

Name: \_\_\_\_\_

Geology 102

## Groundwater flow and contamination demonstration

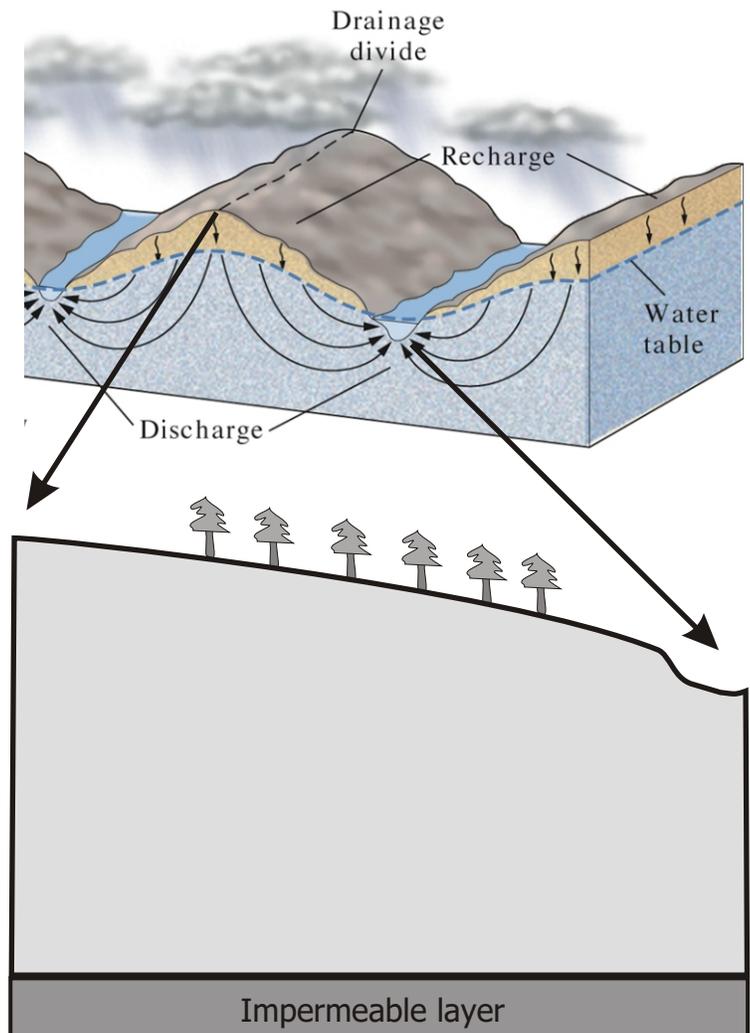
- 1) **Porosity** - We drained the groundwater tank before we brought it to class because it's lighter, but how much lighter? We can determine the weight of water added to the tank if you know the porosity of the gravel inside (which is 25%). The dimensions of the tank are 56 x 86 x 5 cm, giving a total volume of 24,080 cubic centimeters. Porosity is: Void Volume divided by Total Volume

What is the volume of voids?

The density of water is 1 g/cubic cm, how many grams of water does it take to fill the tank?

What is that in pounds (1 lb. = 453 g)?

- 2) **Water Table** - On the schematic below, sketch the position of the water table at 1, 2, and 3 minutes after filling has begun.

