

Diluting Color Demonstration and Activity: Pernell Williams

Teacher's Guide

Goals

- To understand the relationship between phenomena on the macro scale and chemical properties on the molecular level
- To relate color and concentration through dilution

The Activity

This activity has two parts. The first part consists of a classroom demonstration in which the qualitative properties of the colored solutions are emphasized. In the second part, there is a class activity, in which students are asked to calculate the color content of the test tubes. Then, they are given an unknown solution, and they have to estimate its color content, using the dilution series.

Materials for Each Group

- Graphing paper or computer with Excel
- Eight test tubes
- Test tube rack
- Red color solution

SAFETY

Wear goggles at all times when handling chemicals.

The Demonstration

Show the students a set of test tubes with following dilutions of red color, prepared as described.

Preparation

Put eight test tubes in a test tube rack.

In the first test tube, put 25 ml of water and five drops of red color.

In the other test tubes, make a dilution series in which each test tube contains 5 ml of the solution in the previous test tube and 20 ml of water.

Lecture Notes

Tell me which one is more concentrated? How do you know?

Call up a student: Pull out the last test tube and look at it. Please tell us if it's clear.

How about the next one?

I will tell you that these solutions may or may not be clear.

Call up another student (just to make sure the students accept it).

You're looking at an example of what concentration is.

(Explain the preparation of the solutions in the test tubes.)

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Even though it doesn't show, there is red color in it.

Lecture Notes for the Activity

Give to each group of students a test tube with a solution with a different amount of red color.

Determine the amount of color in your test tubes. Be as exact as you can.

Calculate how many drops of red there are in each of the test tubes in the rack.

Figure out how to calculate the first dilution, then go on to the second and third.

Example of a calculation: In the first test tube there are five drops of color.

In the next test tube there are 5 ml from solution 1:

$$5 \text{ [drops of color]} \times 5 \text{ ml [volume of color solution]} / 25 \text{ ml [new volume of color solution]} = 1 \text{ [drop of color]}$$

Draw a graph of the data, on logarithmic scale as well, and explain.

Teaching Tips From Mr. Williams

Emphasize the relation between color and concentration

When you talk about dilution, you talk about very small amounts which cannot be seen, so you can relate macro to micro structures.

The lesson turned out to include a great deal of math. Math is necessary to understand the basics of science. It is used to describe it.

Let the students explain how they calculated.

The goal of the activity is to let the students start thinking.

It's a teaser activity; it is graded but it is just enough for the students to articulate with following activities.

Comment

If you have a spectrophotometer in hand, it is advisable to use it to show the students the real application of absorbance measurements, using the same solutions.

References: Links

<http://www.science.uwaterloo.ca/~cchieh/cact/c123/concolor.html>

A lab-related activity that uses color to monitor an equilibrium system.

References: Readings

"Using Chemistry and Color To Analyze Household Products: A 10-12 Hour Laboratory Project at the General Chemistry Level," *Journal of Chemical Education*, Vol. 75, pp: 214-215.