WATER, WATER EVERYWHERE DIFFERENT

PRE LAB DISCUSSION

This lab will help us compare the properties of water samples from different sources. The ***impurities*** in water may affect its taste or usefulness in specific chemical processes. We will use various techniques to measure these impurities.

Water that tastes ***good*** is not the same for everyone. What tastes good depends on the palette of the taster. To some extent, taste is learned. This is why some of us prefer Coke, some like Pepsi, and others always buy Frank's Cola.

Conductivity

Pure water does not conduct electricity. However, the water in our world is seldom pure. Water is often called the "universal solvent" because many elements and compounds can dissolve in it. Take, for example, rainwater. Rain dissolves both gases and suspended solids as it falls to the ground, leading to such extremes as "acid rain" in highly polluted atmospheres.

Electrical conductivity is a measure of the total amount of dissolved ions in the water. This does not indicate specific elements or compounds, which are dissolved in the water, but rather the total amount of dissolved ions. Water from the same source may show different amounts of conductivity in different seasons or with different weather conditions. For instance, the conductivity of water in the winter changes when there has been a lot of salt applied to the roads to melt ice and snow.

We will use a simple conductivity device. A clear electric light will allow us to compare the *relative* conductivity of the water samples. If we wanted to be more exact we could use a multimeter to measure the exact conductivity in ohms of resistance.

pH

This is a measure of the amount of acidity or alkalinity of the water. This can be measured with either a battery operated pH meter or by using the pH test paper. Neutral water will have a pH of 7. Water that is below 7 is acidic and water that is above 7 is alkaline.

Carbonates

Water that has traveled under ground or over limestone dissolves some carbonates (CO_3). Usually this is calcium carbonate. Water that is high in carbonates usually does not have a low pH. This is because any acids that may have been present in the water have reacted with the limestone. This water will often leave a white residue when it evaporates. Dilute hydrochloric acid will react with solid carbonates producing bubbles.

To test for carbonates in solution, a saturated solution of lead nitrate will be used. The reaction between the carbonate and the lead nitrate produces insoluble lead carbonate. The amount of cloudiness indicates the amount of carbonate in the water. This white substance will slowly settle to the bottom of the test tube.

Hardness (total)

Water is called *hard* when it contains a lot of dissolved minerals. These minerals can include calcium, chlorides and sulfates. This type of water makes it difficult to produce suds of lather and leaves a "ring-around-the tub" residue. Many of the laundry products on the market today include a water softener compound in the detergent to prevent a gray color remaining on washed clothes.

There is a simple test for hardness. Just add a drop of soap solution to 5 ml sample of water and shake for 15 seconds. Then measure the height of suds on the sample. In order for this test to be accurate, each sample must be shaken with the same energy. Testing labs use shaking machines to do this, but we will have to rely upon our own shaking skills.

Total Dissolved Solids

The total amount of solids can be determined by evaporating a measured amount of water and observing the amount of residue.

OBJECTIVES: To determine the differences between the samples of water obtained by the class.

CHEMICALS/EQUIPMENT: At least 5 samples of water including distilled water, rainwater, pond or stream water, pH paper or meter, conductivity tester, lead nitrate solution, soap solution[1], test tubes, stoppers, watch glass, beaker, ring stand, ring, screen, Bunsen burner.

PROCEDURE:

1. Using the conductivity apparatus, test each water sample and rate the samples from the most conductive [1] to the least conductive [5]. Record this rating in the data chart.

2. Determine the pH of each sample and record the pH in the data chart.

3. Place 10 ml of each sample in separate, labeled test tubes. Add 2 ml of saturated lead nitrate solution. Rate the samples from the most lead carbonate produced [1] to the clearest [5]. Record this information on the data chart under carbonates or CO_3.

4. Place 5 ml of each sample in separate labeled test tubes. Add one drop of soap solution to each sample. Shake each sample 15 seconds and measure the height of the suds immediately. Record the height of the suds in the data chart.

5. Place a beaker 3/4 full of tap water above a Bunsen burner using a ring stand, ring, and screen. Then put a watch glass on top of a beaker and fill the watch glass with one of the water samples. Boil the water in the beaker and allow the steam to evaporate the water in the watch glass. Be careful not to allow the beaker to boil to dryness. Repeat this for each water sample. Then compare the amount of residue on the watch glasses and rate the water samples from the most [1] to the least [5] amount of dissolved solids.

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[1] Soap solution can be made using any hand soap dissolved in water. Shampoos and some dishwashing liquids may be designed to foam too well to use in this lab.

DATA CHART

Sample source	Electrical conductivity	PH [acid/base]	Carbonates CO_3	Hardness	Total Solids

THINKING SCIENTIFICALLY

1. Chemists and pharmacists use distilled water when making solutions. Why do they use this type of water rather than tap water?

2. Many women wash their hair in rainwater or "soft water" when it is available. Why would they prefer this water for their hair?

3. If you showered in salt water, could you clean yourself well? Why or why not?

4. Using the information from the data sheet, what effect do you imagine the dissolved chemicals have on the taste of the waters? [DO NOT taste samples from non-approved drinking water sources]

EXTRA

1. Take a survey of students using a questionnaire and determine what type of water they prefer for drinking.

2. Set up a water taste test with drinking water from several sources. Number the water so that the subjects do not know the sources of water. Then select students at random to sample the waters and rate the taste as excellent, good, OK, or poor. [Make sure that the water is safe to drink, e.g. **no** stream or pond water.]

3. Compare the data collected in the two questions above. Use charts and graphs to present the comparisons. What conclusions can be drawn from this data?