Water Purification

Student Worksheet

Name_____

Overview Today it's all about swamp muck science! Can you take your teacher's batch of yucky, mucky ooze and transform it into clean water? You bet!

What to Learn You will see that you can use a whole bunch of different filtering tricks to separate out what you want from what you don't want.

Materials

- "swamp muck" (water, coffee, and coffee grounds)
- sand (clean sand, from the hardware store)
- alum (found in the grocery or drug store) (MSDS)
- lime (found in gardening store) (MSDS)
- clear water
- carbon (found in a fish store—used to clean tanks) (MSDS)
- cheese cloth
- 3 clear containers, such as jars
- Erlenmeyer flask or other container
- funnel
- medicine dropper or syringe dropper
- 2 cotton balls
- measuring spoons (1/4 and 1/2)
- paper towels
- disposable light stick (optional)

Lab Time

1. Aeration:
    a. Pour swamp muck into cup #1. This aerates the sample, allowing trapped gases to be released.
2. Coagulation:
    a. To the swamp muck sample in cup #1, add ½ teaspoon alum (aluminum sulfate) and ¼ teaspoon lime (calcium hydroxide). CAUTION: Lime is a hazardous chemical. Use gloves and eye protection! Alum collects small dirt particles, forming larger, sticky particles called floc.
3. Sedimentation:
    a. Stir; allow to sit for 10 minutes. The larger floc particles will settle to the bottom of the cup.
4. While waiting for sedimentation, prepare the following:
    a. Cup #2: clean water
    b. Cup #3: empty. The sample will be poured into it later
    c. Erlenmeyer flask or other containter: clear water and small scoop of carbon. Use a rubber band to attach cheesecloth over the mouth of the container. Swirl to mix.
5. Make the filter:
    a. Fluff 2 cotton balls as much as possible. Stuff into funnel.

    b. Put funnel in Cup #3 (empty cup) and pour carbon water over cotton balls. Run the dripped-out water back through the funnel a few times, making cotton balls as dark as possible.
    c. Add a layer of sand on top of the cotton balls. It should cover the balls entirely and come right up to the top of the funnel.
    d. Using a dropper, add clean water from cup #2 to get the filter saturated and ready to filter.
6. Filtration:
    a. Without disturbing the sample, notice where the floc is (the dark, solid layer at the bottom). The larger particles have already been filtered out without using a filter!
    b. Using a dropper, take a sample from the layer above the floc (closer to the top of the container) and drip it into the funnel. Observe your clean water!
    c. Continue this process until the liquid starts to turn pale, indicating the filter is saturated and can't filter out any more particles.
7. To make a "radioactive" sample:
    a. Shake a light stick until it glows
    b. Cut open, pour material into filter. This allows you to observe where the swamp muck got stuck.
8. Invert the funnel over four layers of paper towels. Observe where coffee grounds and light stick material is located.

Water Purification Data Table

Action	**Observations** *(How did it work? Why was it important?)*
Pouring swamp muck into cup	
Adding alum	
Allowing swamp muck to sit for 10 minutes	
Using cotton balls in the funnel	
Adding carbon water to the cotton balls	
Putting sand on top of the cotton balls	
Putting glow stick material in the filter	

Exercises Answer the questions below:

1. What are the five stages of filtration?

2. What was the purpose of alum in this experiment?

3. Where were the coffee grounds located?

4. Why did the cotton balls need to be as dark as possible?

Exercises

1. What are the five stages of filtration? (Aeration, coagulation, sedimentation, filtration, disinfection.)
2. What was the purpose of alum in this experiment? (It aided in the coagulation stage, where small bits of dirt stuck to the alum)
3. Where were the coffee grounds located? (In the sand)
4. Why did the cotton balls need to be as dark as possible? (The more carbon, the more efficient the filter will be in filtering out unwanted particles).

Closure Before moving on, ask your students if they have any recommendations or unanswered questions that they can work out on their own. Brainstorming extension ideas is a great way to add more science studies to your class time.