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10- 14

Chemistry in everyday life

Experiment guide

The Christmas Egg

Have you ever wondered what sparklers are made of? Imagine that a sparkler is a small factory for bright stars. In this factory, there are lots of little pieces of metal (e.g. aluminum and iron) that look like dust. When you light the sparkler, it gets so hot that these pieces of metal start to burn and produce sparks. Aluminum powder creates white sparks and a lot of heat. This heat also makes the iron powder give off sparks, which glow gold.

Shiny sparklers for the Christmas egg

How does it work?

In our experiment, we will light a sparkler. For the metal powder to burn, it needs heat and oxygen. Oxygen is not only in the air we breathe, but can also be a part of chemical substances. In the sparkler, the oxygen is hidden in a special salt called barium nitrate. As soon as the sparkler is lit, the barium nitrate reacts. It behaves like a blown-up balloon that is slowly deflated at the opening and releases the oxygen little by little. This is also called a chemical reaction. With the help of this oxygen, the aluminum and iron can burn. But can sparklers only burn in the air, or also in liquids? And if so, for how long? Do your own research and find out!

As you are working with sparklers, do the experiment together with an adult.

Let's light up the Christmas egg!

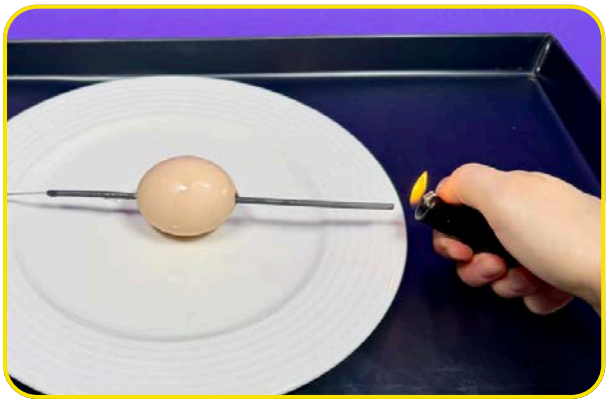
You will need:

- Raw egg
- Tangerine
- Pin or sewing needle
- Sparklers (use thick ones)
- Lighter
- Plate on baking tray (a fireproof surface is important)
- Safety goggles (or sunglasses)
- Fireproof container

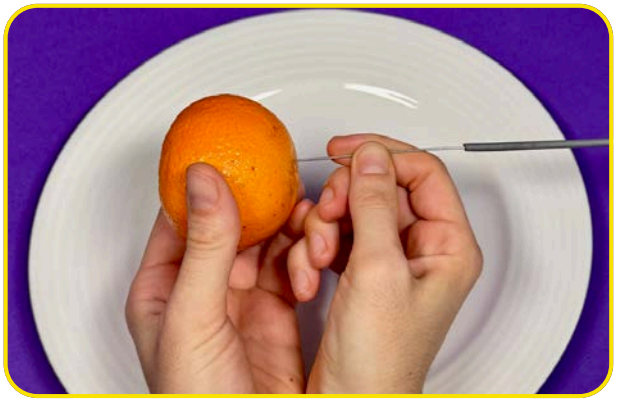
Let's go!

Step by step:

1 Use a raw egg and poke holes in it on two opposite sides.

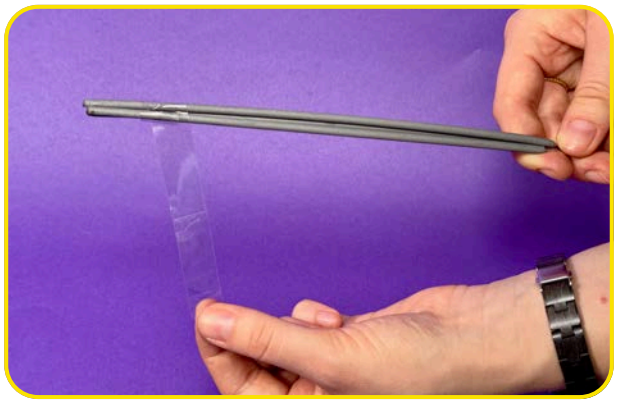


2 Take the metal end of the sparkler and push it through the egg, then light the sparkler. Observe what happens.



3 Push the sparkler through a tangerine (not in the middle but rather at the edge) and light the sparkler. Observe what happens. If your sparklers are very thin, try using two of them.

4 Use a fireproof container and fill it with water. Light a sparkler, wait a few seconds and hold it into the water. Observe what happens.



5 Take two to three sparklers. Leave the top 5 mm free and wrap adhesive tape (approx. 3 cm long) around the following part of the sparklers.

6 Now light the top end of the sparklers and hold them in the water for a few seconds. How does the flame behave?

First observations and further questions

You have probably already noticed a few things during your experiment. What differences did you see between the glow of the sparkler in the tangerine and the glow inside the egg? As the oxygen in the sparkler is in the metal, it can also burn in liquids.
How is it possible that a sparkler in water goes out immediately, but two or three of them wrapped in adhesive tape do not? You can try leaving the tape off. What happens if you hold several sparklers into the water without tape?

Background knowledge

We already know that oxygen is important for burning. Another necessary ingredient is heat. The adhesive tape acts as an insulating layer (keeps the cold out, like a thermos flask) and the cool water does not reach the surface of the sparkler directly.

At ISTA, Stefan Freunberger and his research group work with materials that can be broken down by nature to make batteries more environmentally friendly. In some of their experiments, oxygen is not a help but an obstacle. This is because the chemical reactions are supposed to take place without oxygen. As oxygen is present in our air, there are small rooms with a “protective atmosphere” for these experiments, where there is very little or no oxygen. The experiment is then done with gloves, which are part of the small room.