SCRUMPALICIOUS!

SWEET SHOP

IT'S A WONDERLICIOUS WORLD...

BOOK 2

SWEET LABORATORY EXPERIMENTS & ACTIVITIES

SUPER LAB SWEETS

MAKE YOUR OWN JELLY SWEETS, LOLLIPOPS AND COLOURFUL SWEETS!

AVAILABLE ONLINE: FI DK NO SE CZ

www.hamleys.com/explore-SuperSciencelabkits.irs

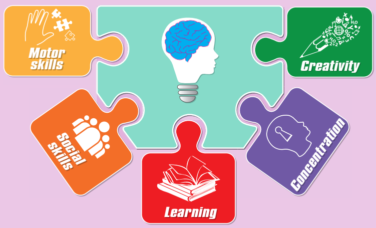
Dear parents and guardians

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 strenghts of our toys. We aim to provide toys which enable children's development of physical, emotional and social skills.

Find out more about the Brain Activator in Science4you toys at:

www.science4youtoys.co.uk/brain-activator

Science4you
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CURRICULUM GOALS
Key stage 1, 2 and 3

This book was produced in accordance with the following key stages and curriculum goals of subjects:
- Science: KS1 and KS2;
- Chemistry: KS3.

SUPER LAB SWEETS

Index

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 after use.
- Make sure that all containers 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 smoke in the cooking area.
- Do not replace foodstuffs in original container. Dispose of immediately.
- Make sure the tools are properly clean before you start preparing food.
- Take care while handling with hot water and hot solutions.
- Use only food contact materials in order to develop the recipes and to store the prepared foods.
- All the preparation stages included in the recipes which require the use of the oven, stove, household appliances and knives, should be performed by an adult.
- If you spill any liquid, blot it up immediately in order to avoid slipping.
- Avoid any contact of the ingredients with the eyes.
- Pay special attention when handling hot and sharp and/or cutting tools such as knives.
- Surfaces, liquids and tools may be very hot.

FIRST AID INFORMATION

- **In case of eye contact:** Wash out eye with plenty of water, holding eye open if necessary. Seek immediate medical advice.

Citric acid and gelatine:

- **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. **Shall only apply to citric acid.**
- **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 without delay. Take the chemical and its container with you.
- In case of injury always seek medical advice.

In case of emergency dial:
USA 911 | UK 999 | Australia 000 | Europe 112

ADVICE FOR SUPERVISING ADULTS

- Read and follow these instructions, the safety rules and the first aid information, and keep them for reference.
- **Allergenic products:** this kit has ingredients that contain or may contain gluten, milk and milk-based products (including lactose), nuts, soybeans, mustard seed, peanuts, sulphites, wheat and egg which can cause allergies (see page 6).
- 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.
- 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.
- The supervising adult should discuss the warnings and safety information with the child or children before commencing the experiments.
- 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.

Kit contents

Description:	Quantity:
1. Sachet of strawberry jelly	1
2. Sachet of tutti-frutti jelly	1
3. Silicone mould	1
4. Sachet of citric acid	1
5. Stickers	1
6. Cornflour	1
7. Sachets of gelatine	3
8. Crepe paper sheets	2
9. Satin ribbons	4
10. Small measuring cup	2
11. Measuring spoon	1
12. Sachet of sprinkles	1
13. Straws	6
14. Lollipop sticks	5
15. Thermometer	1

INGREDIENTS LIST

Citric acid CAS # 77-92-9	 **Warning**

Hazard Statement:
H319 Causes serious eye irritation.
Precautionary Statement:
Prevention:
P264 Wash hands thoroughly after handling.
Response:
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313 If eye irritation persists: Get medical advice/attention.

Cornflour

Strawberry jelly

Ingredients: sugar, gelatin (12%), acidity regulators (E330, E297 and E331), flavourings (contains **sulphites**), salt, colours (E120, E163 and E160aii) and antioxidant (Vitamin C).
May contain gluten, milk, nuts, soy, mustard seeds and peanuts.

Tutti-frutti jelly

Ingredients: sugar, gelatin (12%), acidy regulators (E297, E331 e E330), flavouring (contains **sulphites**), salt, antioxidant (Vitamin C) and colours (E100 and E141ii).
May contain gluten, milk, nuts, soy, mustard seeds and peanuts.

Gelatine
CAS # 9000-70-8

Ingredients: powder gelatine (swine origin).
May contain wheat, milk and egg.

Sprinkles

Ingredients: Sugar, maize starch, maltodextrin, coating agent (E903) and coloring (E100, E120, E133, E171). **May contain gluten, soybeans, milk and nuts.**

Throughout this book, the use of substances or products that can cause food allergies or intolerances, such cereals containing gluten and products thereof; eggs and products thereof; and milk and products thereof, may be suggested.

1. Experiments and recipes

Note: the ingredients and materials included in this kit are labelled with this symbol .

Wash all materials before beginning each experiment or recipe. In between each experiment or recipe, make sure all materials are properly washed too.

1.1. The sweet laboratory

In this book we want to show you more about scientific phenomena using sweet ingredients!

The concepts described are part, even if indirectly, of a cook's routine and are indispensable to make the countless and special recipes that exist!

Experiment 1
Crystalline lollipop

ATTENTION: ask an adult for help.

What you will need:
- Pan
- Wooden spoon
- Teacup (for measurements)
- Cup
- Sugar
- Water
- Food colouring (optional)
- Food flavouring (optional)
- Lollipop sticks

Have you used all your lollipop sticks? Don't worry, you can use skewers!

Steps:

1. Pour a teacup of water into the pan and then add 2 teacups of sugar to it.

2. Ask an adult to put the pan on the cooker until the water starts boiling. Stir the mixture to keep it from sticking.

3. Remove the pan from the cooker and add a little more of sugar, spoon by spoon, until you can't dissolve it anymore. If you want, add a little of colouring and flavouring. Mix well.

4. Pour the liquid into the glass cup, dip the sticks in the liquid and then sprinkle it with a little bit more of sugar.

5. Let the sticks dry. When completely dry, place them again in the cup.

6. Save the cup in a dark and safe place for about a week or until crystals are formed.

7. Now you can offer them to your friends and delight yourself with your own sweet crystals!

To be consumed within 5 days (store in the refrigerator).

Image 1. Sweet and edible crystals in several colours.

Explanation:

To better understand how this experiment works, we first have to know what a solution is.

A **solution** is a homogeneous mixture of two or more substances in which:

- The dissolved substance is called **solute** and normally is present in small amounts.

- The substance that dissolves is called **solvent** and normally is in higher amount than the solute.

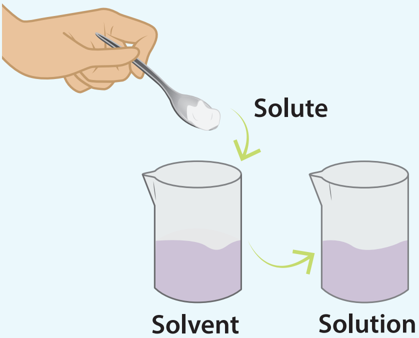


Image 2. Solution: mixture of a solute (such as sugar) in a solvent (such as water).

Considering their composition, solutions can be defined as:

Unsaturated solutions	Saturated solutions	Supersaturated solutions
Have less solute than the one the solvent can dissolve.	Have the maximum amount of solute that the solvent can dissolve, reaching the equilibrium at room temperature.	Have higher amount of solute than the one the solvent can dissolve at room temperature. However, if we heat this solution, more solute can be dissolved.

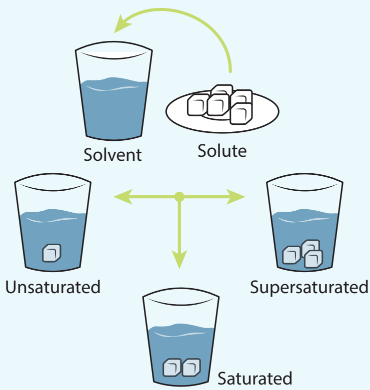


Image 3. Types of solutions.

To make your crystalline lollipops, you've created a supersaturated solution of sugar!

Sugar was the solute and water the solvent.

In supersaturated solutions, the probability of two solute molecules find each other is higher than in others. This means that it's only possible to make crystals with this kind of solutions.

While the lollipop sticks are in a safe and dark place, the water from the solution evaporates and the dissolved substances, in this case sugar, precipitate.

Scientists call precipitation to the phenomenon that originates the formation of a solid in a solution. This solid is called the precipitate and happens when, in a saturated or supersaturated solution, the dissolved substances 'appear' again.

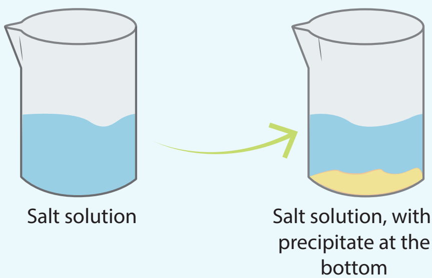


Image 4. The precipitation of salt in a solution.

This is a slow process as all the water of the solution has to evaporate, but allows forming crystals which colour you've settled when added the food colouring.

Experiment 2
Why do popcorns pop in the pan?

ATTENTION: ask an adult for help.

What you will need:
- 1 Popcorn bag
- Pan
- Cooking oil
- Oven glove
- Bowl or tray
- Sugar or salt

Steps:

1. Pour a little of cooking oil in the bottom of the pan.

2. Add the corn to the pan and cover it with the lid.

3. Ask an adult for help to use the cooker.

4. Now pay attention: when you start hearing popcorns popping, low the intensity of the flame and with the pan covered and very carefully, move the pan. Use a glove to not get burnt.

5. You must only turn off the cooker when you don't hear the popping anymore. Now, put the popcorns in a bowl or tray.

6. Add some sugar or salt as you like and delight yourself with popcorn.

To be consumed within 1 day.

Explanation:

Corn consists mainly of water and starch.

Image 5. Corn.

Starch is the main component of the outer part of the corn kernel and in the inside it mainly consists of water.

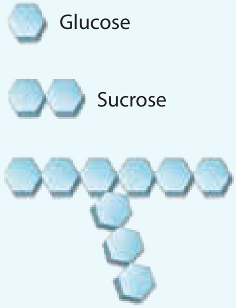


Image 6. Comparison between the glucose, sucrose and starch molecules.

When corn is heated, the water inside it transforms into water vapour (water in gas state).

In gas, molecules occupy more space. This way, the water vapour increases the pressure inside each corn kernel, pushing the outer layer of corn.

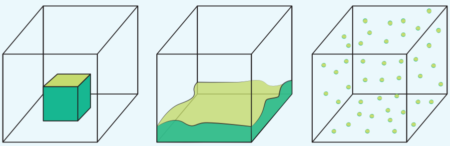


Image 7. Difference of the occupied space by the same amount of water in the different physical states of matter: solid, liquid and gas.

Do you want to learn more about this theme? Then check Experiment 2 from the 'Cookery Book'!

For some time, the corn's outer layer remains intact. However, it then explodes and, by action of water vapour, the starch expands and forms the white part that we can see on popcorns, due to the quick cooling.

DID YOU KNOW…
That if a corn kernel has a crack it doesn't explode and as consequence doesn't transform into popcorn?
It lets the vapour pass and there isn't enough pressure for the corn kernel to burst.

Image 8. Popcorn.

Experiment 3
Let's check the amount of sugar in soft drinks?

ATTENTION: ask an adult for help.

What you will need:
- Soft drinks
- Pan
- Cooker
- Measuring cup

Steps:

1. Pour 100 milliliters (ml) of a soft drink into a pan.

2. Ask an adult to heat it on the cooker.

3. Wait until it boils and all the liquid has evaporated.

You'll know the liquid has completely evaporated when a thick and dark liquid appears at the bottom of the pan.

4. Observe what remains at the bottom of the pan. Use the measuring cup to know the amount of liquid that remains in the pan.

Note: you can also carry out this experiment with different soft drinks, including diet soft drinks, sugar free, and see the differences!

