STEM learning Cookbook

Science of Cooking - Cookbook and toolkit

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Introduction

Dear reader, mentor, educator. In front of you is a learning Cook Book prepared to help you guide your learners through a world of science using cooking as an educational tool.

The book is prepared in a way, that is easy-to-use and encourages learning by doing. Don't worry, even if you are not a scientist this book is presenting science in an easy to understand way, so you can successfully transform scientific phenomena to your group of learners.

The book was developed by 5 partners in the Erasmus+ project Science of Cooking - Learning STEM subjects through cooking for persons with ID which are experts in specific fields and were collaborating closely while developing this book. NOESIS is a Science and technological centre from Greece Thessaloniki and they have contributed all the scientific information, which you can follow while cooking and experimenting. Zveza Sozitje is alliance from Slovenia – experts in the field of working with persons with disabilities. They have provided their expertise when making this book largely accessible. EUFEMIA coming from Torino are presenting gamified contents of the book as well as the importance of sustainable food management. Association CiS is responsible for the visual layout of the book. Gathered information for the mentors with identified skills and competences are provided by the coordinator of the project and experts on the field of adult education – Education Centre Geoss from Slovenia. Each section of the book was developed by the collaboration of all included organizations and also with a collaboration of some associated partners.

Introduction

The book follows the detailed steps developed in the first phase of this project. Therefore, the consortium of this project strongly advises you to read and study the Learning Approach we have prepared for trainers and educators before using this book.

As you can see above, the partnership of the project is international and comes from different European countries. In the book, you will therefore be able to choose from a variety of dishes, some of which are traditional and specific to each country (such as paella in Spain, Cretan Ntakos in Greece, jota in Slovenia, pasta and beans in Italy). In addition, in the book, you will find suggestions for the preparation of plant-based dishes.

The recipes in this book suggest 10 menus, each menu containing a recipe for an appetizer, a main course and a dessert. Some recipes are more simple, some more complex. But they are all written in a way that is easy to read and understandable to implement.

Each recipe in the menus is accompanied by a linking experiment. The simple experiments that accompany the suggested dishes explain the individual scientific phenomena in an interesting, entertaining and highly pictorial way. The experiments are linked to the dish, either to the technique of preparation of the dish, to a particular ingredient or to a property of an ingredient.

Introduction

This cookbook encourages you to observe the individual scientific phenomena that occur with the ingredients during the cooking process itself and to further immerse yourself in science through experimentation after cooking.
Each user is encouraged to approach teaching with the help of this booklet by selecting one dish and enriching it with an accompanying recipe.

The workshop leader can learn about the science behind the cooking itself in a special section of the book, specifically for educators. There, the science is presented in a way that is easy to understand, even for non-experts in STEM fields.

If you judge that it is too complex for your group to do the whole unit in one go, you can present the unit to the learners in two parts.
You are also encouraged to take your learners through the world of ingredients with the special sensory game presented in the book, which brings the learners closer to the knowledge and sensation of ingredients.

The game can also be very good as a teaching tool on its own.
To help you understand the content of the book and the layout of its parts, we have also provided a keyword list and an index of experiments at the end where you can keep track of which science topics each experiment covers.
In the Learning Approach, partners have already developed evaluation tools where you can find evaluation tools for workshop facilitators as well as self-evaluation tools for workshop participants.

Introduction

Cooking is fun, but it can also be dangerous. The book also gives you all the necessary steps to use the kitchen and kitchen utensils safely.

This book is primarily aimed at educators. The individual parts of the book, which are useful for the actual delivery of the workshops and are also useful for the workshop participants, have been prepared in a format based on the easy reading technique. These parts of the book will also be available in a separate manual of their own and can be distributed to participants to help them actively participate in the workshops.

All the learning activities in this book are designed to be done as group work. The Consortium suggests that you form a group of 6 to 10 participants. However, there are many factors to take into account when forming a group. Do the participants know each other from before and is it confirmed that they work well together? What are their abilities and how independent are they? Do the mentor and the group know each other or are they new to each other?

Depending on the nature of the group, you will decide whether there will be more or fewer attendees, but remember that everyone can be part of this unforgettable adventure and that everyone can contribute to the preparation of the food and the learning of science.

Introduction

The worlds of science and cooking are very much linked and this book aims to give you a walk through these combined worlds. This walk should be full of new discoveries, fascinated observation, learning about new worlds, understanding natural phenomena, strengthening soft skills, and delicious socialising.

Learning unit consists out of one recipe and one experiment. As an added value, you will find after each unit a Science snack. Snacks are there to be enjoyed between meals and to provide you with an interesting scientific fact or phenomenon. But how does this phenomenon, which we have observed in our learning unit, manifest itself in everyday life? Take a bite of a snack and find out.

In the Learning Approach of the Science of Cooking project you will also find a chapter on the assessment of skills and competences. The consortium has prepared assessment tools to be used by facilitator BEFORE and AFTER the learning unit itself. The learning unit is therefore one recipe and one experiment. The mentor uses the tool to assess the skill or competence of individual participant before the workshop and the progress observed after the workshop/learning unit. As an added bonus, we have also developed a self-assessment tool specifically for the participants themselves. The learning unit is presented to the participants a journey. With the help of the developed assessment tool, the participant can self-assess his/her own state of mind and level of knowledge, skills and competences BEFORE the workshop. After the workshop, the learner reflects on how it was DURING and AFTER the journey.

Introduction

We hope you enjoy your food

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Duration:
2 hours

Information for the mentor

Objectives

- To follow the procedure of preparing pumpkin soup
- To successfully prepare pumpkin soup as a team
- To learn about different states of matter
- To study the properties of acids or bases
- To observe the neutralisation reaction between acid and base
- To learn how to produce carbon dioxide with vinegar and baking soda
- Experiment with CO2 properties
- To understand the role of each component in the fire triangle

Name of recipe and experiment

- Pumpkin soup
- Invisible Extinguisher

Specific skills and competences

- Distinguish between solid and liquid state of the matter
- Usage of immersion blender
- Usage of knife for chopping hard ingredients
- Understand difference between acid and base ingredients
- Identify vinegar as an acid
- Identify soda as a base
- Observe the neutralization, chemical reaction between acid and base
- Recognize the result of chemical reaction
- Understand the components of fire triangle
- Precision when performing an experiment
- Making prediction what will happen to a flame of a candle during the experiment

Information for the mentor

Connection between recipe and experiment: **Cooking is mainly about solid and liquid ingredients, but the same is not true for gases. They are invisible and their presence can only be verified indirectly if they cause an effect. This is why this experiment was chosen for this recipe to introduce gases as well, in this case CO2, a very common gas.**

Basic sci-info behind cooking

State of matter: Solids and liquids. Solids have a fixed shape and volume, which means they keep their form no matter how you move or handle them. The particles in a solid are tightly packed together and vibrate in place. This is why solids feel hard and stable.
Liquids don't have a fixed shape, but they do have a fixed volume. This means they take the shape of whatever container they're in, but they still have the same amount of matter. The particles in a liquid are still close together, but they can move past each other more freely compared to solids. This is why liquids flow and can be poured.

Basic sci-info behind the experiment:

When base and acid combine, they chemically react.
The chemical reaction leads to the creation of a gas called carbon dioxide (CO2) and water. The reaction is called neutralization, because both the properties of the acid and those of the base are "neutralized", "disappear".

*It's important to handle the jug and the glass carefully. You can lose all the gas (CO2) by spilling it and never even know it.

Pumpkin soup *(starter)*

You need to buy: *(for 4 persons)*

- 1 pumpkin
- 1 carrot
- 1 red onion
- 2 garlic cloves
- 2 tablespoons of olive oil
- ¼ tablespoon of salt
- ¼ tablespoon of pepper
- 1 tablespoon vegetable spice mixture
- 1 l water

Tools that you need:

- Cutting board
- Peeler
- Knife
- Pot with a lid
- Wooden spoon for stirring
- Immersion blender

Cooking steps:

1 Peel and chop the onion and garlic.

2 Peel and slice the carrot.

3 Peel and cut the pumpkin into cubes.

4 Put 2 tbsp of olive oil in a pot.

5 When the oil heats up add onion and stir occasionally.

6 When the onion softens, add garlic.

7 When the garlic releases the aroma add the carrot and stir occasionally.

8 Fry for a minute.

9 Add cut pumpkin, salt, ground black pepper, vegetable spice mixture and stir.

10 Add 1 litre of water.

11 Close the lid and cook over medium heat until the pumpkin is soft.

12 Remove the pot from the stove and turn off the stove.

13 Puree with an immersion blender until it is completely smooth.

14 Serve pumpkin soup in plates and place it on a table with cutlery and paper napkins.

Experiment 1

Invisible Extinguisher

Ok, putting out a candle isn't exactly the most challenging thing in the world.

But what if we do it without blowing it out?

In the experiment with vinegar and soda we study the properties of these materials as acids or bases and observe the neutralization effect. We learn how to make carbon dioxide gas and experiment with its properties.

What you need:

- Vinegar
- Baking soda
- 1 Tablespoon
- 1 Jug
- 1 Glass
- Tealights
- A Lighter
- 1 Tray

*It's important to handle the jug and the glass carefully. You can lose all the gas (CO_2) by spilling it and never even know it.

What to do:

1. Place the jug on the tray.

2. Pour some vinegar into the jug.

3. Add a couple of tablespoons of baking soda into the jug.

   What happens inside the jug?

4. Let the foaming calm down.

5. Light the candles.

6. Hold the jug next to and above the glass.

7. Slowly tilt the jug and “pour” just the gas from the jug into the glass.

   Be careful not to pour the liquid.

8. Hold the glass next to and above the flame of the candles.

9. Slowly tilt the glass and “pour” the gas from the glass onto the flame.

   What happens in the candle flame?

   What makes it go off?

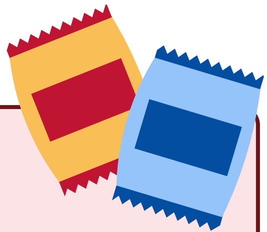
What is going on?

You have just created an invisible extinguisher, using baking soda and vinegar. Baking soda is a base and vinegar an acid. When they combine, they chemically react. The chemical reaction, which is called neutralization, leads to the creation of a gas called carbon dioxide (CO_2) and water. The reaction is called neutralization, because both the properties of the acid and those of the base are "neutralized", "disappear".

Carbon dioxide is a colorless and odorless gas. It is also heavier than air and that's why it sinks at the bottom of a container. The foaming you observed inside the jug was the sign that the chemical reaction of neutralization took place, producing a great amount of carbon dioxide.

The bubbles you saw were full of carbon dioxide. All this heavy gas pushed the air out of the jug. So, at the end of the reaction the jug was full with carbon dioxide. Tilting the jug above the glass, you literally poured the CO_2 into the glass. The glass full with carbon dioxide became your flame extinguisher.

A fire requires oxygen, fuel, and heat to burn. These three components are called the fire triangle. Remove any one of the three components, and the fire goes out. Tilting the glass full of carbon dioxide above the open tealight, you literally poured the gas onto the flame. The gas pushed the air which was around the flame away and the flame finally got out due to lack of oxygen.



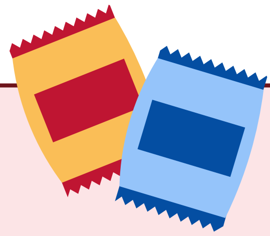
Science Snacks:

Eco cleaner

While baking may be the first thing that comes to mind when you think of baking soda, you can use it to easily and inexpensively clean every room of your house, especially your kitchen, as the most used room in your home!

To keep drains fresh, regularly sprinkle a little baking soda in them while running hot water.

For a deeper clean, a slow-moving drain or mild clog, you can try using baking soda and white vinegar.



Science Snacks:

Relieve itchy bug bites with neutralization

To protect themselves from their enemies, bees and wasps carry a stinger, a tube that communicates with special glands, at the bottom of their abdomen. The venom secreted by the bee's glands contains acid, while the wasp’s glands contain a base. Their stings cause us pain. In order to 'neutralize' it, in the case of a bee sting we use ammonia or baking soda, i.e. a base solution, while in the case of a wasp sting we use vinegar, i.e. an acid solution.

Duration:
2 hours

Information for the mentor

Objectives

- To follow the procedure of preparing chicken wraps
- To successfully prepare chicken wraps as a team
- To learn about frying procedure
- To be precise when measuring portions
- To learn about water as a matter
- To understand terms hydrophobic and hydrophilic
- Experiment with water to study the surface tension of water
- To observe how pepper acts in water
- To observe how water acts when we add soap

Name of recipe and experiment

- Chicken wraps
- Run, pepper run!

Specific skills and competences

- Distinguish between frying and cooking
- Patience when cutting onion
- Precision when measuring portions for individual tortilla
- Carefulness when working with hot ingredients
- Observe the behaviour of hydrophobic and hydrophilic materials
- Study the surface tension of water
- Practice in careful observation
- Understand that water acts differently when we have soap on our skin
- Making prediction what will happen to pepper when we put soap on our finger

Connection between recipe and experiment: **Usage of black pepper.**

Basic sci-info behind cooking

Frying: Food is fried when it is placed with a little fat or oil in a frying pan (shallow frying) or immersed in oil or fat (deep frying) at a sufficiently high temperature. In frying a much higher temperature is used than when cooking in water.

Basic sci-info behind the experiment:

Water molecules like to stick together. They are strongly attracted to each other and they line up in a certain way giving to the top of the water a property called surface tension.
The surface tension of a liquid describes the tendency of a liquid surface to resist an external force.
The surface tension of water may be broken down with specific matters, such as soap. The tension is broken when the attraction of the water molecules is reduced.
Hydrophobic materials are not attracted to water, hydrophilic materials are able to interact with water.

Chicken Wraps *(main)*

You need to buy: *(for 4 persons)*

- 1 pack of tortillas
- 400 g chicken breast
- 1 red onion
- 200 g cooked beans
- 100 g sweet corn
- Lettuce
- 1 red pepper
- Black pepper
- Sweet red pepper
- Salt
- Thyme
- Olive oil

Tools that you need:

- 2 Cutting boards
- Knife
- Wooden spoon for stirring
- Frying pan

Cooking steps:

1 Cut the chicken breast into cubes on one cutting board.

2 Wash your hands after touching meat.

3 On another board with another knife cut the onion and red pepper in small pieces.

4 Put 1 tbsp of olive oil in the pan.

5 Turn on the stove to medium heat and place the pan on the stove.

6 Put the onion in the pan and stir gently until the onion is soften.

7 Add chicken breasts and stir occasionally.

8 When the chicken breasts are fried, add the red pepper and a little water.

9 Open cans with beans and sweet corn.

10 When the pepper softens add the beans and corn in the pan, and then simmer, stirring gently.

11 Add salt, ground black pepper, sweet red pepper, and thyme.

12 When the water evaporates, remove the pan from the stove and turn off the stove.

13 Heat the tortillas one by one in the microwave.

14 When one tortilla is heated, take it and place a piece of lettuce on it. Add chicken with vegetables and wrap the tortilla.

Do the same with all the tortillas.

15 Serve chicken wraps on plates and place on a table with paper napkins.

Experiment 2

Run pepper, run!

Do you know how you get rid of germs when you wash your hands with soap?

Try this pepper and soap experiment to understand!

In the pepper experiment (if we manage to do it and don't keep sneezing) we study the surface tension of water and the ways in which we can change it. We also observe the behavior of hydrophobic or hydrophilic materials.

What you need:

- 1 Deep plate
- Liquid dishwashing soap
- Water
- Black Pepper (grounded)
- 1 Small bowl

What to do:

1. Fill the plate with water almost to the edge. Make sure that it doesn’t overflow.

2. Sprinkle some black pepper over the water. Notice that the pepper floats on the water.

3. Dip your finger in the center of the plate. Do you notice any change? Not much happened, right? You may have just got some pepper flakes stuck to your finger.

   **Imagine that these pepper flakes are germs. If you accidentally touch your face or mouth with your hands contaminated with germs, it could make you sick.*

4. Add a drop or two of liquid soap into a small bowl.

5. Stick your finger into the bowl getting some soap on your finger.

6. Dip your soap-covered finger in the bowl with the water and pepper flakes.

   Do you see anything different this time? What happens to the pepper flakes? In which direction do they move?

What is going on?

The first thing you noticed is that pepper flakes didn't dissolve in water. This is because pepper is hydrophobic, meaning that water is not attracted to it.

You also noticed that the pepper flakes float over the water.

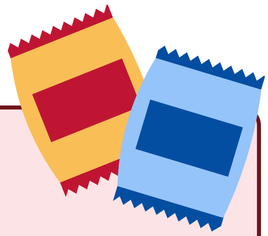
The main reason for this has to do with the properties of water and the characteristics of water molecules. Water molecules like to stick together. They are strongly attracted to each other and they line up in a certain way giving to the top of the water a property called surface tension. The surface tension of a liquid describes the tendency of a liquid surface to resist an external force.

In our experiment, because pepper flakes are light and hydrophobic, the surface tension of water is quite big to keep them floating on top.

When you touched the surface of water with your soapy finger, you noticed that pepper flakes moved away to the edge of the plate.

This happened because soap is able to break down the surface tension of water, reducing the attraction among them. So, the water molecules pull back away from the soap carrying the pepper along with them. The fact that soap breaks down the surface tension of water makes it a great cleaning agent. Soap is effective in cleaning dishes and taking all the grease and dirt away.

Science Snacks:



Walking on water

You might have noticed that there are some insects that can stay, or even walk on the surface of water. It is the surface tension of water that allows it. Because of it, the top of water behaves as an elastic membrane, which doesn’t allow insects' thin legs to penetrate between the water molecules.

The researchers discovered that the middle pair of legs in insects walking on water create vortices a few millimeters below the surface, which transfer momentum backwards and the insect gains forward momentum.

Duration:
1 hour

Information for the mentor

Objectives

- To follow the procedure of preparing a fruit dessert
- To successfully prepare the dish as a team
- To be precise when cutting different fruit
- To learn about the textures of different fruit
- To learn about mixtures
- To learn about cell structure
- To introduce the term DNA
- Understand that DNA is a part of a cell
- To extract the DNA of a fruit

Name of recipe and experiment

- Fruit salad
- What is the taste of DNA

Specific skills and competences

- Careful use of knife when cutting fruit
- Precision when making whipped cream
- Understand that cell is the basic building and functional unit of all living organisms
- Understand that DNA is a part of a cell
- Carefully follow the steps of the experiment in order for it to work
- Observe the alcohol layer above the strawberry liquid inside the glass
- Observe the white cloudy substance (DNA) appearing in the top layer inside the glass

Connection between recipe and experiment: **Strawberries**

Basic sci-info behind cooking

Mixtures are made up of two or more substances which are not combined chemically. Each component of a mixture keeps its original properties and the separation of components can be easily done using physical methods.

Basic sci-info behind the experiment:

Each cell is surrounded by a sack, called “cell membrane” and within each cell there is a second sack, called “nucleus”.
The DNA is a long, stringy molecule, which is found Inside the nucleus.
To see DNA, we have to break open both the cell membrane and the nucleus to release it.
In this experiment this is what the dishwashing liquid does. It breaks open the cells separating the DNA from the proteins and lipids inside them.
At the same time, the salt helps the DNA molecules to stick together creating clumps.
DNA normally dissolves in water but doesn’t dissolve in alcohol.
So, when salty DNA clumps come in contact with rubbing alcohol, they rise up into the alcohol layer and form the white strands you observe floating on the top.

Fruit salad with whipped cream *(dessert)*

You need to buy: *(for 4 persons)*

- 200 g strawberries
- 2 apples
- 200 g raspberries
- 1 melon
- 1 watermelon
- 1 lemon
- heavy whipping cream

You can add other fruit if you like.

If you want you can also add vanilla sugar, cinnamon sugar or brown sugar.

Tools that you need:

- Cutting board
- Knife
- Bowl
- Spoon
- Mixing bowl
- Mixer

Cooking steps:

1 Cut apples into cubes and place in a mixing bowl.

2 Peel and cut the melon and watermelon into cubes and place in a mixing bowl. You do not have to use the whole melon and watermelon.

3 Cut the strawberries in half and place in a mixing bowl.

4 Put whole raspberries in a mixing bowl.

5 Cut the lemon and drain one half, add the lemon juice to the fruit in the mixing bowl.

6 If you want you can also add vanilla sugar, cinnamon sugar and brown sugar as desired.

7 Mix everything with a spoon.

8 Pour heavy whipping cream into the mixing bowl.

9 Mix the cream with a mixer until whipped cream is made.

10 Serve fruit salad with whipped cream in a cup and place on a table with a spoon and paper napkins.

Experiment 3

What is the taste of DNA?

Eating DNA sounds scary but it's completely safe. I do it every day! Let me explain.

We are not a biological laboratory with microscopes and scientific instruments, but with this experiment we actually see the DNA of a fruit.

What you need:

- 2 Strawberries (fresh or frozen)
- 1 large plastic zip bag
- Liquid dishwashing soap
- Salt
- Water
- 2 clear glasses
- 1 Coffee filter
- 1 Spoon
- Rubbing alcohol
- 1 Toothpick

What to do:

1. Pull off any green leaves on the strawberries.

2. Put the strawberries into the plastic bag and seal it.

3. Gently smash the strawberries with your hands for about two minutes.

4. In one glass, pour 1/2 cup of water. Add 2 teaspoons of dishwashing soap, 1 teaspoon of salt. Stir with the spoon to mix them all together.

5. Pour the liquid mixture into the bag with the strawberries.

6. Reseal the bag and gently smash for another minute. Avoid making too many soap bubbles!

7. Place the coffee filter inside the other glass.

8. Open the bag and pour the strawberry liquid into the filter. Twist the filter just above the liquid and gently squeeze it so the remaining liquid strains into the glass.

9 Pour an equal amount of rubbing alcohol down the inside of the glass.

The alcohol will form a separate layer above the strawberry liquid.

Do not mix or stir!

**Remember to put the lid back on the rubbing alcohol.*

10 Observe carefully the liquid inside the glass. Within a minute or two, you will see a white cloudy substance (DNA) appearing in the top layer.

This is the strawberries' DNA.

11 You can pick up the strawberries' DNA!

Just tilt the glass and use the toothpick.

What is going on?

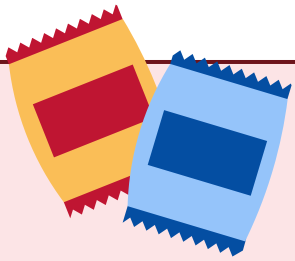
Strawberries, as all plants, consist of cells. Smashing the strawberries inside the bag with your hands,made the strawberries' cells separate from each other.

Each cell is surrounded by a sack, called "cell membrane" and within each cell there is a second sack, called "nucleus". The DNA is a long, stringy molecule, which is found Inside the nucleus.

To see DNA, we have to break open both the cell membrane and the nucleus to release it.

This is what the dishwashing liquid does. It breaks open the cells separating the DNA from the proteins and lipids inside them. At the same time, the salt helps the DNA molecules to stick together creating clumps.

DNA normally dissolves in water but doesn’t dissolve in alcohol. So, when salty DNA clumps come in contact with rubbing alcohol, they rise up into the alcohol layer and form the white strands you observe floating on the top.



Science Snacks:

DNA - Say: dee-enn-ay

DNA is a short nickname for deoxyribonucleic (say: dee-OK-see-ri-bo-new-klee-ik) acid. DNA is the genetic information inside the body's cells that helps make people who they are. It's the instructions for how to make the body, like the code to a video game or blueprints for a house.

If you used a very strong microscope, you would see that DNA looks like a twisting ladder. Four different chemicals called nucleotides (say: NEW-klee-uh-tydes) pair up to make the rungs of the ladder. Groups of nucleotides make up genes. Genes determine things like what color your hair and eyes are and how tall you are. DNA is stored in the chromosomes (say: KRO-muh-soamz) that are inside every cell of the body. Everyone inherits two sets of chromosomes, one from each parent. If you were to purify DNA and taste it all by itself, it would taste slightly salty!

Duration:
2.5 hours

Information for the mentor

Objectives
- To follow the procedure of preparing a starter from Slovenian traditional ingredients
- To successfully prepare the dish as a team
- To be precise when dividing the dough into thirds
- To learn about shaping the dough in a way to tense the surface of a ball
- To learn learn that yeast is a fungus and as every living creature must eat and breath.
- To observe that a warm environment is better for fungus to grow
- To observe that sugar is as much food for humans as for fungus.
- To realise that sugar is as much food for humans as for fungus
- To learn about the chemical reaction of fermentation

Name of recipe and experiment

- Rolls with ham and horseradish
- Hungry yeast

Specific skills and competences
- Careful use of kitchen robot
- Precision when dividing dough into thirds
- Following the safety measures when dealing with hot surfaces
- Notice that changing the conditions of an experiment changes the result
- Recognise when the chemical reaction of fermentation takes place
- Understand the role of sugar in the fermentation process.
- Observe that a warm environment accelerates fermedation

Connection between recipe and experiment: **Dry yeast**

Basic sci-info behind the experiment:

Yeast is a type of tiny living organism called a fungus. It's so small that you can barely see it unless there are many of them, usually as a powder.
Like any living creature, yeast needs food. And sugar is its favourite food. When yeast eats sugar, it gains energy and starts to grow. In fact, there is a chemical reaction that is taking place, called fermentation.
During fermentation a gas is released, called carbon dioxide. It is the same gas released when opening a can of soda or cola.
Yeast likes better warm places. The warm water somehow wakes up the yeast and makes it active. The chemical reaction of fermentation is accelerated and the yeast starts eating the sugar faster.
An easy way to understand if the chemical reaction of fermentation is really happening, is to observe bubbles forming. Bubbles are full with carbon dioxide produced during the reaction.

Rolls with ham and horseradish *(starter)*

*recipe by Tjaša Vede in Blaž Mikuljan, midvakuhava.si

You need to buy: *(for 4 persons)*

Dough:

- 500 g white wheat flour type 500
- 1 bag of dry yeast
- 15 g of salt
- 4 tablespoons of oil
- 30 g of sugar
- 320 ml of lukewarm milk
- 50 g of room temperature butter

Coating:

- 1 egg
- 5 tablespoons of milk

Filling:

- slices of ham
- horseradish with cream

Tools that you need:

- cutting board
- knife
- bowl
- baking plate
- baking paper

Cooking steps: Dough

1 Put all the listed ingredients except the butter in a bowl and mix them together into a homogeneous dough (with a robot it takes approx. 2 minutes).

2 Add butter at room temperature, then knead the dough for 5 minutes, or until the butter is mixed in and the dough is smooth.

3 Shape the dough into a smooth ball by tucking the edges inward, thus tensing the surface of the ball.

4 Leave the dough in the bowl and cover it with a damp cloth.

5 Let it rise until it doubles in volume, about 1 hour.

Cooking steps: Design and baking

1. Divide the dough into thirds, which you shape into lumps.

2. Roll each ball into an oblong rectangle.

3. Spread the dough with horseradish and cream and put the slices of ham over it.

4. Roll everything tightly into a long roulade.

5. Cut off the ends from both sides and cut the roulade into 3 cm long rolls.

6. Place the rolls on a baking plate covered with baking paper.

7. Cover them with a cloth and let them rise for 20 minutes.

8 Turn on the oven at 180 ºC.

9 Coat the rolls with a mixture of egg and 5 tablespoons of milk

10 Bake them for 10-15 minutes at 180 ºC.

jaša Vede in Blaž Mikuljan, midvakuhava.si

Experiment 4

Hungry yeast

Feeding fungus in your kitchen!

With this experiment we will learn that yeast is a fungus and as every living creature must eat and breath. We will see that a warm environment is better for fungus to grow and that sugar is as much food for humans as for fungus.

What you need:

- Cold or room temperature water
- Warm water (around 40°C)
- 4 packets dry yeast
- Sugar
- 4 clear glasses
- A measuring cup
- A teaspoon
- A tray
- Permanent marker (optional)

What to do:

1 Place the 4 glasses onto the tray, the one next to the other.

(Optional: Use the marker and label the glasses: “1”, “2”, “3”, “4”.)

2 Using the measuring cup,

- Pour 250ml of room temperature water in the first and second glass
- Pour 250ml of warm water in the third and fourth glass

3 Add one packet of yeast to each glass and stir well.

4 Don’t add anything else in the first glass.

5 Add 1 spoon of sugar in the second glass

Stir well, so the sugar dissolves.

6 Don’t add anything else in the third glass.

7 Add 1 spoon of sugar in the fourth glass.

Stir well, so the sugar dissolves.

8 Observe each of the glasses for 5-10 minutes.

Do you notice anything happening inside the glasses?

Do you see any difference between them?

What is going on?

Yeast is a type of tiny living organism called a fungus. It's so small that you can barely see it unless there are many of them, usually as a powder.

Like any living creature, yeast needs food. And sugar is its favorite food. When yeast eats sugar, it gains energy and starts to grow. In fact, there is a chemical reaction that is taking place, called fermentation. During fermentation a gas is released, called carbon dioxide. It is the same gas released when opening a can of soda or cola.

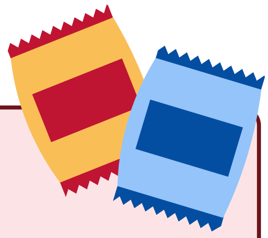
Yeast likes better warm places. The warm water somehow wakes up the yeast and makes it active. The chemical reaction of fermentation is accelerated and the yeast starts eating the sugar faster.

An easy way to understand if the chemical reaction of fermentation is really happening, is to observe bubbles forming. Bubbles are full with carbon dioxide produced during the reaction.

In the first and third glass there were no bubbles at all. This is because there was no sugar inside them. Without sugar fermentation is not happening.

In the second glass, there are no bubbles. Even though there was sugar, the yeas remained asleep because the water was not warm enough to activate it.

In the fourth glass there were a lot of bubbles! This was because the warm water activated the yeast. Since there was a lot of sugar available, the fermentation reaction initiated and yeast started to eat the sugar releasing carbon dioxide.



Science Snacks:

We don’t use yeast only for bread.

Beer yeast is a type of yeast specifically used in brewing beer. It plays a critical role in the fermentation process, where it converts fermentable sugars from malt into alcohol and carbon dioxide. The type of yeast used can significantly influence the flavor, aroma, and characteristics of the beer.

Beer has a long and fascinating history, the Sumerians, one of the earliest civilizations, brewed beer as far back as 5,000 B.C. They even had a goddess dedicated to beer named Ninkasi, who was celebrated for overseeing the brewing process. In fact, one of the oldest known recipes in the world is for brewing beer, written in the form of a hymn to Ninkasi.

Duration:
3.5hours

Information for the mentor

Objectives

- To follow the procedure of preparing a main Slovenian traditional dish - jota
- To successfully prepare the dish as a team
- To carefully follow the steps of the recipe
- To learn about acids and bases
- To be introduced to color indicators
- To get familiar with pH scale and what it indicates
- Experiment with red cabbage and additional matters

Name of recipe and experiment

- Jota
- Acid of base? Cabbage can tell!

Specific skills and competences

- Careful use of knife
- Careful use of peeler
- Following the safety measures when dealing with boiling ingredients
- Distinguish between acidic and basic matters
- Identify ingredient as base or acid
- Observe the colour changes during the experiment
- Understand why we had to use different spoons for each cup in the experiment
- Predict what will happen after adding different ingredient in the cups
- Describe what is happening in each cup
- Compare the colours in the cups
- To acknowledge that red and pink colours indicate the presence of acid and green and blue indicate the presence of base

Connection between recipe and experiment: **Cabbage**

Basic sci-info behind the experiment:

Each substance has some qualities.
One of these is whether it is an acid or a base and how much acidic or basic (alkaline) is.
For example, lemon juice is an acid and is more acidic than orange juice.
We can estimate and measure this quality using the pH scale, which has values from 1 to 14.
If a substance has a pH value below 7, it means that it is acidic.
If it has a pH value above 7 is basic.
Most fruits like lemons, oranges and grapes are acidic and some detergents like bleach or toothpaste are basic.

Jota stew *(main)*

You need to buy: *(for 4 persons)*

- 500 g of sauerkraut
- 200 g of potatoes
- large can of brown / red beans
- 1 teaspoon of salt
- 2 bay leaves
- few grains of black pepper
- 20 g of flour
- 1 onion
- 3 cloves of garlic
- 2 sausages

Tools that you need:

- Cutting board
- Peeler
- Knife
- bowl
- pot with a lid
- saucepan
- frying pan
- wooden spoon for stirring

Cooking steps:

THE PROCEDURE

Preparation: 10 min

Cooking: 1 h 30 min

total: 1 h 40 min

1 Put the sauerkraut in a saucepan, add a bay leaf, salt, and a few grains of black pepper.

2 Add water and cook for about 50 minutes.

3 Drain the cooked cabbage, reserving five tablespoons of the liquid.

4 Peel the potatoes, wash them, and cut them into small pieces.

5 Put the potatoes in a saucepan, cover it with cold water, salt it and cook it for 15 minutes. Drain the boiled potatoes.

