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| --- |
| *[Students’ names and surnames]**Team: [Team identification]**Course of studies: [Studienfach]**Performed on [Datum]* |

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| --- |
| Laboratory Course in Physical Chemistry |
| **[Title of the experiment]** |
| [Semester – Year] |

Structurally, the report of an experiment should follow the guidelines of a scientific publication. Indeed, different publication media show different structures, however, the one given below is the most popular one and the most convenient for our needs.

English is encouraged as language also for the report, so that the students can practice the international language in science. It is mandatory only in case of non-German-speaking supervisors. The students should always **use their own words**, **copy and paste is, of course, not allowed. If the supervisors will realize that this was performed, the students of the responsible teams will need to repeat the laboratory course.**

What matters is not the number of pages of the report but the fact that **all the requested points are listed with good quality and with the student’s own words**.

# Introduction

## Aim of the experiment

One or two sentences to depict the aim of the experiment: **what is measured** in the experiment and **what is obtained at the end**.

## Theory

A **short paragraph to** **summarize the corresponding theoretical background** necessary for a full understanding of the experiment: short description of the **applied method** (why is it the method of choice) and indication of the **relevant equations** (without giving any derivations, just refer to scientific articles, books or the script of the laboratory course). The equations should be numbered, so that the students can refer to them in the evaluation part (example of reference: [[1]](#footnote-1) ).

Example of equation:

|  |  |  |
| --- | --- | --- |
|  | $$f=N-P+2$$ | (1.1) |

# Experimental setup and execution: problems/discrepancies

**Short description** of any **problem or discrepancy with the script** of experimental setup, execution or relevant measuring conditions (temperature, pressure, concentrations, etc.) that would affect the results. **If the experimental execution was the same as in the script you can skip this.**

# Results

**Compact and comprehensible analysis/evaluation** from the raw data, including all important calculations, results and references to the equations. The results should be depicted, preferably, **graphically** (starting from the graphs drafted during the experiment). Any long **tabular form** of the results should be minimized or moved to the appendix. In the analysis/evaluation part it is important to include **the error** **of the measurement (using the correct number of significant digits)**, since the indication of errors is essential for the reliability and evaluation of the results. For clarity, the **detailed implementation** of the error estimation and propagation is **shifted to the appendix**.

Generally, it is very important not to forget **units** and, in graphs, **axes labelling and error bars** (incompleteness and errors will lead to a much lower grade for the report!).

# Discussion

**Compact and clear discussion** of calculations and results including:

* The students must address **all the points requested** in the paragraph **“Data evaluation”** of the script.
* **Interpretation:** depiction of the **scientific meaning** of the results and alternative interpretations in the case of unclear results.
* **Discussion** of the **significance of the results and the corresponding errors** (is the pursued goal achieved?). A plus for the students would be mentioning **alternative methods** that could probably lead to improved results, a **comparison of the data with scientific literature** (never forget to cite an appropriate source, i. e., not Wikipedia but a correct scientific reference there listed) and the **awareness of practical applications** (other than those reported in the script).
* One or two sentences to summarize the **conclusions** of the experiment.

Actually, this chapter is the most important part of a scientific publication or report. However, based on the short experiments of a laboratory course, it is not easy to create an extensive analysis of the results and compare them with the literature. In their reports, the students may thus use this chapter to **speculate** and to formulate **open questions** and **hypotheses**. (example of reference: [[2]](#footnote-2) )

# Appendix

* **Detailed and comprehensible calculations:** Tables need to be clear and compact, try to minimize their number; do not forget to number the tables (legend) and to give the unit of all values. Full-page plots only if necessary.
* **Error analysis:** Remember that errors are not a deficiency but a measurement’s seal of quality!The error analysis must include:
* Indication of the error of all measured data (according to the estimation during the experiment).
	+ Indication of the error of intermediate calculations and results obtained by executing an **error estimation and propagation** (as explained in the relative chapter on the script). Make sure that the arrangement is clear and, if necessary, use tables. In the case of **linear plots**, both a graphical error evaluation (steepest and shallowest line) and a weighted linear regression are desired, including a comparison of the obtained errors.
	+ Always think about whether the **dimension of the errors** is meaningful. Discuss the reasons for too small and non-significant errors, as well as additional sources of errors, if the estimated errors are clearly greater than expected.
1. - H.D.B. Jenkins, Chemical Thermodynamics at a Glance, Chapter 52. Colligative Properties: Boiling Point, Wiley/Blackwell (2007). [↑](#footnote-ref-1)
2. - P.W. Atkins, Physical Chemistry, 6th ed., Oxford University Press, Oxford (1998), pp. 163‑182. [↑](#footnote-ref-2)