

SCILABO101 Introductory Science Laboratory
Fall 2019



**SCILABO101 Introductory Science Laboratory
Fall 2019**

Classroom no: L026
HZ University of Applied Sciences
Edisonweg 4
4382NW Vlissingen
Telephone: 0118-489000
www.hz.nl

Class times: Wednesday 09.00-17.00h

Instructor: L.T. van den Broeke, PhD

Email: l.broeke@ucr.nl

Tel: 06-37597645

Office no. & location: Franklin 2.06

Office hours: Weekdays on appointment

I. Track information

- a. Prerequisites for this course: It is recommended to have followed chemistry in high school. Computer skills using Excel and Word are highly desirable for data analysis and writing lab reports, but a brief introduction to using Excel can be given on request.
- b. This course serves as prerequisite for: Intermediate Science Laboratory (SCILABO202), Advanced Science Laboratory (SCILABO301) and Life Science Laboratory (SCILABO201).
- c. Other courses which are relevant to this course – e.g. as part of a minor: pre-medical track courses, Science courses like Ecology, Chemistry and Earth Science.

II. Course description

The course is a recommended course for all pre-med and science majors. Learning how experimental data are obtained and how they should be analyzed is important when either continuing in practical research or depending on practical research. Experiments are the foundation of many new discoveries in science and also provide proof for computer modeling of experiments. After attending this course the student will be able to plan and carry out experiments while taking safety aspects into account and be able to clearly report the experimental results. Also, observational and experimental skills are developed. The course will be adjusted to cater more specifically the interests of students, either science or medical track.

III. Study Load

This course earns students four credits (equivalent to 7.5 ECTS). The class meets on Wednesdays an entire or half a day. Preparation time is approximately 3-4 hours per week; reporting 4 hours a week, on average.

IV. Course materials

- a) Suggested books and literature:
 - a. Pitzer EW (2014) *Introductory Chemistry*, Bookboon.com.
 - b. Philschatz on-line chemistry-book:
<http://philschatz.com/chemistry-book/contents/m50979.html>
- b) Information presented on Moodle.
- c) Useful web links:
 - a. Material Safety Data Sheets: <http://www.msdssearchengine.com/>
 - b. Periodic table of elements: www.webelements.com

Students are responsible for acquiring all assigned reading individually (thus hardcopies will not be provided.)

V. Course organization and requirements

- a) Two students, in shifts, will arrive 30 minutes in advance to prepare materials for class. The same couple of students will stay to direct their fellow students to store materials and inspect if cleaning has been properly done after the lab session.
- b) Class meetings can encompass prelab assessment, short lectures, experimental work, student presentations, discussion of group/individual work and in-class assignments, see average lab-day below:

8:30 -9:00	Setting up of materials/equipment by team of two students.
9:00 – 9.15	Prelab assessment (multiple choice).
9:15 - 9:45	Introduction to the experiment.
9:45-10:45	Experimental work.
10:45-11:00	Coffee break.
11:00-12:30	Experimental work.
12.30-13.15	Lunch.
13:15-13:30	Evaluation / discussion of problems or suggestions.
13:30-16:40	Experimental work.
16:40-16:55	Cleaning up.
17:00	Leaving the lab after consent of Instructor.

- c) Although in class participation is not graded directly, active participation is expected from you as it will improve your learning.
- d) It is essential that you prepare for class: read the assigned literature and perform the homework assignments. In case of evident lack of appropriate laboratory preparation, for safety reasons, you can be expelled from the practical and the session has to be caught up individually on another date at the end of the semester.

