

Suitable for
3-7 years

- ✓ Solo
- ✓ Pairs
- ✓ Groups

Denny's activity

Build your own water filter

How to guide



Denny's activity

Build your own water filter



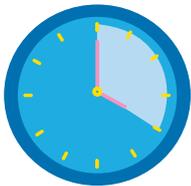
Aim

To introduce the concept of water cleaning using physical filtration.

To understand the important of water treatment for water safety.

Suitable age

5-7 year olds could assemble the system with some support. For younger children pre-build the kit and concentrate on the choice of materials for the filter.



Time required

Prep time 5:00 minutes, Introduction time 10:00 minutes, Working time 45:00 minutes. Total 60:00 minutes.



Materials and equipment

- **Sand**
- **Small stones** ~10 – 20 mm
- **Cotton**
- **Active charcoal chip** Can be obtained from hardware shop
- **Filter papers or coffee filters** – 6cm in diameter, if the filter paper is bigger, then trim it into 6cm)
- **Dirty water** – Prepare by mixing 1 tea spoon of mud/garden soil into water
- **Tubing** – Prepare 2 tubes of 60cm each)
- **Water tubes seal**

- **Large water container** – 500 ml, for dirty water
- **Water container** – 500ml, for filtered water
- **One-way manual water pump**
- **1.5 litre soda bottle** – with pre-drilled holes at the bottom
- **Funnel**
- **Gigo parts**

If you don't have the water testing kit with a pump you can still carry out this experiment but it might take longer for the water to pass through the filter. Find out more details [here](#).



Health and safety

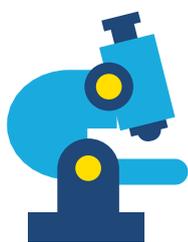
1. Do Not drink the dirty water or filtered water in this experiment.
2. Take care with younger children to make sure that they don't eat or put the small materials in their mouths. (e.g. Stone / Charcoal)
3. Wash hands after the experiment.



Instructions

1. Referring to the Assembly step document, setup the filtration system as shown in Figure 1.
2. Fill up the water bottle that provided (500ml) layer by layer, with total of 5 layers.
 - a. Starting from the lowest layer (5) in the bottle with filter paper.
 - b. Layer 4 will be the Cotton layer, stack up to 2cm thickness.
 - c. Layer 3 will be activated charcoal chip, stack up to 2cm thickness.

- d. Layer 2 will be fine sand, stack up to 2cm thickness.
 - e. The top layer (1) will be the stone, stack up to 2cm thickness.
3. Close the bottle with the pump cap.
 4. Setup the pump with the sucking tube goes to the dirty water container, while the other side will go to the filtering bottle.
 5. Use the pump to suck up the dirty water from the dirty water cup and push down the pump to pump the water into the filter bottle.
 6. Wait until the water is filtered and observe the water in the clean water cup.



How does it work?

The water filter is made out from layers of sands, fine stones and active charcoal chip. The layers of the sands and fine stones are used to remove the larger particles in the dirty water – it does this because the particles get trapped and aren't able to squeeze through the small gaps between the stones or the sand grains; and the active charcoal is to remove the heavy metals or harmful substances in the dirty water, which it does by absorption, i.e. stuff sticking to it. The filter paper is the final layer of the filtration system which acts as a barrier to stop the layers from leaking from the bottle.



Prompt questions

- Ask students: What is clean water? What makes water dirty? You could read *The Water Princess* to talk about access to water around the world.

Discuss how “clean water” is defined by how it is used. For example, what we consider clean water for drinking may not be considered clean water for fish and vice versa.

- Show students the dirty water and explain the general process of water treatment to make water safe to drink. You could read the book *The Magic Schoolbus goes to the Waterworks* to cover stages of water

treatment. The objective of the water treatment is to remove the impurities (mud, sand, germs, chemicals etc) from the dirty water. Additionally, different layers of packaging are used to remove the impurities based on sizes. (Contain of heavy metals, bacterial or virus which may not safe to drink directly.)

- Show the students the filter materials they will be using (stone, sand, and carbon). Ask the students: What will each of these layers remove? You could play the magnetic 'water treatment' game developed by Irene to find out more about contaminants and how to remove them

(Stone and sand remove large and small particles, carbon removes pesticides, chlorine and other chemicals and improves the taste of water).

- Ask students to compare the dirty water with the filtered water. (Colour, smell of the water.)
- Discuss about turbidity of the water. Turbidity refers the amount of cloudiness in the water. This can vary from a river full of mud and silt where it would be impossible to see through the water (high turbidity), to a spring water which appears to be completely clear (low turbidity). (Compare before and after filtration).
- Discuss why even if the water looks clear that does not necessarily mean it is clean and safe for us to drink. Ask the students: Is the water clean enough for us to drink? What else might be in the water that we can't see?

(There could still be harmful bacteria and microorganisms in the water.)



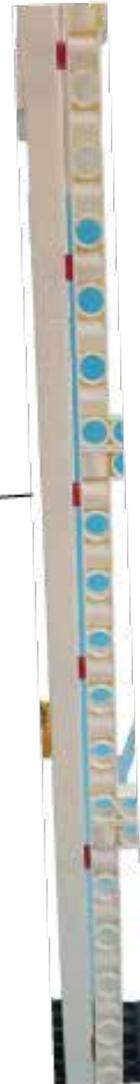
Extension ideas

Experiment with different materials in your filter or different ratios of the materials – does it make a difference to how clean the water looks? Does it make a difference how dirty the water is? Try adding other materials rather than just soil, e.g. soap, kitchen oils, glitter etc

What are other methods of cleaning or filtering water?

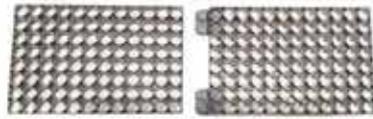
- 1.** Boil homemade filtered water: can further kill harmful bacteria and microorganisms. Do not boil water in order to remove metals and minerals, such as nitrate, lead or some other substances. Boiling water will actually increase the concentration of these substances and not remove them.
- 2.** Filters: Filters can be generally categorised based on the particular that can be removed, such as micro-filter, nano-filter, etc. Most nano water filters available at stores remove 99.99% of waterborne viruses, bacteria and protozoan parasites and have carbon which will improve the taste of the water. This is the recommended way to completely clean water for drinking purposes.
- 3.** UV-C water purifiers: UV-C light can kill bacteria and microorganisms in water because the energy emitted by the light is absorbed by the cells of microbes which prevents the cell enzymes from "reading" DNA. Without intact DNA microbes cannot reproduce.

Figure 1

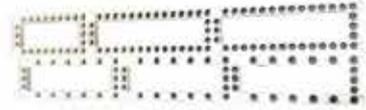
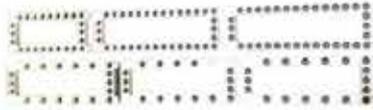


Assembly Steps 1

Step 1



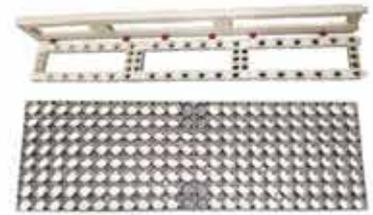
Step 2



Step 3



Step 4



Step 5



Front View

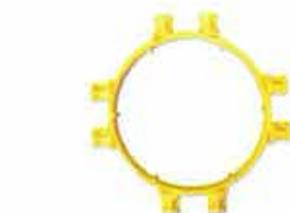


Back View

Step 6



Step 7

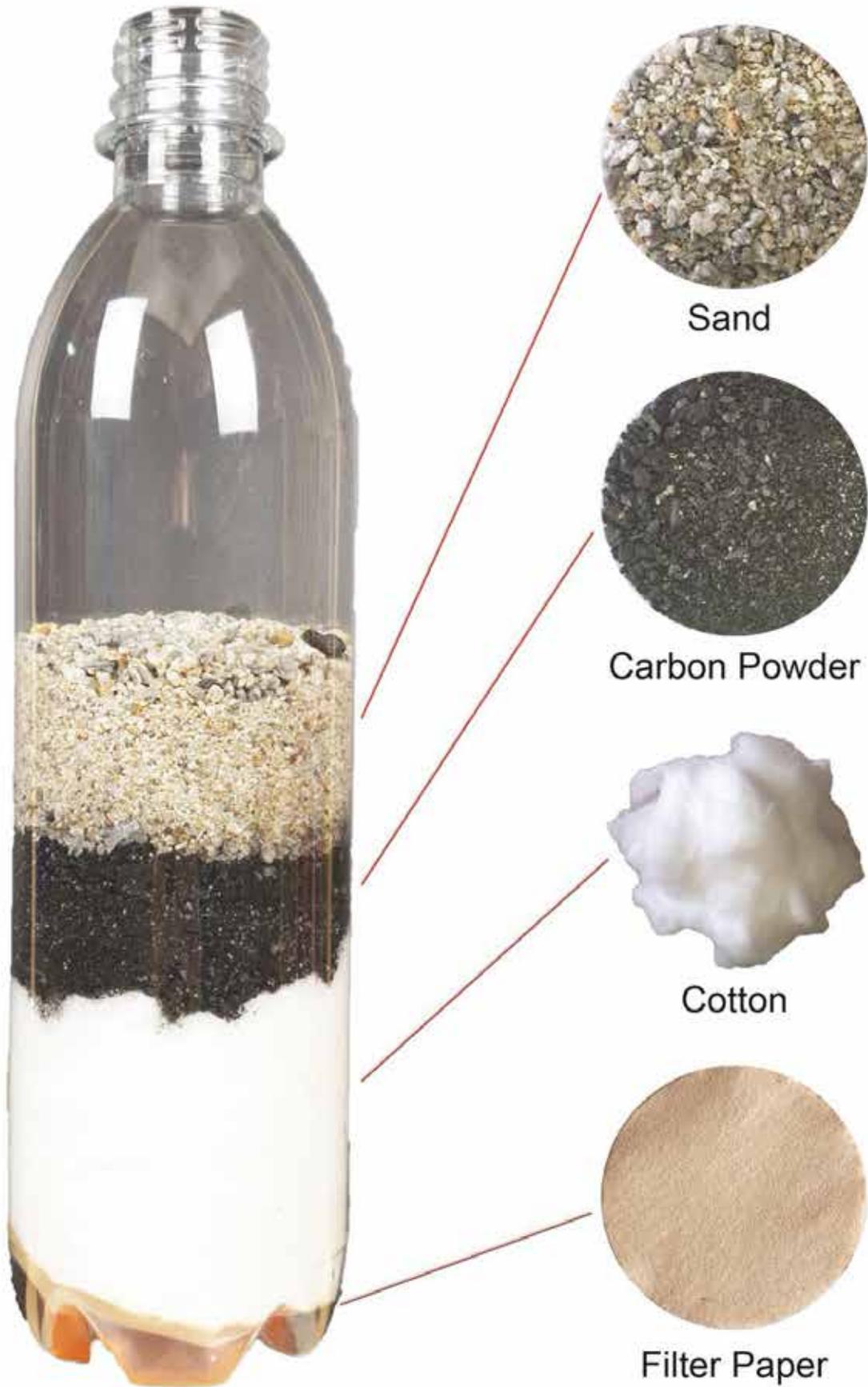


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Assembly Steps 2



Filter Content Structure



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Water Filter Kits - Check List

Item	Description		Qty
1.	5x13 Dual Frame		3
2.	5x15 Frame		2
3.	5x10 Frame		1
4.	Secured Pump		1
5.	Storage Cap		1
6.	Nozzle A		1
7.	O-Ring		1
8.	8 Pin Round Frame For Bottle		1
9.	Long Peg (Red)		8
10.	Short Peg (Blue)		2
11.	Tube		1

12.	Peg Remover		1
13.	Base Grid		2
14.	Bease Grid Connector		2
15.	500ml Clear Bottle		1

* Colour maybe different

* Filter paper, cotton, carbon powder, sand & mud are not included