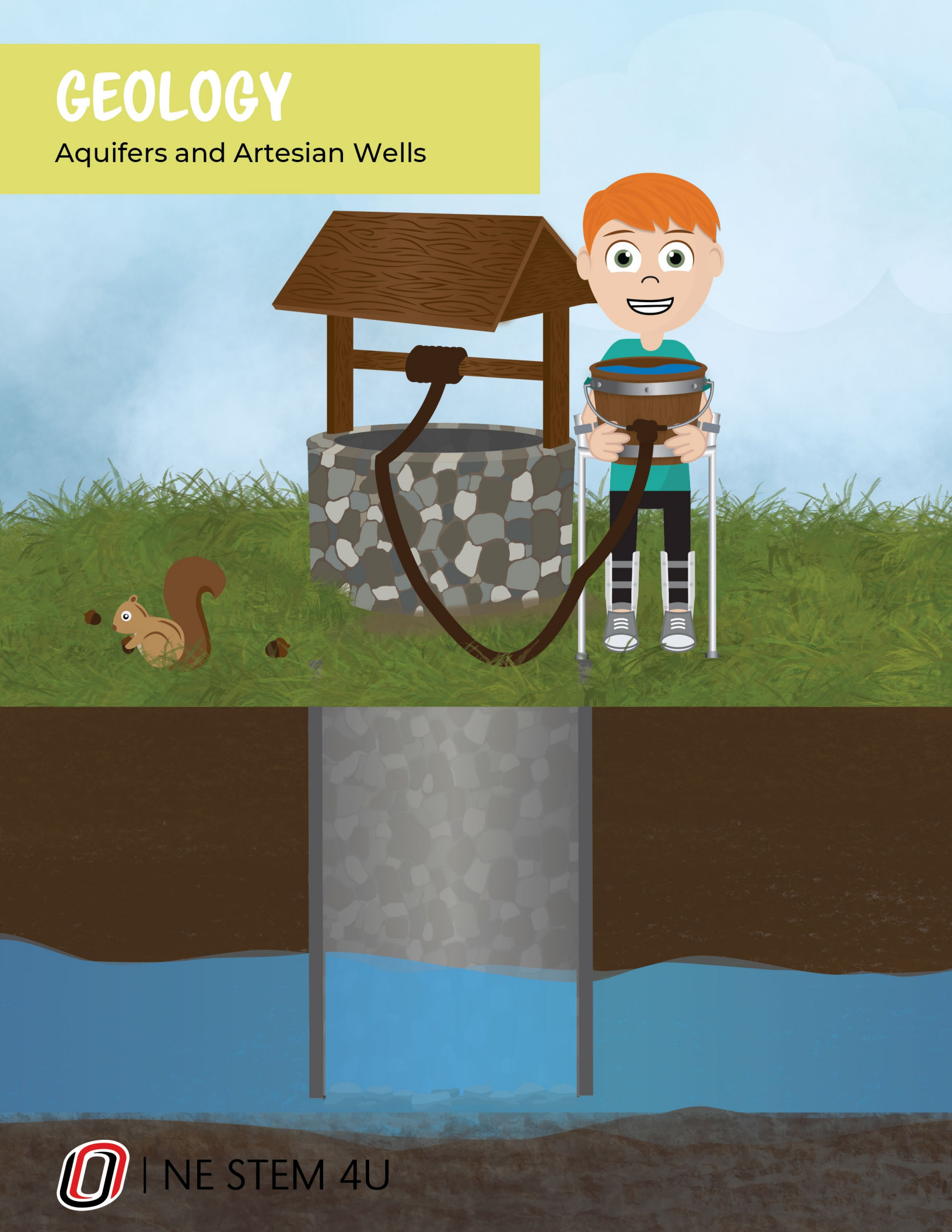
GEOLOGY

Aquifers and Artesian Wells



NE STEM 4U

Aquifers and Artesian Wells

NGSS

5-ESS2; MS-ESS3

Objective

The student will understand what an aquifer and water table are, and how an artesian well functions with regards to these two elements.

The student will be able to develop their own artesian well to highlight its functionality in regards to the vocabulary components.

Vocabulary

Aquifer: An underground lake in which groundwater is contained in permeable rock.

Artesian well: A well drilled into an aquifer, underneath the water table where the natural water pressure pushes the water out.

Water table: The line between the unsaturated and saturated zone; the top of the aquifer.

Permeable rock: Rock that allows air and liquid to pass through due to tiny holes throughout the entire rock.

Background

The scientific method is a multi-step, repetitive process to help people conduct research. The first steps normally are to create a question or objective, find background information/do research into understanding the topic more, and then construct a hypothesis. Then one goes on to test the hypothesis, figure out if the test supports their hypothesis, and then analyze the data (results) from their test and draw a conclusion on why the hypothesis was supported or not. If desired, other steps can be added, such as troubleshooting or adding on more experiments or research into why the experiment did not support the hypothesis.

An aquifer is a large area under the ground where water is stored inside permeable

rock. The permeable rock is in-between layers of non-permeable rock, which is how the water can stay within the layer of permeable rock until acted on by an outside force (such as the digging of a well or formation of a spring). The layer within the aquifer is called the saturated zone because the rocks are saturated with water. The area above the aquifer is called the unsaturated zone because it contains little to no water. The water table is located between the two zones, just below the unsaturated zone and at the very top of the saturated zone.

Artesian wells are wells that are dug into an aquifer below the water table, which do not require extra force to extract water due to the natural water pressure. Water will naturally rise from the bottom of the well to the water table due to pressure, and when the pressure is great enough, the water will rise past the water table and come out of the top of the well.

Materials

For each group (2-3 students):

- Plastic cups (one for each student)
- Small pebbles or rocks
- Straws or small plastic tubing
- Water
- Napkins or paper towels
- Permanent marker
- Tin foil, plastic wrap, or a plastic lid for artesian well models
- Sheet of paper and writing utensil

Procedure

1. Beforehand, create a model that students can observe; it's okay if the model doesn't work, because the students will attempt to design and create a model that works better.
2. Instruct students to write out their hypothesis and the steps of their experiment.
3. Prompt students to create their artesian well models and test them. Have them share with the class whether their hypothesis came true and they were able to get water to rise.

Guiding Questions

- What do you already know about aquifers?
- What do you already know about artesian wells?
- What is your understanding of the scientific method?
- How can the scientific method help us with day-to-day activities?

Career/Future Application

Geologists, geographers, and housing developers. In rural communities, oftentimes a well must be dug to support the house for water use. Digging wells and understanding how to properly extract groundwater are important in these careers.

Sources

https://www.usgs.gov/special-topic/water-science-school/science/artesian-water-and-artesian-wells?qt-science_center_objects=0#qt-science_center_objects

https://www.usgs.gov/special-topic/water-science-school/science/aquifers-and-groundwater?qt-science_center_objects=0#qt-science_center_objects

https://www.sciencebuddies.org/science-fair-projects/science-fair/steps-of-the-scientific-method