6 Put the beans in a large pot with water and add the drained potatoes and sauerkraut (and the saved liquid).

7 If necessary, add salt and cook everything together for another 10 minutes. Boil water for the sausage in a small saucepan and cook it for 15 minutes. If desired, pierce the sausage so that the liquid flows out.

8 Cut the sausage into rings. Peel and chop the onion and garlic. Fry the onion in a pan, sprinkle with flour and add the sausage and garlic.

9 Mix everything well. Stir the mixture into the already cooked jota and serve.

Experiment 5

Acid of base? Cabbage can tell!

Turn red cabbage into a scientific instrument!

In this experiment we will get involved with food acidity. We will learn about acids and bases, and also be introduced to color indicators and pH scale.

What you need:

- Red cabbage
- Hot water
- Vinegar
- Lemon juice
- Orange juice
- Dishwashing detergent
- Baking soda
- A large bowl
- A knife
- A strainer
- A jug
- 5 clear plastic cups
- 5 teaspoons
- A large tray (to contain any spills)

What to do:

1. Chop the red cabbage into small pieces.

2. Place the cabbage pieces in a bowl and cover them with hot water.

3. Let it sit for at least 30 minutes, stirring occasionally.

4. After 30 minutes are over, use the strainer to strain the mixture into the jug. The cabbage juice you take in the jug should be deep purple.

   You just created your red cabbage indicator!

5. Place the tray on a table.

6. Place the clear plastic cups on the tray, the one next to the other.

7. Using carefully the jug, pour red cabbage juice into each cup, filling them about halfway.

   Observe that all the cups are the same deep purple color.

8 Using a different spoon for each cup, add:

- 2 teaspoons of vinegar in the first cup and stir
- 2 teaspoons of lemon juice in the second cup and stir,
- 2 teaspoons of orange juice in the third cup and stir,
- half teaspoon of baking soda in the fourth cup and stir,
- 2 drops of dishwashing detergent in the fifth cup and stir.

9 What happened to the deep purple color of the cabbage juice after adding the above ingredients?

Do you observe any color changes?

What is going on?

The cabbage juice is deep purple.

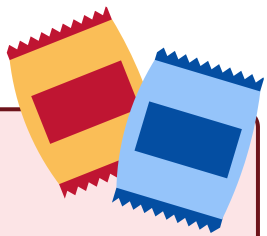
Adding a different substance in each cup of cabbage juice, the juice changes its color. At the end, each one of the five cups have a different color. The new color is not random, it depends on what you added. Adding lemon juice, the color of the cabbage juice turns pink. Adding baking soda, it turns blue. But why?

Each substance has some qualities.

One of these is whether it is an acid or a base and how much acidic or basic (alkaline) is. For example, lemon juice is an acid and is more acidic than orange juice. We can estimate and measure this quality using the pH scale, which has values from 1 to 14. If a substance has a pH value below 7, it means that it is acidic. If it has a pH value above 7 is basic.

The cabbage juice you have made is a pH indicator.

It can tell you whether a substance is an acid or a base, as well as how acidic or basic it is, based on how much its color changes. The purple cabbage juice turns red to pink when it mixes with something acidic and turns green to blue when it mixes with something basic. Most fruits like lemons, oranges and grapes are acidic and some detergents like bleach or toothpaste are basic.



Science Snacks:

Pink to blue flowers

There are some flowers that change color depending on the soil's pH. Hydrangea is such a flower. In acidic soil (below a pH of 6), their flowers will be blue. In basic soil (with a pH above 7), their flowers will be pink, or even red. In neutral to slightly acid soil (pH between 6 and 7), these hydrangeas can have purple blooms, or even a mixture of pink and blue blooms on the same plant.

Duration:
3 hours

Information for the mentor

Objectives

- To train in measuring the volume and the mass of dry ingredients and keep records of our measurements
- To learn about volume and mass
- To follow the procedure of preparing a Slovenian traditional dessert
- To successfully prepare the dish as a team
- To carefully follow the steps of the recipe
- To transfer the knowledge gained in the experiment to cooking procedure

Name of recipe and experiment

- Apple pie
- How much is too much?

A tip: make the experiment before cooking!

Specific skills and competences

- Measure dry ingredients
- Precision when using measuring tools
- Functional literacy when filling in the worksheet
- Compare the results
- Understand the difference between mass and volume
- Observe that equal amounts of different ingredients do not have the same mass (do not weigh the same)
- Understand that the sugar is heavier than flour
- Careful usage of peeler
- Follow safety measures when dealing with hot surfaces

Connection between recipe and experiment: **Measuring**

Information for the mentor

Basic sci-info behind the experiment:
Equal amounts of ingredients do not have the same mass (they do not weigh the same). This is due to the different density of each ingredient.
Density is the physical quantity that tells us how heavy something is compared to its volume.
Mass and volume both are physical units usually used for measurement purposes.
Mass is a measure of the amount of matter an object contains.
Volume interprets the geometric configuration of the matter and is a measure of how much space the object takes up.

Measuring tools:

- Measuring is a fundamental process that has to do with comparing known quantities with unknown ones.
- During cooking in our kitchen, depending on what we wish to measure and how much of it, we choose the most suitable measuring tool.
- We use scales to weigh ingredients, meaning to measure their mass, and cups or spoons to measure their volume. We choose cups for large amounts of dry ingredients and spoons for small ones.
- Making precise measurements is a skill that we can practice.

Measuring process:
Let's assume that following a recipe you need to use 3 cups of flour, and 2 tablespoons of salt. To make sure that you have the exact amount (volume) of these you have to follow the next steps:

- Scoop ingredient with the appropriate measuring tool (cup or spoon) overfilling it
- Flatten its surface with a butter knife
- Keep it in Eye level to be sure it is flat
- Pour the ingredient into a bowl until you have the amount the recipe called for

If you wish to weigh an ingredient, meaning to measure its mass you need to use a scale. To have an accurate measurement you have to follow the next steps:

- Place an empty bowl on the scale
- Set scales to zero (0 gr)
- Pour the ingredient in the bowl

Stop pouring when scales shows the amount (gr or Kg) the recipe called for.

Basic sci-info behind cooking:
Volume and mass. Volume represents the space occupied by an object and can be measured in cubic meters, liters, cubic feet (in the US), or gallons. In kitchen settings, volume measurements may include cups (approximately 250 ml), teaspoons (5 ml) and tablespoons (15 ml).
Volume is influenced by temperature — when substances heat up, they expand, altering their volume.
Mass refers to the quantity of matter an object possesses. In everyday contexts, such as the kitchen, mass is often measured using weight, with common units including grams (g) and kilograms (kg).

Apple pie *(dessert)*

You need to buy: *(for 4 persons)*

for dough:

- 2 cups flour
- 2 cups semolina
- 1 bag baking powder
- 2 cups sugar
- 1 bag vanilla sugar

for filling:

- 1 kg apples
- Half a cup sugar
- 1 bag cinnamon sugar
- 1 bag vanilla sugar

and:

- 150g butter

Tools that you need:

- Cutting board
- Peeler
- Knife
- Grater
- 2 bowls
- Ladle
- Baking pan

Cooking steps:

1 Peel the apples.

2 Grate apples in one bowl.

3 Add half a cup of sugar, 1 bag vanilla sugar and 1 bag cinnamon sugar to the apples and stir.

4 Put in another bowl 2 cups of flour, 2 cups of semolina, 2 cups of sugar, 1 bag vanilla sugar and 1 bag baking powder and stir.

5 Using a ladle, divide the flour and semolina mixture into three equal parts in three bowls.

6 Coat the pan with 50 g of butter.

7 Pour the first part of the flour and semolina mixture on the bottom of the pan and distribute evenly.

8 Spread half of the apple mixture evenly.

9 Pour the second part of the flour and semolina mixture and distribute evenly.

10 Spread the other half of the apple mixture evenly.

11 Pour the third part of the mixture of flour and semolina and distribute evenly.

12 Cut the rest of butter into slices and arrange them on top of the pie.

13 Turn the oven to 180 degrees Celsius.

14 When the oven heats up put the pan in the oven using oven gloves and bake for about 45 minutes.

15 When the pie is baked, remove the pan from the oven using oven gloves (be careful because it is very hot).

16 When the pie cools, cut the cake and serve on plates and place on a table with cutlery and paper napkins.

Experiment 6

How much is too much?

All about measuring dry ingredients!

With this activity we will be trained in measuring the volume and the mass of dry ingredients and keep records of our measurements. We will also observe that different materials don't weigh the same even though they occupy the same space.

What you need:

- Digital kitchen scales (It would be nice to have more than one)
- Measuring cups (1 cup, 1/2 cup, 1/3 cup, 1/4 cup)
- Measuring spoons (1 tablespoon, 1 teaspoon, 1/2 teaspoon, 1/4 teaspoon)
- Flour
- Sugar
- Cocoa powder
- Bowls
- Butter knife or leveler
- Working sheet and pen for recording measurements

What to do:

1. Introduction to Measuring Tools:

1. Measuring is a fundamental process that has to do with comparing known quantities with unknown ones.
2. During cooking in our kitchen, depending on what we wish to measure and how much of it, we choose the most suitable measuring tool.
3. We use scales to weigh ingredients, meaning to measure their mass, and cups or spoons to measure their volume. We choose cups for large amounts of dry ingredients and spoons for small ones.
4. Making precise measurements is a skill that we can practice.

2. Explanation of the Measuring Process:

Let's assume that following a recipe you need to use 3 cups of flour, and 2 tablespoons of salt. To make sure that you have the exact amount (volume) of these you have to follow the next steps:

- Scoop ingredient with the appropriate measuring tool (cup or spoon) overfilling it
- Flatten its surface with a butter knife
- Keep it in eye level to be sure it is flat
- Pour the ingredient into a bowl until you have the amount the recipe called for

If you wish to weigh an ingredient, meaning to measure its mass you need to use a scale.

To have an accurate measurement you have to follow the next steps:

- Place an empty bowl on the scale
- Set scales to zero (0 g)
- Pour the ingredient in the bowl
- Stop pouring when scales shows the amount (g or Kg) the recipe called for

3. After showing and explaining the above steps, you are ready to start with the activity suggested below.

Activity: Measurement of volumes and weighing of their mass

- Divide the participants into 4 groups
- Explain that each group has to measure and weigh several quantities of different materials
- Give each group their working sheet
- Explain how to fill in the sheet
- Let them do the measurements
- At the end compare the results

Flour	1 Cup	1/2 Cup	1/3 Cup	1/4 Cup
Mass (gr)				

Sugar	1 Cup	1/2 Cup	1/3 Cup	1/4 Cup
Mass (gr)				

Sugar	1 tablespoon	1 teaspoon	1/2 teaspoon	1/4 teaspoon
Mass (gr)				

Cocoa Powder	1 tablespoon	1 teaspoon	1/2 teaspoon	1/4 teaspoon
Mass (gr)				

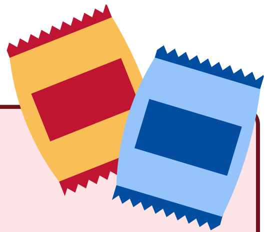
What is going on?

Mass and volume both are physical units usually used for measurement purposes. Mass is a measure of the amount of matter an object contains. Volume interprets the geometric configuration of the matter and is a measure of how much space the object takes up.

While cooking and baking in our kitchen, it's important to measure ingredients accurately. We can measure them by calculating either their mass using scales, or their volume using cups or spoons. Too much or too little can affect, even destroy a recipe, especially in pastry. That's why you need to use the appropriate tools and follow the appropriate method.

For example, if you wish to make bread, a cake or some muffins, measuring flour or sugar with spoons instead of cups isn't the best way to go. When you make tea for a friend, using a tea-spoon to add sugar is the appropriate method. If you want to prepare hot cocoa, measuring cocoa with cups is also not a good idea. If you study the results of all measurements and compare them you will observe that 1 cup of sugar is heavier than 1 cup of flour. The same is for ½ cup, 1/3 cup and ¼ cup as well. Also, 1 tablespoon of sugar is heavier than 1 tablespoon of cocoa. The same is for the smaller quantities too.

This means that equal amounts of ingredients do not have the same mass (they do not weigh the same). This is due to the different density of each ingredient. Density is the physical quantity that tells us how heavy something is compared to its volume. In our experiment, comparing the results we understand that sugar has higher density than flour and also higher density than cocoa.



Science Snacks:

Use of body parts as measuring units

Many cultures, including the Romans and Greeks, used body parts such as the foot or hand span as units of measure. For example, the Roman foot was about 30cm.The ancient Olympic stadium was 600 “Hercules foot” which is approximately 192.27 meters.

In the UK, body weight is commonly measured in stones and pounds. For example, a person might be described as weighing "11 stones 4 pounds," which is equivalent to 158 pounds or approximately 71.7 kilograms.

Duration:
3-7 days

Information for the mentor

Objectives

- To follow the procedure of preparing an Italian starter – stuffed eggs
- To successfully prepare the dish as a team
- To understand the difference between vaporization and boiling
- To experiment with eggs and vinegar
- To study the chemistry of acids and bases
- Distinguish between acidic and basic materials
- To learn about the neutralization as a chemical reaction
- To learn about physical phenomenon called osmosis
- Patience when following all the steps of the experiment
- To measure the egg's circumference

Name of recipe and experiment

- Stuffed eggs
- Naked eggs

Attention for the experiment!

- This experiment has several steps that need time. The final result of the experiment will be apparent after 3-7 days, depending on the egg used.
- We do NOT recommend eating a naked egg prepared this way. Keep in mind you created your egg by soaking a raw egg in vinegar sitting at room temperature for a few days. Instead of eating your Naked Egg, just experiment with it.
- Remember to wash your hands after handling the naked egg at any point in this experiment. Eggs can contain salmonella, so scrub away.

Specific skills and competences

- Precision when boiling the eggs
- Awareness of time when boiling the eggs
- Precision when peeling hard-boiled eggs
- Awareness that raw eggs are not good to eat
- Describe the structure of the egg
- Identify vinegar as an acid
- Observe how egg changes while resting in vinegar for several days
- Distinguish between outer hard shell and the inner membrane

Connection between recipe and experiment: **Eggs**

Information for the mentor

Duration:
1 hour for cooking, 10 minutes to prepare the experiment, 3-7 days to follow the experiment's results

Basic sci-info behind cooking:

Phase tranformations: Vaporization is the process through which a substance transforms from a liquid into a gas. It includes both evaporation and boiling. During evaporation, only the top level of the liquid is turned into vapour. It doesn't produce bubbles and leads to cooling. Hot tea getting cold is such an example. Boiling happens through heating. It is faster and occurs not only at the surface but throughout the liquid, it produces lots of bubbles and does not result in cooling.

Basic sci-info behind the experiment:

From a chemical point of view, white vinegar is acetic whereas eggshells are basic. When these two combine, they chemically react with each other.
The chemical reaction, which is called neutralization, leads to the creation of a gas called carbon dioxide ($CO2$) and water. The reaction is called neutralization, precisely because both the properties of the acid and those of the base are "neutralized", "disappear".
Over time, this chemical reaction dissolves away the hard eggshell, leaving behind a "naked" egg, covered by a thin membrane.
You might think that the outer hard shell of the egg has "transformed" into the membrane you noticed at the end of the experiment, but this is not the case. The outer hard shell and the inner membrane are two completely different layers. If you crack a raw egg it is easy to point out the two different layers.
Comparing the two measurements of the egg's circumference, you might have noticed that the egg got a little bigger at the end of the experiment. Here's what happened...
Some of the water in the vinegar solution (household vinegar is 96% water), due to a physical phenomenon called osmosis, traveled through the egg's membrane into the egg, causing it to expand.

Stuffed Eggs *(starter)*

You need to buy: *(for 4 persons)*

- 6 fresh eggs
- 120 g canned tuna in oil
- 2 tablespoons mayonnaise
- 3 or 4 anchovies in oil
- 4 or 5 capers (rinsed)
- 2 teaspoons apple cider vinegar or white wine vinegar
- 20 g butter (softened)
- Pepper to taste
- Salt to taste
- Chives for garnish

Tools that you need:

- Saucepan
- Bowl
- Spoon
- Knife
- Chopping board

Cooking steps:

1. Start by washing the eggs.
2. Place the eggs in a saucepan and cover them with water. Add a spoonful of vinegar.
3. Bring the water to a boil and cook the eggs for 6 minutes.
4. After cooking, remove the saucepan from heat and cool the eggs by replacing the hot water with cold water.
5. While the eggs are cooling, rinse the capers and anchovies, and drain the tuna.
6. In a bowl, mix the rinsed capers, chopped anchovies, mayonnaise, and drained tuna.
7. Once the eggs are cool, peel them carefully and cut them in half lengthwise.

8 Remove the yolks with a spoon and mix them with the tuna mixture.

9 Add the softened butter, a spoonful of vinegar, and season with salt and pepper. Mix everything well.

10 Use a spoon to fill the egg whites with the mixture.

11 Finally, wash and finely chop the chives to sprinkle on top as a garnish.

Experiment 7

Naked Eggs

Which came first, the rubber egg or the rubber chicken? Make a rubber, or "naked," egg with the help of chemistry. Are you ready for "eggsperiments"?

In the egg experiment we study the chemistry of acids and bases, as well as the neutralization effect. We also observe the transport of substances across the plasma membrane into the cells. At the end of the experiment we will be able to see the structure of the egg.

What you need:

- 1 raw egg (plus a few extras)
- White vinegar (enough to cover an egg in a jar)
- 1 jar (slightly wider & deeper than the egg)
- 1 large spoon
- 1 flexible measuring tape (like one used for sewing)
- Pen and notepad

*Note: *This is not an experiment that can be completed in one day. It has several steps that need time. The final result of the experiment will be apparent after 3-7 days, depending on the egg used.*

What to do:

1 Use the measuring tape to measure the circumference of the egg, at its middle portion. Note the measurement.

2 Place the egg in the jar.

3 Cover the egg with vinegar and store in a safe place. You should see bubbles forming at the surface of the shell.

4 The next day, use the spoon to scoop the egg out of the vinegar.

5 Discard the old vinegar.

6 Cover the egg with fresh vinegar and store in a safe place.

7 Every morning, for the next 2–7 days check on the state of the egg. You don’t need to take the egg out of the jar, nor to replace the vinegar again.

8 After almost a week, the egg should be translucent but still pretty much egg-shaped.

9 Measure the circumference of the middle portion of the egg. Note the measurement.

What is going on?

From a chemical point of view, white vinegar is acetic whereas eggshells are basic. When these two combine, they chemically react with each other.

The chemical reaction, which is called neutralization, leads to the creation of a gas called carbon dioxide (CO2) and water. The reaction is called neutralization, precisely because both the properties of the acid and those of the base are "neutralized", "disappear".

The bubbles you observed forming on the surface of the shell when added vinegar were full of this carbon dioxide because the neutralization reaction took place.

Over time, this chemical reaction dissolves away the hard eggshell, leaving behind a “naked” egg, covered by a thin membrane. That’s why at the end of the experiment, the egg looked translucent.

You might think that the outer hard shell of the egg has "transformed" into the membrane you noticed at the end of the experiment, but this is not the case. The outer hard shell and the inner membrane are two completely different layers. If you crack a raw egg it is easy to point out the two different layers.

Comparing the two measurements of the egg's circumference, you might have noticed that the egg got a little bigger at the end of the experiment. Here’s what happened...

Some of the water in the vinegar solution (household vinegar is 96% water), due to a physical phenomenon called osmosis, traveled through the egg's membrane into the egg, causing it to expand.

Science Snacks:

Honey, I Shrunk the egg!

If you take your naked egg and place it in a glass filled with corn syrup, the egg will shrivel. Osmosis takes the blame! Corn syrup has less water than an egg does. So, when the naked egg sinks in water, the water in the egg moves through the membrane and into the corn syrup to equalize the water concentration levels on both sides.

Science Snacks:

Egg Spinning

Let's discover a practical way of determining whether or not an egg is raw or hard-boiled. Inside its shell, a hard-boiled egg is solid whereas a raw egg is fluid. When you spin the raw egg, a smooth, balanced spin takes place. This is because the solid center of the egg has a fixed center of gravity (or balance point), causing it to move at the same time as the eggshell.

When you spin the raw egg, its center of gravity changes as the fluid inside the eggshell moves around. This results in a wobbling motion in order to achieve balance.

If you try to stop the eggs from spinning by briefly touching them with your finger, you will notice a big difference between the hard-boiled and the raw egg. The hard-boiled egg stops almost at once whereas the raw egg keeps spinning. This is because the inertia of the liquid inside the raw egg is greater than the inertia of the solid interior of the hardboiled egg. Inertia is the tendency of an object to resist when trying to change its state of motion, roughly "how hard it is to stop".

This is related to Newton's First Law of Motion: "An object in motion remains in motion, unless acted upon by an external force”. Put more simply, if something is moving, it'll keep moving unless a force stops it. The friction between the table and egg will slow the egg and eventually stop the spinning. Though the liquid inside the egg keeps moving, it too slows down and stops because of the friction between the hard shell and the table.

Duration:
1.5 hours

Information for the mentor

Objectives
- To follow the procedure of preparing an Italian main dish – spring risotto
- To successfully prepare the dish as a team
- To understand the cooking technique boiling
- To use boiling for cooking a dish
- Experiment with salt and carrots
- To learn about the physical procedure osmosis
- To learn about physical phenomenon called osmosis
- To study matter and its changes
- To observe the transport of substances across the plasma membrane into cells
- To observe how carrot changed when put in salt
- To observe the difference between salted and non-salted carrot
- To predict what happened to the carrot with salt

Name of recipe and experiment
- Spring risotto
- Flexible carrot

Specific skills and competences
- Careful use of knife when chopping hard ingredients
- Awareness of time when cooking the vegetables
- Compare the different states of carrot
- Understand that salt made the difference
- Gentle handling of the carrot during the experiment

Connection between recipe and experiment: **Carrots**

Basic sci-info behind cooking:

Boiling is perhaps the simplest of all kitchen techniques and refers to heating a food in boiling water. For most vegetables the boiling temperature is close to 100 °C, which is the boiling point of water (under standard pressure at sea level).

Basic sci-info behind the experiment:

Carrots are made up of cells. Cells are mostly water, but they are filled with other substances too. In experiment, through a physical procedure called osmosis, the water has moved out of the carrots' cells to the salt, making carrots flexible.
Remember that when plants don't have enough water, they wilt! They rely on the water in their cells to help them stand up straight.
Cells are surrounded by cell membranes. The cell membrane's job is to keep the cell parts protected and control the movement of most chemicals into and out of it.
Cell membrane allows water to move into and out of the cell and the movement of water depends on the amounts of dissolved chemicals (like salt, sugar, starch and other minerals) inside and outside of cells.
When the amount of dissolved chemicals outside the cell is greater than inside, water moves out of the cell. This is the case in our experiment.
Inside the "Salt" bag, water moves from the carrots into the bag. As more cells lose water, the cells start to shrivel and shrink and the carrot becomes soft and flexible instead of crunchy and stiff.

Special note for the educator:

The experiment has to start before start cooking the recipe. Steps 1,2 and 3 must be done at the beginning of the workshop. Steps 5-7 will be done after preparing the recipe, before the end of the workshop.

Spring Risotto *(main)*

You need to buy: *(for 4 persons)*

- 1 liter vegetable broth (onion, carrots, celery, herbs)
- 50 ml olive oil
- 30 g butter
- 100 ml white wine
- 300 g rice (Carnaroli preferred)
- 150 g peas
- 150 g green beans
- 150 g zucchini
- 100 g asparagus
- 1 white onion
- 1 carrot
- 1 celery stick
- 50 g Parmesan cheese
- salt to taste
- pepper to taste
- parsley to taste

Tools that you need:

- Large pot
- Sauté pan
- Ladle
- Knife
- Chopping board
- Grater

Cooking steps:

1 Make the vegetable broth by boiling chopped onion, carrot, celery, and herbs.

2 Wash and chop the vegetables.

3 Heat oil in a pot and sauté chopped onion, carrot, and celery.

4 Add the rice and toast it for a few minutes.

5 Add white wine and let it evaporate.

6 Add vegetables (except asparagus tips) and broth gradually as it cooks.

7 After 10 minutes, add asparagus tips and cook for 4 more minutes.

8 Stir in Parmesan and butter, cover and let rest for 5 minutes.

9 Garnish with parsley and serve hot.

Experiment 8

Flexible carrot

From boiling to curing to pickling, osmosis and salt helps us make food every day!

With this experiment we study matter and its changes and observe the transport of substances across the plasma membrane into cells.

What you need:

- 4 small carrots (or carrot pieces)
- 2 plastic zip bags
- 1 Permanent marker
- Salt
- 1 tablespoon

What to do:

1
Label your bags.

Label one bag “Salt”.

Lebel the other bag “No Salt.”

2
Add 2 carrots to each bag.

3
In the bag labeled “Salt” add 1 spoonful of salt.

Shake the bag to mix the carrots and the salt.

4
Wait about 30 minutes.

5
Observe the two bags.

Do you see any differences?

6
Observe the carrots inside the two bags.

Do they look the same?

7
Try to bend the carrots inside the two bags.

Do you feel them the same?

What is going on?

After 30 minutes have passed, you can see some differences between the two bags.

Carrots inside the “No salt” bag look the same as at the beginning. There is no water inside the bag and if you try to bend them they don’t.

Inside the “Salt” bag there is a lot of water. The carrots in this bag seem to be more “flexible” than before. If you try to bend them you will see that they bend quite easily.

Where did the water in this bag come from? And why do the carrots bend?

The water inside the bag comes from the carrots.

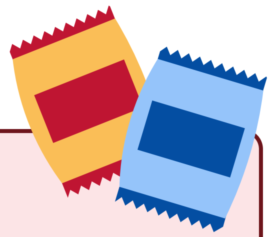
Carrots are made up of cells. Cells are mostly water, but they are filled with other substances too. In our experiment, through a physical procedure called osmosis, the water has moved out of the carrots’ cells to the salt, making carrots flexible.

Remember that when plants don’t have enough water, they wilt! They rely on the water in their cells to help them stand up straight.

Cells are surrounded by cell membranes. The cell membrane’s job is to keep the cell parts protected and control the movement of most chemicals into and out of it. Cell membrane allows water to move into and out of the cell and the movement of water depends on the amounts of dissolved chemicals (like salt, sugar, starch and other minerals) inside and outside of cells.

When the amount of dissolved chemicals outside the cell is greater than inside, water moves out of the cell. This is the case in our experiment.

Inside the “Salt” bag, water moves from the carrots into the bag. As more cells lose water, the cells start to shrivel and shrink and the carrot becomes soft and flexible instead of crunchy and stiff.



Science Snacks:

Saltwater and Freshwater Fish (Osmoregulation)

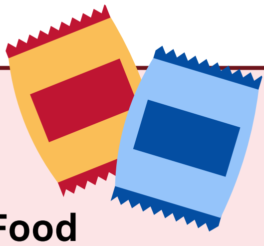
Many forms of life, including fish, use a special technique (called osmoregulation) to control the flow of water into and out of their cells. For example, saltwater fish must keep the water in their cells from flowing out into the salty water around them, because that water has a higher concentration of dissolved particles. On the other hand, fish swimming in freshwater need to prevent freshwater from flowing into their bodies, because their cells have a higher concentration of particles. That's the main reason why a saltwater fish can't survive in freshwater. It absorbs water and bloats. If, conversely, you put a freshwater fish in saltwater, it shrivels.

Humans need freshwater to survive. If they drink saltwater, their cells dehydrate and they die.

Science Snacks:

Plants Don't Drink Water – They Absorb It by Osmosis

Every plant has roots, and the surface of every root is essentially a semipermeable barrier that allows water molecules to pass through. Most plant roots have hairs to increase the surface area of this membrane and maximize water intake. The roots also absorb any nutrients in the soil that are small enough to pass through the barrier along with the water.



Science Snacks:

Making Pickles and Preserving Food

Soaking cucumbers, carrots, peppers and other vegetables in brine is an ages-old way of storing them. The process is called pickling, and it preserves food by drawing water out of the cells and drying them out. The characteristic strong taste of pickles comes from the reduced amount of water on the cells and the resultant higher concentration of solutes, including salt. You don't have to immerse food in salty water to preserve it - a common way to preserve meat is to dust it with salt. When it's time to eat the meat, you just wash off the salt with water.

Duration:
1 hour

Information for the mentor

Objectives

- To follow the procedure of preparing an Italian dessert
- To successfully prepare the dish as a team
- To be precise when cutting peaches in half
- To learn what denaturation means
- Experiment with cocoa powder and milk
- To learn what means hydrophilic and hydrophobic property of a material
- Understand how hydrophobic and dissolving are related
- To learn that fat is hydrophobic

Name of recipe and experiment

- Stuffed peaches
- Hydrophobic Hot Cocoa

Specific skills and competences

- Careful use of knife when cutting peaches
- Measure peaches in half
- Distinguish between liquid cocoa and dry cocoa powder
- Observe that cocoa doesn’t dissolve at once when added in milk
- Observe the change in cocoa’s behaviour when poked with the toothpick

Connection between recipe and experiment: **Cocoa powder**

Basic sci-info behind cooking:

Denaturation: In science, to denature something is to transform its basic qualities in a significant way. In cooking, this can happen with eggs when they're heated or whisked. Whisking egg whites gradually changes their consistency. Whisking traps air in them, increasing their volume. This trapped air helps cakes, soufflés and other dishes to rise. If egg whites are whisked only until they form soft peaks, the proteins are only partially denatured and retain some of their elasticity. If egg whites are whisked until they are stiff, they are fully denatured and have no elasticity. They lose their original properties and aren't able to return to their former state.

Basic sci-info behind the experiment:

Not all materials and substances behave in the same way when they come into contact with water. Some seem to be “water-loving” whereas some others seem to be “water-fearing”.
“Water-loving” means that they like to be near and in contact with water. They like water so much that they can dissolve in it. We call these materials and substances hydrophilic. Sugar or salt are hydrophilic.
The opposite of hydrophilic materials is “water-fearing”, or hydrophobic materials. They do not like water at all. They fear it, they are doing anything they can to make sure they will stay away. Oil is hydrophobic, that’s why it doesn't mix with water, in fact it repels it.

Stuffed Peaches *(dessert)*

You need to buy: *(for 4 persons)*

- 5 peaches
- 60 g sugar
- 30 g cocoa powder
- 30 g butter
- 4 amaretti cookies
- 1 egg
- Pinch of salt

Tools that you need:

- Baking dish
- Knife
- Bowl
- Whisk
- Spoon

Cooking steps:

1. Wash peaches, cut them in half, and remove the pits.
2. Scoop out some peach flesh, set aside.
3. Mix the peach flesh with egg yolk, sugar, cocoa, and crushed amaretti.
4. Whisk egg white with salt until stiff and fold into the mixture.
5. Fill the peaches with this mixture and top with butter.
6. Bake at 160°C for 50 minutes.

Experiment 9

Hydrophobic Hot Cocoa

Never has an experiment been so delicious! If you are patient, at the end of this experiment you will have learned the chemistry of the mixtures but warming it you will have a hot chocolate. Enjoy!

In this "tasty" experiment we study solutions and the phenomenon of dissolution. We also observe what it means for a material to be hydrophobic or hydrophilic.

What you need:

- Cocoa Powder
- Milk
- 1 large cup
- 1 Spoon
- 1 Toothpick

What to do:

1. Pour milk into the cup until it's half full.

2. Get a heaping spoonful of cocoa powder.

3. Carefully dunk your spoonful of cocoa powder into the milk.

   Does the cocoa powder mix in, or stay on the spoon?

   The cocoa powder should have been covered with milk.

4. Take the spoon out.

   What do you notice?

   Is the cocoa powder wet or dry?

5. Poke the pile of cocoa powder with your toothpick.

   What happened? Can you explain it?

   The milk should have quickly fallen off of the cocoa powder.

What is going on?

Not all materials and substances behave in the same way when they come into contact with water. Some seem to be “water-loving” whereas some others seem to be “water-fearing”.

“Water-loving” means that they like to be near and in contact with water. They like water so much that they can dissolve in it. We call these materials and substances hydrophilic. Sugar or salt are hydrophilic.

The opposite of hydrophilic materials is “water-fearing”, or hydrophobic materials. They do not like water at all. They fear it, they are doing anything they can to make sure they will stay away. Oil is hydrophobic, that’s why it doesn't mix with water, in fact it repels it.

