

ILAS (G30) 0053321
Laboratory in Chemistry

(1st yr./2nd semester, Spring
term, Wed, P3 & P4)

Textbook

Laboratory in Chemistry 2019

- Will be provided electronically as a PDF file
- Recorded (ZOOM) lectures will also be provided and PDF files of the PPT.

The textbook is required for the course!

Orientation & Safety Class: Chemical Laboratory and Experiment

Teacher

- Prof. Gabor SAMJESKÉ (Course Master)
- Prof. Quan PHUNG
- Prof. Yoshiaki SHUKU
- Teaching Assistant (TA)
Ms. LI Fangru M1
Mr. HOBBS Daniel (M1)

Course Purpose

Perform experiments

- Efficiently
- Detail-oriented
- Carefully documented

Draw conclusions

- Supported by your experimental findings
- Understandable for others

Prerequisite

Courses already taken or taking concurrently

- Fundamentals of Chemistry 1
- Fundamentals of Chemistry 2

Workflow I

- Part of the experiments will be on-line only (experiments 6 & 9)
- All other experiments will be – principally – carried out by students in the lab
- If the situation changes and access to NU Higashiyama Campus will be restricted or limited for students, then data, photos, and video for those experiments that cannot be carried out in person, will be provided
- Students, who cannot attend experiments in person will be provided with similar electronic material by access to the NUCT system
- The grading will be for the largest part based on the lab reports submitted by the students
- Lab reports are due until the scheduled start of the next experiment, no matter if the experiment will take place in the lab or only data will be provided
- If there is a lecture or break (Golden Week), then there will be additional time for lab report submission

Workflow II

- 1) We will provide you the PDF file of the textbook that you can print but any modification or distribution in either written or electronic form is prohibited for copyright reasons. You may keep an electronic copy or printed version for your self-study purposes during the course
- 2) On the day of the experiments, we will upload the photos with description and any other required data after the experiments have been finished in the lab or the corresponding time if no experiment took place
- 3) Students carrying out the experiments by themselves are expected to use their own data for the lab report
- 4) Students may compare their own experimental data with provided data and in case of large differences are encouraged to briefly discuss the cause of the differences
- 5) However, ... **lab reports shall not exceed six (6) A4 pages!**
- 6) Lectures will be given in the laboratory space and real-time broadcasted using ZOOM for those who cannot attend in person. Dependent on the situation (large time zone difference for a registered student), we will provide recordings of the lecture (ZOOM) by the NUCT system. Lecture recordings are only allowed to be used for own study purposes during the course!

A Guide to Safety

Safety Guidelines

- Laboratory in Chemistry, p. 13~20
- Common Issues, p. 28~48

Laboratory in Chemistry, p13

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- **ALWAYS PROTECTIVE EYEGLASSES!!**
- Dedicated lab coat (preferable 100% cotton)
- NO FOOD, NO BEVERAGES, NO SMOKING!!
- No unnecessary items



Laboratory in Chemistry, p14

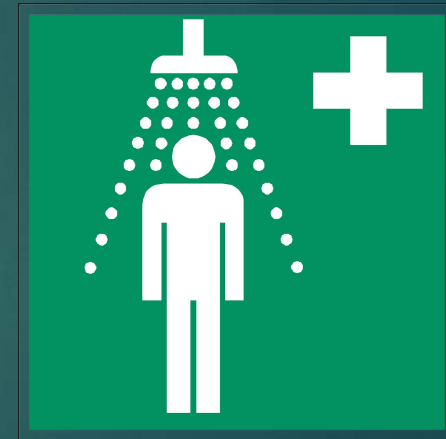
- Comfortable shoes, no pin heels, no open shoes (sandals)
- Dry your shoes on a floor mat on rainy days
- Tie up long hair

Laboratory in Chemistry, p14

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Check and remember (!) locations of
of

- Fire extinguisher
- Emergency shower
- Emergency exit



Experiment

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- Be sure about every experimental step
- Disposal of waste (chemicals, glass, paper) in designated locations
- Make yourself familiar with the usage of devices (heater, centrifuge)
- Follow experimental instructions! (“do it in the fume hood”)

⇒ If unsure, ask!!

Chemicals

- Do not smell, taste, mix, dilute (water) or heat chemicals except explicitly advised to do so
- Never point the opening of a tube, pipette, or beaker into the direction of a person
- Always keep lids of chemical bottles closed
- NEVER DILUTE ACID BY ADDING WATER!

