Concentration of Kool-Aid®

INTRODUCTION

The molarity of a solution is defined as the moles of solute per liter of solution. To determine the number of moles of solute, it is usually necessary to know its gram formula mass. If a concentrated stock solution of the substance has already been prepared, it is also possible to prepare more dilute solutions by a method known has "serial dilution". In working with Kool-Aid ®, we will treat the name like a formula and give each letter the following fake molar masses:

K = 2g O = .75g L = 3.5g A= 0.5g I = 1.5g D= 1g

CLAIM

Solutions of identical concentration of solute should have the same absorbance of light, regardless of the method of preparation.

PROCEDURE

1. Before beginning your lab you and your lab group need to complete/create calculations in BOTH tables of the calculations section of your lab.
   a. **Molarity by Addition of Solute (Show your work)**

How much? How Strong? What does it weigh?

$$(\ 0.100\ L\ )(\ 4\ \frac{mol}{L}\ )(\ Molar\ Mass\ of\ Kool-Aid)\ =\ Mass\ of\ solute\ required$$

Molarity of Solution	**Mass of Kool- Aid ® needed**
4.0 M Solution	_____g of Kool-Aid in 100 mL of solution
2.0 M Solution	_____g of Kool-Aid in 100 mL of solution
1.0 M Solution	_____g of Kool-Aid in 100 mL of solution

   b. **Molarity by Serial Dilution (Show your work)**

$M_1V_1 = M_2V_2$ Molarity 1 x Volume 1 = Molarity 2 x Volume of 2

Molarity of Solution	**Volume of 4 M Stock Solution Needed**
4.0 M Solution	**Stock Solution - No Calculation**
2.0 M Solution	_____mL of 4.0 M solution
1.0 M Solution	_____mL of 4.0 M solution

2. Preparing the plastic cups
   a. If this has not already been done, you will need to mark FIVE plastic cups with a permanent black marker at the 100 mL volume mark.

Preparation by Addition of Solute

3. Weigh out the calculated mass of Kool-Aid to make your 4 M solution. Place it in the plastic cup, and add enough water to dissolve the solute. Use your stir rod to mix the solution until all of the Kool-Aid is dissolved. Now, add water until the solution volume reaches the 100 mL mark. Stir once more to guarantee the solution is uniform.
4. Repeat Step 3 for the next 2 solutions
5. Set them aside for later.

Preparation by Serial Dilution

6. Using a 100 mL graduated cylinder, measure out the volume of 4 M Stock Kool-Aid solution needed to prepare your 2 M solution, as determined in your second set of calculations. Place this in an unused plastic cup. Now, water to the plastic cup until the volume reaches 100 mL.
7. Repeat this procedure for the other solution (1 M)

Comparison by Colorimetry

Your instructor has set up a colorimeter that is connected to a Chromebook. The colorimeter is set to measure absorbance of light at a wavelength of 470 nm (which corresponds to blue light in the visible range). Think about the reasons for this choice with Kool-Aid that is red in color.

8. Obtain a cuvette and rinse it first with distilled water, and then with a sample of the first solution to be tested (in this case, probably the "2M by Addition of Solute" solution you have prepared.
9. Once the cuvette is rinsed, fill it ¾ full with the solution to be tested. Wipe the sides of the cuvette with tissue to remove external moisture and fingerprints. Put a cap on the cuvette and place it in the colorimeter, with the blue mark at the top facing the arrow on the colorimeter's cuvette slot.
10. Close the top of the colorimeter and wait for the reading to stabilize. Record the value.
11. Open the colorimeter, remove the cuvette and rinse it, then repeat the process successively with each of the solutions you have prepared. IT IS CRITICAL THAT YOU USE THE SAME CUVETTE FOR ALL OF YOUR MEASUREMENTS!
12. When you are done, clean the cuvette and all glassware and cups.

RESULTS

Solution	**Absorbance (Wavelength = _____)**
2 M by Addition of Solute	
2 M by Serial Dilution	
1 M by Addition of Solute	
1 M by Serial Dilution	