CRISTAUX Magiques

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Precautions

Warning! Not suitable for children under 8 years. For use under adult supervision. Contains some chemicals which present a hazard to health. Read the instructions before use, follow them and keep them for reference. Do not allow chemicals to come into contact with any part of the body, particularly the mouth and eyes. Keep small children and animals away from experiments. Keep the experimental set out of reach of children under 8 years old. Read these instructions before use, follow them and keep them for reference. Keep young children and animals away from the experimental area. Store this experimental set and the final crystal(s) out of reach of children under 8 years of age. Clean all equipment after use. Make sure that all containers are fully closed and properly stored after use. Ensure that all empty containers/ or non-reclosable packaging are disposed of properly. Wash hands after carrying out experiments. Do not use any equipment which has not been supplied with the set or recommended in the instructions for use. Do not eat or drink in the experimental area. Do not allow chemicals to come into contact with the eyes or mouth. Do not apply any substances or solutions to the body. Do not grow crystals where food or drink is handled or in bedrooms. Take care while handling with hot water and hot solutions. Ensure that during growing of the crystal the container with the liquid is out of reach of children under 8 years of age.

Recommendations for supervising adults

Read and follow these instructions, the safety rules and the first aid information, and keep them for reference. The incorrect use of chemicals can cause injury and damage to health. Only carry out those experiments which are listed in the instructions. This experimental set is for use only by children over 8 years. Because children's abilities vary so much, even within age groups, supervising adults should exercise discretion as to which experiments are suitable and safe for them. The instructions should enable supervisors to assess any experiment to establish its suitability for a particular child. The supervising adult should discuss the warnings and safety information with the child or children before commencing the experiments. Particular attention should be paid to the safe handling of acids, alkalis and flammable liquids. The area surrounding the experiment should be kept clear of any obstructions and away from the storage of food. It should be well lit and ventilated and close to a water supply. A solid table with a heat resistant top should be provided. Substances in non-reclosable packaging should be used up (completely) during the course of one experiment, i.e. after opening the package.

First aid information

- **In case of eye contact:** Wash out eye with plenty of water, holding eye open if necessary. Seek immediate medical advice.
- **If swallowed:** Wash out mouth with water, drink some fresh water. Do not induce vomiting. Seek immediate medical advice.
- **In case of inhalation:** Remove person to fresh air.
- **In case of skin contact and burns:** Wash affected area with plenty of water for at least 10 minutes. In case of doubt, seek medical advice without delay. Take the chemical and its container with you. In case of injury always seek medical advice.

Warning! Plaster can cause serious eye damage and skin irritation.
- **IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- **If skin irritation occurs:** Get medical advice/attention.
- Wash hands thoroughly after handling.

Address and telephone number of the poison control centre to contact:

Please note here the contact details of the poison control centre nearest to you.

For any information or complaints, please write to:
Création Véronique Debroise pour Sentosphère
59, bd du Général Martial Valin -75015 Paris - France
Tel: +33 (0)1 40 60 72 90 – www.sentosphere.com

Contents

2 x 120 g of monoammonium phosphate (allow you to make 2 crystals)

1 sachet of alum saslt of 120 g (allows you to make 3 to 4 geodes)

2 plaster half-spheres

1 tree support

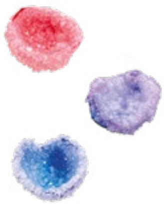
3 colourants

3 pipettes

1 mini measuring spoon

1 flask of potassium phosphate

1 oval beaker



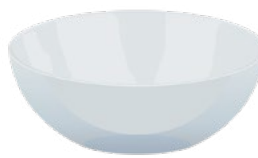
6 tree paper cut outs

Ingredients: Mono Ammonium Phosphate ; Aluminium potassium sulfate ; Potassium Dihydrogen Phosphate ; Plâtre (Plaster) : Calcium Alumina Cement, Water ; Colorant Bleu (Blue dye) : Water, Phenoxyethanol, Chlorphenesin, Glycerin, CI 42090 ; Colorant Jaune (Yellow dye) : Water, Phenoxyethanol, Chlorphenesin, Glycerin, CI 19140, CI 20285, CI 15985 ; Colorant Rouge (Red dye) : Water, Phenoxyethanol, Chlorphenesin, Glycerin, CI 16255.

