

DEQ in the Classroom: The Incredible, Edible Aquifer



**IDAHO
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Grade Level:

Any; best fits grades 4 - 8

Time Required:

30 minutes (can be longer or shorter depending on discussion)

Objective:

To illustrate the geologic formation of an aquifer, how pollution can get into ground water, and how this pollution can end up in drinking water wells. Students will come to understand how our actions can affect ground water and drinking water.

Meets Idaho State Standards:

Grade 4: 430.01.d, 588.02.c, 596.01.a, 596.03.b, 598.01.a, 709.01.a

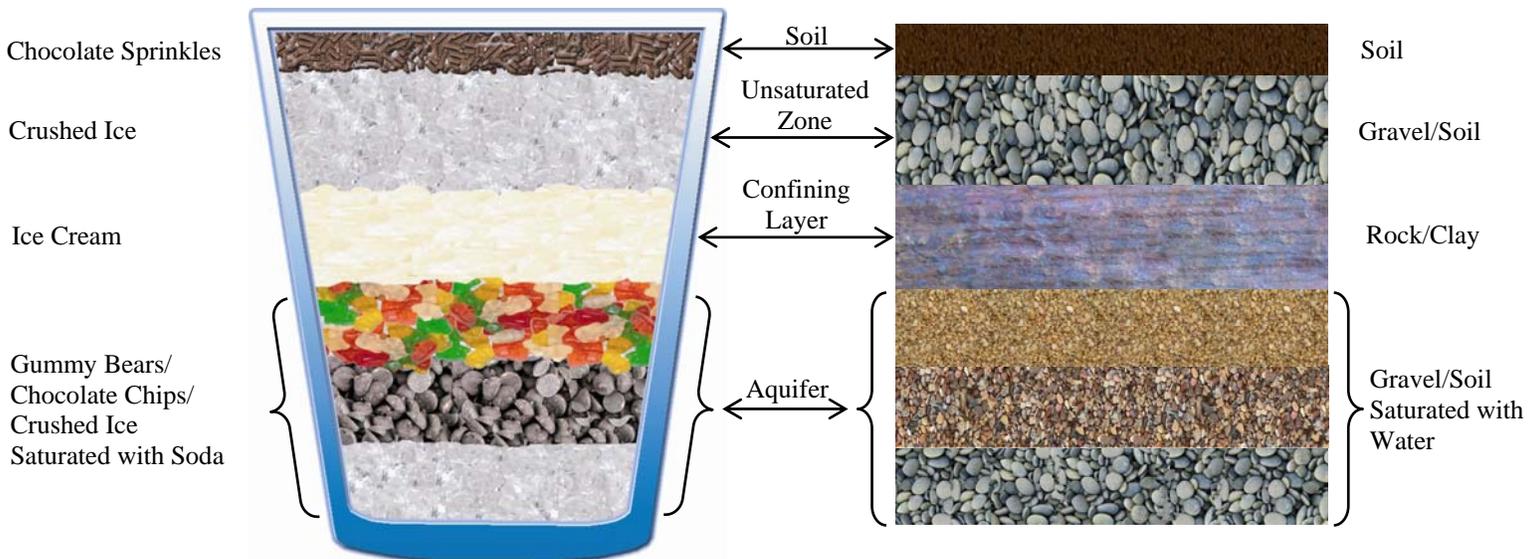
Grade 5: 456.01.b, 458.03.a and .b, 603.02.c, 611.01.a, 611.03.b, 613.02.a, 718.01.a, 814.01.h

Grade 6: 463.04.d; 469.05.a, .b, and .h; 618.02.c; 619.01.a and .e; 620.03.a; 626.01.a and .b; 727.01.a; 823.01.j

Grades 7/8: 463.04.d; 469.05.a, .b, and .h; 633.02.c; 641.02.a; 641.03.b; 832.01.i

Focus:

Ground water/aquifers. Students will build their own edible aquifers and learn about different geologic layers, different types of aquifers, how aquifers become contaminated, and the need to protect and conserve ground water resources.



Materials: (for a class of 25)

Chocolate chips (4, 12 oz bags)

Clear plastic cups (12 or 16 oz) (25 - 30)

Crushed ice (the smaller the better)

Red Kool-Aid® (dry) (4 small packages)

Straws (clear work best) (25 - 30)

Chocolate sprinkles (2, 3 oz containers)

Clear soda (e.g., lemon-lime) (4 liters)

Gummy bears or worms (small) (2 lbs)

Spoons (25 - 30)

Vanilla ice cream (½ gallon or 25 - 30 single serving cups)

Background:

Ground water supplies 95% of the drinking water in Idaho. Wells are drilled through soil and rock into ground water aquifers to supply drinking water. Unfortunately, ground water can become contaminated by improper use or disposal of chemicals such as fertilizers and household cleaners. These chemicals can percolate down through the soil and rock into an aquifer, and eventually into drinking water wells. This contamination can pose a significant threat to human health.

Vocabulary:

Aquifer	A natural underground area where large quantities of ground water fill the spaces between rocks and sediment.
Aquitard	An underground layer over an aquifer that is impermeable or significantly less permeable than the aquifer below it. It helps protect the aquifer from contamination and is usually made of rock and/or clay. Also called a “confining layer.”
Confined Aquifer	An aquifer overlain by one or more layers of impermeable rock or soil (aquitard/confining layer) that restrict water to within the aquifer.
Confining Layer	An underground layer over an aquifer that is impermeable or significantly less permeable than the aquifer below it. It helps protect the aquifer from contamination and is usually made of rock and/or clay. Also called an “aquitard.”
Conserving Water	Not wasting water.
Porous	Full of pores (small spaces). Water can easily pass through it.
Protecting Water	Keeping water clean.
Saturated Zone	An underground layer or area where water fills most of the pores (spaces) in the soil and rock.
Unconfined Aquifer	An aquifer that is not overlain by a layer of impermeable rock or soil.
Unsaturated Zone	An underground layer or area where air fills most of the pores (spaces) in the soil and rock.
Water Table	The top of an unconfined aquifer.