In our experiment, the fat molecules inside cocoa powder are hydrophobic too. They repel water. On the other hand, the starch molecules are hydrophilic. They love water. Milk is mostly water, so the same rules are true for milk.

When you dunk the cocoa powder in milk, the starch molecules quickly absorb the milk. At the same time, the fat molecules stop the milk from getting any further than the surface. This creates a shell of milk around the outside of the cocoa powder.

When you poke it with a toothpick, you break the shell’s surface tension. The milk rolls off the cocoa powder, and back down into the cup.

Science Snacks:

Anti- inflammatory cocoa powder

The antioxidants found in cocoa powder have anti-inflammatory properties that can benefit overall health.

Science Snacks:

“Cocoa” VS “Cacao”

Cocoa beans are called “cocoa” beans and not “cacao” beans by mistake! The word “cacao” originates from the indigenous Nahuatl word “kakawatl.” Although Nahuatl was the language of the Aztecs (1300 AD), evidence suggests that kakawatl dates to the Olmec people, the earliest known major civilization in Mesoamerica (1500 BCE). When the Spanish arrived in the Americas, they translated the word ‘‘kakawatl” to “cacao.” The term “cocoa” originates from a spelling mistake when the English translated it from Spanish.

Duration:
1 hour

Information for the mentor

Objectives

- To follow the procedure of preparing an Italian starter
- To successfully prepare the dish as a team
- To be precise when cutting artichokes
- To learn about acids, bases and salts
- To learn about pH scale and what it means
- Experiment with lemon juice and oil
- To study mixtures and the properties of materials that allow them to be combined with other materials or not
- To learn about miscible and immiscible materials

Additional:

- To understand the term emulsifier

Name of recipe and experiment

- Crispy artichokes
- To mix or not to mix?

Specific skills and competences

- Careful use of knife when cutting artichokes
- Precision when breading the artichokes
- Identify ingredient as acid, base or salt
- Follow instructions and make predictions
- Observe whether lemon juice and oil can mix together by shaking them in a jar
- Distinguish between miscible and immiscible materials

Connection between recipe and experiment: **Usage of lemon juice and oil (and egg yolk – optional)**

Basic sci-info behind cooking:

Acids, Bases and Salts: Most inorganic substances can be classified as acids, bases, or salts. For hundreds of years, people have known that vinegar, lemon juice, amla, tamarind and many other food items taste sour. This is happening because they contain acids. Many substances or chemicals which we use in our daily life, such as detergents, soaps, toothpaste, baking soda or baking powder, are actually bases. Salts are neutral substances and in nature they are crystalline. Table salt is a common salt used to enhance taste and preserve food. In order to define a substance or a food as acidic, neutral or basic, pH scale, from 1-14 is used. A value of less than seven indicates an acid, and a value of more than seven indicates what is called a base (or alkaline) solution.

Basic sci-info behind the experiment:

The chemical properties of the liquids determine if they mix or not. Liquids with similar chemical properties will mix, forming a liquid solution. Those with different properties will not mix.
Water and oils (and fats) have quite different chemical properties, mainly because of their different molecule structure. This difference does not allow the two compounds to strongly interact with each other to form a solution.
When two liquids combine to form a new liquid, we call the liquids "miscible". When two liquids do not mix together and instead form layers, we call them "immiscible."
We can force two immiscible liquids to mix together creating a solution if we add a third substance which acts as an emulsifier.

Crispy Artichokes *(starter)*

You need to buy: *(for 4 persons)*

4 artichokes	Olive oil
1 lemon	salt
3 eggs	pepper
50 g Pecorino Romano cheese	parsley
80 g cornmeal	mint

Tools that you need:

- Baking tray
- Knife
- Chopping board
- Bowl
- Whisk

Cooking steps:

1 Clean and prepare the artichokes, massaging with lemon to prevent browning.

2 Mix eggs, grated cheese, chopped parsley, and mint.

3 Bread the artichoke slices with the egg mixture and cornmeal.

4 Bake at 180°C for 25 minutes until crispy.

Experiment 10

To mix or not to mix?

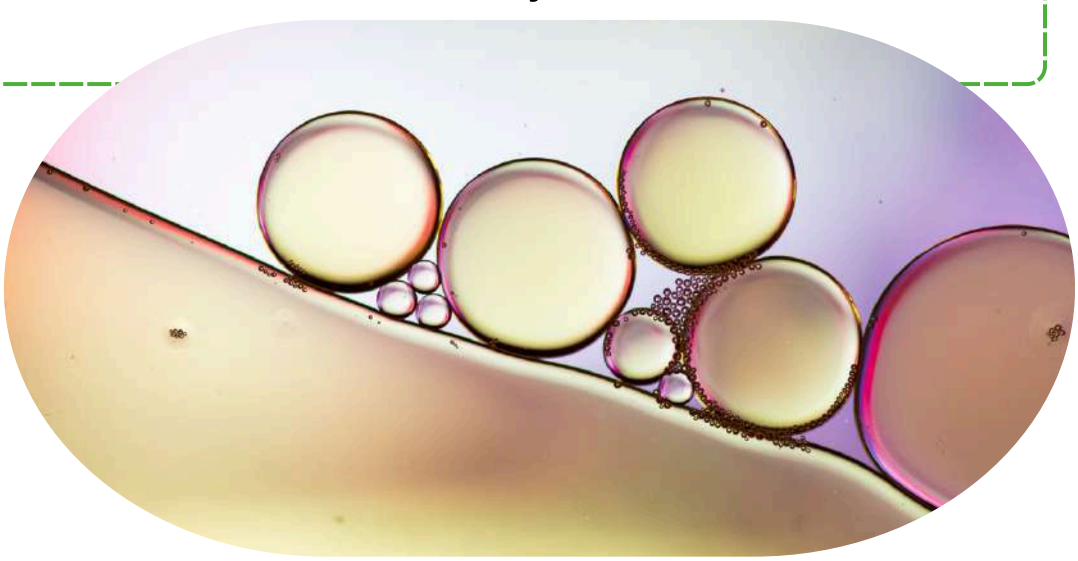
Some things are not meant to happen, no matter how hard you try it!

In this experiment we will study mixtures and the properties of materials that allow them to be combined with other materials or not. Do they sometimes need help? We can observe this in the extended version of the experiment.

What you need:

- A jar with lid
- A tablespoon
- Oil
- Lemon juice

- Optional: Egg yolk (in case you wish to extend the experiment add egg yolk as an emulsifier which makes the mixture a creamy emulsion)



What to do:

1 Pour in the jar 3 tablespoons of olive.

2 Add in the jar 3 tablespoons of lemon juice.

3 Observe how the oil floats in a layer on top of the lemon juice.

This is because the two liquids do not mix.

4 Screw the lid on the jar tightly.

5 Hold the jar with your hands and shake it for 30 seconds.

What do you observe? Are oil and lemon still separated? Can you distinguish the oil from the lemon?

6 Leave the jar on the table for 2 minutes and then observe it.

What happened to the mixture? Can you distinguish the oil from the lemon?

Optional: if you wish to extend the experiment continue with the next steps.

7 Add an egg yolk in the jar and screw the lid on the jar tightly.

8 Hold the jar with your hands and shake it for 30-60 seconds.

What do you observe?

9 Leave the jar on the table for 2 minutes and then observe it again.

What happened to the mixture? Did the materials separate this time or not?

You can use such a mixture as a salad dressing! Just add a pinch of salt and pepper and shake it before use.

What is going on?

Oil and lemon do not mix.

You can force them to mix temporarily by shaking the jar, but they don't mix together properly.

When shaking the jar, the oil turns into small droplets inside the lemon. When left to rest, the two liquids separate again.

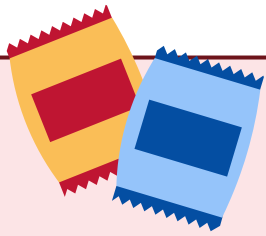
The chemical properties of the liquids determine if they mix or not. Liquids with similar chemical properties will mix, forming a liquid solution. Those with different properties will not mix.

Water and oils (and fats) have quite different chemical properties, mainly because of their different molecule structure. This difference does not allow the two compounds to strongly interact with each other to form a solution.

When two liquids combine to form a new liquid, we call the liquids “miscible”. When two liquids do not mix together and instead form layers, we call them “immiscible.”

We can force two immiscible liquids to mix together creating a solution if we add a third substance which acts as an emulsifier. In our experiment the egg yolk can do this job.

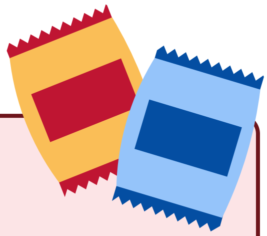
Science Snacks:



Salad dressing

Salad dressing is a mixture of oil and vinegar (or lemon), with some herbs and spices to add flavor. Since we know that oil and water do not mix, we have to shake a bottle of salad dressing before using it. This makes the dressing a mixture for a short time so that we can get even amounts of the oil and vinegar on the salad. Once you stop shaking the bottle, the oil and vinegar (or oil) will quickly separate again.

To keep the salad dressing mixed together longer you can add mustard or egg yolk. These act as emulsifiers, which are substances that help the immiscible ingredients unite in a creamy emulsion. Mayonnaise and hollandaise are sauces that are made using such emulsifiers.



Science Snacks:

Clean it up!

Getting oil and water to mix is at the very heart of cleaning dishes and clothes. A lot of agents that make dishes and clothes dirty are greasy or contain oil. Water alone is not attracted to these compounds. However, because a detergent has one end that is attracted to oil-like molecules, detergents tend to bind to dirt, grease and oil. The other half of the detergent binds to water molecules, allowing the soiling agent to be washed away.

Duration:
1.5 hours + overnight

Information for the mentor

Objectives

- To follow the procedure of preparing an Italian main dish
- To successfully prepare the dish as a team
- To understand why beans are soaked overnight
- To understand the physical phenomenon osmosis
- Experiment with salt and pepper
- Understand what static electricity is and how it works
- Learn about charges and forces among them
- Understand that distance affects these (electrostatic) forces

Name of recipe and experiment

- Pasta and beans
- Pepper jumps

Specific skills and competences

- To follow the procedure of preparing an Italian main dish
- To successfully prepare the dish as a team
- To understand why beans are soaked overnight
- To understand the physical phenomenon osmosis
- Experiment with salt and pepper
- Understand what static electricity is and how it works
- Learn about charges and forces among them
- Understand that distance affects these (electrostatic) forces

Connection between recipe and experiment: **Salt and Pepper**

Information for the mentor

Duration:
Overnight (for soaking beans), additional 1,5 hour for cooking and experiment

Basic sci-info behind cooking:

Soaking beans overnight helps remove some of the oligosaccharides they contain making it easier for our bodies to break them down. This makes it less likely to have gas after eating them. The reason beans "swell" is due to the phenomenon of osmosis, according to which water molecules pass through their membrane increasing their volume.

Basic sci-info behind the experiment:

Mixtures are made up of two or more substances which are not combined chemically. Each component of a mixture keeps its original properties and the separation of components can be easily done using physical methods.
Things can have positive, negative, or neutral electric charge. They become positively or negatively charged, usually due to friction. This is called static electricity.
When we rub two materials together, a charge transfer occurs between them. The one we rub becomes negatively charged, leaving the other positively charged.
When positively or negatively charged materials come close, they interact with each other. They may be attacked or repelled, depending on the charge they have. If they have unlike charges attract, if they have like charges, they repel.

Pasta and beans *(main)*

You need to buy: *(for 4 persons)*

- 320 g short pasta
- 200 g dried beans (borlotti)
- 250 g tomato sauce
- 80 g lard
- 80 g bacon
- 1 onion
- 1 celery stick
- 1 carrot
- 1 garlic clove
- rosemary
- bay leaves
- salt
- pepper

Tools that you need:

- Pot
- Skimmer
- Knife
- Chopping board
- Blender

Cooking steps:

1 Soak beans overnight, then boil them for 80 minutes.

2 Sauté chopped vegetables with bacon and lard.

3 Add beans and their water, followed by tomato sauce, and cook for 20 minutes.

4 Blend some beans with rosemary to make a cream, add back to the soup.

5 Cook pasta in the bean broth, and stir in the bean cream before serving.

Experiment 11

Pepper jumps

We create mixtures every day, but can we also separate them into their ingredients?

Using everyday materials, we will study static electricity and, with its help, experiment with the separation of solid mixtures.

What you need:

- Salt
- Pepper
- A plate
- Balloon
- Wool cloth or clothing

What to do:

1. Measure about a teaspoon of salt and a teaspoon of pepper.

   Put them on the plate and use the spoon to mix them together.

2. Can you separate the salt from the pepper?

   Can you think of a way to separate them using only the spoon?

3. Blow up the balloon and tie its end so it doesn't lose air.

4. Rub the balloon on your hair or on a piece of wool cloth.

5. Hold the balloon close to the pile of salt and pepper.

   Approach it at various distances from the pile and observe what happens.

6. Try to find the right distance at which only the pepper jumps away from the pile and clings to the balloon.

What is going on?

Mixing salt and pepper you created a mixture.

Mixtures are made up of two or more substances which are not combined chemically. Each component of a mixture keeps its original properties and the separation of components can be easily done using physical methods.

Things can have positive, negative, or neutral electric charge. They become positively or negatively charged, usually due to friction. This is called static electricity.

When we rub two materials together, a charge transfer occurs between them. The one we rub becomes negatively charged, leaving the other positively charged.

When positively or negatively charged materials come close, they interact with each other. They may be attacked or repelled, depending on the charge they have. If they have unlike charges attract, if they have like charges, they repel.

In our experiment both salt and pepper are positively charged. As you rub the balloon with the wool clothing or on your hair, you are giving it a negative charge. That’s why the balloon can attract both salt and pepper.

However, pepper is lighter than salt. So, holding the balloon in the right place, the pepper moves more easily and appears to “jump” and separate from the salt.

Science Snacks:

Static electricity

Static electricity is formed much better when the air is dry. When the air is humid, water molecules gather on the surface of the materials, preventing the build-up of electrical charges.

Duration:
1.5 hours

Information for the mentor

Objectives

- To follow the procedure of preparing an Italian dessert
- To successfully prepare the dish as a team
- To be precise when cutting apples
- To learn about convection as a way that heat is transferred
- to Experiment with apples lemon juice
- To observe the chemical process by which air reacts with enzymes in fruits, changing their color
- To learn about the chemical reaction of oxidation
- To understand that the oxygen of the air causes oxidation

Name of recipe and experiment

- All-Apple Cake
- Anti brown experiment

Specific skills and competences

- Careful use of knife when cutting fruit
- Precision when breaking the eggs
- Precision when folding the apple slices
- Awareness of time when baking the cake
- Awareness of time when experimenting
- Follow instructions
- Observe the results of the experiment
- Compare the results
- Distinguish between an apple that has been immersed in lemon juice and an apple that has been left free in air
- Understand that lemon juice prevented the apple to turn brown
- Practice in making conclusions

Connection between recipe and experiment: **Usage of apple and lemon**

Basic sci-info behind cooking:

Convection is a way in which heat travels. It occurs when heat is transferred through the movement of liquids or gases. It can be either natural or mechanical. Natural convection happen when water is heated in a pot. Molecules of water at the bottom of the pot rise and warm while cooler and heavier molecules sink. Examples of mechanical convection include stirring water when heated in the pot or when a convection oven uses a fan to blow hot air over and around the food while baking.

Basic sci-info behind the experiment:

Apples contain an enzyme called polyphenol oxidase. When the apple is cut open, oxygen from the air comes in contact with this enzyme and a chemical reaction (enzymatic oxidation) takes place immediately.
This reaction turns colourless compounds into a brown pigment called melanin and the apple turns brown. It's similar to rust forming on metal.
Melanin is the dark brown pigment that colors hair, skin and the irises of our eyes. It also turns fruit and vegetables brown.
The longer the apple is exposed in the air, the browner will become.
Lemon juice protects apples from browning.
This happens because lemon, which is an acid ($pH<3.0$), creates an acidic environment for the apple. In such an environment the enzyme becomes almost "inactive" preventing (or slowing down considerably) the enzymatic oxidation from occurring.

All-apple cake *(dessert)*

You need to buy: *(for 4 persons)*

- 5 apples
- 2 eggs
- 70 g flour
- 50 g sugar
- 40 g butter
- 100 ml milk
- 7 g baking powder
- Lemon zest
- pinch of salt

Tools that you need:

- Mixing bowl
- Knife
- Electric mixer
- Cake pan

Cooking steps:

1 Slice apples thinly and soak in water with lemon juice.

2 Warm milk and butter together.

3 Beat eggs and sugar, then mix in lemon zest, flour, and baking powder.

4 Fold in the apple slices.

5 Bake at 180°C for 40 minutes, then sprinkle with sugar and butter, bake for another 10 minutes.

Experiment 12
Anti-brown experiment

Should we eat fruits and vegetables if they have turned brown?

With this experiment we will observe the chemical process by which air reacts with enzymes in fruits, changing their color.

What you need:

- 1 apple
- Sharp knife
- 2 lemons
- 1 bowl (big enough to fit half the apple)
- Paper plates
- A marker
- Pen and paper
- Clock/timer

Note: The experiment starts at the beginning of the workshop, before preparing the dessert and is completed and explained at the end. Steps 1-11 are performed before starting cooking the recipe. Step 12 and the explanation is given at the end.

What to do:

1. Take two paper plates.
   With the marker write the word “Control” onto the edge of one plate.
   Write the word “Lemon” onto the other plate.

2. Cut the lemon in half.

3. Use the lemon squeezer and squeeze the lemon pieces.

4. Pour lemon juice into the bowl.
   Make sure that the lemon juice completely covers the bottom of the bowl.

5. Cut the apple in half.

6. Take one half of an apple half and put it into the bowl with lemon juice.
   Make sure it is placed in lemon juice with its white part downwards.

7. Set the timer at 1 minute.

8. In the meantime, take the other apple half and place it onto the plate named “Control”.
   Make sure it is placed with its cut open part upwards.

9 When the timer rings (after one minute), take the apple half of the bowl with the lemon juice.

Put it onto the plate named “lemon” with its cut open part upwards.

10 Place the two plates aside, the one next to another and leave them there.

Set the timer at 20 minutes.

11 When the timer rings (after 20 minutes) observe the apple pieces onto the two plates.

- Do you notice any differences between them?
- What color are the pieces of apple in plate “Control”?
- What color are the pieces of apple in plate “Lemon”?
- Why do you think there is such a difference in the color between them?

What is going on?

You observe a difference in color between the two pieces of the apple. The apple half that was not placed in the lemon juice turned brown. Let's see why.

Apples contain an enzyme called polyphenol oxidase. When the apple is cut open, oxygen from the air comes in contact with this enzyme and a chemical reaction (enzymatic oxidation) takes place immediately. This reaction turns colorless compounds into a brown pigment called melanin and the apple turns brown. It's similar to rust forming on metal.

The longer the apple is exposed in the air, the browner will become. This is exactly what happened in the apple half onto the plate named "Control". It was left free in the air and became brown. The apple half that was covered with lemon juice and placed onto a plate named "Lemon" remained white. Lemon juice protects apples from browning.

This happened because lemon, which is an acid ($pH<3.0$), created an acidic environment for the apple. In such an environment the enzyme becomes almost "inactive" preventing (or slowing down considerably) the enzymatic oxidation from occurring.

Lime juice and cranberry juice would be just as effective as lemon juice, as they also are strongly acidic.

**Melanin is the dark brown pigment that colors hair, skin and the irises of our eyes. It also turns fruit and vegetables brown.*

Science Snacks:

Browning protects!

The enzymatic oxidation reaction is not unique to apples. It also happens in pears, bananas, avocadoes, potatoes, eggplants and other fruit and vegetables. It's believed plants use enzymatic oxidation for defense and protection. When a plant is damaged, the browning of the affected area may discourage animals and insects from eating it. It may also work to heal the plant. The browning creates an antibacterial effect, limiting the spread of destructive germs. Enzymatic oxidation is one of the largest causes of quality loss in fruits and vegetables. However, even if they are not appealing, it is perfectly safe to eat a fruit or vegetable that has gone brown due to enzymatic oxidation.

Science Snacks:

Wrap it!

Another easy way to protect fruits or vegetables from enzymatic browning is to use plastic wrap to cover the open cut parts. The wrap does not allow the air to be in contact with the enzyme, preventing enzymatic oxidation from occurring.

Duration:
1 hour

Information for the mentor

Name of recipe and experiment

- **Gazpacho**
- Liquid Rainbow

Objectives

- To follow the procedure of preparing a Spain starter dish - Gazpacho
- To successfully prepare the dish as a team
- To understand the role of the blender when preparing gazpacho and why it is necessary to use a strainer in addition
- To carefully clean non-edible parts of vegetables
- To learn about density

- Experiment with different liquids
- Understand the difference between weight and volume
- To observe how density affects the ability of liquids to form layers when stacking

Specific skills and competences

- Careful usage of blender
- Patience when mixing ingredient to a liquid state
- Precision when putting ingredients through strainer
- Making decision of thickness of the dish
- Making decision on the decoration of the dish
- Making decision of the final taste of the dish

- Precision when pouring the liquids
- Learn how to weigh using scales
- Taking notes
- Describe what is happening in each step of the experiment
- Describe layers of liquids
- Identify specific liquid in the jar
- Make a conclusion about the different position of liquids
- Understand that the layers are result of different densities of the liquids

Connection between recipe and experiment: **Liquids**

Basic sci-info behind the experiment:

Density is how heavy something is for its size. So, syrup has more density than water, and oil has less density than water.
By experimenting with different liquid and observing their behavoiur, we confirm, that even though all the cups had the same size, meaning all substances had the same volume, their weight differs.

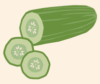
Liquids form their own layers, the one above the other. This happens because of their different densities. Science says that when stacking liquids, the less dense floats on the top of the denser.

Gazpacho *(starter)*

You need to buy: *(for 4 persons)*

 6 or 7 middle-sized tomatoes

 1 green pepper

 1 cucumber

 Half of a small white onion

 1 middle-sized clove of garlic

 60 g olive oil, look for “extra virgin”; plus a bit extra

5 ml sherry vinegar, look for “Vinagre de Jerez”

 a pinch of salt

 Some toppings that you like: For example green apple, onion, croutons (small pieces of crunchy bread), hard-boiled eggs.

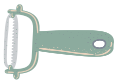
You should dice the topping into small blocks. Only do it shortly before eating.

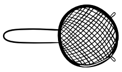
Tools that you need

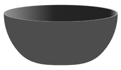
 A cutting board

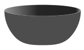
 A knife

 A blender

 A peeler for the cucumber

 A strainer or sieve

 A big bowl that can be covered. For storage in the fridge.

 4 small bowls for serving

Cooking steps:

1 First wash the vegetables: The tomato, pepper and cucumber. Dry the washed vegetables with a clean towel.

2 If you want to, you can peel the tomatoes. Chop the tomatoes into big pieces. Put the pieces into the blender.

3 Cut the pepper in half. Cut along the long side of the pepper. Throw away the seeds and white membranes from inside the pepper. Also throw away the green stalk of the paprika. Cut the pepper halves into pieces. Put the pieces into the blender.

4 Peel the garlic clove. Cut the garlic clove in half. Remove the inner core, because it can be bitter. Put the halves into the blender.

5 Peel the onion. Cut it into quarters (4 pieces). Put the pieces of onion into the blender.

6 Peel the cucumber with a knife or a peeler. Cut the cucumber in half. Add one half to the blender. The other half can be diced or cut into small pieces and used as a topping (see step 14).

7 The pieces of tomato, pepper, garlic, onion and cucumber are in the blender. Now blend it on low speed until they are mostly chopped. Then you blend it on high speed, until it is a pureé (very fine mousse).

8 When finished blending, add salt and vinegar.

9 Keep the blender running on low speed. Slowly add the olive oil, little by little.

10 When everything is blended well, switch off the blender. Now, taste the mixture. You can add a little more salt or vinegar if you want to.

11 If you want to make it thinner, mix in cold water.

12 Pour the mixture through a strainer or sieve into a bowl. This removes tomato skins and lumps.

13 Put the mixture in the fridge for at least 30 minutes.

14 Serve the gazpacho cold in the 4 small bowls.

Decorate with a drizzle of olive oil (very little oil).

Add the toppings that you chose and cut up finely.

Experiment 13

Liquid Rainbow

Stacking liquids challenge. Are you ready?

In this experiment we will learn about density and experiment with different liquids to see how their density affects their ability to form layers when stacking.

What you need:

- A tall narrow clear jar
- Water
- Vegetable oil
- Pancake syrup (or corn syrup)
- Liquid dishwashing soap (colored)
- Espresso cups
- Spoon
- Marker, pen and notepad
- Scale
- Paper towels for clean-up

What to do:

1. Place 4 cups, the one next to the other.

2. Use the marker and label the first cup “syrup”, the second cup “water”, the third “soap” and the fourth “oil”.

3. Fill each cup with the liquid that is written on it. Fill them to the top.

4. Use the scale to weigh each cup. Write in the notepad how much each cup weighs.

5. Place the jar in front of you.

6. Pour the pancake syrup from the cup into the jar. Notice that the syrup forms a layer at the bottom of the jug.

7. Slowly and carefully pour the water from the cup into the same jar. You can use a spoon to pour gently. Where does the water form its layer? Above or below the syrup layer?

8. Pour gently the soap from the cup into the jar. Where does the dishwashing form its layer?

9 Finally, slowly pour the oil from the cup into the jar.

Where does the vegetable oil form its layer?

What is going on?

You had four cups with substances: one with pancake syrup, one with water, one with liquid dishwashing soap and one with oil.

Even though all the cups had the same size, meaning all substances had the same volume, their weight differs. You can confirm it by observing the measurements you took using the scale. The cup with syrup is heavier than this with the water whereas the oil is the lighter of all. This is because of density.

Density is how heavy something is for its size. So, syrup has more density than water, and oil has less density than water.

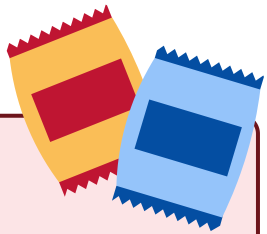
Pouring the four substances into the jar you noticed that they don’t mix together. Instead, they form their own layers, the one above the other. This happens because of their different densities. Science says that when stacking liquids, the less dense floats on the top of the denser.

The syrup that has been poured first in the jar sinks to the bottom.

Water that has been poured second, isn’t as dense as syrup, so it floats on top of the syrup, forming a separate layer.

Soap that has been poured third, being denser than water, but less dense that syrup sinks through water and forms a layer on top of syrup.

Oil that has been poured at the end floats on top of water, above all, confirming that it is the less dense substance of all the others.



Science Snacks:

Diving deeper!

Did you know that when you're swimming in the ocean, the temperature changes as you dive deeper? Near the surface, the water is warmer thanks to the sun, but as you go deeper, the temperature drops quickly. In the deep ocean, the water is chilly and stays that way year-round!

And here's something even cooler: there are underwater rivers in the ocean! These form when freshwater meets saltwater, creating a denser, river-like current that flows beneath the surface. So, next time you're at the beach, remember—there's a whole hidden world of temperature layers and underwater rivers right beneath your feet!

Duration:
1.5 hours

Information for the mentor

Name of recipe and experiment

- Paella
- Invisible ink

Objectives

- To follow the procedure of preparing a Spain main dish - Paella
- To successfully prepare the dish as a team
- To distinguish between frozen and thawed ingredient
- To learn about conduction as a way for heat to be transfered
- To understand and follow the instructions on the product
- To learn about fractions in measurements (quarters and eighths)

- Experiment with lemon, paper and heat
- To learn about the role of temperature in chemical reactions
- To observe how the properties of materials may change if we heat them up

Specific skills and competences

- Careful usage of knife when cutting hard ingredients
- Awareness of time when following specific steps of the recipe
- Measure the ingredients using maths

- Understand that heat changes the ingredients
- Follow safety measurements when dealing with heat and fire
- Predict why we don’t see the message on the paper
- Describe what is happening with the message after it is heated
- Understand that heat was the element that made the message visible

Connection between recipe and experiment: **Lemons, heat**

Information for the mentor

Basic sci-info behind cooking:

Conduction is the transfer of heat through physical contact. During cooking the burners on stoves conduct heat energy to the bottom of the pan sitting on top of it. When vegetables or raw steak touches the hot pan, heat passes through conduct from the pan to the vegetables or steak rising up their surface temperature. Conduction is the slowest method of heating and allows food to be cooked from the outside in, transforming its structure.

Basic sci-info behind the experiment:

Lemon juice is mostly made of a variety of sugars, acids, and water. At room temperature, it is mostly clear and colorless. However, heating up lemon juice causes some of its sugars to react with oxygen in the air (oxidation), which turns these sugars brown.
Acids in the lemon juice also react with fibers in the paper to make more sugars, which again turn brown when heated.
This is exactly what happened in our experiment. Bringing the light up candle close to the paper, the heat made the juice turn brown, revealing the hidden letters you wrote before.

Paella *(main)*

You need to buy: *(for 6 persons)*

- 5 g saffron strands
- 1 vegetable or chicken stock cube, for 600ml stock
- 15 g olive oil
- 125g chorizo (spicy spanish sausage)
- 500g boneless, skinless chicken meat (for example chicken breasts or thighs)
- 1 onion
- 3 garlic cloves
- 1 red pepper
- 4 g paprika spice
- 250g Spanish paella rice
- 4 medium tomatoes
- 75g frozen peas
- 250g cooked prawns with shells on
- small handful of flat-leaf parsley
- 1 or 2 lemons

Tools that you need

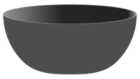
 Paella Pan / Large frying pan with a lid

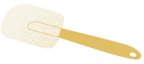
 cutting board

 a knife

 Kitchen paper

 A plate

 Bowl for fried chicken

 Wooden spatula/ Wooden spoon

 Water kettle

Cooking steps:

1 Make sure the prawns are thawed if they were bought frozen. Rinse them with water and place them on the side for later.

2 Prepare the stock cube of vegetable or chicken stock according to instructions on the product. In the end you should have 600 ml stock. Add the saffron strands into the stock. Set it aside to infuse.

3 Wash the red pepper, tomatoes and the parsley.

4 Cut open the pepper to remove all seeds. Then chop the pepper into smaller pieces. Roughly chop the tomato into dices. Also chop the parsley into smaller pieces.

5 Cut the lemon into quarter or eighths wedges.

6 Roughly chop the chorizo.

7 Heat half the olive oil in the pan. Add chorizo pieces and fry for 3 minutes until crisp.

8 Lay some kitchen paper on a plate. Remove chorizo from the pan with a cooking spoon or spatula. Place fried chorizo pieces onto the plate with kitchen paper. Leave the oil in the pan.

9 Cut the boneless chicken meat into smaller strips. Put the pieces of chicken meat into the pan with the oil. Fry them on high heat for 7 to 8 minutes.

10 It is finished when the meat looks golden and is cooked through (check by cutting a bigger piece in halves, to see if it is still raw inside). Put the cooked chicken meat in a bowl and set it aside

11 Peel and chop the onion into dices.

12 Peel the garlic cloves. Then chop them very finely into very small pieces.

13 Add the second half of the oil to the pan. Then add the chopped onion and garlic to the pan. Fry them for 4 to 5 minutes while stirring them.

14 Add paprika spice and the chopped red pepper pieces. If necessary, add a little more oil. Fry it for 2 minutes. Keep stirring.

15 Add the rice to the pan. Mix it well with the oil and everything that's already in the pan. Use a wooden spatula or wooden spoon.

16 Next you pour in the saffron-infused stock, which you prepared earlier.

17 Boil 450 ml of water in the kettle. Add the boiling water to the pan. Stir well.

18 Add the cooked pieces of chicken to the pan. Then add the chopped tomatoes as well. Then cover the pan. Cook everything on medium heat for 10 minutes. Stir once or twice.

19 Add the Peas, Prawns and Chorizo into the pan. Cover the pan again. Cook for 5 to 10 more minutes. It is finished when the rice has absorbed most of the liquid in the pan. Then you remove the pan from the stove and switch off the stove. Leave the lid on for 5 more minutes.

20 Stir a few times to mix the ingredients. Season with salt and pepper to taste. Decorate with the chopped fresh parsley and the lemon wedges. Now you can serve your paella!

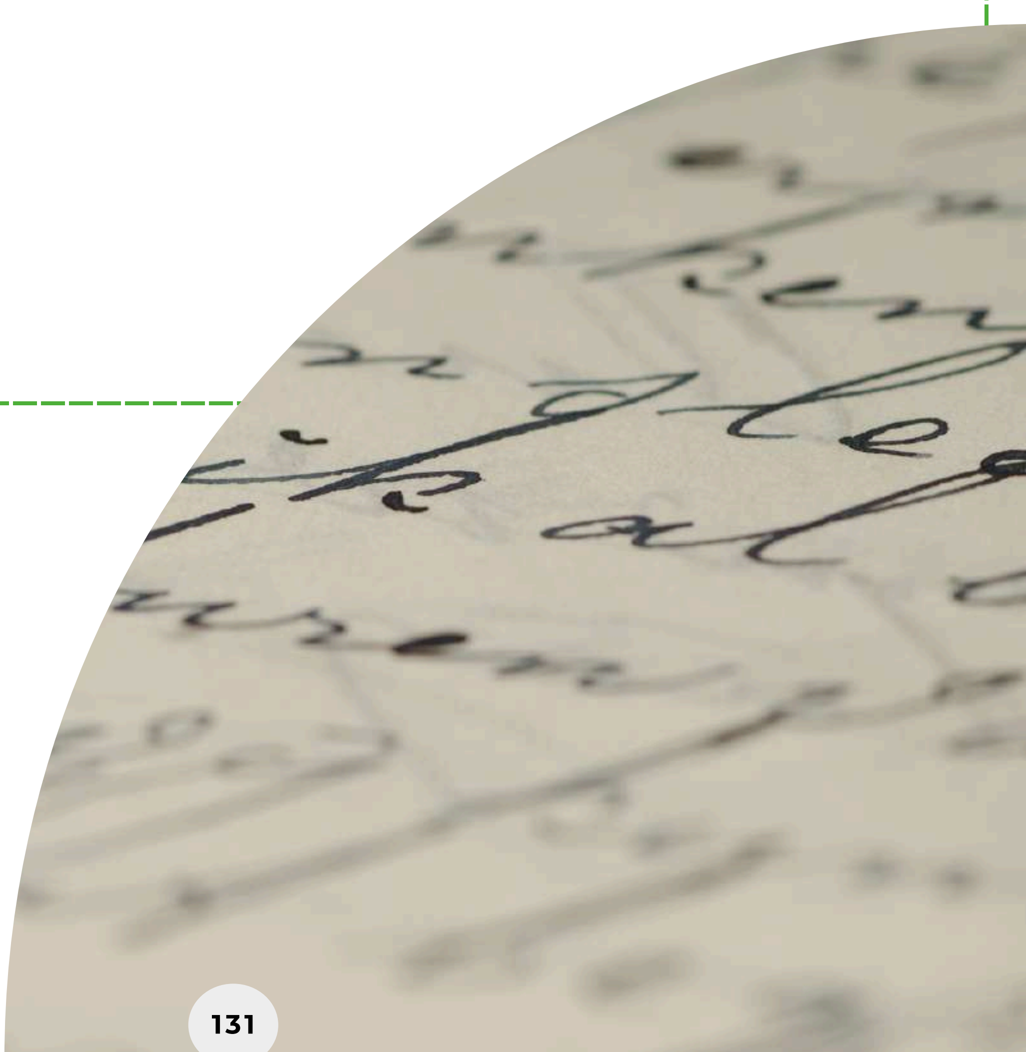
Experiment 14
Invisible ink

Do you wish to create a secret message? Do it while enjoying your homemade lemonade!

This experiment will show us the role of temperature in chemical reactions and help us see how the properties of materials may change if we heat them up.

What you need:

- Lemons
- Small Bowl
- Lemon squeezer
- Cotton swabs
- Paper
- Hair Dryer



What to do:

1. Use the lemon squeezer to squeeze a lemon.

2. Pour the lemon juice into the bowl.

3. Dip a cotton swab into the juice for a second.

4. Using this cotton swab as a pencil, write a secret message on the paper.

   Can you read the message you just wrote?

5. Let the paper dry completely. It may take 1-2 minutes.

6. Try again to read the secret message, or challenge a friend to read it.

   Can you read what you wrote? Why?

7. Turn on the hairdryer and hold it a few inches above the paper.

8. Keep the hairdryer on for a few moments, directing the hot air onto the paper.

9. Do you observe anything happening on the paper?

10. Try again to read the message.

    Can you read it this time?

What is going on?

Using lemon juice to write something on the paper, looks like nothing is happening. It's like you are writing with invisible ink! Let's see why...

Lemon juice is mostly made of a variety of sugars, acids, and water. At room temperature, it is mostly clear and colorless. However, heating up lemon juice causes some of its sugars to react with oxygen in the air (oxidation), which turns these sugars brown.

Acids in the lemon juice also react with fibers in the paper to make more sugars, which again turn brown when heated.

This is exactly what happened in our experiment. By bringing the hairdryer close to the paper, the heat caused the lemon juice to turn brown, revealing the hidden letters you had written earlier.

Science Snacks:

UV-readable ink

Besides lemon, vinegar, milk or a water solution of baking soda can be used as invisible inks. The message that is written with them becomes visible when the paper is heated but remains visible forever afterwards.

Invisible UV-readable inks overcome this. Writing with this kind of inks ensures that the message remains invisible except when placed under a UV light. They work because they contain substances that glow under different types of light but remain invisible to the naked eye.

Duration:
5 hour

Information for the mentor

Objectives

- To follow the procedure of preparing a Spain dessert
- To successfully prepare the dish as a team
- To understand why we need organic oranges when using peels
- To learn about caramelization

- Experiment with lemon peels and a balloon
- To observe the effects of the chemical reaction happening between the material a balloon is made of and the ingredient of a citrus fruit
- To learn about what a balloon is made of

Name of recipe and experiment

- Crema Catalana
- Dissolving drops

Specific skills and competences

- Precision when separating egg yolks from an egg
- Precision when whisking the egg yolk and sugar
- Careful usage of blowtorch
- Understand why we need to cover the mixture with plastic bag when storing
- Patience to wait until the dish refrigerates
- Precision when pouring and dividing the pudding into smaller cups (ramekins or traditional clay dishes)

- Manual dexterity in tying the balloon
- Persistence in carrying out the experiment
- Follow instructions
- Repeat the experiment until having the desirable result
- Describe what is happening in the balloon
- Understand that it is the peel content that caused the burst of the balloon

Information for the mentor

Duration:
1 hours for preparation and experiment, min. 4 hours to refrigerate the dish

Connection between recipe and experiment: **Citrus peels**

Basic sci-info behind cooking:

Caramelization is what happens when any sugar (such as white sugar or the sugar contained in a food) is heated at high temperature. A few tablespoons of sugar put in a pan and heated will eventually melt and, at 170°C start to turn brown. At this temperature water is removed, the sugar compounds begin to break down and new compounds form producing a sweet, nutty, or buttery flavour and golden-brown to dark brown colour.

Basic sci-info behind the experiment:

Modern balloons are made from materials such as rubber, latex, metalized plastic or a nylon fabric.
When you inflate the balloon, it stretches thin. Air is kept inside as long as the rubber or latex is intact. If it gets damaged the balloon will pop.
Lemons and all other citrus fruits contain a chemical called limonene. Limonene is actually used in many cosmetics and cleaning products, which makes them smell fresh.
Latex (or rubber) and limonene are hydrocarbons and they chemically react when they come into contact with each other.
When the limonene oil touches the surface of the balloon, some of the latex (or rubber) from the balloon immediately begins to dissolve in the limonene, resulting in a pop!

Crema Catalana *(dessert)*

You need to buy: *(for 4 persons)*

- 30 g flour
- 4 Eggs (only need the yolks)
- 50 g white sugar
- 100 g brown sugar
- 450 ml Whole Milk
- 1 Cinnamon Stick
- 1 organic orange (only need the peel)

Tools you will need:

- A medium-sized pot
- A peeler
- Whisk
- Small bowl and mixing bowl
- Ramekins or traditional clay dishes
- Plastic wrap
- Blowtorch or traditional iron rod

Cooking steps:

1. Add 450 ml Milk to the pot.

2. Peel the organic orange with a peeler. You only want the orange-colored peel, not the white underneath. Drop the orange peel into the milk.

3. Add the cinnamon stick to the milk as well.

4. Switch on the stove and heat the milk with peel and cinnamon. When it starts to slightly boil, switch off the stove. Remove the pot from the hot stove.

5. In a small bowl, mix the flour with a little water.

6. Separate the egg white from the egg yolk. You only need the egg yolk.

7. In a mixing bowl: Mix the egg yolks with 50 g white sugar. Whisk until it is light yellow.

8 Add the mix of flour and water to the mixing bowl of sugar and egg yolk. Whisk together.

9 Add a little of the warm milk to the mixture in the mixing bowl. Keep whisking.

10 Remove the citrus peels and cinnamon stick from the milk. For example using a spoon or small sieve.

11 Slowly add the egg mixture to the milk in the pot. Whisk in the pot to combine everything. The stove should be on low heat.

12 Keep whisking in the pot until it thickens like a pudding.

13 Pour into the ramekins or traditional clay dishes.

14 Cover each dish with plastic wrap. Press the wrap onto the surface so that it can not form a skin on top.

15 Refrigerate the dishes for 4 hours. Or you can refrigerate it overnight.

16 For serving: Remove the plastic and sprinkle a layer of brown sugar on top of each serving.

17 Use the blowtorch or traditional iron rod to burn the sugar until it is caramelized.

Experiment 15

Dissolving drops

Latex balloons have a major citrus allergy!

With this experiment we observe the effects of the chemical reaction happening between the material a balloon is made of and the ingredient of a citrus fruit.

What you need:

- Balloons
- Lemons
- A knife (if needed)

What to do:

1. Blow the balloon up quite big. Tie its end.
2. Peel a lemon.
3. Take a peel from the lemon in your hand.
4. With your other hand keep the balloon near the lemon peel.

5 Squeeze the lemon peel hard enough to spray its oil to the balloon. What happens to the balloon?

6 If nothing happens, try again with another peel.

What is going on?

Balloons are inflatable flexible bags filled with gas, most often air or helium. Modern balloons are made from materials such as rubber, latex, metalized plastic or a nylon fabric.

When you inflate the balloon, it stretches thin. Air is kept inside as long as the rubber or latex is intact. If it gets damaged the balloon will pop.

Lemons and all other citrus fruits contain a chemical called limonene. Limonene is actually used in many cosmetics and cleaning products, which makes them smell fresh.

Latex (or rubber) and limonene are hydrocarbons and they chemically react when they come into contact with each other.

When the limonene oil touches the surface of the balloon, some of the latex (or rubber) from the balloon immediately begins to dissolve in the limonene, resulting in a pop!

Science Snacks:

Natural latex

Natural latex is harvested from the rubber tree *(Hevea brasiliensis)*. Farmers tap the tree to collect the milky latex sap, which is then processed into rubber products.

Science Snacks:

Limonene

Unlike harsh chemicals, limonene is a natural and non-toxic solvent, making it an eco-friendly way to break down latex. It’s commonly used in cleaning products and air fresheners because it’s biodegradable and safe to use around the house.

Duration:
1 hour

Information for the mentor

Objectives

- To follow the procedure of preparing a Spain starter
- To identify the wooden parts of the ingredient asparagus
- To learn that the material of cooking utensils affects the cooking time

- Experiment with egg and salt
- To learn what density is
- To learn what the term buoyancy is about
- To understand that density affects the ability of an object to float or sink into water
- To realisethat adding salt to a liquid increases its density

Name of recipe and experiment

- Scrambled Egg with Asparagus
- Floating Egg

Specific skills and competences

- Careful usage of sharp utensils, such as knife, when cutting hard ingredients (wooden parts of asparagus)
- Precision when measuring the same length of an ingredient
- Precision when cutting fine slices of garlic
- Making decision when the asparagus is cooked enough
- Making decision when the dish is creamy enough
- Identify when the dish is fully cooked

- Follow directions
- Observe the behaviour of eggs when placed in water or salty water
- Observe that the egg floats in salty water
- Understand that the egg floats because we added salt

Connection between recipe and experiment: **Eggs**

Basic sci-info behind cooking:

Cooking utensils can be made from copper, stainless steel, aluminium or earthen pots. The material of the utensils can decide the time of cooking and also alter the taste of the food. This is happening because different materials have different ability to transfer heat. For example, frying an egg in a pan made of stainless steel needs a lot more time than using an aluminium pot just because the thermal conductivity of aluminium is almost 15 times higher than stainless steel.

Basic sci-info behind the experiment:

Density of an object is the amount of substance (mass) within the volume occupied by the object. A simple definition of density is how heavy something is compared to its volume.
If two objects have the same volume (i.e. same size), the heavier one (this with more substance) is denser than the other (the one with less substance).
If an object is denser than the water, it sinks. On the other hand, if an object is less dense than the water surrounding it, it floats.
The ability of an object to float or rise in a fluid (such as water or air) is called buoyancy.
Buoyancy depends on the density of the fluid in which an object is immersed. The bigger the density of the fluid, the bigger the buoyant force. Adding salt in water increases the density of water. The buoyant force in the egg increased as well. It became bigger than the gravity force, so the egg was raised in the water.

Scrambled Egg with Asparagus *(starter)*

You need to buy: *(for 4 persons)*

- 250 g green Asparagus
- 3 Eggs
- Slices of Bread
- 50 g virgin olive oil
- 1 clove of garlic
- A bit of salt

Tools you will need:

- A knife
- Cutting board
- Two skillets/ pans
- Wooden spoon
- A mixing bowl
- A whisk
- A spatula

Cooking steps:

1 Wash the asparagus well.

2 Use the knife and cutting board. First cut off the hard, wooden part at the bottom of every asparagus. Then cut every asparagus into 3 pieces. The pieces should have the same length.

3 Peel the outer layer of the garlic clove. Cut the garlic into very fine slices.

4 Add some olive oil to a pan, so that the pan bottom is covered with oil. Place the pan on the stove. The stove should be at medium heat.

5 Add the sliced garlic and a little bit of salt. Then add the cut pieces of asparagus.

6 Leave to fry for 5 to 10 minutes. Remember to stir every now and then with a wooden spoon. Test with a fork: Thicker asparagus might take up to 10 minutes to be soft, thinner asparagus might only need 5 minutes. When the fork goes easily into the asparagus, it is ready for the next step (eggs).

7 Lower the heat of the stove.

8 Crack open the eggs on the side of the bowl. Pour egg white and egg yolk into the bowl.

9 Whisk the eggs until it is foamy. Then pour it into the pan with the asparagus.

10 Stir gently on a very low heat. When it looks creamy, carefully try something. Add more salt if necessary.

11 Add some olive oil to the other pan. The stove should be at medium heat. Then add the bread slices two by two. Fry them from both sides until golden. Turn them with a spatula.

12 Put the scrambled egg with asparagus onto the 4 plates. Serve garnished with the bread.

Experiment 16

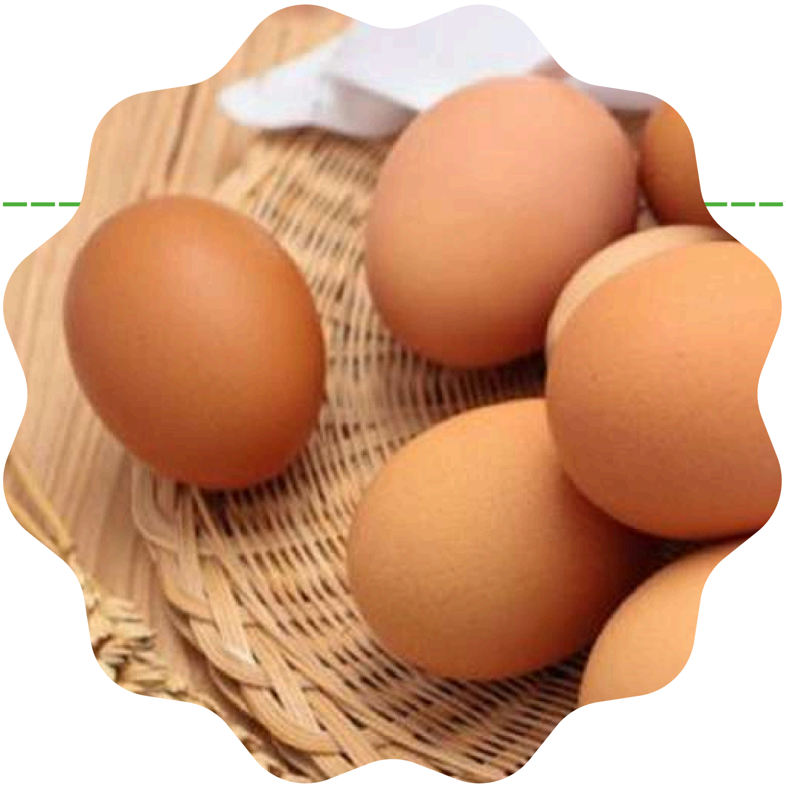
Floating egg

Who doesn't like to play with water by submerging things in it or making things float on its surface?

In this activity we will see how density affects the ability of an object to float or sink into water.

What you need:

- 2 clear glasses
- tap water
- salt
- 2 eggs
- a tablespoon



What to do:

1. Fill the two glasses with tap water.

2. Put an egg into one of the glasses. The egg is sinking.

3. In the other glass, add a tablespoon of salt and stir with the tablespoon. Keep adding salt until no more salt can dissolve. The solution is now saturated (It can't dissolve any more salt).

4. Put the other egg into the saturated salt solution. The egg in this glass is now floating.

What is going on?

Some objects sink in water while others float.

This has to do with the density of the object compared with the density of the surrounding water.

Density of an object is the amount of substance (mass) within the volume occupied by the object. A simple definition of density is how heavy something is compared to its volume. If two objects have the same volume (i.e. same size), the heavier one (this with more substance) is denser than the other (the one with less substance).

If an object is denser than the water, it sinks. On the other hand, if an object is less dense than the water surrounding it, it floats. An egg is denser than freshwater. That's why it sinks to the bottom when you put it in a glass of tap water.

Adding salt to the water increases the mass of the water without changing the volume too much. So, the (salted) water becomes denser. When you add enough salt, the water can become denser than the egg. Therefore, the egg can float in the saturated salt water.

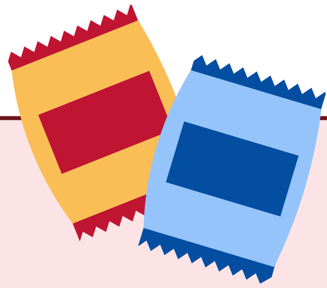
More science...

The ability of an object to float or rise in a fluid (such as water or air) is called buoyancy. Buoyancy describes how well an object floats.

When you put an object in water two forces are acting in the object. The one is the force of gravity, which is exerted by the Earth and pulls the object downward trying to sink it. The other is an upward force, known as buoyant force, which is exerted by the water. If buoyant force is bigger than gravity force the object will sink. If it is smaller the object will float on the surface of the water. If two forces are equal the object will float inside the water.

Buoyancy depends on the density of the fluid in which an object is immersed. The bigger the density of the fluid, the bigger the buoyant force. Adding salt in water increases the density of water. The buoyant force in the egg increased as well. It became bigger than the gravity force, so the egg was raised in the water.

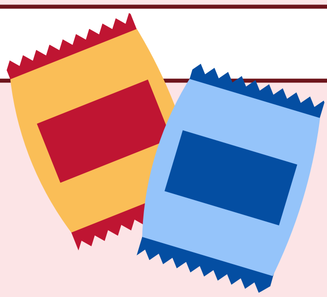
Science Snacks:



Swimming in the Dead Sea

Many objects can float easily in the ocean because it contains salt water. The Dead Sea is famous for its extremely high density salt water and people can easily float in it without much effort.

Science Snacks:



If your egg floats, it is rotten (or not?)

There is a very popular kitchen hack to determine if an egg is fresh or not. Just place it in a bowl of water. If it sinks, it is fresh. If it floats, it is old and you have to discard it.

The hack has a scientific base. Eggs have a small air pocket inside the shell. Eggshells are very porous, so as time goes by, the egg loses moisture, causing its contents to shrink. At the same time its small air pocket starts to expand. The egg becomes less and less dense, causing the egg to float in water.

However, science says that this is not the proper way to determine if an egg is safe or not safe to use. To determine if your egg is safe to eat, crack the egg into a bowl and examine it for an off-odor or unusual appearance before deciding to use or discard it. A spoiled egg will have an unpleasant odor when you break open the shell, either when raw or cooked.

Duration:
3 hours + some days

Information for the mentor

Objectives

- To follow the procedure of preparing a Spanish main dish
- To successfully prepare the dish as a team
- To carefully follow the steps of the recipe without skipping or mixing up steps

- To lean what molecules are
- To learn about plastic and its structure
- Experiment with milk and vinegar
- Understand that chemical reactions create new materials
- To create a new material from edible ingredients – milk and vinegar

Name of recipe and experiment

- Albondigas
- Milky plastic

Specific skills and competences

- Measure ingredients by using fractions (e.g. 1/3 of 45)
- Careful usage of blender/immersion blender
- Careful usage of peeler
- Manual dexterity when creating meatballs
- Literacy when following the multipart recipe

- Precision when heating the milk
- Follow step by step instructions
- Manual dexterity while performing the experiment – making strainer, making balls, decorating balls
- Describe the properties of the new material
- Realise that the new material is plastic
- Compare the ingredients before and after the experiment

Information for the mentor

Duration:
3 hours, additional several days for complete result of the experiment

Connection between recipe and experiment: **Milk, creating balls**

Basic sci-info behind the experiment:

Plastic is anything that is made up of molecules that are repeated over and over again in a chain. These chains are called polymers. All plastics are polymers.
Molecules are the smallest units of any given thing. You, your clothes, your watch, even the food you eat is all made up of molecules! Unfortunately, molecules are way too small to be seen with just your naked eye.
Milk contains many molecules of a protein called casein. These molecules are normally curled up and dissolved.
When you heat milk and add vinegar (which is an acid), a chemical reaction takes place. This reaction makes the molecules curl into a different shape and form long chains, meaning polymers, meaning plastic.

Albondigas *(main)*

You need to buy: *(for 8 persons)*

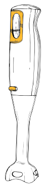
- 35 g Breadcrumbs
- 30 ml milk
- 2 small white onion
- 1 kg ground pork
- ½ kg (500 g) ground beef
- 2 eggs
- 20 g salt
- 7 g black pepper (ground)
- A little Nutmeg (ground)
- 8 g fresh parsley
- 45 ml olive oil
- 1 medium carrot
- 2 g sweet paprika spice
- 400 g tomatoes
- 45 ml brandy
- 230 ml dry red wine
- Flour for dusting the meatballs
- 300 ml chicken broth

Tools you will need:

- A cutting board and knife
- A bowl
- A peeler

Tools you will need:

 A saucepan

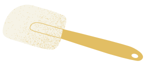
 A blender: standard blender or immersion blender 

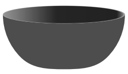
 1 large plate

 Baking paper

 Baking tray with a rim

 Another pan or skillet for frying meatballs

 A spatula

 Bowl for finished meatballs

Cooking steps:

1 Peel and cut 1 onion into small blocks.

2 Add the onion, breadcrumbs and milk to a bowl. Stir well until combined and let it stand for 5 minutes.

3 Cut the fresh parsley into smaller pieces. Add it to the breadcrumb mixture. Then add to the mixture the ground pork and beef.

4 Add the eggs, the salt, ground pepper and ground nutmeg as well. Mix everything gently by kneading it. Cover the mixture in the bowl with a foil or a lid. Refrigerate it. This is the meatball mixture.

5 Next you peel and dice the other onion. Also peel the carrot using the peeler and cut it into small pieces (dice) as well.

Next you also dice the tomatoes.

6 Heat ⅓ of olive oil in the saucepan. The stove should be on medium heat. Then add diced onion and carrot. Fry them and stir until they are soft and gold-brown. This should take 5 to 7 minutes.

7 Add paprika spice, diced tomatoes and brandy. Increase the heat of the stove to high. Cook and stir at least 1 minute.

8 Then add wine and chicken stock (If you bought chicken broth powder: Prepare 300ml according to instructions on its packaging with hot water. Then add it).

9 When it boils, reduce the stove heat to medium-low. Cover the pan. Let the sauce simmer (lightly boil) for 30 minutes. Remember to stir regularly.

Add some salt as you like it (try with a spoon – carefully, it will be hot).

10 If you have a standard blender: Add half the sauce to it and blend. Then add it back to the rest of the sauce.

If you have an immersion blender: Puree half the sauce in the saucepan. (watch out that nothing splashes – it is hot)

11 Keep the sauce on low heat to keep it warm.

12 Get the bowl with the meatball mixture from the fridge. Put a thin layer of flour onto a large plate.

Put a sheet of baking paper onto a rimmed baking tray.

13 Use a teaspoon or tablespoon to scoop small portions of meatball mixture onto the baking tray. They should have a diameter of 3 cm each, more or less. Gently roll a small portion of meatball mixture between your cupped hands, until it is a ball. Then roll the meatball in the flour on the plate. Replace the ball on the baking tray.

Repeat this step until all portions are meatballs covered in flour.

14 Heat another ⅓ of the olive oil in a pan. The stove should be on medium heat. Add half of the prepared raw meatballs to the pan. Brown them on all sides. This should take 3 to 5 minutes. Regularly turn them with the spatula. When they are brown, put them in a bowl.

Repeat this step with the remaining oil and remaining raw meatballs.

15 When all meatballs are done and in the bowl: Add 80 ml of tap water to the empty pan. Scrape up brown bits with the spatula and stir. Add this mixture to the sauce that was made before with the vegetables. Gently stir.

16 Add the meatballs to the sauce. Let them cook on low heat for 5 to 7 minutes. Switch off the stove to let everything cool down for 5 minutes.

17 In the meantime wash the parsley and dry it. Pull it into smaller pieces. Serve meatballs and sauce in a shallow serving bowl or in 8 soup bowls. Decorate it with the parsley.

Experiment 17

Milky Plastic

We don't make plastics only in factories! We can do it in our kitchen!

In this activity we will talk about plastic and its structure. We will experiment with everyday materials to produce plastic from milk and vinegar.

**SOS: Your milk creations are not edible!*

**SOS: The activity uses hot liquids.*

What you need:

- 1 cup of full fat milk (or heavy cream)
- White vinegar
- Pan to heat milk
- Stove top
- A jar
- A tablespoon
- A teaspoon
- Cookie cutters
- A pantyhose
- A Rubber band
- Optional: Food coloring, glitter, markers

What to do:

1. Pour 1 cup of milk into a pan.
2. Place the pan on the stove and warm it at low temperature (Don’t let it boil!).
3. Turn off the heat.
4. Add a drop off food coloring and 4 teaspoons of vinegar. Stir the milk until lumps form.
5. Cut a foot off a pair of panty hose to create a strainer. Put the toe inside the jar. Fold the top over the sides and wrap the rubber band around the top to hold it in place.
6. Pour the milk into the strainer and leave it for 10 min. Squeeze it out into the jar. After squeezing you will be left with little lumps into the strainer.
7. Scoop the lumps out of the strainer, squeeze them and form them into a ball.
8. While still wet, press the ball into a cookie cutter.

9 Remove the cutter. You have your milk creation!

10 Leave your milk creation on some paper to dry. It will take a couple of days for it to dry. Once dry, use markers and glitter to decorate your creation!

**SOS: Make sure your area is well ventilated when creating your milk shapes. Hot milk and vinegar do not create the most pleasant of smells!*

**To avoid clogging your drain, do not put any of the solid white clumps down the sink. Instead, discard them in the garbage.*

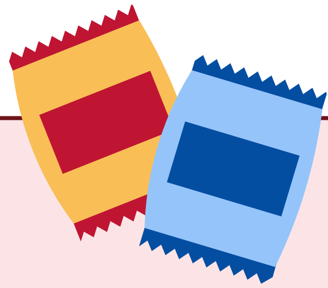
What is going on?

Actually, you have created plastic using milk and vinegar!

Plastic is anything that is made up of molecules that are repeated over and over again in a chain. These chains are called polymers. All plastics are polymers.

Milk contains many molecules of a protein called casein. These molecules are normally curled up and dissolved. When you heat milk and add vinegar (which is an acid), a chemical reaction takes place. This reaction makes the molecules curl into a different shape and form long chains, meaning polymers, meaning plastic.

*Molecules are the smallest units of any given thing. You, your clothes, your watch, even the food you eat is all made up of molecules! Unfortunately, molecules are way too small to be seen with just your naked eye.



Science Snacks:

Made from casein!

Casein is used today to make a huge variety of different products. It can be used to make paint, glue, and our favorite: CHEESE!

Back in the 1900’s, milk was commonly used to make everyday items such as buttons, hair combs, and even jewelry.

Duration:
3 hours

Information for the mentor

Objectives

- To follow the procedure of preparing a Spanish dessert
- To successfully prepare the dish as a team
- To carefully follow the steps of the recipe
- To learn about disposal of used cold oil

- Experiment with flour and oil
- To learn what polymers are
- To explore the properties of polymers
- To make own kinetic dough by mixing ingredients from kitchen

Name of recipe and experiment

- Churros
- Kinetic dough

Specific skills and competences

- Precision when measuring the ingredients
- Careful usage of handheld mixer
- Careful usage of thermometer
- Follow safety measurements when dealing with extremely hot surfaces (hot oil)
- Cooperation when putting churros in the oil
- Precision when creating individual churro

- Describe the state of the ingredients
- Follow instructions
- Motivation to perform an experiment in multiple levels
- Persistence in experimenting to get the desired result
- Test the behaviour of the two different mixtures
- Compare the behaviour of the mixtures
- Describe their behaviour
- Understand that the behaviour of flour changed due to added oil

Connection between recipe and experiment: **Dough**

Basic sci-info behind cooking:

Phase transformation: Melting is the process through which a solid substance transforms into a liquid state under the influence of heat. Ice cubes melt into water when left outside the refrigerator, chocolate melts in your warm hands and butter melts when heated in a pan.

Basic sci-info behind the experiment:

Polymers are materials made from long chains of repeating molecules. The type of molecules and the way they are bonded to form the chains give polymers unique properties. Some polymers bend and stretch, like rubber. Others are hard and tough, like glass.

Polymers are used in almost every area of modern living. Grocery bags, soda and water bottles, textile fibers, phones, computers, food packaging, auto parts, and toys all contain polymers. All these are mainly synthetic polymers. However, natural polymers also exist. Proteins are such polymers made up of amino acids, and nucleic acids (DNA and RNA).

Churros *(dessert)*

You need to buy: *(for 4 persons)*

For churros

- 85 g unsalted butter
- vegetable oil for frying
- 200g sugar
- 2 eggs
- 120 g flour
- 6 g salt
- 30 g ground cinnamon

For chocolate dipping sauce

- 130 g dark chocolate chips
- 180 g heavy cream
- 2,5 g ground cinnamon
- 1,5 g teaspoon salt

Tools you will need:

- Large saucepan
- Wooden spoon
- Rimmed baking sheet or large plate
- Large bowl
- Handheld mixer
- Large pot
- Deep-fry thermometer (for pot)
- Piping bag with large open star tip
- Ruler
- Kitchen scissors
- Slotted spoon or tongs
- Wire rack
- Heatproof bowl
- Small Saucepan
- Whisk

Cooking steps:

For the churro dough:

1. Put the large Saucepan on the stove. It should be at medium heat.

2. Add 85 g butter to the pan.

3. Then add 240 ml of tap water to the pan.

4. When the mixture in the pan boils, stir well and remove pan from heat (switch off stove).

5. Add 120 g flour. Then add 6g salt. Stir everything with a wooden spoon for about 30 seconds. It should thicken.

6. Leave it to cool down for ten minutes.

7. Use this time to take the rimmed baking sheet or large plate. Mix 200 g sugar and 30g ground cinnamon on it. Set it aside for now.

8 Put the cooled mixture from the pan into a large bowl.

9 Add the first egg. Then blend with the handheld mixer. Add the second egg and blend again.

10 Put some of this dough mixture into the piping bag. It should not overflow at the top.

11 Fill the large pot halfway with the vegetable oil. Add the deep-fry thermometer to the pot.

12 Heat the pot on the stove at medium-high heat. Wait until the thermometer shows 375°C.

13 Hold the piping bag a good handspan above the pot. Carefully press downward to pipe a few churros into the pot. They should be about 15 cm long (you can check on the ruler, how long that would be more or less). Every 15 cm you cut off the dough coming out of the piping bag.

14 Let the churros fry in the oil for 4 to 5 minutes. Turn them as needed with the slotted spoon or tongs.

15 When they are golden brown use again the slotted spoon or tongs to put them into the cinnamon sugar. Roll them in the cinnamon sugar. Then put them on the drying rack.

16

Repeat until you have no dough anymore the following steps:

1. Fill dough mixture into the piping bag
2. Make sure the thermometer is at 375°C
3. Pipe churros into the pot; cutting the dough always after more or less 15 cm.
4. Fry the churros for 5 minutes until golden brown. Turn them if necessary in the pot.
5. Use tongs to roll churros in cinnamon sugar.
6. Place churros on drying rack.