Items required

1 saucepan

1 saucepan lid



1 salad bowl

1 cup

1 pair of scissors

1 jam jar

1 inox spoon

1 tube of glue

1 brush

Kitchen roll

Best practices for young laboratory assistants

During handling:

- Always handle in a clean and tidy area.
- Wear appropriate clothing, i.e. clothing with sleeves and feet protected by closed shoes. The use of a smock or apron to avoid getting dirty is recommended.
- Clean all equipment after use.
- Ensure that non-resealable packaging is disposed of correctly (in the appropriate bin) after use.
- Wash your hands once the experiments are complete.
- Do not eat or drink in the area where experiments are being conducted.
- Do not apply substances or solutions to the body.
- Do not use any equipment other than that supplied with the kit or recommended in the instructions for use.
- Handle hot water and hot solutions with care.

For crystal growth:

Ensure that during crystal growth, the container holding the liquid is out of reach of children under 8 years of age and pets.

Do not grow crystals where food or beverages are handled or in bedrooms.

What is a crystal?

Crystals and states of matter

Matter typically exists in three different states:

- A gas, such as the air around us,
- A liquid, such as water or ink from a pen,
- A solid, such as salt or even the paper this leaflet is printed on.

Each state has its own characteristics.

The gaseous state is a state in which matter has no shape or volume of its own. You can see this, for example, when you blow up a balloon. The air takes up all the available space and gives the balloon its round shape, but this air can also be deformed if you press on it. On a molecular scale, which is 10 million times smaller than what can be seen with the naked eye, it is a disorganised state, with each molecule of gas moving freely and randomly without paying attention to the others.

In its liquid state, matter has a specific volume but no specific shape. Indeed, if you fill a square glass to the brim and fill another glass of the same volume but with a round shape, it will also be filled to the brim, but the shape of the liquid will be different. At the molecular level, this is because all the molecules are stuck together, enabling them to slide and move over each other.

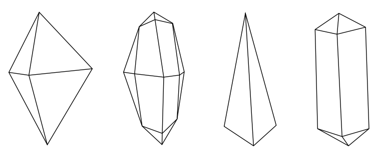
Solids, on the other hand, have their own volume and shape. They do not change shape depending on the shape of the container in which you place them. These molecules are stuck together and do not move.

It is possible to change the state of matter by varying the pressure or temperature. This is the case, for example, when you boil water. Under the effect of heat, water turns into gas, which explains why you see bubbles forming, then steam. Another example is when you put water in the freezer, it turns into a solid: ice!

But what about the crystals in all this?

If you've been following along, you can already guess what it is. A crystal has its own shape and volume. So it's a solid. But not just any solid! The molecules are arranged in geometric shapes. These shapes differ depending on the elements that make them up. That's why all crystals have unique shapes.

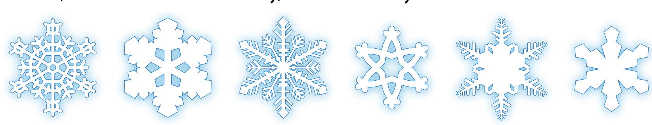
Here are some examples of possible stacks:



But how are they formed?

Depending on how long a liquid is cooled, its molecules can organise and arrange themselves geometrically as they transition to a solid state. This is why, if water is suddenly cooled to below 0°C, it freezes and becomes a solid, whereas if it is cooled slowly, it forms snow crystals!

Here are some examples of snowflakes:



Emeralds, diamonds, rubies and other precious stones are obtained in the same way. They are large crystals that have formed underground over thousands of years.

