Proper Reporting of Experimental Data

The laboratory notebook is a very important reporting tool.

1. Purchase a bound laboratory or composition notebook in which the pages cannot be torn out.
2. Place your name, class title, and professor on front cover of lab notebook.
3. Label pages 1-3 the "Table of Contents."
    a. Document in the Table of Contents the start of each new experiment.
    b. Include page numbers at bottom of each page.
4. ALWAYS write in pen. Use black or blue ink. NEVER use pencil.
5. The **odd numbered** pages will be the data pages and the **even numbered** pages will be designated for calculations/graphs.
    a. The calculations page must only include calculations and/or plotted graphs.
6. Refer to the attached sheet for a proper lab experiment write up. Please include all sections of required information.
7. Upon getting ready for a lab, read over the lab information and prepare the following sections in your lab notebook BEFORE coming to lab:
    a. Student name, experiment title, date the lab will begin
    b. Purpose of the experiment
    c. Balanced equation for the reaction, reaction mechanism, and side products (if a reaction is to be performed.)
    d. Table of physical and chemical properties of reactants and products
        i. This information must be properly referenced.
    e. Brief/simplified procedure
    f. Waste disposal instructions
    g. Data tables
8. Place a title on *everything*!
    a. Experiments must be properly labeled with a title and must include a "Date started."
    b. Graphs must be properly labeled (x-axis, y-axis, title, units).
    c. Data tables must be labeled as well.
    d. If the data and/or calculations run onto another page make sure you write "Data/Calculations continued on page #__.
9. If you make an error, cross out the mistake with one visible line. Do NOT scribble it out or use white-out.
10. If you have made an error in your calculations or need to start over, place one line through the data, and write OMIT next to it. (Include the statement "See page #" for new calculations or data.)
11. If you make a mistake, the experiment can always be repeated. Never try to "guestimate" or make up data.
    a. *Your instructor will initial your data at the completion of every lab!*
12. Always write in a passive, narrative voice in complete English sentences. This is especially important for the conclusion section.
    a. Incorrect: "I used filtration to collect. And then I weighed it = 12g."

b. Correct: "The crude product was collected using vacuum filtration. After allowing to air dry, the mass was measured to be 12.0 g."

13. Upon completion of every experiment, please place your signature and the date experiment was finished at the end of each write-up. This signifies that the experiment has been completed.
14. Lab reports will be turned in using one of the two formats: 1) A photocopy of the experiment as it appears in the lab notebook or 2) a complete typed replica of lab write-up as it appears in the notebook.
15. All laboratory write–ups will be due at the beginning of the next lab period, unless otherwise specified.
16. A grade of 0 will be given if the lab write-up is not completed by the following lab or by the due date. ***No** late work will be accepted.*
17. If there is anything in the write-up of your experiment that you want your instructor to know about, please make a brief comment at the end of the write-up.
18. **Students MUST read the next experiment information and prepare pre–lab information before coming to lab! Your instructor may quiz you or grade your pre–lab write–up upon entering the lab.**

Laboratory Safety Considerations (Abbreviated List)

1. No student is allowed to work in the laboratory without a lab instructor present.
2. Personal protective equipment (PPE), such as protective eyewear (e.g. safety goggles) and gloves will be worn at all times when working with hazardous chemical and biological materials or other hazardous items.
    a. Contact lens use should be avoided when using certain chemicals.
3. Dress sensibly.
    a. Close-toed and close-heeled shoes (such as sneakers) are required at all times in the laboratory room.
    b. Sandals, Crocs, and flip-flops are always prohibited in the laboratory. Shoes should have a low and closed heel with a flat bottom. Socks, that cover the ankle, are required.
    c. Chemical resistant aprons or appropriate lab coats will be worn that completely cover the shoulders, chest, and abdomen. (See instructor for particular details.)
    d. Legs will be covered to the knee or lower.
    e. Loose fitting jewelry or clothing that may become entangled in laboratory equipment or pose any other danger is prohibited.
4. Food, drink, chewing gum, candy, or tobacco products will not be visibly present in the laboratory room at any time.
    a. Do not put anything in your mouth while working in the laboratory.
5. Direct contact with any corrosive material will be immediately flushed with lots of water for no less than 15 minutes.
6. Heating devices, such as Bunsen burners, will only be used when authorized by the instructor.
7. If special precautions or accommodations are required, please supply documentation from the Office for Students with Disabilities or a medical professional.

    a. Please inform your instructor or supervisor if you have any medical condition that may compromise your safety in laboratory. This can be done in confidence in a meeting between you and your instructor/supervisor.
8. Locate and learn how to use all of the safety equipment in the laboratory. This includes, but is not limited to, emergency safety showers, eyewashes, fire extinguishers, fire blankets, emergency shut-off valves, etc.
9. Do not use any laboratory equipment or materials without proper instruction and/or training and proper supervision.
10. Notify your instructor or laboratory supervisory personnel if any laboratory equipment is not working properly or is broken or damaged.
11. Emergency equipment, exits, and aisles will not be obstructed at any time.
12. Avoid crowding and haste and maintain an environment free from clutter.
13. Report all spills, accidents and injuries to your instructor other laboratory supervisory personnel immediately, regardless of how minor.
14. Students will not attempt to clean up chemical spills until consulting with your instructors or laboratory supervisory personnel.
15. Broken glass will be immediately cleaned up by utilizing a dustpan and broom or other approved device.
    a. Do NOT handle broken glass with your hands.
    b. All broken glass will be placed ONLY in designated broken-glass containers.
16. Recap all bottles, especially those containing chemicals or biological materials, immediately after use.
17. Do not deviate from lab procedures or attempt unauthorized experiments without the instructor's approval.
18. Do not allow liquids (i.e. water) to come into contact with electrical equipment, outlets, or cords.
    a. Handle electrical cords with dry hands and remove electrical plugs from outlets by pulling on the plug and not the cord.
19. Wash hands thoroughly with soap and water after handling all chemicals or biological materials.
20. Clean your work table, other worked-in areas, glassware and equipment used immediately after completion of the experiment or activity.
21. Dispose of all waste materials into the designated area(s) as instructed.
    a. All solid waste will be disposed of in approved and designated containers. Do NOT use laboratory sinks for disposal of any solid waste.
22. Liquid wastes will be disposed of in approved and designated containers unless instructed to dispose of into the laboratory sinks.
23. Turn off all equipment if you leave the lab at any time or at the end of lab.
24. Check that all water faucets, gas outlets, and/or other valves are turned off before you leave lab.

