

How is tap water cleaned?

Water purification experiment

Rand Water draws water for purification from the Vaal Dam. This water is transported via canals and pipelines to Rand Water's two purification stations in Vereeniging. Here the water is cleaned and treated to a standard suitable for humans to drink, in line with international guidelines.

The purified drinking water is pumped in underground pipelines from the purification stations, uphill to the Witwatersrand watershed. The drinking water is stored in closed reservoirs and then distributed via underground pipes, using the force of gravity. Rand Water sells water to local authorities, and some mines and factories, in an 18 000 square kilometre area.

The local authorities then supply 11 million people in homes, schools and businesses in Gauteng and parts of the Free State, Mpumalanga, Northern and North West Provinces with clean water that they buy from Rand Water.

Why don't you try out this experiment that shows how dirty water is cleaned at the Rand Water purification stations in Vereeniging?



Apparatus and Ingredients

- a copy of the experiment
- a copy of the 8 purification posters (see pages 35 – 38)
- newspaper to cover work surface
- 1 measuring jug (1 litre)
- 2 litres of water in a 2 litre clear plastic cold drink bottle (with a lid)
- 5 two litre clear plastic bottles with top cut off
- 1 top section of a cut-off 2 litre plastic bottle
- 1 teaspoon
- a piece of netting from an orange or onion bag
- 1 elastic band
- 1 small funnel
- 1 teaspoon slaked lime (calcium hydroxide) - purchased from a pharmacy
- 1 straw
- cotton wool
- bleach (preferably Miltons)
- 2 small pieces of paper with a fish, frog or crab drawn onto them
- 2 small pieces of paper with a floating plant drawn onto them
- 2 pinches of cake decoration called "hundreds & thousands"
- 1 handful of crushed leaves and twigs
- 1 handful of small sweet papers
- 4 teaspoons powdered clay – purchased from a nursery
- 2 pinches Enos
- 2 pinches sugar
- 2 pinches salt
- 1 clear drinking glass
- paper
- a pencil/pen



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Step 1: Making Vaal Dam Water

1. Mix a set of the ingredients that are listed below into TWO separate cut-off plastic bottles. One bottle will be used for the EXPERIMENT and one will be used as the CONTROL. (The control will be used to compare the results of your experiment.):

- 1 litre of water. Use the measuring jug to assist you;
- 1 picture of a fish, frog or crab and 1 picture of a floating plant (to represent large living organisms);
- 1 pinch crushed leaves and twigs (to represent sticks and leaves);
- 1 pinch sweet papers (to represent litter);
- 2 teaspoons powder clay (to represent sand, soil and clay particles);
- 1 pinch of "hundreds and thousands" (to represent small living organisms);
- 1 pinch of Enos (to represent germs, viruses & bacteria);
- 1 pinch of sugar (to represent good guys, eg: calcium, magnesium, zinc, etc.);
- 1 pinch of salt (to represent bad guys, eg: pesticides, lead, mercury, arsenic, etc.)

2. Using the teaspoon, stir the mixture in both bottles;
3. Compare your water to the water in the control bottle. Is there any difference? What?
4. Read the "**How is Tap Water Cleaned?**" poster (page 35) and look carefully at the key which explains what is in the water. How much of

each of these things do you think will be in your water?

5. At the end of the experiment judge the final result on the following:

- a) How visibly clean is the water?; &
- b) How much water has been purified? Remember that you must not waste water during the cleaning process.

Step 2: Screening

1. Place the netting over a clean cut off plastic bottle. Make a small hollow in the netting and secure with an elastic band.
2. Pour the "Vaal Dam" water through the netting into the bottle, whilst stirring well. Note what has been left behind on the net.
3. Compare your water to the water in the control bottle. Is there any difference? What?
4. Read the "**Screening**" poster (page 35).



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Step 3: Coagulation and Flocculation

1. Into the screened "Vaal Dam" water add half a teaspoon of slaked lime (calcium hydroxide) and stir.
2. Pour this water into a clear plastic 2 litre bottle with a lid. You can use a small funnel to avoid any wastage.
3. Close the lid tightly and shake energetically for 2 minutes. This is **COAGULATION**.
4. After 2 minutes roll the bottle on a flat surface slowly backwards and forwards for about 2 minutes. This is **FLOCCULATION**. Look carefully at the mixture to see if clumps of floc are forming in the water.
5. Compare your water to the water in the control bottle. Is there any difference? What?
6. Read the "**Coagulation and Flocculation**" poster (page 36).



Step 4: Sedimentation

1. Leave the bottle to stand upright for at least 5 minutes. The longer you leave it the better the result. Can you see the clumps of "floc" beginning to settle to the bottom of the bottle? This is "sludge".
2. Carefully pour off only the clear water on top into a cut off plastic bottle. Try not to disturb the "sludge" while you are doing this.
3. Compare your water to the water in the control bottle. Is there any difference? What?
4. Read the "**Sedimentation**" poster (page 36).



Step 5: Carbonation

1. Using a straw get one member of the group to blow into the water for about 15 seconds. Now the water is less alkaline and more "balanced". When the slaked lime (calcium hydroxide) was added to the water the pH of the water became alkaline (pH 8-14). Adding CO_2 (an acid) brings down the alkalinity of the water.
2. Compare your water to the water in the control bottle. Is there any difference? What?
3. Read the "**Carbonation**" poster (page 37).



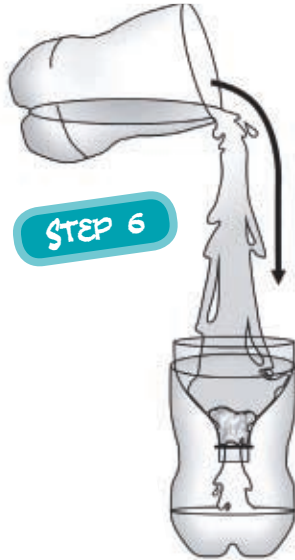
KA-BOOM!



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Step 6: Filtration

1. Plug the inside of a funnel section of a 2 litre plastic bottle with cotton wool.
2. Place this section into a cut off plastic bottle, to make a filter.
3. Pour the water slowly through the filter. What has been left behind on the cotton wool?
4. Compare your water to the water in the control bottle. Is there any difference? What?
5. Read the **"Filtration"** poster (page 37).



Step 7: Chlorination

1. Add a teaspoon of bleach (which represents chlorine) to the water to chlorinate the water. Now the water is free of germs!
2. Compare your water to the water in the control bottle. Is there any difference? What?
3. Read the **"Chlorination"** poster (page 38).

Step 8: Water Supply

1. Measure the amount of water that you have purified using the measuring jug. Subtract this amount from 1 litre (1 000ml) to see how much you have wasted during your experiment.

You cleaned _____ ml water.

1 000ml - _____ ml (amount cleaned) =
_____ ml (amount wasted)

2. Pour your cleaned water into a clean glass. Judge how visibly clean your water is. This works well if there are a number of groups doing the same experiment.
3. Read the **"Water Supply"** poster (page 38).
4. Now take a clean piece of paper and draw Rand Water's purification process using your own words and drawings, without looking at the purification posters. How much can you remember?



Note: The water from this activity is not really safe to drink as it is only an experiment that represents Rand Water's purification process!

LO1: TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technology.