Always remember to take notes of your results!

Explanation:
Soft drinks are industrial beverages, made from water and sugar. Its other characteristics, apart from the sweet taste, are added by synthetic ingredients, such as food flavourings and colourings. These drinks also contain a high concentration of carbon dioxide.

Image 9. One soft drink tin has in average 7 sugar cubes in its composition.

11% of a soft drink's composition is sugar!

Besides being very caloric, the amount of sugar ingested with the consumption of soft drinks reduces the capacity of our organism to absorb other essencial minerals to our heath and well-being.

Since water is its main component, it's easy to understand that when we heat it, water tends to evaporate, as it reaches its boiling point (100ºC/212ºF).

However, the dissolved sugar will become visible.

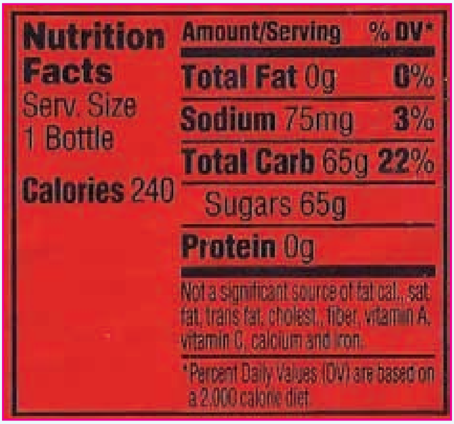


Image 10. Label containing nutritional information of a soft drink.

DID YOU KNOW...
That a teaspoon of sugar contains over 1 trillion molecules of sucrose?

Image 11. Spoon of white sugar.

Sugar, or sucrose, is a molecule composed by hydrogen (H) atoms, oxygen (O) atoms and carbon (C) atoms and has the following chemical formula: $\mathbf{C_{12}H_{22}O_{11}}$.

When we heat sucrose, water molecules (H_2O) are formed which then evaporate, only remaining carbon atoms. These give a dark colour to the result of the experiment.

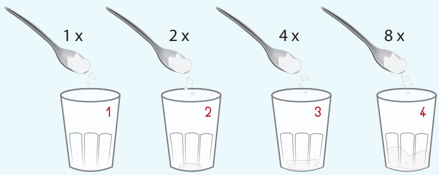
Experiment 4
A sugar rainbow

ATTENTION: ask an adult for help.

What you will need:
- Food colourings (of different colours)
- Water
- Sugar
- 4 Transparent cups
- Measuring cup
- Tablespoon

Steps:

1. The first step is to put sugar in the cups. In the first cup, put 1 tablespoon of sugar, in the second 2 spoons and in the third 4 spoons of sugar. Finally, in the fourth cup, put 8 spoons of sugar. Don't forget to label your cups.

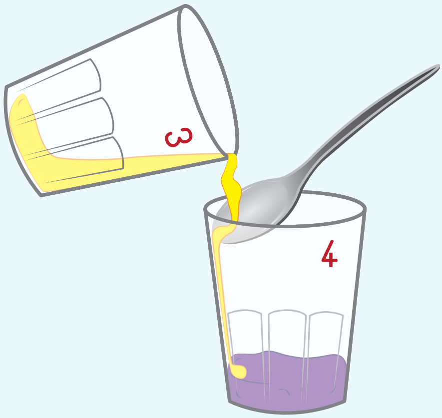


2. Ask an adult to heat 200 ml of water. When it's hot, with the measuring cup, add 50 ml to each cup and dissolve the sugar. You will be preparing 4 solutions of water and sugar.

3. After all the sugar is well dissolved in the cups, add food colouring to each one. Each solution must have a different colour, at your choice.

4. Now you are ready to create a coloured cup. The solution with more sugar is the one that will remain at the bottom and it's to this cup that you'll add the other solutions.

5. Start by pouring the content of cup 3 into the 8 sugar spoon cup (cup 4). Use a spoon to help you: lean the spoon against the cup's side and start pouring the liquid, slowly, as shown in the image.



6. Repeat this step for the cup with 2 sugar spoons (cup 2) and at last for the cup with only 1 sugar spoon (cup 1).

7. Observe what happens.

Explanation:

For sure you've heard about density: this is one of the most studied chemical properties. It's the result of its mass per unit volume and varies with temperature and pressure.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

As so, even though air has weight, since the mass of 1l of air is approximately 1.29 g, **the density becomes lower the higher is the amount of air between molecules**, as the volume increases considerably and the weight doesn't change much.

Since **density** focus on the relationship between mass and volume of a certain body, it's easy to understand that in liquids, the density is related with its **concentration**.

So what is concentration?
It's the relation between the amount of solute and the volume of solvent.

We already know that the solvent is a substance in which we dissolve a solute, for example, in a solution of water and sugar, water is the solvent and sugar is the solute.

As so, for the same amount of solvent, a solution becomes more concentrated the higher is the amount of solute in there dissolved.

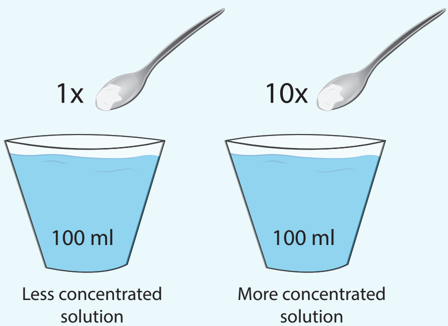


Image 12. Solutions with different concentrations.

As you can see in the image above, the more concentrated solution is the one with 10 spoons of solute.

Concentration can be calculated by the formula:

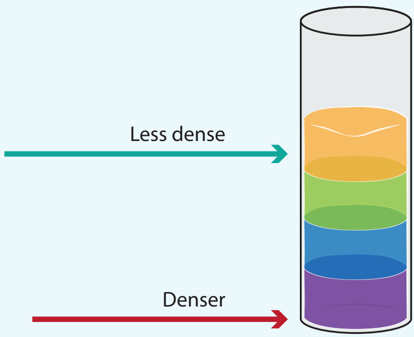
$$\text{Concentration} = \frac{\text{Mass (g)}}{\text{Volume (ml)}}$$

Thus, a solution with 100 ml of water and 200 g of sugar will have a concentration of 2 g of sugar per each ml of water.

