GEEK & CO. SCIENCE!

PROJECT KIT

Ages 8+

PLaSMa REACTOR

THAMES & KOSMOS

Warning.

Not suitable for children under 8 years. For use under adult supervision. Contains some chemicals which present a hazard to health. Read the instructions before use, follow them and keep them for reference. Do not allow chemicals to come into contact with any part of the body, particularly the mouth and eyes. Keep small children and animals away from experiments. Keep the experimental set out of reach of children under 8 years old.

WARNING — This set contains chemicals and/or parts 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.

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Thames & Kosmos UK Ltd, Goudhurst, Kent, TN17 2QZ, United Kingdom | 01580 212000 | www.thamesandkosmos.co.uk

Safety information

WARNING.
Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled.
Keep the packaging and instructions as they contain important information.
Read the notes on experimenting with batteries on the inside back cover.

First aid information

Advice in case any accidents should happen during experimentation.

1. In case of eye contact: Wash out eye with plenty of water, holding eye open if necessary. Seek immediate medical advice.
2. If swallowed: Wash out mouth with water, drink some fresh water. Do not induce vomiting. Seek immediate medical advice.
3. In case of inhalation: Remove person to fresh air.
4. In case of skin contact and burns: Wash affected area with plenty of water for at least 10 minutes.
5. In case of doubt, seek medical advice without delay. Take the chemical and its container with you.
6. In case of injury always seek medical advice.

Poison control

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

Local Hospital or Poison Centre (Europe)
Record the telephone number of your local hospital or poison centre here:

Write the number down now so you do not have to search for it in an emergency.

Notes on disposal of electrical components

None of the electrical or electronic components in this kit should be disposed of in the regular household trash when you have finished using them. Instead, they must be delivered to a collection location for the recycling of electrical and electronic devices. The symbol on the product, instructions for use, or packaging will indicate this. The materials are reusable in accordance with their designation. By reusing or recycling used devices, you are making an important contribution to the protection of the environment. Please consult your local authorities for the appropriate disposal location.

Advice for parents and supervising adults

With this kit, you will be helping your child perform fun, safe chemistry experiments. It is natural to have questions about the safety of a kit that contains chemicals. The experimental equipment in this kit complies with safety standards that specify the safety requirements for chemistry sets. These standards impose obligations on the manufacturer, such as forbidding the use of any particularly dangerous substances. The standards also stipulate that adults should assist their children with advice and assistance in their new hobby.

A. Read and follow these instructions, the safety rules and the first aid information, and keep them for reference.

B. The incorrect use of chemicals can cause injury and damage to health. Only carry out those experiments which are listed in the instructions.

C. This experimental set is for use only by children over 8 years.

D. Because children's abilities vary so much, even within age groups, supervising adults should exercise discretion as to which experiments are suitable and safe for them. The instructions should enable supervisors to assess any experiment to establish its suitability for a particular child.

E. The supervising adult should discuss the warnings and safety information with the child or children before commencing the experiments. Particular attention should be paid to the safe handling of acids and alkalis (bases).

F. The area surrounding the experiment 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.

Due to their limited shelf life, some of the materials, such as cooking oil, effervescent tablets, dishwashing soap, and sugar, will have to be used fresh from your kitchen.

Please have these materials ready before the experiments and provide them in small portions, which will be easier for your child to handle and will avoid the risk of anything getting into the original container.

If foodstuffs are used in the experiments, they should obviously not be eaten or drunk. There should be no eating or drinking during the experiments to avoid mix-ups.

We suggest that all liquids be poured down the drain immediately following the experiments, and that all the kit components be washed by hand, dried, and returned to the box.

The LED light should be protected from moisture, and we ask you to please help your child insert and replace the battery.

Have fun with your experiments!

NOTE! *The additionally required items are highlighted in italic script in the individual experiments. Before starting the experiments, carefully read through everything that will be required and make sure to have all the materials ready.*

Safety rules

Read this before starting any experiments

1. Read these instructions before use, follow them and keep them for reference.
2. Keep young children and animals away from the experimental area.
3. Store this experimental set out of reach of children under 8 years of age.
4. Clean all equipment after use.
5. Ensure that all empty containers and/or non-reclosable packaging are disposed of properly.
6. Wash hands after carrying out experiments.
7. Do not use any equipment which has not been supplied with the set or recommended in the instructions for use.
8. Do not eat or drink in the experimental area.
9. Do not allow chemicals to come into contact with the eyes or mouth.
10. Do not replace foodstuffs in original container. Dispose of immediately.
11. 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.
12. 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.
13. Never work alone. An adult should always be present. Pay attention to the information on the chemical labels, the "Information about hazardous substances" below, and the information provided with each experiment.
14. Pay special attention to the quantity specifications and the sequence of the individual steps. Only perform experiments that are described in this instruction manual.

Information about hazardous substances

Here is information about handling the substances contained in this kit.

Colored fizzing tablets:

Contain sodium bicarbonate, citric acid, mannitol (E421), mineral oil, polyethylene glycol, sodium benzoate (E211), food color dye

Avoid breathing dust. Do not get in eyes. Wash exposed skin thoroughly after handling. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention

The tablets generate carbon dioxide gas upon contact with water. The reacting substances are sodium bicarbonate (CAS 144-55-8) and citric acid (CAS 77-92-9).