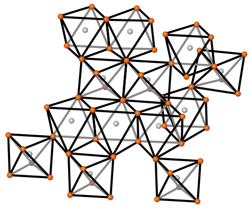
Crystal formation can occur 'synthetically' as in these experiments, but it can also occur in the natural environment. In nature, crystals have been developing in our planet's rocky crust for over 4 billion years. Various factors such as temperature, pressure and evaporation time influence the process and form completely different crystals.

There are two stages:

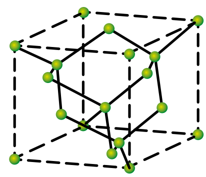
- **Germination** corresponds to the appearance of a crystalline germ in the liquid, a sort of crystalline seed or embryo. As they cool, the molecules of the liquid product, which slide easily past each other, stack up regularly like building blocks to form a solid.
- **Growth** corresponds to the increase in size of the seed to become a crystal. A crystal is born and develops much like a living being. It grows by incorporating other molecules that pass close to it in the surrounding liquid and stick to the surface when they come into contact with each other in an orderly manner.

Here are some examples of crystal lattices:

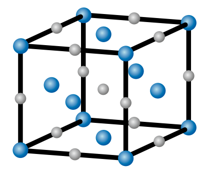
of a ruby



of a diamond



of table salt



Experiment 1: Crystallisation of monoammonium phosphate

We chose it because it naturally stacks into attractive needle shapes.

Monoammonium phosphate is partially soluble in water. When the water is heated, all the crystals dissolve and create a saturated solution. As it cools, the material becomes insoluble again, returning to a solid state and thus initiating the germination stage. This takes place on the plaster hemisphere.

It is porous and cold, so the liquid seeps in and crystallises.

However, depending on the impurities in the water or the dye chosen, the crystals will not all have the same shape. The slower the temperature drops, the larger the crystals will be. This is why, in order to obtain a beautiful set of crystals, you must be careful and avoid sudden changes in temperature and draughts.

Experiment 2: crystallisation of alum salt

We chose it because it stacks naturally in cubes and can be used to reproduce a geode. In nature, a geode is a hollow space covered with crystals inside a rock. These crystals are formed over a very long period of time, starting by crystallising on the walls of this cavity. The molecules dissolved in the water then gradually attach themselves to each other to form larger crystals.

Alum is soluble in water. Once dissolved, the crystals in the water solution will gradually settle and pile up on the seeds you have stuck in your eggshells. This experiment allows you to reproduce in a few days what happens over several years inside the earth and rocks.

