Zajęcia dokształcające z języka angielskiego w chemii **nr. 13**

PISANIE PROTOKOŁÓW LABORATORYJNYCH (LAB REPORTS)

Pierwsza część zajęć będzie poświęcona na omówienie ze studentami zasad pisania protokołów laboratoryjnych na podstawie zamieszczonego poniżej tekstu.

Konstrukcja raportu może być różna w zależności od charakteru prac laboratoryjnych, działu chemii której on dotyczy oraz oczekiwań każdej pracowni. Istnieją natomiast podstawowe elementy, które powinny być zawarte w każdym protokole:

1/ dane: tytuł i datę, kto przeprowadza eksperyment, miejsca oraz czasami oznaczenia wewnętrzne pracowni

2/ cel eksperymentu lub krótkie streszczenie

3/ część teoretyczna

4/ rezultaty wraz z ich interpretacją

5/ procedura czyli opis przebiegu eksperymentu

6/ wnioski

7/ odnośniki literaturowe

In a lab report you explain what you did in experiment, what you learned, and what the results meant. The purpose of a laboratory report is to formally summarize and communicate the results of your experiment as clearly and directly as possible. Your report should reflect both your understanding of the scientific principles that were investigated through the lab and your understanding of the outcome of the lab. A lab report should be typed, while diagrams (when used) can be hand drawn. Past tense should be used to describe what you did in lab. Present tense should be used for statements of fact and chemical properties. It is advisable to use passive forms to make the report sound more objective and impersonal. The report is generally written in the 3rd person. You shouldn't use language, metaphors, slang, rhetorical questions and exclamation marks. All lab reports are expected to be typed, proofread, spell-checked, and written in proper English using complete sentences. You shouldn't plagiarize. Cite all your sources, whether you've quoted them, paraphrased them, or simply used a figure or two.

A standard report format consists of the following sections:

Title Page

Not all lab reports have title pages, but if your instructor wants one, it would be a single page that stating the title of the experiment, your name and your partner's name, your instructor's name, the date the lab was performed or the date the report was submitted.

Title

The title says what you did. It should be brief (ten words or less) and describe the main point of the experiment. It's better to begin your title using a keyword and not an article ('the' 'an' or 'a').

Abstract

This section is only to be found in scientific publications. It is a very concise and yet detailed summary of the report. It exists so that very busy researchers can learn what you've achieved and how you've achieved it, without having to read your whole report. It should contain the purpose of your experiment, the method and conditions used (e.g, RP-HPLC using a Waters Symmetry Shield column; 8% ACN as the mobile phase at a flow rate of 1.1 mL/min.; UV detection at 265 nm, etc.), the results, and your conclusions. It should be no longer than a short paragraph.

Theoretical Background

Some lab reports not only include this part, but consider this part an important part and they can be even several paragraphs long. However, its not required by many instructors. In this section you will describe, in detail, the scientific principles being investigated through the experiment. Begin by approaching the topic in general terms and then break it down into specifics. Be sure to define and discuss any *relevant terms* and *scientific theories*. Also include any necessary *mathematical equations* and *balanced chemical reactions*. This is

Purpose

Purpose of the lab is given here. The purpose is a statement of what you trying to determine. This is the section where you state your hypothesis. A hypothesis is a statement of what do you think will happen or predict as a result of doing something as stated. DO NOT discuss *how* you will accomplish this (the procedure) in the purpose section.

Introduction

Sometimes Theoretical Background and Purpose can be put in one section called

Introduction. It may contain background information (but short and general), briefly summarize how the experiment was performed, state the findings of the experiment, and list the conclusions of the investigation. You need to state the purpose of the experiment, or why you did it and give your hypothesis.

Materials

Not all instructors require you to write this part. If you write it, you list everything needed to complete your experiment.

Safety Notes

If it is necessary, you can include this section. You should say here what safety hazards (equipment or chemical) you faced and what safety precautions should be taken.

Methods / Procedure / Experimental

Describe the steps you completed during your investigation. Include actual amounts of reagents used and a description and weight of products formed. [This information may need to be repeated in tabular form in the Data section.] Be as concise and complete as possible. The procedure should contain all of the necessary details that one would need to achieve the same results and nothing more. But be sufficiently detailed so that anyone could read this section and duplicate your experiment. The idea is to share your operating procedure (exact volumes, amounts, incubation times, etc.), so that your results can be reproduced by other chemists and biochemists who happen to come across your report. If you are borrowing the procedure from a lab manual, a textbook, or a journal article, don't bother copying the whole thing out: it is sufficient to make reference to the source. However, any changes that you bring to that prescribed procedure must be mentioned here.

Data

Numerical data obtained from your procedure usually is presented as a table. Data encompasses what you recorded when you conducted the experiment. It's just the facts, not any interpretation of what they mean. Data collection is a critical part of your experiment. Therefore, you should take care in deciding the best format for the data tables for each lab. Tables should have *titles* and all columns should be *labeled*. Be sure to include *units* where necessary and watch *significant figures*.

Calculations

In this section you will quantitatively analyze/interpret your data. Remember to include *units* and watch *significant figures*. Include a percent error calculation if necessary. This section also includes g***raphs***. All graphs should have *titles* and *labeled axes with units.* Unless specifically directed otherwise on your lab handout, graphs should be computer generated using a spreadsheet program (such as Excel).

Results

Describe in words what the data means. This sections can also include the contents put into Data and Calculations sections.

Discussion or Analysis

The Data section contains numbers. The Analysis section contains any calculations you made based on those numbers. This is where you interpret the data and determine whether or not a hypothesis was accepted. This is also where you would discuss any mistakes you might have made while conducting the investigation. You may wish to describe ways the study might have been improved.

Your goal here is to discuss the outcome/results of your lab. DO NOT simply restate all of your data. DO NOT restate all the details of your procedure. Instead, explain what your data tells you and draw some generalizations regarding what you saw happening in the lab . Also address any *specific questions* given on your lab handout. Since much of the discussion has already been taken care of in the Theoretical Background, your work here should be focused on tying your lab results to the scientific theories you presented earlier. Show how the lab demonstrated the principles that were being investigated?

Conclusions

Most of the time the conclusion is a single concise and direct paragraph that sums up what happened in the experiment, whether your hypothesis was accepted or rejected, and what this means. Use your introduction and your charts and graphs to help explain your results. If you did not get anticipated results, identify possible sources of error and/or explain why you think you got those results. There are specific questions in the lab handouts. Answer those questions in this section. If your results do not support your hypothesis, propose a new hypothesis.

Figures & Graphs

These may come as a separate section or in Data or Result sections. Graphs and figures must both be labeled with a descriptive title. Label the axes on a graph, being sure to include units of measurement. The independent variable is on the X-axis. The dependent variable (the one you are measuring) is on the Y-axis. Be sure to refer to figures and graphs in the text of your report.

References

If your research was based on someone else's work or if you cited facts that require documentation, then you should list these references.

Error Analysis

Every experiment has room for errors. In this section you could discuss possible sources of experimental error and *what effect each error would have on your experiment* . If your percent error calculation indicates that your experiment went well, discuss potential sources of error

and what you did to avoid them. Try to answer the following question: What could you have done (or not done) to improve the outcome of the lab?

W drugiej części zajęć, po omówieniu ogólnych zasad protokołu laboratoryjnego, zostanie przeanalizowany przykład takiego protokołu. Każdy ze studentów przed końcem kursu musi oddać napisany przez siebie w języku angielskim protokół laboratoryjny.
Poniżej został zamieszczony przykładowy protokół:

Lab Report Example

Title Page:

Transpiration

Prepared for: Dr. Chuks Ogbonnaya

By: Deborah A. Smith

February 27, 1990

Introduction Page:

Introduction

Transpiration is the evaporation of water particles from plant surfaces, especially from the surface openings, or stomates, on leaves. Stomatal transpiration accounts for most of the water loss by a plant, but some direct evaporation also takes place through the surfaces of the epidermal cells of the leaves.

The amount of water given off depends somewhat upon how much water the roots of the plant have absorbed. It also depends upon such environmental conditions as sunlight, humidity, winds and temperature. A plant should not be transplanted in full sunshine because it may lose too much water and wilt before the damaged roots can supply enough water.

Transpiration occurs as the sun warms the water inside the blade. The warming changes much of the water into water vapor. This gas can then escape through the stomata. Transpiration helps cool the inside of the leaf because the escaping vapor has absorbed heat.

Materials and Methods Page:

Materials and Methods

The 1000 milliliter flask fitted with a three hole rubber stopper, separatory funnel and a measuring pipet. First, fill Erlenmeyer flask with 250 milliliters of distilled water. Put the glass tube with a right angle bend into one hole of the three hole stopper. Place stopper in flask making sure no air bubbles are trapped.

Take a plant shoot and cut in the sink under running water. Remove the shoot from water and place the stem through the hole in the stopper and allow one inch of the stem to go into the water in the flask. Place a separate funnel in third hole and fill with water to the upper mark. Coat all joints will sealant and record the position of the meniscus at two minute intervals for 30 minutes.

Move the apparatus to the fume hood and measure every two minutes for 30 minutes.