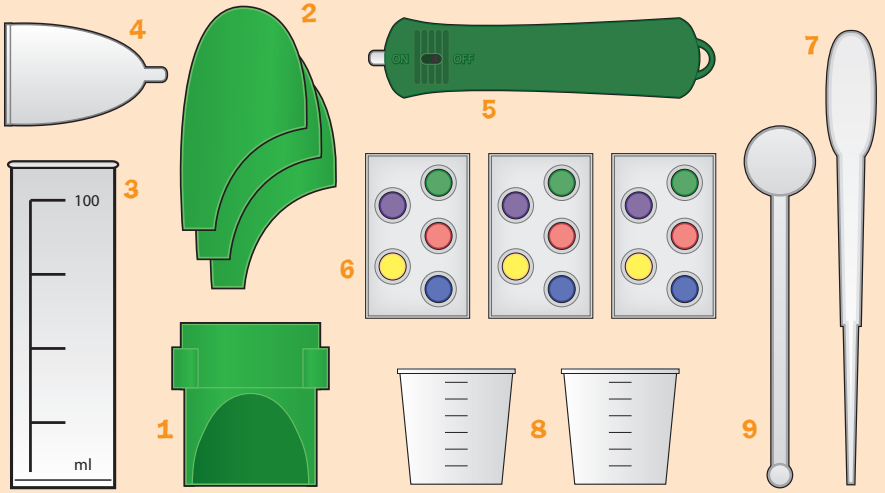
Warning. The following applies to all chemicals: Store locked up. Keep out of reach of children.

This primarily applies to young children, but also to older children who — unlike the experimenter — have not been appropriately instructed by adults.

Also follow this precautionary statement: IF SWALLOWED: There is no harm if a few of the fizzing tablets are swallowed. If more than a few are swallowed, drink lots of water. Get immediate medical advice/attention and have product container or label of chemical substance at hand.

If any chemicals inadvertently get onto the skin, rinse off immediately under running water. Always be careful not to inhale chemical dust or powder when experimenting.

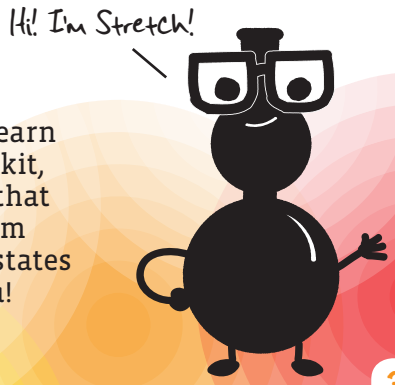
KIT CONTENTS



1 | Rocket base stand
2 | Rocket base feet (3)
3 | Rocket beaker (measuring cup)
4 | Rocket nose (funnel)
5 | LED light
6 | Five colored fizzing tablets (3)
7 | Pipette
8 | Small measuring cups (2)
9 | Stirring rod

YOU WILL ALSO NEED: *Small Phillips (cross-head) screwdriver, one AAA battery (1.5-volt, type LR03), inexpensive cooking oil (such as sunflower oil), aluminum foil, scissors, dishwashing liquid (clear), inexpensive effervescent tablets (such as fizzing vitamin or antacid tablets), sugar, jar of preserved red cabbage, food coloring, paprika powder, paper towels, water*

Hey Rocket Scientists!



Want to make a cool, bubbling lamp and learn some chemistry in the process? With this kit, you can build a fun, oozing, fizzing lamp that uses oil, water, and carbon dioxide gas from fizzing tablets. Learn about the different states of matter: solid, liquids, gases, and plasma! Stretch the Geeker will be your guide!

PART 1

PREPARING FOR BLAST OFF

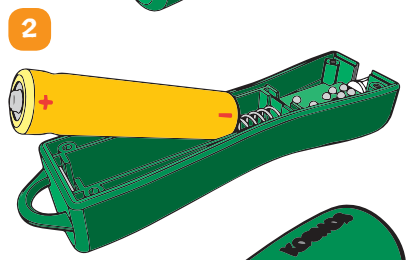
For your bubble rocket experiments, you will need some foodstuffs such as oil and effervescent tablets. Be thrifty with them and only use as much as the instructions tell you. These additional materials are indicated in italic print for each experiment. The colored fizzing tablets will color things strongly, and they can make stains on clothing, furniture, or carpets that you won't be able to wash out. So wear old clothes while experimenting, and work on a table that can handle some abuse and that can be easily wiped off. Have paper towels ready in case something spills! The room should be easy to darken, since the bubble rocket looks even better in the dark. Do not let your rocket remain filled for a long period of time. Clean everything after each experiment and wash your hands. Now, let's get going!

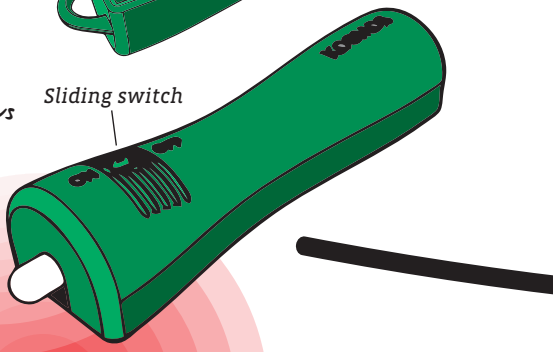
Getting set up

Inserting the battery into the light

1. Use a Phillips screwdriver to loosen the four screws on the underside of the light and remove the lid.

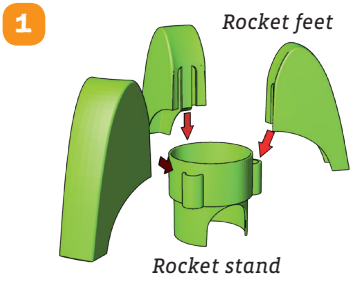
2. Insert the battery into the battery compartment, making sure the polarity is correct, and attach the lid with the screws again.