To keep in mind scientist!

- **Mass:** the amount of matter (solute) present in a certain body or solution.
- **Volume:** the amount of space a certain body or object occupies (the more water the greater volume available).
- **Density:** the relationship between the 2 previous concepts. This way, denser substances have more particles than less dense ones, for a same volume.

We can create the effect seen with the different solutions of water and sugar because the liquids will be arranged according to their density this is to say, the densest solution (the one with more spoons of sugar) will stay at the bottom and the less dense (the one with fewer sugar spoons) at top.



Experiment 5
How to make jelly sweets grow?

What you will need:

- The jelly sweets you've made in heart shape (in 'Cookery Book') or others
- Bowl
- Water

Image 13. Heart-shaped jelly sweets.

Steps:

1. Put your jelly sweets in a bowl with water.

2. Wait a few hours and then note down the changes.

3. Leave your jelly sweets in water for a day and observe the differences.

If you have a scale at home and you want to know the amount of water your jelly sweets absorb you just have to weigh them before beginning the experiment and then when you are finished – the difference in weight will be the amount of water absorbed.

Image 14. Scale.

ATTENTION: observe and analyse the results only, do not eat the sweets you used for the experiments.

Explanation:
Jelly consists of a structural protein called **collagen**.

This protein is formed by large and fibrous molecules with great elasticity. It is also the main component of our skin, bones and tendons.

These proteins are also long and quite inter-twined, which prevents them of breaking easily. This characteristic gives jelly sweets their elastic texture.

However, the bonds of these molecules are weak enough to break when jelly is placed in hot or warm water.

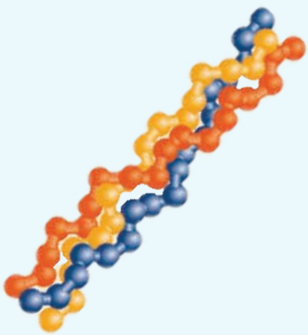


Image 15. Three-dimensional structure of the protein collagen.

So, when we put jelly in water, their bonds break and the water molecules are attracted by the collagen molecules, making the jelly sweets swell.

Note: for this experiment you can also use any kind of jelly sweets as long as they are made of gelatine, such as the worms of 'Cookery Book' experiment 2.

You can also investigate about which jelly sweets are made from gelatine, testing several types that you may have at home. Only the gelatine ones will grow when placed in water!

As you already know, all the sugar in your jelly sweets will dissolve in water. And they might also lose their colour.

Experiment 6
Sweet of jelly with pineapple, why not?

ATTENTION: ask an adult for help.

What you will need:
- Fresh pineapple
- Tinned pineapple
- Bowls
- Water
- Spoon
- Powdered jelly
- Labels or paper to identify the bowls

Steps:
1. Start by preparing your jelly as described in the package.

2. At the same time, ask an adult to heat about 10 fresh pineapple pieces.

3. Divide the jelly you've prepared in 4 bowls.

4. Add to one of the bowls 10 fresh pineapple pieces.

5. In another bowl, add 10 pieces of tinned pineapple.

6. In the third bowl, add 10 pieces of pineapple after heated in the microwave. Attention scientist, ask an adult for help to heat the pineapple.

7. The fourth will have only the jelly. Don't forget to label the bowls.

8. Place the bowls in the fridge and wait some hours.

9. Then, remove the bowls from the fridge and observe them.

Explanation:

In this experiment you've observed that the fresh pineapple was more liquid than the jelly with no fruit. However, the tinned pineapple or the boiled pineapple also solidified in the respective bowls.

Some fruits like pineapple, kiwi, melon and papaya contain an enzyme, **bromelain**, which can prevent the jelly to get structured.

Image 16. Pineapple.

DID YOU KNOW...
That it's due to the presence of bromelain that many people get aphthous stomatitis after eating fresh pineapple?

Since most jellies are made of animal protein, mainly collagen, when we add water, long protein chains are formed in which the water gets 'stuck', creating what is called a semi--solid.

However, since bromelain digests proteins, adding pineapple will destroy these bonds, which turns the jelly into liquid, even when cooled.

Though the boiled or tinned pineapple don't have the same effect because in these two cases, the bromelain is denatured this is, its structure was changed making it lose its effect, allowing the jelly to get structured.

Experiment 7
The influence of different liquids on jelly sweets

What you will need:

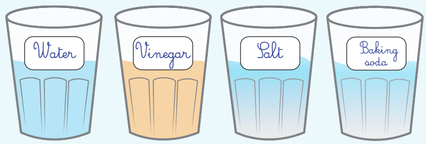
- Sweet jellies all equal
- Cups
- Water
- Vinegar
- Salt
- Baking soda or yeast for cakes
- Labels or paper to identify the cups
- Measuring cup

Steps:

1. Identify 4 cups with the name of the liquids you are going to use.

2. Now prepare the salt solution and the baking soda or yeast solution. For that add 50 ml of water and 15 ml of each of the solutes. Use the measuring cup to help you.

3. Fill each cup with the respective and then put one sweet in each cup.



4. Wait one hour and then observe the results.

ATTENTION: observe and analyse the results only, do not eat the sweets you used for the experiments.

Explanation:

Before going through any other issue, we have to understand some facts first. The jelly and the solutions of salt and baking soda are mixtures of water (solvent) with 'something' dissolved (solute).

Such as in the previous experiments, the jelly sweets that were placed in water grew a lot.

However, the jelly sweets that remained inside a salt solution or baking soda solution, didn't suffer almost any changes in size.

This happens due to a phenomenon called **osmosis**.

This phenomenon can be defined as the passage of water, from a less concentrated area to a more concentrated one. The force that moves water is called **osmotic pressure**.

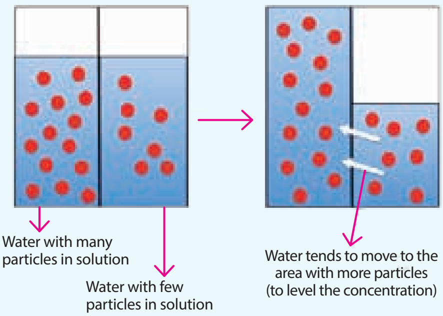
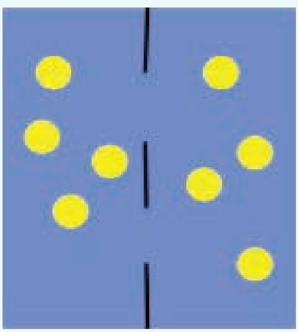


Image 17. Osmosis.

Osmosis isn't influenced by the type of solute but by the number of particles present in a solution. This is, through this process, water goes from the solution with fewer particles to the one with more until reaching balance.



Balance

Image 18. Balance of the solutions.

Balance happens when two different solutions have the same number of particles dissolved. This phenomenon is related with **concentration**, concept explored in experiment 4.

As so, when putting a single jelly sweet in water, the water tends to enter the jelly sweet, making it grow. However, the more molecules there are in the solution where jelly sweets are placed, less amount of water will move toward the jelly sweets!

DID YOU KNOW…

That a jelly molecule weighs approximately 1000 times more than a salt molecule?
For this reason in the solutions of salt and baking soda, jelly sweets grow even if not considerably!

Vinegar, in turn, is an acid. This way it degrades the bonds between the jelly molecules, making them grow but losing their original shape.

Experiment 8
Can you squeeze marshmallows with water?

What you will need:

- Marshmallows
- Water
- Small plastic bottle with lid

Steps:

1. Put two or three marshmallows inside the bottle.

2. Fill in the bottle with water and cover it.

3. Now squeeze the bottle and see what happens to the sweets. Now let go of the bottle.

ATTENTION: observe and analyse the results only, do not eat the marshmallows you used for the experiments.

Explanation:

Marshmallows are spongy sweets that have in between their molecules a lot of air, allowing them to float.

Image 19. Marshmallows.

When you squeeze the bottle you are applying pressure on its walls. This pressure also squeezes the air bubbles located inside the marshmallows. As so, with this force, sweets become smaller.

When you release the bottle, the air bubbles go back to their initial position, inside the marshmallows, which also go back to their original size.

Experiment 9
Marshmallows expansion

ATTENTION: ask an adult for help.

What you will need:

- Cup or bowl suitable for microwave
- Marshmallows

Steps:

1. Put a marshmallow inside a cup or bowl (suitable for microwave).

2. Ask an adult to put it in the microwave for 30 seconds.

3. See what happens!

ATTENTION: observe and analyse the results only, do not eat the marshmallows you used for the experiments.

Explanation:

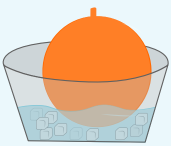
With this experiment you can observe the influence of temperature on air!

As you already know, marshmallows are spongy sweets with many air molecules stuck in a mixture of water, sugar and jelly.

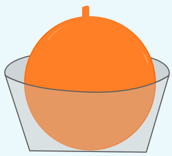
When we heat the marshmallows in the microwave, the air molecules inside them also start heating.

The hotter the air molecules are, more space they will occupy, meaning that inside the marshmallow the air molecules will expand while the sweet is heated.

With heat, the molecules that compose a gas move far apart from each other, increasing the volume of gas. To this phenomenon scientists call **gas expansion**! On the other hand, with the drop of temperature, a gas contraction occurs.



Decrease in temperature (**contraction**)



Rise in temperature (**expansion**)

Image 20. Change in temperature of a gas, with changes on the volume it occupies.

Thus, the hot air will also extend the marshmallow, as if it was a balloon.

However, when we remove it from the microwave, the marshmallow starts cooling and consequently the sweet diminishes in size too, as its air molecules contract!

DID YOU KNOW…
That artificial dyes are additives without nutritional value, added to foods and beverages with the single goal to give colour and consequently make them more attractive?

Image 21. Sweets with several food colourings.

Many of these colourings are insoluble in water.

In this experiment, you may confirm that in the sweets you used, the letters colouring is insoluble. So the letters float on the liquid while all the other components are already dissolved in water.

Experiment 10
Letters that float

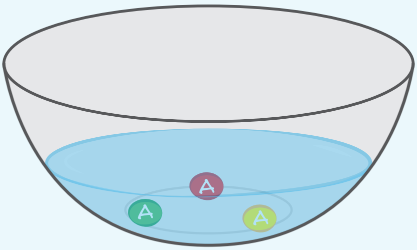
ATTENTION: ask an adult for help.

What you will need:
- *M&Ms*, *Skittles* or other sweets with something written on
- Bowl
- Hot water

Steps:

1. Put hot water inside your bowl (you can use hot water from the tap). Ask an adult for help so you don't get burned.

2. Put 2 or 3 sweets inside the bowl, with the letters upwards.



3. Wait a few minutes, and see what happens.

ATTENTION: observe and analyse the results only, do not eat the sweets you used for the experiments.

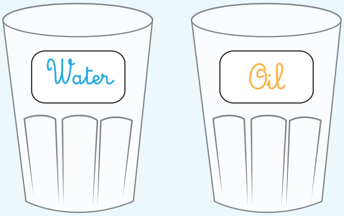
Explanation:
In this experiment, when placing the sweets in water, all sugar will be dissolved.

Experiment 11
Where sugar is better dissolved?

What you will need:
- Water
- Cooking oil
- Cups
- Equal sweets and in the same colour, for example *M&Ms*
- Labels or paper to identify cups
- Small measuring cup

Steps:

1. Start by identifying two cups with the two liquids you are going to use.



2. With the measuring cup add 15 ml of each liquid to its matching cup.

3. Put a sweet in each cup and mix slowly for 30 seconds and see what happens.

4. Take note of your results.

ATTENTION: observe and analyse the results only, do not eat the sweets you used for the experiments.

Explanation:

In this experiment you'll be able to observe that:

- In water, sugar and the colour of sweets will dissolve entirely;
- In oil, we can't observe changes in the sweets.

