**Lab Notebook Guide**

* Write the title of the lab, your lab partner(s) names, and the lab date(s) on every lab
* Write in pen in blue or black ink only
* Cross out mistakes with a line. Do not use whiteout or scribble over your mistakes.
* Underline the title of each section (problem, hypothesis, etc.)- the underlined steps
* Skip a line between sections

***Planning Stage: What must be done before the lab (pre-lab)?***

If a lab has the procedure already written for you, replace the experimental design section with...

**3. Pre-Lab Questions**

Answer the Pre-lab questions in complete sentences

1. **Problem/Purpose**:

What are you trying to determine by completing the lab?

1. **Hypothesis**:

If independent variable, then dependent variable…

1. **Experimental design**:

Answer the following in a table. Skip this step if the procedure is given in the lab handout.

|  |  |
| --- | --- |
| **Independent variable**: | Which variable are you going to change on purpose? |
| **Dependent variable**: | Which variable will you measure? |
| **Controlled Variable(s)**: | Which variables will you keep constant? |
| **Increments**: | How will you change the independent variable? (ex: Every 15 seconds, record time, by 15 mL increments, etc…) |
| **Data Table**: | What data needs to go in your data table? |
| **Graphs**: | Will you need to graph the data? Type of graph (line, bar, pie chart). |
| **Calculations**: | What will you calculate? What formulas will you use? |
| **Trials**: | How many trials will you do? |
| **Observations**: | What observations can you make? (Ex: color, smell, gas bubbles, etc.) |
| **Background** | What do you already know about the experiment that will help you complete the lab activity (for example: a scientific principle like gravity, an equation, definitions…) |

1. **Materials**:

If materials and safety are not given, leave room and come back to 4& 5 after you write the procedure

List the Materials you will need.

1. **Safety**:

What safety precautions must you take? (goggles, gloves, apron, hair tied back, etc.)

1. **Procedure**:

This is a very clear, step-by-step list of things you plan on doing during the experiment. Each step should be short (one phrase or sentence). Draw the setup of lab equipment when necessary. Leave room to add changes or additions to your planned procedure. Follow the format below. *If the procedure is provided, copy the procedure into the same format.*

|  |  |
| --- | --- |
| **Procedure**: | **Changes/Observations**: |
| http://homepage.smc.edu/kline_peggy/Organic/Images/Lab_NB_Sample_2.jpg |  |

1. **Data Table**:

Draw data table(s). Be sure to add a title to each data table, label each heading, and include units.

***Lab Day: What must be done during the lab?***

* Complete the lab you planned and record any changes or observations
* Fill out data Tables.

***After Lab: How do you complete the lab?***

1. **Analysis/Results**:

This is where you explain the meaning of your results. Be sure to include:

* **Graph(s):** Must follow graphing notes and be done on graph paper or done on excel and printed and glued in here (not glued = no credit). Be sure to label the x and y axis and title. Always scale your graph so that you are using as much of the page as possible.
* **Analysis of graph**
  + Describe the shape of the graph (linear, exponential, or inverse).
  + For line graph: give the generic formula; y = mx + b or y = mx (if it crosses y-axis at zero).
  + Restate the formula using the data from the graph. For example s = vt.
  + Calculate the slope of the line and explain what it represents.
* **Calculation(s):** Show all calculations. Be sure to label units and round to the appropriate number of significant figures. If the calculations are for the same substance
* **Claims and Evidence:** Discuss whether or not your hypothesis (your claim) was correct and explain exactly how your evidence (observation, data, graph, or calculation) supports your hypothesis (or how it proves your hypothesis wrong). Be specific.
* **Analysis Questions:** Answer any questions written in the lab handout.

1. **Error Analysis**:

In a few sentences identify the error involved in the lab and the effect the error had on your results.

* **Identification of Errors** 
  + Leave out: human error, miscalculations, time allotted, lameness of lab partner, etc. Focus on the errors in the lab procedure, equipment, and management of time.
  + What are the limitations, weaknesses or errors in your procedures?
  + Are there things that came up that you didn't account for?
  + Is your technique poor, causing large random errors?
* **Effect of Errors**
* Was your value too low? What errors contributed to making it low?
* Was your value too high? What errors contributed to making it too high?
* Which error, of those listed, was the most significant?
* Are your results reliable, given the errors listed? Justify this.
* **http://dev.physicslab.org/img/91a4adf8-b12a-4649-a6f8-ac85b3e3d1e0.gifPercent Error Calculation (if possible)**
  + Show your work!

1. **Conclusion:**

Answer these questions to structure your conclusion:

1. What was I looking for?
2. How did I look for it?
3. What did I find?
4. What do the results mean?

Alternatively, you can use this **Conclusion Template**

* In this lab we attempted to (answer the question / figure out why / measure / verify)      *(question you tried to answer)*      by      *(describe method you chose)*     . Our results (were /showed / gave)      *(state conclusion)*      which (agreed / somewhat agreed / did not agree) with our hypothesis. This means that      *(what you learned about chemistry concepts from this lab)*     . The problems we encountered in this lab were      *(sources of error)*     . We (do / do not) believe these errors significantly affected our results (and / but) we could improve our results by      *(list ways you could have designed/performed the lab so that these problems did not occur)*     . Further questions we could investigate here are      *(other possible answers to the lab question)*     .
* For quantitative results (actual numbers) include your **percent error** when discussing whether or not your hypothesis was right.