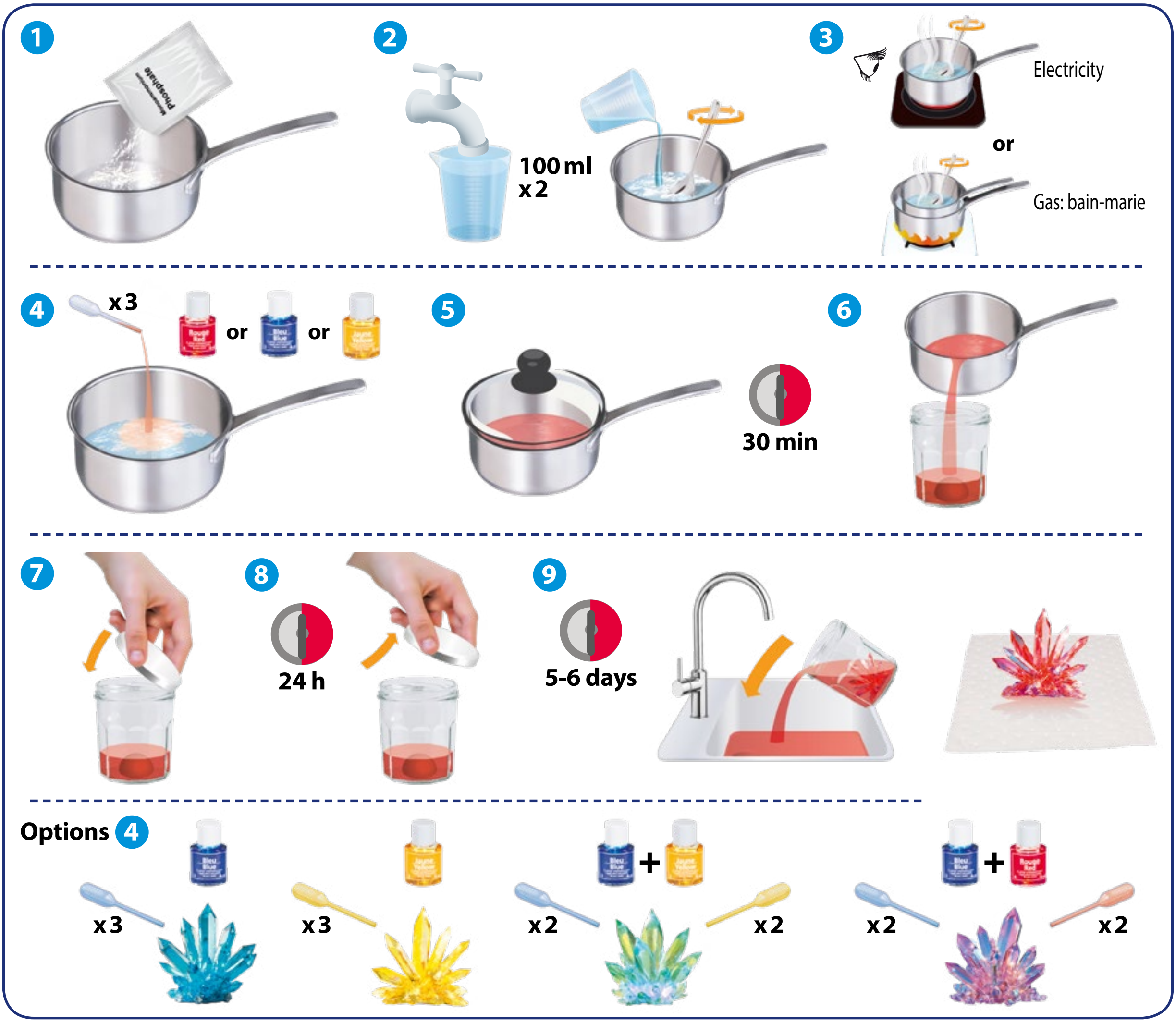
Experiment 3 - Migration of Potassium Phosphate

Paper is mainly composed of cellulose, a polymer that forms the walls of tree cells. It is an extremely hydrophilic material, meaning that it attracts and absorbs water. Porous papers such as those used in the experiment allow water to move easily through them. This movement is called capillarity or migration.

When water is loaded with soluble elements, such as potassium phosphate, it will migrate to the tips of tree branches, carrying with it the molecules dissolved in it. Then, as it evaporates easily, it will deposit (leave behind) the potassium phosphate and dye, which cannot evaporate, at the tips of the branches. The potassium phosphate crystals slowly overlap each other to form delicate clouds of matter which, depending on their colour, can resemble flowers, foliage or even snowflakes.

