

Chem 213
WRITE-UP INSTRUCTIONS FOR
Determination of "Water Hardness"

Prepare a report, 3 pages maximum. For your report include:

1. Name, date, course, lab section, experiment title, objective of experiment (one sentence), and a brief description of the method (2 -3 sentences).
2. Write a balanced equation for the chemical reaction between:
 - a) Ca^{2+} and EDTA (abbreviated as "Y"); indicate the correct charge on the EDTA.
 - b) the reaction that produces a color change at the end of the titration.

3. Show the mass data and resulting molarity for the standard EDTA solution; show calculations.

4. Prepare 4 tables - two data tables and two results tables:

For the data tables (one at pH=10 and one at pH=12), include: amount of tap water, initial and final buret readings for the titration, initial and final buret readings for the blank, and the net titration volume (6 columns total for each table).

For the results tables (one for Ca and one for Mg), show in separate columns: the concentration of Ca and CaCO_3 (in ppm) for each trial. Prepare a similar table for MgCO_3 .

Finally, report the average ppm for Ca, Mg, CaCO_3 and MgCO_3 . Somehow highlight these final results (a box, etc.) so that they are easy to locate. These are what you would report to others.

5. Calculations:

Using net titration volumes, calculate the moles of EDTA for each trial. For pH= 12 data, next calculate the average number of moles of EDTA needed to titrate just Ca; subtract this average value from the number of moles of EDTA for each Ca+Mg trial (at pH=10) to find the moles of EDTA needed for Mg.

Next, using the moles of EDTA needed for either Ca or Mg, find the moles of Ca (or Mg) and then calculate the mg of Ca (or Mg). Next, calculate the mg/L of Ca (or Mg) for each trial, using the volume of tap water that you used. Perform similar calculations to find ppm CaCO_3 (or MgCO_3).

6. Questions -

- a) Primary standards - how many are needed to perform the measurement for this experiment? What primary standards are needed ?

- b) In considering the chemistry involved in this experiment, what assumptions are made about the reactions involved? Is there a way to test those assumptions ?

- c) Based on your understanding of the experiment, what experimental component (or components) limits your ability to report concentrations to greater precision ?

- d) Which measurement do you expect to have the greater amount of error in it - the [Ca] or the [Mg] ? Explain your reasoning.