# Introduction to Electronic Lab Notebooks

**IMPORTANT NOTE**

*For this week only, you are not required to write a pre-lab writing before coming to lab. Your TA will guide you through this, so that from week 2 you will know how to do it properly.*

*This manual is divided in two sections. Part 1 will give you a description of the ELN itself, such as what are the requirements of a lab report.*

*Part 2 includes the model experiment that you are going to do in lab with your TA. This model experiment will be the means by which your TA will explain how to write a lab report, with particular emphasis to how to make entries and content of the various sections.*

## Introduction

This lab is designed as an introduction to some key elements of our general chemistry labs. First of all, you will learn the basics of ELN use such as how to claim your course notebook, log into lab archives, and make headings. In addition, during your first day, your TA will guide you through writing each section of your lab report and through a lab report submission. Your TA will guide you during today's activity in a much more hands-on fashion than in future labs. The purpose of doing this is to provide you with a good idea of how our labs are structured and also to provide you a model lab report of your own that you can use for writing future lab reports. The following list provides some more information about what you can expect.

## ISU General Chemistry Lab Expectations

- Our labs incorporate active learning strategies, which evidence shows enable greater learning to take place. Since active learning takes time, plan to be in the lab for the full three hours of the lab period.
- Each lab is centered on a set of investigation questions, which are stated at the beginning of the experiment in the lab manual.
- Your TA is a guide and will encourage you to think for yourself (active learning style) rather than just tell you information.
- Often, your class will pool their data and have a discussion (guided by the TA) in order to encourage active analysis and to help you draw conclusions from your data.
- It is the student's responsibility to ask questions and read provided documents and your lecture text in order to fully understand the chemical concepts behind each of the performed labs. Your TA is your first resource, but other TAs (help center), fellow students, course instructors, and teaching lab staff are also available as resources for questions.

Summary of requirements for each experiment:

| | Deadline | Points |
|---|---|---|
| **Pre-lab Quiz** | BEFORE performing the experiment | 20 |
| **Pre-lab Writing** | BEFORE coming to lab class | Part of ELN Report |
| **ELN Report** | 11:59 PM the third night after performing the experiment | 40 |
| **Post-lab Quiz** | BEFORE performing the NEXT experiment | 40 |

## Part 1: The Preliminaries

### Part 1A: Claiming, logging into, and generating a page PDF of your ELN

***BEFORE COMING TO LAB CLASS, take the pre lab quiz on Canvas for this week.***

The quiz is located in week 1 content area in Canvas and is labeled "PRE". This quiz will walk you through claiming and logging into your ELN, which is in LabArchives (for more background information, read the document "Quick Guide to Lab Archives" available in the "Student Canvas and LabArchive Tutorials" module on Canvas).

### Overview of Your ELN

In general, your ELN must contain the following elements:

- Your name, your partner's name, a meaningful title, and appropriate headings.
- Pre-Lab Writing (from week 2 on, MUST be written before lab)
  - Investigation questions are re-stated in different words
  - Numbered list outlining procedure
  - Safety hazards specific to the experiment
- Procedure Changes, Observations, and Raw Data (MUST be recorded during lab)
  - Changes from procedure outline are given
  - Raw data and observations
- Analysis and Data Manipulation (May be done in and/or outside of lab depending on the experiment)
  - Answer to all Analysis Questions. These may include: Graphs
    - Calculations (all steps and equations must be shown for full credit)
    - Balanced chemical equations
  - Group and/or Class Data Tables (depending on experiment)

- Reflective Writing
  - Explain, Evaluate, and Extend sections (More detail will be given later)

The rubric for the experiments is included in Canvas right before Week 1. Reading the rubric before beginning an experiment is useful in that the rubric describes what your TA will be looking for when they are grading your report.

