Westminster Academy – Water Purification Project

WA - Water Purification

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Why?

In the event of an emergency where clean water is inaccessible, you must find ways to filter and purify water – using only equipment that is available.

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Research

There are many different ways to purify water:

- Super sand – coated with graphite (Rice University in Texas)
- Using the seeds of the *Moringa oleifera* (Pennsylvania State University)
- Bicycle powered filter with micro-filtration membranes (Nippon Basic)
- Atmospheric Water Generators (EcoloBlue)
- Using activated carbon
- Personal UV Purifiers (SteriPen)
- Water filtration straws

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Our Concept

Having looked at the various systems we settled on a design that we thought would be most achievable.

- Salt to act as a ‘flocculant’
- Filter the water, to capture anything larger than 1 micron in size

The last challenge is killing any microbes that still remain. We decided to build and test our two favourite prototypes:

- Use UV light to kill microbes
- Use distillation
- Use chlorine gas and

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The Basic Design

Water will initially be treated with 20 grams of salt. The water is aerated by putting the lid on and shaking the bottle for 1 minutes. The salt acts as a flocculant that should reduce turbidity of the untreated water.

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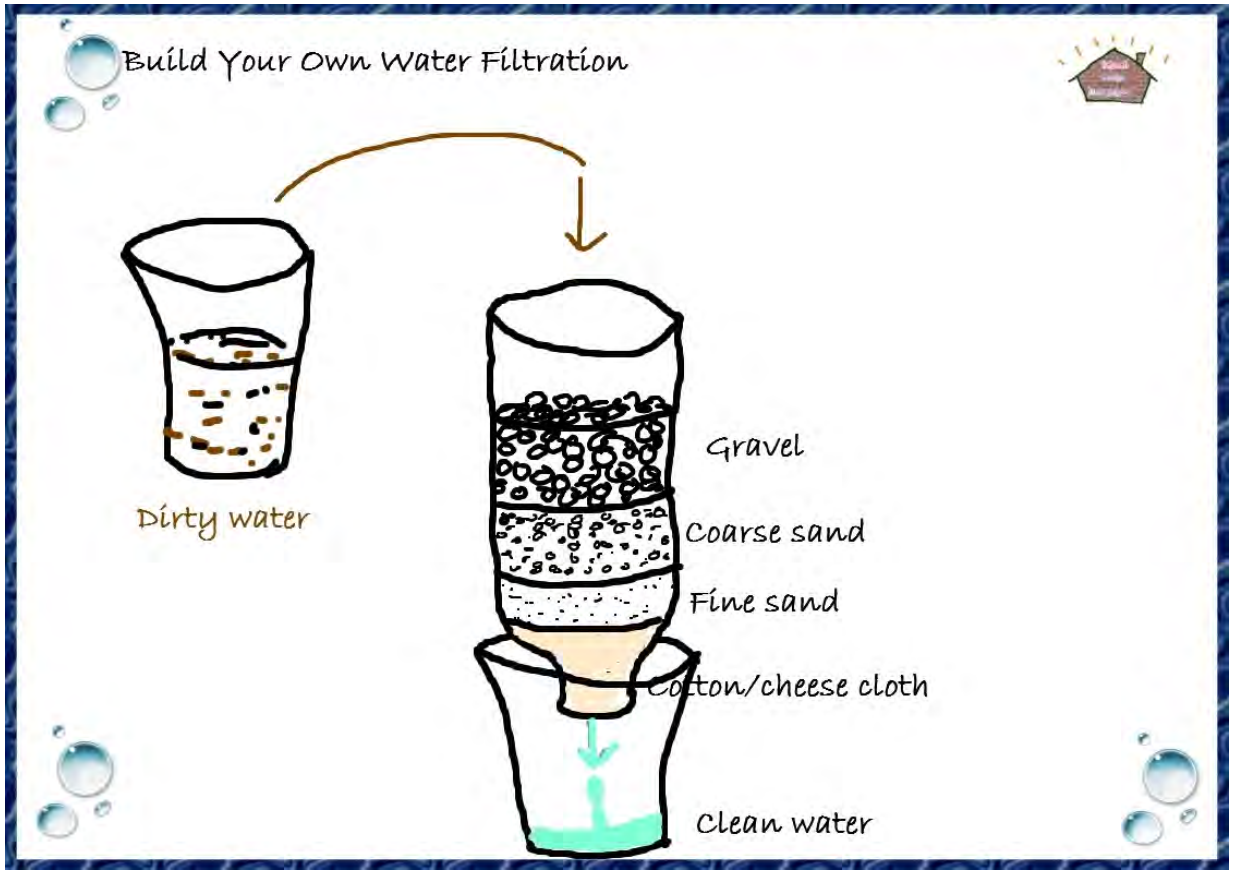
The Basic Design