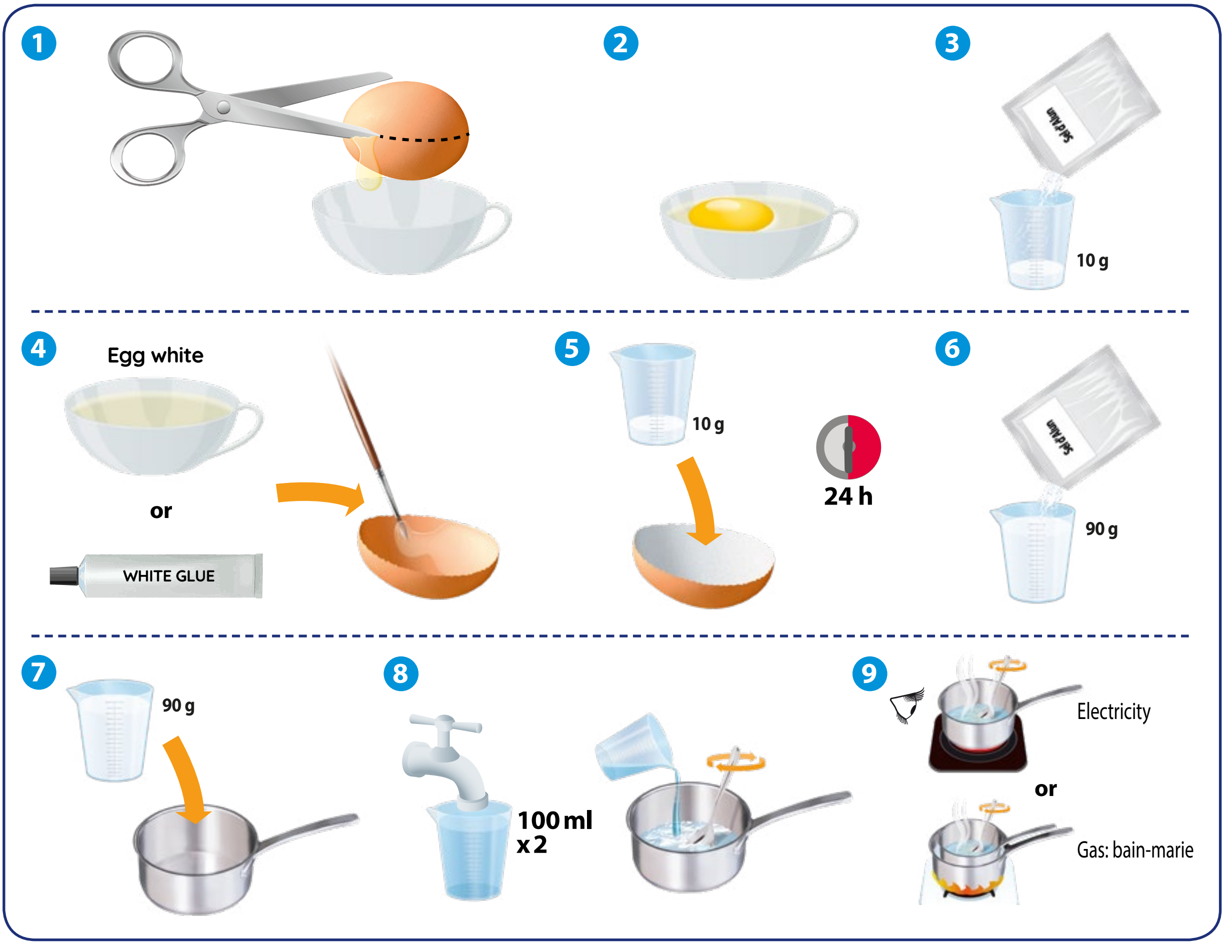
Recycling: if you still have crystals left over at the end of your experiments, you can suggest to your parents that they dilute them in water in a 12-litre watering can. This will allow you to recycle a material that serves as nutrients for plants and will do them good.

