

Workshop 4 - Station 1

How much sugar do you like in your iced coffee? Solutions can be dilute (not much solid dissolved) or concentrated (a lot of solid dissolved). We will learn how to move from concentrated to dilute in Station 2. In this station, we will learn how to make up a specific solution concentration.

Use the colorless and colored flat marbles to make up a "solution" that is 10 BPH (BPH is a fictitious unit that stands for blue marbles per hundred marbles). Use 100 marbles total. If each marble weighs 2.4 grams, what mass of blue marbles would you weigh out?

Instead of BPH, chemists use a unit called molarity, M, which stands for moles of solute per liter of solution. In today's lab, you will be using a ferrous ammonium sulfate solution whose molarity is $5.000 \times 10^{-4} \text{ M}$. This solution is provided for you, but someone had to make it up!

How many grams of solid $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ would be necessary to prepare 500.00 mL of this solution? The "dot" in the formula above means that each molecule of ferrous ammonium sulfate forms a complex with six water molecules. Be sure to include the mass of six water molecules in your molar mass.

Workshop 4 - Station 2

Solutions can move from being more concentrated to less concentrated through a dilution process (can the reverse process occur? How?). Put 50 blue and 50 colorless marbles into a beaker. What is the BPH for this solution? Remove 10 representative marbles from your solution - if your solution is mixed properly, that would correspond to removing 5 blue and 5 colorless marbles. Put these marbles into a new beaker and "dilute" using the colorless marbles to 50 marbles total. What is the BPH of the dilute solution? By what factor has the solution been diluted? Now let's look at the chemical equivalent.

In your lab, you will dilute your $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ solution.

Pipet 1.00 mL of $5.000 \times 10^{-4} \text{M}$ $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ into a 10.00 mL volumetric flask and fill to the line with deionized water. The new solution will be more dilute by a factor of _____. Without using your calculator, determine the molarity of the new solution.

Pipet 3.00 mL of $5.000 \times 10^{-4} \text{M}$ $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$ into a 50.00 mL volumetric flask. In your lab, you will then add several other reagents and then fill the flask to the mark. Calculate the molarity of the new solution.

Workshop 4 - Station 3

Back to the marbles to illustrate how to do the calculations you'll need for your vitamin pill.

For solution X, place 10 blue flat marbles with 40 colorless ones. As you did before, remove 10 representative marbles (what colors should you remove - is this the same "solution" as previous?) and "dilute" with colorless marbles to a total of 50 (solution Y). How would you calculate the "concentration" of blue marbles, in units of BPM for solution X, if solution Y is 4 BPH?

Now, let's look at the chemical equivalent.

a) Solution B is prepared by pipetting 10.00 mL of Solution A into a 50.00 mL volumetric flask and diluting to the mark. If the concentration of Solution B is 0.1045M, what is the concentration of Solution A? Start by drawing a picture to diagram your procedure.

b) If Solution A is contained in a 100.00 mL volumetric flask which was originally filled to the line, and is a NaCl solution, how many grams of NaCl were originally in Solution A?