- e) Deadlines for individual or group work are to be met. Missing deadlines means grade deduction.
- f) Experimental procedures and readings need to be printed out by the students themselves.
- g) Absenteeism needs to be communicated in advance whenever possible.
- h) Repeated lateness may affect your grade or lead to expelling from the course.
- i) Missing an exam without proper reason and prior communication means scoring 0%. If you miss an exam with a proper reason that has been communicated in advance, you will be offered the opportunity to do the exam in week 49, on Wednesday December 4th, at 10 am.
- j) If you miss one lab session and can present a note from the tutor, you have to perform the missed experiment at another time indicated by the instructors (catch-up session). According to institutional guidelines, two missed lab sessions (equivalent to 8 missed classes) means you cannot pass, even if this is due to illness.
- k) You cannot hand in a report for a lab session where you were not present.
- l) Late homework will only be accepted up to 5 work days (max) after the initial date due. There will be a 4% penalty for the assignment, for each day the report is late. If you hand in the report after those 5 days, you will need permission of the instructor to submit the report for grading. Lab reports handed in after an extension date (after 5 days plus the additional days allowed by the instructor) will not be accepted and a score of Zero will be assigned. This is to protect students to fail the course by not handing in homework.
- m) Use Moodle for submitting work. Reports should be in either Word or Excel format (no pdf) to facilitate feedback. All reports should have a straightforward name, for example: NAME_Assignment number (Dorothy_report1.doc or Daniel_report1.xls).
- n) Grade information in Moodle is unofficial. Final grades for a course are set only after a final review by the instructor and the Board of Examiners. Your official final course grades are communicated to you by the Registrar.
- o) Special needs: students with documented learning disabilities or special needs should make their needs known to the instructor at the start of the course.
- p) Plagiarism is a serious academic offence which carries heavy sanctions. Acquaint yourself with the UCR Plagiarism Policy (see Student Handbook). All cases of suspected plagiarism have to be reported to the Board of Examiners.
- q) You are expected to speak English at all times.
- r) If a field trip is scheduled, your participation is compulsory. When absent, you will be given a replacement assignment (which will take you more time).
- s) You should apply to the following basic lab rules:
 - a. Wear lab glasses and clothing according to HZ lab rules at all times. Do not wear a labcoat outside the laboratory facilities.
 - b. Always mark with a permanent black marker which chemicals are present in glassware or other containers.
 - c. If you weigh a chemical, do not return surplus to containers, in order to avoid contamination of the stock.

- d. If you need liquid from a container/bottle always pour it into a beaker glass first and do not pipette from the container/bottle, in order to assure purity of the stock.
- e. Cleaning up is mandatory! Always make sure that:
 - i. chemicals and materials are placed back in the proper place.
 - ii. nothing is left by the sink, in the fume-hood or around the analytical balances.
 - iii. pH electrodes are stored in wet jackets and pipettes in their boxes.
 - iv. glass-ware is cleaned (marker removed) and put back in the cabinets.
 - v. chemical containers (flasks, boxes) are clean on the outside when placed back.
- f. You are not allowed to leave the lab course early without approval of the instructors.

This course is subject to UCR academic rules and procedures. Both students and instructors are required to know and follow these rules and procedures.

VI. Assessment

- a) Initial Written Test: 0%
- b) Midterm Written Exam: 14%
- c) Practical exam: 14%
- d) Data report (2x): 4%, each
- e) Lab reports (3x): 8%, each
- f) Scientific report (1x): 14%
- g) Laboratory performance: 10%, on average
- h) Prelab homework multiple choice test: 10%, on average
- i) Logbook maintenance 6%.

a. Initial Written Test:

Test on day 1, to verify your current knowledge of chemistry and basic calculations. (If needed, consult the on-line books in advance.)

b. Midterm Written Exam:

Test concerning essential laboratory calculations and procedures.

c. Practical exam:

Designing the experimental procedure, carrying out and data processing of an individual experiment. Draft versions of the experimental procedure will not be graded, but may benefit from feedback.

d.e.f. Data reports, Lab reports, Scientific reports and oral presentations:

Reporting/presenting of performed experiments. On occasion, reports may be written together with lab a partner. Deadline: In general, all reports should be handed in the following week after last practical: Tuesday's at 24.00 hour, latest (except for the scientific report, as

mentioned below) to enable personal feedback on Wednesday if needed. Late uploaded reports are subject to grade deduction as indicated below.

- **Data report:** Summary of safety considerations, observations, data analysis, error analysis and discussion of reliability, conclusion. Also answers to questions posed in experimental procedure (if applicable). Writing instructions will be uploaded on Moodle.
- **Lab report:** Description of the aim of the experiment, the materials and experimental procedure, results and data analysis, discussion, safety measures and conclusion, If applicable, also include references, appendices and answers to questions mentioned in the experimental procedure. Writing instructions will be uploaded on Moodle.
- **Scientific report:** Article style report. The article style report should include literature research on the subject. Writing instructions will be uploaded on Moodle. The scientific report should be written individually and may be handed in at the end of the course on December 4th, latest.
- **Oral presentation:** Delivering of an oral presentation on an practical related subject. Grading criteria are: organization, subject knowledge, graphics, connection to audience and elocution.

g. Laboratory performance:

Safe working, perseverance and being actively involved, cleaning-up behavior, choosing/using the appropriate equipment and glassware (including pipette handling and appropriate treatment of chemicals).

h. Prelab homework:

Based on the delivered answers on the prelab multiple choice test students will be further questioned on safety issues and experimental preparations*. Hints:

- Consult Material Safety Data Sheets (MSDS).
- Think about how to handle and dispose the chemicals in a safe and environmental friendly way.
- Find background information on the applied analytical technique. For instance, when working with the spectrophotometer, be aware of the analytical wavelength, understand the principle of absorption of light, apply the law of Lambert Beer etc.
- Study the basic chemistry in the experiment, the reactions and products.
- Calculate how solutions or mixtures should be made.
- Make a dilution scheme for the standard solution series from a known stock solution.
- Read through the experimental steps to see if there should be parallel actions taken and which materials (such as glassware/solutions) need to be ready at which moment.

i. Logbook maintenance:

Keeping of accurate records of all the things that can affect the progress of the experiment, like equipment used, drawings of models, names and weights of resources, results, dead-ends and thoughts that come along the way. The logbook is used to prepare the final report, and the instructors may inspect logbooks as part of the ongoing assessment. Logbooks should be kept with the students whenever work is done on projects.

The guidelines for lab notebooks vary widely between institution and between individual labs, but some guidelines are fairly common. The lab notebook is typically permanently bound and pages are numbered. Dates are given as a rule. All entries are with a permanent writing tool, e.g., a ballpoint pen. The lab notebook is usually written as the experiments progress, rather than at a later date.

In conclusion, you will be involved in the following activities that will be evaluated:

- Preparation.
- Literature search.
- Laboratory performance.
- Reporting.
- Designing an experimental procedure.
- Data analysis (you will receive a computer account at the HZ University of Applied Sciences).
- A midterm written exam based on performed experiments and theory.
- An end-term individual practical exam.

VII. Course schedule (subject to minor changes)

Time	Topics to be discussed	Course material used	Assignments and assessment
Aug 28 Half a day	Introduction (Room L064): <ul style="list-style-type: none"> - Course Outline explanation. - Exercise on chemical calculations. - Information on reporting. - Lab-coat and glasses purchase. - Lab-tour. - Laboratory Fire drill. - Setting up of computer accounts. 	Moodle: <ul style="list-style-type: none"> - Course Outline. 	Initial Written Test.
Sep 04	UV-VIS Spectroscopy (UV-VIS): <ul style="list-style-type: none"> - Using laboratory glassware, balances and automatic pipettes. 	Moodle: <ul style="list-style-type: none"> - Protocol I. - Appendix 3 of Course Outline 	Laboratory performance. Prelab homework.

	<ul style="list-style-type: none"> - Making of calibration series. - Calibration of spectrophotometer with K_2CrO_4. <p>pH measurement:</p> <ul style="list-style-type: none"> - Calibration. - Buffer demonstration. - Determination of the acid dissociation constant. 	(Safety Rules at HZ University of Applied Sciences.).	<p>Lab Report.</p> <p>Logbook maintenance.</p>
Sep 18	<p>Ion Selective Electrodes (ISE), Ion Chromatography (IC):</p> <ul style="list-style-type: none"> - Fluoride in mouthwash. <p>Electrochemistry:</p> <ul style="list-style-type: none"> - Galvanic cells. 	<p>Moodle:</p> <ul style="list-style-type: none"> - Protocol II. 	<p>Laboratory performance.</p> <p>Prelab homework.</p> <p>Lab Report.</p> <p>Logbook maintenance.</p>
Oct 02	<p>Flame Atomic Absorption Spectroscopy (FAAS), UV-VIS:</p> <ul style="list-style-type: none"> - Urine analysis (calcium and phosphate) <p>Set-up Wine Fermentation</p>	<p>Moodle:</p> <ul style="list-style-type: none"> - Protocol III. 	<p>Laboratory performance.</p> <p>Prelab homework.</p> <p>Scientific Report.</p> <p>Logbook maintenance.</p>
Oct 16	Midterm Break.		
Oct 23	<p>Gas Chromatography (GC), High Performance Chromatography (HPLC), IC:</p> <ul style="list-style-type: none"> - Wine Analysis 	<p>Moodle:</p> <ul style="list-style-type: none"> - Protocol IV. 	<p>Laboratory performance.</p> <p>Prelab homework.</p> <p>Lab Report.</p> <p>Logbook maintenance.</p>
Oct 30	<p>Excursion: Covra:</p> <ul style="list-style-type: none"> - depart: 12.10h. at UCR - return: 16.00h. 	NA	<p>Midterm Written Exam. 09:30-11:30h. Room: ...</p>
Nov 13	Organic Synthesis & Analysis:	<p>Moodle:</p> <ul style="list-style-type: none"> - Protocol V. 	Laboratory performance.

Half a day	<ul style="list-style-type: none"> - Synthesis of Aspirin from methyl salicylate. - Recrystallization to increase purity and/or change crystal morphology. - Purity check by FeCl_3 and HPLC. 		<p>Prelab homework.</p> <p>Lab Report.</p> <p>Logbook maintenance.</p>
Nov 20 Half a day	<p>Redox Titration:</p> <ul style="list-style-type: none"> - Oxygen (“Winkler”). 	<p>Moodle:</p> <ul style="list-style-type: none"> - Protocol VI. 	<p>Laboratory performance.</p> <p>Prelab homework.</p> <p>Logbook maintenance.</p>
Dec 04	Catch up session for missed classes.	<p>Moodle:</p> <ul style="list-style-type: none"> - Protocol based on missed class. 	<p>Laboratory performance.</p> <p>Prelab homework.</p> <p>Lab Report.</p> <p>Logbook maintenance.</p>
Dec 11 Half a day	Practical Exam.	Your own designed experimental procedure.	<p>Laboratory performance.</p> <p>Prelab preparations.</p> <p>Data processing.</p> <p>Logbook maintenance.</p>

VIII. Student learning outcomes

More detailed objectives (to be used when studying for exam) will be put on Workspaces!

Period	Teaching activities	Student is able to do
Week 1-2	Practice chemical calculations and making measurements of mass and volume using the appropriate balance and automatic pipettes.	Make appropriate use of laboratory balances, glassware and automatic pipettes.

		Check whether work is performed accurately and precisely.
Week 2-9	<p>The preparation, performing and reporting of a laboratory experiment. On a weekly basis the reporting requirements will be intensified.</p> <p>The last week, the experimental procedure has to be designed, carried out and the data processed, individually.</p>	<p>Make appropriate use of different laboratory equipment and apply basic analysis methodologies.</p> <p>Work safely and precisely, and make experimental observations.</p> <p>Process, report and present data properly.</p> <p>Read and review scientific literature.</p> <p>Make a basic experimental design.</p>

IX. Appendices

1. Financial Contribution:

Since the laboratory course is the most expensive course at UCR, a financial contribution is required:

- Chemicals, lab-material etc.: €43
- lab-glasses: €12
- lab-coat: €20

You can either pay by cash or by bank-transfer:

NL12 RABO 0335 0483 15
 University College Roosevelt
 Mention: Contribution SCILABO101

Naturally, if you have your own lab-coat or lab-glasses, you don't have to buy new ones.

For each lab session you need to bring a lab-journal (bound), a black marker (permanent) and a calculator. You can buy the first two items mentioned at the HZ bookstore, if needed.

