

The Science of Bath Bombs



What is it about?

In this video, Swansea University's Dr Pamela Styles reveals the chemistry behind bath bombs.

Watch video here:
youtu.be/aQxq_RVA40E

Open file in your web browser to click on the links.

How do bath bombs work?

Bath bombs rely on a chemical reaction to make them fizz. Although they can contain many ingredients to add smells and colours, you only need two basic ingredients to make a bath bomb. These are citric acid and sodium bicarbonate, both of which are common baking ingredients. When these are dissolved in water to make an **aqueous solution**, they undergo a **neutralisation** reaction.

What is a neutralisation reaction?

A neutralisation reaction is a reaction between an acid and an alkali, which makes a neutral salt and water.



Activity

We use the pH scale to determine if something is an acid or alkali.

Fill in the gaps below to show when something is an acid or an alkali.

If you're not sure, check out S4's Acids and Alkalis video [here](#).

Acid

Alkalis

Neutral

have a pH greater than 7

have a pH less than 7

Chemicals that have a pH equal to 7 are

Sodium bicarbonate is a special kind of alkali known as a metal carbonate. When metal carbonates are involved in a neutralisation reaction, they release carbon dioxide gas.

The carbon dioxide released during the neutralisation reaction is what makes the bath bomb fizz in the water. The bubbles released are tiny bubbles of carbon dioxide.

Acids

Alkali



Citric acid



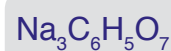
Sodium bicarbonate



Water



Carbon dioxide



Sodium citrate

Try this yourself at home

Make your own Bath Bombs



You will need:

- Sodium bicarbonate (baking soda)
- Citric acid
- A tablespoon
- A small bowl

Make sure you ask an adult's permission first.

- Water
- Bath bomb mould (optional)
- Essential oils (optional)
- Food colouring (optional)

Method

1. Measure 1 tablespoon of citric acid and 3 tablespoons of sodium bicarbonate into a bowl and mix them together. (if you want to make a bigger bath bomb use more of each but remember to use 3 times more sodium bicarbonate than citric acid)
2. If you are adding essential oils or food colouring, add a few drops of each to the bowl.
3. Add a few drops of water to the bowl at a time and mix – add just enough that you can clump the powders together. If you add too much water, the neutralisation reaction will take place whilst you're making the bomb.
4. Place your mixture into a bath bomb mould or shape it into a ball with your hands and leave to dry.

Questions

Interactive: Click on box to start typing



What does the term aqueous mean?

Which gas is released in the reaction between sodium bicarbonate and citric acid?

Neutralisation reactions occur between acids and alkalis. In a bath bomb, citric acid is the acid, and sodium bicarbonate is the alkali.

Can you name any other acids and alkalis?

Acids

Alkalis

Identifying gases

We know that bath bombs create a gas when they are put into water, but how do we know it is carbon dioxide? Different gases behave differently, so we can do tests to identify them.

There are several ways to test for carbon dioxide. One that you might do in a classroom or a lab uses limewater. Limewater is the common name for calcium hydroxide which has been dissolved in water. It normally looks just like ordinary water, but when it is exposed to carbon dioxide it undergoes a chemical reaction.

Calcium hydroxide reacts with carbon dioxide to form calcium carbonate. Calcium hydroxide dissolves in water but calcium carbonate does not. So, when a solution of calcium hydroxide is reacted with carbon dioxide it goes cloudy as calcium carbonate forms as a white solid.

Fill in the gaps below to complete the sentences about solutions.

Things that dissolve to make solutions are _____.

Things that do not dissolve are _____.

When things are dissolved in water the solution is _____.

We can also test for carbon dioxide using fire. Fire needs three things to burn - heat, oxygen and fuel. If you remove any one of these things, the fire cannot burn. We can represent this using a fire triangle.

For example, for a candle the fuel is the wax, it gets oxygen from the air, and it gets heat from its flame. The flame of a candle is small so does not produce much heat, so it is easy to remove the heat with water or our breath. If you leave a candle burning for a long time all the wax will melt and evaporate so there will be no more fuel and the candle will go out. When you blow out a candle as well as making the air around it cold you are exhaling carbon dioxide which removes oxygen from the candle, and it goes out.

The reason carbon dioxide removes the oxygen is because it's heavier than air, so it smothers the candle and stops the oxygen in the air reaching it. Many fire extinguishers use oxygen.



Try this at home!

Testing for CO₂

Safety: Make sure you get an adult's permission. The candle will be hot and may cause burns - do not move once lit and leave it to stand until the wax is solid after extinguishing. Never leave a lit candle unattended.

You will need:

- 1 tealight candle
- Lighter/ Matches
- Citric acid
- Sodium bicarbonate
- Water
- Teaspoon
- Plastic drinks bottle and lid (up to 500 ml)



Method:

1. Add 3 teaspoons of sodium bicarbonate and 1 teaspoon of citric acid to the bottle.
2. Add water to the bottle – do not fill more than halfway.
3. Put the lid on the bottle tightly.
4. Light the candle.
5. Check the reaction in the bottle has produced gas – the bottle should feel hard.
6. Unscrew the lid – make sure you are pointing the top of the bottle away from your face.
7. Tilt the bottle to pour the gas over the candle – be careful you don't want to spill any of the water on your candle.

Write about what happened.

True or False?

TRUE

FALSE

A fire only needs heat and fuel to burn.

Limewater is a calcium hydroxide dissolved in water.

Krypton is commonly used in fire extinguishers.

We use limewater to test for nitrogen.

An aqueous solution is a solution made of water.



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(S4) Funded by the European Social Fund and the Welsh Government.