

Chem 2219 – How to Write an Organic Chemistry Lab Report

Background:

One of the purposes of writing a scientific lab report is to **convey the knowledge that was gained** from doing a given experiment. However, lab reports are also important for the purposes of **reproducibility**. Reproducibility is the degree of agreement of the outcomes for a given experiment by an observer. (*That is, when you do the same experiment, if you always get the same results, then it is considered to be reproducible. If you get different results, it is not.*) While non-reproducible results are considered insignificant to the scientific community, reproducible results are not by default correct results. Even if the data is reproducible, if the underlying hypothesis is faulty, then the results are meaningless. (*For example, a researcher might claim that drinking excessive amounts of water causes cancer. Even if his results are reproducible, his underlying claim might be faulty for various reasons.*)

When writing a scientific lab report, it is also important to try and **avoid any personal bias**. In order to convey **an objective scientific point of view**, lab reports are written in the **third person passive voice**, instead of the first person active voice. By doing this, the focus shifts from the experimenter to the experiment itself. Also, by using the passive voice, it clarifies the procedure, so that it can be more easily reproduced.

An Example of Lab Report Contents – Simple Distillation

General:

Print at the top of every page: *your name (first and last), course and section number, date, title of the experiment.*

Grammar, Spelling, Identifying Sections, Space Voided & Title Information (3 pts each)

Prelab (20 pts) – This is due at class time and graded during the lecture portion of lab.

Objective (3 pts): *When writing the objective, you want to write it in the third person, but in the future tense. You want to include both the purpose of the experiment (what processes or scientific theories are you using) and how you plan on characterizing the products (what methods will you use to verify that the product is what you think it is).* **In this case the process is a method of separation, specifically a simple distillation. The methods of characterization will be determining the melting point for the solid and the boiling point and refractive index for the liquid.**

Table (14 pts): *Should include all of the chemicals to be used and the appropriate chemical properties. Make sure to include column headers.*

Compound	Structure	CAS#	MW	BP / MP lit °C	RI (liquids only)	Hazards	Physical Characteristics
Ethyl Acetate							
2-Butanone (a.k.a. MEK)							
Toluene							
trans-1,2- Dibenzoyl- ethylene							
Fluorene							
2-Nitroaniline							

References (3 pts): *Most Common: Wikipedia, Chem Spider, Science Lab, PubChem, Merck index, CRC, Aldrich catalog*

Lab Report (65 pts) – The lab report is due the week after the experiment is performed.

TA signature is proof of attendance. Lab reports without TA signatures will not be graded.

Procedure & Observations (40 pts) – This portion must be completed while the experiment is being performed. It should not be completed before class or once you have left the lab.

Formatting & Grammar (15 pts): listed above under General.

Key Points in Procedure & Observations Included (25 pts):

1. Description and/or labeled diagram of assembled apparatus.
2. Description of unknown:
i.e., liquid colorless or colored (*If colored, what color is it?*)
3. Description of separation.

Liquid:

Record of Boiling Point Range.
Removal of the distillate using a micropipette.
Forerun & Major Fraction. (*1st & 2nd Sample*)

Solid:

Crystallization of the solid. (Cool to room temp.)
Removal to Filter Paper for drying.

4. Determination of Refractive Indices.
Type of Refractometer used.
(*Abbe or Reichart AR200*)
Temperature of Cooling Water.
Record of RI for Forerun and Major Fraction
5. Determination of the Melting Point.
Name & Number of Melting Point Apparatus used.
(*e.g., Fisher Johns Melting Point Apparatus #4*)
Record of Melting Point Range.

Results (25 pts) – This portion is to be completed after lab.

Data Tabulated: *Sample table shown below.*

Should include: Unknown Liquid's Identification, BP, %Error BP, RI, Corrected RI, %Error RI Unknown Solid's Identification, MP, % Error for MP

Unknown # & State	Identity	BP / MP obs °C	BP / MP lit °C	BP / MP % Error	RI obs water temp- corrected to 20 °C	RI lit @20 °C	RI % Error
22C liquid	2-Butanone	66-68	80.2	16.5%	1.376 @22.4 1.377 @20	1.3778	.06%
22C solid	trans-1,2-Dibenzoyl-ethylene	112-116	109-112	3.2%	xxx	xxx	xxx

Calculations (10 pts):

Must show at least one RI correction calculation & one percent error calculation.

