WJEC (Wales) Chemistry GCSE

1.3 - Water

Flashcards

What are four harmful substances found in ‘natural’ water supplies?

What are four harmful substances found in ‘natural’ water supplies?

Microorganisms, ions, dissolved gases, and pollutants

Why are microorganisms in ‘natural’ water supplies treated? How are they treated?

Why are microorganisms in ‘natural’ water supplies treated? How are they treated?

Many of the bacteria and microorganisms cause disease, so they must be treated - most commonly chlorine is used to kill the microorganisms

How do ions end up in ‘natural’ water supplies?

How do ions end up in ‘natural’ water supplies?

Water dissolves ions from rocks and other materials as it flows within rivers to reach lakes. Although a small amount of dissolved ions is important, too much is dangerous for your health

What are the dissolved gases in ‘natural’ water supplies?

What are the dissolved gases in ‘natural’ water supplies?

Oxygen and carbon dioxide, a byproduct of respiration from the microorganisms living in the water - essential for photosynthesis in aquatic plants

Other gases from the atmosphere can dissolve into natural water

Which dangerous pollutants can dissolve into ‘natural’ water supplies?

Which dangerous pollutants can dissolve into ‘natural’ water supplies?

Pesticides, herbicides and chemical fertilisers - in high concentrations these can affect health

How do you maintain a sustainable water supply?

How do you maintain a sustainable water supply?

Reduce water consumption, reduce environmental impacts of abstracting water, distribute and treat water efficiently

Give examples of how we can reduce water consumption

Give examples of how we can reduce water consumption

- Take short showers instead of baths
- Turn off taps when they're not being used
- Install a short flush button on toilets
- Use leftover bath water for things like watering the plants
- Eat less meat
- Put on full washing machine loads
- Use dishwashers instead of washing by hand
- Buy less cotton clothes - it takes 10 000 litres to make a single pair of cotton jeans!

Give examples of water abstraction

Give examples of water abstraction

- Desalination of seawater
- Building dams and reservoirs
- Collecting from surface sources such as rivers, lakes and streams
- Collecting rainwater
- Accessing underground sources

What are the 3 main steps for treatment of water?

What are the 3 main steps for treatment of water?

Sedimentation

Filtration

Chlorination

What is sedimentation?

What is sedimentation?

Water is added to a large tank

This stops it from flowing, allowing large insoluble particles to sink to the bottom of the tank

What is filtration?

What is filtration?

Water is flown through beds of sand and gravel of different sizes which removes small insoluble particles

What is chlorination?

What is chlorination?

Chlorine gas is bubbled through the water to kill the bacteria and other microorganisms

What is water fluoridation?

What is water fluoridation?

The process where fluoride is added to water

What are the advantages of fluoridation?

What are the advantages of water fluoridation?

- Strengthens the enamel of teeth which prevents tooth decay and cavities
- Protects teeth from demineralisation

What are the disadvantages of water fluoridation?

What are the disadvantages of water fluoridation?

- It is a form of mass medication as people do not have a say in how much fluoride is in their water
- If children are exposed to too much fluoride they can develop fluorosis
- People can make a choice themselves about fluoride by using a toothpaste that contains it
- Links have been made between fluoride and thyroid problems, neurological disorders and some cancers - although evidence is not concrete

What is desalination and what are the two main methods?

What is desalination and what are the two main methods?

Desalination is the removal of salt from seawater

Distillation and reverse osmosis

What are the advantages of desalination?

What are the advantages of desalination?

- Useful water to supply to countries with low rainfall and lots of coastline
- Water produced is of a higher quality than the required standards of potable water
- Using water from the ocean can help protect habitats for animals in natural sources such as rivers or lakes

What are the disadvantages of desalination?

What are the disadvantages of desalination?

- Requires a lot more energy than typical water treatment processes
  - More expensive so harder for poorer countries to afford
  - Increases GHG emissions as more fuel required in desalination
- Desalination plants are often far from where the water is needed, so lots of piping must be installed
- Building of desalination plants is an expensive and high energy process

What is the process of distillation?

What is the process of seawater distillation?

- The seawater is heated, causing pure water to evaporate
- The water vapour is collected and cooled, causing it to condense back into a liquid, giving distilled water
- The leftover salt may be used for various purposes

What is a miscible liquid and how is it distilled?

What is a miscible liquid and how is it distilled?

A miscible liquid is where one liquid completely dissolves into another liquid solution

You must heat liquids to various temperatures to individually evaporate and condense them

What is solubility?

