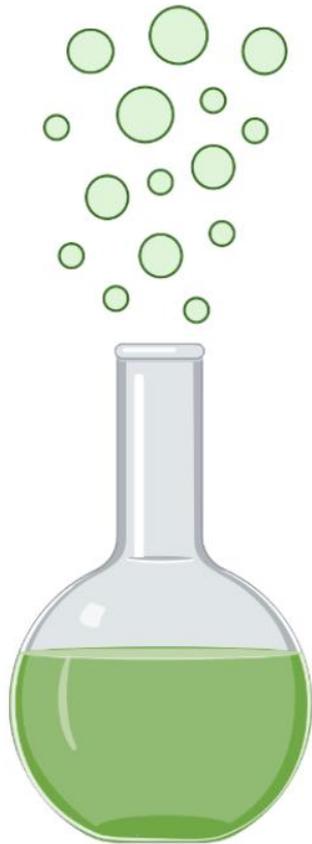


The chemistry of bouncy eggs!



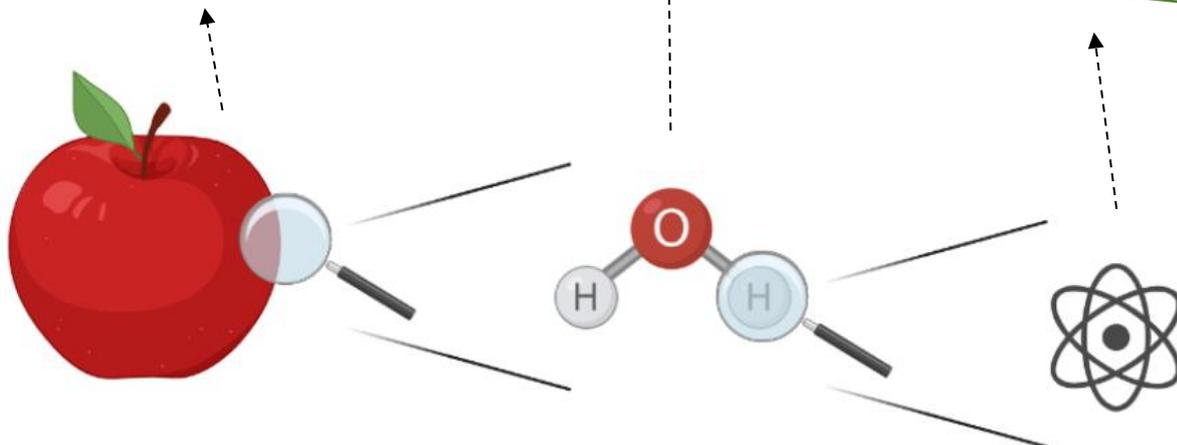
In this week's Pop-Up Science edition, we are dealing with atoms, molecules and other chemistry topics.

Did you know that everything around us is chemistry? Everything is made of atoms and molecules. Plants, animals, people, the earth, the sun, the air, and everything else that exists. But molecules are so small that we cannot see them with the naked eye. Molecules are made up of atoms. This means that atoms are even smaller than molecules!

An apple consists of many different molecules. For example, water, glucose, fructose, vitamins, and many other molecules.

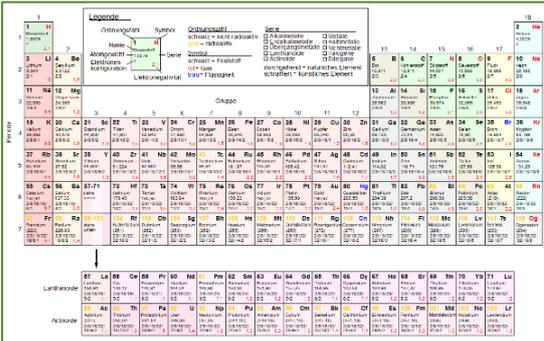
This is what a water molecule looks like. It consists of one oxygen atom (O) and two hydrogen atoms (H).

In the middle of an atom lies the atomic nucleus. The lines represent electrons around the atomic nucleus.



A. Read the following text and underline the most important pieces of information.

The word "chemistry" comes from the ancient Egyptian language and means "black earth". This natural science describes which substances there are and what properties they have. Chemists are still looking for new substances and then try to describe them. The periodic table is an important table for chemists. 118 chemical elements, most of which are found on earth, are listed in it. An element is a substance that consists of the same atoms. And this is what the periodic table looks like:



When substances collide, new substances can be formed. This is called a chemical reaction. Chemical reactions are, for example, the burning of a candle, or the transformation from liquid dough to solid cake. An explosion is also a chemical reaction. Therefore, chemistry can also be dangerous!

