Spectacular
Science kit

Science4you

Play Monster

⚠ WARNING:

CHOKING HAZARD - Children under 8 years can choke or suffocate on uninflated or broken balloons. Adult supervision required. Keep uninflated balloons from children. Discard broken balloons at once.

⚠ WARNING:

This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

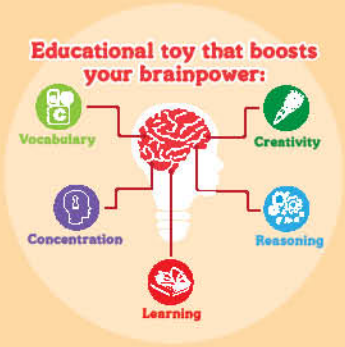
Dear Parents and Guardians:

Through play, children develop different cognitive skills. Scientific studies show that when we are having fun or making discoveries during an experiment, a neurotransmitter called Dopamine is released.

Dopamine is known to be responsible for feelings like motivation, reward and learning and that's why experiences are related to positive feelings. So, if learning is a positive experience, it will stimulate the brain to develop various skills.

Therefore, Science4you aims to develop educational toys that combine fun with education by fostering curiosity and experimentation.

Find out below which skills can be developed with the help of this educational toy!



The educational feature is one of the key strengths of our toys. We aim to provide toys which enable children's development of physical, emotional and social skills.

Find out more about Science4you toys at:

www.playmonster.com

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Science4you

PlayMonster

We wanna hear how much fun you had! Get in touch at:
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playmonster@playmonster.com | 1-800-524-4263
For more fun, visit playmonster.com

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SAFETY RULES

- Read these instructions before use, follow them and keep them for reference.
- Keep young children and animals away from the experimental area.
- Store this experimental set out of reach of children under 8 years of age.
- Clean all equipment before and after use.
- Make sure that all containers and/or non-reclosable are fully closed and properly stored after use.
- Ensure that all empty containers and/or non-reclosable packaging are disposed of properly.
- Wash hands before and after carrying out experiments.
- Do not use any equipment which has not been supplied with the set or recommended in the instructions for use.
- Do not eat or drink in the experimental area.
- Do not allow chemicals to come into contact with the eyes or mouth.
- Do not replace foodstuffs in original container. Dispose of immediately.
- Do not apply any substances or solutions to the body.
- Take care while handling with hot water and hot solutions.
- Do not aim the rockets at eyes or face.

GENERAL FIRST AID INFORMATION

- **In case of eye contact:** wash out eye with plenty of water, holding eye open if necessary. 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 doubt, seek medical advice immediately. Take the chemical and its container with you.
- In case of injury always seek medical advice.

ADVICE FOR SUPERVISING ADULTS

- Read and follow these instructions, the safety rules and the first aid information, and keep them for reference.
- The incorrect use of chemicals can cause injury and damage to health. Only carry out those experiments which are listed in the instructions.
- This experimental set is for use only by children over 8 years.
- 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.
- 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, alkalis and flammable liquids.
- 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. A solid table with a heat resistant top should be provided.

- This experimental set contains colorings. Colorings can stain. Keep it away from objects and delicate fabrics.

In case of poisoning by any of the components used in the experiments of this toy, contact your local poison control center or the nearest hospital. Please consult the following link for more information: https://www.poison.org/

In case of emergency dial:
9-1-1 or Poison Control: 1-800-222-1222

LIST OF SUBSTANCES SUPPLIED

Blue Coloring

INGREDIENTS: CI 42090, SODIUM BENZOATE, POTASSIUM SORBATE

Precautionary Statements:
P202 Do not handle until all safety precautions have been read and understood.
P233 Keep container tightly closed.
P234 Keep only in original container.

LIST OF CHEMICAL SUBSTANCES SUPPLIED

Citric Acid $C_6H_8O_7$ (CAS # 77-92-9)

Hazard Statements:
H319 Causes serious eye irritation.

WARNING

Sodium Bicarbonate (CAS # 144-55-8) $NaHCO_3$

Recommendations for substances and mixtures: Do not ingest. Avoid contact with the eyes and mouth. Use only according to the instructions. Store in tightly closed containers. Keep in a cool, dry place. Protect from moisture, direct sunlight and heat sources.

DISPOSAL OF USED CHEMICALS

Observe national regulations concerning the disposal of chemicals when disposing of chemical substances and / or mixtures. Do not dispose of substances and / or mixtures together with household or other waste. Please recycle packaging materials where local recycling programs exist.

