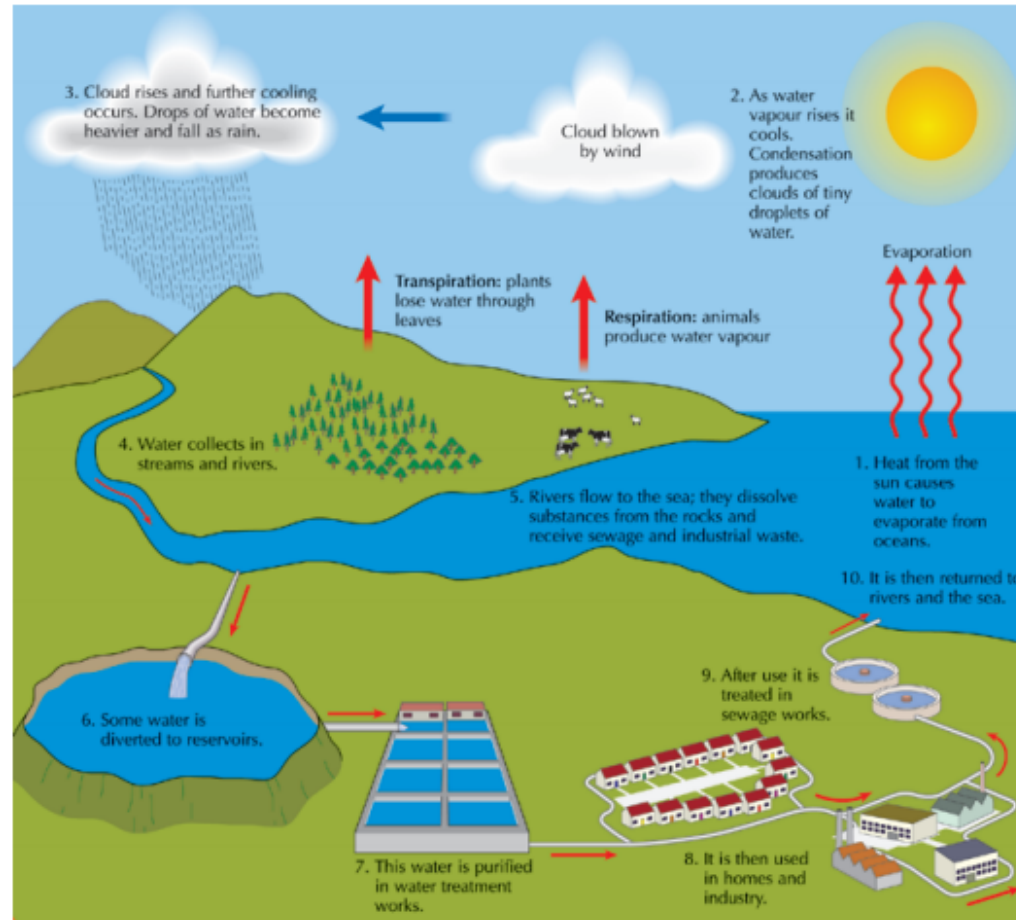


Chapter 27 - Water

In Ireland we each use about 170 litres of water a day!

The water cycle is the continuous circulation of water.
Every molecule of water in your body has passed through a dinosaur!



Properties of Water

The freezing point of pure water is 0°C and the boiling point is 100°C .

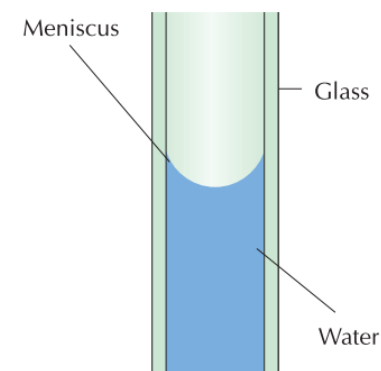
Water expands as it freezes.

The density of water is $1\text{g}/\text{cm}^3$

Water is a good solvent (it dissolves a lot of substances).

Test for water - Cobalt Chloride paper - turns from **blue** to **pink**.

Water clings to glass - causing **meniscus**.

