

### EXPANSION OF WATER

- Generally all substances expand when heated and contract when cooled.
- When water is cooled to 4 degrees Celsius it starts to expand.
- How would I show that water expands when it is cooled?

### EXPANSION OF WATER

- How would I show that water expands when it is cooled?
- Freeze it!

Fig 28.15 Expansion of water

### WATER FACTS!

- The chemical name for water is **hydrogen oxide**.

### PROPERTIES OF WATER

- Colourless, odourless liquid.
- Boiling point = 100°C (degrees Celsius)
- Water is an excellent solvent
- Freezing point = 0°C.
- Expands when freezing
- Density = 1g/cm<sup>3</sup>
- Water tends to cling to glass

### MENISCUS

- Definition : is the curved surface of a liquid in a vessel.
- Water clings to the sides of the containers it is placed in.

### CHEMICAL TESTS FOR WATER

- Anhydrous (without water) copper sulphate will turn from **white** to **blue** in the presence of water.
- Cobalt chloride paper will turn from **blue** to **pink** if water is present.

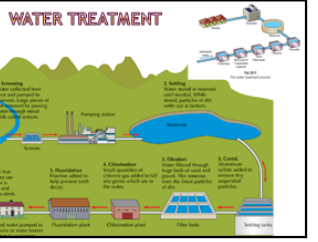
### WATER TREATMENT

Before water is released it has to be fit to drink so it goes through a series of stages to be treated.

- Screening:** the water passes through grids where large particles are removed.
- Settling :** the water is placed into a large tank where heavy particles will settle to the bottom. A chemical called a **flocculant** (e.g. **aluminium sulphate**) is added to cause small particles to clump together.

### WATER TREATMENT

- Filtration:** the water is passed through thick beds of sand. Any remaining particles will be removed here.
- Chlorination:** chlorine is added to kill any bacteria that are present.
- Fluoridation:** fluorine is added to prevent tooth decay. Before the water is released the pH is tested, if it is too high some dilute acid is added, if the pH is too low lime will be added.



### DESALINATION


- This is where the salt is removed from sea water.
- Around 97% of all water is sea water.
- The process of separating the salt and water involves evaporation followed by condensation.

### WATER HARDNESS

- Hard water is water that **does not lather easily** with soap.
- Soft water is water that **lathers easily** with soap.
- The cause of hardness in water is caused by **magnesium and calcium ions**.
- Calcium + soap ions → scum




- When hard water is heated a **white insoluble** (does not dissolve) solid called **limescale** or fur deposits on kettles etc.
- Washing machines and pipes can get blocked
- When the calcium and magnesium ions are removed from water the water is said to be softened.




### SOFTENING WATER (REMOVING HARDNESS)

- Addition of washing soda (sodium carbonate)**  
Calcium ions in the water react with carbonate ions to form insoluble calcium carbonate.
- Distillation**  
removes all soluble and insoluble particles but it is very expensive because of high fuel costs.



- Ion exchangers**  
The ions that cause hardness are replaced by ions that do not cause hardness.
- Deionisers**  
Remove all ions from the water.

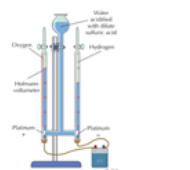


### HARD WATER

Advantages	Disadvantages
1. Provides calcium for teeth and bones	1. Blocks pipes, leaves scale on kettles and boilers
2. Nicer taste	2. Wastes soap
3. Good for brewing and tanning	3. Produces scum

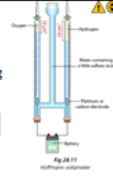
### SPLITTING WATER

- The **chemical name** for water is **hydrogen oxide**.
- It can be split into hydrogen and oxygen using a piece of apparatus called a **Hoffman Voltmeter**.



### ELECTROLYSIS

- The process where water is split using an electric current is called **electrolysis**.  
Water → hydrogen + oxygen
- Electrolysis is the production of a chemical change by electricity
- Pure water is a **poor electrical conductor** so a small amount of **dilute sulphuric acid** is added to improve its conductivity



- Twice as much hydrogen is collected as oxygen. Why?
- Hydrogen** forms at the **negative** electrode. (cathode)
- Oxygen** forms at the **positive** electrode. (anode)