Sections of a Lab Write – Up

Student Name, Experiment Title, Date Started, and Unknown Number:

- Student name
- Title of experiment
- Date the lab was begun
- If assigned an unknown compound or mixture, record the number/letter for that unknown.

Purpose of the Experiment:

- What is the lab about?
    a. When appropriate, include reaction type(s) and chemicals used/synthesized.
    b. Include chemistry techniques employed in the experiment to synthesize, purify, assess purity, etc.
- What is the main goal?
- Be brief.

Reference to Source of Procedure:

- Always reference the source of the procedure using an appropriate bibliography method.
- In most cases, reference your lab book or handouts.
- An acceptable reference is shown below:
    a. Barnett, "Experiment #7: The Complete Synthesis of Sulfanilamide from Benzene," *Experimental Laboratory Manual for Organic Chemistry-II*, 2012, pg. 60 – 72.

Balanced Equation(s) for Reaction(s):

- If performing a reaction, include balanced equation here.
- Include important reaction features and solvents, such as Δ for heat, etc.
- If no reaction is to be performed, please indicate "N/A" or "None" for this section.

Side Reactions:

- If by–products or other reaction routes are possible, provide a balanced equation for their formation.
- If no side reaction exists or this information is not provided, please indicate "N/A" or "None" for this section.

Complete Reaction Mechanism:

- If provided with this information, show all steps of the reaction mechanism using proper arrow pushes.
- If this information is not provided, please indicate "N/A" or "None" for this section.

Table of Physical & Chemical Properties of Reactants and/or Products:

- Include all relevant properties of reactants, products, and solvents.
- Draw the chemical structure and/or formula or symbol for each relevant reactant, product, and/or solvent.
- Include the following important physical and chemical properties:
    - Name of Chemical/Element
    - Atomic/Ionic/Molecular formula and/or structure
    - Atomic/Ionic/Molecular mass/weight
    - Melting and/or boiling point
    - Density
    - Other important information such as p*K*a (if an acid), solubility, reactivity, etc.
- Important safety/hazard information of each chemical.
- This table must be referenced and information can be found from the following sources:
    - **www.msdsxchange.com, www.msdshazcom.com,www.hazard.com, www.chemexper.com**
    - The Merck Index
    - The Handbook of Chemistry and Physics
    - DO NOT use Wikipedia.
- See the attached example template

Procedure:

- Record a brief outline of the experiment based on the experimental procedure.
- Rely upon this outline to perform the experiment.
- DO NOT simply copy the given procedure; you must summarize and put into your own words, phrases, or abbreviations.

Waste Disposal and Lab Clean–Up Instructions:

- Provide waste disposal instructions for excess or waste materials.
- Follow these directions during lab and indicate that these steps have been performed.

Observations

- Discuss what you observed during the experiment.
- Be specific in terminology.

Data Collected:

- Create a data table to include all measurements with units.
- You may be provided with data tables in your lab book or handout; please affix these to a data page when available.

Theoretical Yield:

- Provide the correct theoretical yield if a reaction is performed where yield information is investigated.
- This can be derived on the calculations page.

Actual Yield:

- Provide the actual yield from the data table if a reaction is performed where yield information is investigated.

Percent Yield (or Percent Recovery):

- Provide the correct percent yield if a reaction is performed where yield information is investigated.
- This can be derived on the calculations page.
- % Yield = (Actual Yield/Theoretical Yield) X 100%

Observed Melting/Boiling Points:

- Record observed melting points and/or boiling points if measured.
- Moreover, include the theoretical melting points and/or boiling points to compare and contrast.

Conclusion:

- This is probably the most important aspect of your lab notebook.
- In your first paragraph, briefly introduce the subject of your experiment.
- In subsequent paragraphs, discuss the data collected and observations made upon performing the experiment.
- Provide yield information and/or melting point/boiling point determinations when appropriate.
- Discuss sources of error for yield information and/or melting/boiling point data and discuss how the data was affected by these errors.
- Comment on the purity of your product, if a reaction was performed.
- Discuss all other sources of error and how these errors directly affect data/results.
- Provide the identity of all unknowns when applicable and the data to support these claims.

Lab Complete: Date of completion & **Signature**: YOUR signature

(Do not forget the answer the questions assigned. These can be included in the conclusion.)

Table of Physical and Chemical Properties for Reactants and Products:

Chemical Name	Atomic, Ionic, Molecular Formula and/or Structure	Atomic, Ionic, Molecular Mass or Weight: (in g/mol)	Melting Point (MP): (in ^{o}C)	Boiling Point (BP): (in ^{o}C)	Density: (g/mL)	Other Info: (such as pK_a, solubility, etc.)	Hazard and Safety Info: