

Cooperative Project III: Designing a Calcium Supplement

For cooperative project III, we will follow the lab on page 101 of the *Cooperative Chemistry Laboratory Manual, 5th edition*. There will be additional requirements to this lab, which are stated in this document. There are four goals to this project; 1. investigate the solubility of various calcium salts; 2. synthesize 0.5 g calcium carbonate; 3. design a calcium supplement with properties that fall within a given set of conditions; 4. conduct a literature search.

There will be two prelab assignments/quizzes for this lab. The prelab assignment will focus on key concepts of the lab by focusing on questions about the theory of the experiment, experimental procedures, the substances being used and/or the calculations involved in the lab. Before coming to lab, be sure to read all background reading assignments and complete all practice problems.

Requirements for Goal 1:

- Investigate the solubility of various calcium salts. Consult a table of solubility rules and make a table of soluble calcium compounds and insoluble calcium compounds. You should make this table before coming to lab.
- When writing your weekly summary for Goals 1&2, be sure to include the information requested on page 102 under "Part I Summary Questions and Activities" in your lab manual. These chemical equations should also be included in the results section of your final lab report.

Requirements for Goal 2:

- As a group, you will need to synthesize 0.5 g of calcium carbonate by reacting 1 M aqueous solutions of calcium chloride and sodium carbonate.
- Each group will prepare 25.00 mL of 1M aqueous solutions of calcium chloride and sodium carbonate. It is not important that your solutions are exactly 1M, but it is important that you know the exact concentration of the solutions your group prepares. Be sure to use proper technique for preparing aqueous solutions of known concentration. Next, determine how much of each solution is needed to prepare 0.5 g of calcium carbonate. Be sure to use the proper technique for transferring your aqueous solutions to a reaction container.
- Calculate your percent yield and include these calculations in your results and discussion section of your lab report.

Requirements for Goal 3:

- Each group will be required to design and prepare two calcium supplements. You will have to split the work between your group members in order to have enough time to complete the experiment.
- Be sure your calcium supplement falls within the specifications outlined in the lab manual.
- When writing your weekly report, be sure to include the information requested on page 102 under "Part II Summary Questions and Activities" in your lab manual. This information should also be included in the results section of your final lab report.

Requirements for Goal 4- Literature Search:

- Goal 4 requires you to use various reference sources for finding scientific data. This is an individual assignment. Each member of your group must conduct their own literature search.
 - i. Use SciFinder** to find the following data:
 - The RDA for calcium for a child.
 - Source(s) of calcium for commercially available Ca supplements
 - Be sure to include the reference for each journal article from which you obtain information.

**SciFinder is an electronic database of scientific information. When searching for information, SciFinder provides the abstract to the journal article in which the given data is found. You will be able to obtain the necessary information from the abstract, and you are not required to obtain the complete journal article. You are required to provide the reference for each journal article from which you obtained information from in your final lab report.

- ii. Provide the answers to the following questions in your lab report. You must find this data in a CRC Handbook or a Merck Index. You must provide a reference for each response.
- What solvent is calcium carbonate soluble in?
 - What is the density of sodium chloride (in g/mL)?
 - What is the melting point of sodium chloride?
- iii. Provide the answers to the following questions in your lab report. You must find this data in a safety data sheet (SDS). You must provide a reference for the SDS used.
- Find the following SDS for hydrochloric acid and answer the following questions. Assume you will be using small amounts of hydrochloric acid in a laboratory setting.
 1. <http://fscimage.fishersci.com/msds/11155.htm>
 2. What is the CAS number for hydrogen chloride?
 3. What type of personal protective equipment is required when working with hydrochloric acid?
 4. What type of safety equipment should be available in the lab in which hydrochloric acid is used?
 5. Report a LC₅₀ value for hydrogen chloride. There are multiple LC₅₀ values for hydrogen chloride; you only need to report one value.
 6. Report the LD₅₀ value for water.

- Reference format for referencing a journal article:
 - Author, A. A.; Author, B. B.; Author, C. C. Title of Article. *Journal Abbreviation (italics)* [Online if online] **Year (boldface)**, *Volume (italics)*, Page numbers.
 - Example:
 - Slunt, K. M.; Giancarlo, L. C. Student-Centered Learning: A Comparison of Two Different Methods of Instruction. *J. Chem. Educ.* **2004**, *81*, pp 985-988.

- Reference format for referencing a scientific handbook:
 - Editor, A. A., Editor, B. B., Eds. *Handbook Title (italics)*, Edition number [Online if online]; Publisher: Place of Publication, Year; Page numbers or other identifying information.
 - Example:
 - Lide, D. R., Ed. *CRC Handbook of Chemistry and Physics*, 84th ed. [Online]; CRC Press: Boca Raton, FL, 2003; p 83.

- Reference format for referencing an SDS:
 - **Hard copy (paper) SDS**
 - *Titanium Dioxide*; MSDS No. T3627; Mallinckrodt Baker: Phillipsburg, NJ, November 12, 2003.
 - **SDS obtained from an Internet search**
 - *Titanium Dioxide*; MSDS No. T3627; Mallinckrodt Baker: Phillipsburg, NJ, November 12, 2003. <http://www.jtbaker.com/msds/englishhtml/t3627.htm> (accessed 4/15/04).

Requirements for keeping a laboratory notebook:

- Each member of your group is required to keep a scientific notebook. Your notebook is where you will record your day-to-day activities in the lab. You should describe experiments as you do them and note observations as you make them. Record and analyze your data in your notebook.
- The notebook must be a carbonless, duplicate page notebook.
- Be sure to keep the following in mind when recording data in your notebook:
 - Include a descriptive Table of Contents
 - Pages must be numbered
 - Include date data was collected
 - Record raw data
 - Record procedures and observations
 - Write in ink
 - Mistakes must be crossed out appropriately

Requirements for writing weekly summaries:

- List all group members present for the lab
- Give a short overview of the lab
- Present results in tables and/or graphs
- When writing your weekly summary for Goals 1&2, be sure to include the information requested on page 102 under "Part I Summary Questions and Activities" in your lab manual. These chemical equations should also be included in the results section of your final lab report.
- When writing your weekly summary for Goal 3, be sure to include the information requested on page 102 under "Part II Summary Questions and Activities" in your lab manual. This information should also be included in the results section of your final lab report.
- Discuss future work

Requirements for writing your lab report:

- The lab report is an individual project. Although you collected data in a group, the lab report is an individual project.
- Often scientific data is reported in tabular format. This provides the reader with a quick and easily readable format for obtaining information. If appropriate, you should report your data in a tabular format. (Use your textbook as a reference to see the proper format for a scientific table.)
- In the results and discussion section of your lab report, include the complete balanced equation, the complete ionic equation and the net ionic equation for the reaction between aqueous solutions of calcium chloride and sodium carbonate. Be sure to include the physical state of each of the reactants and products.
- All lab reports must be typed including all tables.

Grading Cooperative Project II:

- Prelab Assignment
- Notebook
- Two weekly summaries
- Peer Evaluation
- Lab Report
 - Results and Discussion
 - Is data reported in tables?
 - Is data reported in the proper scientific format?
 - Include the complete balanced equation, the complete ionic equation and the net ionic equation for each reaction that resulted in the formation of a precipitation in part 1 and for the reactions used in part 2.
 - Include calculations for determining the concentration of your calcium supplement.
 - Be sure to include the following information: solubility results, equations, equations for the reaction between CaCO_3 and the acid, pH of both solutions, calculations, concentration of Ca^{2+} in solution mol/L, literature search results.

Safety Precautions:

- Wear your safety goggles at all times. You will be using several different acid, base and salt solutions. If you get any solution on you, wash immediately with lots of water and inform your lab instructor.
- When working with acids, wear protective gloves.
- Dispose of all waste in the labeled containers in the common equipment area. Use a wash bottle to rinse glassware into the container.
- You will use several different reagents throughout this experiment. Many of the reagents are located in the common reagent area in the front of the lab. When you need a reagent, take a container to the stock solution and pour the amount that you need into your container.
- Never pour anything back into the stock solution.
- Never lay reagent bottle stoppers or caps on the lab bench. The entire reagent may become contaminated. In addition, the residue on the bench may be hazardous and linger for days or weeks. This could injure someone well after the fact. Hold the stopper in your other hand while you get the material out of the bottle. Replace stoppers immediately and completely.
- Balances are especially sensitive, expensive devices. **Never weigh chemicals directly on the pan.** Use a container such as a beaker or flask. Remove the container from the balance, add the chemical and then replace the container. If you spill anything onto the balance, please notify the instructor immediately.

Background Reading and Practice Problems:
Cooperative Chemistry Laboratory Manual

- Safety Rules, Laboratory Etiquette (12-14)
- NFPA Hazard Codes, Waste, MSDS's (15-16)
- Recording and Reporting Results (17-19)
- Writing Lab Reports (19-23)
- Reporting Numerical Results, Significant Figures, Graphs (35-40)
- Measuring Devices (47-49)
- To Make up a Solution of Known Concentration (64)
- Preparing and Using a Buret and Titration (66-69)

Chemistry: An Atoms-Focused Approach, by Gilbert, Kirss, Foster

- Molarity: Read Section 8.1 (320-324); Complete End of Chapter Problems 8.11a; 8.14a,b; 15a,b;
 - Acids and Bases: Read Section 8.4 (329-335) including Sample Exercise on page 334; Complete End of Chapter Problems 8.51b, 8.53b
 - Precipitation Reactions: Read Section 8.5, (335-3340); Read Section 8.5 including Sample Exercise 8.7 and 8.8, complete Practice Exercises on pages 339 and 340 and End of Chapter Problems 8.65, 8.69, 9.72
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