The fun-flavoured way to learn science

Experiments for the family to do together

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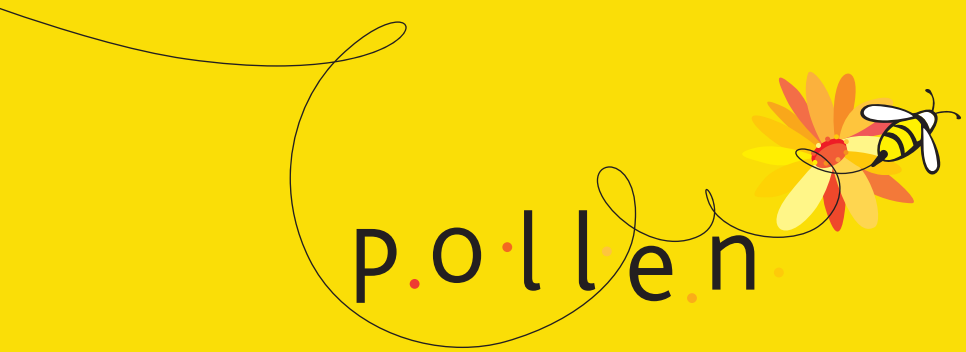
In Portugal, the Pollen project was carried out in Loures schools from 2006 to 2009.



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The role of the family in the children's science education

Introduction

The progress that science has made plays a vital role in the way we live today and its influence increases with each passing day. Science-related issues and their effects on everyday life are topics of discussion in the newspapers and on radio and TV each day. All of us have been involved in discussions about science at some time or another and often need to make decisions which could be better if they were based on scientific knowledge.

One of the developments that has had the greatest impact in recent years is of course the progress made in the way we communicate and access information. The ease with which we can be contacted 24 hours a day in any part of the world as well as the ease of access to information through the internet, which allows us to gather information about any topic in a matter of minutes, no matter where we are, have truly changed our way of life.

There are many other developments which have similar effects on our life-style, for example, the synthetic materials we know as plastics, which have a very wide range of uses; means of transport; advances in agriculture and the food industry which, though frequently controversial, can enable us to feed an ever-growing population which is located mainly in the large cities.

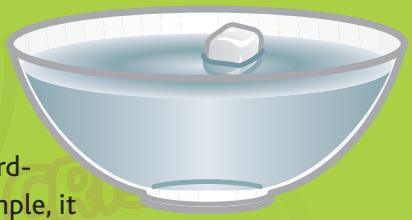
Yet, despite their undeniable benefits, scientific advances can also be the cause of great concern. The negative aspects of scientific and technological development are very often highlighted owing to their extent and effect, and science can have a less positive image for a large number of people. Topics such as genetically-modified food, mad cow disease, toxic waste incineration, environmental issues, drugs which have to be withdrawn from the market because they turn out to have serious side-effects, just to mention a few, are a very real cause of concern for the average person. This can be particularly detrimental as much of the population does not have enough scientific culture to understand the beneficial effects of scientific advances on everyday life, the extent and seriousness of these or other identical situations, or the explanations given by scientists and technicians, and make informed decisions. These decisions may be fairly simple and basic but they can have far-reaching consequences in cases like: "what should I eat?", "what kind of medical treatment should I try?", "should I recycle or not?".

When it comes to children, it is essential that they have a sound scientific base to prepare them for living and working in the XXI century. It is important for them to get a head start, but nowhere more so than in science. Why? Because situations like the ones we have mentioned here can only be overcome when the population as a whole possesses a sound scientific culture. This is certainly one of the roles of the school but science is an area where the family too can play a very important part.

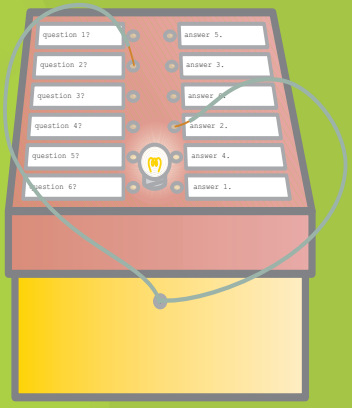
What do we mean when we talk about studying science?

The first question that is asked when it comes to talking about science and technology with children is what these two words actually mean. For many of us, their real meaning may be unclear, they may even generate a certain degree of anxiety as they are associated with abstract theories, difficult concepts, complex machinery... Yet there is no need for concern.

For children in this age group, studying science means examining and understanding a range of situations in their everyday lives and surroundings. Through the study of science, we are helping them to learn about what goes on around them. For instance, when children do experiments to learn about the characteristics and properties of water, they are studying science.



The word technology relates to how science is applied to find a practical solution for a problem, especially to create something which fulfils some human need. Examples of technology abound in our daily lives, ranging from bridge-building to audio and video recording production systems. For children, for example, it is about using their knowledge of electricity to make a game or to light up a model.



Although there is a difference between science and technology, it is not hard to see that the two areas overlap and so it makes sense to talk about studying and researching science and technology.

Science is not just a bunch of facts. Some facts really do belong to science and there is basic information that must be studied and learnt, for instance, it is important to know that water turns into a solid at 0°C and into a gas at 100°C. But science is much more than this. Learning science and understanding how

to work in science means observing, formulating hypotheses, carrying out thorough and methodical tests, interpreting experiments and drawing conclusions. It also involves trial and error: experiment, get it wrong, understand why and try again. It means reformulating our ideas as we gain more knowledge. It is important for children to understand this process and the fact that getting it wrong is not unusual, but that the main thing is to understand why you have got it wrong and then go on to make improvements and learn more. That is how science is meant to be.

There is no mystery about science! The science that you can do with your children is basically about being curious, observing, asking questions about how things work, looking for answers, experimenting and learning.... learning to interpret the experiment results, conclude and correlate. Above all, it is about being aware that science concerns us all and is part and parcel of our day-to-day lives.

How to learn science in the family

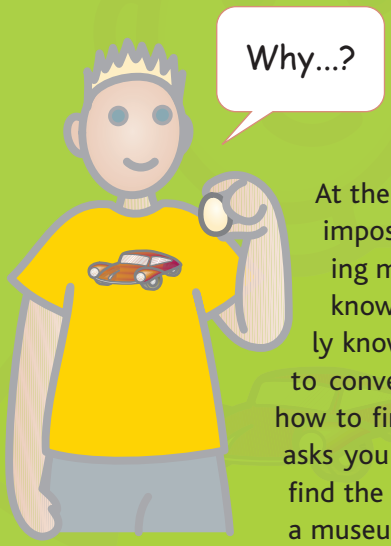
As parents, we must prepare our children for a world that is very different from the one in which we grew up. This is no easy task.

Talking about science and carrying out research and experiments are very important activities for a child's development. You may think so too, but are not sure whether you can help your children to learn science - you might think that you never even studied that much science to begin with or that it was all such a long time ago... But don't worry, you don't need to have a science degree to get good results in science, the most important thing is curiosity and a willingness to learn. What is particularly important is that you:

- Stimulate the children's curiosity;
- Encourage them to ask questions;
- Provide incentive and help them to experiment;
- Talk. It is important to talk a lot because it helps them to think ideas through and to learn to respect other people's ideas and, above all, it helps them to think critically and gain confidence in their problem-solving abilities.

That's a hard question

Stimulate their curiosity and don't worry if you don't know the answer to every question. This isn't important - nobody knows everything! Don't be afraid to say "I don't know" or "I've never thought about it" - there are so many things that we have become so used to seeing that we don't even think about why they are the way they are.



At the current stage of scientific development, it is impossible to know everything - advances are being made on a daily basis. It is more important to know how to find the information than to actually know it by heart. These questions are important to convey this idea to children and to teach them how to find the information they need. When a child asks you "why", you can use books or computers to find the answers or you could even arrange a visit to a museum. You should be aware that in order to find information, it is vital to know exactly what kind of information you're looking for. It is essential that the children understand that the information is available and that they start learning how to use all the available information resources as early as possible.

The most important thing is to learn how to look for information, how to select and interpret it, to learn how to interpret experiment results and, above all, to stimulate curiosity. And all of this you can do together as a family.

Doing experiments

As far as the experiments themselves are concerned, let the children do the experimenting. Let them touch, handle and measure, just be there to help them all the time, it is a joint project after all, but let them do it themselves.

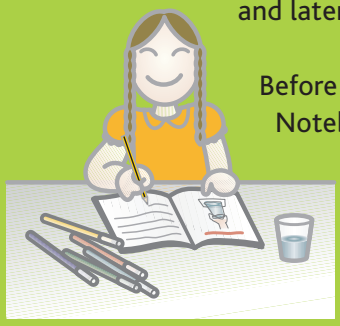
Don't complicate things and don't try to do too much the first few times. One experiment at a time, a well-organized, well-interpreted experiment, repeated in order to make improvements, is more important than doing lots of experiments which are not explored in sufficient detail.

Take your time, it's best not to do so much but give the children the chance to explore the situations fully. It is better to do a little and deal with each theme in depth than to skip from topic to topic without ever actually benefiting fully from what each one has to offer. Remember too that although learning is important, what is more important is the exploring, questioning, experimenting and spending time together as a family.

In short, start with simple things and don't expect to be able to do a lot or to feel at ease the first few times - it requires time and experience. Don't lose heart... persevere!

The experiments notebook

It is a good idea to keep records of everything you do; recording data is an important part of scientific work. These records allow us to repeat, improve and later on recall what we did.



Before you begin, get a notebook – the Experiments Notebook – where you will write down and draw what you do, the conclusions you reach, ideas for new research... You should always have this notebook with you when you do experiments.

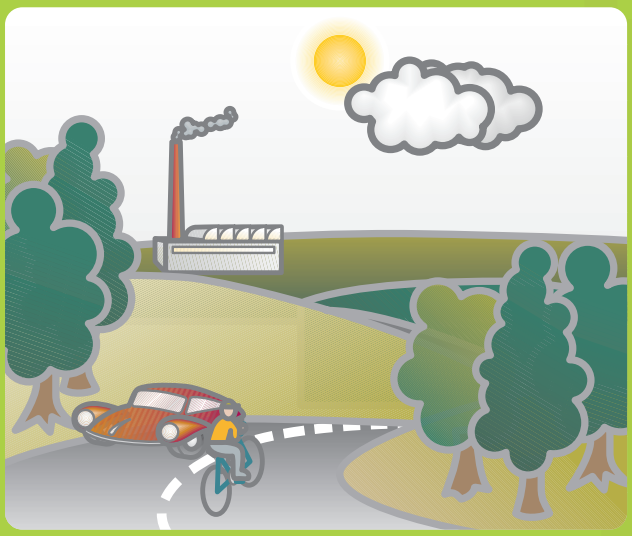
Some final pointers

Don't forget that everyone has their own way of learning. When a child works at its own pace and in its own way, everything seems easier. Give them all the time they need, try to see how it would work better and, above all, talk to them and have fun because it is also very important to enjoy yourselves.

Never forget that any question beginning with "Why...?" is a good way to start doing experiments because questions stimulate the brain to look for answers, to think, discover, make connections.

Remember that science is part of our everyday life and that everyday life provides numerous opportunities to ask questions and experiment. What is particularly good is that many of these experiments do not require any special equipment and cost practically nothing.

Your enthusiasm and encouragement can be decisive and you will soon discover that as you learn more you develop a more positive attitude to science, which you can then transmit to your children.



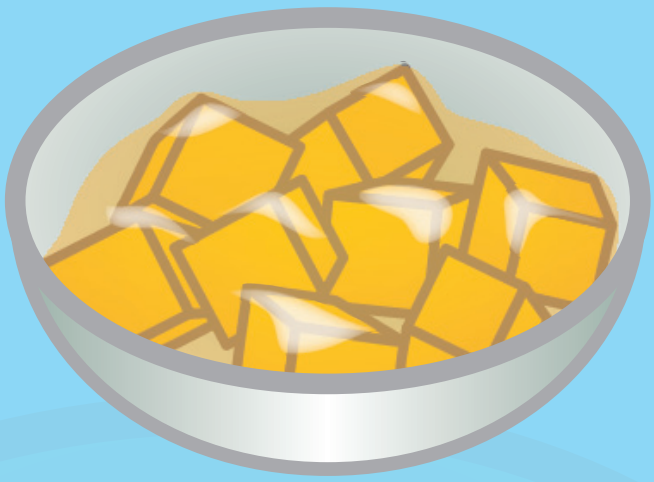
The kitchen as a laboratory

Science is part and parcel of everyday life. Have you ever realised that your kitchen is actually a miniature laboratory? Every day we bring about tasty chemical reactions, appetising physical phenomena and delicious biological processes happen!

Yes indeed... and in the activities we are going to suggest, we will focus mainly on food and the activities we do in the kitchen.

This booklet suggests some simple activities that you can do with your children. But don't stop here, go on... with this theme and others too. There is a wide variety of books in libraries and bookshops that you can use.

The water in our food

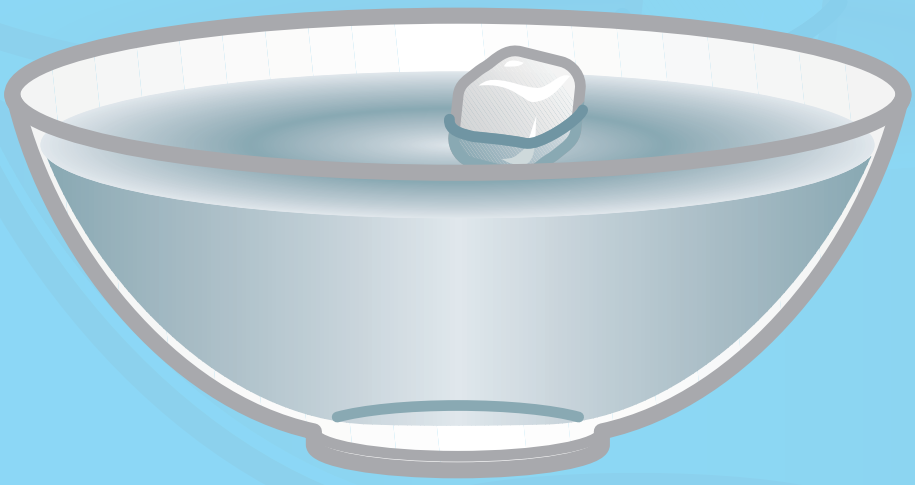


In this set of experiments the central topic will be water, particularly the water in our food. Although it may not often seem so, water is an important part of all living beings, animals and plants, and its presence in certain foods must be taken into account in the cooking process.

- Why does an ice cube float?
- Why do we water plants?
- Do vegetables contain water?
- Why do we have to prick holes in potatoes to roast them in the microwave?
- Why does corn "pop" when we make popcorn?
- What makes meringues rise?

Why does an ice cube float?

Have you ever noticed that when you put an ice cube into a container with water, the ice cube floats on the surface?



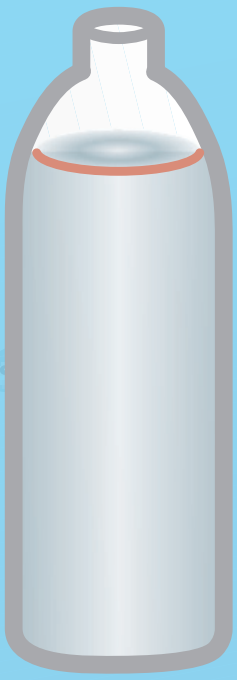
This is because water gets bigger when it freezes. There is an experiment you can do to prove this.