Procedure:

Step 1. Fill a clear plastic cup 1/3 full (total) with a combination of gummy bears, chocolate chips, and/or crushed ice.

These represent gravels and soils that make up the aquifer.

Step 2. Add enough soda to just cover the candy/ice.

The soda represents ground water. Notice that the soda fills all of the spaces among the gummy bears, chocolate chips, and ice. The aquifer is now saturated with soda; it is a “saturated zone.” In an unconfined aquifer (see Step 3), the top of the saturated zone is called the “water table.”

Step 3. Add a layer of ice cream. (Optional)

This layer, called a “confining layer” or an “aquitard,” is impermeable or significantly less permeable than the aquifer below it (it is difficult for water to soak through). It helps protect the aquifer from contamination and is usually made of rock and/or clay. An aquifer under a confining layer is called a “confined aquifer.” An aquifer without a confining layer is called an “unconfined aquifer.”

Some aquifers, such as the Spokane Valley-Rathdrum Prairie Aquifer in north Idaho, do not have a confining layer. If your local aquifer does not (or even if it does), consider omitting the ice cream or having half the class use ice cream and half not to compare the results.

Step 4. Add crushed ice on top of the confining layer/water table.

This represents the unsaturated zone, the area where air fills most of the pores (spaces) in the soil and rock.

Step 5. Scatter chocolate sprinkles over the top.

The sprinkles represent the soil, which is very porous.

The aquifer is now complete. Your aquifers will probably be messy and not look like the picture on the front page. That’s OK! Real aquifers aren’t neatly layered either.

Step 6. Sprinkle Kool-Aid[®] over the top.

The Kool-Aid[®] represents contaminants on the ground (e.g., fertilizer). Does anything happen to the Kool-Aid[®] right away? (Usually nothing will happen.)

Step 7. Using a drinking straw, “drill” a “well” into the center of the aquifer.

Observe the aquifer and Kool-Aid[®]. What, if anything, happens when the well is drilled?

Step 8. Begin to “pump” the well by slowly sucking on the straw.

Watch the decline in the level of the soda and observe what happens to the contaminants. Do contaminants (Kool-Aid[®]) leak through the confining area (ice cream) and get sucked into the well? If so, do more contaminants get into wells in confined or unconfined aquifers? (If your class made both; see Step 3)

Step 9. Pour a small amount of soda over the top.

The soda represents precipitation. It recharges the aquifer (adds new water). Watch how the Kool-Aid[®] dissolves and moves into the aquifer. The same thing happens when contaminants are spilled on the ground. Do you think you could get the Kool-Aid[®] back out of the soda?

Review what you have learned and eat your aquifer! Use the questions on the next page to start the discussion.

Questions for Discussion:

1. What observations/results surprised you? What did not?
2. How did results compare among different aquifers? (Even if all students used the same option in Step 3, each aquifer will be somewhat different.)
3. What parts of the activity were most/least like what would happen with a real aquifer? Why?
4. What happens if all of the water is pumped out of an aquifer? Where does more ground water come from? How long do you think it would take? Is there always more ground water, or could we run out?
5. Do you think a contaminated aquifer can be cleaned? If so, how?
6. How can we conserve (save) ground water? What specifically can kids do?
7. How can we protect ground water (keep it clean)? What specifically can kids do?

Assessment/Follow-Up:

Before the Activity:

- Ask students to define “ground water” and “aquifer.” Record their key words on a white board to compile relatively accurate definitions. Leave the definitions on the board.

After the Activity:

- Complete “Questions for Discussion,” above.
- Refer back to the definitions students wrote before the activity. Ask if they would like to modify them.
- Have students to list as many potential ground water contaminants as they can.
- Include vocabulary in spelling lists.
- Test on definitions of vocabulary.
- Have students research ground water and aquifers in your area and compile an oral or written report.

Additional Resources:

A Citizen's Guide to Ground Water Protection (U.S. EPA Web site)

<http://www.epa.gov/safewater/protect/citguid.pdf>

DEQ Kids: Water Does a Lot for Us...What Can We Do For Water? (Publication on DEQ Web site)

http://www.deq.idaho.gov/water/educ_tools/water_quality_kids_brochure.pdf

DEQ Kids: Water Quality in Idaho (Publication on DEQ Web site)

http://www.deq.idaho.gov/water/educ_tools/water_kids_tips_fs.pdf

Drinking Water and Ground Water Kids' Stuff (U.S. EPA Web site)

<http://www.epa.gov/safewater/kids/index.html>

Eastern Snake River Plain Aquifer (Idaho State University Web site)

<http://imnh.isu.edu/digitalatlas/hydr/snakervr/esrpa.htm>

Ground Water in Idaho: Aquifers (DEQ Web site)

http://www.deq.idaho.gov/water/prog_issues/ground_water/aquifers.cfm

Ground Water in Idaho: Overview (DEQ Web site)

http://www.deq.idaho.gov/water/prog_issues/ground_water/overview.cfm

The Groundwater Foundation: Get informed <http://www.groundwater.org/gi/gi.html>

The Groundwater Foundation: Kids Corner <http://www.groundwater.org/kc/kc.html>

Spokane Valley-Rathdrum Prairie Aquifer (Eastern Washington University Web site)

<http://www.geology.ewu.edu/ftrips/aquifer/aqtour.htm>

Water Quality: Educational Tools (DEQ Web site) http://www.deq.idaho.gov/water/educ_tools.cfm