Do you remember our plant maze? We planted a bean and the plant grew through a shoebox. It grew towards the light! The plant does this through photosynthesis. This is a chemical reaction that allows the plant to build up itself. It takes carbon dioxide (CO_2) from the air and water from the soil and converts it into sugar in its leaves. Sugar is the basic building block of the plant. Through this reaction, the plant releases oxygen into the air. Chemical reactions are therefore important for all living things! Did you know that chemical reactions also constantly take place in us humans? For example, when you eat a sandwich. During chewing, enzymes in your saliva break down certain molecules of the sandwich. This makes it easier for your digestion to process the food further. In the stomach, the bread is then broken down further by chemical reactions. Through this, your body can use the ingredients.

Recently you observed a chemical reaction yourself! In our hands-on experiment on Monday you put a raw egg in vinegar or citric acid. The bubbles that formed on the eggshell were CO₂. This is carbon dioxide. But what exactly happened here?

The eggshell is made of lime. And vinegar turns lime into gaseous carbon dioxide (bubbles) and soluble calcium (invisible)! That is why the eggshell in vinegar disappears almost completely after some time! So, no magic, but pure chemistry!

Special knowledge: Vinegar is sour, or acidic. This is not only said because it tastes sour, but also because the so-called pH value of vinegar is very low. The pH value describes how acidic or basic a liquid is. Acidic is for example citric acid or dissolved baking powder. Liquid soap or

This was fun? You can start another egg experiment!

1. Take a fresh egg and smear toothpaste on part of the eggshell. **Important:** You have to use a fluoride toothpaste! Check the list of ingredients for *sodium fluoride*, *amino fluoride* or similar!
2. Use a pencil to mark the part of the eggshell on which you have spread the toothpaste.
3. Then repeat the experiment from Monday.
4. Can you see a difference to the experiment without toothpaste?

For this you need:

- An egg
- Fluoride toothpaste
- A glass of vinegar
- Citric acid

The difference is the following: On the marked area, there are less bubbles forming. The eggshell, when coated with fluoride toothpaste, does not dissolve as quickly. The reason is that fluoride protects against acids.

On our teeth, acidic foods can dissolve calcium and phosphate from the enamel and soften it, just like the eggshell. This makes our teeth more susceptible for caries. If we lack enamel, our teeth are also very sensitive to cold and heat. Fluoride in the toothpaste hardens the teeth and protects the enamel. With this, our teeth are better protected against tooth decay.

B. Try to answer the following questions.

Tick the correct answers.

1. A water molecule consists of one _____ atom (O) and two _____ atoms (H).

2. How many chemical substances are listed in the periodic table of elements?

1180

206

118

3. What is NO chemical reaction?

The photosynthesis of plants. Plants transform carbon dioxide (CO₂) to oxygen (O₂) and sugar.

The search for a new chemical substance.

The conversion from liquid to solid cake dough.

4. Saliva can cause chemical reactions! During chewing, enzymes in saliva break down the food into smaller components. This makes it easier for the digestive system to break down the food further.

true

false

5. Why does an eggshell not dissolve so quickly when fluoride toothpaste is smeared on it beforehand?

6. **Special question:** Which substance has a basic pH value?

citric acid

washing detergent

dissolved baking powder

C. The master baker and the secret recipe book

Once upon a time there was a master baker. He was a simple but clever man and he was always happy. He was known in the whole village for his extraordinary bread and pastries. He loved to experiment and every week he had new, delicious breads and pastries. Every week the villagers queued up in front of his bakery hoping to get a piece of his wonderful new delicacy.

One morning the baker wanted to try a new recipe, which he had tried and written down the day before. For his recipes he had a top-secret book, which he kept in a locked box. But that morning he noticed that the box had been broken open! The big iron lock on the wooden box had been destroyed! He stood in front of the empty box and became very angry. That morning the master baker had nothing new to offer. The villagers were surprised and disappointed.



Illustration created with <https://biorender.com>

One day later a new bakery opened opposite the master baker's shop. Ludwig stepped out. The master baker knew him from many stories and rumors. It was said that Ludwig was an insidious baker who often stole knowledge from other bakers. The master baker knew that he must have stolen his secret recipe book! This suspicion was confirmed when Ludwig offered the special pastry for sale, the recipe of which only the master baker knew. The master baker was furious!