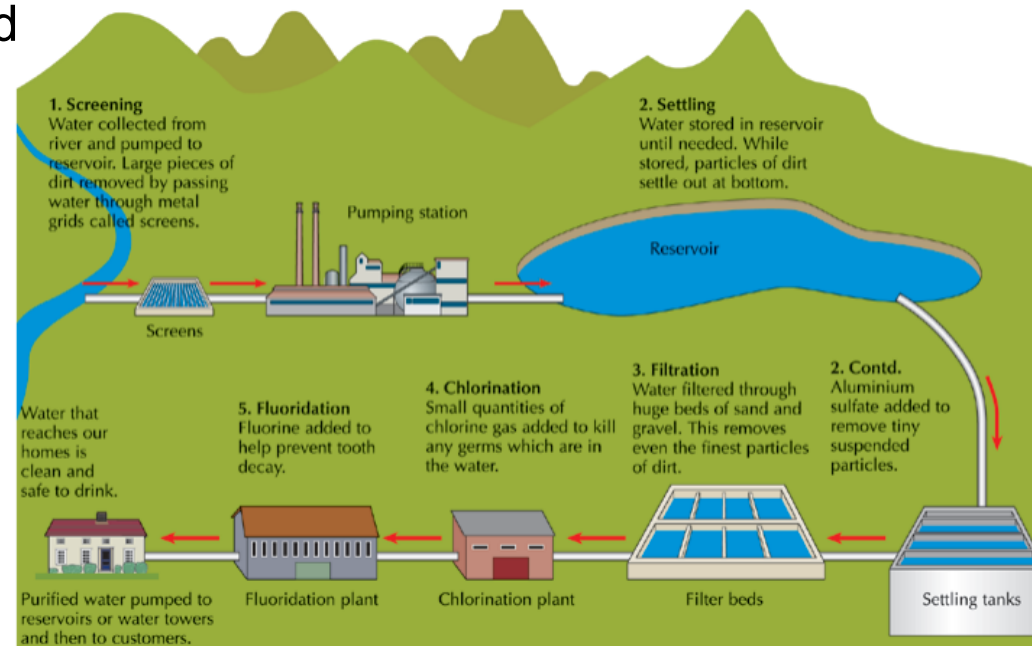


Pond Skater uses **'surface tension'** to walk across water.



Water Treatment

1. **Screening** - wire mesh
2. **Settling** - stored in tanks
Aluminium Sulphate added to settle out large lumps
3. **Filtration** - Filter beds
Sand and gravel filter the water
4. **Chlorination** - germs are killed by Chlorine
5. **Fluoridation** - Added to help prevent tooth decay



Water - A pure substance?

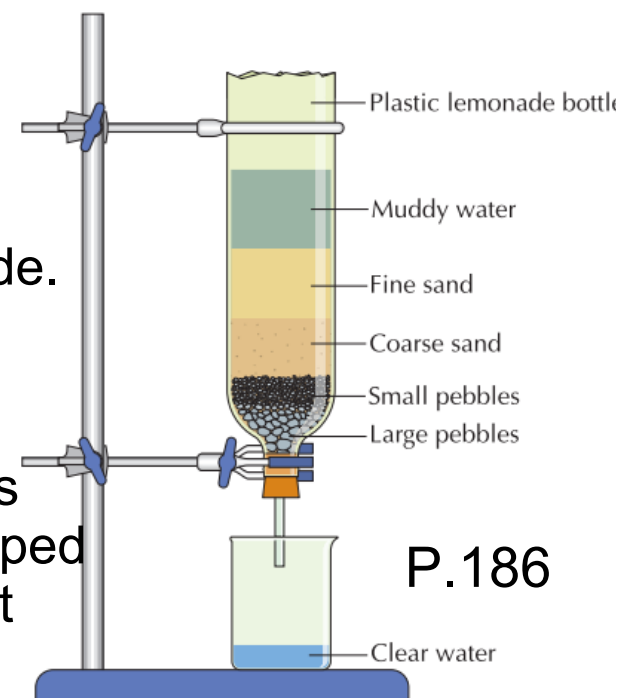
- Water is an excellent **solvent** so it dissolves many things.
- It is difficult to find water in the pure state because of this.
- The purest form of water is Distilled Water.

Tap water contains

Dissolved **gases** like Oxygen and Carbon Dioxide.

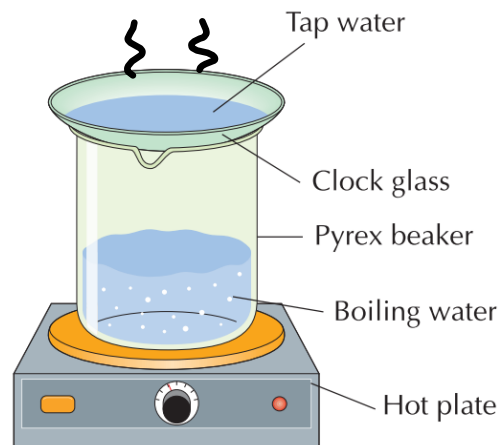
Dissolved **solids** and **minerals**.