17

When all dough has been used and all churros were made, switch off the stove and let the pot with oil cool down. Do not throw the cold oil down the drain! It has to be disposed of specially. Or you keep it in a container for the next time you are making churros.)

18

For chocolate dipping sauce:

Place the chocolate chips in a medium heatproof bowl.

19

Heat the heavy cream in the small saucepan. The stove should be at medium heat.

20 When the cream is simmering or slightly boiling: Pour it over the chocolate chips into the bowl. Wait 2 minutes.

21 Add 2,5 g ground cinnamon and 1,5 g salt. Whisk it to combine it smoothly.

22 Serve the churros on a platter with the dipping sauce in the bowl.

Experiment 18

Kinetic Dough

Edible "play dough!

In this activity we will explore the power of polymers and experiment with them, making our own kinetic dough by mixing ingredients from our kitchen.

What you need:

- 2 cups flour
- Cooking oil
- 2 bowls
- A glass
- 2 tablespoons
- A fork
- Oil or gel-based food coloring (optional)

What to do:

1. Measure 1 cup of flour into each bowl. Set them side by side so you can make comparisons as you work.
2. Take the first bowl of flour in front of you and put your hands into it.
3. Try to mold a shape in the flour by squeezing it in your fist. What does the flour feel like? Does it hold a shape when you squeeze it? How quickly does it fall apart? Does the flour stick to your hands and the bowl?
4. Rinse your hands with water and dry them thoroughly.
5. Measure 3 tablespoons of oil into the glass.
6. Add a few drops of oil food coloring into the glass with the oil and stir with a tablespoon.
7. Take the second bowl of flour in front of you
8. Slowly add 1 tablespoon of oil into one bowl of flour. Use your fork to mix the oil and the flour. Keep mixing, until the oil is no longer visible and there are no big clumps of flour.

9 Into the same bowl of flour add slowly another tablespoon of oil.

10 Use your fork again to mix the oil and the flour well. Use your fingers too to blend them together. What do you notice about the texture of the flour? Does it stick together? What if you squeeze the flour in your fist?

11 If the flour does not hold a shape when squeezed, slowly add half a tablespoon of oil. Mix and test your flour again. If it still doesn't hold a shape, add the remaining oil. Don't add too much oil! The dough should be dry to the touch.

12 Once the flour is able to hold a shape when squeezed, you have your kinetic dough!

13 Now try to mold a shape in your kinetic dough by squeezing it in your fist. How does the kinetic dough mixture differ from the flour alone? Can you form shapes with the dough? Do you notice that it sticks more or less to your hands than the flour alone?

14 Rinse your hands with water and dry them thoroughly.

What is going on?

Experimenting with the flour in the first bowl you observed that you couldn't form a shape and hold it. The flour was very soft and any shape you tried to form, immediately fell apart.

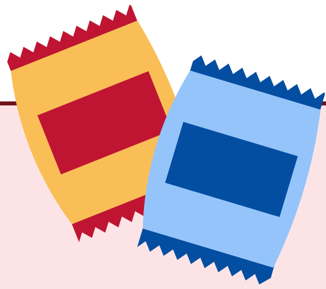
Adding oil to the second bowl with flour changed the texture of the flour and its behavior. This happened because oil is a polymer.

*Polymers are materials made from long chains of repeating molecules. The type of molecules and the way they are bonded to form the chains give polymers unique properties. Some polymers bend and stretch, like rubber. Others are hard and tough, like glass.

Polymers are used in almost every area of modern living. Grocery bags, soda and water bottles, textile fibers, phones, computers, food packaging, auto parts, and toys all contain polymers. All these are mainly synthetic polymers. However, natural polymers also exist. Proteins are such polymers made up of amino acids, and nucleic acids (DNA and RNA).

The polymer chains in the oil you added made the flour particles stick together creating a dough. In contrast to the flour by itself, you could form a ball or other shapes with this dough and these shapes could stay together fairly well for a short time.

The dough was sticky. It stuck best to itself, and less well to your hands or the bowl. This is because the oil polymers like to grab onto each other more than they like to grab onto things like your hands, the bowl or the countertop. That's why it is not difficult to clean it up!



Science Snacks:

Silicone

The texture and the properties (behavior) of a known substance can be changed if you add specific ingredients. You added cooking oil, a simple ingredient, into flour and you changed the texture and the behavior of the flour, creating a sticky dough. Commercial companies add silicone oil into regular sand and they create commercial products like Kinetic Sand or Magic Sand.

**Silicone is a term used to refer to a group of materials that contain the elements silicon and oxygen. Silicones are also polymers, meaning molecules made up of long chains of repeated units, which are all around us! They are used in everything, from your hand lotion to your car engine oil.Silicones are used so prolifically because they have some very unique properties. They can behave as liquids, semisolids, and rubbery solids, depending on the pressure you add. This property is known as 'viscoelasticity'. The degree of viscoelasticity depends on how long the polymer chains are in the silicone oil. Longer chains of polymers tend to hold their shape more effectively than shorter chains.*

Duration:
2 hours

Information for the mentor

Objectives

- To follow the procedure of preparing a plant-based starter
- To successfully prepare the dish as a team
- To learn about plant-based diet
- To learn about fermentation

- To use fractions when measuring the ingredients
- Experiment with different types of flour
- Learn that gluten is a protein found in wheat and some other grains
- Understand that the gluten in combination with water makes dough stretchable
- Study of differences in dough properties in relation to gluten content

Name of recipe and experiment

- Tuscany beans with bread
- Stretchy dough

Tip: rather than buy it, make your own bread.

Specific skills and competences

- Careful usage of knife when chopping onion
- Careful opening cans
- Patience while waiting for dough to rise
- Understand that the yeast helps the dough to rise

- Follow directions
- Precision when measuring and weighing the ingredients
- Repeat the experiment
- Compare the texture of the 3 different doughs and how soft they are when handling them
- Precision when perform length measurements
- Compare the elasticity of the 3 differents doughs
- Realise that gluten content affects the texture and the elasticity of the doughs

Connection between recipe and experiment: **Dough**

Basic sci-info behind cooking:

Alcoholic fermentation is a process of chemical change in food or drink because of the action of yeast. It is an essential process when making bread, causing bread dough to rise. Yeast organisms consume sugars in the dough and produce alcohol and carbon dioxide. The carbon dioxide forms bubbles in the dough, expanding it to a foam. Alcoholic fermentation helps make bread and bakery items easier to digest, more nutritious and it also adds wonderful flavour. This kind of fermentation also takes place when making beer giving the beer both its alcohol content and its carbonation.

Basic sci-info behind the experiment:

Wheat flours mainly consist of carbohydrates, gluten proteins and some fibres. When mixing wheat flour with liquid (such as milk or water) the individual gluten proteins in the flour unravel. They hook onto one another creating strong bonds and form a network of interconnected gluten strings.
This network holds the dough together giving it its structure. Kneading the dough slowly unfolds the network and the result is an elastic, stretchable dough. This way the gas bubbles are trapped during fermentation making the dough to expand and during baking making it to rise.

Tuscany Beans *(starter)*

You need to buy: *(for 4 persons)*

- 1 Red onion
- 2 Shallots
- 2 cloves of Garlic
- 2 cans (400 g) of beans (for example 1 can of Butter beans and 1 can of Cannellni beans)
- 50 ml Olive oil
- 1 can (400 ml) of Tomato sauce
- A pinch of each Spice (rosemary, thyme, basil, tarragon, oregano)
- 4 slices of Bread

Tools that you need:

- Cutting board
- Knife
- Wooden spoon
- Bowl

Cooking steps:

1 Chop the red onion, the shallots and garlic into small pieces.

2 Heat the olive oil in a bowl.

3 Fry the onion, shallots and garlic in oil. They should become slightly brown and softer.

4 Open the cans of beans and add them in a bowl.

5 Open the can of Tomato sauce and pour it over the beans.

6 Mix well for 10 to 15 min.

7 While mixing add seasoning.

8 The dish is ready when it has thickened and the flavours have come together.

9 Serve with bread.

Make your own (wholemeal) bread

You need to buy:

- 300–350 ml Warm Water
- 500 g Wholemeal flour
- 5 g Sugar
- 5–10 g Salt
- 30 ml Oil
- 10 g Yeast

Tools that you need:

- Bowl
- Wooden spoon
- Baking tray

Cooking steps:

1 Put the wholemeal flour in a bowl and make a cavity in the middle of the flour.

2 Crumble the yeast into the cavity and sprinkle it with sugar.

3 Sprinkle salt on the edge of the flour.

4 Pour 100 ml warm water over the yeast and sugar.

5 Allow the yeast to form a nice sponge. This takes about 15 minutes.

6 Add the oil and pour 200 ml of warm water over the mass.

7 Mix well with a wooden spoon. After it is joined together, start kneading.

8 Knead the dough well.

9 Cover the bowl with a clean cloth and leave to rise.

10 It should rise up to three times its original volume. This takes about 1 hour.

11 After 30 min turn on the oven to 230 °C

12 After another 30 min place the dough in the baking tray and place it in the preheated oven.

13 Bake for 15 minutes at 230 °C

14 Change the temperature to 180 °C and bake for another 35 min.

Experiment 19

Stretchy Dough

Getting to know about gluten! Find out why different flours lead to different results.

With this experiment, in addition to fermenting, we learn about the role of gluten in food. We also experiment with different types of flour and study the difference in elasticity of the dough.

What you need:

- 3 types of flour:
  1. Bread flour
  2. All-purpose flour (for pastry)
  3. Gluten-free flour
- Water
- Scale
- 1 Measuring cup
- 3 Bowls
- 1 Small parallelogram mold
- Marker
- Ruler
- Pencil
- Notepaper

What to do:

1. Use the marker and label the 3 bowls: The first is “Bread flour”. The second is “All -purpose”. The third is “Gluten-free”.
2. Into the “Bread flour” bowl, measure out 1 cup of bread flour.
3. Add slowly water. You might need about 1/2 to 3/4 cups of water.
4. Knead the mixture until it forms a soft, rubbery ball of dough.
5. Repeat the steps 2-4 for the other two types of flour. At the end you will have 3 bowls with 3 different balls of dough inside them.
6. Let the dough balls in their bawls rest for about 10-15 minutes.
7. Use the scale and measure 100 g of the “bread flour” dough.
8. Place this quantity in the mold. Make sure you "layer" the dough evenly, covering the mold from edge to edge.
9. Remove the dough from the mold and hold it with both hands.
10. Stretch the dough to elongate it as much as possible, without damaging it.

11 Lay the stretched dough on the table. Use the ruler and measure its length. Note the measurement on the notepaper.

12 Repeat the steps 7-9 for the other two dough balls.

What is going on?

Comparing how the 3 different dough balls felt in your hands and observing the length measurements you took, there are noticeable differences.

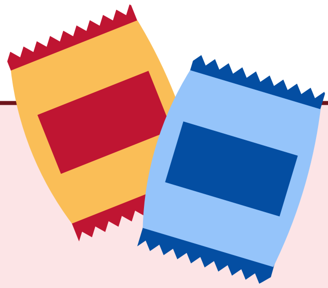
All-purpose dough feels softer than bread-flour dough. It is more elastic and is easier to stretch without destroying it. On the other hand, the gluten-free dough feels crumbly and falls apart when trying to stretch it.

Let’s see why…

Wheat flours mainly consist of carbohydrates, gluten proteins and some fibers. When mixing wheat flour with liquid (such as milk or water) the individual gluten proteins in the flour unravel. They hook onto one another creating strong bonds and form a network of interconnected gluten strings.

This network holds the dough together giving it its structure. Kneading the dough slowly unfolds the network and the result is an elastic, stretchable dough. This way the gas bubbles are trapped during fermentation making the dough to expand and during baking making it to rise.

Think of gluten as the rubber of a balloon: The stronger the balloon, the more gas it can hold. Without gluten, there is nothing to hold the gas that makes dough expand and rise.

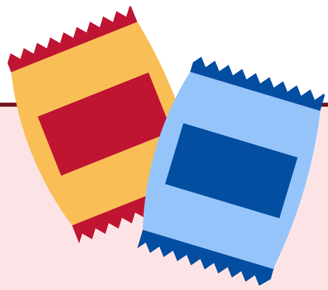


Science Snacks:

Gluten or gluten free flours?

Different types of flours contain different amounts of protein, depending on how they are meant to be used. A high-protein/gluten flour makes a dough good for hearty yeast breads. Pastry chefs, on the other hand, prefer low-gluten flours that yield delicate, tender doughs for their creations.

A gluten-free dough is crumbly, falling easily apart. Bakers add ingredients such as xanthan gum, guar gum and/or ground seeds to keep the baked goods together, but making a gluten-free version of some fine pastries, fluffy croissants and delicate wheat breads can be challenging!

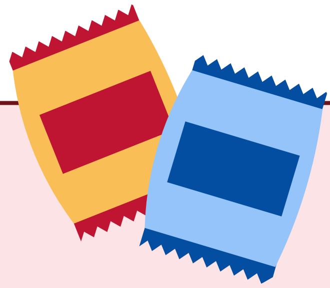


Science Snacks:

Not every grain has gluten.

Rice, corn and some types of oats don’t have gluten. A lot of people judge every kind of grain the same, but as you can see some have gluten, others do not. You have some options when it comes to eating grains and also avoiding gluten.

Science Snacks:



Beans cause gas

Beans can cause gas in some people due to the oligosaccharides they contain.

Soaking the beans before cooking and gradually increasing their intake can help reduce gas production.

Duration:
1,5 hours

Information for the mentor

Objectives

- To follow the procedure of preparing a plant-based main dish
- To successfully prepare the dish as a team
- To learn about plant-based diet
- To learn the term “al dente”
- To get familiar with a word vegan

- To learn about states of the matter
- To learn about what boiling is
- Experiment with water and salt
- To learn what temperature we call the boiling point
- To find out how we can change the boiling point

Name of recipe and experiment

- Penne with vegan feta and cherry tomatoes
- Salt “The Retarder”

Specific skills and competences

- Precision when cooking pasta to the al dente point
- Following safety measurements when working with hot ingredients and surface

- Follow directions
- Motivation to perform an experiment in several phases
- Identify the visual signs of boiling water
- Careful usage of thermometer
- Precision when measuring temperature
- Practice in taking notes (data)
- Compare the measurements (data)
- Observe the differences in the boiling point
- Understand that adding salt to water increases its boiling point

Connection between recipe and experiment: **Boiling**

Basic sci-info behind the experiment:

Matter usually exists in one of three states or phases: solid, liquid, or gas.
Solid water is called ice. This is water with the lowest energy and temperature. When solid, the molecules in water are held tightly together and don't move easily.
Liquid water is just called water. Liquid molecules are looser and can move about easily.
Gas water is called steam or vapor. When water boils, it will turn to vapor. These molecules are hotter, looser, and moving faster than the liquid molecules. They are more spread apart and can be compressed or squeezed.
When a liquid becomes a gas, it is called boiling or vaporization. At a certain temperature, called the boiling point, the molecules will gain enough energy to break free and become a gas. The boiling point for water is 100 degrees C (212 degrees F).

Penne with vegan feta and cherry tomatoes *(main)*

You need to buy: *(for 4 persons)*

- 500 g Penne (egg-free)
- 5 cloves of Garlic
- 50 ml Olive oil
- 500 g Cherry tomatoes
- 200 g Vegan feta
- A pinch of Pepper
- A handful of Basil
- 2 l boiling water
- 2 pinches of salt

Tools that you need:

- Cutting board
- Knife
- Bowl
- Baking tray

Cooking steps:

1 Pour 2 litres of water into a bowl and salt it a little.

2 Cook it until it boils and throw 500 g of Penne in boiling water.

3 Cook Penne to become al-dente*

**Al dente is an Italian term meaning to the tooth. Pasta cooked al dente is the most appreciated in the culinary world. It is the pasta that is still a little firm and sometimes sticks to your teeth – al dente.*

4 Turn on the oven to 200 °C.

5 Put olive oil and finely chopped garlic in a baking tray.

6 Sort the whole cherry tomatoes on the baking tray.

7 In the middle of the baking tray place the whole cube of feta.

8 Pour some olive oil over the feta and season it with pepper.

9 Place the baking tray in the pre-heated oven.

10 Bake until tomatoes become loose and until feta melts.

11 This takes about 15–20 minutes.

12 Take the baking tray out of the oven and mix the ingredients well.

13 Add penne and a season with basil.

Experiment 20

Salt "The Delayer"

Have you ever wondered if adding salt affects the boiling temperature of the water when cooking pasta?

No, we don't cook, but we learn about what boiling is and what temperature we call the boiling point. We also find out how we can change it.

What you need:

- salt
- water (distilled)
- 1 measuring cup
- 2 tablespoons (one for measuring and one for stirring)
- 1 cooking pot (small)
- 1 cooking thermometer
- 1 pencil
- the worksheet

What to do:

Phase A

1. Fill up a small pot with one cup of distilled water.
2. Place the thermometer in the water. Be careful, the thermometer must not touch the bottom of the pot.
3. Place the pot on the stove and set it in medium heat. The water starts heating.
4. Start the timer.
5. Every 10 seconds see the thermometer. Note its temperature on the worksheet.
6. When you notice that the water starts to boil, note the time on the worksheet. You can tell that water starts to boil when you see bubbles on its surface.
7. Keep writing down the temperature until you take 3 more measurements. Empty the water from the pot into the sink and rinse it.

Now let's see what happens if we repeat the experiment adding salt into the water.

Phase B

1. Fill up the same pot with one cup of distilled water.
2. Add 2 tablespoons of salt and stir.
3. Repeat the steps 2-7 of Phase A.

Phase C

1. Fill up the same pot with one cup of distilled water.
2. Add 4 tablespoons of salt and stir.
3. Repeat the steps 2-7 of Phase A.

Study your measurements in the worksheet. Do you notice any differences among phase A, phase B and phase C?

What is going on?

Matter usually exists in one of three states or phases: solid, liquid, or gas. The chair you are sitting on is a solid, the water you drink is liquid, and the air you breathe is a gas.

Solid water is called ice. This is water with the lowest energy and temperature. When solid, the molecules in water are held tightly together and don't move easily.

Liquid water is just called water. As ice heats up, it will change phases to liquid water. Liquid molecules are looser and can move about easily.

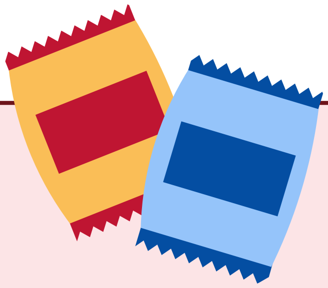
Gas water is called steam or vapor. When water boils it will turn to vapor. These molecules are hotter, looser, and moving faster than the liquid molecules. They are more spread apart and can be compressed or squeezed.

When a liquid becomes a gas, it is called boiling or vaporization. At a certain temperature, called the boiling point, the molecules will gain enough energy to break free and become a gas. The boiling point for water is 100 degrees C (212 degrees F).

Observing your notes for the three different phases of the experiment you will see that the boiling point has changed.

In phase B it was higher than in phase A. In phase C it was even higher.

This happened because adding in water a substance that can be dissolved in it, such as salt or sugar, increases the boiling point. The more salt you add, the higher the boiling point becomes therefore the solution takes a longer period of time to boil.



Science Snacks:

High altitude affects the boiling point of water

Altitude also impacts the boiling point of water, meaning the temperature at which liquid water begins turning to vapor. Water at sea level boils at 100°C (212°F). At 1.500 m above sea level, the boiling point is 95°C (203°F). Up at 3.000 m, water boils at 90°C (194°F).

At 1.500 m, where water boils almost 5 degrees cooler than at sea level, you need about double the cooking time.

Duration:
1 hour

Information for the mentor

Objectives

- To follow the procedure of preparing a plant-based dessert
- To successfully prepare the dish as a team
- To learn about plant-based diet
- To get familiar with a term vegan
- Experiment with water and salt
- To learn about the three states of the matter and their characteristics
- To learn about the phase transformations of water
- To understand what the melting point or freezing point is
- To discover how we can change the melting point of water

Name of recipe and experiment

- Vegan panna cotta
- Sticky ice

Specific skills and competences

- Patience when mixing the paste for panna cotta
- Precision when mixing in the agar agar
- Careful when pouring paste in the smaller cups
- Patience when waiting for the panna cotta to firm

- Realise that ice is water in solid state
- Observe that ice cube surface melts when adding salt
- Observe that the ice cube surface freezes again

Connection between recipe and experiment: **Freezing and melting**

Basic sci-info behind cooking:

Freezing or solidification is the process by which a liquid substance turns into a solid when it loses heat energy. When a liquid cool down enough, its molecules slow down and come closer together, forming a rigid structure. As they do this, they lock into place, creating the solid shape we recognize as ice. Freezing is like pressing pause on the movement of molecules, trapping them in a fixed arrangement.

Basic sci-info behind the experiment:

Matter makes up our planet and the whole universe. On Earth, all matter exists in one of three main states: solid, liquid or gas.
Depending on its temperature, matter can change state. Heating, cooling, evaporating and condensation are ways in which a material changes state.
Melting is the process of changing a solid into a liquid.
Evaporation is the process of changing a liquid into a gas.
Condensation is the process of changing a gas into a liquid. Freezing is the process of changing a liquid into a solid.

Vegan Panna Cotta *(dessert)*

You need to buy: *(for 4 persons)*

1 teaspoon of agar powder


1 can (400 ml) of full fat coconut milk


60 ml Maple syrup

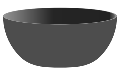

1 Vanilla sugar


A pinch of Salt


150 g Berries by choice

20 g Sugar

Tools that you need:


Bowl


Wooden spoon


Cups (200-300 ml)


Pan

Cooking steps:

1 Pour coconut milk, vanilla sugar and maple syrup in a bowl.

2 Put the bowl on the stove and mix until it starts boiling.

3 Turn off the stove.

4 Spread the agar powder over the liquid.

5 Mix with the stirring.

6 Divide the mass into smaller cups and put them in the refrigerator.

7 It should take about 40 minutes to firm.

8 Take a pan and put frozen berries in the pan.

9 Put them on a stove and mix it.

10 Add sugar and mix until berries soften.

11 Wait until the berries are cold.

12 Take the cups with panna cotta out of the fridge.

13 Pour a small amount of berries over each cup.

Experiment 21

Sticky Ice

Let's go ice fishing! It doesn't seem possible to pick up ice with only an untied string, but it is. As long as you have the special ingredient!

With this experiment we learn what melting and freezing are. We also find out what temperature we call the melting point and discover how we can change it.

What you need:

- 1 Bowl
- 5-6 Ice cubes
- 1 Measuring Cup
- Water
- String
- 1 Teaspoon
- Salt

What to do:

1. Put the ice cubes into an empty bowl.
2. Add water into the bowl.
3. Try to use the string to pick up a piece of ice. You will find that it isn't possible.
4. Lay the piece of string over the ice.
5. Sprinkle 1 teaspoon of salt over the string.
6. Wait for 1-2 minutes.
7. After the time has passed, pick up the string and watch what happens.

What is going on?

Matter makes up our planet and the whole universe. On Earth, all matter exists in one of three main states: solid, liquid or gas.

A solid can hold its shape. Ice cubes for example are water in solid form. A liquid, like water, cannot have a specific shape taking the shape of its container. For example, you can form a pool. A liquid flows or runs but it can't be stretched or squeezed.

A gas also doesn’t have a specific shape. It can flow, but also expand and be squeezed. if a gas is in an unsealed container it escapes. For example, steam which is water in gas form leaves the pot while cooking.

Depending on its temperature, matter can change state. Heating, cooling, evaporating and condensation are ways in which a material changes state.

Melting is the process of changing a solid into a liquid.

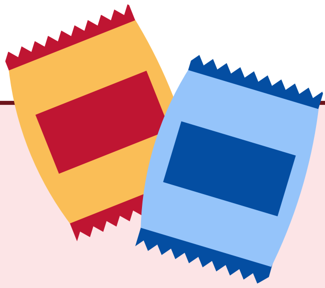
Evaporation is the process of changing a liquid into a gas.

Condensation is the process of changing a gas into a liquid. Freezing is the process of changing a liquid into a solid.

In our experiment, once the salt was added to the ice, the ice melted a little and then quickly refroze around the string. This causes the ice to stick to the string when it is pulled out of the glass.

When salt comes in contact with ice, it causes the ice to melt a little. The small amount of water from the melted ice and the salt combine together, lowering the freezing point of water, which is 0°C (32°F).

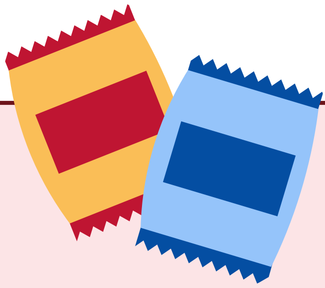
Saltwater has a lower freezing point than fresh water around -2°C (28°F). This lowered freezing point makes it harder for water molecules to recrystallize into ice.



Science Snacks:

Winter is coming!

The same phenomenon takes place when you add salt to your driveway or sidewalk during the winter. The salt lowers the freezing point of water, causing it to melt. So, you can more easily remove it.



Science Snacks:

Farenheit

Fahrenheit is a unit of temperature in the imperial system of units. It was originally developed by physicist Daniel Gabriel Fahrenheit who set 0°F as the stable temperature of a mix of ice, water and salt. He then set 32°F as the temperature of an equal mix of water and ice, and set 96°F to the approximate human body temperature.

Duration:
1 hour

Information for the mentor

Objectives

- To learn about plant-based diet
- To follow the procedure of preparing a plant-based starter
- To successfully prepare the dish as a team
- To identify when vaporisation takes place
- To learn what kind of organisation mushrooms are
- To get familiar with the term fungi

- Experiment with water
- Learn about the phenomenon of diffusion
- Understand that temperature affects the rate of diffusion

Name of recipe and experiment

- Mushroom soup
- Hot and furious

Specific skills and competences

- Careful usage of peeler
- Careful usage of knife when cutting vegetables
- Distinguish between vegetables and mushrooms

- Observe food coloring spreads in water (diffusion)
- Describe differences in diffusion among the three settings
- Observe that the hotter the water the quicker the diffusion
- Name the water temperature as the factor that causes the differences

Connection between recipe and experiment: **Hot water**

Information for the mentor

Basic sci-info behind cooking:

Mushrooms aren't really plants, they are types of fungi that have a "plantlike" form - with a stem and cap. Fungi are neither plants nor animals but rather organisms that form their own kingdom of life. The way they feed themselves is different from other organisms: they do not photosynthesize like plants and neither do they ingest their food like animals. Fungi need an organic substrate where they can grow and consume nutrients. Moisture is also required for their growth. Yeast, molds and truffles belong to fungi kingdom as well.

Basic sci-info behind the experiment:

Both water and food coloring consist of molecules that are constantly moving around. Food coloring is more dense than water. So when they mix, the molecules of food coloring are moving through water molecules, until they are evenly spread out. This movement is called diffusion and is very common in liquids and gasses.
In hot water, the molecules have more energy and are moving faster. This makes it easier for the food coloring to get mixed throughout the water and dissolve in it.
In cold water, the molecules have less energy and are moving slower, so the food coloring takes longer to get mixed and dissolve in the water.

Mushroom soup *(starter)*

You need to buy: *(for 4 persons)*

- 50 ml Olive oil
- 1 Onion
- 1 clove of Garlic
- 3 Potatoes
- 2 Carrots
- 500 g Fresh mushrooms (champignons, porcini, mix ...)
- A pinch of Pepper
- 1 l Water
- A handful of Parsley
- 100 ml Soya cooking cream (or oat)
- 5 pinches of Salt

Tools that you need:

- Cutting board
- Knife
- Wooden spoon
- Bowl

Cooking steps:

1 Chop the onions.

2 Peel the potatoes and carrots.

3 Clean the mushrooms.

4 Cut mushrooms, potatoes and carrots on smaller cubes.

5 Put olive oil in a bowl and heat it.

6 Fry onions in the olive oil until it becomes slightly brown.

7 Add mushrooms, potatoes and carrots.

8 Fry until the liquid vaporizes.

9 Pour a litre of water over and mix.

10 Cook for 15 minutes.

11 Mix in the plant-based cooking cream and cook for an additional 5 minutes.

12 At the end add parsley.

Experiment 22

Hot and furious

Make some amazing art using nothing but food color and a little bit of science!

This experiment demonstrates how temperature affects the movement of molecules in a liquid and provides a visual and engaging way to understand the concept of diffusion.

What you need:

- Three glass jars
- Room temperature water
- Ice cubes
- Hot water
- Spoons
- Food coloring

What to do:

1. Fill one jar with cold water. Add 3-4 ice cubes to keep it cold.
2. Fill the second jar with room temperature water.
3. Fill the third jar with hot water.
4. Add 2-3 drops of food coloring to each jar. What is happening to the color drops inside the jars?
5. Use the spoons to softly stir a bit of the water in the jars. Observe how the food coloring dissolves in each jar and the patterns it creates. How quickly the color spreads in each of the jars?

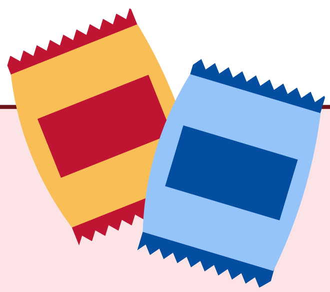
What is going on?

You observed that the food coloring was spread inside the jars creating colorful patterns. The way it was spread was different in cold water, in room temperature water and in hot water.

Both water and food coloring consist of molecules that are constantly moving around. Food coloring is more dense than water. So when they mix, the molecules of food coloring are moving through water molecules, until they are evenly spread out. This movement is called diffusion and is very common in liquids and gasses.

In hot water, the molecules have more energy and are moving faster. This makes it easier for the food coloring to get mixed throughout the water and dissolve in it.

In cold water, the molecules have less energy and are moving slower, so the food coloring takes longer to get mixed and dissolve in the water.



Science Snacks:

Air fresheners

Air fresheners work better in warm rooms because the heat increases the diffusion rate of the fragrance molecules, making the scent spread more quickly and evenly throughout the space.

Duration:
1 hour

Information for the mentor

Objectives

- To follow the procedure of preparing a plant-based main dish
- To successfully prepare the dish as a team
- To learn about plant-based diet

- To learn about the terms acid and base
- To learn about pH scale and what it means
- Experiment with everyday ingredients
- To learn about how natura pH indicators work while painting using fruits, spices and detergents.

Name of recipe and experiment

- Tofu pie
- Turmeric pH-indicator

Specific skills and competences

- Precision when folding the dough
- Precision when spreading the paste
- Persistence when layering the pie
- Understand tofu is a plant-based ingredient
- Distinguish between tofu and cottage cheese

- Manual dexterity when painting
- Follow instructions
- Name the colours in the paper during the experiment
- Observe that the color of canvas changes when painting on it with a different ingredient

Connection between recipe and experiment: **Lime**

Basic sci-info behind the experiment:

Each substance has some qualities. Its colour is one of them. Another one is whether it is an acid or a base.
Most fruits like lemons, limes, oranges and grapes are acidic and some detergents like washing powder, bleach or toothpaste are basic.
We can estimate and measure how acidic or basic (alkaline) a substance is, using the pH scale, which has values from 1 to 14. If a substance has a pH value below 7, it means that it is acidic. If it has a pH value above 7 is basic. The more acidic the substance, the closer it is to 0, the more basic, the closer it is to 14. Value equal to 7 means that the substance is neutral.
In nature there are some substances that can tell if something is acidic or basic, by changing their color. They are called natural pH indicators and turmeric is one of them. In the presence of acids or neutrals (pH less than 7.4), turmeric remains yellow. In the presence of basic (alkaline) substances (pH greater than 8.6) turmeric turns dark red.

Tofu pie *(main)*

You need to buy: *(for 4 persons)*

- 400 g Tofu
- 500 g Pulled dough (wholegrain)
- 800 g Coconut cream
- 100 ml Lime juice
- 5 pinches of Salt
- 100 ml Plant-based milk (oat, soy, rice ...)

Tools that you need:

- Bowl
- Wooden spoon
- Baking tray

Cooking steps:

1 Crumble the tofu.

2 Add coconut cream.

3 Add salt and lime juice a little at a time, mix and taste.

4 The final taste of the paste must be similar to cottage cheese.

5 When you are satisfied with the taste, prepare the baking tray.

6 Spread the olive oil over the baking tray.

7 Turn on the oven at 200 °C.

8 Now you are folding – one layer of dough over the bottom of the baking tray.

9 Spread over a thin layer of paste.

10 And so on, until you are out of dough and paste.

11 Careful – the last layer should be dough.

12 Spread olive oil over the last dough layer.

13 Put the dish in the oven.

14 Bake until it is nicely brown.

15 This takes approximately 30 minutes.

16 When it is nicely brown, take the dish out of the oven.

17 Pour over Plant-based milk, especially on the edges.

18 Bake for an additional 5 minutes.

Experiment 23

Turmeric pH-indicator

Turmeric is more than just a delicious spice. It can be the canvas that makes paintings appear and disappear!

