Barbie

FUNDAMENTAL CHEMISTRY SET

Storybook and Experiment Manual

CHEMISTRY FUN FOR EVERYONE!

WARNING — Chemistry Set. This set contains chemicals that may be harmful if misused. Read cautions on individual containers and in manual carefully. Not to be used by children except under adult supervision.

THAMES & KOSMOS

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Safety Information

Please observe the safety rules and first aid information below, advice for supervising adults on page 1, information about hazardous substances on page 2, and safety rules on page 3. Keep packaging and instructions as they contain important information.

First Aid Information

- In case of eye contact: Wash out eye with plenty of water, holding eye open. Seek immediate medical advice.
- If swallowed: Wash out mouth with water, drink some fresh water. Do not induce vomiting. Seek immediate medical advice.
- In case of inhalation: Remove person to fresh air.
- In case of skin contact and burns: Wash affected area with plenty of water for at least 10 minutes.
- In case of cuts: Do not touch or rinse with water. Do not apply any ointments, powders, or the like. Dress the wound with a clean, dry first-aid bandage. Foreign objects (e.g. glass splinters) should only be removed by a doctor. Seek medical advice if you feel a sharp or throbbing pain.
- In case of doubt, seek medical advice without delay. Take the chemical and/or product together with the container with you. For household substances, take the retail packaging with you.
- In case of injury always seek medical advice.

Poison Control Centers (United States)
In case of emergency, your nearest poison control center can be reached everywhere in the United States by dialing the number:

1-800-222-1222

⚠ WARNING:

CHOKING HAZARD — Small parts. Not for children under 3 yrs. The glasses are a toy, not a safety protective device.

Kosmos Quality and Safety

More than one hundred years of expertise in publishing science experiment kits stand behind every product that bears the Kosmos name. Kosmos experiment kits are designed by an experienced team of specialists and tested with the utmost care during development and production. With regard to product safety, these experiment kits follow European and US safety standards as well as our own refined proprietary safety guidelines. By working closely with our manufacturing partners and safety testing labs, we are able to control all stages of production. While the majority of our products are made in Germany, all of our products, regardless of origin, follow the same rigid quality standards.

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A Word to Parents and Supervising Adults

Dear Parents,
Please read and follow these instructions as well as the safety rules and the first aid information. Please keep this information for reference.

A. This chemical toy is not suitable for children under 6 years. For use under adult supervision. Keep this chemical toy set out of reach of children under 6 years old.
B. Read and follow these instructions, the safety rules and the first aid information and keep them for reference.
C. Incorrect use of chemicals can cause injury and damage to health. Only carry out those activities which are listed in the instructions.
D. Because children's abilities vary so much, even within age groups, supervising adults should exercise discretion as to which activities are suitable and safe for them. The instructions enable supervisors to assess any activity to establish its suitability for a particular child.
E. The supervising adult should discuss the warnings, safety information and the possible hazards with the child or children before commencing the activities. Particular attention should be paid to the safe handling of alkalies, acids, and flammable liquids.
F. The area surrounding the activity should be kept clear of any obstructions and away from the storage of food. It should be well lit and ventilated and close to a water supply. A solid table with a heat resistant top should be provided.
G. The working area should be cleaned immediately after carrying out the activity.

Emphasize to your child the importance of following all instructions and warnings, and the importance of carrying out only those experiments that are described in this manual. Inform your child, but do not frighten her or him – there's no need for that.

Devote special care to information about the safe handling of acids (such as citric acid) and bases (such as sodium hydrogen carbonate) and to experimenting with hot liquids.

A special "laboratory" will not be necessary for these simple experiments. A sturdy table with a washable, heat-resistant surface is good enough. It should be well lit and ventilated, equipped with a nearby water tap, and not too close to any stored foods. The surroundings should be free of all obstacles. Always get any required equipment and chemicals ready before beginning an experiment. Your child should wear old clothes (or an old smock). After completing the experiments, he or she should pick up and clean the work area and thoroughly wash his or her hands.

We hope you and your child enjoy doing these experiments!

STEP-BY-STEP VIDEOS

Scan the QR code or follow the link for instructional videos.

QRS.LY/XB5X3AE

Information about Hazardous Substances

None of the substances in this kit are classified as hazardous substances in the quantities included and the applications presented in this kit. However, you must read these safety instructions before use, follow them, and keep them for reference.