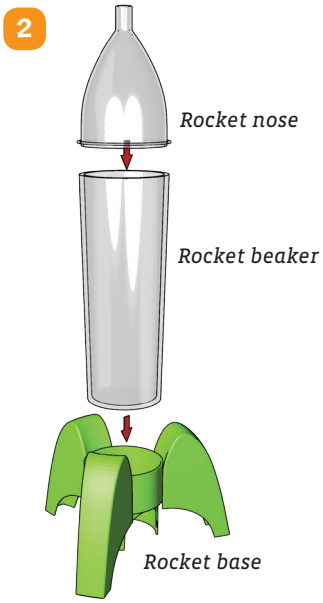
Assembling the bubble rocket

1. Assemble the rocket base from the three rocket feet and the stand.
2. Place the rocket beaker on the base and the rocket nose on top of that.



How to use the pipette

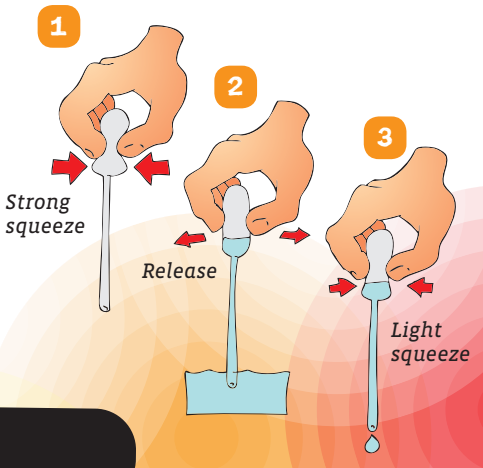
1. Squeeze the upper part of the pipette between thumb and index finger and dip the pipette tip into the liquid.
2. As soon as you release the pressure, the liquid rises up the pipette.
3. By applying careful pressure, you can make the liquid drip out again.

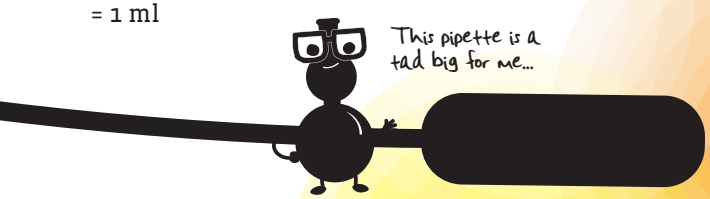


How to use the measuring cup

On the rocket beaker and the small 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





PART 2

ACTIVATING YOUR PLASMA REACTOR

Colorful bubble rocket

You will need:

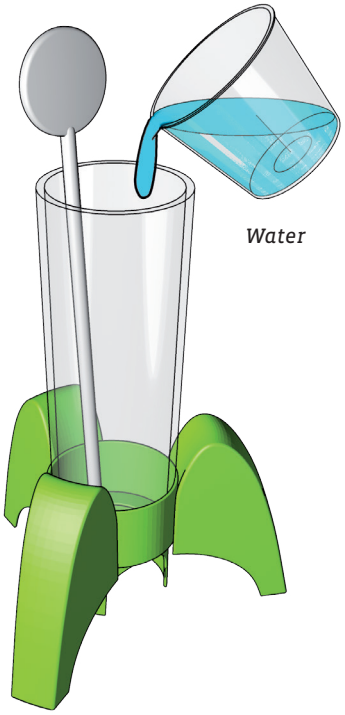
Rocket base, rocket beaker, rocket nose, fizzing tablets, stirring rod, measuring cup, *cooking oil, water*

Here's how:

1. Using the measuring cup, pour 30 ml of water into the rocket beaker.

2. Fill the rocket beaker up to the 90 ml mark with cooking oil. It works best if you tip the beaker a little and pour the oil slowly down the side.