KIT CONTENTS

Large measuring cup

Straws

Small measuring cup with lid

Pipette dropper

Wooden sticks

Craft wire

Origami sheets

Balloons

Spoon

Paper clips

Wooden stirrers

Funnel

Rubber bands

Ball

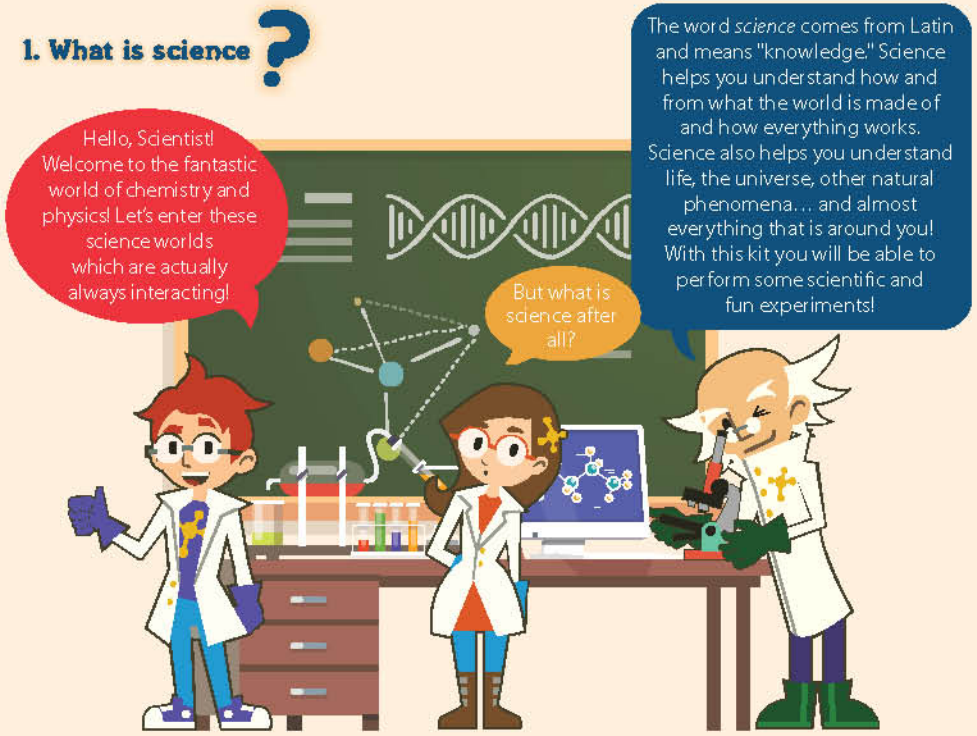
Card with graphic elements

Blue coloring

Sodium bicarbonate

Citric acid

1. What is science ?

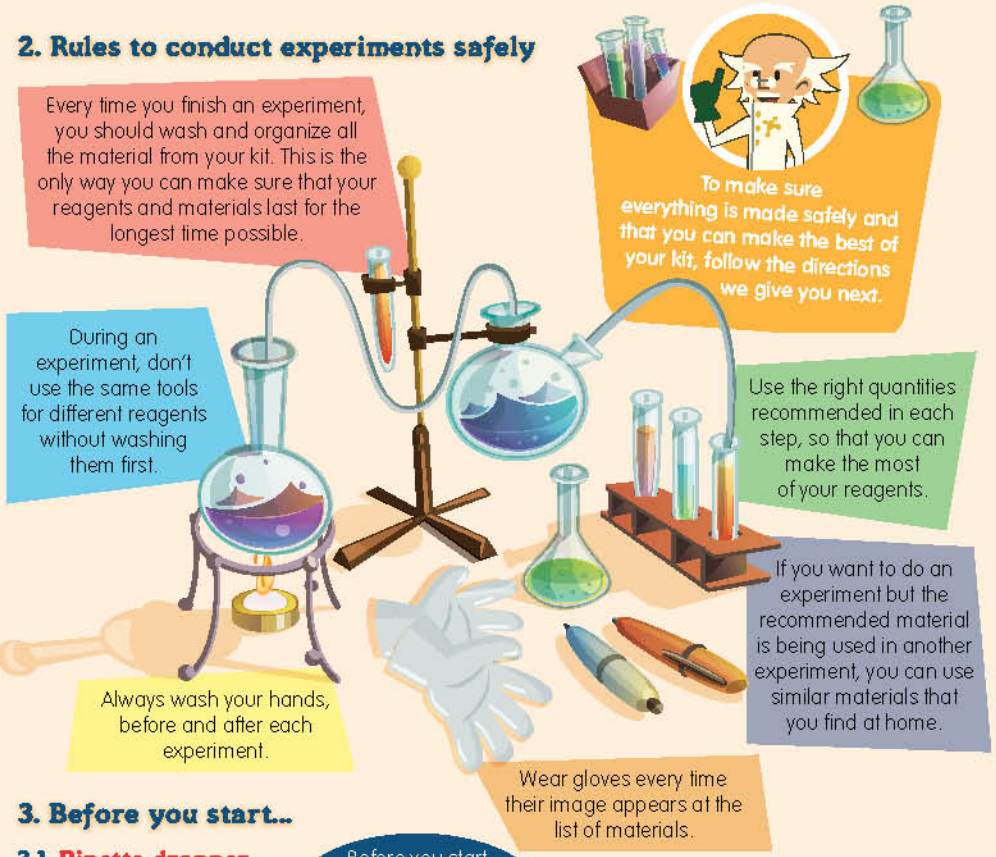


1.1. What is the work of a scientist? – Experiments and procedures

Scientists study the world around us, trying to understand it and find answers to things or problems that we still don't know so well. But, not every scientist studies the same things, they become specialized in diverse areas.

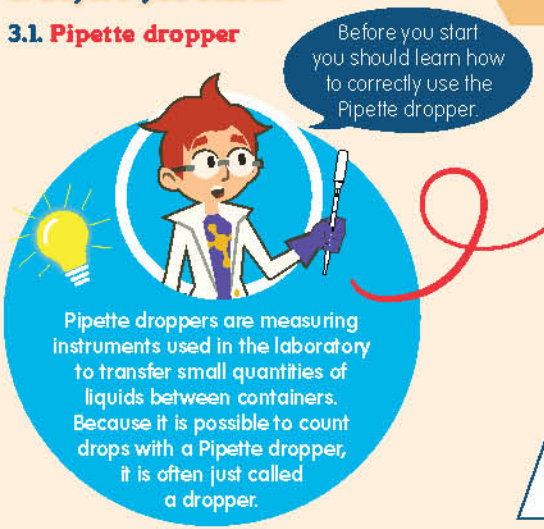
To understand how things work, how are they made, and get some answers, scientists conduct experiments.

2. Rules to conduct experiments safely

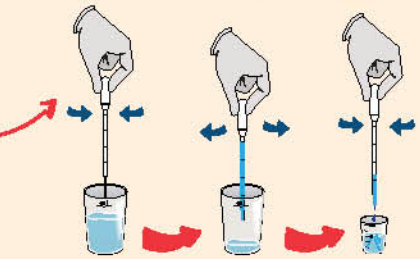


3. Before you start...

3.1. Pipette dropper



How to use the Pipette dropper:



1st Squeeze out the air from the top of the Pipette dropper	2nd Release the pressure inside the liquid to fill the Pipette dropper	3rd Press slowly until drops start to fall one at a time

4. Experiments

Part 1. Chemistry

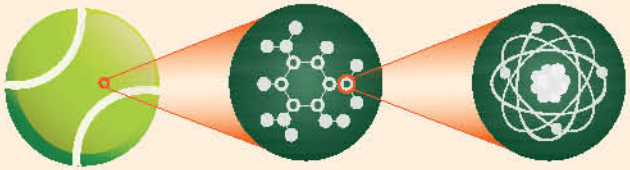
Chemistry is the science that tells us what things are made of, **the science of substances**, its properties and what happens when substances are mixed together.

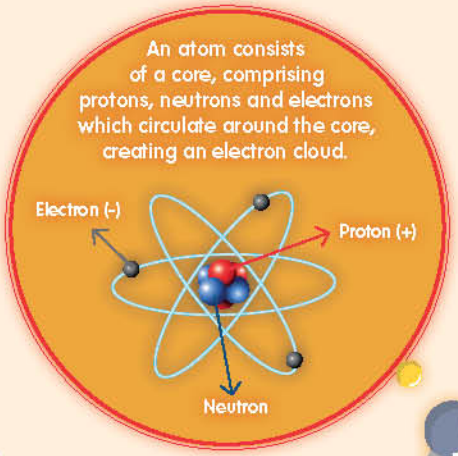
If you look around, there are millions of different substances and matter: metals, plastics, glass, plants, people and so many others!

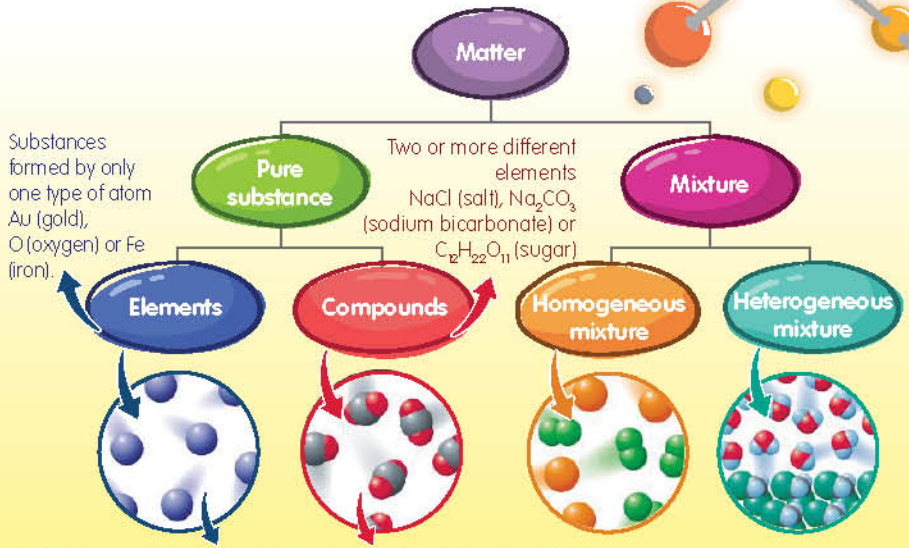
Matter and materials

The world is made of **substances!** Matter is everything that occupies space and that has mass.