Experiment 1: Crystallisation of monoammonium phosphate



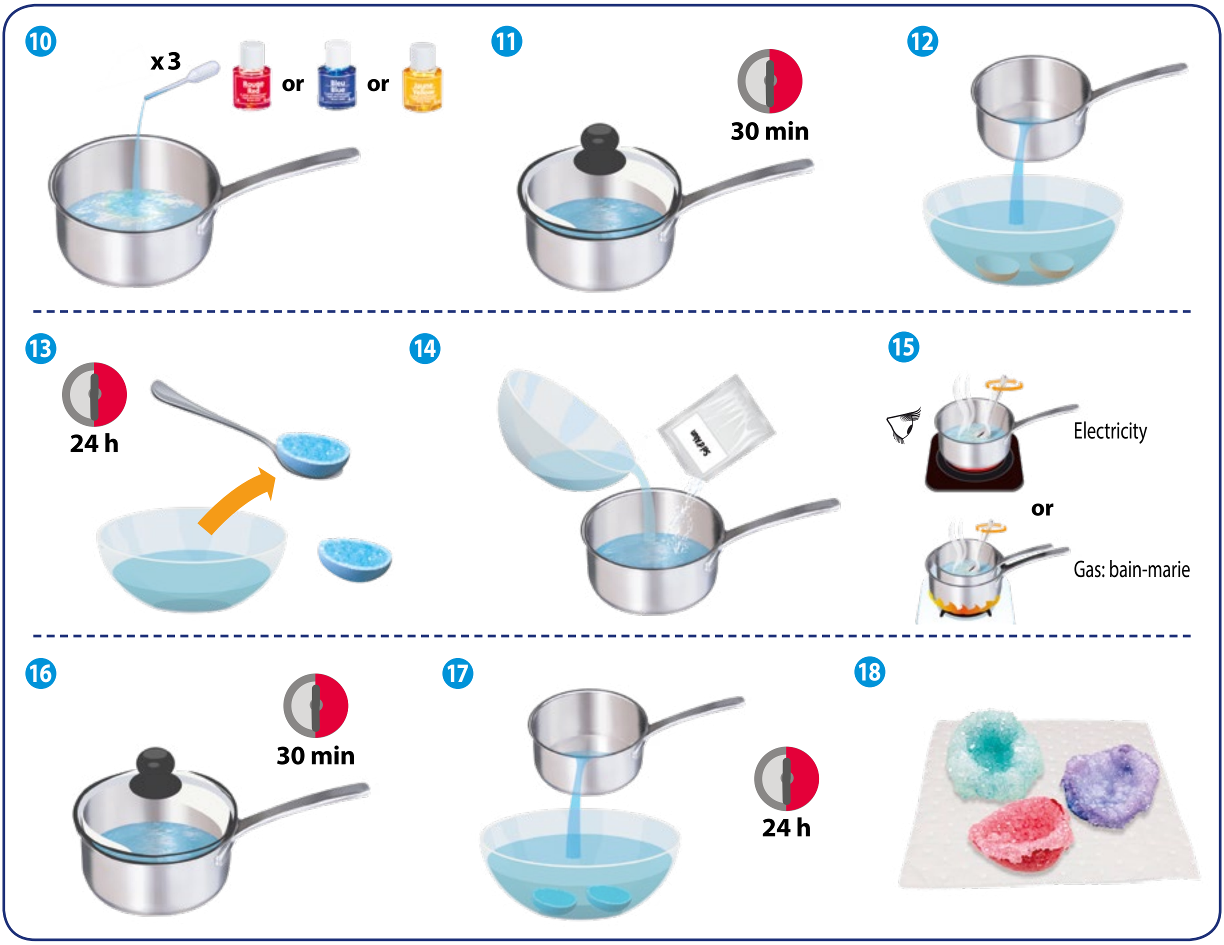
1. Place the entire contents of the monoammonium phosphate sachet into a saucepan.
2. Using the measuring jug, add 200 ml of tap water (100 ml x 2) and stir with a stainless steel spoon.
3. Ask an adult to heat this mixture over medium heat, stirring continuously until all the crystals have dissolved in the water.
4. Remove the saucepan from the heat. **Be careful not to burn yourself!** If you want to colour your crystals, add the contents of 3 pipettes of blue, yellow or red food colouring.
5. Cover the pan immediately with a lid and leave to cool for **30 minutes**.
6. After **30 minutes**, place a plaster half-sphere in a crystallisation tray (glass jam jar with lid). Slowly pour your monoammonium phosphate solution into your crystallisation tray.
7. Place your crystallisation tray in a safe place away from light. Check that the plaster is in the centre of the container, reposition it with a spoon if necessary and close the crystallisation tray with its lid. Do not move your tray.
8. After **24 hours,** carefully remove the lid without moving the jar. You will be able to observe the crystals growing every day!
9. After **5 to 6 days**, you can drain the water into the sink and carefully remove the crystal, placing it on a paper towel. You now have a beautiful coloured crystal!

