

# Water Treatment Notes

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Safe drinking water is something many people take for granted. The process of making clean safe drinking water, called Potable water, can be assessed at GCSE. But there are only a few stages and they are pretty straight forward.

## Sources of water

In the UK the water that is collected for purification comes from:

1. Aquifers – underground rocks containing groundwater.
2. Rivers.
3. Lakes.

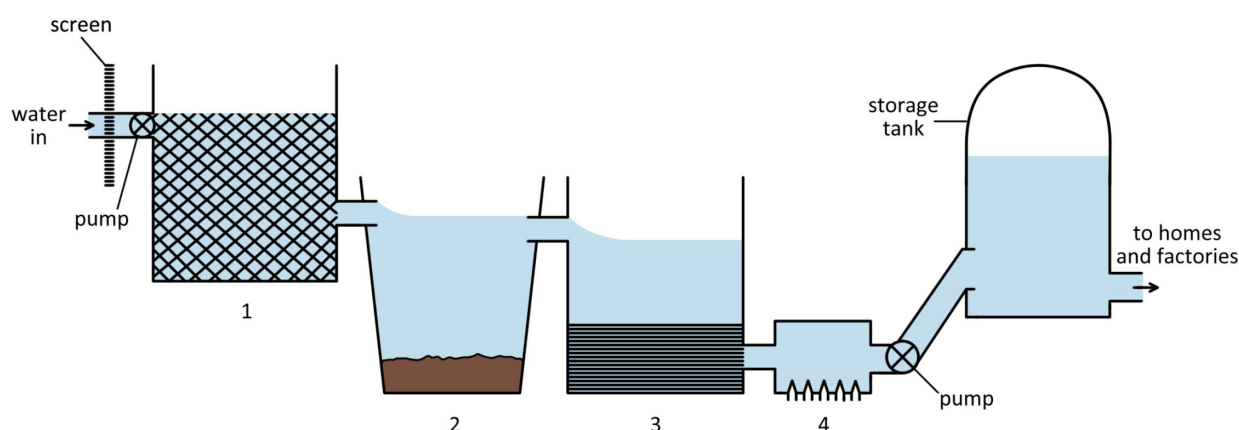
## Stages of Potable Water Production

**Stage 1: Screening.** Water is passed through screens and sieves to remove large debris like twigs and leaves.

**Stage 2: Sedimentation** – In this stage the water is allowed to sit in place for a while. This allows small particles that made it past the filters to gather at the bottom of the sedimentation tank. Alum is sometimes added to help sedimentation happen more quickly.

**Stage 3: Filtration** – The water is then passed through beds of fine sand and gravel to remove any remaining small particles.

**Stage 4: Sterilisation** – In this stage treatments are done to kill harmful microorganisms. There are three common methods used. These are using chlorine gas, using ozone gas and ultraviolet light.



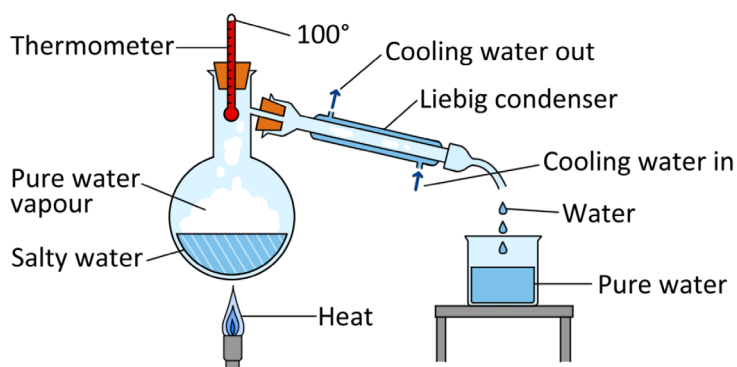
Some countries are quite warm and don't have many rivers or lakes, so how do they get enough water for their needs? Some of them have access to the sea, so they convert sea water into drinking water by removing the salt. This process is called desalination.

**Desalination:** the process of removing salts from water to produce pure water.

This is often done in a similar fashion to simple distillation. The seawater is heated and the water evaporates and is collected in a condenser. The salt does not evaporate as its boiling point is much higher than water. We now have safe drinking water.

**Note:** the water produced in this method is safe, but it doesn't taste the same as water from the ground. As the water from the ground contains dissolved calcium carbonate and other minerals which are removed in this process.

The figure below shows the standard set up for a simple distillation.



## Waste Water Treatment

Treating waste water is a relatively recent process. Before that, raw sewage was just released into rivers and the ocean. As you can imagine the smell was awful and it had a negative impact on the environment and people's health. As a result, we now treat water before we release it into rivers or the ocean.

**Water treatment:** the process of removing many of the harmful substances present in waste water and sewage before it is released into the environment.

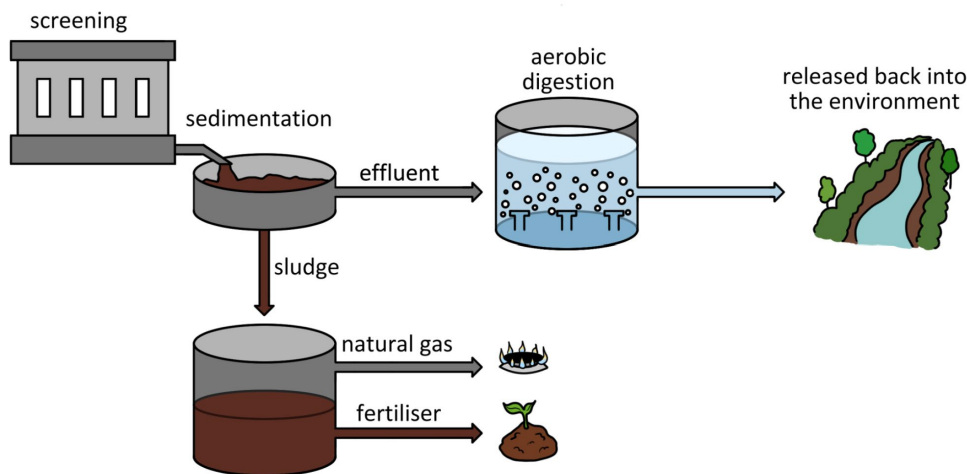
### What pollutants are we getting rid of?

|                                                           |                                                   |                                              |
|-----------------------------------------------------------|---------------------------------------------------|----------------------------------------------|
| 1. <u>Toxic metal compounds such as lead and mercury.</u> | 2. <u>Agricultural waste such as fertilisers.</u> | 3. <u>Harmful bacteria from human waste.</u> |
|-----------------------------------------------------------|---------------------------------------------------|----------------------------------------------|

### The Stages of Waste Water Treatment

| Stage                                      | Why we do it...                                                                                                                                                                                                                                                                 |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stage 1: <b>Screening and grit removal</b> | This is done to remove debris such as toilet paper, rubbish and anything else that people flush down the toilet.                                                                                                                                                                |
| Stage 2: <b>Sedimentation</b>              | This is done to allow all of the solid waste to fall to the bottom of the tank. Alum is a substance that is added to speed up this process as it causes small debris to clump together and fall to the bottom of the tank.                                                      |
| Stage 3: <b>Anaerobic digestion</b>        | The <b>sludge</b> from stage two is digested anaerobically (without O <sub>2</sub> ). This breaks down the organic matter, reducing its volume and producing natural gas (biogas). The remaining solid can be used as a fertiliser.                                             |
| Stage 4: <b>Aerobic digestion</b>          | The liquid <b>effluent</b> from stage two is treated aerobically. Air is bubbled through the water to encourage helpful bacteria to break down any remaining organic matter and harmful microorganisms. The treated water can then be safely released into rivers or the ocean. |

The figure below shows the stage of waste water treatment.



## Life Cycle Assessments

A life-cycle assessment or LCA is an analysis of the impact of a manufactured item on the environment through its life.

| Life cycle stage:                                                 | Impact on the environment:                                                                                                                                                             |
|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. <b>Obtaining the raw materials needed.</b>                     | <ul style="list-style-type: none"> <li>Using up limited resources such as metal ores and crude oil.</li> <li>Damaging habitats through quarrying, mining, or felling trees.</li> </ul> |
| 2. <b>Manufacturing the product.</b>                              | <ul style="list-style-type: none"> <li>Using up land for factories.</li> <li>The use of machines – pollution.</li> </ul>                                                               |
| 3. <b>Using the product.</b>                                      | <ul style="list-style-type: none"> <li>Will using the product produce pollution, for example a car.</li> </ul>                                                                         |
| 4. <b>Disposing of the product at the end of its useful life.</b> | <ul style="list-style-type: none"> <li>Using the land for landfill sites.</li> <li>Whether some or all of the product can be recycled.</li> </ul>                                      |

**Exam note:** LCAs are not perfectly objective. While we can easily measure the exact amount of water or energy used, we cannot easily put a number on things like visual pollution or habitat damage. Because of this, LCAs rely on subjective judgements, which means they can be biased (especially if a company is writing it to make their product look good!).