Atoms are the basic unit from which all these substances, and matter, are made. Atoms can connect between themselves through chemical bonds, creating **molecules**.







These are formed by **chemical bonds** between elements. On the other hand, mixtures of substances are formed by association of compounds.

The **Periodic Table** contains all known chemical elements: it relates the chemical elements in lines called periods and columns called groups, in ascending order of their atomic number (the number of protons in an atom).

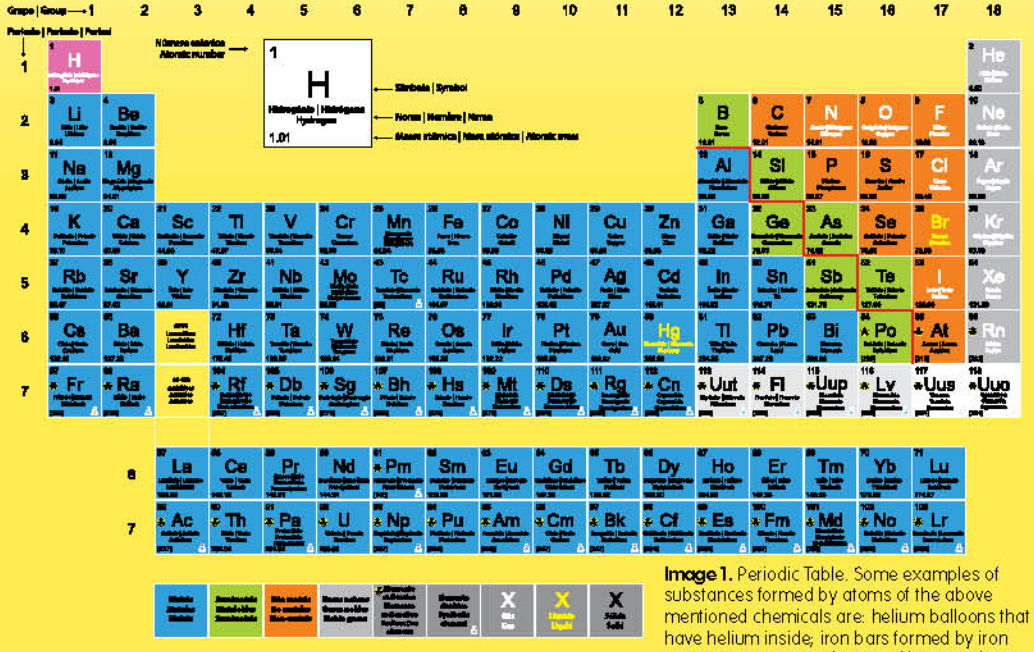


Image 1. Periodic Table. Some examples of substances formed by atoms of the above mentioned chemicals are: helium balloons that have helium inside; iron bars formed by iron atoms; neon atoms often used in neon signs; copper wire formed by copper atoms.

EXPERIMENT 1 — Secret messages

WHAT YOU WILL NEED::

Materials included in the kit:

- Wooden stirrer
- Pipette dropper
- Small measuring cup
- Large measuring cup

Extra items you will need:

- Red cabbage leaves
- Water
- Lemon
- Yeast
- Strainer
- Saucepan
- Cup
- Paintbrush
- Cotton swab
- Sheets of paper
- Teaspoon

Always ask an adult for help!

Part I - Home-made pH indicator

Steps:

1. Remove three or four outer leaves of the red cabbage. Cut the leaves in small pieces.

2. Put these pieces in a pan with water and heat them until they start boiling. To do this step you should ask an adult for help.

3. Let the water boil for around 10 minutes. After this time take, the pan off the stove and let it cool down.

4. Put the strainer over the cup and pour the mixture through it so that the leaves get separated from the liquid.

5. Notice that the liquid/juice that resulted from this procedure has a strong purple color and the leaves that remained in the strainer lost their purple color and are now actually greenish.

ATTENTION: when you finish the experiment, throw away all used food.

Part II - Acid basic message

Steps:

1. Prepare the "invisible" paints.

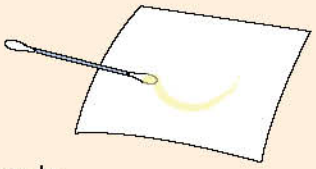
1 x

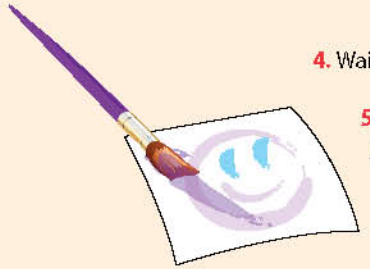
- **Basic solution:**
In a large measuring cup, add 10 ml of water and a teaspoon of yeast. Mix it well with a wooden stirrer.

- **Acid solution:**
In small measuring cup, put the juice of half a lemon (or vinegar) and add a Pipette dropper full of water.

2. Dip the tip of the cotton swab in one of the solutions and start writing or drawing whatever you want on a sheet of paper.

3. With the other end of the cotton swab, keep writing or drawing, but now dipping it in the other solution.





4. Wait until the "invisible" paints dry.

5. After they dry, dip the paintbrush in the red cabbage juice and pass it on the paper.

You will see what you wrote/drew appearing with different colors!

Explanation:

When your messages are revealed, they show different colors because red cabbage juice is a natural pH indicator, and changes its color according to the pH of the medium:

- In the presence of an **acid**, it shows a color between **pink and red**
- In the presence of an **base**, it shows a color between **blue and green**

The pH is used to measure the acidity and basicity of a solution or compound. It is defined as the quantity of H^+ and OH^- ions present in a certain solution or compound.

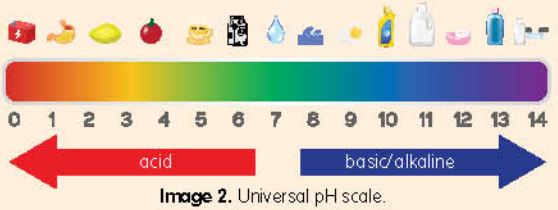


Image 2. Universal pH scale.

We can say that, substances can be **acid**, **basic/alkaline** or **neutral**. Using pH indicators, chemical substances which change colors, it is possible to determined if we are in the presence of acid, neutral or basic substances. These indicators can be natural or synthetic. It is also common to use a paper indicator, called universal indicator. This paper allows for a good identification of the pH values, once it has well-defined colors for each one.

EXPERIMENT 2

Launching a chemical rocket

WHAT YOU WILL NEED:

Materials included in the kit:

- Wooden stirrer
- Small measuring cup with lid
- Citric acid
- Sodium bicarbonate
- Large measuring cup

Extra items you will need:

- Warm water
- Paper napkin or toilet paper
- Teaspoon

Citric Acid
WARNING
Hazard Statements: Causes serious eye irritation.

Always ask an adult for help!

If the cup is not closed properly, the gas that is created can escape outside and the pressure needed for the cup to take off is not created.

Steps:

1. Pour about 10 ml of warm water into the small measuring cup (you'll have to keep holding the cup throughout the steps).

2. Cut a piece of napkin or toilet paper to cover the opening of the cup. Cover the opening with the piece of napkin. Make sure that the piece of napkin you're using is a little larger than the cup diameter, as you observe in the illustration.

3. On the large measuring cup put one coffee spoon of citric acid and one teaspoon of sodium bicarbonate. Mix well with wooden stirrer.

