Underground Water - Teacher's Notes

Water Level - Teacher Demonstration

When rain falls on the ground it sinks through spaces between soil grains and percolates through pores in rocks until an impermeable layer of clay or rock stops its downward movement. Over many hundreds and thousands of years the groundwater level rises within the rock or soil and an underground water reservoir is formed. The top of the reservoir is called the "water table" and is almost horizontal. The first demonstration (below) can be skipped if you cannot find the equipment but it is a source of amazement and amusement to many students, especially if pairs of them are asked to demonstrate movement of the tube ends.
Aquarium tubing is inexpensive and other clear tubing is stocked in hardware shops.

Materials

- A length of clear plastic tubing. (aquarium tubing is inexpensive and ideal)
- Water (coloured if possible).
- A jug and funnel if you have one.

Method

1. Hold the tubing in a U shape.
2. Half fill with coloured water.
3. Ask the students what they think will happen to the water level if one tube end is raised or lowered.
4. Demonstrate what happens.

Draw what happens when the ends of the tube are moved? Water level remains the same or the top of the water remains level.

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Since ancient times, builders have used this technique to test that foundations are level. A small channel was cut into the outer edge of the base and this was filled with water. If the foundations were level the channel would fill and no water would spill. If the foundations were not level, water would spill out of the lowest point.

The carpenter's spirit level works on the same principle to test if beams are truly horizontal or vertical.

Moving Water - Student Activity

This activity tests for concept transference.

Materials

- A beaker, a jam jar or a glass.
- An eraser or book to chock up the beaker at an angle.
- Coloured water in a jug.
- A pencil (the same colour as the water if possible).

Method

1. Pour water into the beaker until it is about one third full.
2. Draw what this looks like on your diagram.

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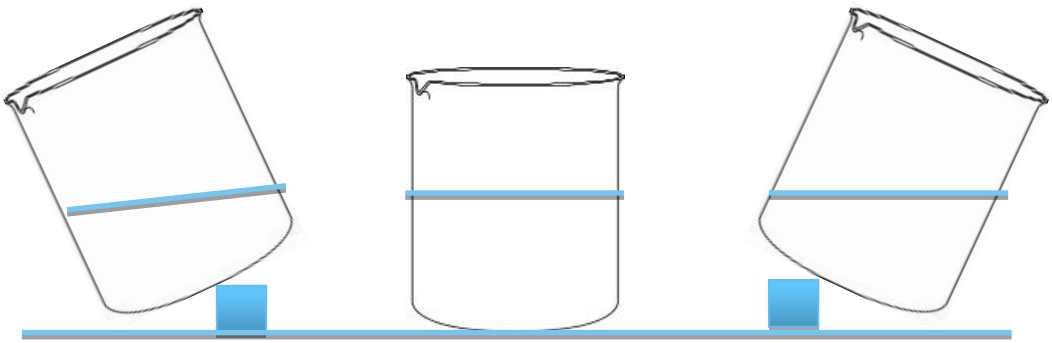
3. Tilt the beaker by placing the eraser under one side
4. Draw what this looks like on your diagram.
5. Tilt the beaker in the other direction and place the eraser under it
6. Draw what this looks like on your diagram.

Observations



Draw what you think will happen when the beaker is tilted See drawing
Does water always find its own level? Yes

Groundwater Supplies – Teacher Demonstration

Aboriginal people and early settlers dug wells to find the water table and fresh water supplies they needed. They also used soaks and springs where the land surface naturally dipped to cut the water table and water bubbled out. Aboriginal meeting places were often near such soaks and later European settlements relied on them. There was conflict over "ownership". A worksheet on Aboriginal perspectives on water is included in this topic. Living in the driest habitable continent, we cannot depend solely on rainwater so have come to rely on groundwater supplies from boreholes sunk below our farms, towns and cities.

Underground Water - Teacher's Notes

There is a major student misconception that underground water is found in great lakes in caverns below the surface. The water really only fills pore spaces within sands, sandstone and limestone. There is no huge hole or empty space. Water from rain falls on the ground and seeps downward until something stops it. Impermeable layers of clay or igneous rock underlying them can trap water above. The trapped water is called groundwater and the reservoir an aquifer (water maker). Aquifers can take millions of years to build up.

When the water table lies below the surface, as in the model, some plants can send roots down to get water, but animals must depend on water drawn from wells or raised by windmills and other pumps.

If too much water is pumped from the aquifer and is not replaced by rainfall the water table will drop, trees die and bores have to be deepened. In Perth we are drawing on water supplies that have formed over thousands of years. Because the dams, which were built to collect rainfall runoff, are no longer sufficient for the needs of our much greater population we now rely on groundwater and desalinated seawater.

Most major cities in Western Australia depend on bore water from their underlying aquifers.