WARNING. The following applies to all chemicals:
- Do not ingest.
- Wash hands thoroughly after handling.
- Use only as instructed. Read cautions in this manual carefully.
- Store locked up. Keep out of reach of children. This primarily applies to young children, but also to older children who — unlike the experimenter — have not been appropriately instructed by adults.

The following applies to all powdered chemicals:
- Do not get in eyes, on skin, or on clothing.
- Avoid breathing dust.

Also follow this precautionary statement:
- IF SWALLOWED: Get immediate medical advice/attention and have product container or label of chemical substance at hand.

Here is information specific to each chemical in this kit:

Polymer slime powder
- Ingredients: Locust bean gum, guar gum, silica, sodium phosphate, sodium benzoate, color pigment, glitter (copolyesters, acrylic copolymer)

Color-changing putty powder
- Ingredients: Locust bean gum, guar gum, silica, sodium phosphate, hypercolor dye, sodium benzoate, color pigment

Acid powder
- Ingredients: Citric acid

Base powder
- Ingredients: Sodium hydrogen carbonate (Sodium bicarbonate)

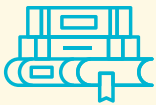
Fizzing reaction tablets
- Ingredients: Sodium hydrogen carbonate, citric acid, mannitol (E421), mineral oil, polyethylene glycol, sodium benzoate (E211), color dye
- Do not get in eyes.
- The tablets generate carbon dioxide gas upon contact with water. The reacting substances are sodium hydrogen carbonate and citric acid.

Crystal feather solution
- Ingredients: Aqueous solution of Potassium dihydrogen phosphate (KH_2PO_4)
- Do not get in eyes, on skin, or on clothing.

Golden putty
- Ingredients: Polydimethylsiloxane, boric acid, silica, glycerine, color pigment
- Do not get in eyes or on clothing.

How to dispose of waste

Leftover chemicals can be poured down the drain with plenty of water. Please dispose of leftover solids in the household garbage.



Safety Rules

The first thing a researcher does is to get an overview of what he or she will be doing. All of the experiments described in this manual can be performed without risk, as long as you conscientiously adhere to the advice and instructions. Read through the following information very carefully. Think about everything that you will need. Always pay attention to the safety notes that accompany an experiment.

1. Read these instructions before use, follow them and keep them for reference.
2. Keep younger children under the specified age limit and animals away from the activity area.
3. Store chemical toys out of reach of young children.
4. Wash hands after carrying out activities.
5. Clean all equipment after use.
6. Do not use any equipment which has not been supplied with the set or recommended in the instructions for use.
7. Do not eat, drink or smoke in the activity area.
8. Make sure that all containers are fully closed and properly stored after use.
9. Ensure that all empty containers are disposed of properly.
10. Do not allow chemicals to come into contact with the eyes or mouth.
11. Do not replace foodstuffs in original container. Dispose of immediately.
12. Do not apply any substances or solutions to the body.
13. Store this experimental set and the additional materials out of reach of children under 6 years of age, e.g. in a cabinet that can be locked.
14. Carefully prepare your work area for the experiments. Clear off the table and gather everything you will need.
15. Always leave your work area in clean condition. Always pay attention to proper disposal of any residues.
16. Always work slowly and carefully. Do not stir up chemical dust and do not squirt or spill any solutions. If you get something in your eye by mistake, rinse out your eye with plenty of water. Have an adult help you.
17. When experimenting, wear old clothes that can take a little abuse, or wear something over your clothes (such as an apron or old shirt).
18. Take care while handling with hot water or hot solutions. Store solutions out of the reach of small children (under 6 years of age).
19. Pay special attention to the quantity specifications and the sequence of the individual steps. Only perform experiments that are described in this instruction manual.
20. Do not use any eating, drinking, or other kitchen utensils for your experiments. Any containers or equipment used in your experiments should not be used in the kitchen afterward.
21. Immediately wipe up any spills with a paper towel to avoid leaving any stains.
22. If chemicals should come in contact with eyes, mouth, or skin, follow the first aid advice (inside front cover of this manual) and contact a doctor if necessary.
23. Do not grow crystals where food or drink is handled or in bedrooms.

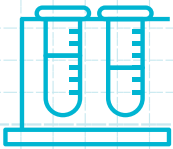
If you have any questions about the experiments, your parents or older siblings will be able to help you.
Now let's get started. Have fun with the experiments!