1



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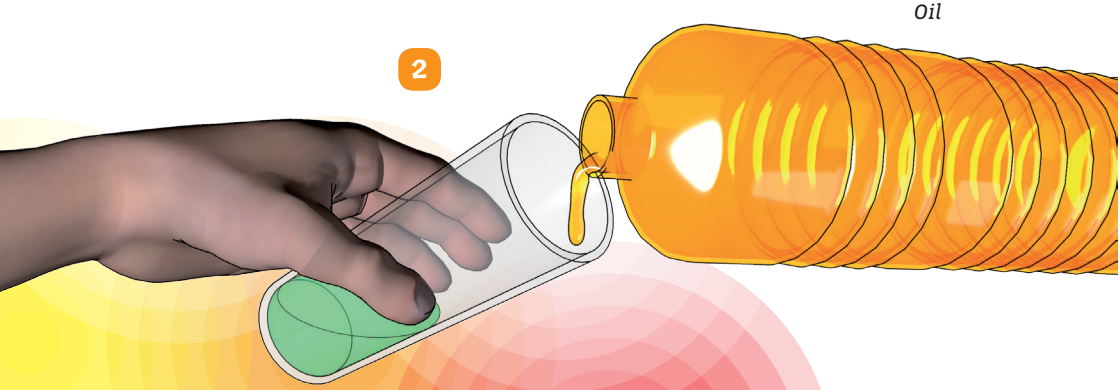
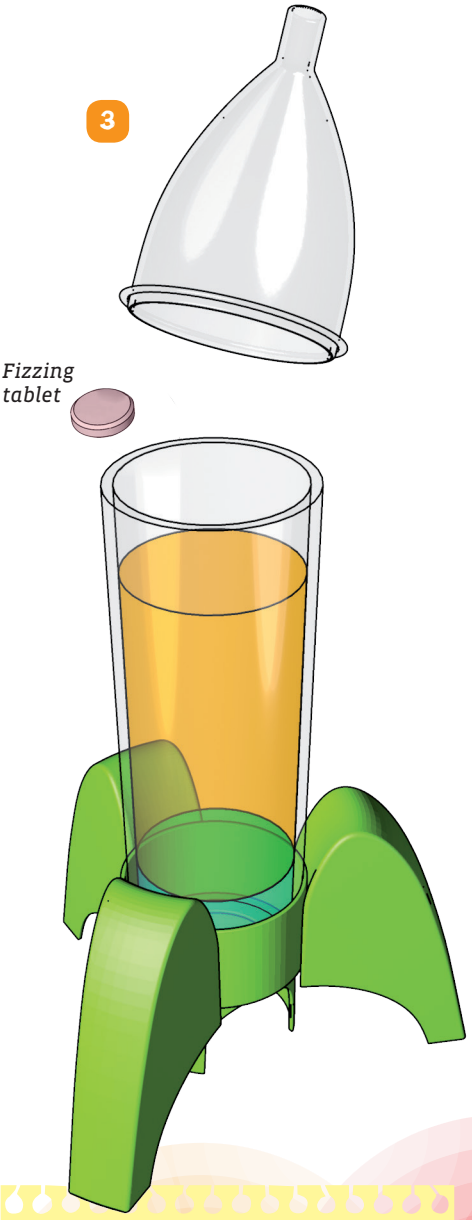


3 Drop one colored fizzing tablet into the rocket beaker and set the nose on top.



GEEK OUT!

WHAT'S HAPPENING?

After a little while it will start to fizz, and 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 like molasses. The oil has a molecular structure that keeps it from mixing with the water.

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 that make your bubble rocket work. This is also how baking powder makes baked goods rise!

TIP!

If the fizzing stops, just drop in a new tablet. Or try using half a tablet, or even another type of effervescent tablet from around the house.

Bubbling light rocket

You will need:

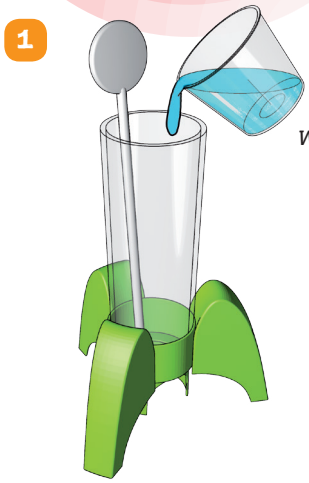
Material from the first experiment, light, *aluminum foil, scissors*

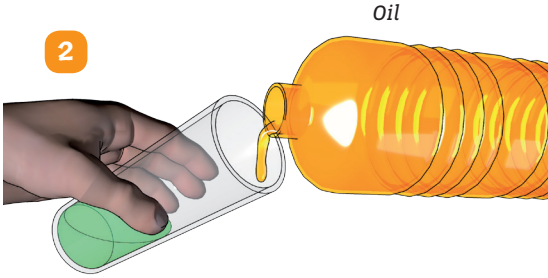
Here's how:

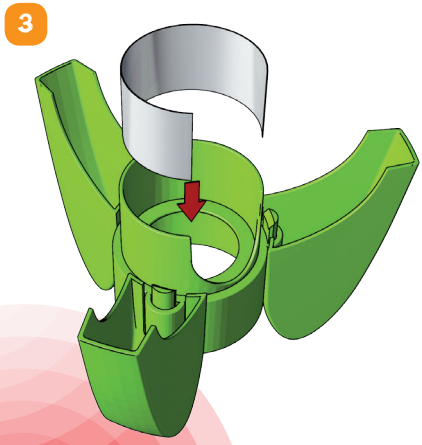
1. Using the measuring cup, pour 30 ml of water into the rocket beaker.

2. Fill the rocket beaker up to the 90 ml mark with cooking oil. It works best if you tip the beaker a little and pour the oil slowly down the side.

3. Now line the inside of the rocket base with aluminum foil by tearing off a piece of foil, cutting a rectangle out of it (see pattern), and spreading it smooth on the inside wall of the rocket base.



