Kansas Geological Survey Educational Materials

AQUIFER MODEL ACTIVITY

KANSAS GEOLOGICAL SURVEY

The University of Kansas

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Short Description

Students will create their own aquifer model to demonstrate how groundwater moves through sediment and is pumped to the surface. Students will also use this model to measure how aquifer water levels change as a result of pumping.

Learning Goals (Students will be able to...)

- Explain the physical function of a well and a water pump
- Describe how water moves through sediment
- Demonstrate how scientists measure well water levels
- Analyze the relationship between pumping and water level

Education Level

These activities were designed for secondary learners (grades 6-12).

Standards

The activities in this document meet the following Kansas educational standards:

- MS-ESS3-1
- MS-ESS3-3
- MS-ESS3-4
- HS-ESS3-1
- HS-ESS3-6

AQUIFER MODEL ACTIVITY

Materials

- Sand
- Gallon-size container
- PVC pipe
- Water
- Soap pump
- Wire mesh
- Duct tape
- Ruler
- Wooden dowel (if the PVC pipe has an internal diameter that is smaller than the width of the ruler)

Steps & Questions

1) Measure out a set amount of water that is far smaller than the container.

    a) Write the amount of water here for future use: _____

2) Pour that water into the container.

3) Dip the rod into the container until it reaches the bottom. Let it sit for a few seconds.

4) Pull out the rod and use a ruler to measure the water line as seen in Fig. 1. Dry off the rod.

    a) Record the water level measurement from the ruler here: _____

5) Insert the soap pump into the water and decide how much water you will pump out.

   a) Write the number of pumps here: _____

6) Pump the water out with the amount from 5a into a separate container.

7) Record your water depth measurement with the ruler after pumping.

   a) Record the new measurement here: _____

8) How many inches/centimeters did the water level go down?

   a) Subtract your 7a measurement from your 4a measurement:_____

9) Dump the water out of the container.

10) Place the PVC pipe, standing upright, into the middle of the container (see Fig. 2).

11) Carefully pour the sand around the pipe. Make sure no sand is in the pipe.

12) Fill the sand up to the top of the container or pipe, whichever comes first (see Fig. 3).

13) Apply a small amount of wire mesh to the bottom of the soap pump. Wrap duct tape around the mesh so it stays in place. This is to ensure no sand enters the pump (see Fig. 4).

14) Gently insert the soap pump into the sand (see Fig. 5). (Tip: it may be helpful to preemptively poke a hole in the sand to insert the pump into, but make sure there is no air around the pump).

15) Slowly pour the same amount of water from 1a back into the container. Be sure to pour onto the sand and not into the pipe. It should look similar to Fig. 5.

16) Record your observations after you pour the water:

_____

_____

_____

17) Ensure that the measuring rod is mostly dry, then insert it through the PVC pipe until it reaches the bottom. Let it sit for a few seconds, then remove it and measure the water level with your ruler.

a) Record the water level measurement from the ruler here: _____

18) Compare your answer from 17a to 4a. How are they different? Why?

_____

_____

_____

19) Carefully pump water out of the model using the same amount of pumps as in 5a. If the pump is struggling, try reinserting it but this time into the PVC pipe.

a) How clean/dirty is the pumped water?

_____

20) After you pump the water, and ensure the rod is mostly dry, use the rod to re-measure the water level as you've done before.

a) What is the new measurement of the water line?_____

21) Subtract the water line from 17a to the water line in 20a.

a) Record the difference here:_____

22) Compare your answers from 8a to 21a. How different are they? How would you explain this phenomenon?

_____

_____

_____

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23) If you have time, carefully remove the pump from the aquifer. Your mission? Design a new pump and use whatever materials you have on hand to create a more efficient pumping mechanism, with cleaner water than before!

a) Photograph or set aside the pumped water sample from the first pump. This will be used to compare to the final result.

b) Brainstorm with your group on how to design your new pump. Write down your idea here:

_____

_____

_____

c) Assemble the pump and gently reinsert it back into the model. Pump out the same number of pumps as before. Compare your new water sample with the old one. Is it cleaner than before? Why or why not?

_____

_____

_____

24) Test different soil! Remove the sand from the container and replace it with a new "soil": finer sand, dirt, large pebbles, etc. Add the same amount of water as in 1a. Measure the water level and compare it to the water level from 17a.

a) What's the new water level? _____

b) Why do you think the water level is different?

_____

_____

_____

c) Is the pumped water cleaner or dirtier than the original water? Why?

_____

_____

_____

d) How might soil content affect real life irrigation?

_____

_____

_____

Fig. 1

Fig. 2

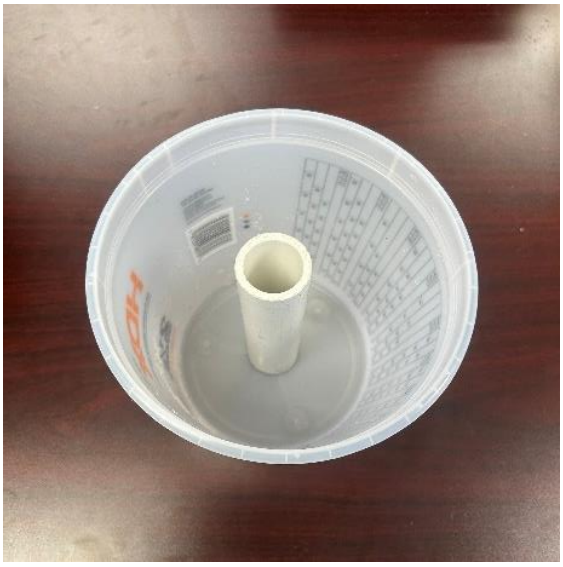

Fig. 3

Fig. 4

Fig. 5