We can filter tap water using the filter apparatus with gravel and sand. The dirt particles get trapped in the sand and gravel and the water comes out quite clean, but not pure.



Mandatory Experiments

To show the presence of dissolved solids in a sample of water.



- Place water to be tested in the Clock glass and bring water in beaker to the boil.
- Result - The water in the clock glass evaporates leaving behind rings of solids on the glass.
- Note - Mineral water leaves more solids than tap water.

The Dead Sea



Sea water is very dense and the Dead Sea has 300g of salt per Kilo of water!

HARD and SOFT Water

Learn : Hard water is water that does not easily form a lather with soap.



- Hard water is 'hard' because it contains Calcium ions.
- Another problem with Hard water is that it forms a 'scum' instead of bubbles.
- The ions are from dissolved calcium from Limestone.
- Areas like County Clare have Hard water for tap water.

Calcium Carbonate + Carbon Dioxide + Water \longrightarrow **Hydrogencarbonate**
 (Insoluble) (Soluble)

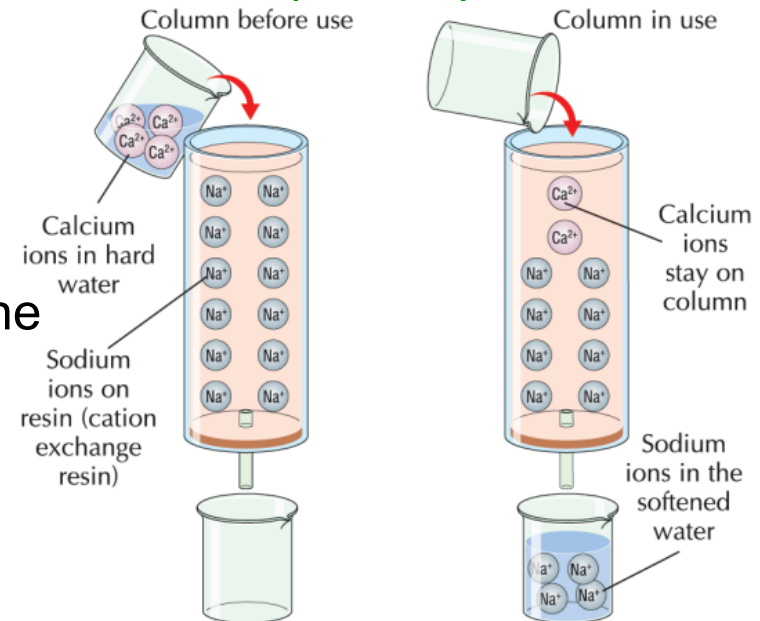
Limestone + Acid Rain \longrightarrow Hard Water

Removing Hardness



Ion Exchange

Using an **ion exchange resin** we can remove hardness from Hard water. This replaces the **Calcium** (Ca) ions in the water with **Sodium** ions (Na). This means the water is now soft and the Calcium is left in the resin exchange.

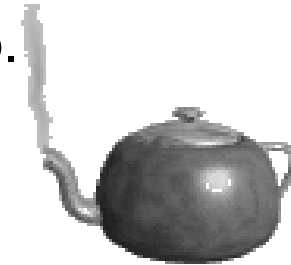


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Boiling

To remove Hardness from water we can **boil the water**. This changes the Calcium back into a '**fur**' or '**scale**' that sticks to the pipes and heating element. It can damage kettles and washing machines if it builds up.

You can use **chemicals** to break down the fur and make your water softer so that detergents can work better. an example is CALGON.

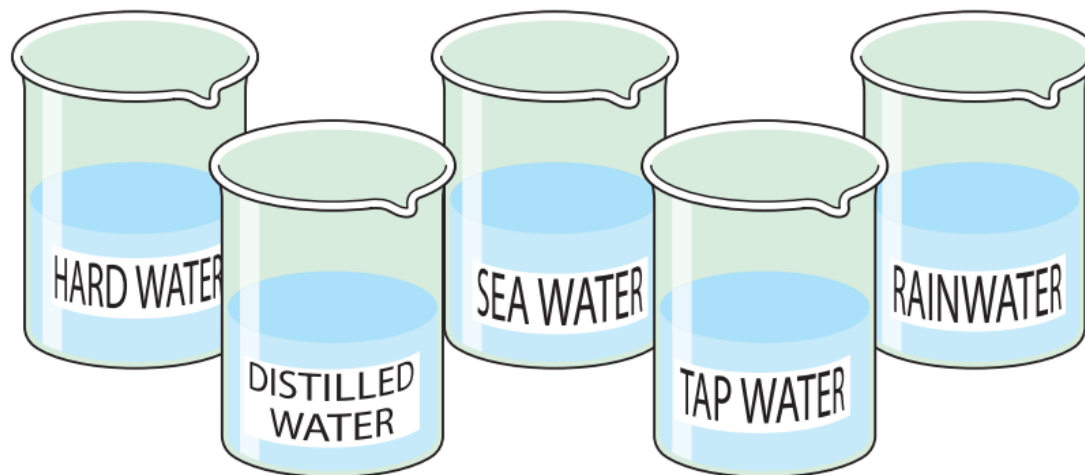


Testing water samples for Hardness

In this test we use tap water, distilled water, mineral water, seawater and rain water to find how hard they are.

To do this we add soap to each one till it produces bubbles.

The more soap it takes to make the bubbles, the harder the water.



Results

The mineral water is the hardest because it contains a lot of Calcium and Magnesium ions.

The seawater would also be very hard due to dissolved salts.

The tap water would be the next hardest.

The rainwater would be quite soft.

Finally the deionised water should be the least hardest (softest).

Test tube	Water Type	Hardness
A	Tap	Slightly hard - Some bubbles
B	Ballygowan	Hardest (no bubbles)
C	Distilled	Softest (bubbles)
D		

Add the same amount of each water type into the correct test tube.

This is to ensure the test is fair.

Now add 5 drops of soap solution into each test tube and shake each one.

Note if any bubbles form.

Add 5 more drops of water, shake and note if bubbles form.

Repeat this till all the test tubes have bubbles.

You should know which order they got bubbles.

Hard water doesn't form bubbles easily.

Advantages/Disadvantages of Hard Water

ADVANTAGES	DISADVANTAGES
Calcium for teeth and bones	Blocks pipes and causes scale
Nice Taste	Wastes Soap
Brewing and Tanning leather	Produces Scum



Splitting water into its Elements

Water is made of **Hydrogen** and **Oxygen**.

Water can be separated into Hydrogen gas (H_2) and Oxygen gas (O_2)

To do this we use a **Hofmann Voltmeter**

When water (H_2O) is split it separates into 2 Hydrogens and 1 Oxygen.

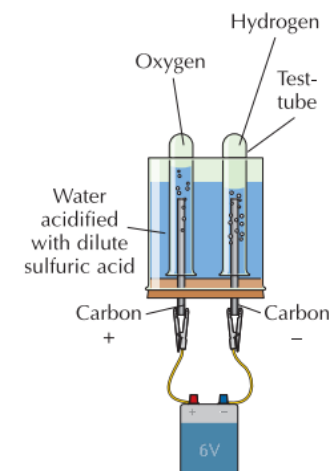
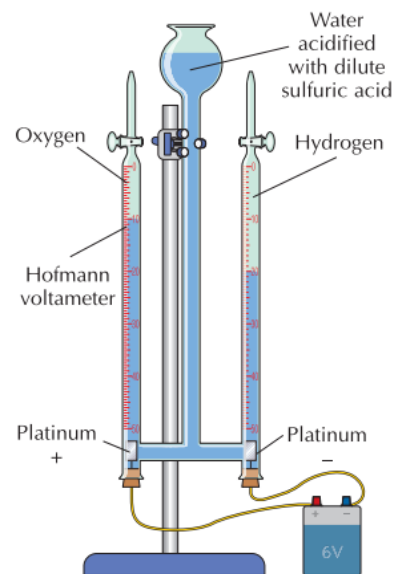
The Hydrogen tube will fill up quicker.

This is a piece of equipment that is filled with water and **acid**.

Electricity is then put through the water, the acid allows the electricity to move.

This is called **Electrolysis**.

Electrolysis - is a chemical change caused by an electric current.



Water Split

Water is split from H_2O into **Hydrogen** and **Oxygen**.

There is always **twice** as much Hydrogen as Oxygen.