### Part 1B: Writing a Pre-lab

The purpose of your pre-lab writing is to prepare you so that you know what you are doing once you enter the lab. **The goal is to have you know what you are going to do from a practical point of view so that, in lab, the class can focus on the big picture of the experiment through pre- and post-lab discussions with the TA.**

a. First of all, you are asked to describe the purpose of the experiment. Your description should include the investigation questions provided at the beginning of each experiment. Be sure to reword the investigation questions so that you are not just copying, or otherwise you will loose points for that. Incorporating investigation questions in your description is important because the whole reason for doing the experiment is to answer these questions. Having these in mind while performing the experiment prevents you from mindlessly running through a series of actions that mean nothing to you. You can compare it to having an actual destination in mind when going on a road trip rather than just going for a random drive. (**Reminder**: Cutting and pasting from lab manuals, published material, or another person's work is PLAGIARISM, which is viewed as academic misconduct at ISU.)

b. In your pre-lab writing, you are also required to outline the procedure so that you have an idea of what you will be doing. Thinking about what you will do before coming to lab class allows you to work much more effectively just as it is much more effective to plan a road trip to a particular place ahead of time than to just hop in your car hoping to somehow magically arrive at your destination. Use a numbered list for your procedure outline so that you can easily refer to a step by number if you need to record procedural details or changes later on in your ELN. You must include just enough detail that you could do the experiment without looking at the lab manual.

c. The last thing you need to include in your pre-lab writing is a safety summary SPECIFIC for the particular experiment. The reason for requiring this is that you do not injure yourself or someone else due to lack of knowledge when handling something potentially dangerous. Again, cutting and pasting information from the "Chemicals and Safety Information" table in your lab manual is plagiarism so do not do it.

## Part 1C: Recording Changes, Observations, and Data

Now, we move on to the writing you would normally do DURING lab class. In the "Changes, Observations, and Data" section of your ELN, you will be recording any changes or additions to the procedure outline given in your pre-lab writing. You will also be recording observations and data from your experiment.

How should you record observations? There is not an easy answer to this question. It takes some practice to find the balance between recording enough but not too much detail, as well as recording what is truly important. **As a start, your TA will guide an analysis discussion comparing two examples of observations from student notebooks.**

**Example 1**

*Moisture appeared on the watch glass. The watch glass turned from dry to wet.*

**Example 2**

*Boiled 70 mL of water in a 100 mL beaker. Started as a clear colorless liquid. As the water heated, the watch glass began to collect water vapor, which turned the watch glass cloudy. Small bubbles began to form on the bottom of the beaker and, as the beaker continued to heat, the bubbles started to quickly rise to the surface. Droplets of water began to form on the watch glass after about 3 minutes of heating on a high setting.*

## Part 1D: Analysis

After the "In-lab writing, your lab report should contain the "Analysis" section. Depending on the experiment, this section will include different items such as tables, graphs, and answers to analysis questions. Please see below a model referring to the examples 1 and 2 of the previous section.

Also, please note that you do not need to write anything in your notebook NOW. The answers to these questions will be written in the context of Part 2.

## Analysis Questions

1. Which of the above examples does a better job of giving you a clear picture of what the student did and what happened?
2. What information about what was done is left out of example 1?
3. What is some important information that example 2 provides?
4. As a class (and with your TA's help since they will be grading your lab reports) come up with some general guidelines for effectively recording observations in your ELN.

**Note** You will answer the questions of this example in lab with your TA while you are doing the water/ethanol activity. For the remainder of the semester, you are required to answer

Analysis Questions individually or as a class when specifically mentioned in the lab manual.

### Part 1E: Reflecting Writing

Every experiment will have a Post-Lab Discussion guided by the TA at the end of the period. The post discussion questions are designed to help you understand what you did during the experiment and to help you write the reflective writing portion of your lab report thoughtfully and correctly. The answers to the post lab discussion questions MUST be incorporated into your Reflective Writing. Depending on the type of question, you will decide which section of the Reflecting Writing to answer it.

Before beginning the class discussion, create a heading in your ELN labeled “Reflective Writing”.

***Explain*** The first section of reflective writing is “Explain”. In this section you answer the investigation question(s) and justify and explain your answers using your data, observations, and analysis. Be sure to indicate in your ELN that you are writing the “Explain” section.

***Evaluate*** The next section for the reflective writing section of your ELN is “Evaluate”. In this section, you evaluate whether your results are consistent for your entire class and whether they make sense with what you have learned in chemistry lecture. You also comment on what you would do differently or what could be changed in order to get better results if you had a chance to repeat the experiment. This is actually really important. We look at your comments to try to improve the experiment for future students.