YOU WILL NEED:

- one 2.5 dl water bottle
- one marker pen
- freezer

PROCEDURE:

1. Use the marker pen to draw a line on the bottle to show the water level.



2. Stand the uncovered bottle straight up in the freezer and wait until the water has completely frozen.

3. Check to see what has happened.

RESULT:

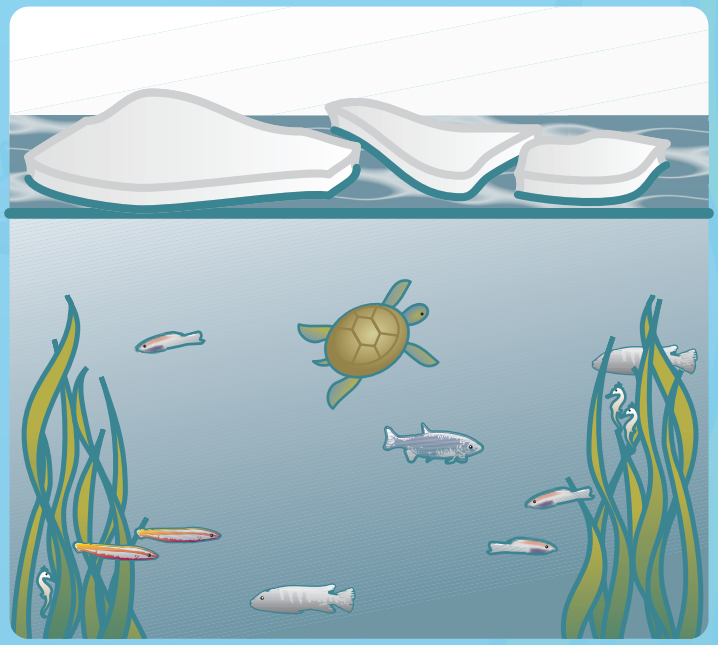
The ice is above the line you drew, isn't it?

EXPLANATION:

As with all substances, water contracts when it begins to cool. However, unlike other substances, water stops contracting when the temperature reaches 4°C and, if the cooling continues, it begins to expand. As a result, water in its solid state is lighter than the same water in a liquid state. In other words, water is less dense in the solid state than in the liquid state.

Water and Life

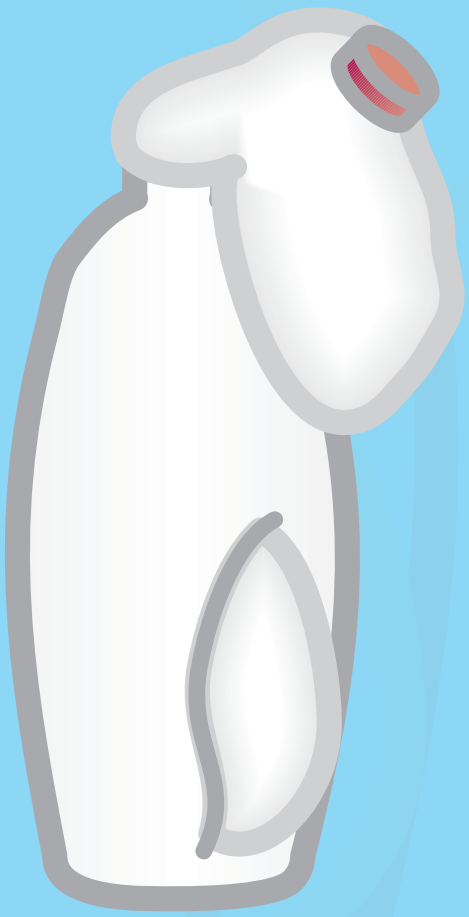
This very particular property of water has significant consequences for aquatic life in colder regions. If water contracted when it freezes, the heavy blocks of ice that form over our oceans and lakes would sink. The oceans and lakes would freeze over completely and the organisms that live in them, like animals and even algae, would die.



As the ice is less dense than the liquid water, these large masses of ice float, insulating the water below from the cold air and preventing it from freezing.

USEFUL TIP:

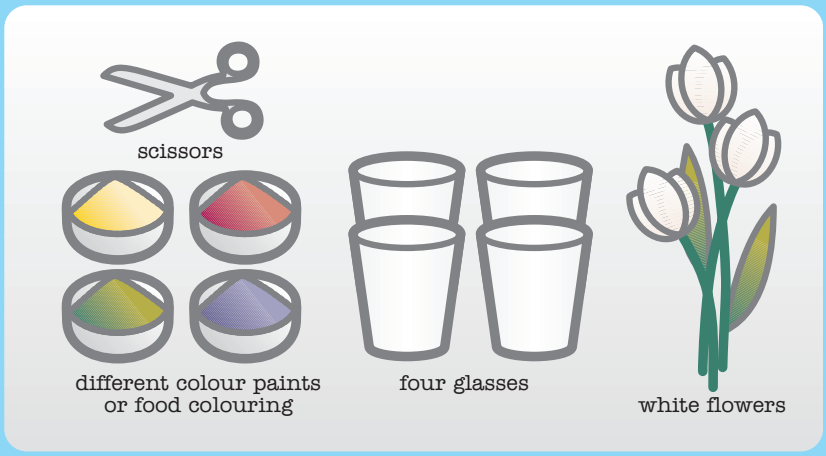
If you want a really cold bottle of water, put it in the fridge. Never put it in the freezer because, if you forget about it and leave it there too long, the water will freeze and the bottle might burst.



Why do we water plants?

Plants need water to live just as you do. Put some flowers into a container with coloured water, then watch what happens and draw your own conclusions.

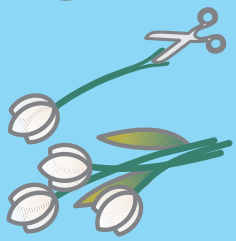
YOU WILL NEED:



PROCEDURE:

1. Pour some of the colouring or paint into each glass. Then add water.

2. Cut the stem crossways. Then cut several centimetres along the length of the bottom part of one of the stems.



3. Put one flower into each glass of coloured water. Put each of the two halves of the cut stem into a different glass.

4. Place the flowers in a warm room. You will notice that they begin to change colour very slowly.

EXPLANATION:

When we put a flower into a vase of water, it "drinks" the water from the vase and this water moves up along the stem into the leaves and flowers.
In the same way, plants in the ground get their food by using their roots to absorb the water from the soil, which contains other nutrients that are essential for the plant to grow.

Do vegetables contain water?

In order for plants to live, you have to water them because they feed off water and the substances that dissolve into it from the soil where they are planted. Did it ever occur to you that if plants feed off water, they must contain water? Here's a good way to find out for sure.

YOU WILL NEED:

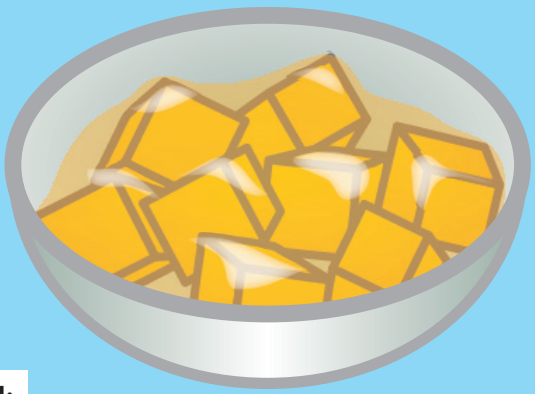
- 1 bowl
- Cubes of pumpkin (or strawberries, carrot or potato)
- Sugar

PROCEDURE:

1. Put the pumpkin cubes into a bowl.
2. Add sugar and mix well until all the cubes are covered in sugar.
3. Watch and see what happens.

RESULT:

Water begins to seep out and after a few hours the pumpkin cubes will be covered in water.



EXPLANATION:

The sugar helps to draw the water out of the vegetables. What you are seeing is a process which scientists call osmosis.

Vegetables, in this case pumpkins, contain water with some dissolved substances. Outside the pumpkin cubes, there is a lot of sugar which is dissolved by the water that seeps out of the pumpkin and creates a sugar-water mixture. This makes the water inside the pumpkin seep out in order to make the liquids inside and outside it as similar as possible. As there is a lot of sugar outside, a lot of water needs to seep out.

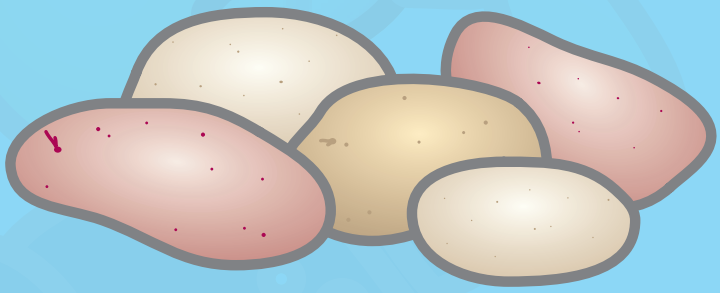
Water and Life

Just as with plants, the human body contains water. The percentage varies according to age but on average is around 65%. We lose about 2.5 litres each day of normal activity so we have to replace this to maintain our organic balance. We should drink 1.5 litres of water every day. The rest is replaced with the water we take in with our food.

Why do we have to prick holes in potatoes to bake them in the microwave?

2008 was declared the "International Year of the Potato" by the UN (Resolution 60/191 of the United Nations General Assembly, of 22 December 2005).

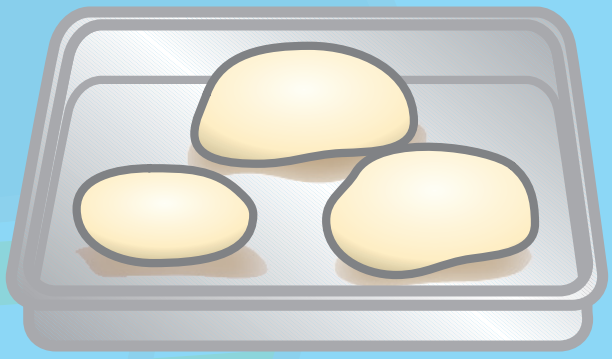
http://www.potato2008.org



The potato is eaten to some extent or another all over the world. The aim of the "International Year of the Potato" was to draw attention to the importance of the potato in solving global problems like hunger, poverty and environmental threats.

Baking potatoes in the microwave oven is a very quick and easy way to cook a few tasty potatoes.

But because safety is always important and because we want the potatoes whole, you should prick them several times with a fork or the tip of a knife before you put them into the microwave.

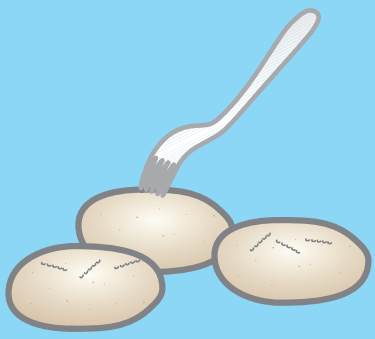


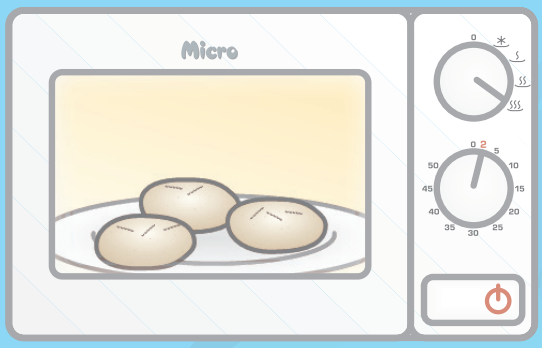
YOU WILL NEED:

- potatoes
- 1 fork
- 1 dish
- paper towel
- microwave oven

PROCEDURE:

1. Choose potatoes which are more or less the same size. They should not be very big. Wash them well and dry them with the paper towel. Prick them several times with a fork.





2. Put the potatoes on a plate, making sure to keep them well apart, and place the plate into the microwave at maximum power for two minutes. Turn them over and put them back in for another two minutes. Check to see if they are cooked. If they are not, put them back to cook for a little longer.

3. Cut them open and season to taste.

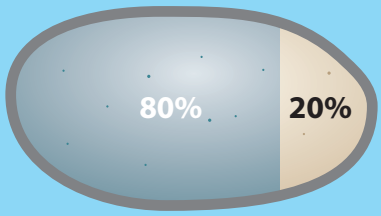
Have you considered why it is necessary to prick the potatoes with the fork before putting them in the microwave?

EXPLANATION:

Look at the average composition of a potato:

COMPOSITION	
Water	80%
Protein	2%
Lipids	0.1%
Carbohydrates (starch – 15 %)	17%
Other	0.9%

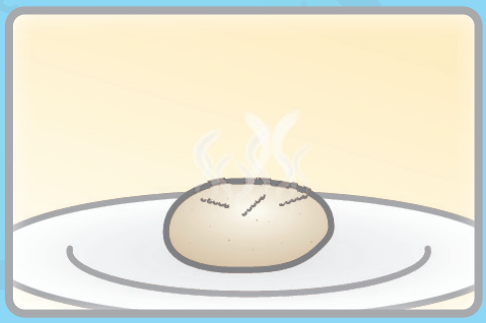
Note that 80% of a potato is water, in other words, if you divided the weight of the potato into five sections, approximately, four of them would be water.



Have you ever noticed what happens when you boil water? It gives off steam, doesn't it?

When we put a lid on a saucepan of boiling water, the steam puts pressure on the lid and it begins to lift off. Something similar happens with potatoes. When we cook them in the microwave, the water inside the potato heats up and part of it turns into steam. The water increases in volume and puts pressure on the skin and "pushes it out". If the steam has no escape vent (the holes you made with the fork), the skin bursts and everything gets messy - it isn't safe either. We can get the best results by pricking holes in the skin.

Bake some more potatoes and watch the steam coming out of the holes you made in the skin.



Why does corn "pop" when we make popcorn?

Do you like popcorn? Do you know how to make it? You get corn kernels and heat them up. Each kernel of corn "bursts" and out pops a piece of popcorn. Would you like to make some?

YOU WILL NEED:

- 1 bag of popcorn kernels

- 1 container for making popcorn in the microwave oven
- microwave oven

PROCEDURE:

1. Put three tablespoons of corn kernels into the container for making popcorn and place it in the microwave for around 3 minutes.

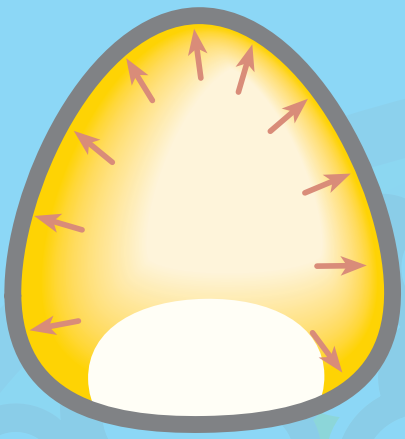
2. Watch and listen carefully. Write down everything you notice.

3. Take out the container and open it carefully. Put the popcorn into one container and the kernels that did not "burst" into another.

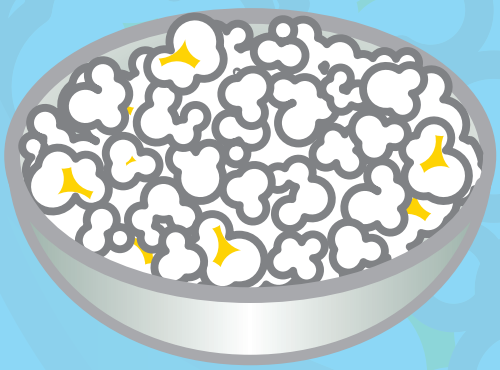
Let's see what happens when we make popcorn.