Kit Contents

Kit Contents

✔	No.	Description	Quantity	Item No.
❍	1	Chemistry set case	1	719 145
❍	2	Large test tube	2	717 120
❍	3	Small test tube	1	717 119
❍	4	Test tube lid	3	719 688
❍	5	Test tube stand	1	719 687
❍	6	Measuring cup	2	714 771
❍	7	Pipette	4	714 772
❍	8	Toy safety glasses	1	719 129
❍	9	Wooden spatula	2	717 692
❍	10	Polymer slime powder, 6.5-7.5g	1	719 149
❍	11	Color-changing putty powder, 6.5-7.5g	1	719 157
❍	12	Acid powder, 4.5-5.5g	1	719 167
❍	13	Base powder, 4.5-5.5g	1	719 166
❍	14	Fizzing reaction tablets, 3 pieces	1	719 169
❍	15	Crystal feather solution, 19.5-20.5g	1	719 168
❍	16	Die-cut paper feather	1	719 150
❍	17	Golden putty, 14.5-15.5g	1	719 165
❍	18	Sticker sheet	1	719 148

For some experiments, you will also need: *water, scissors, cooking pot with hot water, marker, tape, dye (optional), cooking oil*



Please check to make sure you have all of the correct parts and chemicals. If you are missing any parts, please contact Thames & Kosmos customer service at: techsupport@thamesandkosmos.com

Use the materials carefully, as they may stick to or stain fabric, wood, carpet, or other materials. Clean with water.

THE STORY BEGINS . . .

"Another great job," said Ms. Morris as she handed the graded chemistry tests back to Barbie and Nikki. "All your hard work has really paid off!"

Barbie and Nikki loved chemistry class. It was fun to learn about all the different materials in the world and the small particles, called atoms, that they are made of. They liked the classroom work where they learned about the structure of the atom and chemical formulas. And they loved the lab sessions where they were able to conduct real experiments and see chemical reactions happen before their very eyes.

"Would you like to help me share some chemistry lessons with the other students in the school?" the teacher asked the girls.

"Yes!" Barbie and Nikki said at the same time.

"The coolest part of chemistry is the hands-on work in the lab. That's when you see chemistry in action and understand why it's so important to learn," Barbie said. "Why don't we build a portable science lab and bring it around to the other classrooms to show the other kids some of the science experiments that we can do?"

"Nice idea," said Nikki. "And I know how we can put it together."


H_2SO_4
1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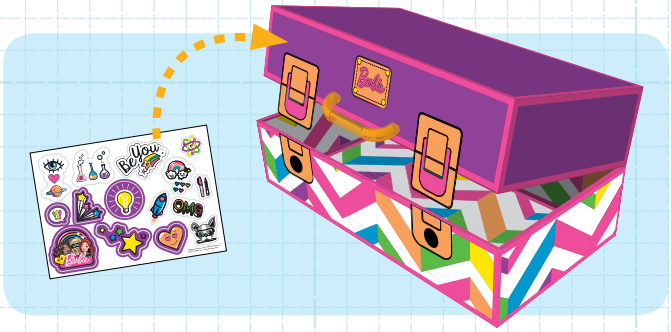
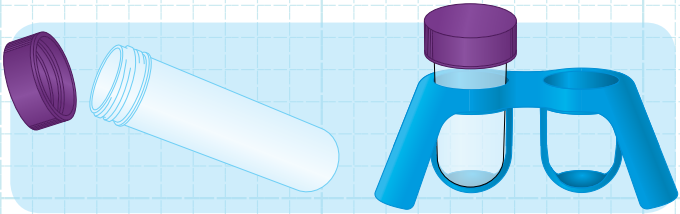


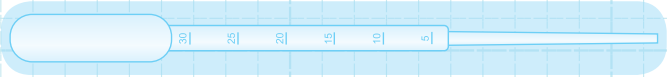
"Let's use this colorful portable trunk for our science lab," Nikki said.

"Great idea," said Barbie. "We can put all the tools, chemicals, and supplies we need into it."

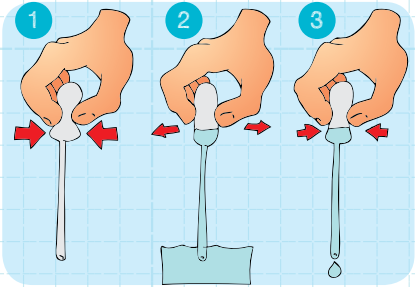
"And we can decorate it with these stickers!" Nikki added.

