

You will need

- A piece of memory metal
- Hot water
- A Bunsen burner or other source of naked flame
- Tweezers to hold hot metal

Health and safety

- Be careful with hot water
- Be careful with naked flames
- Be careful handling the hot metal (use tweezers)



What you can do

Note: Use tweezers whenever you remove the wire from hot water, or hold it in the Bunsen burner flame

- Set your water bath to hot (about 70°C).
- Take your memory metal wire and make a note of its shape. Twist and deform the wire, but do not tie a knot in it! Now put the wire into the hot water.
What happens?
Does it remember its original shape?
- Make a bend in your wire. Hold the wire with tweezers and use your Bunsen burner to heat the bent bit of wire for 10-20 seconds. Place in the cool water.
- Now place it back into the hot water
What happens?
- Take it out of the hot water and let it cool again. Twist and deform it again and place it back into the hot water.
What shape does it adopt?
- Cool your water to 25°C. Twist your wire and put it in the cooler water.
Does anything happen?
- Increase the temperature of your water bath by 10°C and try again. Keep doing this until something changes.
What changes and at what temperature?
What do you think is happening?
How can you explain everything that is happening?
Why do you think this type of wire is used in braces for teeth?

What's happening?

Most metals are very hard and take a lot of effort to deform, but once they have been moulded into shape they will stay like that until another force changes them.

Memory metals are different. They can be 'programmed' to remember a specific shape and if the metal is bent or deformed it quickly returns to its original configuration. They are called **Shape Memory Alloys**. The one you have in your hand is called **Nitinol**.

Memory metal has two distinct crystal structures at the nanoscale and can be made to flip between them. Both are regular **crystal lattices**.



What does it mean?

Shape memory alloy (SMA) is any metal that 'remembers' its original shape and if deformed can return to that shape after it is heated up.

Nitinol is a type of SMA made of nickel and titanium.

Crystal lattice is the regular arrangement of atoms making up an element or compound.



To find out more

- <http://www.stanford.edu/~richlin1/sma/sma.html>
- <http://jmmedical.com/nitinol.html>
- http://en.wikipedia.org/wiki/Nickel_titanium#Applications
- <http://www.nitinol.com/nitinol-university/>