

How Safe Is Our Groundwater? Strand 2.4

In many parts of the United States, drinking water is supplied by underground wells. In fact, more than 130 million Americans get their water from underground water supplies. Although this water varies in quality, it usually comes directly from the ground clean and safe to drink – at least it has in the past. In recent years there have been more and more reports of tainted wells and polluted groundwater.

BACKGROUND

In this investigation you will organize into small teams and explore how layers of earth act as a filter for groundwater supplies. You will make models of the Earth’s natural filtration system and put them to the test to see how well they filter out various substances. Although most of the substances used in the exploration are not normally dangerous to human health, they will help you explore how safe our groundwater supplies are from surface contamination.

PREPARE

1. Label four cups as follows “contaminant glucose,” “contaminant soil,” “contaminant food coloring,” and “water” (control).
2. Fill these cups two-thirds full with clean water. Then add to each cup the contaminant listed on its label. (See the chart below for the amount of each contaminant.) Stir each mixture thoroughly. These mixtures will represent surface water.
3. Carefully observe each beaker, and log your observations in your notebook. Create a data table similar to the one below to organize your observations

Observations of Substances in Surface Water		
Contaminant	Appearance	Measurements (if any)
Glucose (5 mL)		
Soil (5 mL)		
Food Coloring (5 drops)		
Water (control)		

GROUND FILTRATION MODELS

4. Set cups aside, and make four separate ground filtration systems. To do this, use a thumbtack to pole six holes in the bottoms of four plastic cups. Then fill each cup with layers of gravel, sand, and soil as shown on the picture. Make each model identical to the next. Be sure to approximately 2 cm of space between the surface of the soil and the top of the cup.
These cups of gravel, sand, and soil represent the earth through which surface water percolates on its way to underground water supplies. You have made four models so that you can test four different water mixtures.

TEST YOUR EARTH FILTERS

5. You are now going to pour each surface water mixture through an earth filter model. But first predict how well the filters will clean each water sample. Write your predictions in your notebook.
6. Stir a water mixture in its cup, and immediately pour it through an earth filter into a clean cup. Do the same for each water mixture. To reduce then number of cups needed, clean the empty beakers as you proceed. Re-label the beakers to keep track of the contaminants.

ANALYZE YOUR RESULTS

7. Once each water mixture has been filtered, observe the resulting “groundwater.” In your notebook, record your observations in a table similar to the one shown previously. This new table should be titled “Observations of Substances in Groundwater.” This should be in your notebook

8. Test the glucose-water mixture for the presence of glucose. Is glucose still present after filtering? Can you see it?
9. Was the soil removed from the water by filtering? Was the food coloring removed? How do you know?
10. How accurate were your initial predictions? What conclusions can you draw from this filtration experiment? Write your prediction results and conclusions in your notebook.

ON YOUR OWN

11. Choose a common substance from the materials list that hasn't been tested and that you think represents a threat to our water quality. Or, you may want to pick your own substance. Predict what would happen if you mixed this substance in the water supply and then filtered it through the earth. Would the earth filter it out? What did you learn from the previous experiment that would lead you to your prediction?
12. Now test your prediction. Use the filter that was the control in the earlier experiment. This filter would not have been contaminated. How did your results compare with your prediction?
CAUTION Do not taste any of the substances you are testing. Dispose of all substances according to your teacher's instructions.
13. Compare the results with the results of other teams. What generalizations can you make about what substances will or will not be filtered by the natural percolation of the surface water down through earth? What precautions do you recommend for keeping groundwater clean? Write a summary of your investigation of the new substance tested in your notebook.

MATERIALS

- 12 oz plastic cups (9)
- marking pen
- glucose solution
- red food coloring
- 100 ml graduated cylinder
- stirring rod
- glucose test paper
- thumbtack
- gravel
- sand
- soil
- metric ruler
- optional substances: motor or cooking oil, vinegar, fertilizer, detergent
- notebook
- pen or pencil