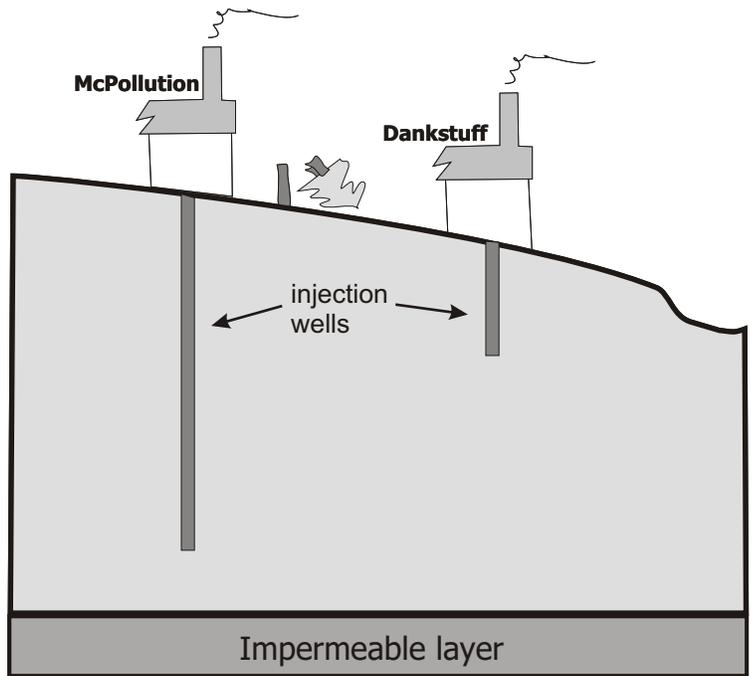


- 3) **Steady state flow** - If the rate of recharge equals the rate of discharge, the amount of water in the hillslope aquifer will be constant.

How do we know when we have achieved steady state flow?

Sketch the steady state water table and the flowpaths that water takes from the recharge zone to the discharge zone.

**4) Contamination** - Two companies built chemical plants on the hillslope (McPollution, Inc., and Dankstuff, Inc.). Both companies plan to inject toxic chemicals into wells beneath their facilities.

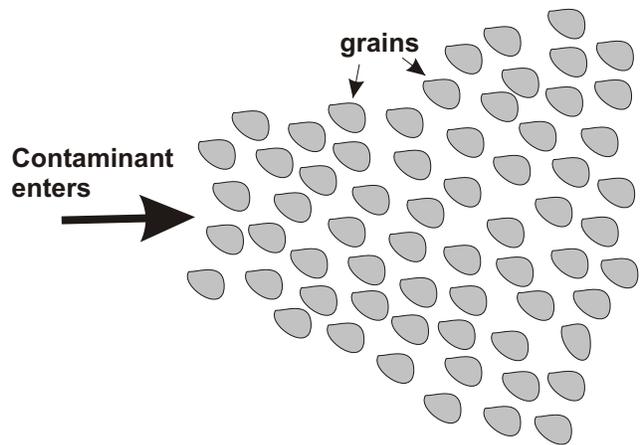


Which plant's chemicals will enter the river channel first? Why?

Outline the positions of the contaminant plumes as they evolve during the experiment.

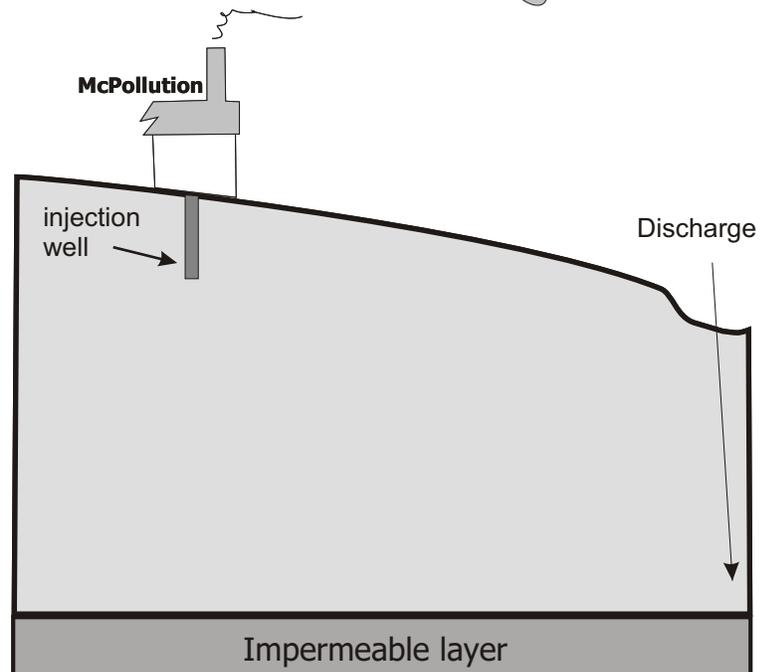
How might your answer change if McPollution had a shallow well and Dankstuff had a deep well?

**5) Dispersion**- The contaminant plumes emerge from a narrow outlet at the bottom of the wells, but the plumes quickly enlarge due to hydraulic dispersion.



Draw how this process works: Show the pathway of contaminants through the package of grains on the right:

**6) Unsaturated transport** - A prolonged period of dry weather causes the water table to lower and regional flow drives discharge along the base of the aquifer. If McPollution injects contaminant into a shallow well in the unsaturated zone, what will result?



How do flow rates vary in the unsaturated and saturated zones? Why?

Draw the water table and the position of the contaminant plume during the experiment: