Clark Fork Watershed Education Program
Education Portal Lesson: What is a Part Per Million?
Student Worksheet

Introduction

Water quality is generally determined by how much and what kind of "stuff" is dissolved in the water, as well as other conditions like temperature and cloudiness (turbidity). Some things that are dissolved in water are good for us. For example, oxygen dissolved in water is necessary for aquatic life and ultimately determines the health and diversity of life in our streams. Most city water systems add fluoride to their water supply. Fluoride is important for healthy teeth. However, some things dissolved in water are not good for human health and are also not good for aquatic life. In this lesson, we will investigate drinking water standards, which are expressed in units of concentrations (e.g., parts per million) and examine water quality test results from various areas along the Clark Fork River prior to restoration and clean-up efforts.

Scientists measure things dissolved in water by measuring how many "parts" of the substance being measured compared to how many "parts" of water in the solution.

Explore

With your group, count the number of beads of each color in the jar given to you by your teacher.

- What is the total number of beads you have?
- How many blue beads do you have?
- How many clear beads do you have?
- Write a ratio to express the number of blue beads to the total number of beads.
- What is the percent (%) concentration of blue beads in your jar?
- Write a sentence that describes how many "parts" blue beads to the total number of "parts beads" in your jar
- Imagine you had one blue bead in a jar with 99 clear beads. How many "parts" blue beads do you have now?

Elaborate

Now let's apply the same concepts of concentration to an actual solution. You will create three solution samples.

Sample 1:

1. Measure 99 drops of water into a graduated cylinder. Record the volume of this amount of water in your notebook. (You will need this measurement later to avoid having to measure out another 99 drops). Pour the water from the 99 drops into a cup marked "Sample 1".

2. Add one drop of dark food coloring to Sample 1. Stir the water and record the color in your notebook using crayons or colored pencil.

3. What is the concentration (**one drop = one part**) of food coloring in Sample 1?

4. Can you see the food coloring in Sample 1?

5. Suppose the food coloring was a harmful substance, how would you "clean" the water?

Sample 2:

1. Measure an amount of water equal to 99 drops using the graduated cylinder. Pour the new water into a cup marked "Sample 2:

2. Add **one drop** of **Sample 1** to Sample 2.

3. Stir and record the resulting color in your notebook.

4. What happened to the color of the water in Sample 2?

5. What is the concentration of the food coloring in Sample 2?

Sample 3:

1. Measure an amount of water equal to 99 drops using the graduated cylinder. Pour the new water into a cup marked "Sample 3".

2. Add **one drop** of **Sample 2** to Sample 3.

3. Stir and record the resulting color in your notebook.

4. Can you see the food coloring in Sample 3?

5. If you cannot see the food coloring, does that mean it is no longer in there? Why or why not?

6. What is the concentration of food coloring in Sample 3?

7. How could a "parts per **billion"** concentration solution be made?