Name: _____

Raw Water Activities

Directions:
Record your observations during each activity in the boxes below. Draw a picture of your test if you'd like. Answer the discussion questions below each notes box.

pH Activities A and B

pH Activity 1A - Steps:

1. Dispense a portion of each solution into paper cups
2. Test each one by dipping the litmus paper into the solution.
3. If the litmus paper turns red, the solution is acidic.
4. If the litmus paper turns blue, the solution is basic.

Solution	Prediction (color)	Actual (color)	Is it acidic or basic?

pH Activity 1B Steps:

1. Fill test cell to the line with the water sample to be tested.
2. Add 5 drops of the pH solution to the test cell.
3. Place cover over the test cell and invert several times to mix.
4. Compare the color obtained during the reaction to the respective color standards.

Solution	Prediction (color)	Actual (color)	What is the pH level?

Discussion Questions:
Summarize what we learned about the pH scale.

How do you think pH contributes to or indicates the quality of the water?

How do you think water quality affects life in an ecosystem?

What do you think would happen to an ecosystem if the pH suddenly shifted either more acidic or more basic?

Chlorine Activity

Steps:

1. Fill test cell to the line with the water sample to be tested.
2. Add 5 drops of the OTO solution to the test cell
3. Place cover over the test cell and invert several times to mix.
4. Compare the color obtained during the reaction to the respective color standards.

Solution	Prediction (color)	Actual (color)	What is the chlorine level of the sample?

Discussion Questions:
Summarize what we learned about Chlorine.

How do you think the chlorine level contributes to or indicates the quality of the water?

Should chlorine be in natural water sources such as rivers and lakes?

What do you think would happen to a natural ecosystem if the chlorine levels were too high?

Hardness Activity

Steps:

1. Fill each of two jars with ¼ cup of distilled water.
2. Label one jar with an "S" for soft and the other with an "H" for hard.
3. Add ¼ teaspoon of Epsom salt to the jar labeled "H". Allow the salt to completely dissolve.
4. Add one drop of dishwashing liquid to each of the jars.
5. Tighten the lids and shake both jars for 30 seconds.
6. Allow both jars to stand for 15 seconds.
7. Use the ruler to measure the height of the suds above the water level. Record results.

Sample	Height of Suds (in cm)	What does that tell you?
"S"		
"H"		

Discussion Questions:
Summarize what we learned about hardness.

How do you think the hardness level contributes to or indicates the quality of the water?

What levels of calcium and magnesium do you think are present in natural/raw water (before being treated)?

What do you think would happen to a natural ecosystem if the hardness levels were too high? Too low?

Water Treatment and Pollutant Cleanup Activities

Directions:
Record your observations during each activity in the boxes below. Draw a picture of your test if you'd like. Answer the discussion questions below each notes box.

Oil Spill Cleanup

Steps:

1. Discuss Water Pollution & Water Purification prior to conducting activities (use the background information section). This will serve as base-level knowledge for the information presented and other activities in this lesson.
2. Fill the pie pan half full with water.
3. Carefully drip ten drops of the motor oil on the surface of the water. Try to form one large drop of floating oil on the surface of the water.
4. Use the toothpicks to gather small drops of oil into one large drop if necessary.
5. Carefully sprinkle the vermiculite over the entire oil drop. It may be useful to use the paper to assist in this task.
6. Use the toothpicks to move the vermiculite-covered oil around. Experiment with methods of removing the oil coated vermiculite from the water. Observe the mixture after it has remained undisturbed in the water for thirty minutes.
7. Record observations.

Draw a picture in the box below of your oil spill:

Write what procedure you used for cleaning up your oil spill:

What does that tell you about how oil is cleaned out of water?

Discussion Questions:
Summarize what we learned about water pollution specifically oil pollution.

What were the ways BP tried to clean the oil spill in the gulf coast in 2010?

What are the complications of an oil spill besides obvious harm to the environment? What else happens as a result? Who else is affected?

Phosphate Cleanup

Steps:

1. Prepare "alum water" by dissolving one teaspoon of alum in one-quarter cup of water. Label the cup as "alum water"
    a. Note: some of the alum may not dissolve. Allow the "alum water" to sit for one minute before using.
2. Prepare "phosphate contaminate" water by dissolving one tablespoon of plant food into one-half cup of water. Stir to dissolve the fertilizer in the water.
3. Clean up the "phosphate contaminated" water by adding one-half teaspoon of the "alum water" to it. After mixing, allow to set for several minutes to several hours before recording observations.
4. Record observations.

Draw a picture of your samples:

"alum water"	"phosphate contaminate"
Observations:	

Discussion Questions:
What can we learn from what we observed?

Summarize what we learned about water pollution specifically phosphates.

Where do phosphates come from?

Who is ultimately in charge of cleaning phosphates out of wastewater?

Why is in important to do this? Why should we be concerned about cleaning or treating wastewater?

What is wastewater used for? Why?

Groundwater Contamination

Steps:

1. Wrap the straw with the gauze.
2. Hold the wrapped straw in the center of the cup and carefully place the gravel around the millimeters of the top of the gauze.
3. Carefully slip the straw out of the gauze allowing the cloth to remain in the hole.
4. Pour clean water into the cup.
5. After a few minutes the water should appear in the opening of the "well".
6. Use the eyedroppers to remove the clean water from the well. Return the clean water to the well.
7. Add a drop of food coloring (simulates contamination) to the gravel surrounding the well.
8. After a few minutes remove the water again from the well. The water will now contain contamination from the food coloring.

Draw a picture of your groundwater model:

Observations:

Discussion Questions:

Summarize what we learned about groundwater and groundwater contaminants.

Do you think groundwater is more or less pure after it is pumped from the ground? Why?

Why is groundwater harder to clean?

Knowing what we know now about groundwater contaminants and cleanup, how do you suggest we protect groundwater from becoming polluted in the first place?

Water Treatment Simulation

Steps:

1. Prepare water to be purified by mixing one cup water with approximately ½ tsp potting soil.
2. Aeration: simulate aeration by pouring the dirty water back and forth between two cups.
    a. Water is sprayed into the air to release any trapped gases and to absorb additional oxygen.
3. Coagulation: add one teaspoon of the alum to the dirty water. Mix well.
    a. To remove dirt suspended in the water, powdered alum is dissolved in the water and it forms tiny, sticky particles called "floc" which attached t the dirt particles. The combined weight of the dirt and the "floc" becomes heavy enough to sink to the bottom during sedimentation.
4. Sedimentation: allow the sample to remain undisturbed for several minutes. While the sample is settling, prepare the filter materials described in step 7. The larger "floc" particles settle to the bottom.
5. Filtration: prepare the filter by lining the paint filter with two cone-shaped coffee filters and adding a layer of gravel to the bottom of the filter assembly followed by the layer of sand on top of the gravel.
    a. Place the filter over a clean, empty cup. Pour the sample that has been allowed to settle into the filter.
    b. The "floc" particles are trapped in the layers of sand and gravel.
6. Disinfection: add a small amount of very dilute bleach solution to disinfect the sample. At this point, you can us a pool kit capable of measuring chlorine to measure how much disinfectant is present in the "finished" sample.
    a. A small amount of disinfectant is added to kill the remaining bacteria.
    b. Note: DO NOT drink this water!

Draw a picture of what you did at each step:

Aeration
Coagulation
Sedimentation
Filtration
Disinfection

Discussion Questions:
Summarize what we learned about the water treatment process.

Why are there so many steps?

Why is each step important?

Why is water treatment important for human health?

Do we need to treat water for other uses other than drinking?