# Hard Water vs Soft Water
# The Ultimate Test!

*Have you ever been on holiday or travelled to a different area and noticed that the water tastes different? This is because there are two main types of water: soft water and hard water.*

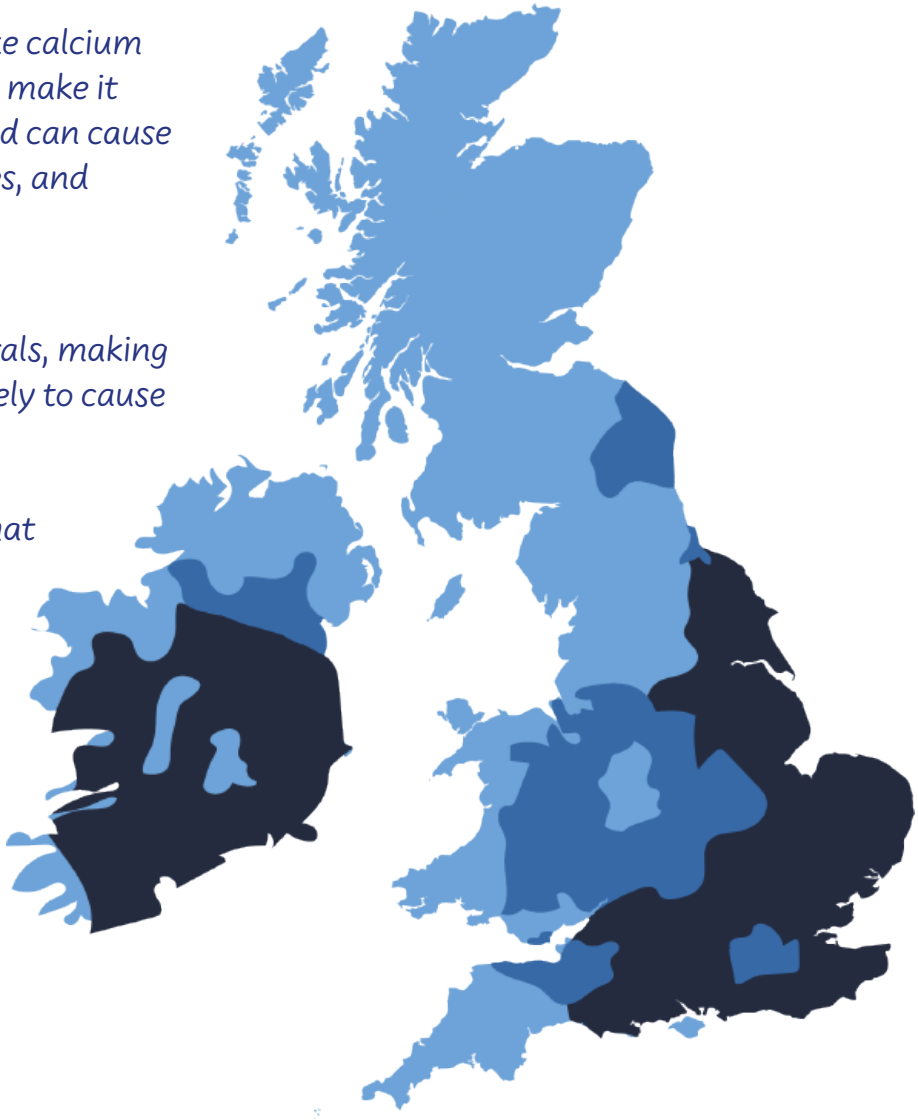
## What is Hard Water?

*Hard water contains minerals like calcium and magnesium. These minerals make it harder for soap to form foam and can cause limescale buildup in kettles, pipes, and washing machines.*

## What is Soft Water?

*Soft water contains fewer minerals, making it better for cleaning and less likely to cause limescale buildup.*

*However, it may lack minerals that improve water's taste.*



- **Hard to very hard**
  *Above 250ppm as calcium carbonate equivalent*
- **Medium to hard**
  *150 - 250ppm as calcium carbonate equivalent*
- **Soft to moderately soft**
  *0 - 150ppm as calcium carbonate equivalent*

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**You will need**

- 2 identical empty containers with lids (no more than 300cm$^3$, e.g. water bottles or glass jars)
- Epsom salt (approximately 10 tablespoons)
- 1 teaspoon of soapy liquid (e.g. shower gel or handwashing soap; avoid dishwashing soap)
- Measuring jug or cylinder
- Tablespoon
- Teaspoon
- Plain white paper for notes or reflections
- Timer

## To complete the activity

1. Label the two containers as 'Hard Water' and 'Soft Water'.

2. Use a measuring cylinder or jug to measure 100cm$^3$ of water and pour it into the 'Hard Water' container.

3. Add 2 tablespoons of Epsom salt to the container, close the lid, and shake until the salt dissolves. Repeat this process, adding 2 tablespoons at a time and shaking after each addition, until no more salt can dissolve. You will know this has happened when a solid layer of undissolved salt forms at the bottom of the container. This may require up to 10 tablespoons. This container now represents hard water, which contains minerals such as calcium and magnesium, just like real hard water.

4. Add 1 teaspoon of soapy liquid (e.g. hand soap or shower gel) to the 'Hard Water' container. Close the lid and shake the container for 10 seconds.

5. Use a measuring cylinder or jug to measure 100cm$^3$ of water and pour it into the 'Soft Water' container.

6. Add 1 teaspoon of soapy liquid to the 'Soft Water' container. Close the lid and shake it for 10 seconds.

7. Observe both containers carefully. Compare the clarity, foam production, and any differences between the two types of water.

## Record your observations below

| Container | Clarity (clear/cloudy) | Foam production (none/some/lots) |
|---|---|---|
| **Hard water** | | |
| **Soft water** | | |

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## Reflect on the experiment by answering the following questions:

What differences did you notice between hard and soft water?

How does the presence of minerals in hard water affect foam production?

## In this experiment, only one factor (variable) was changed: the type of water (hard vs soft). All other factors were kept constant. Can you list all the factors that were kept the same to ensure a fair trial?

**Additional Task**

- Research the pros and cons of living in areas with hard or soft water.
- What kind of water do you prefer? Why?
- Find out where your area falls on the UK hard/soft water map.

Hard water can cause limescale buildup that costs the UK millions in maintenance every year!