Solubility and Chemical Changes in Groundwater

Objective: Students will test pH of water before and after it travels through different substrates (igneous pebbles and limestone) to determine how soluble materials can affect groundwater.

TEKS: 6.a.2, a.3, a.4, a.5, b.3, b.6, b.7, b.8, b.9, b.14 **Time Allotment:** 55 minutes

Materials: two 2-liter soda bottles (1 model bottle, 1 collection bottle), nylon screen, 1000 ml of igneous pebbles, 1000 ml of limestone, 20 ml of diluted hydrochloric acid, beaker, test tubes, pipettes, pH Indicator Solution (phenolphthalein)

Background: Solubility is a solid's tendency to dissolve. If the minerals making up rock, or materials put into the ground (like trash, fertilizers, pesticides, etc.) are **soluble**, then those materials will end up in groundwater. When the **groundwater** changes in composition its behavioral properties also change. An acidic water may react with or cause other materials to dissolve that otherwise would not. If acid rain is present in an area, then water entering the ground is already acidic and may react with the surrounding rocks and materials. In this activity, we will pour acidic water through two different model aquifers: one consisting of igneous pebbles and the other of limestone. Then, we will check pH of the water ("acid rain") that has passed through the aquifer with a pH Indicator Solution (phenolphthalein). A **chemical indicator** is something that changes color depending on its surroundings (see the pH chart on your table for details).

Procedures:

1. Put screen on model bottle.
2. Add 1000 ml of igneous pebbles and limestone.
3. Place model bottle on the ringstand over the collection bottle.
4. Test the pH of the diluted hydrochloric acid by putting two pipettes of the diluted hydrochloric acid and three drops of pH Indicator solution into a test tube. Enter the data into the chart.
5. Slowly pour 20 ml of diluted hydrochloric acid into the model aquifer.
6. Collect water in the collection bottle.
7. Transfer two pipettes of water from the collection bottle to the test tube and add three drops of ph Indicator Solution to test the pH.
8. Fill out the data table and answer the questions.
9. Share your data for your substrate (igneous pebbles and limestone) with other lab groups.

Data:

DATA TABLE

	Color of indicator/water solution	**pH (#)**
Before passing through the model aquifer		
After passing through igneous pebbles		
After passing through limestone		

Questions:

1. What happened to the pH of the water going through the igneous pebbles aquifer? ___

_____

2. What happened to the pH of the water going through the limestone aquifer? _____

_____

3. What are other soluble materials that could enter the ground water? _____

_____

_____

4. Can pollution always be seen? If not, give some examples of unseen pollution.

_____

_____

5. What should we try to do or not do in a recharge zone? _____

_____

6. What was your favorite thing that you learned in this lab?_____

_____

7. How could this lab be improved? _____

_____

8. How did the model aquifers help you understand the parts of an aquifer and the process of recharge?_____

_____

9. What are some limitations of the models? _____

_____

References: ESI: Edwards Aquifer Hydrogeology CD; ESI: Outreach Lecture Series (20) CD, Dr. J. M. Sharp; Soda Bottle Hydrology (DOE/EM-0215)