4. Put the mixture on the top of the piece of napkin.

5. Put the lid on the mini rocket. Make sure it's closed tight, otherwise the mini rocket won't lift off.

6. Countdown from 3 and then quickly turn the mini rocket upside down, placing it on top of a smooth surface.

Explanation:

In this experiment there is an **acid-base reaction** and carbon dioxide (CO_2) is released. This gas stays stuck inside the small measuring cup, which is closed.

This way, the quantity of gas inside the cup rises, leading to a higher probability of collisions between the gas molecules and the walls of the cup and the pressure inside the cup also rises.

The rise in the pressure can lead to the opening of the measuring cup, creating the spacial rocket effect.

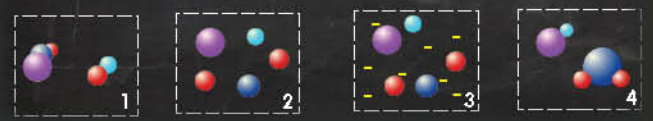
Chemical reactions

Many substances can be used to create other substances. They may change if they are heated, but they mainly change when they are mixed with other substances. This change is called a **chemical reaction**.

- Reactions occur between atoms of different substances, but the results affect the whole of the substances.
- Substances that react are called **reagents** and any substances created by the reaction are called **products**.
- Reactions absorb and release **energy**, usually in the form of heat or light.

But what happens to molecules during a reaction ?

1st They find each other
2nd They decompose for a fraction of seconds
3rd They offer, receive or share electrons
4th They form new molecules



Reactions can be represented as equations, through symbols, numbers, and arrows:

$A + B \rightarrow C + D$

$NaOH + HCl \rightarrow NaCl + H_2O$

In chemical reactions, globally, nothing is eliminated or created. This is called **The Law of Conservation of Mass**, or Lavoisier's Law!

Chemical changes


Iron rusting


Burning wood


Metabolism


Cooking eggs


Baking a cake


Electroplating


Rotting fruit


Vinegar and baking soda mixture


Fireworks


Chemical battery

No matter how predisposed a substance is to react: a certain amount of energy is always required to start the reaction — **activation energy** — this will help to break the bonds between the reactants!

Chemical reactions can be detected through the effects we observe, such as color change, temperature variation, a gas or solid release, or even flame formation. Let's cause some other reactions!

EXPERIMENT 3 — Proteic foam

WHAT YOU WILL NEED:

Materials included in the kit:


• Wooden stirrer


• Pipette dropper


• Sodium bicarbonate


• Blue coloring

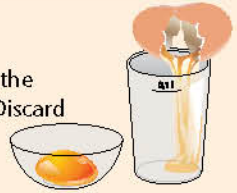
• Small measuring cup

• Large measuring cup

Extra items you will need:
• Egg (egg white) • Bowl • Vinegar • Teaspoon

Steps:

1. Carefully, separate the yolk from the white. Discard the yolk.

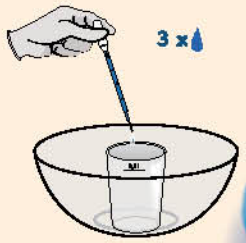


2. Put half of the egg white in the large measuring cup and then put the large measuring cup inside the bowl.

3. Measure 25 ml of water with the small measuring cup and put it in the large measuring cup together with the egg white.

4. Add one teaspoon of sodium bicarbonate to the large measuring cup. Stir with the wooden stirrer.

5. Use the Pipette dropper to add 3 drops of a blue coloring to the mixture.



6. Measure 25 ml of vinegar with the small measuring cup and put it in the large measuring cup.

ATTENTION: when you finish the experiment, throw away all used food.

What happens?

Explanation:
Vinegar's acid — called acetic acid — reacts with sodium bicarbonate (which is a base), forming carbon dioxide. This gas stays "stuck" in the egg white, which creates a large quantity of foam.

SUPER SCIENTIST:
Repeat this experiment, but without the egg white. Does the reaction looks the same? Is it faster or slower?

Who doesn't like soap bubbles? Did you know that it is due to the characteristics of materials that make up the detergents that we are able to make soap bubbles?

EXPERIMENT 4 — Recipes for soap bubbles

WHAT YOU WILL NEED:?

Materials included in the kit:

- Gloves
- Small measuring cup
- Large measuring cup

Recipe 1. Simple solution

Extra items you will need:

- Dish soap
- Water
- Container with lid
- Teaspoon
- Bowl

Always ask an adult for help!

Steps:

1. Use the small measuring cup to measure 50 ml of water and put it in the bowl. You will have to make two measurements of 25 ml each.

2. With an adult's help, use the small measuring cup to add 15 ml of dish soap to the bowl.

3. Carefully, mix everything slowly with the teaspoon.

4. Save this solution in a container with lid. Don't forget to label it!

Recipe 2. A more resistant solution

Extra items you will need:

- Distilled water (or water from the tap)
- Dish soap
- Sugar
- Container with lid
- Teaspoon
- Dessert spoon

Always ask an adult for help!

Steps:

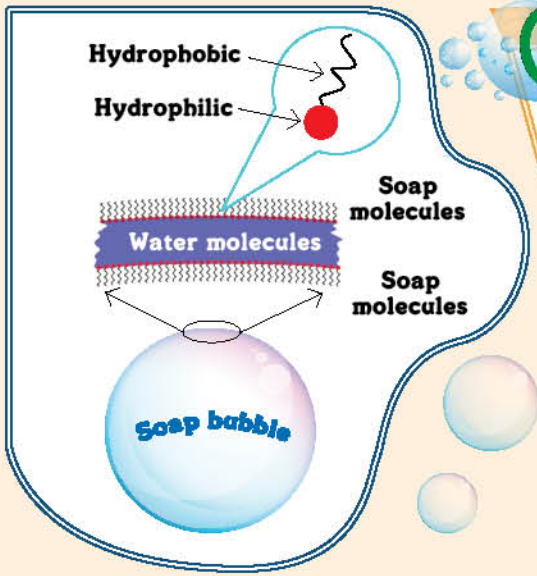
1. Use the small measuring cup to measure 50 ml of distilled water and put it in the large measuring cup.

2. With an adult's help, use the small measuring cup to add 15 ml of dish soap to the large measuring cup.

3. Add ½ teaspoon of sugar to the mixture. Stir all slowly with the teaspoon.

4. Save this solution in a container with lid. Don't forget to label it!

ATTENTION: when you finish the experiment, throw away all used food.



Extra activity. Fun hoops for soap bubbles

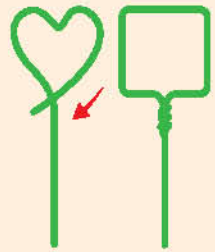
WHAT YOU WILL NEED:?

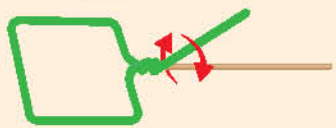
Materials included in the kit:

- Wooden stick
- Craft wire

Steps:

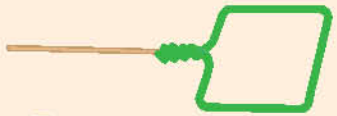
1. Create any shape you want with the craft wire, like a heart or a square. Always leave a bit of wire left over, just like the image shows.





2. Fix the tip of the craft wire to a wooden stick, so your handle will be longer.

3. Use your fun wands with the solutions for soap bubbles that you have already prepared.



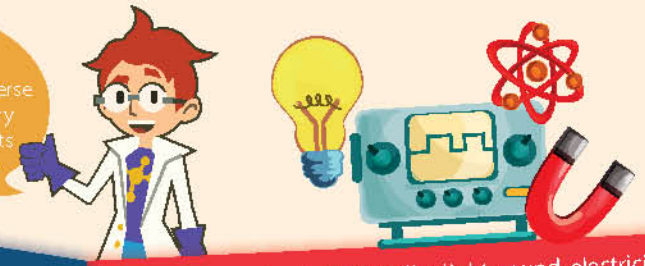
Scientist, observe that your soap bubbles are not influenced by the shape of the wand that you use — any shaped wand will create round soap bubbles!

Have fun making soap bubbles with your new wands!

Explanation:

The sphere corresponds to the minimum surface area that is necessary to comprise a certain volume. This means, it is the most efficient shape to make a bubble. That is why bubbles are always spheric/round, so that they put less energy on the soap film.

So you're asking, what is physics? Everything in the universe has an effect on every other thing. Physicists study those effects.



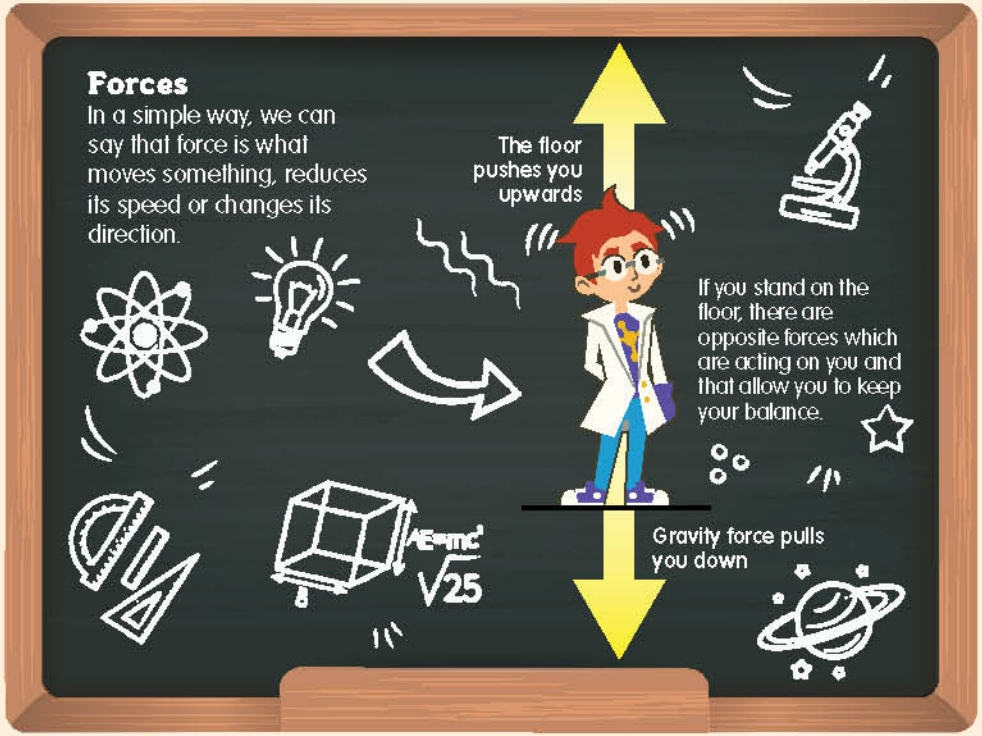
Part 2. Physics

Physics is the science that studies light, sound, electricity, energy and forces! Scientists who study this science also study the laws and theories that rule our universe.

Everything on Earth, everything in our solar system, everything in our galaxy, and everything in the Universe moves and interacts, and forces play a big part in that. Physics studies those **forces and interactions.**

Forces

In a simple way, we can say that force is what moves something, reduces its speed or changes its direction.



Newton's laws

Isaac Newton was an English mathematician, physicist, astronomer, alchemist and philosopher considered one of the most influential scientists of all time.

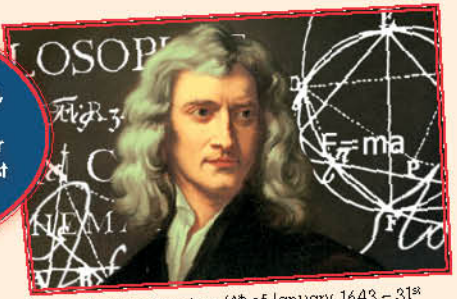


Image 3. Isaac Newton. (4th of January, 1643 – 31st of March, 1727).

1st Law of Inertia

A body will remain at rest, or moving at constant velocity, unless it is acted on by unbalanced force.

2nd Law of Force and acceleration

The force experienced by an object is proportional to its mass times the acceleration it experiences.

$\vec{F} = m\vec{a}$

3rd Law of Action and Reaction

If two bodies exert a force on one another, the forces are equal in magnitude, but opposite in direction.

$\vec{F}_{12} = -\vec{F}_{21}$

Did you know that physics can also help to explain some phenomena, like how birds fly or how can we make a ball levitate?

EXPERIMENT 5 The levitating ball

WHAT YOU WILL NEED:

Materials included in the kit:

- Straw
- Funnel
- Ball

Steps:

1. Fit a straw in the long part of the funnel.

2. Put the other end of the straw in your mouth and prepare to blow.

3. Start blowing and release the ball over the funnel.

4. Can you make the ball levitate, Scientist?

With zones of high pressure above and below the ball, it looks like it is defying gravity!

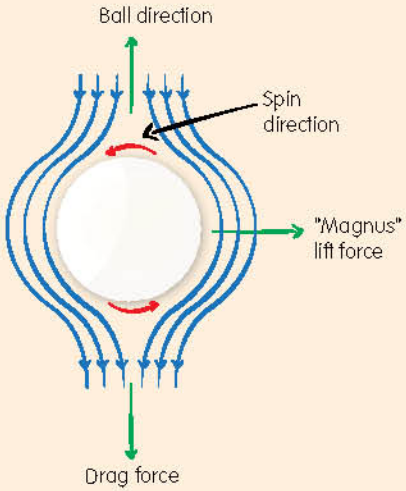
Explanation:

In this experiment you were able to keep the ball suspended in the air with only the force of the wind.

This phenomenon is called **Bernoulli's principle**: the air blow pushes the ball upwards, passing through its sides.

As air moves around an object, it creates different pressures on that object.

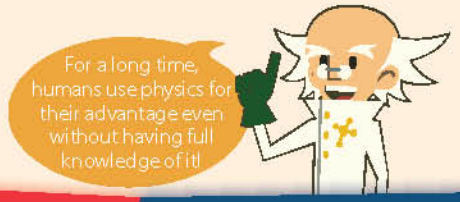
A ring of low pressure is created around the ball. This low pressure is the force that keeps the ball suspended in the air!



Faster air **Slower air**

Less pressure **More pressure**

This principle states that as the velocity of fluid increases, the pressure exerted by that fluid decreases. In practical terms it means, a slow-flowing fluid exerting more pressure than a fast flowing fluid. This means that in a moving fluid, pressure and velocity are inversely proportional. When one is high then the other is low. If the other is high then the other is low.



EXPERIMENT 6 — Catapult

WHAT YOU WILL NEED:

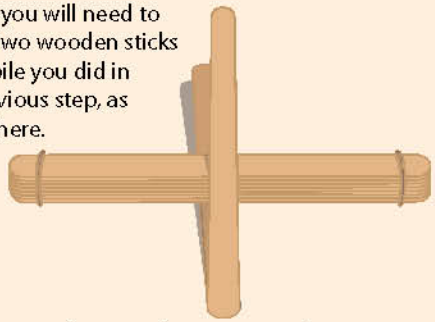
Materials included in the kit:

- Rubber bands
- Wooden stirrers
- Ball
- Spoon

Steps:

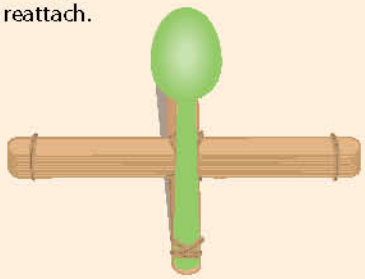
1. Pile up eight wooden stirrers and use two rubber bands to secure them, one at each end.

2. Now you will need to attach two wooden sticks to the pile you did in the previous step, as shown here.



3. Use a rubber band to secure the lower part of both stirrers (the part where one touches the other). Use another rubber band to secure the whole set of stirrers, more or less in the middle, just like you see in the image. Keep passing the rubber band around all the tips of the wooden stirrers.

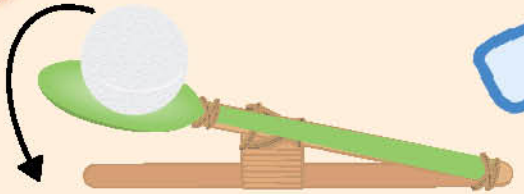
4. Attach the spoon handle to the rubber band that secures both wooden stirrers. If necessary, remove the rubber band and reattach.



5. Put a final rubber band attaching the upper part of the spoon handle to the wooden stirrer (near the bowl of the spoon).

Test your catapult!

6. Put the ball in the spoon pressing it a bit downwards and then release it. What happens, Scientist?

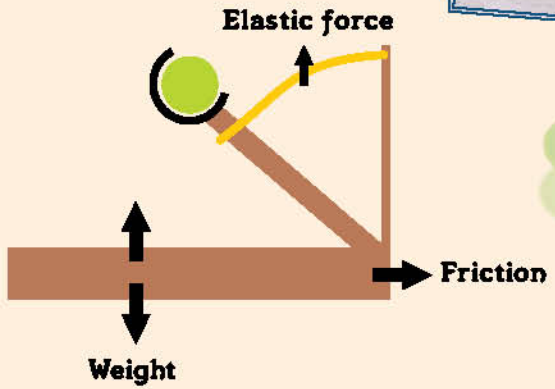


Explanation:
Catapults were invented to help humans to launch projectiles during war.

The first catapults appeared in Greece, in the 4th century BC, and it worked through tension forces.

Its main function was to bring down castles and forts by throwing huge stones.

Catapults work with the physical **principle of storing tension**, being possible to launch very heavy objects by applying a quite small force.



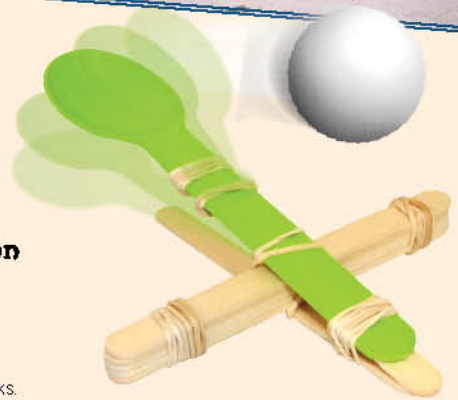


Image 4. Fundamental physics which explains how a catapult works.

EXPERIMENT 7 — Jet car

WHAT YOU WILL NEED:

Materials included in the kit:

- Balloon
- 2 Straws
- 2 Wooden sticks
- Card with graphic elements

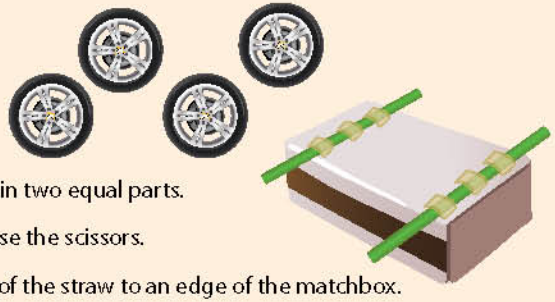
Extra items you will need:

- Empty matchbox
- Scissors
- Adhesive tape
- Needle

Always ask an adult for help!

Steps:

1. Start by cutting the 4 wheels from the card with graphic elements.

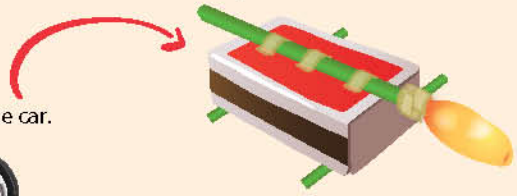


2. Again with the scissors cut the straw in two equal parts.

Note: always ask an adult to help you use the scissors.

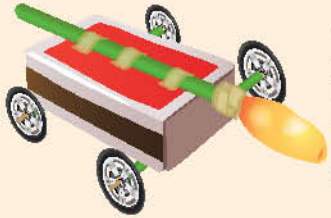
3. Use the sticky tape to stick each half of the straw to an edge of the matchbox.

4. Put a straw in the balloon opening and secure them together with a lot of sticky tape. To make sure no air comes out, fill the balloon through the straw and then cover the straw, as if it were a balloon (pressing it with the fingers). If you see that the balloon loses air, add more tape.



5. Stick the straw to the upper part of the car.

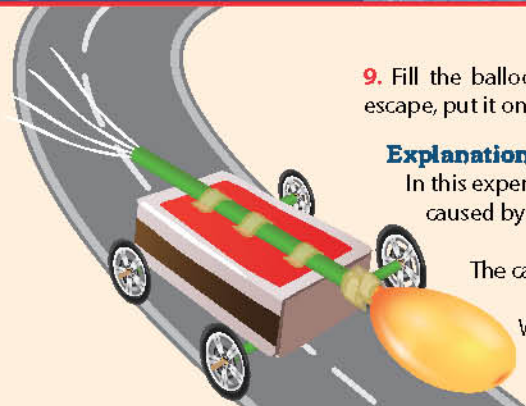
6. Ask an adult to use a needle to make a hole in the middle of each wheel.



7. Put a wooden stick inside one of the straws and then put a wheel in each side of the wooden stick, just like the image shows. If you have problems putting the wheel in the stick, ask an adult to widen the hole with the needle. Repeat this step for all the wheels.

8. Your jet car is ready and now you only need to make it move.

9. Fill the balloon through the straw and without letting the air escape, put it on the floor. Count down, and release the straw!



Explanation:

In this experiment you observe the propulsion phenomenon caused by the **force of air.**

The car moves in the opposite direction of the air release.

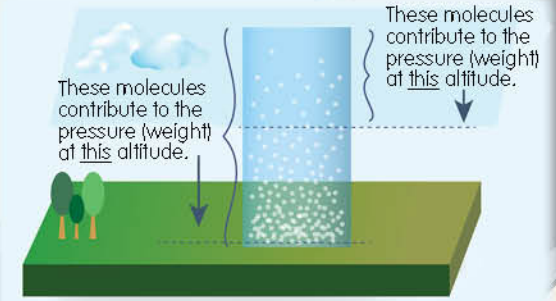
When you fill a balloon, the air molecules create pressure against the walls of the balloon. This pressure allows the balloon to grow by stretching the rubber of which it is made. However, the balloon itself also exerts a pressure in the opposite direction, opposing the force of air. When you release the balloon, the air goes out through the opening, propelling the car and making it move!

Air

Air is a mixture of different gases that float around our planet, due to **gravity** force.

Air has weight and it is responsible for the **atmospheric pressure**! The atmospheric pressure is measured with a barometer.

Pressure is determined by the force of gravity combined with the total mass of the air column above a certain place on the surface of a body. Therefore, the closer the air is to the surface, the greater the exerted force is and thus the higher the pressure that the atmosphere does on a certain point.



surface air pressure = weight of air in column above unit area

OUTDOOR EXPERIMENT

Lets have some fun with a water bomb!

EXPERIMENT 8 — Mini water bomb

WHAT YOU WILL NEED:

Materials included in the kit:

- Small measuring cup
- Origami sheet

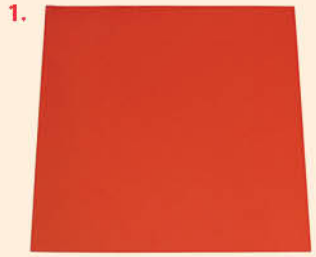
Extra items you will need:

- Scissors
- Water

Always ask an adult for help!

Steps:

1. Fold the sheet of paper as illustrated:



2.

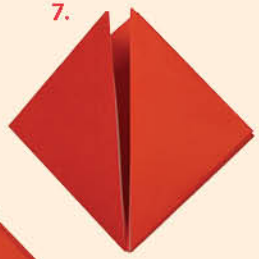
3.

4.

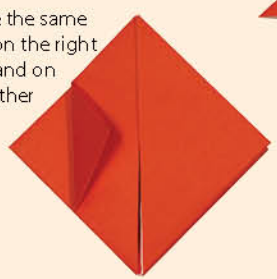
5.

6. Make the same fold on the other side.

7.



8. Make the same fold on the right side and on the other side.



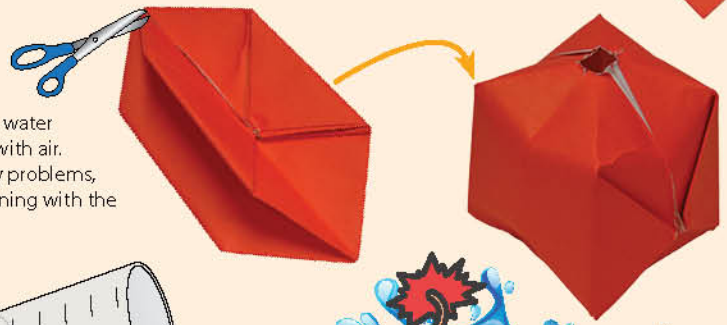
9.

10. Crease the loose tips of each side.

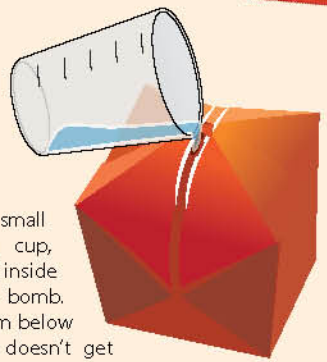
11. Insert each tip in the openings that were made, just like the image shows.

12. Repeat steps 10 and 11 on the other side.

13. Blow into your water bomb to fill it with air. If you have any problems, widen the opening with the scissors.



14. With the small measuring cup, pour water inside your water bomb. Hold it from below so that it doesn't get ruined while you fill it.



You have about **10 seconds** until your water bomb explodes!

15. Throw the water bomb at a surface and have fun with your friends!

Explanation:

With the sheet of paper folded as explained, it becomes more resistant to withstand the water. When you throw your mini water bomb, the energy created with the impact, forces the water to come out and the bomb explodes.

EXPERIMENT 9 — Water that doesn't spill

WHAT YOU WILL NEED:

Materials included in the kit:

- Card with graphic elements
- Small measuring cup

Extra items you will need:

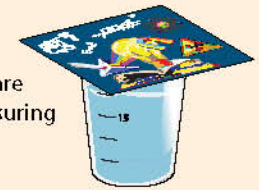
- Bowl
- Scissors
- Water

Always ask an adult for help!

Steps:

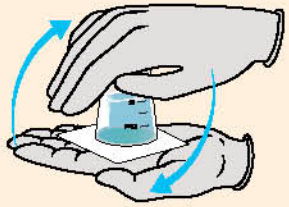
1. Ask an adult to help you use the scissors and cut one of the squares (see image) from the card with graphic elements.

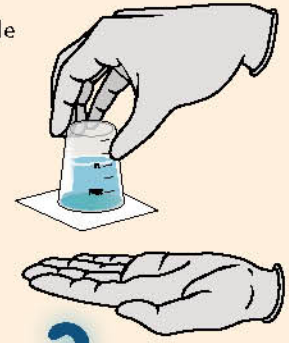
2. Fill the small measuring cup with water until the 20 ml mark.



3. Put the card square over the small measuring cup with water.

4. With one hand hold the measuring cup from the top and with the other from below, as the image shows.





5. Perform this step above the bowl. Quickly turn the cup upside down, as shown in the image. Then, remove the hand that is holding the cardboard square.

Could you make magic and keep the water in the cup, Scientist?

Explanation:

When the cardboard square touches the water, it becomes wet and adheres to the cup. Even though water has weight, the **atmospheric pressure**, which acts in all directions, will exert pressure on the cardboard, from the bottom, **holding the water's weight**.

Since atmospheric pressure doesn't act inside the cup, because the cup is sealed by the cardboard, water doesn't fal. This happens because the pressure exerted on the cardboard is higher than the weight of the water.

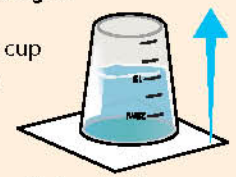


Image 5. Atmospheric pressure exerts force upwards, holding the water's weight.

DID YOU KNOW...

That it is also because of gravity that the celestial bodies stay in orbit? The terrestrial atmosphere — the gas layer that surrounds planet Earth — is attracted by the planet's gravity.

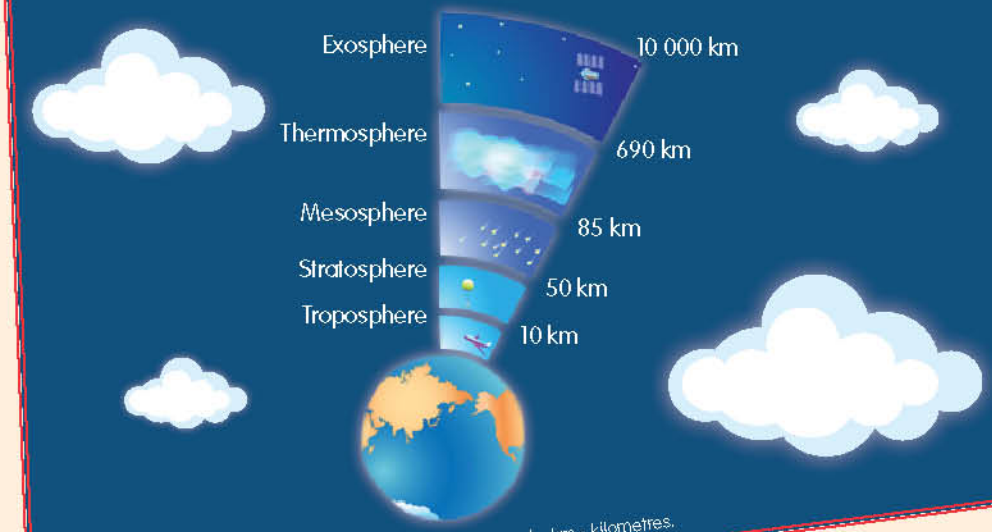
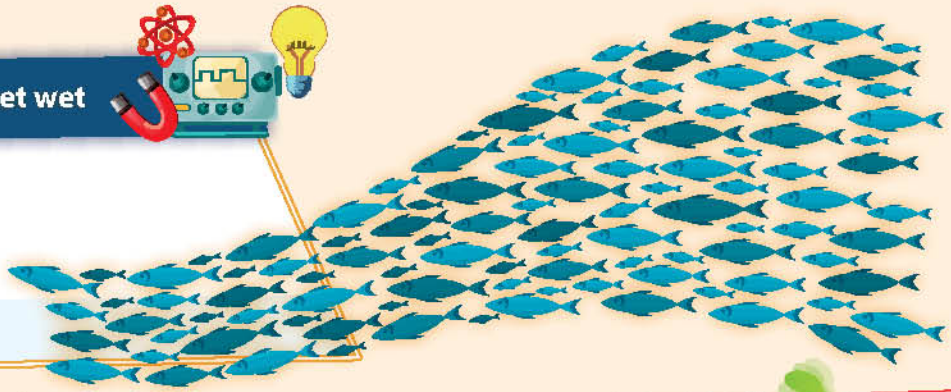


Image 6. Atmosphere layers. Keywords: km - kilometres.

EXPERIMENT 10 The fish that doesn't get wet



WHAT YOU WILL NEED:

Materials included in the kit:

- Card with graphic elements

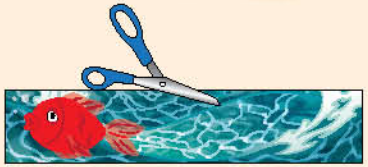
- Small measuring cup

Extra items you will need:
- Bowl
- Scissors
- Water

Always ask an adult for help!

Steps:

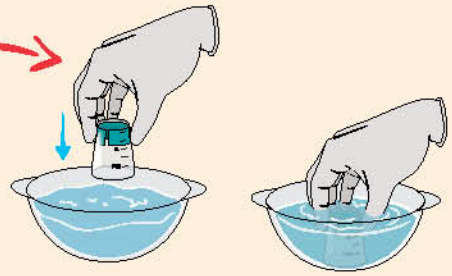
1. Ask an adult to help you use the scissors to cut the rectangle with the fish (see image) from the card with graphic elements.



2. Insert the rectangle with the fish in the bottom of the small measuring cup and turn the cup upside down to make sure the rectangle stays on the bottom of the cup.

3. Fill the bowl with water.

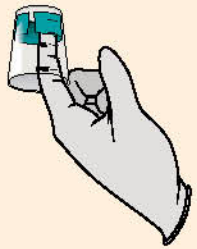
4. It is time to see whether the fish gets wet. For that, keep the small measuring cup turned upside down and put it in the bowl with water.



Note: it is extremely important that the cup enters straight inside the water, without tilting it towards one side.

5. Without tilting the cup, remove it from the water.

6. Insert your finger until the bottom of the cup and check whether the fish is wet.

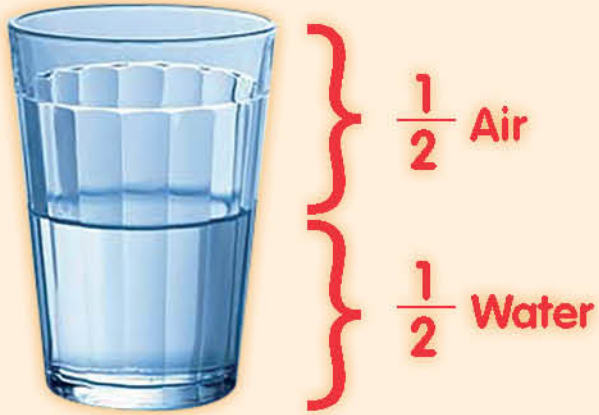


Explanation:
Air also occupies space. When you place the cup inside the bowl with water, turned upside down, all the air inside it can't get out. As air occupies space, the water will not be able to enter inside the cup because it doesn't have space available. That way, the paper fish doesn't get wet.

DID YOU KNOW...

That "there aren't empty spaces in nature" and that "two bodies can't simultaneously occupy the same space?"
These are 2 famous scientific statements that explain a high number of phenomenons.

If you have a glass half full with water, the other half is full with "air." If you continue to pour water into the glass, the air that occupied the "empty" part is replaced by the water.



Actually, the glass is always full.

Image 7. The glass half empty or half full theory.

Thus, given gas properties, when we move, the air that surrounds us, changes the position of its molecules and, consequently, its shape, in order to let us pass through.

Scientific Challenge 1.
Discovering the Periodic Table

WHAT YOU WILL NEED:

Materials included in the kit:

- Periodic table (page 11)

Extra items you will need:
- Pencil
- Chemistry book
- Eraser

Steps:

1. With the Periodic table from page 11, complete the following table:

Group	1			17				12
Period			2			4		
Relative atomic mass		12,01					196,97	
Atomic number					13			80
Exists/Is used in...								
Chemical symbol	H				Al			
Name				Iodine			Gold	

Scientist, can you find any relation between the position of the elements and their atomic number and relative atomic mass?

Solution:

Name	Hydrogen	Carbon	Fluorine	Iodine	Aluminum	Iodine	Gold	Mercury
Chemical symbol	H	C	F	I	Al	Ca	Au	Hg
Exists/Is used in...								
Atomic number	1	6	9	53	13	20	79	80
Relative atomic mass	1,01	12,01	19,00	126,90	26,98	40,08	196,97	200,59
Period	1	2	2	5	3	4	6	6
Group	1	14	17	17	13	2	11	12

Scientific Challenge 2.
Newton's disc

WHAT YOU WILL NEED:

Materials included in the kit:

- Card with graphic elements
- Wooden stick

Extra items you will need:
- Scissors
- Needle

Always ask an adult for help!

3. Push the wooden stick through the hole you made.

Note: if you see that the disc slides around easily, use tape to secure it better to the pencil.

Steps:

1. Ask an adult to help you cut the Newton's disc from the card with graphic elements.

2. Again with the help of an adult use a needle to make a hole in the center of the disc.

4. Now spin the disc like a top. What do you see?

Scientific Challenge 3.
Paper helicopter

WHAT YOU WILL NEED:

Materials included in the kit:

- Card with graphic elements
- Paper clips

Extra items you will need:
- Scissors

Always ask an adult for help!

5. Fold upwards the interior part of the structure.

6. Fix it with a paper clip. Put another clip on top of that one to add more weight.

7. To make it work, you just have to toss it in the air vertically and forward, as high as you can. Observe its trajectory!

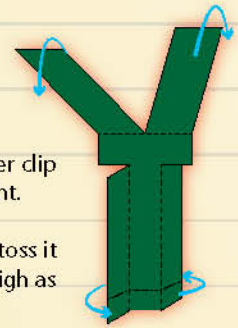
Steps:

1. Ask an adult to help you and with the scissors cut the helicopter rotor. Cut only the filled lines.

2. Crease the dashed lines.

3. Fold the largest halves, one to each side, just like the image shows.

4. Fold both lower sides over the middle, one to each side.



Check out more COOL experiments!

Science4you

Learn about these kits and more at www.playmonster.com!

Play MonSter

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