Correction for Refractive Index Temperature (for both Forerun and Major Fraction)

$$n_D 20 = n_D T + 0.00045(T-20 \text{ } ^\circ\text{C})$$

Percent Error RI (*based on corrected RI*)

$$[\% \text{Error} = (\text{Theoretical} - \text{Experimental}) / \text{Theoretical}] \times 100$$

Percent Error BP

Percent Error MP

Conclusion (10 pts): *In a paragraph, summarize results and reflect on the experiment.*

Unknown # Recorded

Identification of Unknown Liquid – Correctly Identified

Identification of Unknown Solid – Correctly Identified

References: If there is information in your results table that was not cited in your prelab table, then you will need to cite the source(s) for product's physical properties data included in the results table.

Grammar Review

The paper should be written in the 3rd person, passive voice, past tense (or perfect tense), indicative mood.

1. Person

	<u>Singular</u>	<u>Plural</u>
First Person:	I	we
Second Person:	you	you
Third Person:	he, she, it	they

2. Voice and Tense

a. Active Voice (*the action is being done by the subject "dog"*):

In the following tenses, there is a sense of ongoing action.

Present:	The dog is burying the bone.
Imperfect Past:	The dog was burying the bone.
Future:	The dog will bury the bone.

In the following tenses, there is a sense of completed action.

Perfect:	The dog has buried the bone.
Perfect Past:	The dog had buried the bone.
Future Perfect:	The dog will have buried the bone.

b. Passive Voice (*the action is being done to the subject "bone"*):

In the following tenses, there is a sense of ongoing action.

Present:	The bone is being buried by the dog.
Imperfect Past:	The bone was being buried by the dog.
Future:	The bone will be buried by the dog.

In the following tenses, there is a sense of completed action.

Perfect:	The bone has been buried by the dog.
Perfect Past:	The bone had been buried by the dog.
Future Perfect:	The bone will have been buried by the dog.

3. Mood

a. Indicative (*Everyday speech is usually in the indicative.*)

Used to express statements, direct questions and opinions.

Direct Statement: The dog is burying the bone.

Direct Question: Is the dog burying the bone?

Opinion: Dogs are extremely intelligent animals.

b. Imperative (*Directions for experiments are usually written in the imperative.*)

Used to express commands or requests.

In most imperative sentences, "you" are the implied subject..

Directive: Bury the bone in the backyard.

c. Subjunctive (*More rarely used than the other two.*)

Used to express conditional or imaginary situations.

Primarily used in lab reports as "if / then" statements.

If / then statement: *Sometimes the "then" is implied.*

If the solution had still been acidic, (*then*) additional 5% NaHCO₃ solution would have been added. Since it was not acidic, this step was not necessary.

Guided Practice: Starting with Line 1 from the Simple Distillation Experiment

Given:

1. Preheat the hot plate and Al block at a heat setting of ~130-145 °C while you assemble your glassware.

To convert the directions to third person passive voice past tense:

1. Split apart any compound sentences.
 - a. Preheat the hot plate and Al block at a heat setting of ~130-145 °C
 - b. while you assemble your glassware.
2. Look at the first part of the sentence
Preheat the hot plate and Al block at a heat setting of ~130-145 °C
3. Identify the direct object (*this is the object receiving the action*), it is now your subject:
The hot plate and Al block
4. Change the verb from the present tense to the past tense
preheat → *was preheated*
5. Double check your noun verb agreement (and = plural noun, was = single noun)
Since they do not agree, change to a plural verb.
was preheated → *were preheated*
6. Complete the thought with the prepositional phrase.
at a heat setting of ~130-145 °C
7. Record your actual data (e.g., 185 °C), not just what is listed in the directions.
at a heat setting of ~130-145 °C → at a heat setting of 185 °C
8. Complete and record the first sentence.
The hotplate and Al block were preheated at a heat setting of 185 °C.
9. Look at the second part of the original sentence.
while you assemble your glassware.
10. Identify the direct object. Don't forget to add articles (a, an, the) as needed.
glassware → The glassware
11. Convert the verb and verify verb agreement.
assemble → was assembled.
12. No additional phrases, so complete and record the second sentence.
The glassware was assembled.

Independent Practice (A Graded Assignment)

In order to practice writing in the third person, passive voice, past tense, additional steps from the procedure have been placed on Canvas under the Quizzes tab as “Quiz over Third Person Passive Voice Past Tense.” The quiz is supposed to be set up such that if you do not get the answer correct, you can try again without any penalty. The questions are fill in the blank and the answers should be simple rearrangements of the words in the “original” sentence – similar to what was done above in the guided practice. The quiz should be completed before you do the simple distillation experiment. An email will be sent out when the link is made available. Thank you! ☺