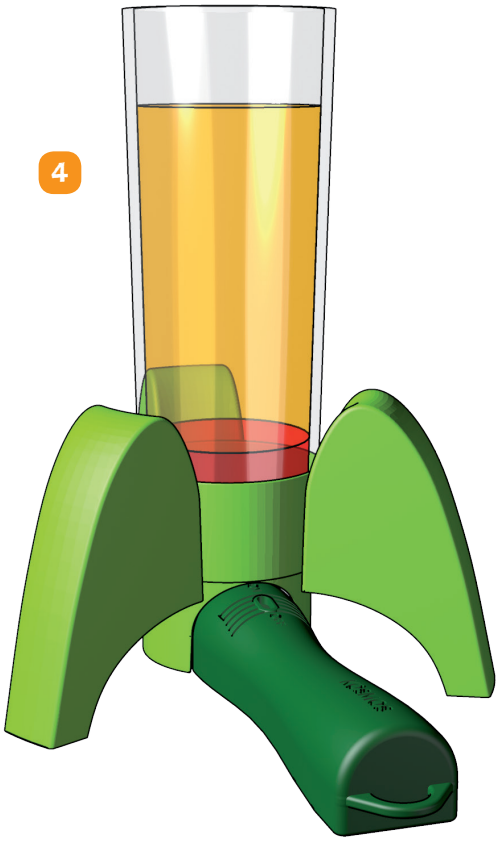




4 Switch on the light and slide it into its docking station at the bottom of the rocket base. Darken the room.

5 Now add a fizzing tablet and place the nose on top.

6 Also try lighting the bubble rocket from the top through the nose or from the side.



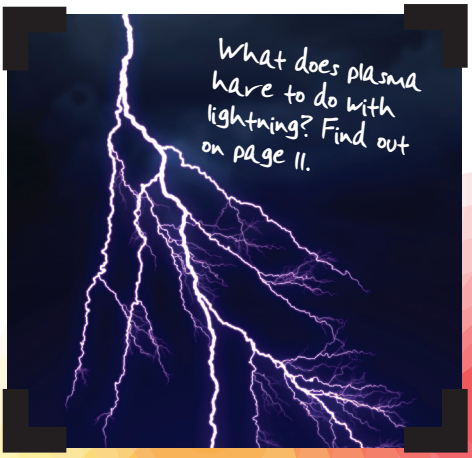
GEEK OUT!

WHAT'S HAPPENING?

Wow! The lighting gives the bubbling rocket a fascinating liquid motion lamp effect. Unlike those cult favorites from the 70s, your rocket bubbles are driven by gas rather than from the heat of the light. The LED in your light produces virtually no heat. Like a liquid motion lamp, though, your rocket also contains two liquids that don't mix easily.

TIP!

You can also mix the various fizzing tablet colors to create whatever color you like!



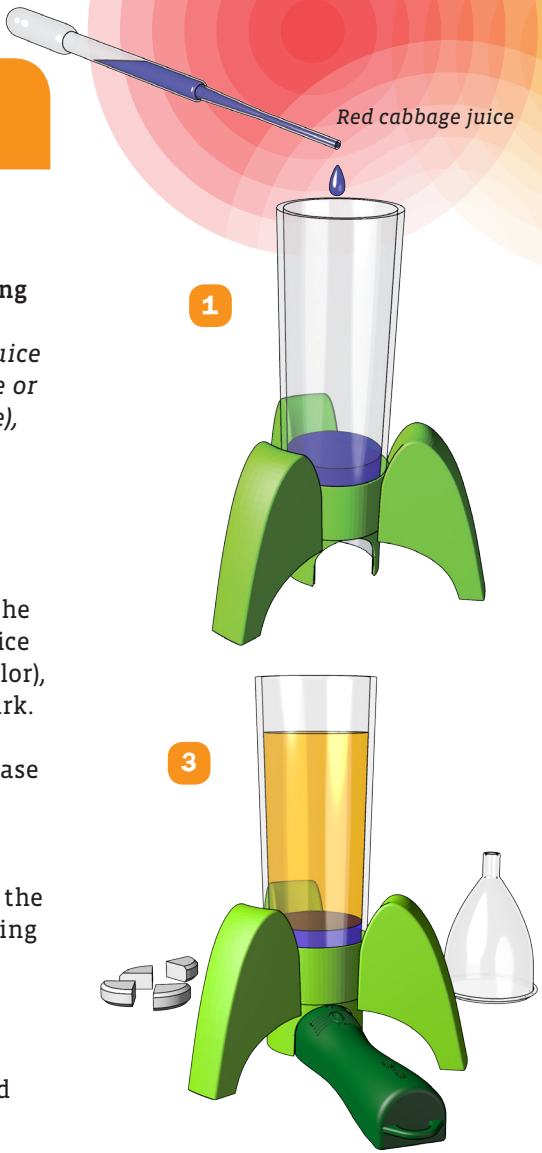
Color-changing light rocket

You will need:

Light, rocket base, rocket beaker, rocket nose, measuring cup, stirring rod, pipette, *cooking oil, colorless effervescent tablet, red cabbage juice (from jar of preserved red cabbage or made by boiling fresh red cabbage), water, aluminum foil ring from second experiment*

Here's how:

1. Pour 30 ml of cold water into the beaker, add a little cabbage juice (which is probably a purple color), and add oil up to the 90 ml mark.
2. Line the inside of the rocket base with the aluminum foil ring.
3. Break off a piece of the effervescent tablet, switch on the light, and slide it into its docking station at the bottom of the rocket base. Darken the room.
4. Drop the piece of effervescent tablet to the rocket beaker and place the nose on top.



GEEK OUT!

WHAT'S HAPPENING?

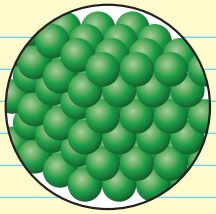
As in the last experiment, the water starts to fizz and bubbles rise up. But soon the bubbles start to change color! It might turn red, indicating an acid, or blue, indicating a base. This happens because the cabbage juice contains an indicator pigment that changes color depending on how acidic something is. Depending on what type of effervescent tablet you are using, it will yield a slightly acidic or basic reaction. That's where the impressive color change comes from!

GEEK OUT!

THE FOUR STATES OF MATTER

Yes, FOUR!

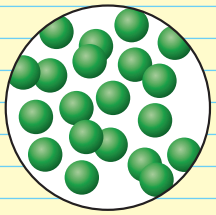
You've probably heard of the three **states of matter: solid**, **liquid**, and **gas**. Pretty much all the stuff you see in the world can be characterized as being in either a solid, liquid, or gas state. But there is a fourth state of matter that can be observed in everyday life: **plasma!** There are other, more exotic states of matter, but they are not commonly observed in everyday life or are still only theoretical.



Solid

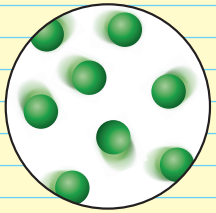
The atoms of solids are packed together densely and have fixed positions in space relative to each other (like bricks in a wall), which makes solids rigid.

Liquids have atoms that are packed less densely than are those of solids, and while solids form a rigid shape, liquids move freely. But when liquids are poured into a container, they must conform to the shape of the container, except for possibly one surface (like the surface of water in a fish tank).



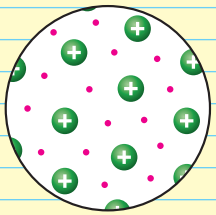
Liquid

This is not the case for gases, which must conform to the shape of the container entirely (like water vapor in a fish tank, which would have no surface different from the walls of the tank). The atoms of gases are packed the least densely of all three states, and are in relatively random motion. Gases have no definite shape or volume, can expand and contract greatly with changes in temperature and pressure, and spread easily to distribute themselves evenly throughout a container.



Gas

Plasma forms when air or another gas is charged, or ionized. Amazingly, this gives it properties similar to metals. It conducts electricity and reacts to magnetic fields. You can see plasma in lightning, neon signs, and decorative plasma globes. Plasma is actually the most abundant state of matter in the universe, because all stars are mostly plasma!



Plasma

Colorful jellyfish bubbles

You will need:

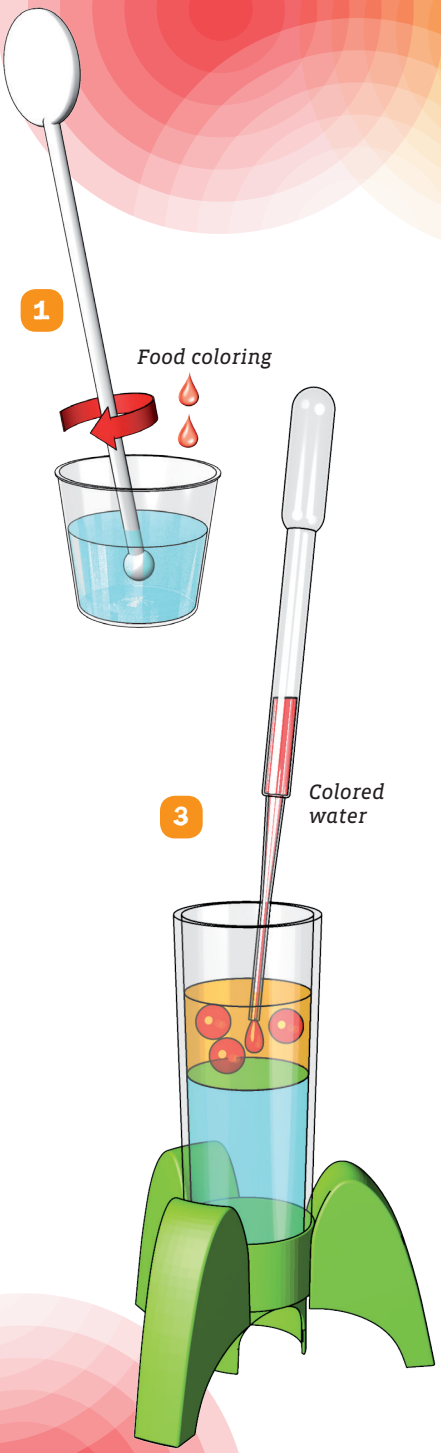
Light, rocket base, rocket beaker, pipette, measuring cup, stirring rod, *cooking oil, food coloring, water*

Here's how:

1. Add 15 ml of cold water to the measuring cup, put a drop or two of food coloring into the water, and stir it with the stirring rod until the water is evenly colored. You can also use a few pieces of the fizzing tablets to color the water, but let them release all of their gas completely.

2. Pour 60 ml of cold water into the rocket beaker and slowly add oil up to the 90 ml mark (tilt the beaker a little).

3. Draw the colored water up into the pipette. Dip the pipette tip into the oil and carefully release a few drops of dye into the oil. Watch the colored jellyfish as the drops burst. You may have to wait a little depending on the size of the bubble.



GEEK OUT! WHAT'S HAPPENING?

The surface tension between oil and water creates a little bulge, but the water bubbles don't burst right away. As soon as they break up, though, they release their colored water and the jellyfish gradually sink down.

TIP!

Try darkening the room and watch the colored jellyfish from all sides as you shine the light on them. Or see what happens if you drip in two different colors at the same time or one after the other.

GEEK OUT! IS IT REALLY PLASMA?

Frankly, no! Your bubble rocket does not have any plasma in it. But, it does have the other three states of matter in it. Can you name the solids, liquids, and gases in the bubble rocket? For the answers, see below. So, you see, we used the exciting idea of the fourth state of matter to teach you about the other three! Pretty tricky, huh?

Solids: Plastic, fizzing tablet before reaction, solid dye from tablet before it dissolves into the water, metal inside light, aluminum foil
Liquids: Water, oil
Gases: Air, carbon dioxide released from fizzing tablets

Alien plasma strings

You will need:

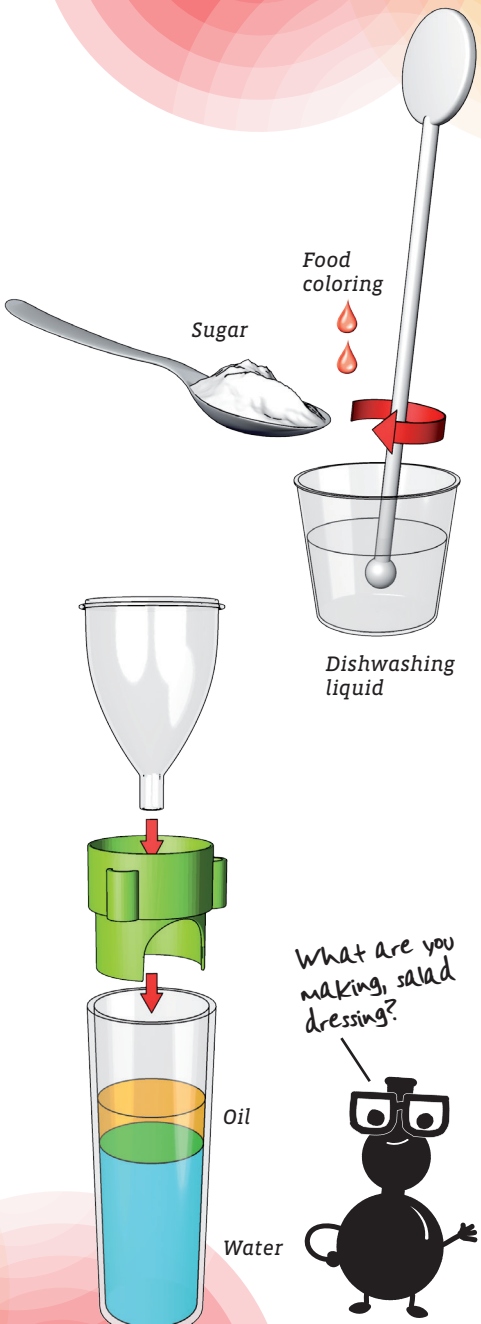
Stand (rocket base without feet), rocket beaker, rocket nose, 2 measuring cups, *food coloring (2 colors), cooking oil, sugar, dishwashing soap, tap water, paprika powder, teaspoon*

Here's how:

1. Add 15 ml of dishwashing liquid to one of the measuring cups. Add a few drops of food coloring and a heaping teaspoon of sugar. Stir until you get a thick, colored alien plasma mixture. Mix a second color of alien plasma in the second measuring cup.

2. Pour 60 ml of cold water into the rocket beaker and slowly add oil up to the 80 ml mark (tilt the beaker a little).

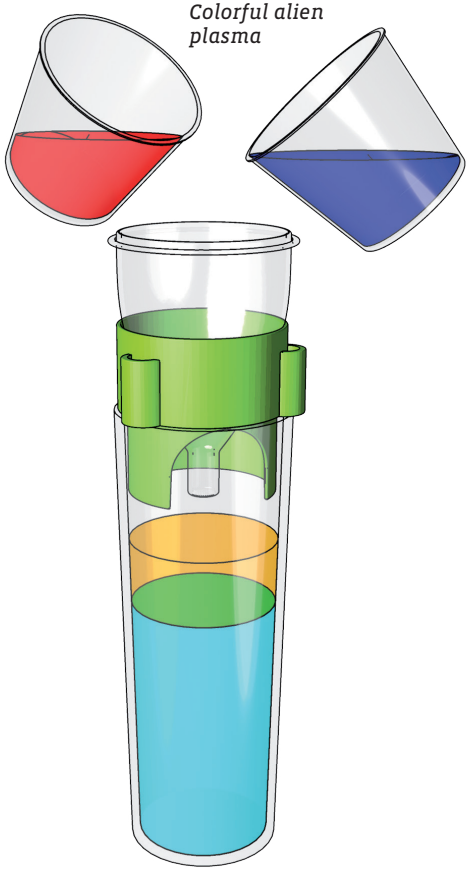
3. Set the stand on the rocket beaker and place the rocket nose in it like a funnel, with the small hole pointing down.



TIP!

Would you like some sparkling strings? Just get some glitter and add it to the alien plasma! Aliens love glitter!

4 Pour both plasma mixtures into the funnel at the same time from opposite sides.

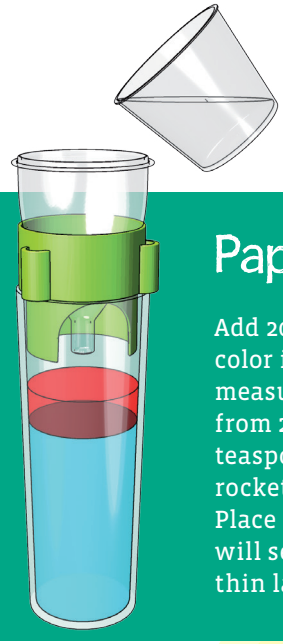


Colorful alien plasma

GEEK OUT!

WHAT'S HAPPENING?

The alien plasma flows slowly through the oil as long, two-colored strings, because the dishwashing liquid in it becomes coated with a thin layer of oil as it sinks. That prevents the colored plasma from dissolving in the water. The sugar makes the alien plasma heavy and syrupy, so the string glides slowly toward the bottom.



Paprika Plasma Trails

Try it!

