

Molarity Lab

Investigating the concentration of a solution

Purpose: To investigate the concept of molarity and to determine the concentration of an acid which has an unknown molarity.

Background information: One way to express concentration of a solution is using Molarity. The symbol for molarity is M; which means, moles of solute per liter of solution.

Safety: Please wear your safety goggles at all times.

Procedure:

Day 1:

1. Carefully label and weigh a dry 100 mL beaker. Record mass in the data table. Put a marble chip into the beaker (calcium carbonate). Record mass.
2. Using a graduated cylinder add 50.0 mL of hydrochloric acid, HCl(aq), of unknown concentration to the beaker. Using a setting of 2-3, gently heat on a hot plate, with stirring, until the reaction is well under way (15-20 mins).
 - a. During this time complete questions #1,6-8 of the write-up.
3. Place beaker in a designated area to finish the reaction over night.

Day 2:

4. Discard the remaining solution (calcium chloride + water) by decanting (pouring off) into the sink, taking care to leave the marble chip in the beaker.
5. Using the graduations on the beaker, wash the chips with three separate 25 mL portions of distilled water. Decant the rinse water each time into the sink without losing the marble chip.
6. Using the graduations on the beaker, add approximately 5 mL of acetone. Acetone is a solvent for removing any additional water. Swirl the acetone in the beaker for a minute and then decant into a container marked "Acetone Waste".
7. Place the beaker and any unreacted marble chips on a warm hot plate (lowest setting) until you are sure the beaker and contents are completely dry.
8. After cooling, weigh the beaker and contents. Record. Discard unreacted marble chips in waste basket.

DATA:

1. Mass of 100 mL beaker	g
2. Beaker + CaCO ₃ before reaction	g
3. Mass of CaCO ₃ before reaction	g
4. Beaker + CaCO ₃ after reaction	g
5. Mass of CaCO ₃ after reaction	g
6. Mass of CaCO₃ used up in the reaction	g
7. Volume HCl solution	50 mL = _____ L

ANALYSIS/CALCULATIONS: Show work, include units and box your final answer.

1. Write out and balance the following equation:

Calcium carbonate reacts with hydrochloric acid to yield calcium chloride, carbon dioxide and water.

2. Using the mass of calcium carbonate that was used up in the reaction, calculate the **moles of calcium carbonate** reacted. (*Hint: g → mole conversion*)
3. Use your answer from #1 and #2 to find the **moles of HCl** that reacted. (*stoichiometry!*)
4. Use your answer from #3 and the volume of HCl used, to determine the **molarity of the HCl** solution in moles per liter.

$$\text{molarity} = M = \frac{\text{moles HCl}}{\text{volume HCl(in liters)}}$$

5. State in words what the numerical value of the concentration from #4 means.
6. Assume that you use 2 g of NaCl to make a 50 mL solution with water. What is the **molarity** of the solution?
7. You have a 3 M solution of NaOH that has a final volume of 1.5 L.
- How many **moles of NaOH** were used?
 - How many **grams of NaOH** were used?
8. A 6M solution of MgCl₂ was prepared for an experiment using 10 moles of solute. What is the final **volume** of the solution?