Materials

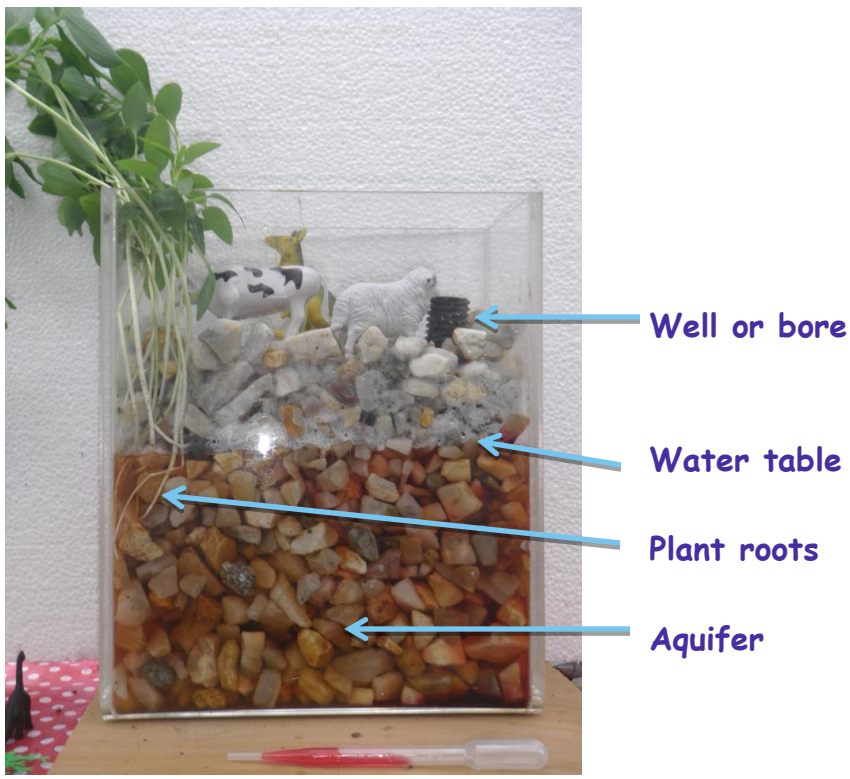
- A large transparent container. Old fish tanks or worm farms are excellent. School canteens often have large glass jars, which contained mayonnaise, which work well.
- Washed gravel or aquarium pebbles. The model in the photograph had pathway gravel but loose road gravel works well. Place in a sieve and rinse well. No need to dry as it will mostly be wet.
- A piece of tubing to represent the well or bore. I used garden hose but if that isn't available, cut about 7cm from the top of an empty cool drink bottle and use that.
- Some plants with roots.

Underground Water - Teacher's Notes

- Water (coloured if possible).
- Option. Plastic animals.

Method

1. Half fill the container with gravel.
2. Hold the tubing that represents the bore so that the top will be slightly above ground level.
3. Hold plants with roots below ground level and infill the rest of the gravel so that the plant roots are covered and the top of the well protrudes above the surface.
4. You may create a dip on the surface to make a lake or soak where your animals may drink.
5. Add animals
6. Add water until the water table appears in the lake depression at the surface.



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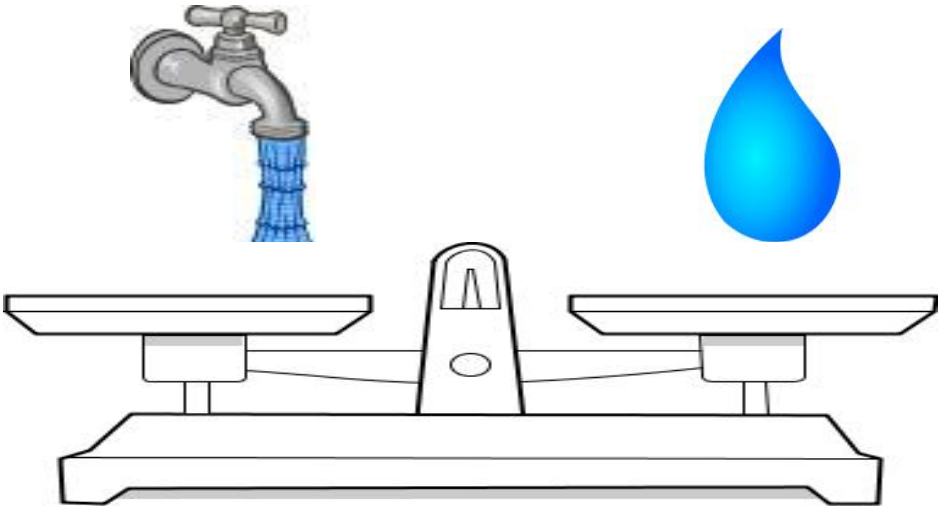
You can demonstrate a drop in the water table either by simulating summer leaving the model in the sunshine causing water to evaporate, or by drawing water from the well using a pipette or drinking straw and watching the water disappear for the animal's drinking hole/soak/lake. In either case animals and plants are deprived of water.

Recharge (How Much is Enough?)



Some aquifers are enormous and it takes a lot of pumping before there is a noticeable change in the level of the water table. Many remote areas depend on much smaller local perched water tables that are closer to the surface and often lie above small clay pans within soils. These can be slow to recharge and, being smaller, are more sensitive to pumping.

Materials

- A bucket, a glass and a teaspoon
- Masking tape or permanent marker
- Water

Underground Water - Teacher's Notes

Method

Almost fill the bucket and the glass with water
Mark water levels on both
Remove two teaspoons (10mL) of water from each
Observe any change of water level

Observation

Water loss/a drop in water level is hardly noticeable in the bucket but is much more apparent in the glass.

A water bore has always supplied this household with water. The garden does not need to be watered and the animals can drink at a nearby soak or billabong because the water table is close to the surface.
What will happen if;
More water is needed for a new swimming pool? This will lower the water table. If sufficient water is removed, the plants will die because their roots are not long enough and the soaks will dry killing the animals
Rainfall is halved? Again the level of the water table will drop because it is not being recharged
The family moves away and stops drawing water from the bore? The level of the water table will eventually recover and rise. With luck plants and animals will return.