

EQ in the Classroom: The Incredible, Edible Aquifer



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.

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.

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.

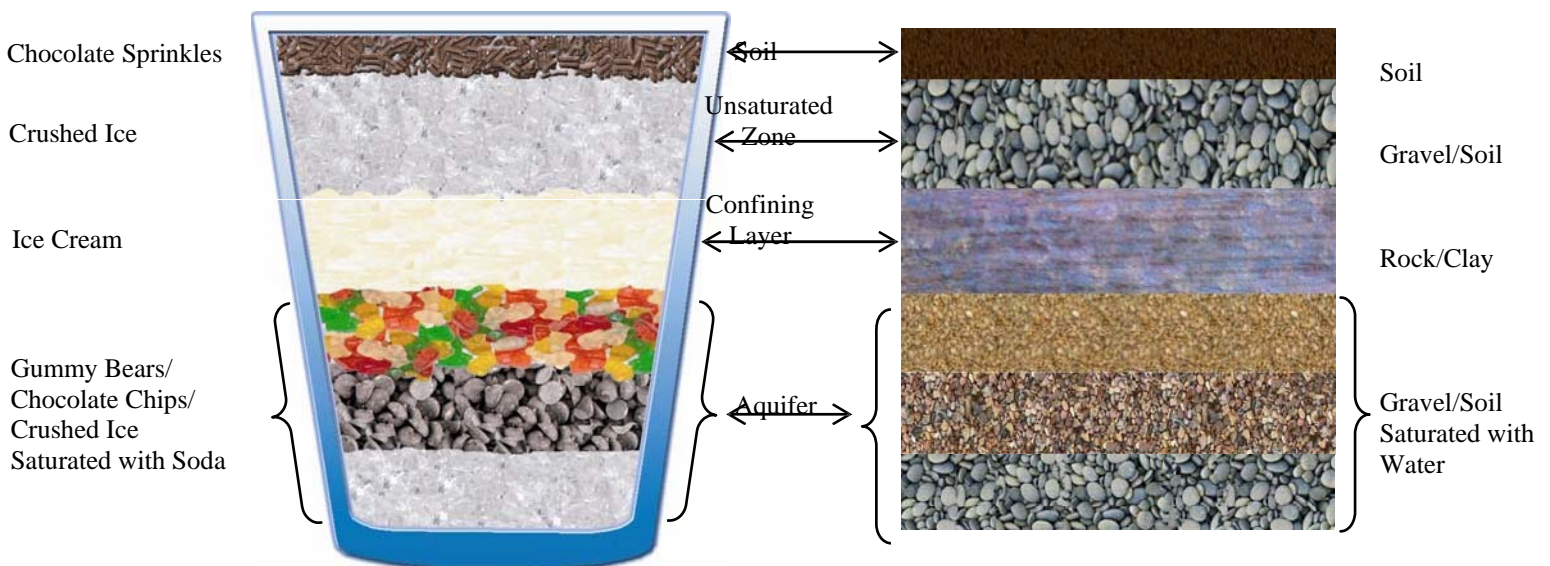
Background:

Ground water supplies 51% of the drinking water for the total population (99% in rural areas). 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.

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 Food coloring
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)



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 (pop) 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.

*This layer, called a “confining layer” or an “aquitard,” is impermeable or significantly less permeable than the aquifer below it (this means that 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.**”*

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. Place 2-3 drops of food coloring over the top.

The food coloring represents contaminants on the ground (e.g., fertilizer). Does anything happen to the food coloring right away?

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

Observe the aquifer and food coloring. 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 (food coloring) 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?

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 food coloring moves into the aquifer. The same thing happens when contaminants are spilled on the ground. Do you think you could get the food coloring back out of the soda?

Questions for discussion

1. What observations/results surprised you? What did not?

Answers may vary

2. How did results compare among other groups aquifers?

Answers may vary

3. What parts of the activity were most/least like what would happen with a real aquifer? Why?

Most like: Contaminants will move through the layers of the earth and contaminate the ground water

Least like: Contaminants do not move that quickly.

Many other responses are acceptable.

4. What happens if all of the water is pumped out of an aquifer?

Then we don't have any groundwater to be able to use to supply water to people with wells.

5. Where does more ground water come from?

Precipitation, runoff, etc

6. Do you think a contaminated aquifer can be cleaned? If so, how?

It is not easy to clean an aquifer-it can take years to clean a contaminated aquifer