PRELIMINARY ACTIVITY FOR

Water Treatment

Every community has a method for pre-treating drinking water from a ground or surface water source. Sometimes the term *water purification* is used for this treatment, but this term incorrectly suggests that the end result of this process will be *pure* water, with no impurities. A better term to describe this process is *water treatment*. In order to be assured that water from a well, stream, or lake has enough impurities removed by water treatment to be used as drinking water, it must go through several water treatment steps. These steps may include settling, filtration, or pH adjustment. Far from making the water "pure," the treatment will in many cases simply reduce some impurities to a level found to be acceptable by government agencies. Some typical EPA (Environmental Protection Agency) standards for drinking water are shown in this table.

Selected EPA Drinking Water Standards	
Contaminant	**Standard**
pH	6.5-8.5
Total Dissolved Solids	< 500 mg/L
Turbidity	< 5 NTU
Chloride	< 250 mg/L
Nitrate	< 10 mg/L
Copper	< 1.3 mg/L
Lead	< 0.015 mg/L

In the Preliminary Activity, you will gain experience using a Conductivity Probe, a pH Sensor, and a Turbidity Sensor as you determine the total dissolved solids (TDS), the pH, and the turbidity of a water sample provided by your teacher.

Here is a brief summary of each of the three measurements you will be making:

- **pH** is a measurement of how acidic or basic a water sample is. The pH scale ranges from 0 to 14. Drinking water with a pH greater than 7 is *basic*, and with a pH less than 7 is *acidic*. It is quite common for drinking water to be slightly basic (between 7 and 8.5), due to the presence of hard-water minerals. EPA standards recommend that drinking water be in the pH range of 6.5–8.5. Because slightly acidic water can cause metal pipes to corrode, if drinking water has a pH less than 7, communities will sometimes adjust that pH to a value that is greater than 7.

- **Total dissolved solids** (**TDS**) is found to be in a wide range of levels in drinking water. The TDS level of a drinking water supply should be less than 500 mg/L, according to EPA standards; however, high level of TDS from dissolved ions is not usually considered dangerous or harmful, however, and at worst results in water being "hard" (*hard* to make soap suds), or gives it a slightly bitter or salty taste.

- **Turbidity** is a measurement of the cloudiness (or lack of clarity) of water. The EPA standard for turbidity of drinking water is a value of less than 5 Nephelometric Turbidity Units (NTU). Water with readings in this range will appear to be clear. To reach low levels of turbidity during water treatment, it is sometimes necessary to remove particles or suspended particulates by filtration, screening, or flocculation.

After completing the Preliminary Activity, you will first use reference sources to find out more about water treatment before you choose and investigate a researchable question. Some topics to consider in your reference search are:

- drinking water purification
- water treatment
- filtration
- settling

- pH adjustment
- wastewater treatment
- sewage treatment

PROCEDURE

1. Obtain a sample of untreated water.

2. Stir the untreated water sample, and then use a Conductivity Probe to obtain the total dissolved solid (TDS) value for the *unsettled water*. Set the switch on the Conductivity Probe box to 0–2000 µS/cm (2000 µS/cm = 1000 mg/L TDS). Record the value (in mg/L).

3. Stir the untreated water sample, and then use a pH Sensor to measure the pH of the *unsettled water*. Record the value.

4. Collect turbidity data.

   a. Connect a Turbidity Sensor to the interface. Allow the powered Turbidity Sensor to warm up for five minutes.
   b. Calibrate the sensor or manually enter calibration values following instructions from your teacher.
   c. Fill your turbidity cuvette with *unsettled water* until the bottom of the meniscus is *exactly* at the top of the line on the cuvette. This sample level is critical to obtaining correct turbidity values.
   d. Gently invert the cuvette four times to mix any particles that may have settled.
   e. Measure the turbidity of the *unsettled water* sample. Record the value (in NTU).

QUESTIONS

1. What were the TDS, pH, and turbidity values (in mg/L, pH units, and NTU, respectively) for the unsettled water that you tested in the Preliminary Activity?

2. Which of the three water quality characteristics of the water you tested, TDS, pH, and turbidity, met EPA drinking water standards? Which did not meet EPA standards?

3. How are suspended particles that give water an unpleasant, murky appearance removed from water?

4. Why do some communities adjust the pH of drinking water?

5. List at least one researchable question for this experiment.