Once left to stand, the water will be poured carefully into the filtration system – take care to leave all the sedimentation at the bottom of the bottle.



Design 1: UV Light

Ultraviolet germicidal irradiation (UVGI) has been used as a disinfectant method since the mid-20th century. The short ultra-violet wavelength damages the DNA of micro-organisms thus rendering water safe to drink.

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Design 2: Distillation

Distillation is a method of water purification during which water is heated to its boiling point. Chemicals that boil off at a lower temperature are collected and discarded. Once optimum temperature is reached (100˚C at sea level), the water vapour is collected – this is the safe drinking water.

To be effective there needs to be a suitable container in which to heat the water, free of any contaminants and stable enough to ensure unwanted chemicals are not leached from the receptacle during the distillation process.

A general consensus was to use a cooking pan to heat the water.

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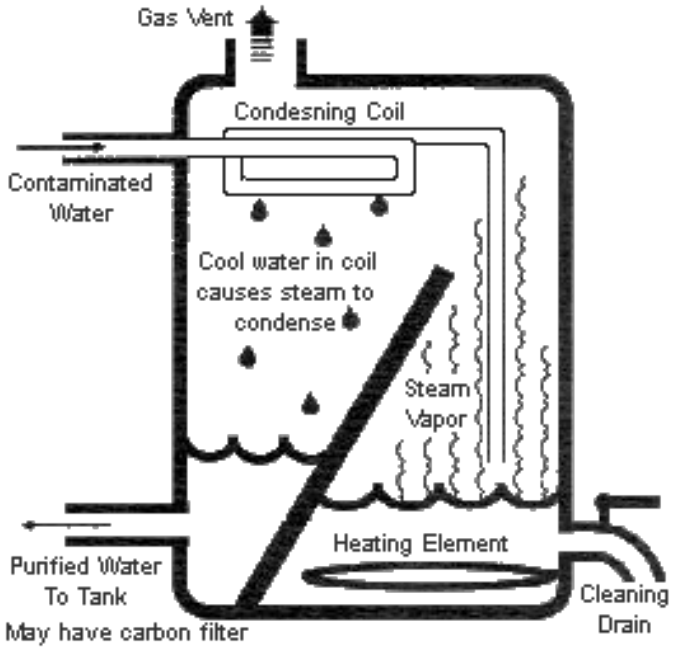
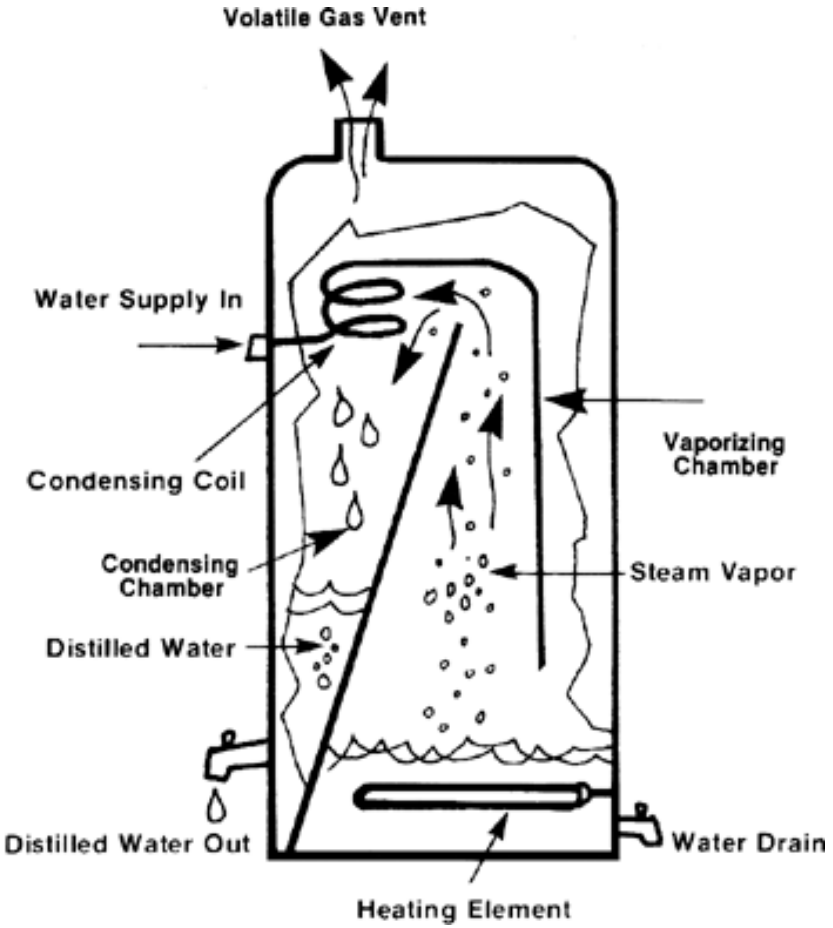
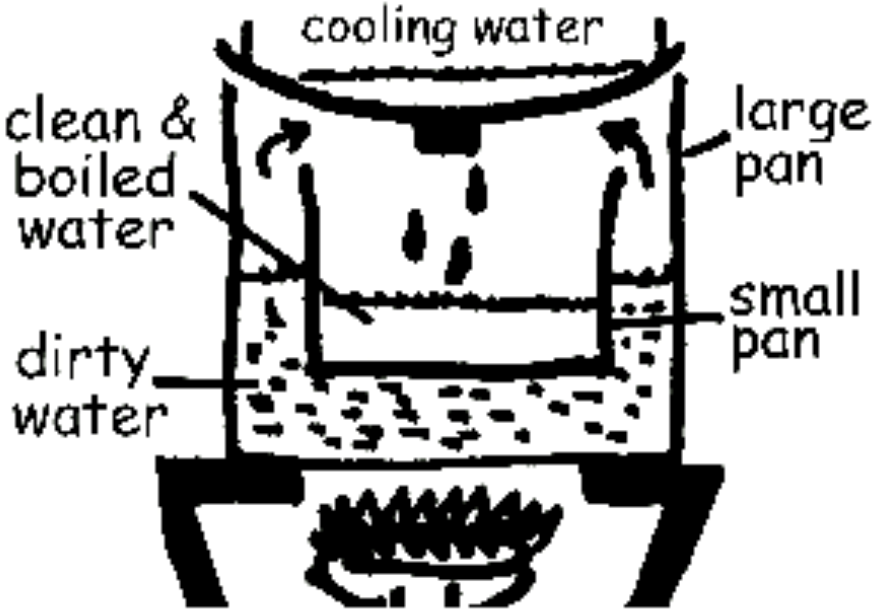
Info on distillation design set up







Design 3: Chlorine gas and activated carbon

Granular activated carbon filtering works by creating a high surface area to volume ratio, allowing the adsorption of many compounds. Unfortunately activated carbon filtering will not kill viruses. To do this, the water will first be treated with chlorine gas, extracted from salt water using electrolysis.

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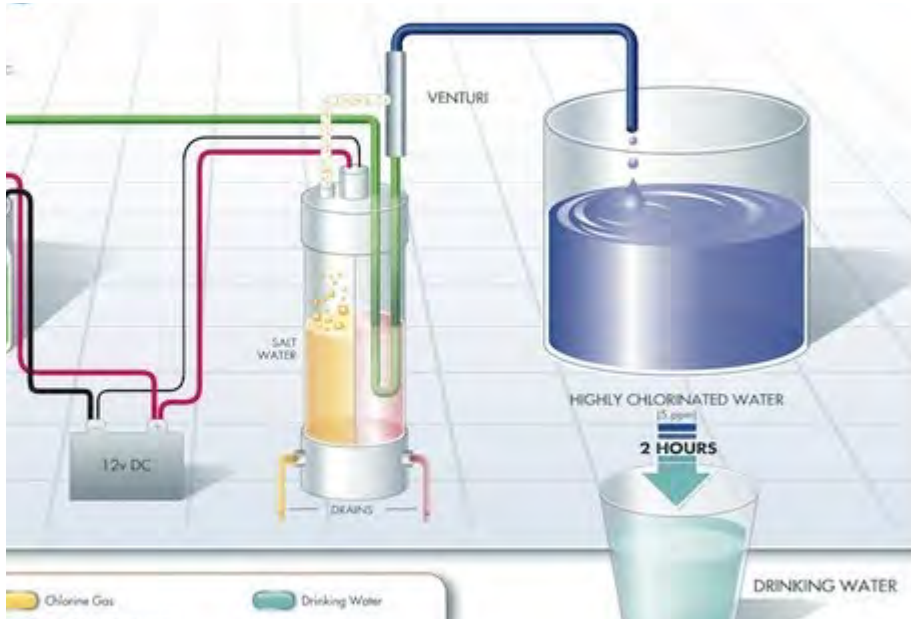

Extracting Chlorine Gas

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The Procedure

Water was taken from the Union Canal – this was cultured to see the number of microbes present. The water turbidity and pH was also recorded.

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The Results

Control Sample – Microbe presence: 50%, Turbidity: 7, pH: 6

	Microbe Presence			Turbidity			pH		
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Design 1: UV Light	40%	35%	40%	7	6	7	7	7	7
Design 2: Distillation	0%	2%	0%	2	4	3	7	7	7
Design 3: Chlorine gas and activated carbon	0%	0%	0%	1	2	2	7	7	7

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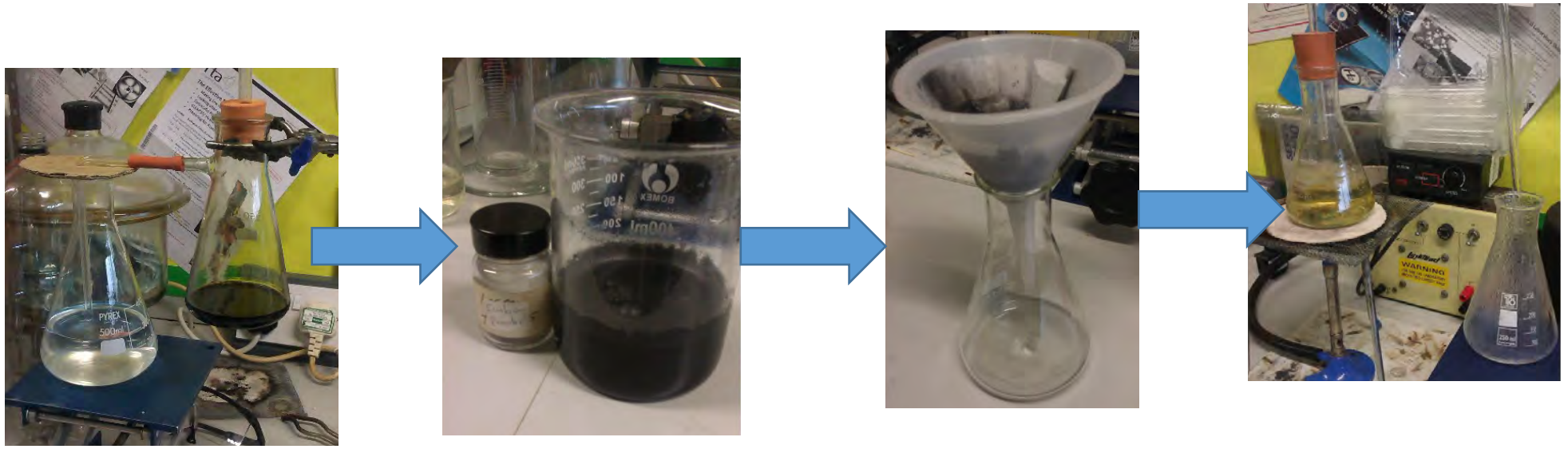
The Conclusion

Turbidity – we scored our water using a scale of 1 – 10 with 1 being the cleanest.



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