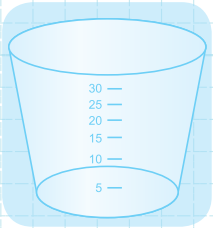


"This is called a **test tube**," Ms. Morris said. "Test tubes are thin vessels that are usually made of heat-resistant glass. They are very common in chemistry labs. You can fit a lot of them in test tube stands so you can conduct many variations on an experiment in a relatively small space. Our **test tube stand** holds two test tubes upright, so you can easily do your experiments. Please be aware that these tubes here can't be heated, because they are made of plastic."



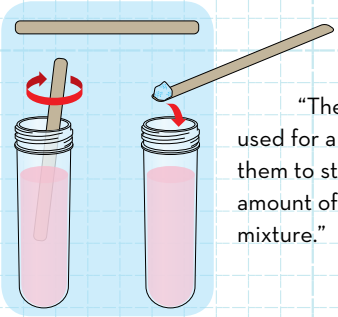
"And here is a **pipette**," she continued. "Pipettes, or droppers, are used to carefully measure small amounts of liquid and drip them into other containers. You use it by first squeezing the bulb and inserting the tip into the liquid. Then you release the bulb a little to draw the liquid up the tube. Finally, you remove the pipette from the liquid and squeeze the bulb again to release the liquid from the pipette. The pressure holds the liquid in the tube."



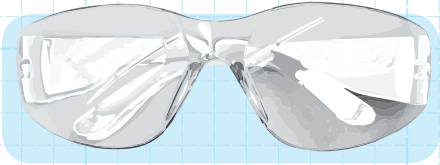


"This is a **measuring cup.** Measuring is a critical aspect of chemistry. You have to know how much of certain chemicals react with how much of other chemicals.

On the side of the measuring cups, you will find numbers that get larger as you go from the bottom to the top. They refer to the volume in milliliters (abbreviated ml). The 'cc' stands for 'cubic centimeter,' which is simply another term for milliliter. (1 cc = 1 cubic centimeter = 1 milliliter = 1 ml)"



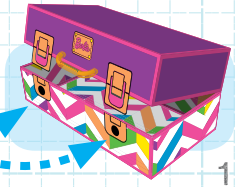
"These **wooden spatulas** can be used for a variety of things. You can use them to stir solutions or pick up a small amount of chemical powder to add it to a mixture."



"And don't forget your **safety glasses**. Real safety glasses protect your eyes from splashes and particles flying through the air in the laboratory." (However, the safety glasses in this kit are just toy glasses, because no hazardous substances are included in this kit.)

"The portable science lab is finished," Nikki declared. "Now let's bring it around the school, from classroom to classroom, so we can share our chemistry experiments."

"That looks great, girls! Good work. Let's take our traveling chemistry show to the first classroom. I can help explain some of the chemistry behind your experiments as we show them off to the other students," Ms. Morris said.



You can use the flaps on the side of the case to secure the case closed. First, pull the flaps out from the inside of the case.

The girls first visited the first-grade classroom. They showed the first graders how mixing water with a dry slime powder would create a slimy, oozy substance.

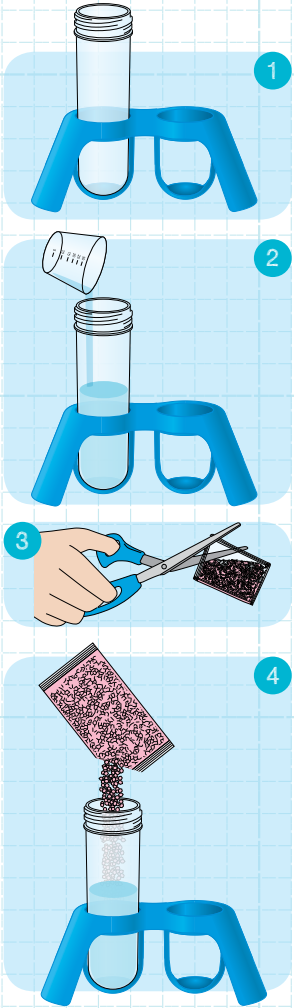
Ms. Morris explained that the sliminess of the slime is caused by a polymer material and that the glittery effect of the slime is caused by light bouncing off of tiny squares of reflective foil in the slime.