But he was a clever man! Not only did he have the finest feeling for the perfect ingredients in the most diverse types of pastry, but he was also very talented in chemistry! He knew all the properties of the ingredients and knew how they react with one another.

The master baker had an idea! That evening he took a small plastic bag and mixed a special concentration of baking soda and vinegar. A white sheet hung over his head, he dressed as a ghost. He stepped in front of the window of Ludwig's bakery,

disguised his voice and shouted "I am Anand, the bread ghost! I know that you have stolen the master baker's book! For this terrible deed I will punish you and blow up your bakery!" The master baker detonated his homemade bomb, which made a loud bang. Ludwig was so terrified that he fled from his bakery without taking anything with him. Thereupon the master baker sneaked into the house of his competitor and took back his secret recipe book.

Although no damage was done by the homemade bomb, Ludwig was so frightened that he left the village the very next morning. Ludwig was never seen again. And if the master baker did not die, he still sells his extraordinary breads and pastries today.

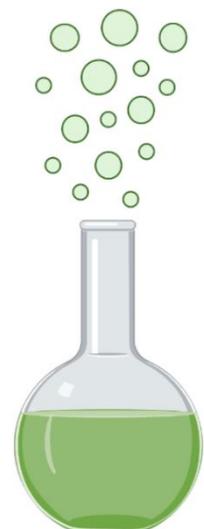
D. Are you a demolition expert?

Here is how you can rebuild the master baker's bomb! **IMPORTANT:** Only conduct this experiment together with an adult!

For this you need:

- 1 ziplock-bag
- 2 tea spoons of baking soda
- 50 milliliter vinegar
- 1 sheet of toilet paper

1. Put the baking soda in a small pile on the toilet paper.
Then pack the pile with the toilet paper. Form a small package.
2. Pour the vinegar into the ziplock-bag.
3. Now it gets tricky! Put the baking soda in the ziplock-bag.
Try to hold the bag so that the soda package does not touch the vinegar. Now close the bag quickly and take a few steps back.
4. Soda and vinegar react, and the bag explodes!



E. Word search

Can you discover all the hidden words in our word search this time?

ATOM

PERIODICTABLE

ACID

MOLECULE

REACTION

BASIC

OXYGEN

PHVALUE

ELEMENTS

HYDROGEN

PHOTOSYNTHESIS

EXPLOSION

Circle each word. Have fun!

U	F	I	I	U	H	A	U	Z	H	E	L	U	V	R	T	A	R	O	B
I	U	G	B	T	V	U	L	E	W	U	C	N	D	O	H	Y	Y	L	D
R	K	Z	E	C	N	W	I	O	O	O	J	C	Y	W	E	K	K	Q	V
E	X	E	U	O	W	J	I	T	J	O	I	A	L	V	G	Y	B	E	L
A	U	Y	X	M	E	R	P	G	V	E	S	G	T	X	E	R	H	H	L
C	G	H	H	P	E	P	M	B	L	V	W	M	L	V	M	W	B	L	L
T	V	S	T	X	L	Z	H	D	P	C	B	D	W	R	Q	K	O	K	D
I	V	N	N	D	B	O	W	V	R	E	R	H	F	P	I	F	U	E	N
O	I	S	E	P	A	A	S	X	A	Q	T	M	Y	L	B	H	F	Q	F
N	S	G	G	H	T	R	S	I	Z	L	V	O	L	D	K	Y	N	R	S
W	T	A	Y	H	C	U	P	I	O	P	U	I	K	I	A	A	D	M	J
K	N	I	X	J	I	G	S	M	C	N	M	E	P	U	I	S	H	R	O
N	E	G	O	R	D	Y	H	J	Z	M	O	L	E	C	U	L	E	M	N
D	M	T	R	Z	O	G	N	Y	Y	O	T	R	L	K	H	D	E	D	I
N	E	T	E	Y	I	N	H	K	F	P	A	F	C	S	G	S	U	E	U
V	L	V	P	H	R	T	S	X	A	F	R	W	S	K	D	Y	L	E	X
A	E	F	B	D	E	U	E	W	A	H	T	A	F	N	D	D	D	U	R
Y	D	Y	J	W	P	H	O	T	O	S	Y	N	T	H	E	S	I	S	M
Q	G	O	K	H	R	I	S	H	F	V	N	J	M	I	A	Q	C	N	B
A	S	W	K	B	W	G	U	Q	F	L	E	F	F	E	Q	S	A	N	B