

How Crystals Are Made.

Crystallisation in Action!

Now that we have learnt about solutions and crystallisation, we are ready to watch a video showing crystallisation happening. What we have learnt so far will help us understand what is happening in the video.

Do not worry if you don't have access to it. A step-by-step description is available right before the explanation.

 **Tip:** Search for the words in **bold** in the glossary at page 7 of the **Activity Worksheet**.

The image of the molecules in the next page is taken from a structure from the CSD with refcode **BOPKOG02**. To view different 3D crystal structures for sodium acetate, follow the link in “Further Learning and Useful Links” in the **activity webpage**.





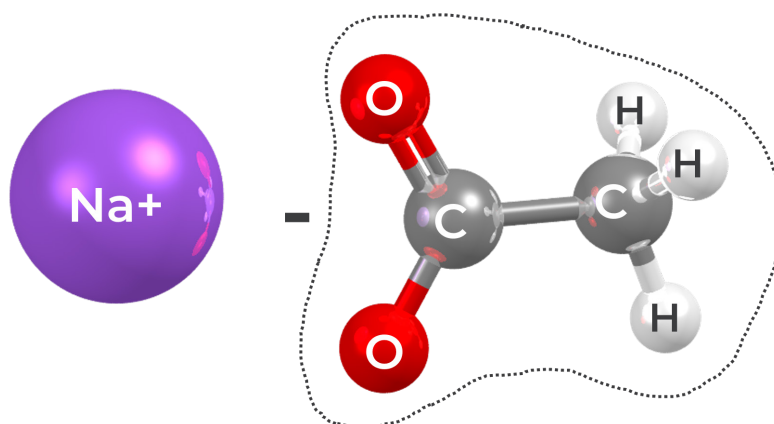
1 What's in the jar

The video we are going to watch shows rapid nucleation happening in a jar. This jar contains a solution of sodium acetate in water.

The solution is thus made of:

- Water (**formula** H_2O) as the **solvent**.
- Sodium acetate as the **solute**. This is a **salt** with **formula** CH_3COONa .

You can see sodium acetate in the following image. In purple we have the sodium **ion**, with formula Na^+ (**Na** is the symbol used in chemistry for the element sodium), while the other atoms form the acetate ion, CH_3COO^- (carbon **C** in grey, hydrogen **H** in white and oxygen **O** in red).



? Why are there a + and a – next to the formulas?

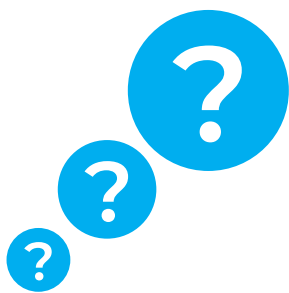
This is because the two parts of this compound are **ions**.

Ions are atoms or molecules that carry a charge, which can be **positive**, like in the case of sodium, or **negative**, like in the case of acetate. Positive and negative charges attract each other.

For salts, the formation of **bonds** also takes place during nucleation. Bonds are formed between the positively charged sodium ions and the negatively charged acetate ions.

Bond making gives out energy, in this case in the form of heat. This is called, an exothermic reaction.

You may have come across this reaction if you have ever used reusable **hand warmers**. Hand warmers use this chemical process to produce heat to keep your hands warm!

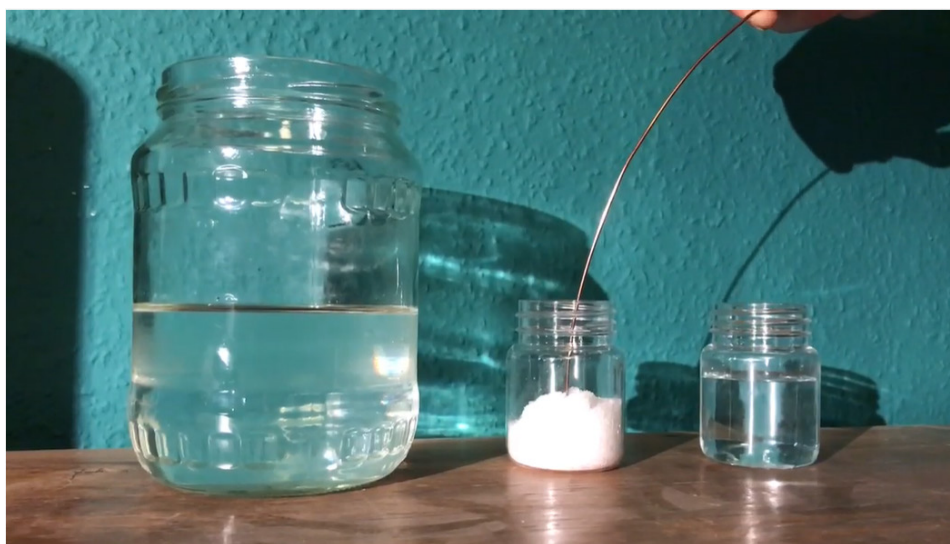


2 Crystallisation video

You can now head back to the [activity webpage](#) to watch the video of the crystallisation experiment.

The [detailed experiment description](#) in the following will support you in case you do not have access to the video.

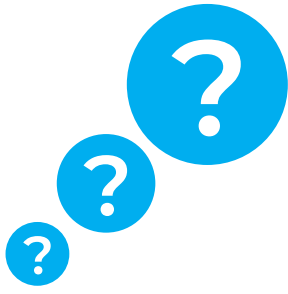
You can then read the [explanation](#) in the following page after or while re-watching the experiment.



In the video, there are three jars. From left to right:

- the big jar contains a [supersaturated solution of sodium acetate in water](#);
- the second one, smaller, contains a white powder of [sodium acetate crystals](#);
- the third small jar is filled with [liquid water](#).

A metallic wire is first dipped into the water jar to make it slightly moist. Then, it is dipped in the second jar with crystals of sodium acetate. Some of these crystals stick to the moist wire.



When the wire is immersed in the big jar containing the supersaturated solution, **crystallisation takes place immediately and very quickly**. We can notice that the solution turns into a white solid starting from the wire and it quickly spreads to the entire jar, so that all the sodium acetate crystallises, and the white solid replaces all the solution.



What is happening?

The crystals that were stuck on the wire create a **nucleation point** in the supersaturated solution of sodium acetate, which is a point where the nucleation starts. This causes the solution to rapidly crystallise.

As we discussed earlier, bonds are being formed between the sodium ions and the acetate ions. Bond forming is an **exothermic** process, which means it gives out energy to the surroundings in the form of heat.