Dangerous Chemicals



chemistry.umeche.maine.edu

Poisonous: poisonous substance

Deleterious: deleterious substance

Flammable: flammable at room temperature (10 °C)

Combustible: combustible material

Irritating: highly irritating and generates vapor that can damage skin and mucous membranes

Silver nitrate	Deleterious
Zinc nitrate	Deleterious
Hydrochloric acid	Deleterious, irritating
Sulfuric acid	Deleterious
Nitric acid	Deleterious, irritating
Ammonia	Deleterious, irritating
Sodium hydroxide	Deleterious
Lead nitrate	Deleterious
Copper nitrate	Deleterious
Potassium dichromate	Deleterious
Lead acetate	Deleterious
Potassium hydroxide	Deleterious
Oxalic acid	Deleterious
Ethanol	Flammable
Acetic anhydride	Combustible, irritating
Hydrogen peroxide	Deleterious, irritating
Acetone	Flammable
Tributyl phosphate	Poisonous
Ligroin	Flammable
Hydrogen sulfide	Poisonous, irritating
Diphenylamine	Deleterious
Hexane	Flammable
Dioxane	Flammable
Ethyl acetate	Flammable
Acetonitrile	Flammable

Chemicals

Disposal

Type	Disposal
Aqueous (no acid, no base, no heavy metal)	Waste liquid "No heavy metal"
Containing heavy metal	"heavy metal ion"
Solid inorganic compound	Designated container
Alcohol/acetone	Designated container
Other organic compound	"Organic waste liquids"

Devices

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- Heating: Water bath (beaker) on electric heater
- Centrifuge: Always balanced (centrifuge tubes on opposite sites)
- Damaged glass:
 - 1) Inform TA
 - 2) Carefully (!) collect pieces and dispose in glass waste

Accidents

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Report EVERY accident to faculty member or TA immediately!!

Spilled chemicals on skin:

- Small amounts of acid, base, metal salt solution, methanol, acetone \Rightarrow Rinse with water
- Large amounts of above \Rightarrow Remove soaked clothes & emergency shower
- Other organic compound: Wipe off (tissue paper) & seek advice (TA)

Accidents

- Spilled chemicals into eyes:
Immediately wash with tap water for 15 ~ 30 min ⇒ inform faculty member ⇒ ophthalmologist (eye doctor)
- Swallowed chemicals
Immediately inform faculty member
- Skin inflammation
Immediately inform faculty member
- Inhaled vapor
Immediately to fresh air and inform faculty member

Accidents

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In case of fire shout “Fire!!” and alarm everybody around you!

- Remove any burnable goods as quickly as possible
- Use fire extinguisher
- If clothes caught fire ⇒ **Immediately** emergency shower!
- If fire gets quickly large ⇒ Evacuate quickly but calmly & activate fire alarm!

Earthquake

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Tokai earthquake **information**

- Stop any experiment
- Return chemicals into shelves
- Turn off heater

Occurrence of earthquake (strong shaking)

- Stop any experiment
- Turn off heater
- Evacuate calmly
- Do not hide under tables with water bath or chemicals

Lab notes

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Be prepared before the experiment starts! (If you are going to carry out the experiment in person)

Must contain

- Experiment number
- Every experimental step (adding chemicals, heating, cooling, stirring, centrifugation etc.)
- All measured data in the prepared tables
- Observations (color change, precipitation, dissolution)

Reports (p.89-93)

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Write carefully and be sure to answer the questions!

- Objectives
- Procedures
- Methods
- Observations
- Tabulated data & Figures } Results
- Answers to questions/problems
- Discussion
- Conclusions
- Literature

Reports (p.89-93)

- Results must be consistent with records in the lab notes
- Graphs have always to be based on tabularized data
- Only include objective observations

Your report should demonstrate how well you have met the objectives of the experiment

Reports (p.89-93)

Reports should not

- exceed 6 pages in total!!!
- contain a copy of the experimental description in “Chemistry Laboratory Manual”
- *be a summary of what you were supposed to do but of what you actually carried out!*

A Few Words on Errors

- Absolute error is a **difference** between the **R**eal and **M**easured value, and it has units: **$AE = M - R$**
- Relative error is a **ratio** of the absolute error to the real value, and it is in %:
 $RE = (M - R)/R$

A Few Words on Errors

- **Standard deviation (SD)** is a property of the data set!
- **Standard error of the mean (SEM)** is a property of the single point—the mean!

Error bar	Type	Description	Formula
Range	Descriptive	Amount of spread between the extremes of the data	Highest data point minus the lowest
Standard deviation (SD)	Descriptive	Typical or (roughly speaking) average difference between the data points and their mean	$SD = \sqrt{\frac{\sum (X - M)^2}{n - 1}}$
Standard error (SE)	Inferential	A measure of how variable the mean will be, if you repeat the whole study many times	$SE = SD/\sqrt{n}$
Confidence interval (CI), usually 95% CI	Inferential	A range of values you can be 95% confident contains the true mean	$M \pm t_{(n-1)} \times SE$, where $t_{(n-1)}$ is a critical value of t . If n is 10 or more, the 95% CI is approximately $M \pm 2 \times SE$.