

Chapter 6. How Much is a Lot?

Lesson 1. Understanding water quality measurements and terms

Overview: We have seen in past lessons that water quality is really a matter of perspective. It is just how we look at the water and its intended use. The water quality issue is sometimes quite subjective. At those times, it is unclear, a matter of perspective and not easily expressed to others.

There are ways to describe and discuss water quality objectively. In those cases, the term, value or description is clear and definable to all observers. In this lesson, we will examine some objective ways to measure and talk about water quality.

Every human being, whether he or she knows it or not, has a concern for water quality. Occasionally, we need to speak with others about it. To ensure understanding when we do, we use standard terms, definitions and methods of measurements. Understanding these special terms makes water quality issues easier for us to understand.

Purpose: The purpose of this lesson is to explore some common terms, definitions, and units of measurement used to characterize the quality of water. Students will have the opportunity to make some calculations of water quality parameters.

Ideas Taught: The idea taught in this activity is that "concentration" is the actual amount of something (a contaminant or constituent) dissolved or present in a known amount (usually volume) of water. "Load" is another commonly used water quality term, is the total contaminant or constituent in a unit of water.

Materials Needed:

- Several plastic cups or bowls to hold small items
- A supply of small items (thumb tacks, paper clips, tooth picks, marbles)
- A roll of masking tape
- Measuring stick, ruler, or tape ruler
- Chalk
- Blackboard

Procedure: Before the class begins, place several pieces of the small item (paper clips, thumb tacks, tooth picks, marbles) in each cup and put one cup on each bench. You should have one cup for each group of two to three students, putting a different number of objects in each cup. When class begins, start by discussing with the class the issue of water quality. Write the words "subjective" and "objective" on the board. Ask the students if they know what these terms mean. If they do not know, explain that subjective means something like a general description, while objective means something like an exact definition. For instance, if someone were to ask you if you how much money you have in your pocket and you said, "a lot," that would be a subjective answer. However, if you said, "I have 95 cents," that would be an objective answer.

Now, ask the students what we mean when we talk about water quality. In other words, do we talk about it subjectively or objectively? On the blackboard write three headings, as follows:

Ask the class to explain in just a few words what it means when we talk about water quality. Typical answers might be "How dirty the water is," "Will it make me sick?" "Is it safe to drink?" Write or list the students' ideas under the column heading "What It Means."

Repeat the exercise, this time asking the question, "What kind of thing do we consider or measure to show quality?" List the answers under the Quality Indicators column. Some answers might be: temperature, color, clarity, taste, smell, salt level, chemicals, pesticides, metals, bacteria. Point out how some of these are physical, chemical, or biological. Point out that some of these are health-related, some are not, and the effects of some are unknown.

Finally, ask the class, "How do we describe it?" Tell them you are interested in the units or dimensions we use to describe water quality when talking to someone. For instance, we measure temperature in degrees, either Fahrenheit or Centigrade. If we say to someone that the water temperature is 36 degrees F, we know it is too cold to bathe or swim in, but just right for a cold drink. On the other hand, if we say the water is 100 degrees F, we know it is just right for a bath or shower, but not hot enough for soup. Speaking of degrees allows us to define the quality in terms everyone understands. We need to be able to do this with other aspects of water quality.

Now finish listing the responses the class makes about how we measure or describe water quality. Other ways include concentration, clarity, pH, load, milligrams per liter, parts per million, and grains per gallon. Your table might look like the following table when you finish.

| Water Quality | | |
|--|---|---|
| What It Means | Quality Indicators | How Described |
| How dirty is the water? Will it make me sick? Is it safe to drink? | Temperature, taste, smell, color, salt level, clarity, chemicals, pesticides, metals, bacteria | Degrees, milligrams/liter, parts per million, grains per gallon, feet light penetrates |

Before moving on to the next section, ask the class if they know the difference between a contaminant and a constituent. Write these two words on the blackboard: "contaminant," and "constituent." Listen to the answers the students give. Explain that a contaminant introduced into the water diminishes or deteriorates the water quality for its intended use. A constituent is naturally occurring, an integral part of the water, which does not necessarily adversely affect quality. In short, everything that is present in water is not necessarily a contaminant.

Tell the class you are now going to talk about commonly used units or dimensions for describing water quality. The unit is "concentration." Ask the class what they think concentration is. Write the word "concentration" on the board. Let's look at some examples.

Have the class separate into teams of 2-3 persons each. Have each team count the number of items (paper clips, thumb tacks, tooth picks, marbles, or another small item) in the cup in front of them. Tell them that each single item or unit could be a molecule, a milligram (one one-thousandth of a gram), or a pound of some thing. Place all the items in the cup in a quart of water. The concentration would be _____ per quart, where the blank is the number of units and dimensions (for instance 10 marbles per quart). For instance, if each item in the cup were one gram and there were 20 units of the item, then the concentration would be 20 grams per quart. If the volume of water had been one liter, then the concentration would be 20 grams per liter.

Ask each team what the concentration would be if each unit were a gram and all of them were placed in a quart of water. This is what concentration means: the total amount of something dissolved or contained in a specified amount (usually volume) of water.

With the tape, mark out a 3' x 3' square on the floor. Ask three students to stand inside the square. Now ask the class what the concentration of students is inside the square (three per nine square feet). Ask what is the concentration per square foot (0.3 per square foot). Ask what is the load inside the square (three people). If you ask each student his/her weight and add the three numbers together, the concentration will be _____ pounds per nine square feet and the load

will be _____ pounds.

Write the word "load" on the board.

The lesson above was adapted from "What is Water Quality? A Resource Guide for 4-H Leaders and Teachers," 80 pages of activities and experiments related to water quality. (\$5.00) Order from the Montana 4-H Program at Montana State University-Bozeman. Phone 406-994-3501.