EXPERIMENT

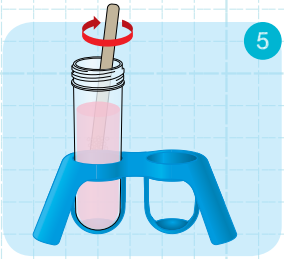
Glittery Slime

You will need: Large test tube, test tube lid, test tube stand, measuring cup, polymer slime powder, spatula, *water, scissors*

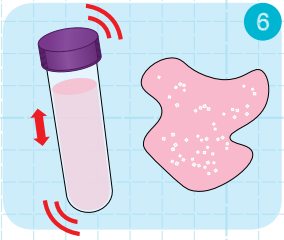
1. Place a large test tube in the test tube stand.
2. Using the measuring cup, measure 75 ml of water (30 + 30 + 15 ml) and pour it into the test tube.
3. Open the packet of slime powder using a pair of scissors. Do not use your teeth. Be careful not to get any of the powder in your eyes or mouth.
4. Pour all of the powder slowly into the tube and avoid creating airborne dust.



5 Use the wooden spatula to mix the powder into the water.

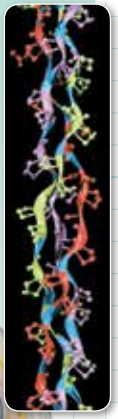


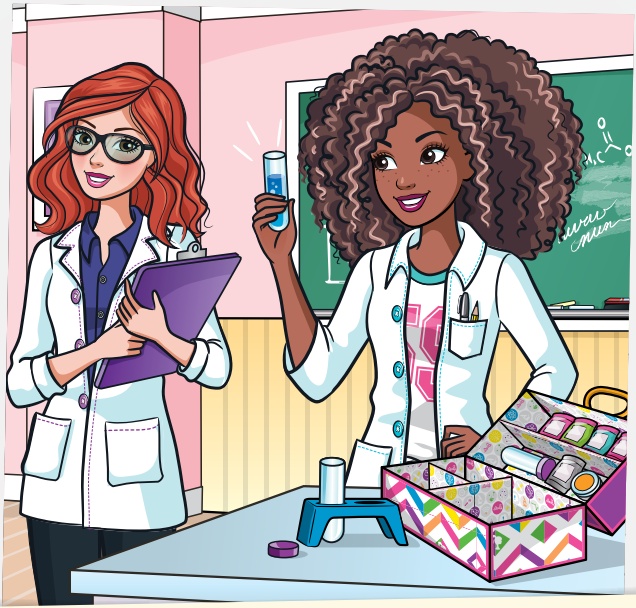
6 After the powder is mixed with the water, close the test tube with the lid and shake it for 30 seconds. Let the contents sit, shaking the tube every few minutes, until they have solidified. This takes about 15–20 minutes. After it has solidified, you can open up the test tube and have fun playing with the slime.



WHAT'S HAPPENING?

The slime powder contains a material called a **polymer.** Polymers are long molecules that are made up many repeating parts, like a chain with many chain links. When the polymer powder gets wet, the polymer molecules attach together, growing longer. These long strands get all tangled up with each other, like a bowl of spaghetti. When you stretch the slime, the tangled-up strands resist being pulled apart. When you squish the slime in your hand, the jumbled-up strands also resist being compressed too tightly – like a handful of rubber bands!





Next, Barbie and Nikki visited the second-grade classroom. There, they mixed another powder with water in a test tube and shook it up. Another slimy substance formed. At first the slime appeared blue, but then Nikki held the slime in her hand and it turned to green.

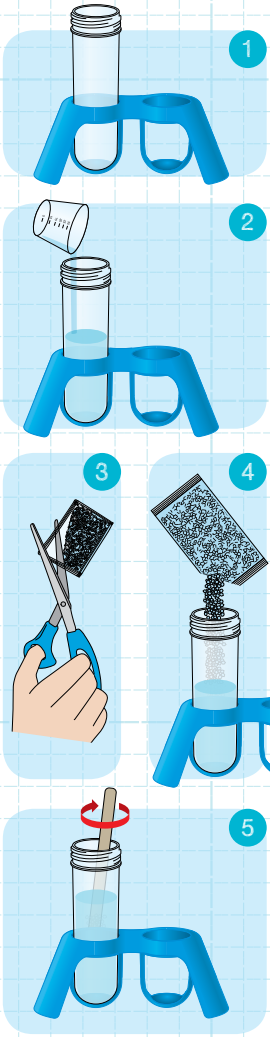
Ms. Morris explained that the color-change effect is caused by a heat-sensitive pigment that changes color when warmed up or cooled down.

EXPERIMENT

Changing Colors

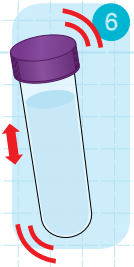
You will need: Large test tube, lid, stand, measuring cup, color-changing putty powder, spatula, *water, scissors, pot of hot water*

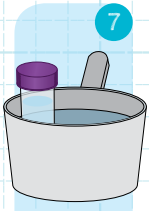
1. Place a large test tube in the test tube stand.
2. Using the measuring cup, measure 75 ml of water (30 + 30 + 15 ml) and pour it into the test tube.
3. Open the packet of putty powder using a pair of scissors. Do not use your teeth. Be careful not to get any of the powder in your eyes or mouth.
4. Pour all of the powder slowly into the tube and avoid creating airborne dust.
5. Use the wooden spatula to mix the powder into the water.
6. After the powder is mixed with the water, close the test tube with the lid and shake it for 30 seconds. Let the contents sit, shaking the tube every few minutes, until they have solidified. This takes about 15–20 minutes.



7 Put the putty in the test tube and place the test tube in a pot of hot water. Have an adult help you heat the water safely. Be careful not to burn yourself. Observe the slime for a period of five to ten minutes. What do you notice?

8 Remove the test tube from the hot water, wipe it dry, and place it into the holder. Let the slime cool down to room temperature. What happens when the slime has cooled down?





Safety Note: Caution! High temperatures. There is a risk of burns. Adult supervision is required.

WHAT'S HAPPENING?

Mood ring

A material that changes color due to a change in temperature is called **thermochromic.** A thermochromic material changes color because when it is heated the way that its molecules absorb and release light changes. This process is reversible because it does not involve a change in the structure of the molecules in the material. This type of change is called a **physical change.** A classic example of a thermochromic material is a mood ring which changes color in response to the wearer's body heat. There are two common groups of thermochromic materials: liquid crystals and leuco dyes. As the name suggests, liquid crystals are materials that are in a state between a liquid and a crystal solid. A common use for liquid crystals is in liquid crystal displays (LCDs), which are used in TVs and computer monitors. Leuco dyes are chemicals that can switch between two different forms, one of which is colorless, depending on exposure to light, heat, or pH.

LCD screen

The girls then made their way to the third-grade classroom. The third graders were learning about the states of matter: solids, liquids, and gases. Barbie and Nikki showed them how a gas can be formed from a liquid by a chemical reaction caused by mixing an acid and a base material in a test tube.

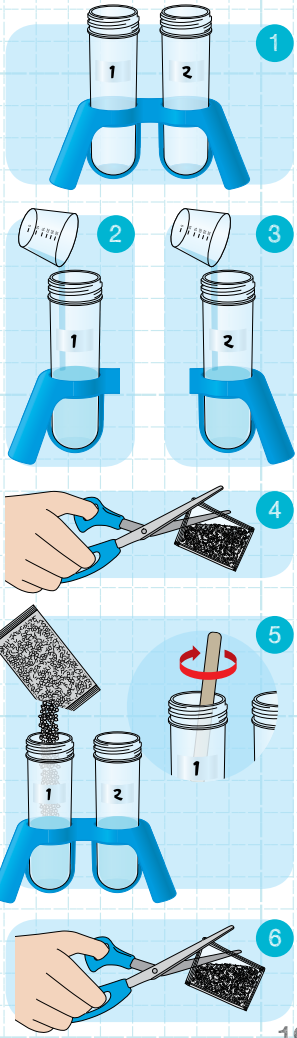
Ms. Morris explained that the acid and the base react with each other, which releases carbon dioxide gas, which is what fizzes up in the test tube.

EXPERIMENT

Fizzy Fun

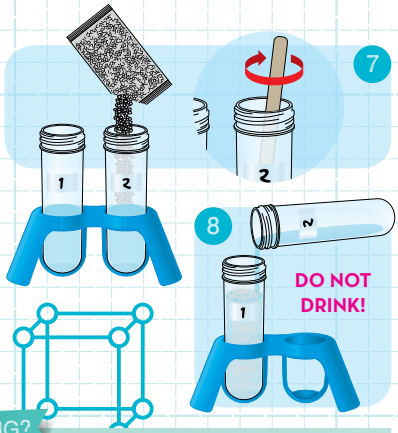
You will need: 2 large test tubes, stand, measuring cup, acid powder (citric acid), base powder (sodium hydrogen carbonate), spatula, *marker, tape, water, scissors, dye (optional)*

1. Put two large test tubes in the test tube holder. Label the test tubes "1" and "2".
2. Measure 30 ml of water with the measuring cup and pour it in the first test tube.
3. Measure 30 ml of water with the measuring cup and pour it in the second test tube.
4. Cut the corner off of the acid powder packet with scissors.
5. Pour the acid powder into the first test tube. (You can add a drop of dye to the solution as well.) Stir to mix.
6. Cut the corner off of the base powder packet.



7 Pour the base powder into the second test tube. (You can add a drop of dye to the solution as well.) Stir to mix.

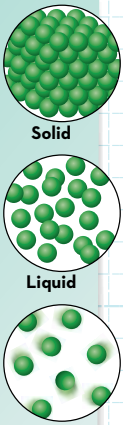
8 Pour the solution from test tube 2 into test tube 1. Watch what happens.



WHAT'S HAPPENING?

The acid and base powders are **solids** in the form of small particles. A solid is a state of matter that is rigid, holds its shape, and doesn't flow like a liquid. Even though the powders appear to pour and take the shape of their containers, the individual particles of the powder hold their shape, and are thus considered solids.

When you add the powders to the water, you create an acidic **solution** in the first test tube and a basic solution in the second. The solids are dissolved into the water, which is a **liquid.** A liquid is a state of matter that flows and takes the shape of the container it is in, filling the bottom first. When you mix the acidic and basic solutions together, a chemical reaction occurs — the product of which is a **gas.** A gas is a state of matter that flows and expands to fill the entire container it is in. The gas forms in the liquid solution as bubbles, which rise up out of the solution and escape into the air.



The acid is citric acid and the base is sodium hydrogen carbonate. When these mix, they react to form water, carbon dioxide gas (the bubbles!), and sodium citrate. This reaction is similar to how baking powder reacts to form bubbles that cause cookies and cakes to rise!

The girls visited the fourth-grade classroom next. They showed the students how to make a cool, oozing lava-lamp-like effect in a test tube with just oil, water, and colored fizzing tablets.

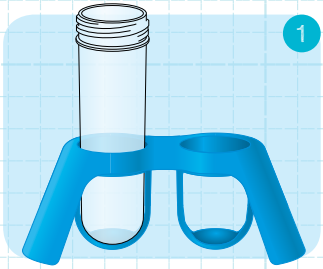
Ms. Morris explained that the fizzing tablets released carbon dioxide gas, which is what caused the oozing bubbles to form.

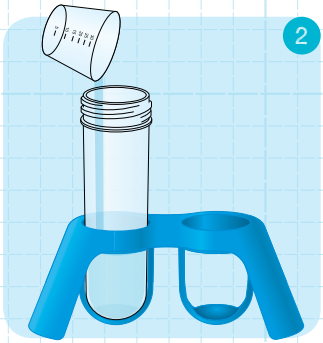
EXPERIMENT

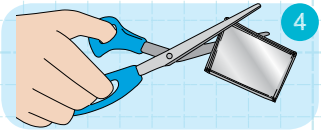
Oozing Bubbles

You will need: Large test tube, lid, stand, measuring cup, fizzing reaction tablets, *water, cooking oil, scissors*

1. Place a large test tube in the test tube stand.
2. Using the measuring cup, measure 30 ml of water and pour it into the test tube.
3. Using the measuring cup, measure 60 ml of oil (2 x 30 ml cups) and pour it into the test tube. It works best if you tilt the test tube a little and pour the oil slowly down the inner side of the tube.
4. With scissors, cut open the bag of colored fizzing tablets and take out one tablet.
5. Drop one colored fizzing tablet into the test tube and observe what happens.







WHAT'S HAPPENING?

After a little while, the tablet will start to fizz. Colorful bubbles will rise to the surface and then slowly sink back down again. When the fizzing tablet dissolves, it creates a gas that carries the bubbles to the top. The gas escapes, and the bubbles become heavy and sink. The cool swirling effect occurs because the oil is thick, or **viscous.** The oil has a molecular structure that keeps it from mixing with the water.

This reaction is similar to the one in the last experiment. The fizzing tablets contain sodium bicarbonate (baking soda) and citric acid. When they come into contact with water, a chemical reaction occurs between the baking soda and the acid. The products of this reaction are sodium citrate and carbon dioxide gas. The sodium citrate is a weak base which can be used to neutralize stomach acid. This is why tablets very similar to these tablets are sold as antacids to reduce stomach acid and ease indigestion. The carbon dioxide gas is what causes the fizzing bubbles. This is also how baking powder makes baked goods rise!