***Extend*** In this section, you talk about how the experiment relates to anything OUTSIDE chemistry lecture or lab. This could be another course, something in the news, an everyday experience, and so on. If you are using information beyond your personal experience, you MUST reference the source information.

### Part 2: An Inquiry Activity: What happens when you mix ethanol and water?

For this part, you will perform a simple activity that requires making careful observations in order to draw some conclusions. Please work with a partner.

### Materials

- Small test tube
- Plastic dropper

## Chemicals and Safety Information

**WEAR GLOVES, SAFETY GLASSES AND LAB COAT WHEN WORKING IN LAB.**

| Compound | Hazards |
|---|---|
| water / ice<br>$H_2O$ *(aq) or (s)* | No significant hazards. |
| ethanol<br>(ethyl alcohol)<br>$CH_3CH_2OH$ *(l)* | Flammable. Slightly hazardous for contact or ingestion. |

## Procedure

a. Use a plastic dropper to fill a small test tube half way with water.
b. CAREFULLY fill the rest of the test tube with 95% ethanol. Make sure the test tube is as full as you can get it. Write down anything you notice about the filled test tube in your ELN.
c. Completely cover the test tube with your second finger and invert the test tube a few times. Write down any observations in your ELN.

## Analysis Questions

Please refer to the questions listed in Part 1D.

Add a heading in your ELN labeled “Analysis”. As your class discusses the following questions, record the answers in your ELN. **All answers to analysis questions need to be recorded in your ELN for full credit**.

## Post Discussion Questions

For this experiment only, you will be doing your reflective writing in class with guidance from your TA so that you clearly understand your TAs expectations for this part of the lab report. **For all future experiments, you will write your Reflective Writing independently after your lab period is over**.

Please refer to Part 1E for detailed descriptions on what each section of the reflective writing is.

- What happened when you mixed ethanol and water?
- How could this be explained?
- Does your explanation for what happened when your mixed ethanol and water make sense based on what you have previously learned in chemistry lecture? Explain.
- Did everyone in the class get the same results? If not, explain SPECIFICALLY what might be causing the discrepancy (“human error” receives NO points)
- What would you do differently or what changes would you suggest to get better results or make the experiment more interesting?
- How does what you did today tie in with anything outside chemistry lecture and lab?

Before beginning the class discussion, create a heading in your ELN labeled “Reflective Writing”.

Answer the following questions as a class and then spend some time **independently** writing the "Explain" section of the reflective writing section in your ELN. Be sure to indicate in your ELN that you are writing the "Explain" section.

*Explain*

- What happened when you mixed ethanol and water?
- How could this be explained?

As before, discuss the following questions as a class and then independently write the "Evaluate" section in your ELN.

*Evaluate*

- Does your explanation for what happened when your mixed ethanol and water make sense based on what you have previously learned in chemistry lecture? Explain.
- Did everyone in the class get the same results? If not, explain SPECIFICALLY what might be causing the discrepancy ("human error" receives NO points)
- What would you do differently or what changes would you suggest to get better results or make the experiment more interesting?

Again, discuss this as a class and then **independently** write the extend section in your ELN.

*Extend*

- How does what you did today tie in with anything outside chemistry lecture and lab?

## Finishing Up

For this lab only, you will submit your lab report on Canvas during lab class. **For all future experiments, you finish your lab report outside of lab class and submit it by 11:59 PM on the third day after completing the experiment.**

- Submit your lab report by clicking on the "Submit" button within your LabArchives at the top of your ELN using the assignment link given in the content area labeled "Week 1" on Canvas. The assignment link is labeled "ELN".
- **REMEMBER TO LOGOUT BEFORE YOU LEAVE**.
- Remember to take your **post-lab quiz** for this lab and the **pre-lab quiz** for the next lab by the appropriate deadlines (see the syllabus for details.)

As in any other learning situation, you will get out of this class what you put into it. As such, it follows that you will benefit most if you ask your TA, other students, other TAs in the help center, you instructor and lab staff lots of questions and ask for clarification whenever you are confused. It's YOUR education…