But why is water a better solvent for sugar?

For a liquid to be able to dissolve a solid there has to be attraction between the molecules of both substances.

Sucrose (present in sugar) is a polar molecule, such as water. This way, these molecules are attracted to each other, as they have free electrons (charge).

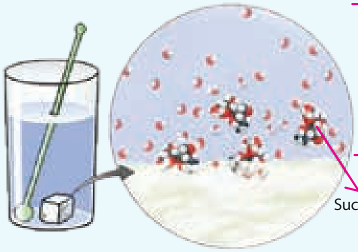


Image 22. Solution of water in sugar.

Water molecules are capable of attracting the positive and negative charges of the polar parts of sucrose molecules, allowing sucrose to be dissolved in water.

In non-polar substances it's not possible to dissolve polar molecules. An example is oil and that's why you weren't able to dissolve the sugar from your sweets.

Experiment 12
How to fasten the dissolution

ATTENTION: ask an adult for help.

What you will need:
- 2 Bowls
- Water
- 2 Equal sweets - you can use the jelly sweets or other sweets you've made or others you have at home

Steps:

1. Start by filling in two bowls with water.

2. Choose one of the bowls and ask an adult to heat the water. Leave the other bowl at room temperature.

3. Add to each bowl one sweet.

4. Observe in which bowl the sweet is absorbed faster.

ATTENTION: observe and analyse the results only, do not eat the sweets you used for the experiments.

Explanation:

As we've already mentioned before, sweets are dissolved in water, because they are made of sugar.

However, the higher is the temperature, the greater will be the movement of molecules.

As so, the higher is the water temperature, more molecules will move and 'find' the sugar molecules.

DID YOU KNOW…
That in cold water it's not possible to dissolve chocolate?
Chocolate is made of cocoa butter, which in its composition has fat that does not mix with water. This is why it's impossible to dissolve chocolate in cold water. However, in hot water, cocoa butter melts and so it's possible to mix it with water.

Experiment 13
Are jelly sweets acidic?

What you will need:
- Different types of jelly sweets
- Cups
- Water
- Baking soda or yeast for cakes
- Teaspoon
- Labels or paper to identify cups

Image 23. Different types of jelly sweets.

Steps:

1. Start by putting water in several cups according to the number of jelly sweets you want to test. Don't forget to identify the cups with the name of each jelly sweet! You can use labels or stick a paper on each cup.

2. Now add the jelly sweets to their cups and observe.

3. Finally add a teaspoon of baking soda or yeast in each cup.

4. Observe in which cups is possible to see the formation of gas bubbles (effervescence).

ATTENTION: observe and analyse the results only, do not eat the sweets you used for the experiments.

Explanation:

When mixed with an acid, baking soda (sodium bicarbonate – $NaHCO_3$) decomposes and releases a gas (carbon dioxide), in the following chemical reaction:

$$NaHCO_3 + Acid \rightarrow Na\text{-}Acid + CO_2 + H_2O$$

Here several reaction products are obtained: a **salt** (Na–Acid) that dissolves in **water** (H_2O), which is also a final product of this reaction and also **carbon dioxide** (CO_2) that, for being a gas, bubbles through the liquid of the solution.

Image 24. Effervescence.

DID YOU KNOW...
That in the production of soft drinks, the gas is obtained in the same way?

Thereby, effervescence can only be seen in jelly sweets with acid in their composition!

Experiment 14
The sweetest volcano!

ATTENTION: ask an adult for help.

What you will need:

- Bottle of *coca-cola*, preferably *diet coke*
- *Mentos* (sweets)

Steps:

1. Start by choosing a place where if needed you can make a mess. Open air is a good option.

2. Open your soft drink bottle.

3. Ask an adult for help and as fast as you can put one or two *mentos* inside the bottle.

4. Move away and see the soft drink erupting!

Explanation:

Sparkling soft drinks have in their composition a high amount of dissolved carbon dioxide, in balance and under pressure, ready to come out when the pressure at the surface of the solution diminishes. So, when we open the bottle this gas escapes to the outside. This is the reason why, when you open a soft drink bottle, you hear that characteristic sound.

When we drop a *mentos* in a soft drink bottle, the carbon dioxide bubbles start forming at the sweets surface. All these bubbles form so quickly that they end up dragging the soft drink out of the bottle.

Image 25. Reaction between the *coca-cola* and *mentos*.

DID YOU KNOW…
That scientists can't yet define if this is a chemical or physical phenomenon?

When we add the sweet to the soft drink, we create a carbon dioxide (that is dissolved) release nucleation points.

In fact, we know that when we put any porous object, for example salt, in a liquid with gas, we can observe that the carbon dioxide is released rapidly.

If we examine a *mentos* with a magnifying glass we see that its surface is porous and rough, and it's from these irregularities that the gas is released.

Image 26. *Mentos* sweets.

These sweets contain a surfactant (compound with the capacity to change the superficial properties of a liquid) that reduces the tension between the *coca-cola* molecules. Thus, allows forming larger bubbles.

Note: the result of this experiment works better with *diet coke* because it also has surfactants (the sweetener used to replace sugar).

1.2. Workshop of sweets

After making your sweets, for sure you'd like to learn some creative and nice techniques to save them or to offer them to someone special.

Attention scientist, all jelly sweets must be kept in the fridge to guarantee their ideal consistency.

So, let's learn some tricks!

Activity 1
Wrap your jelly sweets

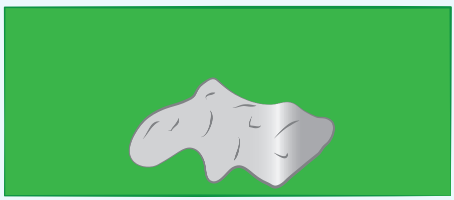
A nice way to save your sweets is by wrapping them.

What you will need:
- Aluminium foil
- Crepe paper sheets
- Satin ribbon or wool

Steps:

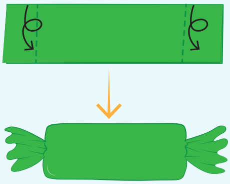
1. First you must put the sweets you want to wrap in aluminium foil.

