



Ground Water: High School

Standards met: NGSS Standards: HS-ESS3-1; HS-ESS3-2; HS-ESS3-4; HS-ESS3-6

Lecture:

What is ground water? Permeability. Water table, saturated and unsaturated zones. Impacts of humans on the water table. Impacts of wild fire and drought on runoff and water table. Etc.

Create a graph representing water on earth

If all of the Earth's water from oceans, icecaps and glaciers, lakes, rivers, groundwater and the atmosphere were collected in one place, the total volume would equal approximately 332.5 million cubic miles (mi³), where one cubic mile equals more than 1.1 trillion gallons. Of that total volume, 97% is saline water in oceans, meaning only 3% (about 22,339 mi³) is freshwater. Of that freshwater portion, approximately 69% is frozen in glaciers and ice caps, 20% is groundwater and only 1% is accessible surface freshwater. Of that 1% of accessible surface freshwater, only about 53% is located in lakes and streams (Shiklomanov, 1993; U.S. Geological Survey [USGS], 2016). Therefore, water in freshwater lakes and streams is about 52% of the 1% accessible water, of the 3% of the total which is freshwater, or only 0.015% of the total water in the Earth!

<https://waterknowledge.colostate.edu/hydrology/water-cycle/>

Facts: 97% of earth's water is salt water. 2.4% is frozen in ice, .5% is unavailable (too far underground, polluted, trapped in soil, etc), .1% is available for human use and consumption.

1,000 squares on graph represents all water.

970 squares are salt water

24 squares are frozen water

5 squares are not available

1 square is potable water.

Demonstrate groundwater pollution

1. Fill a small cup with sand or gravel and place a small hole in the bottom.
2. Place a teaspoon full of grape cool aid in one spot under the surface of the sand or gravel at the edge of the tray. Make sure it is not visible.
3. Run a small stream of water into the cup from a faucet. The water coming out of the hole in the bottom will begin to appear purple in color.

Ground Water Lab

Materials:

Foil tray

Spray bottle

Powdered lemonade mix

pH paper

sand or gravel (using different sizes and mixes of materials could add additional content to the lab)

beaker or glass of clean water

straws

small blocks or boards to raise one end of tray

materials to clean water (cotton balls, popsicle sticks, gauze, paper towels, paper, tissue paper, toothpicks, material scraps, etc.)

Prelab Questions:

What are some potential sources of ground water pollution?

Dumping oil after oil change, fertilizers for gardens/farms, soapy water from washing a car in the yard or camping, human and animal waste, industrial emissions, air pollution (washed down by precipitation)

How does run off impact groundwater?

Is it a source of pollution or does it clean up the pollution?

How do floods impact ground water?

Is ground water a renewable resource?

Finding the source of pollution: Place students in groups of two or three.

1. Fill the tray with sand, gravel, or a mixture of both. (vary what is used by groups to extend learning opportunities).
2. Bury a teaspoon of powdered lemonade somewhere under the surface of the material. Make sure that it cannot be seen. Create a picture of your tray on grid paper with an X marking the location of the lemonade. Turn this into your teacher.

Change stations so that each group has access to a new tray.

3. Tip one end of the tray up by placing a block or board under it.
4. Create a picture of your tray on grid paper.
5. Spray the top of the slope with water from the spray bottle for approximately 10 minutes.
6. Insert the straw into the sand, place your finger over the top of the straw, and remove it from the sand.
7. Allow the water from the straw to drain onto the pH paper. Record the pH and the location of the straw insertion on your picture.
8. Clean the straw by rinsing it in the beaker of clean water.
9. Repeat steps 6-8 until your group is certain it has found the location of the lemonade pile. Mark this location with an X on your picture.

Groundwater Cleanup

10. Using the materials provided by the teacher, create a process to clean the groundwater in your tray. You can test the effectiveness of the process using your straw and pH paper just as you did for testing. Be sure to record the results of your testing and describe what worked and what did not work.

Lab Write up

Your lab write up should contain the following:

Title

Materials list

Safety considerations

Procedure for finding the source of the pollution

Grid map of your tray with pH levels and the location of source marked.

Procedures followed to find clean up strategy (what worked and what did not with data)

Final description and effectiveness of your process with justification

If you had more time to design your clean up procedure, what would you try?