



## INSTANT FREEZING WATER TRICK

### EFFECT:

You take a container of water and touch the surface of it. Just by the power of your touch, the water freezes solid!

### DESCRIPTION:

You start with a tray of water and then gently place a finger on the surface of the water. As your friends stare at it, ice starts to expand out from your fingertip until the whole block of water is solid ice. You don't even need to touch the water directly: take a bottle of water and pour it into a glass. As it pours into the glass it starts to freeze until there is a frozen block of ice in the glass.

### HOW IT WORKS:

The liquid that you're freezing is not pure water and the resulting 'ice' is not actually frozen, it is just crystallised.

Instead of pure water, what you are using is a solution of water that contains sodium acetate (strictly the IUPAC name for this compound is sodium ethanoate, but let's not quibble). Sodium acetate is a salt, much like normal table salt except instead of each sodium atom being attached to a chlorine atom (giving sodium chloride, which is what you have in your kitchen), they are attached to acetate ions (the anion of acetic acid). Sodium acetate looks like normal salt and tastes just like salt (do not taste it though!) except with an acidic flavour (due to the reaction of the acetate ion with water/moisture to produce a weak solution of acetic acid i.e. vinegar!) as well. For this reason, sodium acetate is often used as flavouring on salt and vinegar crisps! If you check the ingredients on a savoury snack and see E262 listed, then that's sodium acetate that you're eating.

Like salt, you can dissolve lots of sodium acetate in water but eventually the water will reach a point where it cannot dissolve any more. However, if you heat this saturated solution up you can keep dissolving more and more salt into it. Once you've heating water up near its boiling point of 100C and dissolved in as much sodium acetate as you can, you then let the water cool back down again. All of the sodium acetate will stay dissolved but there is now much more than would normally be low temperatures. This is called a super-saturated solution and the moment you give the sodium acetate a way to leave the solution, it will!

Sometimes, just touching the solution – or even bumping it – will cause all the sodium acetate to crystallise back out. To make sure it does this when you want, you can put a few sodium acetate crystals on the tip of your finger, or in the glass, so where the solution contacts them they start a chain crystallisation reaction.

### CHEMICAL INFO:

Sodium acetate can be easily ordered through most chemical supply companies. If you talk to a science teacher they will be able to order it through the school's lab technician. They'll also have the equipment to safely heat and super-saturate a solution.

### HINTS AND TIPS:

The sodium acetate will come out of super-saturated solution really easily if it contacts anything or is disturbed. Make sure you only put it in

new and completely clean containers. If you cool the containers, there is less chance of the sodium acetate coming out of solution. This can be a very difficult trick to perform because of how easily the sodium acetate comes out of solution.

When the sodium acetate solution 'freezes' it actually gives off a lot of heat! A reaction like this that produces thermal heat energy is known as an exothermic reaction. If you later apply heat to the crystallised sodium acetate, it will go back into solution ready to release that heat again when it re-crystallises. Re-usable heat pads are actually full of sodium acetate for this very reason!

Sodium Acetate:  
 $\text{CH}_3\text{CO}_2\text{-Na}^+$   
 and Sodium Chloride:  
 $\text{Na}^+ \text{Cl}^-$