With this experiment, we will learn about how pH indicators work while painting using fruits, spices and detergents.

What you need:

- Watercolor paper OR white sheet 160gr
- Turmeric
- Powder detergent for laundry
- Lime
- Water

- Cotton make-up removal pads
- Cotton ear buds
- 3 Small bowls
- Tablespoon
- Lemon squeezer

What to do:

1. Use the lemon squeezer to squeeze a lime.

2. Pour the lime juice into a bowl.

3. In another bowl add 5 tablespoons of turmeric. Add water with the spoon and mix. In another bowl add 5 tablespoons of powder detergent. Add water with the spoon and mix. Place the paper on the table in front of you.

4. Dip a make-up removal pad in the bowl with the turmeric. Use the pad as a paintbrush to paint the paper. You have thus created the yellow canvas for your design.

5. Dip a cotton ear bud in the bowl with the detergent powder. Use it as a pencil and draw your sketch on the yellow canvas. (You could draw a flower, a heart or anything else you want). What color is your sketch?

6. Now take another ear bud and dip it in the bowl with the lime juice for a second. Use it as an eraser and try to erase the sketch you have drawn before! Is it working?

What is going on?

Each substance has some qualities. Its color is one of them. Another one is whether it is an acid or a base.

Most fruits like lemons, limes, oranges and grapes are acidic and some detergents like washing powder, bleach or toothpaste are basic.

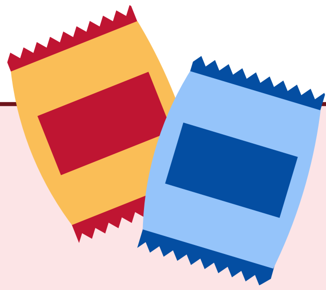
We can estimate and measure how acidic or basic (alkaline) a substance is, using the pH scale, which has values from 1 to 14. If a substance has a pH value below 7, it means that it is acidic. If it has a pH value above 7 is basic. The more acidic the substance, the closer it is to 0, the more basic, the closer it is to 14. Value equal to 7 means that the substance is neutral.

In nature there are some substances that can tell if something is acidic or basic, by changing their color. They are called natural pH indicators and turmeric is one of them. In the presence of acids or neutrals (pH less than 7.4), turmeric remains yellow. In the presence of basic (alkaline) substances (pH greater than 8.6) turmeric turns dark red.

Dyeing the paper with turmeric, you created not only a yellow canvas, but also a pH-metric paper.

Using the washing powder to paint on the canvas revealed a deep red sketch. This happened because the washing powder is basic (alkaline), so the turmeric in this area changed its color from yellow to dark red, making your sketch visible.

You were able to use lime juice as an eraser (turning your deep red sketch back to yellow) because lime is acidic. The acidic juice came into contact with the alkaline wash powder and the two ingredients chemically reacted. They neutralized each other in the area of contact which made turmeric go back to yellow again.



Science Snacks:

About natural pH indicators

Red cabbage, grape juice, turmeric, curry powder, turnip skin, cherries, beetroots, onions, tomatoes, black tea etc. are some of the most common natural indicators examples. Each of them changes color at a particular pH level. This usually means that a single pH indicator will only tell you the general pH range of a solution. To accurately calculate the pH of a solution, you usually need to use several different indicators and compare the results. One might tell you that the pH is less than 4. The next tells you that it is more than 3, so now you have a good idea what it is...

Duration:
1 hour

Information for the mentor

Objectives

- To follow the procedure of preparing a plant-based dessert
- To successfully prepare the dish as a team
- To learn about plant-based diet
- To get familiar with a term vegan

- Experiment with baking soda and vinegar
- Observe the chemical reaction of neutralisation between acids and bases
- Produce carbon dioxide using everyday ingredients
- Confirm the production and presence of the gas by observing the inflating balloon

Name of recipe and experiment

- Vegan yoghurt cake
- Trap the gas!

Specific skills and competences

- Careful usage of electric mixing
- Follow safety measurements when dealing with hot oven
- Patience when sifting the flour
- Precision when observing the toothpick
- Making decision when the dish is finished Understand that the batter arose because of the help of baking powder

- Precision when using the funnel
- Observe the bubbles inside the bottle once vinegar and soda come together
- Observe that the balloon inflates
- Make the connection that the gas which inflates the balloon is the gas produced inside the bottle

Connection between recipe and experiment: **Baking soda/baking powder**

Basic sci-info behind cooking:

Baking powder/baking soda is a base. It works by chemical reaction when mixing baking soda and acid to release carbon dioxide, which rises (lifts or loosens) the dough. Baking soda can be used in yoghurt recipes; it causes the dough to rise due to the acidity of the yoghurt.
Baking soda VS Baking Powder. Both baking soda and baking powder are leavening agents, but baking soda needs an acidic ingredient to trigger the leavening while baking powder already contains an acidic ingredient: cream of tartar. If you're out of baking soda, use baking powder instead. Double or triple the amount of baking powder because it contains less baking soda. Using baking powder instead of baking soda may change the flavour of a recipe. If you're out of baking powder, make your own using baking soda and cream of tartar. Mix 2 parts cream of tartar with 1 part baking soda. For example, mix 2 tsp of cream of tartar with 1 tsp of baking soda. No matter how much homemade baking powder you made, if the recipe calls for 1 1/2 tsp., add exactly 1 1/2 tsp. of your mixture. If you have leftover homemade baking powder, you can store it in a labelled, zipper-type plastic bag to use later. Homemade baking powder acts and tastes much like commercial baking powder.

Basic sci-info behind the experiment:

Vinegar is an acid and baking soda is a base.
When an acid and a base come together they chemically react with each other.
During the reaction a gas named carbon dioxide is released.

Vegan yoghurt cake *(dessert)*

You need to buy: *(for 8 to 10 pieces)*

- 300 g soft white flour
- 300 ml vegan (soy, coconut) yoghurt
- 100 ml sunflower or rapeseed oil
- a pinch of grated orange or lemon peel
- 100 g sugar
- 1 vanilla sugar
- 1 baking powder
- A pinch of salt

Tools that you need:

- 2 bowls
- Electric mixer
- Wooden spoon
- Baking tray
- Longer toothpick
- Strain with fine holes

Cooking steps:

1 Turn on the oven on 180 °C

2 Sift the flour with the salt and baking powder.

3 Stir the sugar into a separate bowl.

4 In this bowl add the orange/lemon peel and vanilla sugar.

5 Add oil and yoghurt.

6 Mix with an electric mixer for a few minutes to melt the sugar.

7 Add sifted flour to the mixture.

8 Prepare a baking tray. You can line it with baking paper or brush with plant-based butter.

9 Pour the batter into the tray and put it in the oven.

10 The cake will be baked after approximately 45 minutes.

11 You can do the test with a longer toothpick.

12 Carefully open the oven after about 40 minutes.

13 Stick a toothpick in the centre of the cake and pull it back.

If the toothpick is clean, the cake is baked!

Experiment 24

Trap the gas!

If a chemical reaction produces a gas, you might not notice it, unless the gas has a color or a smell. Use your kitchen as a science lab and capture a gas in a visually exciting way!

Using materials found in a kitchen and a balloon, we will observe the chemical reaction between acids and bases and confirm the presence of the gas which is produced.

What you need:

- Baking soda
- Vinegar
- A cup
- A small plastic bottle
- A Funnel
- Balloons
- A tablespoon

What to do:

1. Use the funnel to pour 1/2 cup of vinegar into the plastic bottle.

2. Stretch the balloon in order to be more elastic.

3. Use the funnel to add 2 tablespoons of baking soda in the balloon.

4. Carefully stretch the neck of the balloon over the mouth of the bottle.

   We don’t want the baking soda to fall into the bottle at this step.

5. Lift the balloon so that the baking soda falls into the vinegar.

   What is happening inside the bottle?

   What happens to the balloon?

What is going on?

In this experiment you used vinegar and baking soda.

When vinegar and baking soda mixed together inside the bottle, bubbles have created and the balloon started to inflate. Let’s see why...

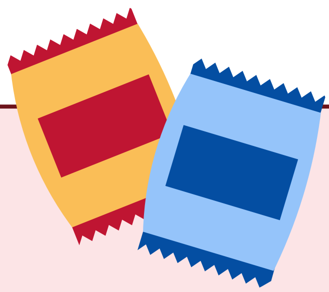
Vinegar is an acid and baking soda is a base.

When an acid and a base come together they chemically react with each other.

During the reaction a gas named carbon dioxide is released.

In our experiment, the bubbles you saw inside the bottle prove that the reaction took place.

The bubbles are filled with carbon dioxide. Even though you can’t see it, because it's invisible, it is there! You know it because this is the gas that inflates the balloon.



Science Snacks:

Carbon dioxide

Carbon dioxide is not a rare gas. In fact, it is quite common. It is what we exhale when we breathe. It is also the same gas inside the bubbles of spring water, cola drinks and sodas.

Duration:
1 hour

Information for the mentor

Objectives

- To follow the procedure of preparing a Greek traditional dish – Cretan Ntakos
- To successfully prepare the dish as a team
- To learn about dehydration
- To observe different states of milk
- To understand the term »food preservation«
- To understand dehydration is one way of preserving food
- Identify milk powder as a result of dehydration

Name of recipe and experiment

- Greek Cretan Ntakos
- Seems different but it's the same!

Specific skills and competences

- Recognize ripe vegetables and fruits (tomatoes)
- Recognize dehydrated ingredients (barley rusks, dried oriegano)
- Careful usage of grater
- Precision when cutting ripe tomato
- Patience when waiting for the dish to set in
- Follow instructions
- Identify the white powder as milk
- Predict what will happen to powder milk after stirring it with water
- Distinguish between liquid and solid (powder) state of the milk
- Compare the taste of the powder milk and the liquid milk

Connection between recipe and experiment: **Usage of dehydrated ingredients.**

Basic sci-info behind cooking:

Food preservation by dehydration. Drying or “dehydrating” food is a method of food preservation that removes enough moisture from the food so bacteria, yeast and molds cannot grow. Many types of food can be preserved for indefinite periods using this method. There are several ways often used to dehydrate foods, including sun drying, air drying, solar drying, oven drying, and electric dehydrators. Dehydration is one of the oldest methods of food preservation and was used by prehistoric people to dry seeds in the sun. The dehydration process in foods may change their original form but retain their taste and nutritional value.

Basic sci-info behind the experiment:

Whole cow's milk contains about 87% water. However, the components that are dissolved in water (proteins, fat, carbohydrates, vitamins and minerals) make milk the richest natural food in terms of nutrients that the body needs. The white powder you use in this experiment is dried milk. But how did the milk turn from liquid to powder? With a proper processing called dehydration, that removes the water from milk we can make it a powder. Through heating, most of the water evaporates, leaving behind a thick, concentrated milk. This concentrated milk is sprayed into a hot chamber. There the remaining water quickly evaporates, leaving fine milk powder behind. By drying food, you can significantly reduce its weight and extend its expiration date.

Greek Cretan Ntakos *(starter)*

You need to buy: *(for 4 persons)*

- 2 big round barley rusks
- 3 ripe tomatoes
- 2 tablespoons olive oil
- 1 tablespoon grape vinegar
- 1 teaspoon dried oregano
- 2 heaping tablespoons Cretan xinomyzithra cheese (or Greek Feta cheese)
- 1 tablespoon caper
- 1 tablespoon sliced olives
- salt

Tools that you need:

- Big plate
- 2 bowls
- Cutting board
- Knife
- Grater
- Tablespoon
- Fork (optional)

Cooking steps:

1

Wash 3 tomatoes.

In a bowl grate 2 tomatoes, using the big holes of the grater.

Add a pinch of salt, 2 tablespoons of grape vinegar and stir well.

2

Put 2 barley rusks on a big plate.

Pour 1/2 tablespoon olive oil over each rusk.

Sprinkle each rusk with a pinch of dried oregano.

3

Using a tablespoon, put the tomato mixture from the bowl on the 2 rusks.

4

Cut the third tomato into little pieces.

Top the rusks with the tomato pieces.

5

Break by hand or with a fork the xynomyzithra or the Feta cheese in big pieces.

Top each rusk with 1 heaping tablespoon of xynomyzithra or Feta pieces.

6 Drizzle each rusk with 1/2 tablespoon olive oil.

Sprinkle each rusk with a pinch of dried oregano.

7 Top each rusk with caper and sliced olives.

8 Set aside for 5 minutes to let the hard rusks soften.

9 Serve.

Experiment 25

Seems different but it's the same

Dry your food to make it last!

This dried milk experiment will give us the opportunity to talk about the dehydration process in foods that may change their original form but retain their taste and nutritional value.

What you need:

- Dried milk powder
- Water
- A jug
- Small cups or glasses
- Spoons for stirring

What to do:

1. Mix the dried white powder with water in the jug, according to the instructions on the package.
2. Stir well with a spoon until all the powder dissolves in water. Does the liquid look like milk?
3. Pour the liquid into small cups or glasses.
4. Drink the liquid. Does it taste like milk?

What is going on?

Milk is a white liquid food produced by the mammary glands of mammals, including humans.

Milk consists mainly of water. Whole cow's milk contains about 87% water. However, the components that are dissolved in water (proteins, fat, carbohydrates, vitamins and minerals) make milk the richest natural food in terms of nutrients that the body needs.

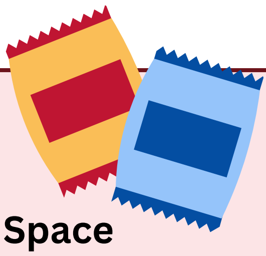
The white powder you use in this experiment is dried milk. But how did the milk turn from liquid to powder? With a proper processing called dehydration, that removes the water from milk. Let's see how...

First, the liquid milk is heated. Through heating, most of the water evaporates, leaving behind a thick, concentrated milk. This concentrated milk is sprayed into a hot chamber. There the remaining water quickly evaporates, leaving fine milk powder behind.

By drying food, you can significantly reduce its weight and extend its expiration date.

If you want to use dried milk, you have to mix it with water. The powder dissolves in water, reconstituting the milk back to its liquid form.

The ratio of powder to water is usually provided on the packaging.



Science Snacks:

Dried milk on Earth and in Space

The concept of dried milk dates back to the 13th century. It is believed that the Mongols under Genghis Khan carried dried milk with them on their campaigns.

Dried milk is often included in emergency and survival kits because of its long shelf life and nutritional value.

Astronauts take dried milk with them on space missions. It's lightweight, easy to store, and provides essential nutrients in a compact form.

Duration:
3 hours

Information for the mentor

Objectives

- To follow the procedure of preparing a Greek traditional dish – Cretan Mpoureki
- To successfully prepare the dish as a team
- To understand the term »food preservation«
- To learn that fermentation is a chemical process
- To realise that fermentation is a way of preserving food
- To learn that cheese and yogurt are foods produced due to fermentation process
- To experiment with air pressure and realise how it works
- To learn that temperature affects the volume of the air and its pressure
- To learn that air always flows from high-pressure areas to low-pressure areas
- To observe the ability of air to push and squeeze things

Name of recipe and experiment

- Cretan Mpoureki
- Egg in a bottle

Specific skills and competences

- Recognize ripe vegetables and fruits
- Careful usage of a peeler
- Precision when slicing the ingredients thinly
- Patience when waiting for the dish to set in
- Hygiene when using hands for working with edible ingredients
- Distinguish between raw and hard-boiled eggs
- Carefulness when dealing with fire
- Observe that the egg on the top of the bottle is moving when the temperature of the air inside the bottles rises.
- Observe that the egg is sucked into the bottle when the bottle gets cold.
- Predict how to get the egg out of the bottle
- Observe that the egg is getting out of the bottle when adding air in the bottle

Information for the mentor

Connection between recipe and experiment: **Eggs**

Basic sci-info behind cooking:

Food preservation by fermentation. Fermentation is a process of chemical change in food or drink because of the action of bacteria or yeast. It is one of the most common types of food preservation. The fermentation process not only preserves food and creates new textures and flavours, but also produces properties that could have a positive impact on health. This is the case of yogurt. Yogurt forms when bacteria convert the milk sugar, known as lactose, into lactic acid. The lactic acid makes the milk more acidic causing the proteins to clump together. This type of fermentation (lactic acid fermentation) is also employed in the production of sauerkraut and pickles.

Basic sci-info behind the experiment:

Air has mass and is able to push or even crush objects. When you started the experiment, the air pressure inside the bottle was the same as the air pressure outside of the bottle. This is because the air was at the same temperature. The egg could stand on the bottle because the bottle's opening is smaller than the egg. After you placed the burning paper in the bottle, the air inside the bottle began to heat up and expand. A few seconds later, the fire went out and the paper stopped burning, because the egg blocked fresh air and oxygen which are needed to keep the fire alive. This caused the air inside the bottle to cool down and contract.

When the air contracted, its volume was reduced and the air pressure inside the bottle became less than the air pressure outside the bottle. Air always flows from high-pressure areas to low-pressure areas, in order to fix any imbalances. That's why the air outside the bottle pushed the egg down into the bottle.

In the second part of the activity, by blowing air inside the bottle you watched the egg coming out of it. This time the opposite thing happened than before. Adding air from your lungs into the bottle, you increased the air pressure inside. The high-pressure air trying to fix the imbalance inside and outside the bottle squeezed the egg out of it. The same principle applies in every occasion that something is "sucked".

Safety Note: Remember to always use safety measures when dealing with fire.

Cretan Mpoureki *(main)*

You need to buy: *(for 4 persons)*

- 6 potatoes
- 6 zucchinis
- 700 g anthotiro (or cottage cheese, or ricotta cheese)
- 300 g xinomizithra (or Greek feta cheese)
- 4 heaping tablespoons flour
- 4 big eggs
- 7 tablespoons olive oil
- 200 g Greek yoghurt (strained yoghurt)
- 1 ripe big tomato
- 1/3 bunch spearmint
- salt
- pepper

Tools that you need:

- Large deep sided oven pan
- 2 Large bowls
- Mini blender
- Cutting board
- Knife
- Peeler
- Tablespoon
- Teaspoon
- Fork
- Silicone spatula
- Square spatula
- Parchment paper
- Oven gloves
- Trivet

Cooking steps:

1 Peel and wash the potatoes.

2 Wash and cut the ends of the zucchinis.

3 Slice the potatoes and the zucchinis very thinly using a vegetable peeler.

Put them in a very large bowl and mix with your hands.

4 Add 1 teaspoon of salt and a pinch of pepper into the bowl.

Add 4 heaping tablespoons of flour.

5 Wash 1/3 bunch of spearmint.

Chop spearmint finely using a mini blender.

Add it to the bowl and mix well with your hands.

6 Preheat the oven to 180° C (set to upper and lower heat).

7 Break by hand or with a fork 300 g xynomyzithra (or feta cheese).

Add it into the bowl.

8 Add 700 g anthotiro (or cottage, or ricotta cheese) into the bowl.

Mix very well using your hands.

9 Drizzle a large deep sided oven pan with 3 tablespoons of olive oil.

10 Empty the bowl content into the pan and flatten the surface with your hands.

11 Wash 1 ripe tomato and cut it into small pieces.

Top the pan with the tomato pieces.

12 Break 4 eggs in a bowl, remove any eggshells.

Stir well with a fork.

13 Add 200 g Greek yoghurt.

Add 4 tablespoons of olive oil.

Stir well until creamy using a fork.

14 Pour your egg mixture in the pan and flatten the surface using a silicone spatula.

Cover the pan with parchment paper.

15 Wearing oven gloves, open the oven door (Be careful it is very hot!).

Place the pan in the oven and bake for 60 minutes.

16 Wearing oven gloves, open the oven door and remove the parchment paper.

Bake for another 30 minutes until the boureki is golden brown.

17 Turn the oven off.

Wearing oven gloves, remove the pan and place it on a trivet.

18 Let the boureki cool down for 15-20 minutes.

Cut into large pieces and serve with a square spatula.

Experiment 26

Egg in a bottle

Use differences in air pressure to force an egg into and out of a bottle.

With this experiment we will understand how air pressure works. We will see the ability of air to push and squeeze things whenever an imbalance of air pressure occurs.

What you need:

- 4 hard-boiled eggs
- 1 glass bottle with the opening slightly smaller than the hardboiled egg. (milk or juice bottles work well)
- A plate
- Matches/Lighter
- Small strips of thick Paper

What to do:

Part A

1. Place the glass bottle on the table. Peel the egg and place it onto the plate.
2. Discard the egg shells in the trash can.

3 Place the egg over the neck of the bottle. Can the egg fit inside the bottle without being damaged?

4 Remove the egg of the bottle neck and place it again onto the plate.

5 Use the lighter to light a strip of paper on fire.

6 Once the paper is burning, carefully but quickly drop it into the bottle.

7 Immediately, place the egg on the top of the bottle. What is happening to the egg? Observe the egg sucked into the bottle!

8 Can you think of a way to get the egg out of the bottle without damaging the bottle or the egg?

Part B

9 Turn the bottle upside down and hold it over your head.

10 Blow hard into the bottle. What is happening to the egg? What do you think forces the egg to get out of the bottle?

What is going on?

During the first part of the activity you saw the egg slowly moving into the bottle. If you were lucky enough the egg stayed in one piece as it was "sucked" into the bottle! If not, don't worry, even a damaged egg inside the bottle proves that science works!

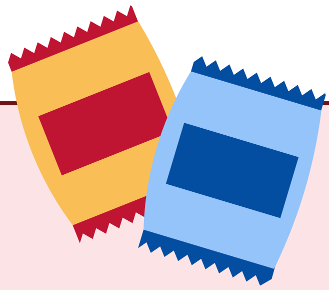
Let's see how...

Air has mass and is able to push or even crush objects. We don't often see air pushing or crushing objects because air molecules surrounding objects push on objects equally in all directions. When you started the experiment, the air pressure inside the bottle was the same as the air pressure outside of the bottle. This is because the air was at the same temperature. The egg could stand on the bottle because the bottle's opening is smaller than the egg.

After you placed the burning paper in the bottle, the air inside the bottle began to heat up and expand. A few seconds later, the fire went out and the paper stopped burning, because the egg blocked fresh air and oxygen which are needed to keep the fire alive. This caused the air inside the bottle to cool down and contract.

When the air contracted, its volume was reduced and the air pressure inside the bottle became less than the air pressure outside the bottle. Air always flows from high-pressure areas to low-pressure areas, in order to fix any imbalances. That’s why, in our case, the air outside the bottle pushed the egg down into the bottle.

In the second part of the activity, by blowing air inside the bottle you watched the egg coming out of it. This time the opposite thing happened than before. Adding air from your lungs into the bottle, you increased the air pressure inside. The high-pressure air trying to fix the imbalance inside and outside the bottle squeezed the egg out of it. The same principle applies in every occasion that something is “sucked”.



Science Snacks:

Drinking from a straw

When you drink from a straw, you create a little space of low pressure inside your mouth and in the top of the straw. The atmospheric air outside the straw becomes greater and pushes down on the surface of your drink, forcing the liquid up through the straw and into your mouth.

Duration:
2.5 hours

Information for the mentor

Objectives

- To follow the procedure of preparing a Greek traditional dish – Revani Veroias
- To successfully prepare the dish as a team
- To carefully break eggs without leaving eggshells
- To distinguish between liquid and dry ingredients
- Experiment with hot and cold water and sugar
- To understand the mechanism of dissolving as a physical phenomenon
- To learn to use the terms solution, solvent and solute
- To observe that temperature affects the ability of a solvent to dissolve a solute

Name of recipe and experiment

- Revani Veroias
- Hungry water

Specific skills and competences

- Patience when mixing ingredients to a fluffy state
- Careful usage of grater
- Patience when waiting for the cake to absorb the syrup
- Carefulness when working with hot tools
- Recognize that dissolving is the main part of preparing a syrup
- Observe that sugar dissolves in water
- Observe that hot water can dissolve more sugar than cold water
- Understand that dissolving is happening faster in hot water

Connection between recipe and experiment: **Dissolving**

Basic sci-info behind cooking:

Dissolving: The term "dissolve" refers to incorporating any solid, liquid, or gas substance into another substance. A lot of substances dissolve when you mix them with water. When a substance dissolves, it might look like it has disappeared, but in fact it has just mixed with the water to make a transparent (see-through) liquid called a solution. For example, sugar dissolves in water and a sweet solution is forming.

Basic sci-info behind the experiment:

Sugar is made up of many molecules that are holding together with weak bonds. When you add sugar in the water, water molecules come in contact (collide) with sugar and break these bonds into individual molecules. These molecules are then dispersed throughout the water and are so small that you cannot see them.
When sugar is dissolved in water, it forms a “solution”. The water in this case is “solvent” and the sugar is “solute”.
Hot water can dissolve more sugar cubes (or teaspoons of sugar) than the cold water.
Hot water has more energy than cold. When water is heated its molecules gain energy and move faster. As they move faster they come in contact (collide) with sugar more often, causing it to dissolve faster.

Revani Veroias *(dessert)*

You need to buy: *(for 4 persons)*

For the syrup

- 650 g sugar
- 600 g water
- 1 cinnamon stick
- 2 organic oranges, unwaxed
- 50 g cognac or brandy

For the cake

- 200 g sugar
- 3 eggs
- 170 g flour
- 2 organic oranges, unwaxed
- 1 g vanilla powder
- 20 g baking powder
- 40 g semolina fine
- 1 pinch of salt
- 200 g Greek yoghurt (strained yoghurt)
- 1/2 tablespoon butter for the pan
- 1 tablespoon semolina for the pan

Tools that you need:

- Mixer with whisk attachment
- Medium pot
- Deep sided oven pan (32x25cm)
- Scales
- Peeler
- Grater
- Whisk
- Spoon for stirring
- Tablespoon
- Ladle
- Spatula
- Knife
- Bowl
- Cup
- Oven gloves
- Trivet

Cooking steps: for the syrup

1 In a medium pot add 600 g water and 650 g sugar.

Wash and peel 2 oranges.

Add only the peels into the pot.

2 Transfer the pot over high heat and bring it to a boil.

Stir carefully till sugar melts.

3 Add 50 g cognac or brandy.

4 Turn off the heat and set the pot aside to cool.

Careful! The stove remains hot.

Cooking steps: for the cake

1. Preheat the oven to 170° C (set it to the fan function).

2. Break 3 eggs in a cup, removing any eggshells.

3. In a mixer's bowl add 200 g sugar and the 3 eggs.

   Beat with the whisk attachment until it gets very fluffy.

4. In another bowl, add 170 g flour, 20 g baking powder, 1 g vanilla powder, 40 g fine semolina and 1 pinch of salt.

   Stir all the dry ingredients well.

5. Wash 2 oranges and grate (zest) only the coloured part of the orange peel.

6. Into the mixer's bowl, add:

   The mixture with the dry ingredients, the orange zest and 200 g Greek yoghurt.

   Beat for 10 seconds.

7 Use 1/2 tablespoon of butter to grease a 32x25 cm deep sided oven pan.

Sprinkle the bottom of the pan with 1 tablespoon of semolina.

8 Spread the mixture from the mixer’s bowl into the pan.

9 Wearing oven gloves open the oven door. Be careful, it is very hot!

Place the pan in the oven and bake for 30 minutes.

10 Once done, turn off the oven and wearing oven gloves, remove the pan on a trivet.

Turn off the oven.

11 Remove the orange peels from the syrup and pour the cold syrup over the hot cake with a ladle.

12 Let the revani sit for 1 hour to absorb the syrup and cool down.

13 Cut the revani in pieces and serve on dessert plates.

Experiment 27

Hungry Water!

Do not throw away the hot solution, you can use it for making a really sweet lemonade! When the solution cools down, you just have to add freshly squeezed lemon juice, some water and ice for serving it.

With this experiment we will make a solution, we will get familiar with the phenomenon of dissolving and observe that temperature affects the ability of a solvent to dissolve a solute.

What you need:

- Two glass jars or jugs
- Tap water
- Some ice cubes
- An electric kettle or a small pot to heat the water
- Sugar cubes or granulated sugar
- Teaspoon (if you use granulated sugar)
- Two large spoons, that fit in the jars, to agitate the solutions

What to do:

1. Put water with a few ice cubes in one jar and put the same amount of hot water in the other jar. Be very careful with the use of hot water! We do not want you to burn your hands.

2. Drop one cube of sugar (or a teaspoon of sugar) into each jar.

3. Use the spoons to mix the two solutions until all the sugar we threw in dissolves.

4. When almost all the sugar is dissolved, add another sugar cube to each solution and for one more time stir. Do not forget to count how many cubes you have dropped into each solution.

5. Continue to add more sugar until sugar stops dissolving.

6. In which solution did more sugar dissolve? Why do you think this happened?

What is going on?

You see that when you add sugar in water and stir with the spoon the sugar disappears. In fact, sugar is dissolving in the water (meaning is mixing with water and becomes part of it).

Sugar is made up of many molecules that are holding together with weak bonds.

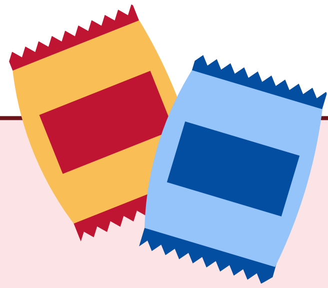
When you add sugar in the water, water molecules come in contact (collide) with sugar and break these bonds into individual molecules. These molecules are then dispersed throughout the water and are so small that you cannot see them.

In terms of science, we say that the sugar is dissolved in water, forming a “solution”. We call the water “solvent” and the sugar “solute”.

Keeping adding sugar into the jars and stirring, you see that at some point the sugar stops dissolving. This point is different for the two jars. The hot water can dissolve more sugar cubes (or teaspoons of sugar) than the cold water.

This is happening because hot water has more energy than cold water. When water is heated its molecules gain energy and move faster. As they move faster they come in contact (collide) with sugar more often, causing it to dissolve faster.

Science Snacks:



Water: the universal solvent

Water is called the "universal solvent" because it is capable of dissolving more substances than any other liquid.

This ability is essential for life on Earth. It allows nutrients to be transported in the bloodstream, waste products to be removed from the body, and chemical reactions to take place in cells. Water also plays a vital role in the environment, as it allows minerals to be transported in the soil and nutrients to be transported in bodies of water.

However, the universal solvent property of water can also have negative effects. For example, water pollution can occur when pollutants are dissolved in water and transported to other areas. This can lead to harmful effects on the environment and human health.

Duration:
1.5 hours

Information for the mentor

Objectives

- To follow the procedure of preparing a popular Greek starter dish – Tzatziki
- To successfully prepare the dish as a team
- To observe how a vegetable releases liquids when mixed with salt
- To get familiar with electricity
- To see how chemistry and electricity are connected
- Experiment with everyday materials
- To create an electric circuit using simple electric elements
- To make a battery from everyday materials

Name of recipe and experiment

- Tzatziki
- Pickle battery

Specific skills and competences

- Distinguish between small and big holes of the grater
- Careful usage of grater
- Recognize when the ingredient has released enough liquid to move to the next step
- Skilful usage of drainer
- Hygiene when using hand for mixing edible ingredients
- Patience when peeling garlic cloves
- Name the basic elements of an electric circuit
- Identify conductive matter (coin, nails)
- Discover the correct way to connect a LED light in a circuit to light up

Connection between recipe and experiment: **Cucumber**

Basic sci-info behind the experiment:

A battery can make electricity to power things like flashlights, toys and other gadgets.

Lots of different chemicals can be used in batteries, depending on how the battery is made, or what you're using it for. A simple battery is made of a pair of different metallic surfaces and a special liquid (electrolyte).

An electrolyte is a substance that dissociates into ions when dissolved or melted, thereby becoming electrically conductive. Since they are generally composed of ions in solution, they are also known as ionic solutions. Electrolytes are generally acids, bases and salts.

The battery in your simple circuit is made of a coin (made of copper), a galvanized nail (which has a zinc surface) and a pickle soaked in salty water. The copper coin and the nail are the pair of different metals and the salty water inside the pickle is the electrolyte.

Salty water helps carry electricity, just like the chemicals inside a regular battery. In fact, salty water inside the pickle helps the copper and the zinc to chemically react with each other. This reaction creates a small amount of electricity. The leads carry this electricity to the LED light, causing it to light up!

The LED light lights up because of the creation of a simple electric circuit consisting of a battery, a light bulb and wires.