EXPLANATION:

The kernels we use to make popcorn are mostly composed of starch and water. When the kernels get hot, whether in the cooker or in the microwave oven, the water inside the kernel turns into steam. The steam takes up more space, the pressure rises and the steam "pushes" out the outer layer of the kernel – the pericarp.



The outer hull can remain intact up to an inner pressure level of around 9 times the atmospheric pressure, then it "explodes".
During this process, the steam also makes the starch expand and form the white part that we eat.



The steam is released and we can see it when we open the closed container (for instance, when we use microwave popcorn bags). We have to be very careful when we do this or we could get burnt.

Some kernels don't "burst". This happens because the hull is cracked and the steam escapes through the cracks or because the kernels are too dry. In this case, the water inside does not reach a high enough pressure to burst the hull.

What makes meringues rise?

Many people believe that what causes a mixture to rise is the air that is introduced into it, which dilates when heated and causes the increase in volume, like a soufflé for example. But this isn't quite right...

We can prove this by microwave cooking meringues. The egg whites are not beaten so no air is introduced but what we get is a firm dough which when it's cooked, gives us very large airy meringues.

Do you want to make some quick and very sweet meringues?

1 - 2 - 3 meringue

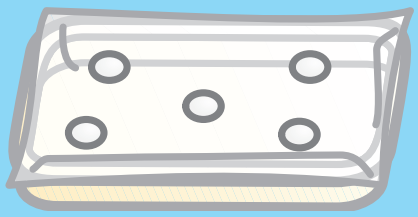
YOU WILL NEED:

- 1 egg white
- 300g icing sugar
- 1 bowl
- 1 fork
- 1 spoon
- 1 sieve
- 1 plate or serving dish
- paper towel
- microwave

PROCEDURE:

1. Sieve the icing sugar to get rid of any lumps.
2. Beat the egg white very lightly with a fork.
3. Add the sugar to the egg white and mix until they have formed a dough (almost like plasticine).

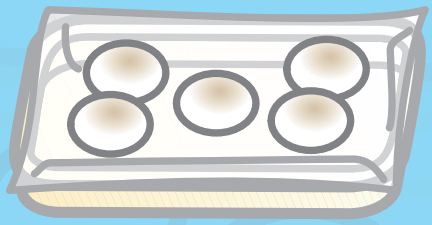
4. Make small balls a little smaller than a walnut.



5. Cover a microwave-safe plate or serving dish with a sheet of paper towel. Place the little balls well apart on the paper. You should not put more than three on a normal flat plate.

6. Place it in the microwave for about 1 minute (it depends on the power of the microwave, you have to experiment to find the right time. If you leave them in too long they will burn).

7. See how big they have got.

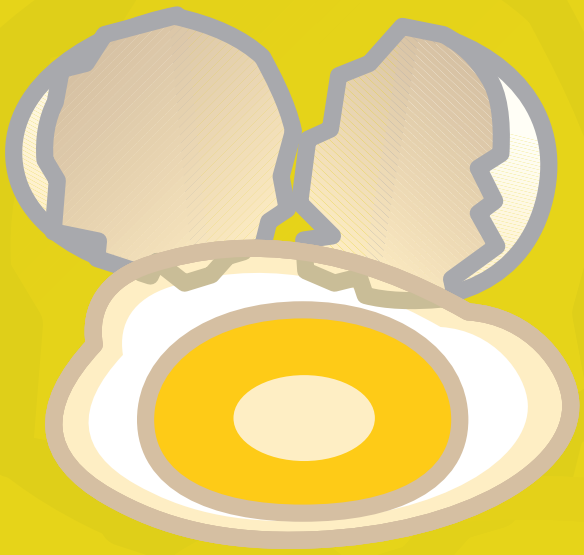


EXPLANATION:

Water is the "culprit" yet again. But you're thinking that you didn't add any water, right? No, you didn't, but you did add egg white and it has a lot of water. It was the water in the egg white that evaporated and made the meringues rise so much.

N.B.
You can use a smaller quantity, put just a little egg white and keep adding sugar until you obtain the consistency you want.

Eggsperiments

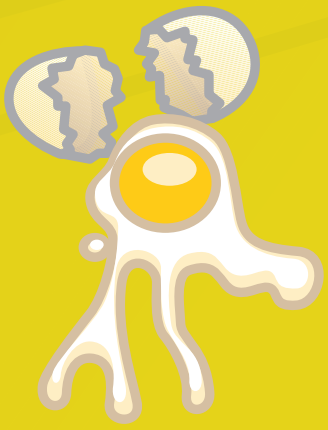


The next set of experiments is going to teach us a little more about eggs. They seem so simple, don't they, but there's a lot to be said about them. Quite a lot in fact...

- Are eggs really fragile?
- Can you take the shell off an egg without breaking it?
- Fresh egg? Does it float or not?
- Raw egg, cooked egg... Aren't they different! I wonder why?
- How can you tell the difference between a raw egg and a cooked egg?
- Let's dye eggs for Easter.
- Can you put an egg into a bottle without pushing it?

Are eggs really fragile?

Have you ever noticed how easy eggs are to break? You always have to handle them really carefully, right?



Have you ever noticed that eggs come in special protective boxes at the grocer's and the supermarkets?

The hen has to hatch the eggs for the chicks to be born. If eggs really were very fragile, there would have been no chickens or other animals that hatch from eggs for a very long time now.

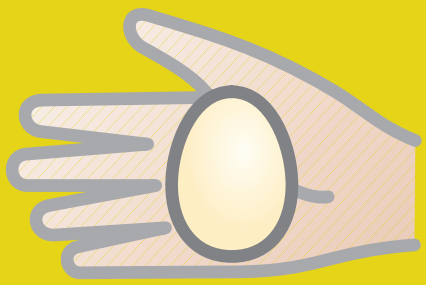
Let's test the strength of an egg.

YOU WILL NEED:

- 1 egg

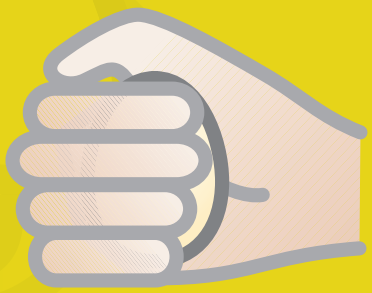
PROCEDURE:

1. Place an egg in the palm of your hand (but first take off any rings you are wearing).



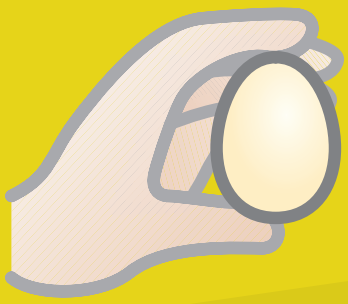
If you like, you can put the egg into a small plastic bag. Sometimes an egg can have small cracks that you can't see and if that happens, it might break. If it is in a bag, it won't get all over the table or your hand.

2. Close your hand and squeeze the egg as hard as you can.



Were you able to break it? See how strong the egg is...

3. You could also try squeezing the egg from the top and the bottom at the same time.



EXPLANATION:

The egg gets its strength from its shape. If you squeeze it (or squeeze the top and bottom) evenly, the pressure is distributed all round the entire shell and this makes the egg very strong. However, if you hit the egg or squeeze it unevenly, it will break easily.

