes away the oxygen from around the candle and **extinguishes the flame**. This, by the way, is exactly how carbon dioxide fire extinguishers work.



HOW TO PUT OUT A CANDLE PART 3



This time, you'll be pouring the carbon dioxide gas over the flame.

MATERIALS:

- short tealight candle stand with tealight candle
- measuring cup with household vinegar (from the last experiment)
- lid
- sodium bicarbonate (baking soda)
- measuring spoon
- stick lighter

BEFORE THE SHOW

Get everything ready.



PERFORMANCE

Light the candle



The vinegar reacts with the baking soda to produce carbon dioxide. (Add 5 large spoonfuls of baking soda from the vial to the measuring cup with the vinegar. It will start fizzing quite a bit.)



By the way, carbon dioxide is heavier than air. So you can actually pour it.



Wait until the fizzing stops. Now, the carbon dioxide is sitting in a thin layer on top of the vinegar in the measuring cup.



DRUM ROLLLL!



And now, a drum roll please!

DRUM ROLLLL!

ATTENTION!



Now, carefully pour the invisible carbon dioxide over the flame. Be careful not to let any liquid pour out with it.



You can see how the flame goes out — once again, the carbon dioxide is pushing away the oxygen.



Great experiment, don't you think? Thank you! (small bow, applause)



TIP

The exact quantity of baking soda depends on your vinegar. Experiment a little beforehand.



HOW TO PUT OUT A CANDLE PART 4



This time, you will be extinguishing the candle from a distance with a gust of air, without using any chemistry at all!

MATERIALS:

- short tealight candle stand with tealight candle
- empty, thin-walled non-reusable plastic water bottle (1.5 liter), rinsed clean, without label (see-through) and without a cap
- stick lighter

BEFORE THE SHOW

Get everything ready on the table.



PERFORMANCE

You can also put out a candle without using carbon dioxide!
(Light the tealight again.)



NAMELY,
by USING this!
(Show the bottle.)



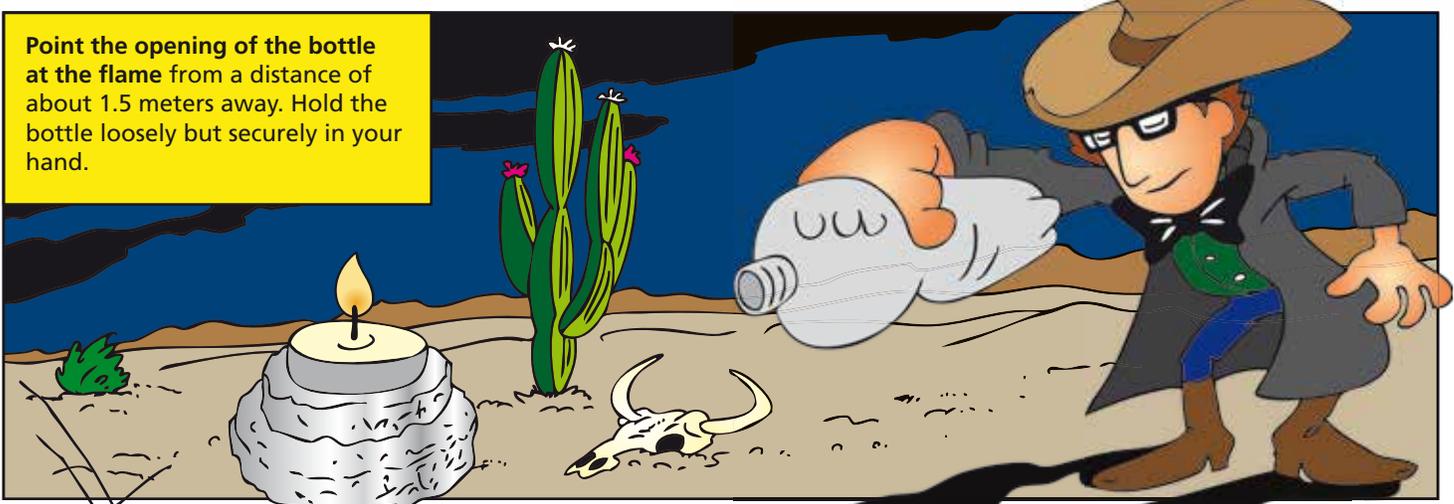
And now, a drum roll please!

DRUM ROLLLL!

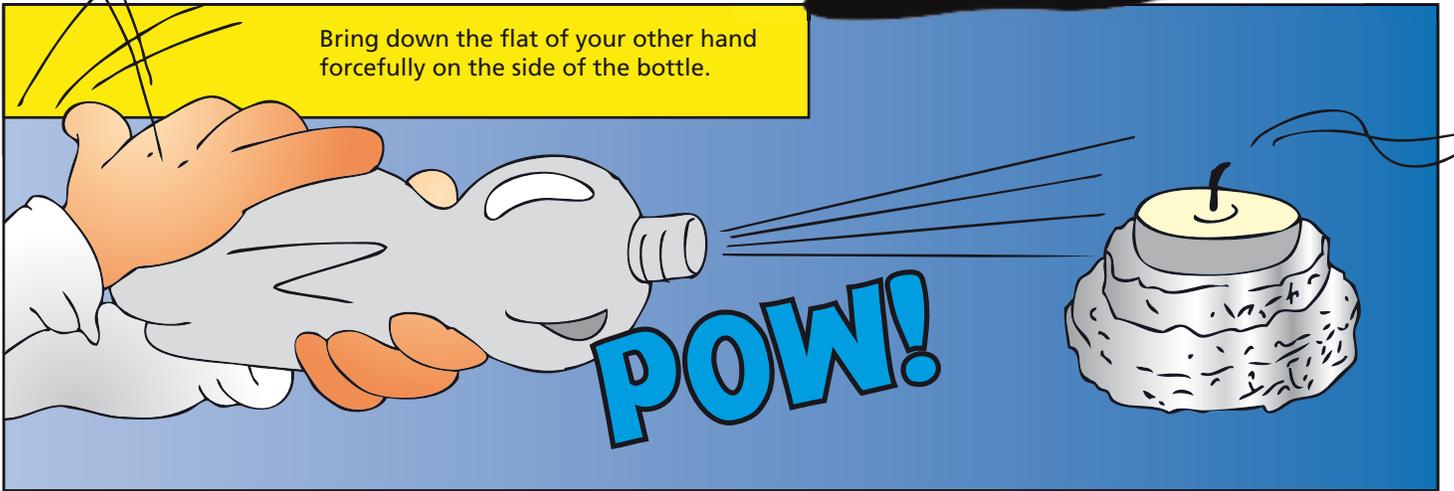


ATTENTION!

Point the opening of the bottle at the flame from a distance of about 1.5 meters away. Hold the bottle loosely but securely in your hand.

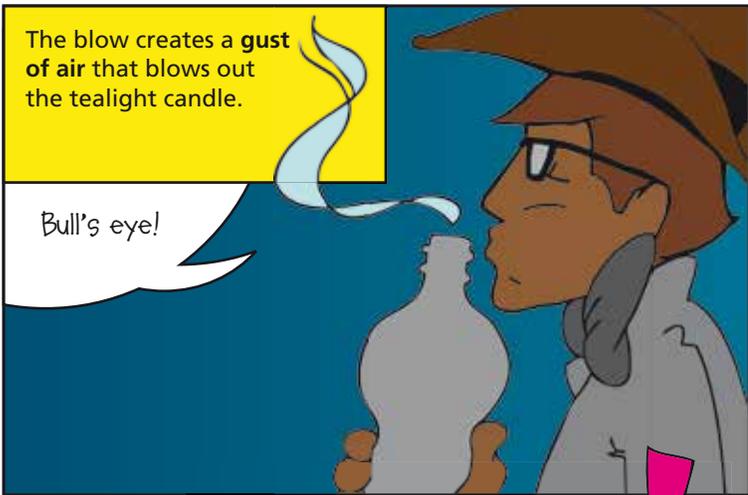


Bring down the flat of your other hand forcefully on the side of the bottle.



The blow creates a **gust** of air that blows out the tealight candle.

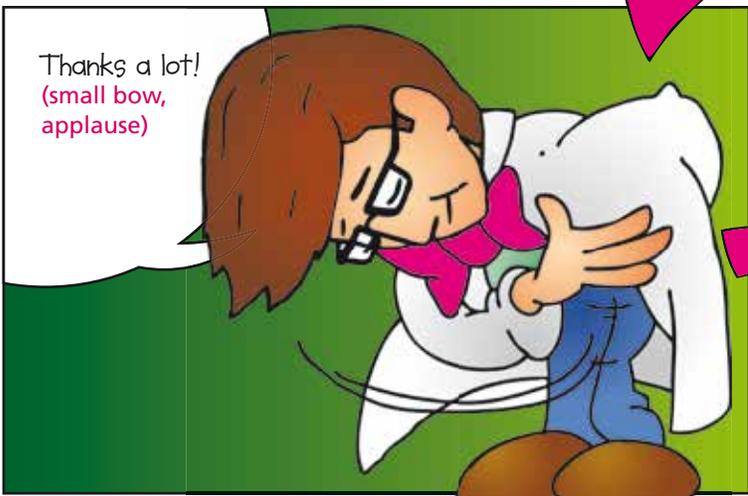
Bull's eye!



TIP

With a little practice, you will soon be able to hit the flame. To get a sense for the gust of air, first try aiming at **your face**. You will feel the gust quite clearly. You can also practice your aim on a **balled-up piece of tissue**. If it moves from the gust of air — bull's eye!

Thanks a lot!
(small bow, applause)





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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