Tzatziki *(starter)*

You need to buy: *(for 4 persons)*

- 300 g Greek yogurt (strained yogurt)
- 1 cucumber
- 1 small garlic clove
- 3 tablespoons grape vinegar or apple vinegar
- 1/4 bunch of dill
- ¼ teaspoon salt
- pepper
- 3 tablespoons of olive oil

Tools that you need:

- 2 bowls
- Cutting board
- Knife
- Peeler
- Grater
- Rice drainer
- Tablespoon
- Teaspoon
- Fork
- Food wrap

Cooking steps:

1 Wash and peel the cucumber.

2 In a bowl, grate the cucumber using the large holes of a grater.

Add a pinch of salt and 1 tablespoon of grape or apple vinegar.

3 Mix lightly with a fork and set aside.

We want the mixture to release its liquids.

4 Peel the garlic clove and grate using the small holes of a grater.

5 In a large bowl add 300 g Greek yogurt, the grated garlic clove, 2 tablespoons olive oil and 2 tablespoons of grape or apple vinegar.

Mix with a tablespoon until creamy.

6 Use a rice drainer to drain the cucumber.

Squeeze it with your hands to remove excess liquid.

7 Into the yogurt mixture add the squeezed cucumber, ¼ teaspoon salt and a pinch of pepper.

Stir well with a tablespoon.

8 Wash and chop finely ¼ of a bunch of dill.

9 Into the yogurt mixture add the chopped dill.

Mix lightly with a spoon.

Drizzle with 1 tablespoon of olive oil.

10 Cover the bowl with plastic wrap.

Refrigerate until serving.

Experiment 28

Pickle battery!

Pickle juice, pickle juice here comes the energy!

With this experiment we will get familiar with electricity and see how chemistry and electricity are connected. We will make our own battery from everyday materials and we will create an electric circuit using simple electric elements.

What you need:

- Large pickles
- Copper coins
- Galvanized nails (coated with zinc)
- Two alligator test leads
- Small LED lights (5mm)

What to do:

1 Insert a coin into one end of the pickle.

2 Insert a nail into the other end of the pickle. Make sure that the coin and the nail don't touch each other inside the pickle.

3 Attach one lead to the coin, using its clip.

4 Attach the other lead to the nail, using its clip.

5 Take a LED light in your hands. With your fingers gently move the two "legs" of the LED light a bit apart, so that they are not too close to each other.

6 Using the free clip of the lead which is attached to the coin, attach it to the shorter leg of the LED light.

7 Using the free clip of the other lead (which is attached to the nail), attach it to the longer leg of the LED light.

8 Observe the LED light. Is it on?

9 If the LED light is not on, disconnect the leads from the legs of the LED light.

10 Now connect the lead which is attached to the coin with the longest leg of the LED light and the lead which is attached to the nail with the shortest leg of the LED light.

11 Observe the LED light again. Is it on now?

Tip: If the LED light stops lighting after a while, try using a new pickle, a new coin and a new nail.

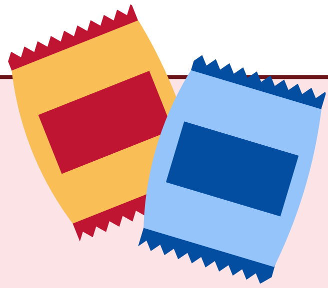
What is going on?

The LED light lights up because you have just created a simple electric circuit consisting of a battery, a light bulb and wires.

A battery can make electricity to power things like flashlights, toys and other gadgets. Lots of different chemicals can be used in batteries, depending on how the battery is made, or what you're using it for. A simple battery is made of a pair of different metallic surfaces and a special liquid (electrolyte).

The battery in your simple circuit is made of a coin (made of copper), a galvanized nail (which has a zinc surface) and a pickle soaked in salty water. The copper coin and the nail are the pair of different metals and the salty water inside the pickle is the electrolyte. Salty water helps carry electricity, just like the chemicals inside a regular battery. In fact, salty water inside the pickle helps the copper and the zinc to chemically react with each other. This reaction creates a small amount of electricity. The leads carry this electricity to the LED light, causing it to light up!

Science Snacks:



About batteries

The oldest known battery is the Baghdad Battery, which dates back to 200 B.C. This ancient device consisted of a clay jar with an iron rod surrounded by copper, and some believe it might have been used for electroplating or generating electricity.

Lead-Acid Battery, one of the most popular in the car industry, was Invented by a woman in 1917. Her name was Martha C. Weston and the patent dates back to 1859 when she was 17 years old!

Invented in the 1970s, lithium-ion batteries are now the power source behind most smartphones, laptops, and electric cars. They are lighter and store more energy than traditional batteries.

Duration:
2 hours

Information for the mentor

Objectives

- To follow the procedure of preparing a popular Greek main dish – Stuffed tomatoes and peppers
- To successfully prepare the dish as a team
- To handle tomatoes carefully
- To follow safety instructions when working with hot utensils and surfaces
- Experiment with rice
- To understand that friction is a force acting between objects in contact

Name of recipe and experiment

- Gemista – Stuffed tomatoes and peppers
- Rise the rice

Specific skills and competences

- Careful usage of mini blender
- Precision when measuring small amounts of ingredients
- Patience when scooping the tomatoes
- Describe what is happening to the rice when pushing the chopstick in and out
- Observe the level of rice in the bottle during stamping it with the chopstick
- Notice that it is more difficult each time to push the chopstick into the rice
- Realise that friction is the reason that makes the experiment work

Connection between recipe and experiment: **Rice**

Basic sci-info behind the cooking:

Baking: In a baking oven the air temperature is kept fixed in the range 150-250 °C by a thermostat system. Air circulates the oven due to convection or forced circulation. In baking the water at the food surface is evaporating and the food is dehydrated.

Basic sci-info behind the experiment:

Friction is a force that occurs when two objects are in contact. It slows or stops movement when those two surfaces are sliding or trying to slide across each other. Friction depends on the surfaces and the force pressing the surfaces together.
By inserting the chopstick into the rice, the trapped air escapes and the rice grains are pushed against the bottle. This increases the pressure and the friction between the rice grains and the chopstick. Once the rice grains are packed so closely together that the friction becomes overwhelming, the chopstick is held in place, allowing you to pick up the whole bottle.
*In this case, the friction is bigger than the gravitational force that is pulling the rice and the bottle towards the Earth.

Gemista - Stuffed tomatoes and peppers *(main)*

You need to buy: *(for 4 persons)*

- 4 large tomatoes
- 4 large green bell peppers
- 14 heaping tablespoons rice
- ½ bunch parsley
- ½ bunch dill
- 1 teaspoon oregano
- 3 garlic cloves
- 2 large onions
- 1 ½ teaspoon salt
- pepper
- ½ teaspoon sugar
- 1 heaping tablespoon of tomato paste
- 1 can of crushed or diced tomatoes
- 1 can of tomato juice
- 1 cup of water
- 4 potatoes
- olive oil plus more for over the peppers when they are stuffed and ready to go into the oven

Tools that you need:

- Large deep sided oven pan
- Mini blender
- Peeler
- Cutting board
- Knife
- Large bowl
- Cup
- Tablespoon
- Teaspoon
- Fork
- Parchment paper
- Oven gloves
- Wooden stick

Cooking steps:

1

Preheat the oven to 200°C (set to fan function).

2

Wash 4 tomatoes and cut off the tops.

Scoop the flesh of the tomatoes. (Be careful not to push through the sides).

Keep tops and scooped flesh for later.

3

Wash the peppers, cut off the tops, clean seeds and make some holes with a fork all over them.

4

Place the tomatoes and the peppers upright in the oven pan.

5

Peel 2 onions and 3 garlic cloves.

Put them in a mini blender and add the scooped tomato flesh.

Blend and put the mixture in a large bowl.

6

Wash ½ bunch of parsley and ½ bunch of dill.

Chop them using a mini blender and transfer them in the bowl with the onions.

7 Add in the bowl and mix well with a tablespoon:

14 heaping tablespoons rice, 1 teaspoon salt, a pinch of pepper, ½ teaspoon sugar, 1 teaspoon oregano, 1 heaping tablespoon of tomato paste, 1/2 can crushed or diced tomatoes and ½ can tomato juice.

8 Stuff all the peppers and tomatoes with the mixture of the bowl.

(If there's leftover filling, spread it around them in the pan).

9 Peel 4 potatoes, wash them and chop into large chunks.

Place them in the oven pan around the stuffed peppers/tomatoes.

10 Pour some olive oil all over the peppers/tomatoes and potatoes.

Pour ½ a can of tomato juice and ½ can of diced tomatoes over the top.

11 Place the tops back on the stuffed vegetables and sprinkle ½ tsp salt, a pinch of pepper, and a pinch of sugar over them.

12 Add 1 cup of water in the oven pan.

Cover it with parchment paper.

13 Wear your oven gloves and place the oven pan in the oven.

14 Bake for about 50 min. Check occasionally after 30 min.

The potatoes must be soft, (check with a wooden stick) and the rice cooked.

15 Once they are done, remove the parchment paper.

Cook for another 10 min to brown the tops.

16 Wear your gloves and take out the oven pan.

Turn off the oven.

17 Let the food cool down for 15 minutes and serve.

Experiment 29

Rise the Rice

Can you lift a bottle full of rice with only a chopstick?

With this experiment we will experiment with the force of friction and see its power.

What you need:

- A plastic bottle
- Uncooked rice grains
- A chopstick
- A funnel

What to do:

1. Use the funnel to fill the bottle up with rice. Make sure you fill the bottle all the way to the top. Place the bottle on the table.
2. Insert the blunt end of the chopstick into the rice and press it all the way to the bottom.
3. Lift slowly the chopstick to test if the bottle comes up with it.

   It doesn't work!

Repeat pushing the chopstick in and out of the rice several times.

4 Observe that the level of rice in the bottle is getting lower and lower. It is also getting harder and harder to push the chopstick all the way down into the rice.

5 When you feel the chopstick to stick in the rise, lift it all the way up. Watch the whole bottle with the rice lift off the table!

What is going on?

When you first fill the bottle with rice, there is a little bit of space in between each grain and its neighbors.

As you press the chopstick into the bottle, the grains of rice are pushed together to make room for the chopstick. Each time you stamp the rice, the chopstick rearranges the grains more tightly. Grains are packed closer and closer together, allowing trapped air to escape and leaving the grains with less air in between. At some point the chopstick “sticks” in the rice and you can lift the whole bottle with the rise up. This is happening due to friction.

Friction is a force that occurs when two objects are in contact. It slows or stops movement when those two surfaces are sliding or trying to slide across each other. Friction depends on the surfaces and the force pressing the surfaces together.

By inserting the chopstick into the rice, the trapped air escapes and the rice grains are pushed against the bottle. This increases the pressure and the friction between the rice grains and the chopstick. Once the rice grains are packed so closely together that the friction becomes overwhelming, the chopstick is held in place, allowing you to pick up the whole bottle.

***In this case, the friction is bigger than the gravitational force that is pulling the rice and the bottle towards the Earth.**

Science Snacks:

At the beach

The same thing happens at the beach with your own umbrella when you are trying to fix the umbrella in the sand.

Science Snacks:

Walking or slipping

Friction is very useful in everyday life. We can walk because there is friction between the soles of our shoes and the ground. When there is water or ice on the ground, friction is reduced making it easier for us to slip.

Duration:
3 hours

Information for the mentor

Objectives

- To follow the procedure of preparing a popular Greek dessert – Risogalo
- To successfully prepare the dish as a team
- To understand the difference between simmering and boiling
- To use simmering cooking technique
- Distinguish between liquid and solid state of matter
- Experiment with a mixture of cornflour and water
- Observe that liquid and solid state of matter may coexist in a mixture
- Understand that some materials can act as solid or liquids, depending on the way we treat them.

Name of recipe and experiment

- Risogalo
- Oozing

Specific skills and competences

- Precision when measuring liquid ingredients
- Precision when measuring dry ingredients
- Patience when stirring milk
- Practice hands-on skills using different ways of handling the mixture
- Distinguish the behavior of the mixture when handled differently

- Describe how the mixture feels like when treated slowly and softly
- Describe how the mixture feels like when applying sudden pressure

Connection between recipe and experiment: **Corn flour**

Basic sci-info behind the cooking:

Boiling and simmering are two different techniques of cooking. Simmering instead of boiling allows the ingredients to cook slower at a lower temperature, creating a tender consistency without a mushy texture. Simmering gently softens the ingredients and melds the seasonings into a delicious one-pot meal.
While boiling, liquid reaches 100°C, large bubbles vigorously rise from the bottom of the pot and continually break the surface. While simmering, liquid reaches 82-88°C, small bubbles rise from the bottom of the pot and occasionally break the surface.

Basic sci-info behind the experiment:

Corn flour is made of lots of long, stringy particles. They don't dissolve in water, but they do spread themselves out. This allows the mixture to act both like a solid and a liquid. When the mixture is left to rest or is held up and allowed to dribble, the particles slide over each other and feel like a liquid. The same is when you gently stir it or slowly sink your finger into it. When you apply pressure to the mixture or roll it in your hands, the particles join together and the mixture feels solid.
This is an example of fluid that does not follow Newton's law of viscosity, also known as non-Newtonian fluid. Such examples are also: toothpaste, ketchup, paint, shampoo.

Rizogalo *(dessert)*

You need to buy: *(for 4 persons)*

- 1 l water
- 100 g round grain rice
- 1 cinnamon stick
- 1 l milk
- 180 g sugar
- 6 g vanilla powder
- 60 g corn flour
- 1 pinch of salt

Tools that you need:

- Medium pot
- 5 bowls (4 small for serving and 1 large for mixing)
- Scales
- Measuring jug
- Rice drainer
- Whisk
- Silicon spatula
- Tablespoon
- Fork
- Food wrap

Cooking steps:

1 In a medium pot add 1 L water, 100 g rice, 1 cinnamon stick.

Place the pot over medium heat.

2 Simmer for 30 minutes, stirring now and then with a tablespoon.

If the rice is not soft, simmer until soft.

Turn off the heat. (Be careful the stove remains hot!).

3 Place a rice drainer in the kitchen sink.

Pour the rice into the drainer and let it drain.

Remove the cinnamon stick using a fork.

4 Use the same pot and place it over medium heat.

5 Pour 700 ml milk into the pot and add 180 g sugar.

Stir and bring to a boil, then remove from heat.

(Be careful, the stove is still hot and we are going to use it again).

6

In a bowl pour the rest of the milk (300 ml).

Add 6 g vanilla powder and 60 g corn flour.

Stir until the corn flour is fully dissolved.

7

Put the pot back on the stove, in medium heat.

8

Add the drained rice into the pot.

Add the mixture with the milk and corn flour.

Add a pinch of salt.

9 Stir with a silicone spatula for 3-4 minutes until the mixture thickens to a cream.

Turn off the heat. (Be careful, the stove remains hot!).

10 Pour the risogalo into small bowls.

Use food wrap to cover each bowl.

11 Place the bowls in the fridge for 2 hours.

12 Serve cold, sprinkle each bowl with cinnamon powder.

Experiment 30

Oozing!

Wear an apron for this messy activity!

Can two states of matter coexist in a mixture? We will mix materials and observe how atoms change the behavior of a mixture depending on how we treat them.

What you need:

- A big bowl
- A cup
- A spoon
- Water
- Corn flour
- Food dye (optional)

What to do:

1. Put 2 cups of corn flour into the bowl.
2. Add a cup of water.
3. Add 2 drops of food dye (optional).

4 Mix the corn flour, the water and the food dye smoothly with your hands, or with the spoon. It will take a few minutes to blend them all together.

5 Take some of the mixture with your hand and hold it up. Let it dribble through your fingers.

6 Take some of the mixture and roll it into a ball between your hands. What happens when you stop rolling?

7 Sink softly/slowly your finger into the mixture in the bowl. How does it feel?

8 Sharply, punch the mixture into the bow. How does it feel now?

What is going on?

Your mixture is made from corn flour and water.

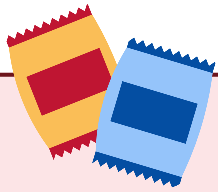
Corn flour is made of lots of long, stringy particles. They don't dissolve in water, but they do spread themselves out.

This allows the mixture to act both like a solid and a liquid.

When the mixture is left to rest or is held up and allowed to dribble, the particles slide over each other and feel like a liquid. The same is when you gently stir it or slowly sink your finger into it.

When you apply pressure to the mixture or roll it in your hands, the particles join together and the mixture feels solid.

Science Snacks:



Water, and most common fluids, are ideal fluids or Newtonian fluids. When you exert force against them, such as by sticking your finger in them or stirring them with a spoon they move out of the way. If you press against them slowly, they will move out of the way slowly, and if you press against them more forcefully, they will move out of the way faster.

Your mixture is a non-Newtonian fluid. These fluids do not behave this way. Their viscosity can change when subjected to force and they can appear solid or liquid. There are many non-Newtonian fluids around and each one is weird in its own way.

Quick Sand

"Quick Sand" is a non-Newtonian fluid acting in the same way with your slime. If you ever find yourself sinking in a pool of quicksand stay calm and try swimming toward the shore very very slowly. The slower you move, the less the quicksand will resist your movement.

Ketchup

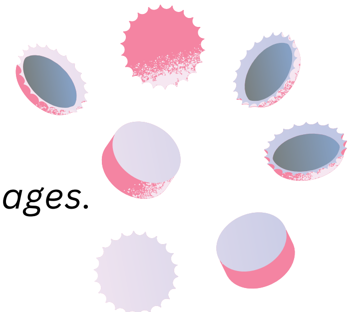
Ketchup, is a non-Newtonian fluid, acting in the opposite way! When you apply a force to ketchup it gets runnier, so shaking the bottle makes the ketchup flow more easily out of the bottle – for a short time, at least!

Hygiene and Safety Procedures in the Kitchen

What is kitchen hygiene?

Kitchen hygiene is crucial for ensuring the health of those who eat. Following hygiene and safety rules helps prevent illnesses and accidents. For example, washing hands thoroughly before handling food is a simple yet effective way to avoid spreading germs.

Risk Assessment in the kitchen

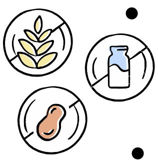


Physical Hazards:

- Pieces of glass or metal (from broken utensils).
- *Example: Regularly inspecting tools and tableware for damages.*
- Foreign objects in food (such as bottle caps or hair).
- *Example: Implementing asystem for monitoring food prep areas to catch these before serving.*
- Slippery surfaces (due to water or oil).
- *Example: Using anti-slip matting in high-traffic areas to prevent falls.*

Chemical Hazard:

- Cleaning products (if not rinsed properly). 
- *Example: Ensuring all surfaces are rinsed after cleaning with chemicals.*
- Allergens in foods (e.g., nuts, gluten).
- *Example: Clearly labeling all ingredients and potential allergens on the menu.*



- Pesticide residues on fruits and vegetables.
- *Example: Washing produce thoroughly before use or sourcing from organic suppliers.*

Hygiene and Safety Procedures in the Kitchen

<u>Biological Hazards:</u>

- Bacteria (if food is not cooked or stored properly).
- *Example: Following strict cooking and storage guidelines to prevent bacterial growth.*
- Viruses (such as Hepatitis A).
- *Example: Ensuring all employees are trained in proper hygiene practices, like handwashing.*
- Parasites (e.g., in unwashed salad).
- *Example: Ensuring that all raw vegetables are washed thoroughly before preparation.*

What is the HACCP protocol?

HACCP (Hazard Analysis and Critical Control Points) is asystem that helps us identify and control risks in the kitchen. It is based on seven fundamental principles:

1. Identify hazards - *Example: Checking for any physical contaminants in food products, like broken glass or metal fragments from broken utensils.*

2. Establish Critical Control Points (CCPs) - *Example: Setting the cooking temperature for chicken at 75°C to ensure harmful bacteria are killed.*

3. Establish critical limits - *Example: Ensuring that food is stored at the correct temperatures, such as keeping refrigerated items below 4°C.*

4. Monitor CCPs - *Example: Regularly checking food temperature with aprobe thermometer to ensure it is cooked to the required level.*

5. Establish corrective actions - *Example: If abatch of food does not reach the required cooking temperature, it should be returned to the heat until done.*

6. Establish verification procedures - *Example: Periodically reviewing temperature logs to confirm compliance with safety standards.*
7. Create records - *Example: Maintaining alogbook for temperature checks and cleaning schedules to ensure accountability.*

Creating asimple HACCP (Hazard Analysis and Critical Control Points) manual for a home kitchen can help ensure food safety practices are followed.
Here's abasic example:

HACCP Manual for Home Kitchen

This HACCP manual is designed for use in a home kitchen to help prevent foodborne illnesses. By following these guidelines, you can ensure safe food handling practices and maintain a clean cooking environment.

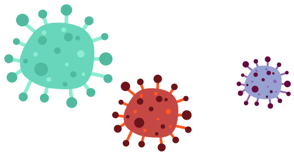
HACCP Principles:

1. Conduct a Hazard Analysis: Identify potential hazards in your food preparation, cooking, and storage processes.
2. Determine Critical Control Points (CCPs): Identify points in the process where you can prevent, eliminate, or reduce hazards.
3. Establish Critical Limits: Set limits (time, temperature, pH) for each CCP to ensure food safety.

4. Establish Monitoring Procedures: Determine methods for monitoring each CCP to ensure compliance with critical limits.
5. Establish Corrective Actions: Define actions to take when monitoring indicates a deviation from a critical limit.
6. Establish Verification Procedures: Establish methods to verify that the HACCP plan is working effectively.
7. Establish Record-Keeping and Documentation Procedures: Keep detailed records of monitoring, corrective actions, and verification activities.

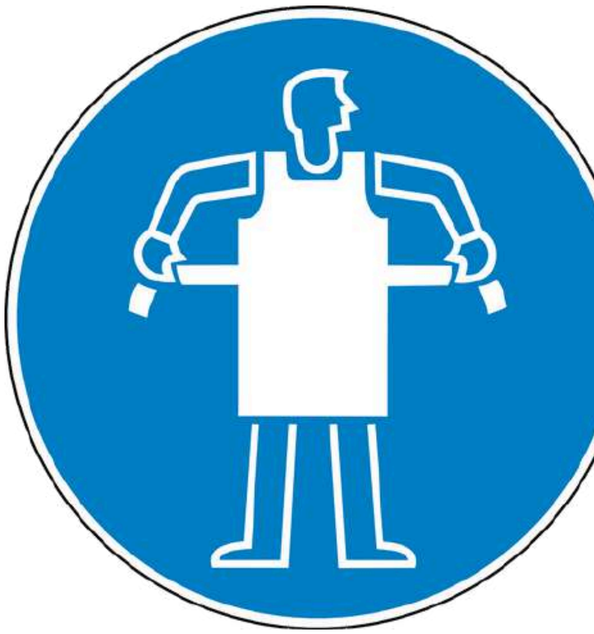
This HACCP manual is designed for use in a home kitchen to help prevent foodborne illnesses. By following these guidelines, you can ensure safe food handling practices and maintain a clean cooking environment.

1. Hazard Analysis



Common Hazards

- Biological Hazards: Bacteria (e.g. Salmonella E. coli), viruses (e.g., Norovirus).
- Chemical Hazards: Pesticides, cleaning agents.
- Physical Hazards: Bone fragments, metal shards.



High Risk Foods:

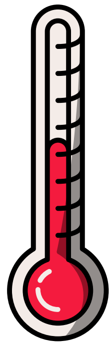
- Raw meats
- Seafood
- Dairy products
- Eggs
- Cooked rice and pasta

2. Critical Control Points (CCPs)

Step	Process	CCP	Critical Limit	Monitoring	Corrective action
1	Receiving food	Temperature	<5°C for cold items	Thermometer check upon receipt	Reject items above limit
2	Storage	Temperature	<5°C for refrigeration, <-18°C for freezing	Daily temperature log	Adjust fridge/freezer settings or dispose of items
3	Cooking	Internal temperature	>75°C for meats	Use food thermometer	Re-cook to required temperature

Step	Process	CCP	Critical Limit	Monitoring	Corrective action
4	Cooling	Temperature	<5°C within 6 hours	Measure with thermometer	Rapid cooling methods (ice bath)
5	Reheating	Internal temperature	>75°C	Use food thermometer	Reheat thoroughly
6	Serving	Time	≤4 hours for food at room temperature	Timer/check at 2hours	Discard after 4 hours

4. Monitoring Procedures



- Monitor temperatures using a calibrated thermometer.
- Keep daily logs for refrigerator and freezer temperatures.
- Regularly check cooking temperatures using a food thermometer.

5. Corrective Actions

- If food is stored above the critical limit, discard it.
- If cooking does not reach the critical temperature, return to cooking until the limit is met.
- If food is left out for longer than the allowable time, discard it.

6. Verification Procedures

- Review temperature logs weekly.
- Conduct a quarterly review of procedure effectiveness and training.
- Recalibrate thermometers periodically.

7. Record-Keeping

- Keep a log of:
  - Temperature checks (daily/monthly)
  - Cooking temperatures
  - Corrective actions taken
  - Training sessions conducted

Conclusion By implementing this HACCP plan, you can minimize food safety risks and ensure a healthier cooking environment in your home kitchen.

Fire Safety Regulations

1. Fire Prevention:

a. Never leave the kitchen unattended while cooking.

Example: Assigning aresponsible person to monitor the stove and cooking processes at all times.

b. Keep flammable materials (napkins, plastic bags) away from heat sources.

Example: Designating aspecific area away from the stove for temporary storage of these items.

2. Using Fire Extinguishers:

a. Know the location of fire extinguishers and how to use them.

Example: Conducting regular training sessions for staff on fire extinguisher operation.

b. Use the extinguisher for class Kfires (grease and oil fires) and other types of fires.

Example: Teaching kitchen staff the difference between various extinguishing agents.

3. Evacuation Plan:

a. Be aware of emergency exits.

Example: Posting clear evacuation maps in the kitchen area to guide employees during emergencies.

b. Follow instructions in case of a fire.

Example: Conducting fire drills to ensure everyone knows the evacuation procedure.

First Aid Tips

In case of injury:

1. For cuts:

a. Wash the wound thoroughly with soap and water.

Example: Using warm water and mild soap to clean the area before applying an antiseptic.

b. Apply a disinfectant and cover with a bandage.

Example: Keeping afirst-aid kit stocked with various-sized bandages for easy access.

c. If the cut is deep, seek help.

Example: Having a procedure for contacting medical assistance immediately.

2. For burns

a. Cool the burned area with cold water for at least 10 minutes.

Example: Keeping a cold-water tap easily accessible for emergency use.

b. Do not apply ice directly to the skin.

Example: Using a clean cloth to wrap ice instead of direct application.

c. Cover with a clean, dry cloth. If severe, contact a doctor.

Example: Having a burn care kit readily available, including sterile gauze.

3. For scalds

a. Follow the same procedure as for burns.

Example: Ensuring there's a designated area in the kitchen for assessing injuries and providing aid.

b. Do not break blisters.

Example: Educating staff on the importance of protecting blisters without popping them.

4. In case of severe emergencies:

a. Call emergency services (112 in Italy) immediately and provide clear nformation about the situation.

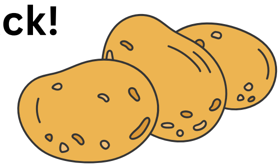
Example: Training staff to communicate effectively with emergency responders.

Conclusion

Keeping the kitchen clean and safe is essential for preventing health issues and accidents. Following hygiene and safety rules, including HACCP protocols, helps everyone work and eat safely. Always remember to stay vigilant and seek help when necessary!

Three tips to reduce waste in the kitchen

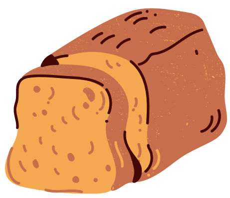
Don't throw away potato skins. Make this delicious snack!



1. Wash the potato skins.
2. Dry the skins using cloth.
3. Sprinkle some oil over the dry potato skins.
4. Season to taste (for example dried rosemary, garlic).
5. Mix with hands.
6. Spread evenly on a baking tray (you can use baking paper).
7. Bake for 10-15 minutes in a preheated oven at high temperature (200-230 °C).

You don't like the taste of ripe bananas? We bet you will like this tasty classic:

1. Peel 3 ripe bananas and mash them with a fork.
2. Add 75 g butter (you can melt it before adding and stir over mashed bananas).
3. Add 1 teaspoon baking soda, a pinch of salt and 1 vanilla sugar.
4. Add 100 g sugar.
5. Add 1 egg.
6. Mix everything.
7. Mix in 200 g of all-purpose flour (you can use wholegrain as well).
8. Pour the batter into a greased baking tray (instead of grease, you can use baking paper).
9. Bake for 60 minutes in a preheated oven at temperature (175 °C).



Three tips to reduce waste in the kitchen

Did you ever wonder how does the green parts of the carrots taste like?

Try it in this pesto sauce

1. Use the greens that was left after preparing a dish: for example, carrot top greens, cauliflower leaves, poor spinach leaves, poor lettuce leaves.
2. Put these greens in the mixer bowl.
3. Add 200 ml lemon juice.
4. Add 3 leaves of fresh basil.
5. Add 50 g of parmesan cheese.
6. Add 50 g of pine nuts (or almonds or macadamia nuts).
7. Pour in 100 ml olive oil.
8. Mix everything in the blender.
9. Add oil if needed.
10. Put in jar, store in fridge.
11. Use this sauce with pasta.