Finally, Barbie and Nikki visited the fifth-grade classroom. The fifth-graders were learning about crystals. Barbie showed the class how a delicate type of crystal can be grown quickly. The students clapped.

Ms. Morris explained how the crystals formed.

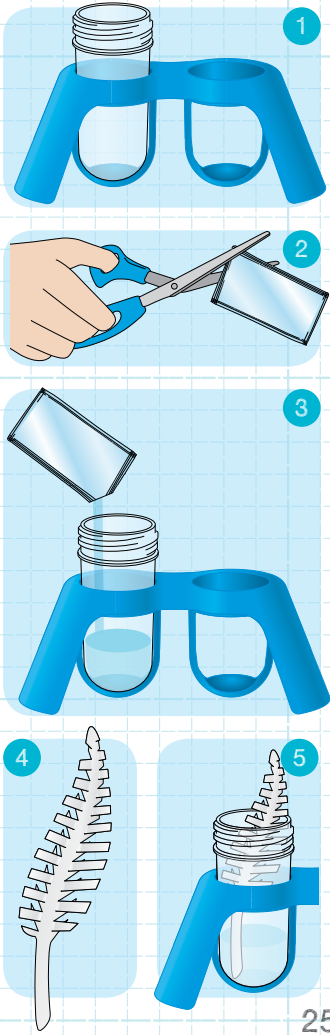
"And that concludes our chemistry demonstration for today," Ms. Morris said. "I hope you enjoyed this, and that you continue to observe the world around you and look for the science in everything!"

EXPERIMENT

Crystal Feather

You will need: Small test tube, stand, crystal feather solution, feather paper, test tube lid, *scissors*

1. Put the small test tube into the test tube stand.
2. Cut the corner off of the packet of crystal feather solution.
3. Pour all of the crystal feather solution into the test tube.
4. Fold the barbs of the feather so that adjacent barbs are folded away from each other.
5. Place the crystal feather into the test tube. Wait for a number of hours. Check back often to monitor the crystal growth.



6 When the solution has entirely crystallized, examine the final crystal structure. Look closely at it. What do you see?

WHAT'S HAPPENING?


Sugar crystals


Salt crystals


Ice crystals

You won't need all that much patience, because you will start to see crystals growing pretty quickly. The liquid will first start to rise up the paper feather. You will see that the paper turns darker when it's wet. After a few hours, you will notice that most of the liquid has disappeared from the dish. You will start to see a few fine needles at the edges of the paper feather, which will proceed to grow in size and number as time passes. Eventually, all the edges and some of the flat surfaces will be coated with a thick layer of white needles. Your feather has grown a pretty, glittering center.

The crystal growing solution contains a chemical called potassium dihydrogenphosphate, which is a type of salt that quickly forms into crystals.

But what are crystals? Some minerals possess a very special quality: They form cubes, sharp needle shapes, crooked squares, octagons, or other complicated shapes with smooth faces that reflect light. They form in all sorts of different colors. These regular shapes are called **crystals.** They form when atoms or molecules line themselves up in ordered ways. You can find crystals all around you — salt and sugar both consist of crystals. In winter, you can marvel over ice and snow crystals.

Barbie and Nikki were thrilled with how well their chemistry experiments worked and how much the students liked them. They went back to their classroom and started brainstorming more exciting experiments they could do the next time they conducted their chemistry experiment demonstrations.

THE END

EXPERIMENT

Golden Putty

You will need: Golden putty

1. Remove the golden putty from its container. Be careful that you do not get it on your clothes or other fabrics around your house.
2. Try stretching the putty apart. What do you notice?
3. Try squeezing the putty in your hand. What do you notice?
4. Roll the putty into a ball and bounce it. Does it bounce?
5. Try breaking the putty apart and then squishing it back together. Does it go back together into one piece?

Based on what you learned in the first experiment about polymer slime, what is one guess you can make about the composition of this golden putty?

WHAT'S HAPPENING?

Is the golden putty a solid or a liquid? Like a solid, it holds its shape when rolled into a ball and it can break apart when you stretch it very fast. But when you let it sit for a long period of time, it will slowly flow to form a puddle or fill the bottom of a container it is in, like a liquid. The answer is that it is a special liquid that does not follow the standard laws of physics for fluids.

When stress (for example, from the force of your squeeze) is exerted on the putty, the putty responds like an elastic solid similar to rubber. When the stress is removed, the putty flows like a viscous fluid.

STEP-BY-STEP VIDEOS

Scan the QR code or follow the link for instructional videos.

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