Preparing Solutions and Dilutions Lab

Name:
Date:
Per.

Molarity (M) $= \dfrac{\text{moles solute}}{\text{L solution}}$

Percent by Mass of solute $= \dfrac{\text{mass of solute}}{\text{mass of solution}} \times 100$

Molarity by Dilution: $M_1V_1 = M_2V_2$

Objectives:

Two skills that are **essential** to a chemist are preparing solutions of known molarity (M) and diluting solutions of known molarity (M) to new, less concentrated solutions. As a basis for understanding this concept, students will learn:

  1) To accurately prepare a stock solution of known molarity.
  2) To accurately dilute this solution to a new desired molarity.

Materials:

- (2) 100 mL volumetric flask with caps
- Funnel
- Balance
- NaCl
- Tap water
- 10 mL graduated cylinder
- dropper
- small beaker filled with water

Pre-Lab

1. Differentiate between the terms <u>solute</u> and <u>solvent</u>.

2. How many grams of $AgNO_3$ are necessary to make 1.0 L of a 6.0 M stock solution?

3. How would you make 1.0 L of a 0.1 M solution of $AgNO_3$ from your 6.0 M stock solution?

Part 1: Preparing a 0.5 M NaCl Stock Solution

Background

Volumetric flasks *(see figure)* are designed for easy and accurate preparation of solutions of a given volume. The flask is easily swirled to mix the contents if the liquid level is below the neck. The volume measurement at the fill line is very accurate. The flasks can be stoppered for long term storage of solutions.

fill line →

neck of the flask
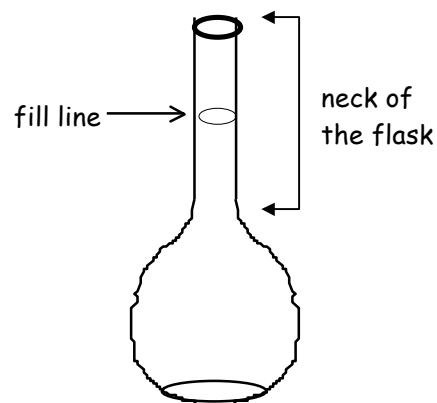
A volumetric flask

Procedure – work as accurately as possible!

1. Obtain a 100 mL volumetric flask.
2. Calculate the mass (grams) of solid NaCl necessary to prepare 100 mL of a 0.50 M NaCl aqueous stock solution. **Show your work in the calculations section**.
3. Use the funnel to add the NaCl solute to the dry volumetric flask.
4. Fill the flask about halfway with tap water. Be sure to rinse any solute stuck in the neck down into the flask. Swirl to dissolve the solute.
5. Add solvent carefully to the marked line on the neck of the flask. For the most accuracy, the last drops are best done with dropper or squirt bottle.
6. Invert the flask several times for final mixing.
7. Bring your solution and calculations to Mrs. Nielsen for approval and a stamp.

Teacher Stamp

Calculations:

1. Calculate the mass (in grams) of solid NaCl necessary to prepare 100 mL of a 0.50 molar aqueous solution of NaCl. (Hint: Find the # of moles of NaCl, then convert to grams)

2. What is the percent by mass of NaCl in your stock solution? (Hint: use mass of solution = 100.0 g)

Analysis

1. What is the solute in your solution? What is the solvent?

2. In your own words, describe the steps you took to make your solution.

3. Why do you not fill the flask with solvent to the line, and then add the solute?

Part 2: Diluting a Stock Solution to a New Concentration

Background:

Dilutions are prepared by adding extra solvent to a solution of known concentration (also called a "stock" solution) to reduce the concentration of solute. The amount of stock solution needed is calculated from $M_1V_1=M_2V_2$.

Procedure:

1. Obtain a second 100 mL volumetric flask
2. Calculate the volume (mL) of 0.50 M NaCl stock solution needed to make 100 mL of a diluted solution with a concentration of 0.03 M. **Show your work in the calculations section.**
3. Using a graduated cylinder, measure and pour the appropriate volume of stock solution into the new volumetric flask. Use the funnel to pour your solution into the flask if necessary.
4. Add tap H_2O to the marked line on the flask
5. Invert the flask a few times to mix. Double check: see if solution is at the line. Mixing occurs easily since two liquid phases are being combined.
6. Bring BOTH solutions AND your calculations to Mrs. Nielsen for approval.
7. Dispose of the solutions down the sink. Scrub your beakers. Rinse volumetric flasks three times since they cannot be scrubbed on the inside.

Teacher Stamp

Calculations:

1. Calculate the volume (mL) of 0.50 M NaCl stock solution needed to make 100 mL of a diluted solution with a concentration of 0.03 M. (Hint: Use $M_1V_1=M_2V_2$)

2. What is the percent by mass of NaCl in your diluted solution? (Hint: There are 3 steps – first find the #of moles of NaCl, then convert to the number of grams, then find the percent mass. Use the mass of solution = 100.0g)

Analysis:

1. Why is the second solution called "diluted"?

2. Describe the steps you took to make your solution.

3. What did you learn from doing this lab?