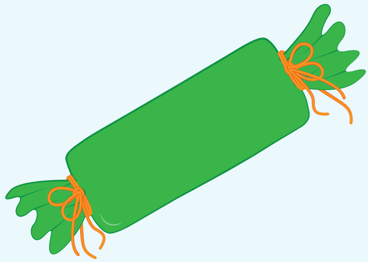
2. Now, cut the crepe paper in the size you want and place the sweets (already in foil) on it.



3. Now, you just need to fold it for the sweets to be covered, just like this:

4. Then, twist the paper ends.





5. Finally, use the satin ribbon or wool string to tie up the ends. Have you seen the lovely effect you've created? You may also decorate this wrapping with your stickers!

Activity 2
A box of origami

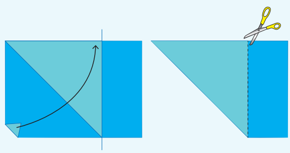
What about saving your sweets, wrapped or not, in an origami box?

ATTENTION: ask an adult for help.

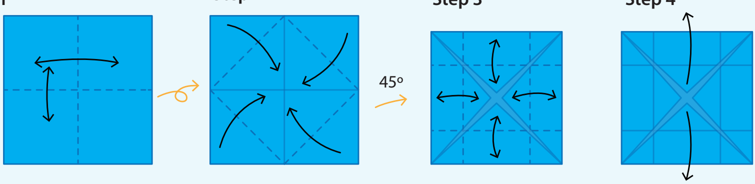
What you will need:
- A4 paper sheet, preferably coloured

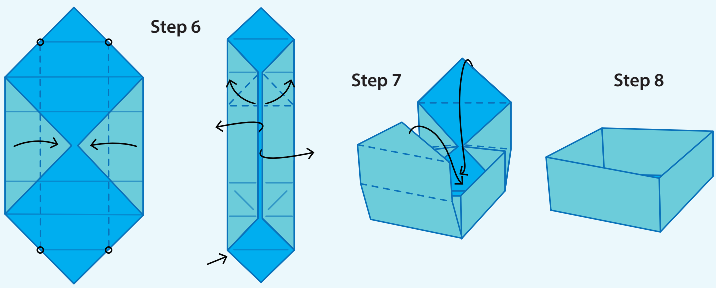
Steps:

1. Start by folding the paper as you see in the image and then cut it into a square.



2.





3. If you want, decorate your origami box with the stickers.

DID YOU KNOW...
That origami is a traditional japanese art of paper folding?
With a single sheet of paper it's possible to assemble geometric figures, animals, plants and other objects without cutting it or using glue.

Activity 3
A paper cup

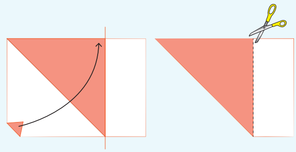
Learn how to make a fantastic paper cup in which you can put your lollipops and other sweets.

ATTENTION: ask an adult for help.

What you will need:
- A4 paper sheet, preferably coloured

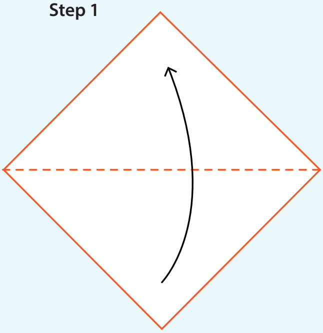
Steps:

1. Start by folding the paper as you see in the image and then cut it into a square.

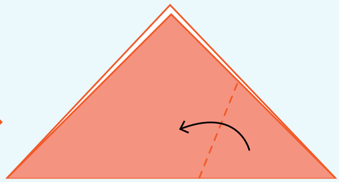


2.

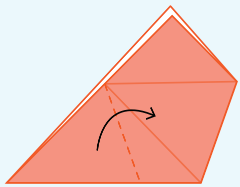
Step 1



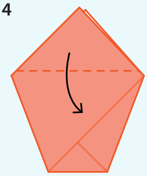
Step 2



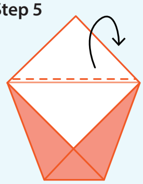
Step 3



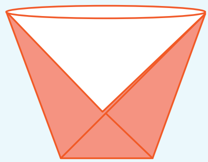
Step 4



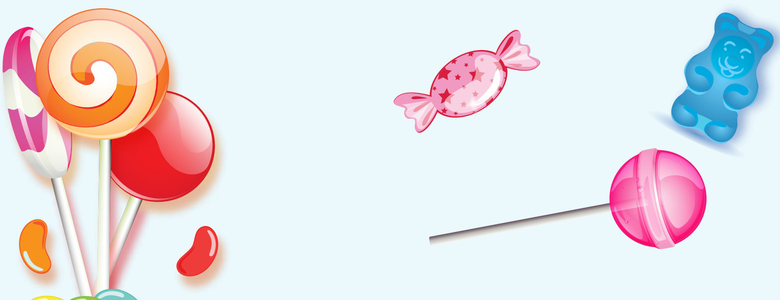
Step 5



Step 6



3. If you want, decorate your paper cup with the stickers!



Activity 4
A cone for sweets

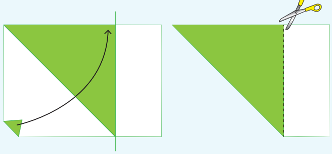
ATTENTION: ask an adult for help.

What you will need:

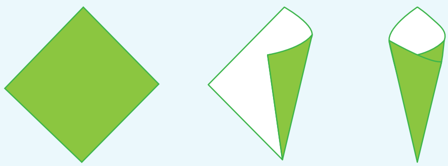
- A4 paper sheet, preferably coloured

Steps:

1. Start by folding the paper as you see in the image and then cut it into a square.

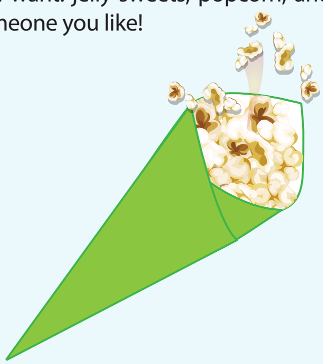


2. Now, roll each end to the middle of the paper and hold it with transparent adhesive tape.



3. Leave free space in the cone so you can put your sweets in it.

4. Now you can fill your cone with whatever you want: jelly sweets, popcorn, and offer to someone you like!



Activity 5
A coloured cone for sweets

Did you like your cone however you think it would look prettier with colours? You can use coloured sheets of paper or be the artist that gives colour to your cone!