2. Group Layout*:

Sep 4 th	Sep 18 th	Oct 2 nd	Oct 23 th	Nov 13 th	Nov 20 th
UV-VIS, pH	ISE, IC, Galvanic cells	FAAS, UV-VIS	GC, HPLC, IC	Organic synthesis	Titration
Nicole Brackenborough Demi Clarijs	Nicole Brackenborough Filippo Venturoni	Nicole Brackenborough Nynke Weterings	Nicole Brackenborough Yosun-Amber Kaya	Nicole Brackenborough Dana Maestri	Nicole Brackenborough Anna Sherlock
Marcia Fernandes Anna Sherlock	Marcia Fernandes Demi Clarijs	Marcia Fernandes Filippo Venturoni	Marcia Fernandes Nynke Weterings	Marcia Fernandes Yosun-Amber Kaya	Marcia Fernandes Dana Maestri
Hiba Atrach Dana Maestri	Hiba Atrach Anna Sherlock	Hiba Atrach Demi Clarijs	Hiba Atrach Filippo Venturoni	Hiba Atrach Nynke Weterings	Hiba Atrach Yosun-Amber Kaya
Achraf Ouaali Yosun-Amber Kaya	Achraf Ouaali Dana Maestri	Achraf Ouaali Anna Sherlock	Achraf Ouaali Demi Clarijs	Achraf Ouaali Filippo Venturoni	Achraf Ouaali Nynke Weterings
Olivier Braas Nynke Weterings	Olivier Braas Yosun-Amber Kaya	Olivier Braas Dana Maestri	Olivier Braas Anna Sherlock	Olivier Braas Demi Clarijs	Olivier Braas Filippo Venturoni
Daimy Zaal Filippo Venturoni	Daimy Zaal Nynke Weterings	Daimy Zaal Yosun-Amber Kaya	Daimy Zaal Dana Maestri	Daimy Zaal Anna Sherlock	Daimy Zaal Demi Clarijs

Groups indicated in yellow are expected to make lab preparations at 8.30 h.

*: at some sessions work is done individually.

3. Safety Rules at HZ University of Applied Sciences.

IN CASE OF AN INCIDENT OR ACCIDENT IN THE LAB:

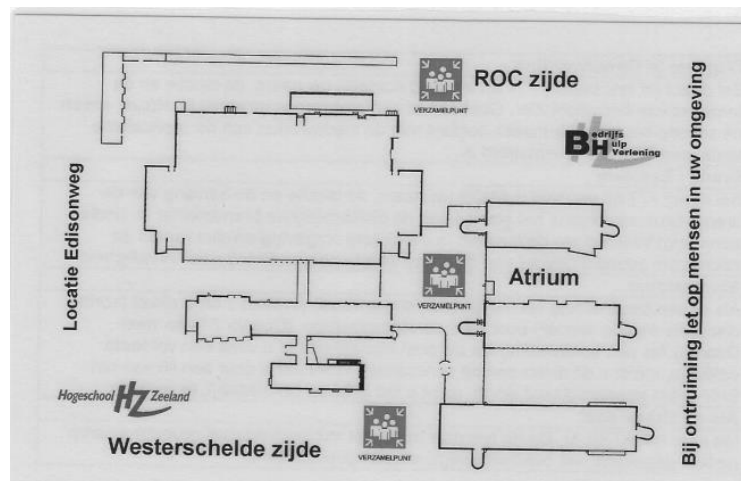
- a. Notify Instructor.
- b. When Instructor is not present (or unable to respond) notify Laboratory Head: Sandra de Reu.
- c. When neither the instructor nor Laboratory Head is available call: 9 7 7 7

IN CASE OF A FIRE/EXPLOSION:

1. Notify Instructor if possible and/or push the fire alarm button.
2. Call: 9 7 7 7
3. Try to extinguish beginning fires (training provided).
4. If necessary shut down electricity using big red knob on the left side of the door.
5. Close doors and windows.
6. Use escape route (do not use elevators).
7. Gather at designated meeting point outside the HZ building (ATRIUM).

IN CASE THE SIREN SOUNDS:

Gather outside at the ATRIUM



B	Rules of conduct for practicals
B1	General rules of conduct for the practicals
1	Order and neatness are required to work safely. For each practical two students will be appointed labwatch to assist in keeping order and neatness.
2	Smoking, drinking and eating is not allowed in the laboratory. Always wash hands before leaving the laboratory or when appropriate (e.g. chemicals on hands)
3	The student needs to know the escape routes to leave the building in case of an alarm. Also, the gathering place where he needs to report after leaving the building needs to be known and fled to. The instructor or supervisor needs to do a headcount here. The gathering place is at the so-called 'plofhok'.
4	At the start of a practical the student needs to sign the attendance list. When a student needs to temporarily leave the laboratory, he needs to report this to the instructor or the labwatch student. At the end of the practical the lab journal needs to be signed by the instructor.
5	For every experiment, a proper preparation of the students regarding safety and experimental procedure is mandatory.
6	The student needs inform himself or herself about the potential dangers of a certain experiment. When in doubt always consult an instructor.
7	The student must report defects of apparatus immediately to the instructor.
8	The student must wear safety glasses at all times in the laboratory and a buttoned up lab coat, proper shoes (no sandals, high heeled pumps etc.). It is not allowed to wear shorts or short skirts for safety reasons. Pants are preferred.
9	No caps, hats, shawls or other should cover the head, yet loose long hair must be tied with an elastic, hairclip etc. Garments such as ties, shawls are prohibited. Clothing worn for religious purposes must adhere to standard safety rules (contact instructors).
10	Pipetting of fluids may only be done by using the pipette balloon, not with the mouth!!!
11	Waste that is hazardous for the environment may not be flushed down the sink but must be disposed of in the appropriate waste containers.
12	The student may not stay in the laboratory without supervision of an instructor or assistant.
13	The student may not skip a practical. When the student is absent for relevant reasons, he must report this to the administration of education and needs to contact the instructor on how to catch up with the practicals.
14	The student needs to hand in the lab reports in time. If reports such as safety reports and reports on experimental procedures are not handed in in time, the instructor may deny the student entry to the lab.
15	The use of a lab journal is mandatory
16	The instructor appoints one or two students as lab watch. This student has the following tasks <ul style="list-style-type: none"> - Checks if the attendance list has been signed by all students - Checks is all the chemicals have been put back into place - Checks if the used apparatus is turned off - Checks whether the lab counters, sinks, weighing tables and equipment and hoods are cleaned properly

	The lab watch reports to the instructor at the end of the practical
17	Do not write on your lab coat or decorate it otherwise. You are allowed to put your name in the lab coat if it is your personal property.
18	It is not allowed to carry or use walkmans, mobile phones or other distracting things in the laboratory

B2	Additional rules of conduct for microbiological practicals
1	Below follow the specific rules of conduct that apply to microbiological experimentation.
2	Wear a buttoned up lab coat; sleeves from a shirt or sweater may not come from under the lab coat sleeves.
3	Keep your nails, short; take off watch and rings.
4	Always work above a lab bench; in case you spill the infection will be contained to the table. Place as few pens and papers as possible on the bench. Never work right above your manual or lab journal.
5	Keep all tubes, nutrient media etc. that are used for growing bacteria closed as much as possible. The same holds for tubes, nutrient media etc. that are infected with bacteria.
6	Walk as little as possible with infected material through the laboratory. Infected materials may never leave the laboratory.
7	No infected material may be thoughtlessly cleaned or discarded. - Small infected disposables – like papers, cotton wads, slides, Pasteur pipettes etc. – must be submersed in the trays with disinfecting liquid (which are located on top of the lab benches). - Larger infected disposables – like overgrown Petri dishes etc – must be placed in a special waste basket which is lined with a double plastic bag. - Infected test tubes are collected in a special metal basket. - Infected pipettes are first placed in the containers with disinfecting liquid located on the lab benches. At the end of the practical, they are moved to the centrally located pipette cylinder also containing disinfecting liquid.
8	- Infected glass that needs to be reused – like Erlenmeyer flasks, measuring cylinders etc. – are submersed in a centrally located large container with disinfecting liquid. - Non-infected materials may be cleaned or disposed of in the usual way.
9	Pipetting of fluids may never be done by mouth. If you use a the pipette balloon to pipette infected material, only remove the balloon of the pipette once the tip of the pipette is in the disinfecting liquid. To pipette small volumes, use a special pipette with a disposable sterile plastic tip.
10	When an infection occurs – for example because of a falling tube containing cultures, accidentally opened Petri dishes, leaking pipettes etc. – immediately take the appropriate disinfecting measures, like cleaning the infect place with disinfecting liquid. Avoid infecting yourself and others. In case of accident warn your instructor!
11	At the end of the practical, sprinkle the lab benches with disinfecting liquid and distributed it with cotton wool or paper towels of the benches.

12	Take of your lab coat before you leave the laboratory. Then wash your hands with special disinfecting soap; dry your hands with a paper towel. Only then put back on your watch and rings.
13	An infected lab coat should be taken off very carefully, folded up inside out, and transported in a plastic bag. Wash it separately (hot!).