Seasons of vegetables

Spain | Italy | Slovenia | Greece

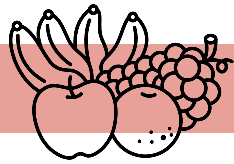
Vegetable	01	02	03	04	05	06	07	08	09	10	11	12
Artichoke	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain			Spain	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Greece
Asparagus		Spain	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece						
Aubergine	Spain	Spain	Spain	Spain	Spain, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Greece	Spain, Greece	Spain	Spain
Beetroot	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Greece	Spain, Greece	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece
Broccoli	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Greece	Spain	Spain	Spain, Slovenia	Slovenia	Spain, Slovenia	Spain, Slovenia	Spain, Italy, Greece	Spain, Italy, Greece
Brussels sprouts	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Greece	Greece					Spain	Spain, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece
Cabbage	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Greece	Spain, Greece	Spain, Greece	Spain, Greece	Spain, Greece	Spain, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece
Carrot	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece
Cauliflower	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Spain	Spain	Slovenia	Slovenia	Spain, Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Greece	Spain, Italy, Greece
Celery	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Italy, Greece	Italy, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece
Corn	Spain	Spain	Spain				Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Greece	Spain	Spain	Spain
Cucumber	Spain	Spain	Spain	Spain	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Greece	Spain	Spain
Green Bean	Spain	Spain	Spain	Spain, Greece	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Greece	Spain, Greece	Spain
Kale	Spain, Italy, Slovenia	Spain, Italy	Spain, Italy	Spain	Spain	Spain	Spain	Spain, Slovenia	Spain, Slovenia	Spain, Slovenia	Spain, Italy, Slovenia	Spain, Italy, Slovenia
Kohlrabi	Italy	Italy	Spain, Italy	Spain	Spain	Slovenia	Slovenia	Slovenia	Spain, Slovenia	Spain, Italy, Slovenia	Spain, Italy	Italy
Leek	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Spain	Spain	Spain	Spain	Spain, Slovenia	Spain, Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece

Seasons of vegetables

Spain | Italy | Slovenia | Greece

Vegetable	01	02	03	04	05	06	07	08	09	10	11	12
Lettuce	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece
Mushrooms	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia	Spain, Slovenia	Spain, Slovenia	Spain, Slovenia	Spain, Slovenia	Spain, Italy, Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece
Onion	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece
Paprika	Spain	Spain	Spain	Spain	Spain, Greece	Spain, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Greece
Parsnip	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Greece		Slovenia	Slovenia	Slovenia		Italy	Spain, Italy	Spain, Italy, Greece
Peas		Spain	Spain	Spain, Italy	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Slovenia				
Potato	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece
Pumpkin	Spain, Italy	Spain, Italy	Spain	Spain	Spain	Spain	Spain, Greece	Spain, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy
Radish	Spain	Spain	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Greece	Spain
Red Cabbage	Spain, Italy, Slovenia	Italy, Slovenia	Italy, Slovenia				Slovenia	Slovenia	Slovenia, Greece	Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece
Rhubarb				Spain, Italy, Slovenia	Spain, Italy, Slovenia	Spain, Italy, Slovenia	Spain					
Spinach	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Greece	Spain	Spain	Spain, Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Greece
Spring Onion	Spain, Greece	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Greece	Spain, Greece	Spain, Greece	Spain, Greece	Spain, Greece
Sweet Potato	Spain								Italy	Spain, Italy, Slovenia	Spain, Italy, Slovenia	Spain
Tomato	Spain	Spain	Spain	Spain	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Spain	Spain
Zucchini	Spain	Spain	Spain	Spain	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Spain	Spain

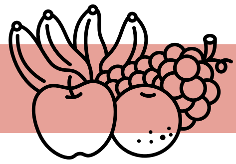
Seasons of fruits and nuts



Spain | Italy | Slovenia | Greece

Vegetable	01	02	03	04	05	06	07	08	09	10	11	12
Apple	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia	Italy, Slovenia	Italy, Slovenia	Slovenia	Spain, Slovenia	Spain, Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece
Apricot				Spain	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia				
Avocado	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Italy	Italy	Spain, Italy	Spain, Italy	Spain, Italy	Spain, Italy, Greece
Banana	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy	Spain, Italy	Spain, Italy	Spain, Italy	Spain, Italy	Spain, Italy, Greece	Spain, Italy, Greece
Blackberry					Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia	Spain		
Blueberry				Spain	Spain	Spain, Italy, Slovenia	Italy, Slovenia	Italy, Slovenia, Greece	Italy, Slovenia, Greece			
Cerry					Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia				
Chestnut									Spain, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Italy
Currant	Greece	Greece	Greece	Greece	Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Slovenia, Greece	Greece	Greece	Greece	Greece
Elderberry				Slovenia	Slovenia			Spain, Italy	Spain, Italy			
Grape						Spain	Spain, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Greece	Spain
Grapefruit	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy							Spain, Slovenia	Spain, Italy	Spain, Italy, Greece
Hazelnut	Slovenia	Slovenia	Slovenia	Slovenia	Slovenia			Spain	Spain, Italy, Slovenia	Spain, Italy, Slovenia	Spain, Slovenia, Greece	Slovenia, Greece
Kiwi									Spain, Italy	Spain, Italy, Greece	Spain, Slovenia, Greece	Spain, Greece
Lemon	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy	Spain, Italy	Spain, Italy	Spain, Italy, Slovenia	Spain, Italy, Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece
Mango	Italy, Greece	Italy, Greece	Italy, Greece	Italy	Italy	Spain, Italy	Spain, Italy	Spain, Italy	Spain, Italy	Spain, Italy	Spain, Italy	Spain, Italy, Greece

Seasons of fruits and nuts



Spain (yellow) Italy (green) Slovenia (pink) Greece (blue)

Vegetable	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**
Nectarine				Spain	Spain	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Greece	Spain		
Orange	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy	Spain, Italy	Spain	Slovenia	Slovenia	Slovenia	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Greece
Peach				Spain	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Greece	Spain	Spain	
Pear	Italy, Slovenia	Italy, Slovenia	Slovenia	Slovenia		Spain	Spain, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia
Plum						Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain		
Raspberry	Spain	Spain	Spain	Spain	Spain	Spain, Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia	Spain, Slovenia	Spain	Spain
Strawberry		Spain	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Slovenia	Slovenia	Slovenia	Slovenia	
Walnut	Slovenia, Greece	Slovenia, Greece	Slovenia	Slovenia	Slovenia			Spain	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Slovenia, Greece
Watermelon				Spain	Spain	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece			

Seasons of herbs

Spain Italy Slovenia Greece

Vegetable	01	02	03	04	05	06	07	08	09	10	11	12
Arugula	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia	Italy, Slovenia	Italy, Slovenia	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia, Greece
Basil					Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Slovenia		
Chieves	Slovenia	Slovenia	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Italy, Slovenia, Greece	Slovenia	Slovenia	Slovenia
Dill	Slovenia, Greece	Slovenia, Greece	Slovenia, Greece	Slovenia, Greece	Italy, Slovenia	Spain, Italy, Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Italy, Slovenia, Greece	Slovenia, Greece	Slovenia, Greece	Slovenia, Greece
Fennel	Italy	Italy	Italy, Greece	Italy, Greece	Italy, Slovenia, Greece	Slovenia, Greece	Slovenia, Greece	Spain, Slovenia, Greece	Spain, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Italy	Italy
Garlic	Spain	Spain	Spain	Spain	Spain, Greece	Spain, Italy, Greece	Spain, Italy, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain	Spain
Ginger										Spain	Spain	
Mint	Slovenia	Slovenia	Slovenia	Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Slovenia, Greece	Slovenia	Slovenia
Oregano	Slovenia	Slovenia	Slovenia	Slovenia	Slovenia	Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia	Spain, Italy, Slovenia	Slovenia	Slovenia
Parsley	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece
Rosemary	Italy, Slovenia	Italy, Slovenia	Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia	Italy, Slovenia	Italy, Slovenia	Italy, Slovenia	Italy, Slovenia	Italy, Slovenia
Thyme	Italy, Slovenia	Italy, Slovenia	Italy, Slovenia	Spain, Italy, Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Italy, Slovenia, Greece	Italy, Slovenia	Italy, Slovenia	Italy, Slovenia
Wild Garlic			Spain, Italy, Slovenia	Spain, Italy, Slovenia, Greece	Spain, Italy, Slovenia, Greece	Slovenia, Greece						

Sensory grocery shopping

In this experience, players will recreate a recipe by selecting the required ingredients using only their sense of touch, smell, and taste. The recipe must be selected from those proposed during the workshop.

Duration of the Experience

The duration of this experience can vary greatly depending on the abilities of the participants. Trainers have complete flexibility to choose recipes of varying complexity, enabling them to adjust the overall timeframe to suit the group.

Number of Participants

The experience can accommodate groups ranging from 2 to 6 players.

Number of Trainers

The experience requires at least one trainer to guide the group, but larger groups may benefit from having two trainers to ensure smooth facilitation.

Necessary Materials

- Ingredients for preparing the recipe
- Ingredients not needed for the recipe
- 1 table
- 1 small perforated box for each ingredient

Sensory grocery shopping

Objectives of the Experience

<u>Benefits for the Target Audience's Well-Being</u>

- Use of olfactory and tactile stimuli beneficial for the well-being of individuals with mental disabilities
- Foster greater independence in the participants involved
- Improve communication skills

<u>Environmental Impact of Food</u>

- Educate about the environmental impact of purchasing a local product compared to a foreign product
- Raise awareness of more sustainable purchasing and consumption practices

Skills Involved in the Game

In this experience, players enhance their sensory skills of smell and touch while also developing communication skills during the discussion and decision-making phases with their group members.

Preparation of Game Materials

Trainers select a recipe from those available in the workshop. They then determine the number of ingredients necessary for the experience, including selecting ingredients that are not required for the recipe's preparation. Once the total number of ingredients is defined, the preparation of the containers to hold them can begin. For the Tactile Phase, we use the Montessori method's mystery box. For the Olfactory Phase, we use special devices designed for teaching children about different smells. These devices must be covered with black tape on the transparent parts to prevent players from seeing the ingredients inside.

Sensory grocery shopping

Costs

Complete Material Purchase Costs

Mystery Box

- Cost: 28 € per pz LINK

Bottle of Smells

- Cost: 21 € per set (8 pz per set) LINK
- Cost Nastro Isolante: 8 € per set (5 pz per set) LINK

Internal Production Material Costs

Mystery Box

- Production Time: 15minutes per piece
- Cost per Box: /
- Cost of Adhesive Tape: €14 per set (6 pieces per set) LINK
- Cost of Felt Fabric (Pannolenci):€16 per set (40 pieces per set) LINK
- Number of People Required: 1 per piece

Bottles of Smells

- Production Time: 1 minuto a pezzo
- Cost of Spice Rack: €1.50 per piece LINK
- Cost of Black Tape: €8 per set (5 pieces per set) LINK
- Number of People Required: 1 per piece

Mystery Box

Bottled of Smells

Sensory grocery shopping

Preparation of the Game Environment

A table is arranged in the room, with the boxes containing the ingredients placed on it. Each ingredient serves as a station.

Conducting the Experience

The groups move along the table, stopping at each station to engage the analysis phase. This phase is divided into three parts:

- **Tactile Phase:** In the Tactile Phase, players take turns touching the ingredient inside the box. Once all participants have finished touching the ingredient, they move on to the discussion phase. When the group comes to a consensus, the trainers indicate whether the response is correct or not. If it is correct, the trainers remove the ingredient from the table and guide the group to the next station; if it is incorrect, they proceed to the next phase.
- **Olfactory Phase:** In the Olfactory Phase, players take turns smelling the ingredient inside the box. Once all players have finished smelling the ingredient, they move on to the discussion phase. When the group agrees on a common answer, the trainers reveal whether the answer is correct or not. In this case, it doesn't matter if the answer is right or wrong; the name of the ingredient is revealed, it is removed from the table, and the group proceeds to the next phase.
- **Tasting Phase:** During the Tasting Phase, players can sample the ingredient they're analyzing. Once all the players have tasted the ingredient, the trainer asks which basic flavor is most dominant in the ingredient just tasted. The group then moves on to the discussion phase, where each player shares the flavor they found most dominant. After completing this phase, they proceed to the next station.

Sensory grocery shopping

These phases are repeated for all the ingredients until each one has been analyzed by the players. At the end of the experience, the recipe is cooked and presented to all participants. If it is not possible to prepare the dish, each player receives a card outlining the necessary ingredients and the preparation steps.

Recommendations 

In the case of jams, sauces, and similar products, we recommend allowing players to touch and smell the raw ingredients in their original state. This approach can also be applied during the tasting phase, but it is ultimately up to the trainers to decide whether to implement it.

For example: If the recipe includes tomato sauce, players should smell and touch the tomatoes from which the sauce is made.

Green practices included in the book

In the book you can also observe suggestions for green practices in the kitchen. By including these, we wanted to express our support toward responsible responsible and respectful handling of food and cuisine in general. Partners have done their best to present some suggestions for reducing waste in the kitchen. A special chapter guides you through the seasonality of each ingredient, so you can follow when in each country an ingredient is most likely to be produced by local producers, so you can buy and support local.

In addition, two whole menus are dedicated exclusively to plant-based diet. A plant-based diet is the consumption of plant-based foods such as fruits, vegetables, grains, legumes, nuts, and seeds as the main source of nutrition. Plant-based diets can vary in strictness, from completely vegan (excluding all animal products) to eating small amounts of animal products such as fish or dairy or in general focusing on consuming primarily plant-based foods and meals.It is often considered more sustainable and ethical than a diet that relies heavily on animal products because it requires fewer natural resources and has a smaller environmental footprint.

Sustainable Development Goals

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. Altogether there are 17 goals which and how are adressed in our STEM learning Cookbook:

2	ZERO HUNGER	By promoting the use of local and seasonal ingredientswe help ensure food security and improve nutrition.
12	RESPONSIBLE CONSUMPTION AND PRODUCTION	By highlighting the use of local ingredients, reducing food waste (such as using leftovers to make breadcrumbs), and preferring organic options, The text promotes more sustainable consumption and production practices.
13	CLIMATE ACTION	By reducing ecological impact through the choice of local and organic ingredients and optimizing the use of resources such as energy and water, we contribute to the fight against climate change.
3	GOOD HEALTH AND WELL-BEING	By promoting a balanced diet that combines plant and animal proteins and reduces the use of white sugar, the text aligns with goals of improving health and well-being.
8	DECENT WORK AND ECONOMIC GROWTH	By supporting local producers, we foster the economic growth of the local community, contributing to the creation of job opportunities.
9	INDUSTRY, INNOVATION AND INFRA-STRUCTURE	An innovative approach to food sustainability can stimulate the creation of new practices and infrastructures in the food sector.
15	LIFE ON LAND	By supporting sustainable agriculture and reducing waste, the text promotes the conservation of biodiversity and ecosystems.

Conclusion

As the journey through the Cookbook tells us, science is an important component of cooking and is an indispensable constant when handling food. We believe that this Cookbook presents science in an engaging, interesting, understandable and accessible way. In addition to presenting the science, we wanted this cookbook to present a diverse range of dishes. That is why we have included some traditional recipes, some general, some plant-based. Some are more simple, some more complex. But there is certainly something for everyone in the diverse range of the cookbook. We hope you have enjoyed or will enjoy the carefully prepared journey through cooking to science. And don't forget to follow the cooking safety tips when you're on your journey. You can use the sensory game to awaken your senses, and if you get hungry for science between starter and lunch or lunch and dinner, eat one of the exciting Science Snacks we have prepared.

And we haven't forgotten to take care of the environment. So you'll find a few extra recipes in the book to give you ideas on what to do with leftovers to avoid throwing them away. You can also follow the seasonality of food in 4 European countries. This will help you decide which recipe is more suitable for you at the moment if you want to buy as local as possible.

Conclusion

A holistic book is therefore much more than just a cookbook. It is a teaching tool, it is a handbook, it is cooking, it is preparing dishes, it is handling kitchen utensils, it is observing scientific phenomena, it is linking cooking and science, it is the diversity of Europe, it is a walk through the seasons, it is a play of the senses... in short, it is a journey through an extraordinary and unique world.

Our Cookbook will be further supported in the future. A learning game is also in the pipeline, where science and cooking will once again come together. This time in a different way and with complementary content of the Cookbook which you have witnessed.

Index of experiments

Table 1 shows 25 scientific topics matched to experiments in the cookbook, each marked with a unique number.

Table 2 provides the experiment titles and related recipes.

Scientific subject	Experiments
Acids and bases	1 5 7 12 17 23
Air	26
Buoyancy	16
Cells	3 8
Chemical reactions	1 7 12 14 15 17 23 24 28
Density	6 13 16
DNA	3
Elasticity	8 19
Electricity	11 28
Fermentation	4
Friction	29
Gas	1 4 24
Hydrophoby / Hydrophily	2 9
Ice	21

Index of experiments

Index of experiments

Nr.	Experiment	Key words	Recipe
1	Invisible extinguisher	Acids and bases, Chemical reaction, Neutralization, Fire triangle	Pumpkin soup
2	Run pepper run!	Surface tension of water, Hydrophobic and hydrophilic materials	Chicken wraps
3	What is the taste of DNA?	Cell, DNA	Fruit salad with whipped cream
4	Hungry yeast	Yeast, Fungus, Fermentation	Rolls with ham and horseradish
5	Acid or base? Cabbage can tell!	pH scale, Color indicator, Acid, Acidic, Base, Basic	Jota/Stew
6	How much is too much?	Volume, Mass, Weight, Density	Apple pie
7	Naked eggs.	Chemical reaction, Neutralization, Osmosis	Stuffed eggs
8	Flexible carott	Cells, Biochemistry, Osmosis	Spring risotto
9	Hydrophobic Hot Cocoa	hydrophilic, hydrophobic	Peaches stuffed with chocolate and amaretto
10	To mix or not to mix?	Liquid, Mixture, Miscible, Immiscible, Emulsifier	Crispy artichokes
11	Pepper jumps	Mixture, Electric charge, Static electricity	Pasta and beans

Index of experiments

Nr.	Experiment	Key words	Recipe
12	Anti-brown experiment	Enzyme, Chemical reaction, Oxidation, Acid, pH scale, Melanin	All-apple cake
13	Liquid Rainbow	Density	Gazpacho
14	Invisible ink	Chemical reaction, Oxidation	Paella
15	Dissolving drops	Chemical reaction	Crema catalana
16	Floatting egg	Density, Buoyancy	Scrambled egg with asparagus
17	Milky plastic	Polymers, Plastic, Molecules, Chemical reaction	Albondigas (Meat balls in tomato sauce)
18	Kinetic Dough	Polymers, Molecules, Silicone	Churros
19	Stretchy dough	Protein, Elasticity	Tuscany beans and bread
20	Salt “The Delayer”	Boiling, Boiling-point	Penne with vegan feta
21	Sticky Ice	States of matter, Solid, Liquid, Gas, Freezing/Melting, Freezing/Melting point	Vegan panna cotta
22	Hot and furious	Dissolving, Diffusion	Mushroom soup
23	Turmeric pH-indicator	Acid, Acidic, Base, Basic, pH scale, pH indicator, Chemical reaction, Neutralization	Tofu pie

Index of experiments

SCI-info

Small paragraphs giving information about the phenomenon takes place during cooking. There are 23 such paragraphs, which are related to the 23 cooking recipes given below.

Pumpkin soup

Solids and liquids. Solids have a fixed shape and volume, which means they keep their form no matter how you move or handle them. The particles in a solid are tightly packed together and vibrate in place. This is why solids feel hard and stable. Liquids don't have a fixed shape, but they do have a fixed volume. This means they take the shape of whatever container they're in, but they still have the same amount of matter. The particles in a liquid are still close together, but they can move past each other more freely compared to solids. This is why liquids flow and can be poured.

Chicken Wraps

Frying. Food is fried when it is placed with a little fat or oil in a frying pan (shallow frying) or immersed in oil or fat (deep frying) at a sufficiently high temperature. In frying a much higher temperature is used than when cooking in water.

Fruit salad with whipped cream

Mixtures are made up of two or more substances which are not combined chemically. Each component of a mixture keeps its original properties and the separation of components can be easily done using physical methods.

Apple pie

Volume and mass. Volume represents the space occupied by an object and can be measured in cubic meters, liters, cubic feet (in the US), or gallons. In kitchen settings, volume measurements may include cups (approximately 250 ml), teaspoons (5 ml) and tablespoons (15 ml). Volume is influenced by temperature —when substances heat up, they expand, altering their volume. Mass refers to the quantity of matter an object possesses. In everyday contexts, such as the kitchen, mass is often measured using weight, with common units including grams (gr) and kilograms (kg).

SCI-info

Stuffed eggs

Vaporization is the process through which a substance transforms from a liquid into a gas. It includes both evaporation and boiling. During **evaporation**, only the top level of the liquid is turned into vapor. It doesn't produce bubbles and leads to cooling. Hot tea getting cold is such an example. Boiling happens though heating. It is faster and occurs only at the surface but throughout the liquid, it produces lots of bubbles and does not result in cooling.

Spring risotto

Boiling is perhaps the simplest of all kitchen techniques and refers to heating a food in boiling water. For most vegetables the boiling temperature is close to 100 °C, which is the boiling point of water (under standard pressure at sea level).

Crispy artichokes

Acids, Bases and Salts. Most inorganic substances can be classified as acids, bases, or salts. For hundreds of years, people have known that vinegar, lemon juice, amla, tamarind and many other food items taste sour. This is happening because they contain acids. Many substances or chemicals which we use in our daily life, such as detergents, soaps, toothpaste, baking soda or baking powder, are actually bases. Salts are neutral substances and in nature they are crystalline. Table salt is a common salt used to enhance taste and preserve food. In order to define a substance or a food as acidic, neutral or basic, pH scale, from 1-14 is used. A value of less than seven indicates an acid, and a value of more than seven indicates what is called a base (or alkaline) solution.

Pasta and beans

Soaking beans overnight helps remove some of the oligosaccharides they contain making it easier for our bodies to break them down. This makes it less likely to have gas after eating them. The reason beans "swell" is due to the phenomenon of osmosis, according to which water molecules pass through their membrane increasing their volume.

SCI-info

Paella

Conduction is the transfer of heat through physical contact. During cooking the burners on stoves conduct heat energy to the bottom of the pan sitting on top of it. When vegetables or raw steak touches the hot pan, heat passes through conduct from the pan to the vegetables or steak rising up their surface temperature. Conduction is the slowest method of heating and allows food to be cooked from the outside in, transforming its structure.

Crema catalana

Caramelization is what happens when any sugar (such as white sugar or the sugar contained in a food) is heated at high temperature. A few tablespoons of sugar put in a pan and heated will eventually melt and, at 170°C start to turn brown. At this temperature water is removed, the sugar compounds begin to break down and new compounds form producing a sweet, nutty, or buttery flavor and golden-brown to dark brown color.

Scrambled egg with asparagus

Cooking utensils can be made from copper, stainless steel, aluminum or earthen pots. The material of the utensils can decide the time of cooking and also alter the taste of the food. This is happening because different materials have different ability to transfer heat. For example, frying an egg in a pan made of stainless steel needs a lot more time than using an aluminum pot just because the thermal conductivity of aluminum is almost 15 times higher than stainless steel.

Churros

Melting is the process through which a solid substance transforms into a liquid state under the influence of heat. Ice cubes melt into water when left outside the refrigerator, chocolate melts in your warm hands and butter melts when heated in a pan.

SCI-info

Tuscany beans and bread

Alcoholic fermentation is a process of chemical change in food or drink because of the action of yeast. It is an essential process when making bread, causing bread dough to rise. Yeast organisms consume sugars in the dough and produce alcohol and carbon dioxide. The carbon dioxide forms bubbles in the dough, expanding it to a foam. Alcoholic fermentation helps make bread and bakery items easier to digest, more nutritious and it also adds wonderful flavor. This kind of fermentation also takes place when making beer giving the beer both its alcohol content and its carbonation.

Vegan panna cotta

Freezing or solidification is the process by which a liquid substance turns into a solid when it loses heat energy. When a liquid cool down enough, its molecules slow down and come closer together, forming a rigid structure. As they do this, they lock into place, creating the solid shape we recognize as ice. Freezing is like pressing pause on the movement of molecules, trapping them in a fixed arrangement.

Mushroom soup

Mushrooms aren't really plants, they are types of fungi that have a "plantlike" form - with a stem and cap. Fungi are neither plants nor animals but rather organisms that form their own kingdom of life. The way they feed themselves is different from other organisms: they do not photosynthesize like plants and neither do they ingest their food like animals. Fungi need an organic substrate where they can grow and consume nutrients. Moisture is also required for their growth. Yeast, molds and truffles belong to fungi kingdom as well.

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Vegan yoghurt cake

Baking soda VS Baking Powder. Both baking soda and baking powder are leavening agents, but baking soda needs an acidic ingredient to trigger the leavening while baking powder already contains an acidic ingredient: cream of tartar. If you're out of baking soda, use baking powder instead. Double or triple the amount of baking powder because it contains less baking soda. Using baking powder instead of baking soda may change the flavor of a recipe. If you're out of baking powder, make your own using baking soda and cream of tartar. Mix 2 parts cream of tartar with 1 part baking soda. For example, mix 2 tsp of cream of tartar with 1 tsp of baking soda. No matter how much homemade baking powder you made, if the recipe calls for 1 1/2 tsp., add exactly 1 1/2 tsp. of your mixture. If you have leftover homemade baking powder, you can store it in a labeled, zipper-type plastic bag to use later. Homemade baking powder acts and tastes much like commercial baking powder.

Cretan Ntakos

Food preservation by dehydration. Drying or "dehydrating" food is a method of food preservation that removes enough moisture from the food so bacteria, yeast and molds cannot grow. Many types of food can be preserved for indefinite periods using this method. There are several ways often used to dehydrate foods, including sun drying, air drying, solar drying, oven drying, and electric dehydrators. Dehydration is one of the oldest methods of food preservation and was used by prehistoric peoples to dry seeds in the sun.

Revani Veroias

Dissolving. The term "dissolve" refers to incorporating any solid, liquid, or gas substance into another substance. A lot of substances dissolve when you mix them with water. When a substance dissolves, it might look like it has disappeared, but in fact it has just mixed with the water to make a transparent (see-through) liquid called a solution. For example, sugar dissolves in water and a sweet solution is forming.

Gemista (Stuffed tomatoes and peppers)

Baking. In a baking oven the air temperature is kept fixed in the range 150-250 °C by a thermostat system. Air circulates the oven due to convection or forced circulation. In baking the water at the food surface is evaporating and the food is dehydrated.

SCI-info

Rizogalo

Boiling and simmering are two different techinques of cooking. Simmering instead of boiling allows the ingredients to cook slower at a lower temperature, creating a tender consistency without a mushy texture. Simmering gently softens the ingredients and melds the seasonings into a delicious one-pot meal. While boiling, liquid reaches 100°C, large bubbles vigorously rise from bottom of pot and continually break surface. While simmering, liquid reaches 82-88°C, small bubbles rise from bottom of pot and occasionally break surface.

Vocabulary

Simple definitions of the terms used as key words in the experiments.

Acid	A chemical substance which contains hydrogen, produces hydrogen ions when dissolved in water. Acids have a sour taste and turn certain dyes red.
Air pressure	The amount of force applied on a surface by the air above it.
Base	A substance that accept hydrogen ions when dissolved in water. They turn certain dyes blue. Bases often taste bitter and are slippery to the touch.
Biochemistry	The study of chemical processes within and relating to living organisms.
Boiling	The rapid phase transition from liquid to gas. The process of bringing a liquid to the temperature at which it bubbles and turns to vapor.
Boiling point	The temperature at which a liquid starts to change into steam or vapor. At this temperature the liquid and gas phases both exist in equilibrium.
Buoyancy	The ability of an object to float or rise in a fluid (such as water or air). It describes how well an object float.
Cell	The smallest unit with the basic properties of life of animal or plants
Center of gravity	An imaginary point in an object where the total weight of the object may be thought to be concentrated. The point at which weight is evenly dispersed and all sides are in balance.
Chemical reaction	A process in which one or more substances are converted to one or more different substances. The atoms of the starting substances are rearranged to form new substances that have different properties.
Condensation	The process of changing a gas into a liquid.
Density	Density expresses how heavy something is for its size. It compares the mass of an object to the volume it occupies.

Vocabulary

Diffusion	The process by which particles of one substance spread out through the particles of another substance. It can be seen in all states of matter, but is most common in liquids and gases.
Dissolving / dissolution	The process by which a solute in a gaseous, liquid, or solid phase dissolves in a solvent to form a solution.
DNA	A substance found in cells that contains information about the characteristics of a living thing. Plays a part in the passing on of characteristics from parent to offspring.
Drying / Dehydration	The removal of water by evaporation, from a solid or liquid food, in order to obtain a solid product with significantly less water inside.
Elasticity	Elasticity is the ability of a body to resist a distorting influence and to return to its original size and shape when that influence or force is removed.
Electricity	A form of energy that comes from the movement of tiny particles called electrons.
Emulsifier	An additive that helps two immiscible liquids to mix to create a solution called an emulsion.
Enzyme	Proteins that help speed up metabolism, meaning the chemical reactions in our bodies.
Evaporation	The process of changing a liquid into a gas.
Fermentation	A process of chemical change in food or drink because of the action of yeast or bacteria.
Fire triangle	A simple model that explains what elements need to be present for a fire to ignite and burn: heat, fuel, and oxygen.
Fluid	Substances that flow easily and do not have fixed shape. Liquids and gasses are considered as fluids.
Freezing	The process of changing a liquid into a solid.
Friction	The force between two surfaces that are sliding, or trying to slide, across each other

Vocabulary

Fungus	Any of a wide variety of organisms that reproduce by spores, including the mushrooms, molds, yeasts, and mildews
Gas	A substance that doesn't have a specific shape or volume. Its molecules can move freely and It can only be contained inside a closed container. It can flow, but also expand and be squeezed.
Hydrophilic / Hydrophobic	Hydrophilic means water-loving. It Is a property of molecules that make them mix with water. Hydrophobic means 'water-fearing'. Is a property of molecules that make them not to mix with water, but to repel it.
Immiscible	When two liquids do not mix together and instead form layers, we call them "immiscible."
Inertia	The tendency of an object to resist when trying to change its state of motion.
Liquid	A substance that flows and keeps no specific shape. Its molecules are loosely packed and constantly moving. It can flow or run but can't be stretched or squeezed. It takes the shape of its container but maintains constant volume.
Mass	The amount of matter an object contains.
Miscible / Immiscible	When two liquids combine to form a new liquid, we call the liquids "miscible". When the liquids do not mix together and instead form layers, we call them "immiscible."
Mixture	Mixtures are made up of two or more substances which are not combined chemically. Each component of a mixture keeps its original properties and the separation of components can be easily done using physical methods.
Molecule	The smallest unit of a substance that has all the properties of that substance. A molecule is made up of a single atom or group of atoms.
Neutralization	A chemical reaction in which an acid and base react together to form salt and water as products.
Osmosis	The movement of water (or other liquid) molecules from a region of higher concentration to a region of lower concentration through a semipermeable membrane

Vocabulary

Oxidation	Oxidation is a process in which a substance changes because of the addition of oxygen.
Particle	Any basic unit of matter and energy
pH / pH scale	A measure of how acidic or basic a substance or solution is. pH is measured on a scale of 0 to 14. A pH value of 7 is neutral, which means it is neither acidic nor basic. A pH value of less than 7 means it is acidic, and a pH value of more than 7 means it is basic.
pH indicator	A chemical or physical compound which, when added to a substance or a solution, changes color according to how acidic or alkaline the substance or the solution is
Plastic	An artificial material made from various organic polymers, that can be formed into almost any shape when still in melted form.
Polymer	A natural or synthetic compound which consists of molecules that are repeated over and over again in chains.
Pressure	The amount of force applied over a certain area.
Protein	Is a substance found in food and drink such as meat, eggs, and milk. Proteins are large, complex molecules that play many critical roles in the body.
Silicone	A term used to refer to a group of materials that contain the elements silicon and oxygen. Silicones are polymers, meaning molecules made up of long chains of repeated units
Solid	A substance that has specific shape and volume and can hold them without a container. Its molecules cannot move freely except to vibrate.
Solution / solvent / solute	A solution is a special type of mixture composed of two or more substances. The substance which is dissolved is called the solute and the substance in which the solute is dissolved is called the solvent. The solvent is usually a liquid, but the solute can be a solid, liquid, or gas.
States of matter	The distinct forms in which matter can exist. Three states of matter are observable in everyday life: solid, liquid and gas.

Vocabulary

Static electricity	A type of electricity that occurs when there is an imbalance between negative and positive charges on the surface of an object.
Surface Tension	Describes the tendency of a liquid surface to resist an external force.
Volume	Interprets the geometric configuration of the matter. A measure of how much space an object takes up.
Weight	The force of gravity with which the earth (or another massive object) attracts a body towards its center.
Yeast	Yeast is a type of fungus. Is an essential ingredient in baking, brewing, and winemaking

References

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Štrukeljci s šunko in hrenom – Rolls with ham and horseradish

Tjaša Vede in Blaž Mikuljan, Štrukeljci s šunko in hrenom, https://midvakuhava.si/, https://midvakuhava.si/strukeljci-s-sunko-in-hrenom/

Some of the recipes in this Cookbook were inspired by our parents, grandparents, our everyday cooking or from our previous project Metura. Some of the inspirations we took from an online recipes and cooking suggestions, which we adapted to the needs of our project.

Below, we are listing some of the recipes, which which have been helpful and inspiring for us in developing and creating the recipes for our project:

Churros

Makinze Gore, Easy homemade churros, Delish test kitchen, https://www.delish.com/cooking/recipe-ideas/a27117110/easy-churros-recipe/

Albondigas

Marissa Stevens, Spanish Meatballs, Pinch and swirl, https://pinchandswirl.com/spanish-meatballs/

Scrambled Egg with Asparagus

Mercado Malaga, Scrambled eggs with asparagus, https://mercadomalaga.es/en/recipes/vegetable/scrambled-eggs-with-asparagus/

References

Gazpacho

Lauren Aloise, Authentic Gazpacho Recipe - The Best Spanish Gazpacho, Spanish sabores, https://spanishsabores.com/recipe-gazpacho-andaluz/

Paella

TESCO Real Food, Easy Spanish paella recipe, https://realfood.tesco.com/recipes/paella.html

Crema catalana

Lauren Aloise, Crema Catalana Recipe - Authentic Spanish Version, Spanish sabores, https://spanishsabores.com/homemade-spanish-crema-catalana-recipe/

Pumpkin soup, Chicken Wraps, Apple Pie, Fruit salad with whipped cream, Apple pie:

MeTURA. (2020). Andragogical material for the implementation of the Family Education MeTURA-Back to the Roots, https://www.erasmus-metura.eu/wp-content/uploads/2021/09/Joint-version-O7-IC-Geoss-SL-def-compressed.pdf

Vegan Yogurt Cake

Mojca Grum, Jogurtovo pecivo brez jajc, Znam, https://znam.si/recepti-in-hrana/sladice-in-sadje/jogurtovo-pecivo-brez-jajc/

and Carine Claudepierre, Yogurt Cake (4 Ingredients, No Eggs), The conscious plant kitchen, https://www.theconsciousplantkitchen.com/yogurt-cake/

Vegan Panna Cotta

Minimaliost Baker, Vegan Panna Cotta with Mixed Berries, https://minimalistbaker.com/vegan-panna-cotta-with-mixed-berries/

and Christina, Addicted to dates, Vegan Panna Cotta, https://addictedtodates.com/vegan-panna-cotta/

For the references in the field of STEM - science subjects, see the document on the link below, where you can read all about the Methodology and approaches behind this Cookbook.

Science of Cooking. (2024). Learning Approach, Science of Cooking - Learning STEM subjects through cooking for persons with intellectual disabilities, https://www.scienceofcooking.eu/results/

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