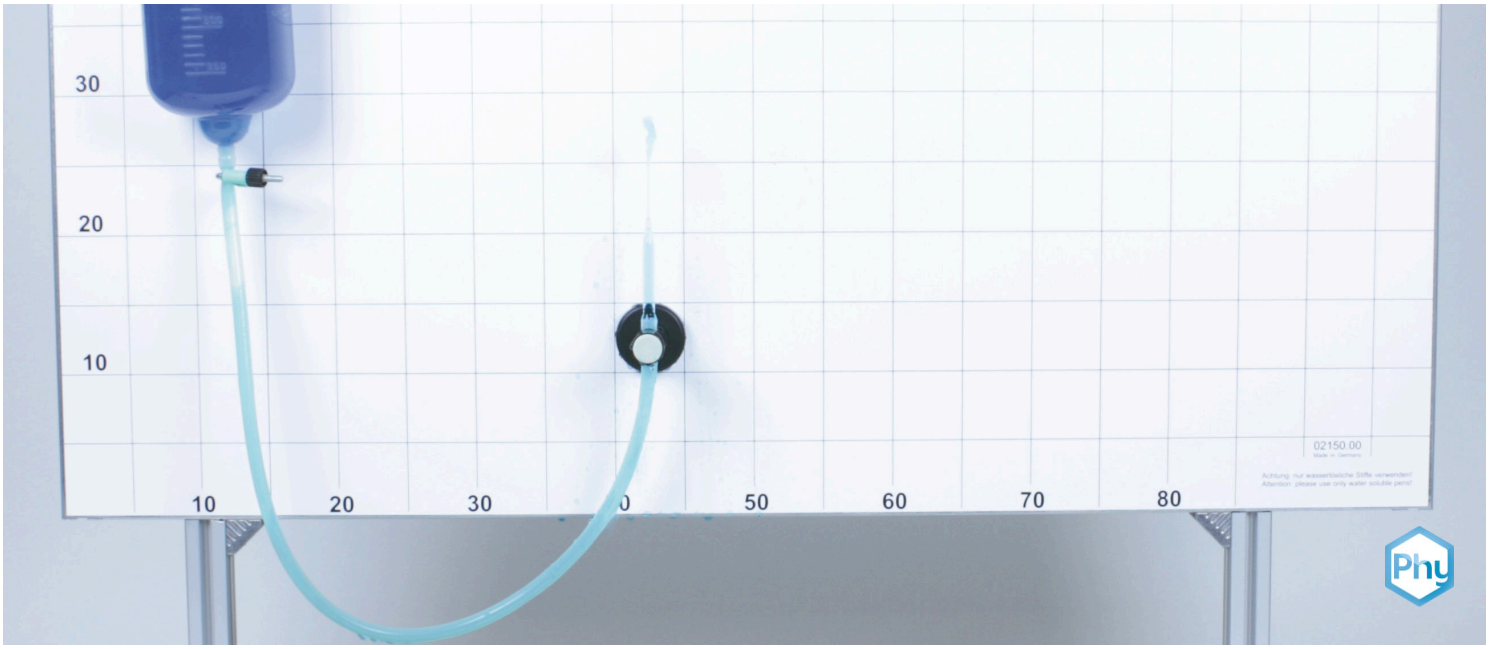
Artesian well



P1297100

Physics	Mechanics	Mechanics of liquids & gases

Difficulty level	Group size	Preparation time	Execution time
easy	-	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/66d5950a57310e0002e06acf

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General information

Application

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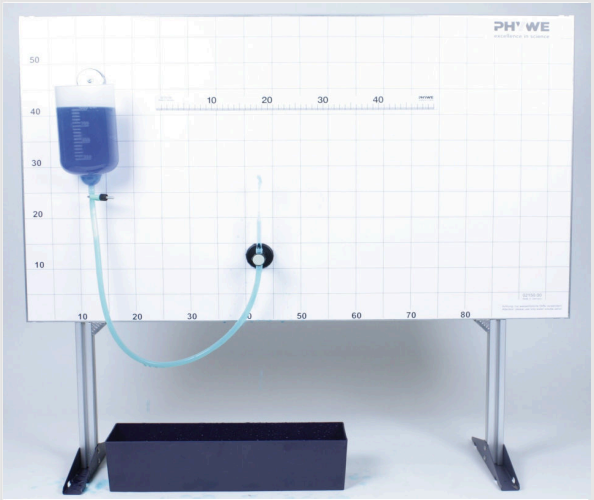

Fig. 1: Experimental setup

An artesian well is a well in a depression below the groundwater table in which water is pressurised. This "hydraulic potential" is so high that the water rises to the surface or higher by itself, i.e. without pumping.

Artesian wells have been drilled in China, North Africa and the Near East many centuries ago. In Europe, the first such well was discovered in 1126 in the Artois region of northern France, in the Pas-de-Calais department, and named after it.

Artesian wells have many uses, including the supply of drinking water, agricultural irrigation, energy production and mineral water production.

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Other information (1/2)

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Prior knowledge

Students need previous knowledge of artesian wells, and should have knowledge of hydrostatic pressure.

Principle

The principle of an artesian well will be demonstrated.

Other information (2/2)

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Learning objective

The students are supposed to learn the basics of the artesian well in this experiment. The students are also supposed to understand the role the hydraulic potential plays in this.

Tasks

The demonstration of an artesian well is shown to the pupils. The pupils are supposed to observe the water coming out of the "artesian well".

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Safety instructions

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The general safety instructions for experimentation in science lessons apply.

Theory

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An artesian well is a well below the groundwater table from which water emerges of its own accord. Artesian wells are only possible in depressions in the landscape.

Pressurised groundwater from hydrostatic pressure is the most important prerequisite for an artesian well. If an aquifer (a water bearing stratum) is sealed off from above by an aquiclude (water impermeable stratum) and at the same time the large-scale geological structure of the aquifer allows hydrostatic pressure to build up, artesian wells can be created. If an aquifer with pressurised groundwater is drilled or trenched, the groundwater rises according to the principle of communicating vessels in the drillhole or shaft to a maximum level of the free (unpressurised) groundwater surface in the water-bearing layer. If this level is higher than the earth's surface at the well, the groundwater spurts upwards under pressure from the underground.

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Equipment

Position	Equipment	Item no.	Quantity
1	PHYWE Demo Physics board with stand	02150-00	1
2	Scale for demonstration board	02153-00	1
3	Clamping holder, 0-13 mm, fixing magnet	02151-07	1
4	Storage tray, 413 x 120 x 100 mm	47325-01	1
5	Overflow vessel on fixing magnet	02158-00	1
6	Graduated beaker, 1000 ml, plastic (PP)	36640-00	1
7	Beaker, 100 ml, plastic (PP)	36011-01	1
8	Screw clamp	02014-01	2

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Setup and procedure

Setup and procedure (1/2)

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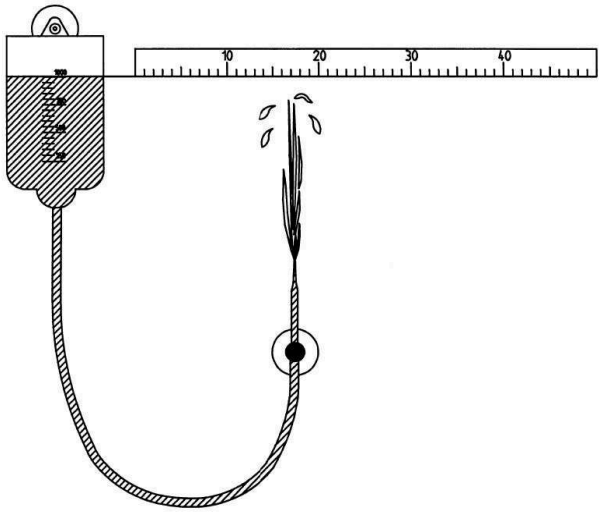

Fig. 2

- Place the overflow vessel at the top edge of the demo panel, place and tighten the clamping holder directly in front of the glass nozzle.
- Pour about 1000 ml of water into the container and squeeze air bubbles out of the tube.
- Place the bowl on the table under the board.
- Place the clamp with the nozzle of the overflow vessel on the lower edge of the panel and align the nozzle so that it is not completely vertical.

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Setup and procedure (2/2)

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- Place the scale on the board at the height of the water level (Fig. 2).
- Loosen the clam on the tube and observe the water escaping from the "artesian well".
- During the process, use the cup to pour water evenly into the overflow vessel so that the water level changes as little as possible.

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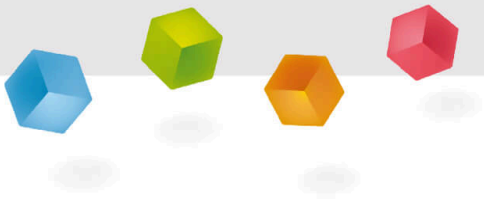

Evaluation

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Evaluation

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The water emerging from the nozzle reaches a height below the water level in the overflow vessel.

The overflow vessel, the nozzle pipe and the connecting tube form a system of communicating vessels. If there were no friction, the water emerging from the nozzle would have to reach the water level in the overflow vessel.

The gravitational pressure of the water is the reason why the artesian well works; the frictional forces are the reason why the fountain cannot reach the height of the water level.

Notes

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The nozzle pipe should not be completely vertical because then the escaping water collapses in itself and reaches less height.

It is advisable to also place a large absorbent cloth under the bowl before the experiment to catch splash water.

If groundwater can accumulate between two impermeable layers of earth and these layers form a depression, then water can escape under pressure from the ground after drilling into the upper layer in the depression. The wells created in this way are called artesian wells after the French county of Artois, where - according to contemporary documents - this type of well already existed in the 12th century.

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