Add 20 ml of cooking oil to a measuring cup and color it red with a little paprika powder. In the other measuring cup, stir up some clear alien plasma made from 20 ml of dishwashing liquid and a heaping teaspoon of sugar. Now add 60 ml of cold water to the rocket beaker followed by the colored oil (slowly). Place the funnel on top and add the alien plasma. You will see how the alien plasma becomes coated with a thin layer of red as it moves through the oil.

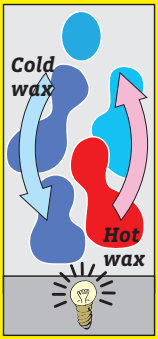
GEEK OUT!

LIQUID MOTION LAMP

Liquid motion lamps — which you may have around the house, and which are commonly referred to using the name of that hot molten rock that erupts out of volcanoes — work similarly to the bubble rocket. The principle of the liquid motion lamp was discovered over 100 years ago, but the colorful lamps have only been manufactured since 1963. They were especially popular in the 1970s. Since then, they have been sold in all sorts of shapes and colors.

DENSITY AND MOTION

The original liquid motion lamp and our bubble rocket both work on the basis of the **density** difference between liquids and gases. Oil has a lower density than water, so it floats to the top. The effervescent tablet releases a non-hazardous gas that carries the water bubbles through the oil. An actual liquid motion lamp uses a wax that changes its density depending on the temperature. At the bottom, it is heated by a light bulb, which lowers its density, and it rises up and then cools. That raises its density again and it sinks to the bottom. And that's how the blobs move up and down!



LIGHT-EMITTING DIODE

Regardless of how long your LED light shines, it will never get hot. Unlike ordinary light bulbs, which contain a thin glowing wire, its light comes from crystals with current flowing through them. These special bulbs are called LEDs for short.

CARBON DIOXIDE

You have seen how a gas is created when the effervescent tablet dissolves. This gas is called **carbon dioxide**, or **CO_2**. It forms when two substances from the tablet react with each other in water: a non-hazardous acid (usually citric acid) releases the CO_2 from sodium bicarbonate. Take a look at the ingredients list for the tablets and see if you can find these two substances!

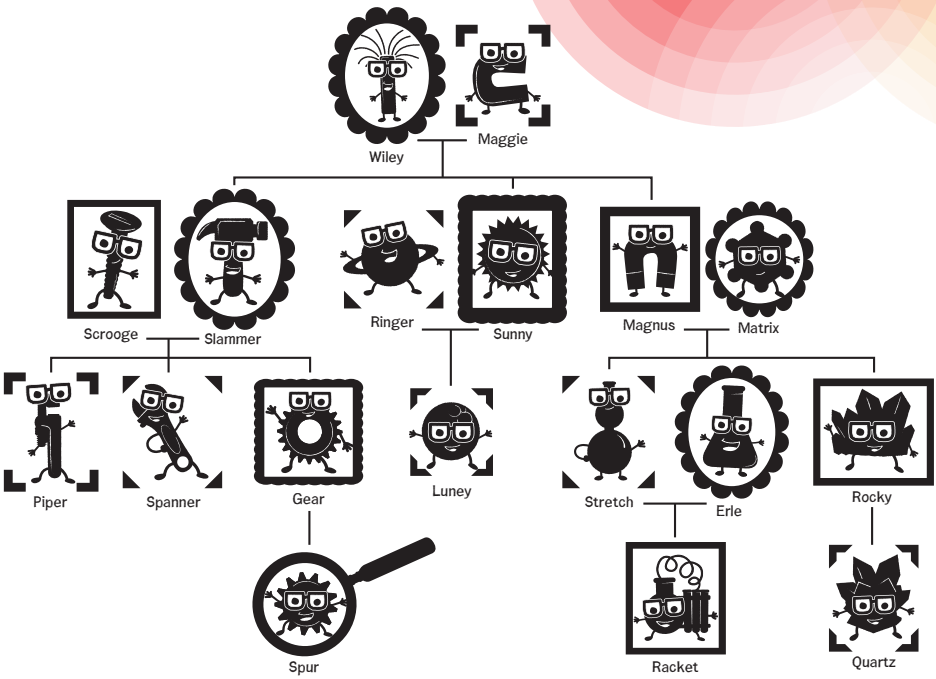
Kosmos Quality and Safety

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.

Notes on experimenting with batteries

Warning. Only suitable for children over 8 years. Instructions for parents or other supervising adults are included and must be followed. Save the packaging and instructions. They contain important information.
Wires are not to be inserted into socket-outlets. Never perform experiments using household current! The high voltage can be extremely dangerous or fatal!
The batteries should only be inserted into the light and replaced by an adult.
One AAA battery (1.5-volt/LR03) is required, which could not be included in the kit due to its limited shelf life.
Different types of batteries or new and used batteries are not to be mixed.
Do not mix old and new batteries.
Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
Always insert batteries in the right polarity orientation, pressing them gently into the battery compartment.
Non-rechargeable batteries are not to be recharged. They could explode!
Rechargeable batteries are only to be charged under adult supervision.
Rechargeable batteries are to be removed from the toy before being charged.
Exhausted batteries are to be removed from the toy.
The supply terminals are not to be short-circuited. A short circuit can cause the wires to overheat and the batteries to explode.
Dispose of used batteries in accordance with environmental provisions.
Be sure not to bring batteries into contact with coins, keys, or other metal objects.
Avoid deforming the batteries.
Have an adult check the light before you use it so you can be sure it was assembled properly!
Important! Protect the light from moisture. If the light gets damp, it should be cleaned and dried well before being used again.

MEET THE GEEKERS!



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