Experiment 2: crystallisation of alum salt



1. Using scissors, cut an egg in half lengthwise over a bowl. Carefully wash the two eggshells under water and leave them to dry.
2. You can keep your egg and use it for cooking.
3. Open the bag of alum salt and, using the beaker, weigh out 10 g of salt (= 10 ml).
4. Using a brush, apply egg white or liquid glue to the inside of your two eggshells.
5. Pour in the 10 g of alum salt; it should stick evenly to the inside of your two eggshells. Quickly clean your brush with water to remove any glue residue. Wait **24 hours** for the glue to dry and the crystal to set firmly on the shells.
6. Using the beaker, measure out 90 g of alum salt (= 80 ml).
7. Pour it into a saucepan. Keep the rest of the powder for the rest of the experiment.
8. Using the beaker, add 200 ml of tap water (100 ml x 2) and stir with a stainless steel spoon.
9. Ask an adult to heat this mixture over medium heat, stirring continuously until all the crystals have dissolved in the water. Then remove the saucepan from the heat. **Be careful not to burn yourself!**

Experiment 2: crystallisation of alum salt



10 If you want to colour your crystals, add the contents of 3 pipettes of blue, yellow or red dye.

11 Cover the pan with a lid and leave to cool for **30 minutes.**

12 After **30 minutes**, place your 2 eggshells coated with alum salt in a crystallisation tray (salad bowl). Gently pour in your coloured alum solution, filling the shells first so that they remain at the bottom, and place the tray in a safe place (the two shells must be completely submerged and must not touch each other).

13 After **24 hours**, carefully remove your two eggshells from the solution and set them aside. The first phase of crystallisation has taken place.