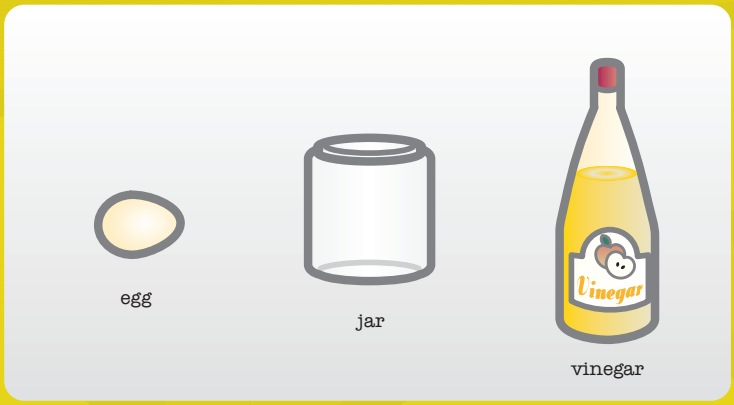
Now you see why the instructions said to take off your ring. If the ring came into contact with the egg, the pressure in that spot would be greater and the egg would break.

Architects and engineers have used structures with similar forms to that of an egg throughout the centuries to support heavy weights, like the arches you see in churches, palaces, bridges and other buildings. The shape of the arch distributes the pressure and the materials are able to resist the pressure and bear great weights.

Can you take the shell off an egg without breaking it?

It seems like an impossible task. But in this case, as in many others, science can help. Try this experiment.

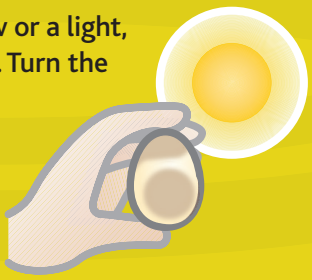
YOU WILL NEED:



PROCEDURE:

1. Carefully place the egg inside the jar.
2. Pour enough vinegar into the jar to cover the egg completely.
3. Wait 2 days.
   During this time, you should look at the egg often and record your observations.
   Open the jar from time to time to let out the gas that forms.
4. Take the egg out of the jar very carefully and wash it well. If there's still shell on it, put it back into the jar and change the vinegar.
5. When all the shell has come off, wash the egg well.

6. If you look at the egg near a window or a light, you'll be able to see the yolk inside. Turn the egg and you'll see it move.



7. Put the egg into a jar of water and keep it in the fridge. Then you can observe it for another few days.

EXPLANATION:

When you steep the egg in vinegar, gas bubbles begin to form around the egg. The eggshell becomes thinner and after a few days will disappear completely.

The eggshell has a substance called calcium carbonate, which is what makes it hard. When we add vinegar (an acid) to the egg, a chemical reaction takes place between the vinegar and the calcium carbonate and a gas is formed (carbon dioxide). The eggshell disappears because it is used up during the reaction.

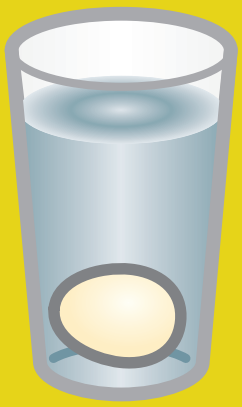
Did you know that chalk is also made of calcium carbonate and if you put it in vinegar it will disappear?

If you looked really carefully, you might even have noticed that the egg has expanded, in other words it is bigger than it was before you put it into the vinegar.
The membrane around the egg has holes which are so tiny that you cannot even see them with a magnifying glass, but they allow water to pass through. While the egg was in the vinegar and the water, some of the vinegar and water passed into the egg so it got bigger that it had been at the beginning.

Fresh egg? Does it float or not?

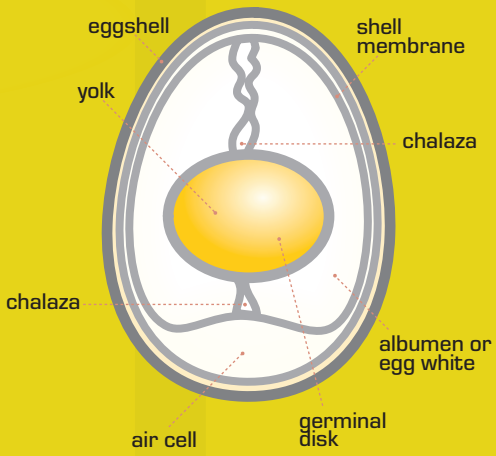
Do you want to learn a trick to surprise your family or friends and teach them some science?

Did you know that if you have eggs at home and you want to know if they are fresh, all you have to do is put them into a tall glass of water? If the egg sinks to the bottom, it's fresh; if it floats, you had better throw it out as it must be very old; if it stays in the middle of the glass it still has a few days left so it's safe to eat.



fresh egg

Do you know why this happens? Let's begin by looking at the diagram of the inside of an egg:



Note that the egg has a pocket of air called an air cell. The shell has pores, which are very tiny holes that leave air in and out and also let out water which evaporates over time.

When the water evaporates, more air moves in to replace it. As air weighs less than water, the egg becomes lighter, if the egg is fresh the air cell is small and the egg is heavy so it sinks to the bottom. The older the egg, the larger the air cell and the lighter the egg, so it will eventually become lighter than the same volume of water, in other words it will be less dense than water so it rises to the surface.

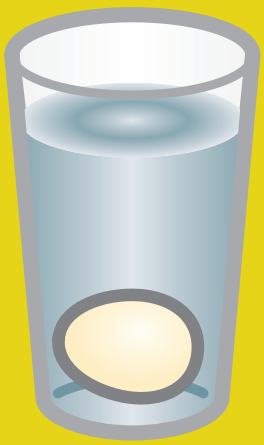
Do you want to play a joke on your friends and family?

YOU WILL NEED:

- 2 eggs
- salt
- 2 tall glasses
- 1 teaspoon

PROCEDURE:

1. Pour the same amount of water into the two glasses.
2. Put eight spoons of fine salt into one of the glasses and mix it well. It may turn a whitish colour but if you wait a while this will disappear and you won't even notice that there's salt in it.
3. Explain to your friend what you have just learnt and ask him or her to do an experiment with you to see whether the eggs are fresh.



water

salt and water

4. Give your friend an egg and the glass that has only water in it and ask him or her to put it into the glass. Do the same with your own. You'll see that his or her egg will sink and yours will float.

5. Take the eggs out with a spoon and swap them. Put them into the glasses again. By now your friend will be amazed. All the eggs he or she puts in the glass are fresh, but when you do it they are old... that's odd... Now you can explain what is going on.

EXPLANATION:

When you pour the salt into the water it dissolves and disappears. It is well mixed into the water. This mixture is heavier than water - heavy enough for the egg to weigh less than the same volume of water and salt (in other words, the egg is less dense than the salty water), so it floats.

Raw egg, cooked egg... Aren't they different? I wonder why

Now that you've done the previous experiments, you know a lot more about eggs and you've seen what a raw egg looks like too. And of course you must have already eaten boiled eggs and seen what they're like.

Let's cook some eggs then!

YOU WILL NEED:

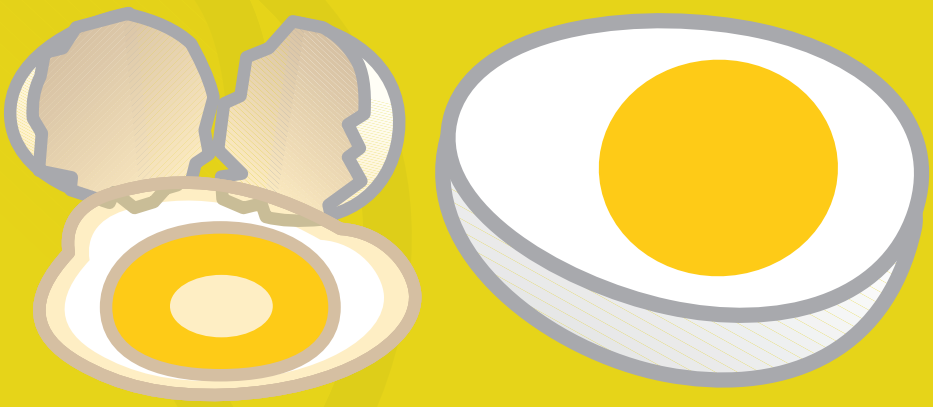
- eggs
- 1 saucepan

PROCEDURE:

1. Put the eggs you want to cook into a saucepan in just one layer so that they won't break.
2. Pour in enough water to cover the eggs to a depth of two fingers above the top of the eggs and ask an adult to put them on the cooker.
3. As soon as they start to boil, ask an adult to turn down the heat and, using a watch to tell the time, cook them for 10 minutes.
4. Ask an adult to take the eggs off the burner and run cold water over them.
5. When they are cold, peel off the shell and cut the egg in half, observe carefully the differences between a raw egg and a cooked egg and note them down.

RESULT:

The egg that was initially liquid has become solid and the colour has changed.



EXPLANATION:

Boiled eggs are different from raw eggs because the substances that form the egg, mainly proteins, undergo changes caused by the heat. They bind together, forming a kind of net, while the yolk and white, which had been liquid, turned solid.

The colour has changed too, the egg white was almost transparent before but now it is completely white. This is because the light was able to pass through it before it was boiled but it can no longer do this because of the net which has formed.

How can you tell a raw egg from a cooked egg?

Imagine that you are given a carton of eggs in which half of the eggs are cooked and half are not.

Which ones are cooked and which ones are raw?

This is a good question but one which can be hard to answer. Imagine if they told you that you can only take them out of the carton and put them on the table, and that you have to discover which is which without taking them off the table and, of course, without breaking the shell.

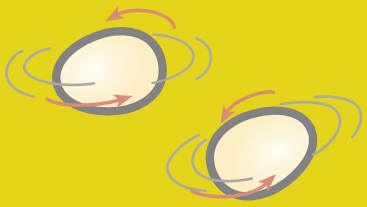
But science can help you to solve this problem.

YOU WILL NEED:

- 1 raw egg
- 1 cooked egg

PROCEDURE:

1. Spin each egg around the table.



2. While the egg is spinning, touch it with your finger to stop it but take your finger away immediately.

3. If the egg stays still, it is cooked, but if it continues to spin, it is raw.

EXPLANATION:

The cooked egg is completely solid while the raw egg is liquid inside. When you stop it and let it go again, the raw egg keeps on spinning because the liquid inside keeps moving so the egg keeps moving too. If the egg is cooked, this does not happen and when you touch it with your finger, it stops and stays still.

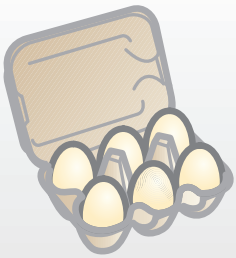
If you experiment several times you will see that you don't always need to stop them to know which is raw and which is cooked. Cooked eggs spin much better and more easily than raw eggs, because the inside of the raw eggs is liquid and moves when we spin the egg.

Let's dye eggs for Easter

Painting and decorating eggs is a very old Easter tradition. You are going to learn a very easy way to do it using onion skins as colouring.

If you want darker eggs, choose onions with a darker skin. If you want lighter eggs, use lighter onions. The final colour also depends on the amount of onion skin you use.

YOU WILL NEED:



6 eggs

3 onions

saucepan

PROCEDURE:

1. Peel off the onion skin (only the dry dark part, which seems like paper) and put it in a saucepan with about half a litre of water.

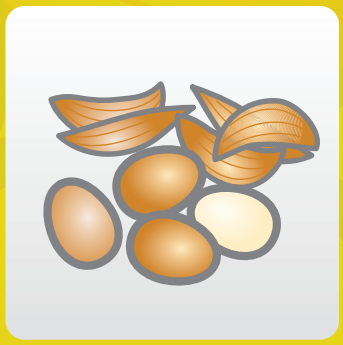
2. Ask an adult to help you put it on the cooker and let it boil for approximately 20 minutes. The water should have changed colour.

3. Let the water cool with the skins still inside.

4. Take out the onion skins.

5. Ask an adult for help again. Carefully put the eggs into the saucepan and put it on the cooker. When the water starts to boil, turn it down and let it simmer for 10 minutes.

6. Take the eggs out of the water and let them cool down.



Do you know why the eggs changed colour?

EXPLANATION:

In nature, there are living beings and materials that have the most varied colours. This is because they have certain substances which give them these colours.

Until around 150 years ago, people needed the coloured substances they got from animals, plants and minerals to colour fabrics and other items and also

for painting. Some colours, like blue and purple, were very hard to get, which is why they were only used by royalty.

Science knowledge today allows us to create colourful substances that will make our surroundings more colourful and more pleasant.

The onion skin has a substance called quercetin which gives it its colour. When you boil the onion skins in water, some of this substance passes into the water. Then, when the eggs are cooked in the coloured water, it will colour the eggshells.

Quercetin also has medicinal properties. Some people even use onion skin tea (to which they add lemon and sugar or honey) to help cure throat problems like hoarseness and inflammation.

Can you put an egg into a bottle without pushing it?

Science can help you...

YOU WILL NEED:

- 1 boiled shelled egg
- 1 bottle with a slightly narrower opening than an egg (it can't be a water bottle or a wine bottle because the opening is too narrow).
- boiling water

PROCEDURE:

1. With the help of an adult, pour the boiling water into the bottle and leave it for 5 minutes (time it using a watch).

2. Ask your adult helper to pour out the water. Then very quickly place the egg on top of the bottle, completely blocking the opening. Keep your eyes peeled for what happens next.

RESULT:

After a while the egg will slide into the bottle without having to be pushed.

EXPLANATION:

Hot air takes up more room than cold air. The bottle was hot so the air that went in when you poured out the water got hot too. As it cools, it takes up less space. When the egg blocked any air from getting in, it was sucked into the bottle.

Other experiments

Here's another set of experiments that will help you to learn a little more about food and the processes that take place in the kitchen.

- Cake-in-the-mug
- How does baking powder work?
- Can you find out which foods have starch in them?
- What's this powder?
- Try the apples... Find the differences

Cake-in-the-mug

What if you got a sudden longing for a cake... it's quick, easy and very tasty! Make a cake in a mug.

Have you ever wondered how much science in involved in making a cake? There really is quite a lot of it!

Let's get down to work!

YOU WILL NEED:

4 tablespoons
of self-raising flour

4 tablespoons
of sugar

2 tablespoons of cocoa
(or chocolate powder)

1 egg

2 tablespoons of oil

2 tablespoons of milk

PROCEDURE:

1. Mix the flour, sugar and cocoa well together in a microwave-safe bowl.

2. Add the egg, the oil and the milk and mix well with a fork. Put the mixture into the microwave at maximum power for 2 minutes. If it is still not cooked, put it back in for a little while longer.

3. Try adding coconut, chocolate chips, dried fruit, etc...

RESULT:

If you watched carefully, you would have seen that after you mixed all the ingredients together, there was a thick brown liquid mass in the mug. It didn't look much like a cake, did it? But after you cook it, it does look like a cake.

It has risen... so now the cake takes up more room than the mixture did. And it smells good, right? Be careful, though, because it's hot... ask an adult for help to take it out and wait a little until it cools...

It seemed like smoke was coming out of the cake, didn't it? Do you know what this is? It's steam. Most of the water from the eggs and the milk turned into steam when it was heated and then escaped into the air...

But let's go back to the cake and try to understand what happened.

EXPLANATION:

How did the cake rise?

One of the things that causes this is a raising agent - the baking powder. Baking powder is made up of substances that turn into something else when they are heated - we call this a chemical reaction. One of the substances formed is a gas [look at the experiment "How does baking powder work?"]. The gas bubbles that formed in the mixture in the mug are what give the cake its soft spongy texture.

How did the cake harden?

You started off with a thick liquid mixture which changed into a soft spongy mass after you cooked it. This is because the heat made the substances that make up the egg (particularly the proteins) change and bind together, forming a kind of net. Then the egg, which was liquid, hardens (See the experiment "Raw egg, cooked egg" Aren't they different! – I wonder why?). The starch in the flour also changes and helps make the cake solidify.

In summary, when the cake was put into the microwave, the cake mixture heated and the baking powder gave off a gas which changed the mixture into foam. The heat also caused changes to the starch and the proteins and this caused the foam to solidify.

While you eat...

You might be wondering what the other ingredients are for: the milk and the oil make the cake softer and moister. The cocoa adds the chocolate flavour. And the sugar... well, you already know that it makes it sweeter... but it also makes the cake softer and moister.

Tasted good, didn't it?

How does baking powder work?

Do you know why we add baking powder to our cakes - it's so that they will rise and become softer. But what exactly is baking powder? The raising agent for cakes is a chemical raising agent. It is composed of a base (sodium bicarbonate) and an acid which will interact (the chemical terminology is "react") in the presence of water and create new chemicals, the most important of which is carbon dioxide (a gas).

Why don't you try the following experiment to get an idea of the amount of carbon dioxide that is produced?

YOU WILL NEED:

- baking powder
- hot water
- a glove
- 1 glass
- 1 teaspoon

PROCEDURE:

1. Pour the hot water into the glass.
2. Put two or three teaspoons of baking powder into a plastic glove.
3. Slide the glove onto the glass and, holding it tightly, drop the baking powder into the water. You'll see that it immediately produces enough gas to fill up the glove.

4. **Repeat the experiment with cold water and you will notice that very little gas is released. The reaction is much faster with hot water.**

EXPLANATION:

When you mix the baking powder with the liquid, a chemical reaction takes place between the bicarbonate and the acid and new chemicals are formed. This reaction takes place more quickly in warmer conditions. The most important feature of this reaction is the formation of carbon dioxide – a gas that makes millions of little bubbles that help make cakes lighter. It is this gas that makes the cake rise and become spongy.

Do you see now why cakes should be put into the oven very quickly? The gas starts to form and escape, but very slowly. In the oven, gas is formed rapidly, at the same time, the mixture coagulates and the cake rises and becomes soft.

Can you find out which foods have starch in them?

Discover the starch in different foods using the iodine test.

YOU WILL NEED:

- potato
- apple
- carrot
- bread
- tincture of iodine
- 1 plate

PROCEDURE:

1. Put the different pieces of food on the plate.
2. Sprinkle a few drops of tincture of iodine on each one.
3. Watch what happens. If the tincture of iodine stays its original brown colour, there is no starch in the food. If it changes to blue, the food has starch in it.

4. Record your observations and draw your own conclusions.

5. Repeat the experiment with other types of food.

EXPLANATION:

When iodine and starch come together, the iodine binds to the starch and changes from brown to a kind of blue that is almost black.

If a food has starch and you sprinkle some drops of tincture of iodine on it, the iodine binds to the starch in the food and changes colour. The iodine is brown and the stain you see on the food will turn blue. If there is no starch in the food, the colour of the iodine will not change.

Starch is the plant's nutrient reserve, in other words, it is where the plant stores nutrients it might need if there is a lack of food. These nutrients can also be useful for us. Starchy foods are very nutritional and a good source of energy and they should be part of our diet.

What's this powder?

When I was tidying out my pantry, I put the corn starch, the sugar, the baking soda and some plaster of Paris that I found there into some jars. I was in such a hurry that I forgot to put on the labels. All the jars were the same so now I don't know what is in each one.

I did some research and discovered that each of these powders behaves differently when it is mixed with water, vinegar or tincture of iodine. I was able to find out what was in each jar by doing a few tests.

Would you like to do some tests to identify these powders?

Let's do it!

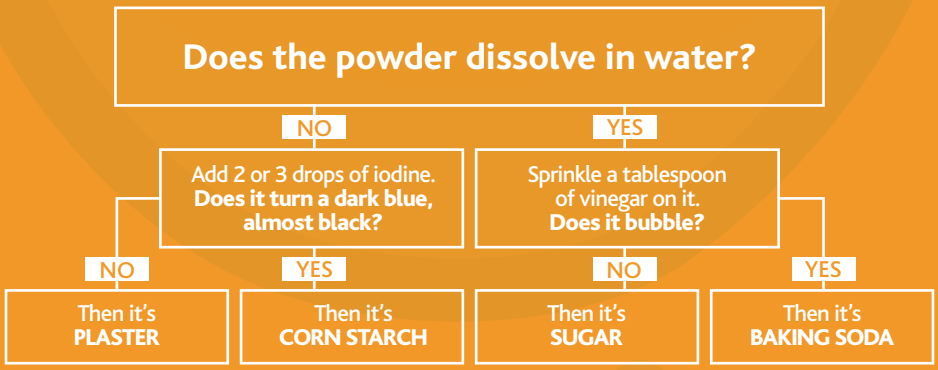
YOU WILL NEED:

- 4 unlabelled jars with white powders – corn starch, plaster, sugar and sodium bicarbonate (ask an adult to fill them but not to tell you what is in each one. He or she should put a letter on the jar so that they will know what is in it).

- water
- vinegar
- tincture of iodine
- 4 glasses
- 2 tablespoons
- 4 teaspoons
- markers or labels

PROCEDURE:

1. Take a half teaspoon of the powder you want to identify and put it into one of the glasses.
2. Write the letter from the jar from where you took the powder on the glass.
3. Add 5 tablespoons of water and mix well.
4. Follow the instructions below and try to identify each of the white powders.

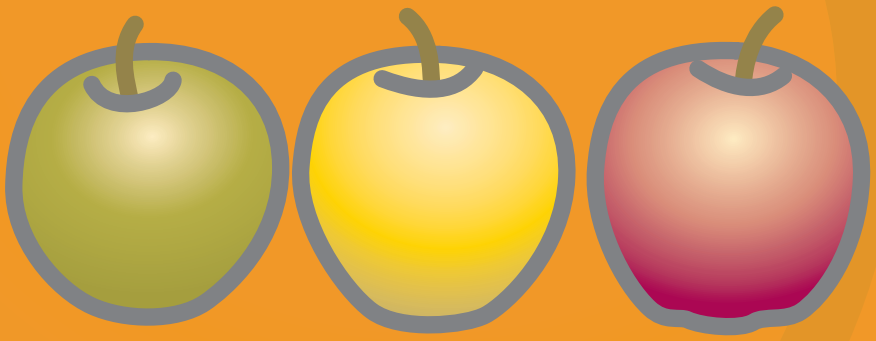


POWDER	Does it dissolve in water?	Does it turn blue if you add iodine? (fill in if the powder does not dissolve in water)	Does it bubble if you add vinegar? (fill in if the powder does not dissolve in water)	I found out what the powder is:
A				
B				
C				
D				

EXPLANATION:

Did you know that sometimes tests have to be done to find out what a substance is or to discover how many substances there are in a mixture? Now you know how it's done. We can identify substances by testing them because materials behave in a characteristic manner when they are mixed with other substances. Exactly like you did just now...

Try the apples...
Find the differences



There are many different types of apples. Use your five senses (touch, smell, sight, taste and hearing) to discover the differences between them.

Experiment with three apples like the ones in the table below and write in your findings for each type of apple.

Variety	Touch		Smell		Sight	Taste		Hearning	
	Smooth	Rough	Strong smell	Weak smell	(colour)	Sweet	Sour	Loud Crunch	Low Crunch
Golden									
Starking									
Granny Smith									