Place a plastic bag over the leafy part of the shoot and fasten with a rubber band. Measure this for an additional ten minutes.

Results Page:

Results and Discussion

This experiment was conducted to show how different effects such as wind or temperature affect transpiration. The results of transpiration under normal room conditions on the plant showed the fastest rate of transpiration. This faster rate showed that the temperature had the greatest effect on the pea plant leaves. This also was indicated by the control group.

The next effect on transpiration come from the wind factor present in the fume. The rate of water loss and demand was 0.45 centimeters. This proved that plants do lose water when outside conditions change such as in the presence of windy conditions.

When our plant was placed in the bag and the carbon dioxide and water vapor level was cut the plant had no movement of transpiration going on. It was at this time that our plant had taken in enough water to meet the plants current water level needs. Therefore, the stomata was closed. The plant had no water loss to the atmosphere and so water was not taken into the plant.

Table 1: Room Conditions 25 degrees Celsius

Time	Measurement	Amount of Change
12:13 pm	1.5 cm	-----
12:15 pm	1.75 cm	0.25 cm
12:17 pm	2.0 cm	0.25 cm
12:19 pm	2.25 cm	0.25 cm
12:21 pm	2.25 cm	-----
12:23 pm	2.45 cm	0.20 cm
12:25 pm	2.50 cm	0.05 cm
12:27 pm	2.50 cm	-----
12:29 pm	2.60 cm	0.10 cm
12:31 pm	2.65 cm	0.05 cm
12:33 pm	2.65 cm	-----
12:35 pm	2.65 cm	-----
12:37 pm	2.65 cm	-----
12:39 pm	2.7 cm	0.35 cm
12:41 pm	2.7 cm	-----

Total Transpiration - 1.5 cm

Table 2: Under Hood 20 degrees Celsius

Time	Measurement	Amount of Change
12:45 pm	1.9 cm	-----
12:47 pm	1.9 cm	-----
12:49 pm	1.9 cm	-----
12:51 pm	1.9 cm	-----
12:53 pm	2.0 cm	0.1 cm
12:55 pm	2.1 cm	0.1 cm
12:57 pm	2.1 cm	-----
12:59 pm	2.1 cm	-----
1:01 pm	2.2 cm	0.1 cm
1:03 pm	2.2 cm	-----
1:05 pm	2.3 cm	0.1 cm
1:07 pm	2.3 cm	-----
1:09 pm	2.3 cm	-----
1:11 pm	2.35 cm	0.05 cm
1:13 pm	2.35 cm	-----

*Total Transpiration - 0.45 cm

Table 3: Plant at Room Temperature 25 Degrees Celsius
(Variable Plastic Bag Placed Over Plant)

Time	Measurement	Amount of Change

1:12 pm	2.5 cm	-----
1:14 pm	2.5 cm	-----
1:16 pm	2.5 cm	-----
1:18 pm	2.5 cm	-----
1:20 pm	2.5 cm	-----

*No Transpiration Change

Table 4: Control Peas (At Room Temperature 25 degrees Celsius)

Time	Measurement	Amount of Change
12:13 pm	1.5 cm	-----
12:15 pm	1.75 cm	0.25 cm
12:17 pm	2.0 cm	0.25 cm
12:19 pm	2.25 cm	0.25 cm
12:21 pm	2.25 cm	-----
12:23 pm	2.45 cm	0.20 cm
12:25 pm	2.50 cm	0.05 cm
12:27 pm	2.50 cm	-----
12:29 pm	2.60 cm	0.10 cm
12:31 pm	2.65 cm	0.05 cm
12:33 pm	2.65 cm	-----
12:35 pm	2.65 cm	-----
12:37 pm	2.65 cm	-----
12:39 pm	2.7 cm	0.05 cm
12:41 pm	2.7 cm	-----

*Transpiration Amount - 1.2 cm

Conclusion Page:

Conclusion

A shoot was placed in the hole in the rubber stopper and inserted into colored water in the flask. As the plant takes up water, air moves into the pipette. Under set conditions the measurements were made on the volume and the rate at which water was transpired by following the movement of the interface between the water and air in the pipette.

Once the shoot was removed the rate of water uptake was greatly increased to 1.5 centimeters. This was a new rate of water uptake. The fact that the equilibrium rate of the plant freed from its roots was higher shows that the roots were unable to take up water as rapidly as the shoot was capable of transpiring it.

The rate of water uptake rose steadily during the first experiment and continued to rise at a slower rate in the fume. Once the plant was placed under the plastic bag equilibrium had been reached and therefore, the plant was full and turgid.

Since the roots on the plant no longer depressed the rate of movement of water into the plant, transpiration reached a new, constant equilibrium rate which was higher than that of the intact plant.