What is solubility?

A substance (called the solute) is described as soluble if it will dissolve in another substance, known as a solvent

How is solubility measured?

How is solubility measured?

In terms of the maximum mass of solute (in grams) that will dissolve in a given volume of solvent

What is the method of determining solubility?

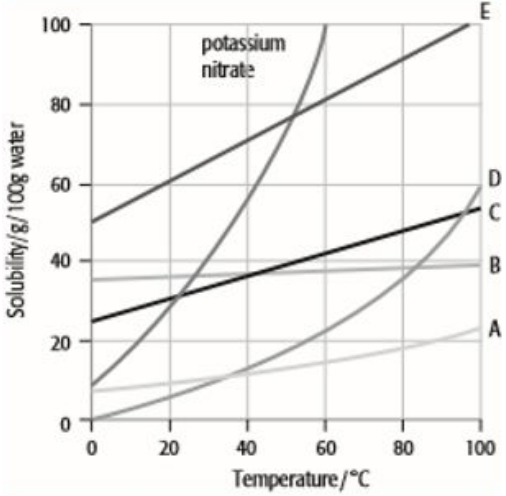
What is the method of determining solubility?

- Gradually add the solute to a known volume of solvent so it dissolves
- Add solute until no more solute dissolves
- Filter the undissolved solute and discard it
- Heat the leftover solution to evaporate the solvent, leaving the solute that had dissolved
- Weigh the remaining solute and calculate the mass of solute that was dissolved

What is a solubility curve?

What is a solubility curve?

A solubility curve shows the variation of how solubility changes with temperature - generally, solubility increases as temperature increases



What causes hardness in water?

What causes hardness in water?

Hardness in water is caused by dissolved calcium and, to a lesser extent, magnesium.

What do hard water and soap form?

What do hard water and soap form?

They form scum, as it is difficult to form a lather with hard water

What do soft water and soap form?

What does soft water and soap form?

They readily form a lather

What is temporary hardness in water?

What is temporary hardness in water?

- Caused by dissolved calcium hydrogencarbonate
- The hardness can be removed by boiling the water and thermal decomposition occurs

What is permanent hardness in water?

What is permanent hardness in water?

- Caused by dissolved calcium sulphate
- This hardness cannot be removed by boiling the water

What are the processes to soften water? There are three

What are the processes to soften water? There are three

- Distillation
- Adding sodium carbonate
- Using an ion exchange column

What are the advantages of using distillation to soften water?

What are the advantages of using distillation to soften water?

Removes both temporary and permanent hardness

What are the disadvantages of using distillation to soften water?

What are the disadvantages of using distillation to soften water?

High energy process and therefore high cost

What are the advantages of using sodium carbonate to soften water?

What are the advantages of using sodium carbonate to soften water?

Cheap and easy

Removes both temporary and permanent hardness

What are the disadvantages of using sodium carbonate to soften water?

What are the disadvantages of using sodium carbonate to soften water?

The calcium carbonate (limescale) builds up and can block pipes

What are the advantages of using an ion exchange column to soften water?

What are the advantages of using an ion exchange column to soften water?

Removes both temporary and permanent hardness

What are the disadvantages of using an ion exchange column?

What are the disadvantages of using an ion exchange column?

The column is expensive

The column becomes saturated and less efficient

How does using distillation to soften water work?

How does using distillation soften water?

The hard water is heated so the water evaporates. The water then condenses and is collected, leaving behind the ions that made it hard

How does an ion exchange column work?

How does an ion exchange column work

A column is packed with resin which contains sodium ions

As hard water flows through the column, Mg^{2+} and Ca^{2+} are exchanged for Na^{+} ions, removing the magnesium and calcium ions, leaving the water soft

How does adding sodium carbonate make water soft?

How does adding sodium carbonate make water soft?

The carbonate ions in Na_2CO_3 react with the calcium ions in the water to form solid calcium carbonate

What are the advantages of hard water?

What are the advantages of hard water?

- The mineral ions in hard water help prevent some heart and cardiovascular diseases - sodium ions in soft water can increase the risk of many of these diseases and cause high blood pressure
- Many people prefer the taste of hard water
- Calcium ions help strengthen bones and teeth

What are the disadvantages of hard water?

What are the disadvantages of hard water?

- Limescale forms when hard water is used, reducing the efficiency of heating elements and potentially blocking water pipes
- It is difficult to form a lather with soap but it's easy with soft water
- Scum forms, wasting soap