



Grade Level:
11th Grade

Subject:
Chemistry

Exhibit:
#13 Demand
Management
(The Aquifer Well)

**Approximate
Time Frame:**
2 hours (more than one
class period)

Materials:

- paper
- pencil
- pvc pipe
- five gallon bucket
- screening
- coarse aquarium gravel
- water
- topsoil
- thin rubber tube
- siphon

Lesson Plan - "Work that Well"



Science TEKS:

1. A Demonstrate safe practices during field and laboratory investigations.
1. B Make wise choices in the use and conservation of resources and the disposal or recycling of materials.
2. A Plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology.
2. B Collect data and make measurements with precision.
2. C Express and manipulate chemical quantities using scientific conventions and mathematical procedures such as dimensional analysis, scientific notation, and significant figures.
2. D Organize, analyze, evaluate, make inferences, and predict trends from data.
2. E Communicate valid conclusions.
3. A Analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information.
3. B Make responsible choices in selecting everyday products and services using scientific information.
3. C Evaluate the impact of research on scientific thought, society, and the environment.
3. D Describe connections between chemistry and future careers.

Related TEKS: Physics, Chemistry and Biology

Vocabulary of Instruction:

- aquifer
- soil types
- gravel types

Advanced Preparation: Organize students' into groups

Instructional Procedure (5 E)

Engage: The students will prioritize water use by importance at an individual level, agricultural level and industrial level. Incorporate alternatives to water use. Design and complete a variety of lab exercises to help understand sources of water, water scarcity, and water conservation.

Explore: Cut a piece of $\frac{3}{4}$ inch pvc pipe that is just as long as the depth of a five gallon bucket.

Secure a piece of screening on one end of the pvc.

Place the screen end of the pvc pipe into the bucket and hold the pipe vertical as you pour coarse aquarium gravel or some other small landscaping rocks into the bucket being careful not to pour any rocks into the pipe.

Fill the bucket up with the gravel leaving about an inch of pipe sticking up above the gravel.

Pour water into the gravel filled bucket being careful not to fill the water level above the top of the gravel. Measure and record the amount of water you poured into the bucket of gravel.

Cover the top of the gravel with a layer of topsoil. Be careful not to get any dirt into the pipe sticking out of the gravel.

The water in the gravel should fill up the pipe through the screened bottom to the water table level in the bucket.

Place the bucket on top of a table. Use a thin rubber tube to place into the pipe and siphon the water out into another container on the floor. Measure and record the amount of water you were able to siphon out.

The water level in the tube will drop as the water table level drops in the bucket.

Explain: A common misconception about the structure of an aquifer is that they are a giant void, or empty space like a cave that stores water. An aquifer is more like a deep layer of sandy coarse soil with interstitial spaces that trap water. How does the water company get this water out of the sandy soil? To help develop a conception of this you can build an aquifer in a bucket and siphon the water out.

Elaborate/Extend:

Questions:

How does a water well work?

How much water did the gravel mixture hold?

How much did you get out through your well?

Explain why you did not get the same amount of water that you put into the bucket.

Try different mixtures of soil and gravel types and determine the water



How
does a
water well
work?

capacity the bucket of gravel can hold.

How does the water company estimate the amount of water in an aquifer?

Determine the volume of your bucket and then calculate the amount of water a cubic mile of your gravel samples will hold.

Evaluate: Closure of class will consist of student groups developing and presenting a statement about what they learned today and how it may change their ideas toward their water use and other water usage in the city.