Let's start!

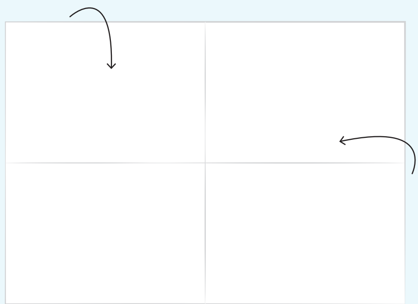
ATTENTION: ask an adult for help.

What you will need:

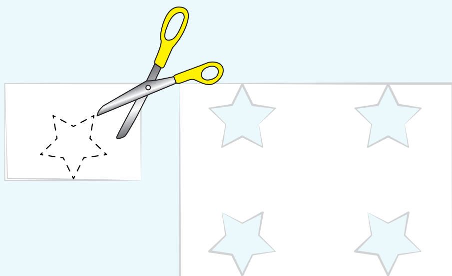
- Sheets of paper
- Sponges
- Watercolours
- Scissors

Steps:

1. Fold an A4 paper sheet in 4.



2. Now cut out shapes that you like but without separating the paper parts. It will look like this:

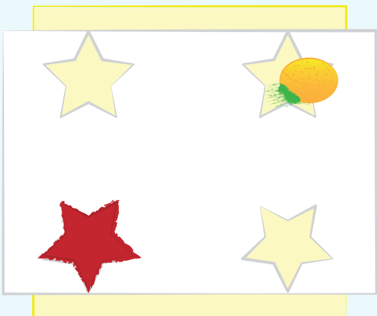


3. Choose the watercolours you want and paint, using the sponge:

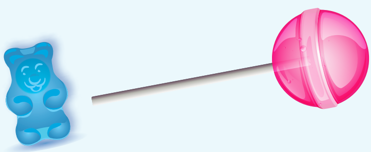
- Prepare an A4 paper sheet for a cone, such as you did in the previous experiment (activity 4).

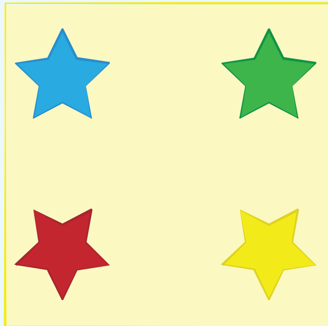
- Put the sheet of paper with the cut shapes over the one you've prepared.

- Dip the sponge in the paint you want to use and then pass it over the sheets.

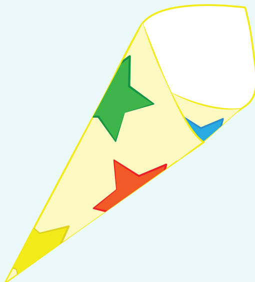


- You'll see that the painting appears only on the sheet where you cut the shapes off in the first sheet.





- Doesn't it look fantastic?



Note: you can decorate these sheets as you like: with drawings, collages, paintings or even using the stickers. Use your imagination and surprise your friends! You can also use these techniques for the paper cup or origami box.

Curiosities

Do you want to know more about jelly sweets?

Become a real scientist and discover the curiosities we have for you in the following link:

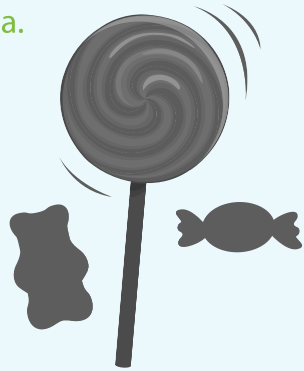
www.science4youtoys.co.uk/super-lab-sweets

Shadows Game

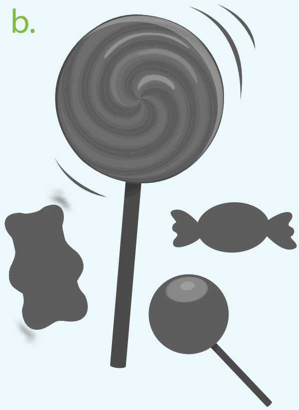
Find out which of the following shadows belongs to the coloured image!

Have fun!

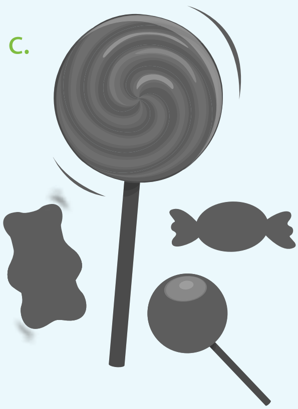
a.



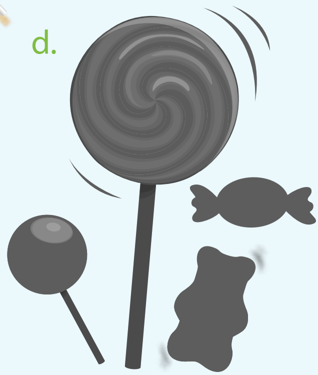
b.



c.



d.

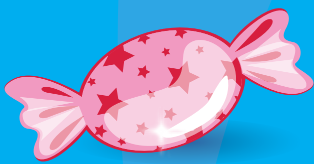


Answer: b.

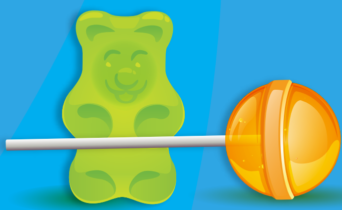
SCRUMPALICIOUS!

SWEET SHOP

IT'S A WONDERLICIOUS WORLD...



SUPER LAB SWEETS



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