14 Pour the coloured solution back into a saucepan, then add the rest of the alum salt packet.

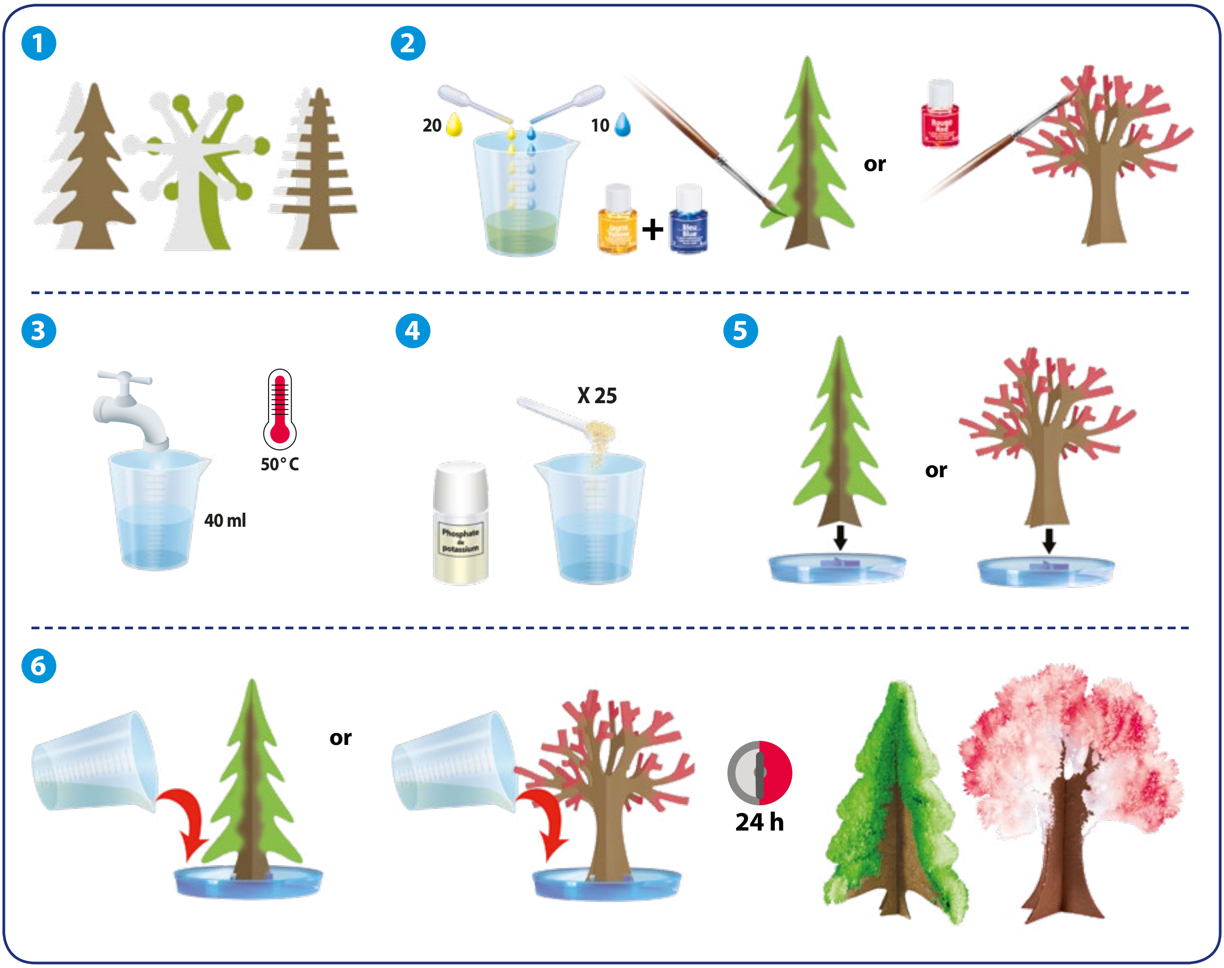
15 Ask an adult to heat the mixture over medium heat.

16 Once all the powder has dissolved in the water, wait **30 minutes** for the solution to cool.

17 After **30 minutes**, place your two eggshells in the bowl. Slowly pour in your coloured alum solution, filling the shells first so that they remain at the bottom, and place the bowl in a safe place (the two shells must be completely submerged and must not touch each other).

18 After another **24 hours**, you can remove your geodes from the solution by placing them on kitchen paper and you can pour the water down the sink. You now have some beautiful geodes!

Experiment 3 - Migration of Potassium Phosphate



1. Choose a tree and assemble it so that it can stand upright and stable.
2. Choose a dye to paint the ends of your trees: this will allow the microcrystals to be coloured in the shade of your choice. If you want a tree in bloom, use red dye; for a tree with leaves, use green dye made by mixing a few drops of yellow and blue dye; if you want a snow-covered tree, do not add any dye. To obtain trees with a uniform green colour, you can prepare your dye a few hours before use and stir the mixture well. This will allow the dyes to dissolve properly. Otherwise, if you use your green dye straight away, it will migrate quickly to the branches, separating the blue and yellow pigments and making your tree less uniform.
3. While the dye is drying, prepare the magic crystallisation solution. To do this, ask an adult to prepare 40 ml of hot water at around 50°C in the beaker.
4. Put 25 level mini-spoons of potassium phosphate into the beaker. Then stir with a spoon, which you should clean thoroughly afterwards. Wait for the powder to dissolve completely (if the water is too cold, you can ask your parents to heat the solution in the microwave for **10 seconds** on a low setting).
5. Choose a place where you want to grow your trees without having to move them for several hours, and where you can observe the growth of the crystals. Avoid places with draughts, as the crystals are fragile. Place your little tree in the growth saucer.
6. Pour your solution into the saucer (be careful not to spill it). Wait **24 hours** to see your tree fully blossom. To keep the crystals intact for a few days, you can try spraying them with hairspray from a distance of 10 cm.