

**Implementation Regulations CER HZ**

**Bachelor**

**CHEMISTRY**

**Full-time**

**CROHO 34396**

**2022-2023**



## INDEX

<b>CHAPTER 1 GENERAL PROVISIONS .....</b>	<b>2</b>
1.1 General .....	2
1.2 Establishment and evaluation .....	2
<b>CHAPTER 2 IMPLEMENTATION REGULATIONS HZ CER.....</b>	<b>3</b>
2.1 Registration, prior educational requirements, and admission policy.....	3
2.1.1 Overview of additional prior educational requirements .....	3
2.1.1a Enrolment 180 ECTS track for VWO students .....	3
2.1.2 Deficiency investigation .....	4
2.2.3 Additional requirements .....	4
2.2 Programme and education structure .....	5
2.2.1 Programme profile .....	5
2.2.2 Learning outcomes.....	6
2.2.3 Programme structure.....	10
2.2.4 Courses 'propedeuse' phase.....	13
2.2.5 Main phase courses .....	31
2.2.6 HZ Personality .....	69
2.2.7 Specialisations .....	69
2.2.8 Internship .....	70
2.2.9 Minor.....	70
2.2.10 Participation in international exchange programme .....	70
2.2.11 Graduation .....	70
2.2.12 Transition arrangement .....	70
2.3 Study recommendation .....	71
2.4 Experiment.....	71
<b>CHAPTER 3 ESTABLISHMENT.....</b>	<b>72</b>

## CHAPTER 1 GENERAL PROVISIONS

### 1.1 General

- 1.1.1 The HZ Course and Examination Regulations Bachelor programme full-time (hereinafter: HZ CER ba ft) cover the core of education within the HZ. This document provides a general overview of all programmes taught at the HZ. The HZ CER Ba ft contains institution-specific provisions, i.e. those that apply to the entire HZ. A programme-specific HZ CER Implementation Regulation (hereinafter: Implementation Regulation) is determined for each programme by the executive board each year.
- 1.1.2 The HZ Course and Examination Regulations Bachelor programme full-time applies to this HZ CER Implementation Regulation Bachelor programme full-time.
- 1.1.3 The Dutch Higher Education and Research Act (WHW) as well as the HZ CER ba ft mention study credits. These Implementation Regulations, in addition to the term credits, also refer to ECTS (European Credits Transfer System), where 1 ECTS is equal to 1 credit and thus a study load of 28 hours (article 7.4 paragraph 1 of WHW).

### 1.2 Establishment and evaluation

- 1.2.1 The process of establishment and evaluation of this Implementation Regulation is described in article 1.3.4 CER HZ ba ft.
- 1.2.2 The programme committee evaluates the manner of implementation of the education and examination regulations and the Implementation Regulations in question every year (article 1.3.4 CER HZ ba ft).

## CHAPTER 2 IMPLEMENTATION REGULATIONS HZ CER

### 2.1 Registration, prior educational requirements, and admission policy

#### 2.1.1 **Overview of additional prior educational requirements** (article 2.3 HZ CER Ba ft in addition to the requirements as listed under article 2.2 and 2.2a and 2.2b of HZ CER Ba ft)

Legend

√ Admissible  
X Not admissible

<b>Students with a havo diploma</b>				
Havo profiles:	<b>NT</b>	<b>NG</b>	<b>EM</b>	<b>CM</b>
Admissible:	√	√	X	X

<b>Students with a vwo diploma</b>				
Vwo profiles:	<b>NT</b>	<b>NG</b>	<b>EM</b>	<b>CM</b>
Admissible:	√	√	X	X

#### 2.1.1a **Enrolment 180 ECTS track for VWO students** (article 2.2a CER HZ Ba ft)

Anyone who wishes to be admitted to a three-year Degree programme must comply with one of the following educational entry requirements:

- a. a pre-university education diploma (Dutch: VWO);
  - a. Students with a NT and/or NG profile are admissible to the 180 ECTS VWO programme only if Chemistry, Mathematics B, Physics and Biology were part of the curriculum; both chemistry and mathematics should be finished with a final mark of at least 5.5.
  - b. International students are admissible to the 180 ECTS VWO programme only if Nuffic has determined that their diploma is equal to the Dutch VWO diploma. The diploma must, at a minimum, contain the subjects chemistry, biology, physics and mathematics.
- b. a diploma deemed by ministerial decree to be at least equivalent, or at least equivalent to it in the opinion of the Executive Board. The Executive Board may also decide to admit another person to a three-year Degree programme than the one meant in the first paragraph if, in the opinion of the Executive Board, they have shown they are suitable for that programme.

2.1.2 **Deficiency investigation** (article 2.4 CER HZ ba ft)

The holder of a diploma that does not meet the admission requirements (deficiency) (see article 2.1.1) can be admitted on the condition that the requirements for the contents are met by means of a deficiency investigation. The deficiency investigation for the study programme Chemistry is an assessment of the knowledge of and skills in Mathematics (B) and Chemistry at HAVO level. If the candidate is able to prove by means of the assessment that he or she possesses the required knowledge, he or she will be admitted to the study programme. An assessment for deficiency investigation requires a minimal age of 21 years.

2.2.3 **Additional requirements** (article 2.5 CER ba ft)

No additional requirements apply to the Chemistry programme.

## 2.2 Programme and education structure

### 2.2.1 **Programme profile** (article 3.2 CER HZ Ba ft)

*Study programme profile, according to DAS profile, version 3.0, June 2020.*

The main focus of the programme is solving problems or answering questions, either individually or in a group, at the molecular level in the fields of chemistry, pharmacy, nutrition and health, generally by conducting experimental research in a laboratory. The use of advanced and often automated equipment is becoming an important aspect of this. It is clear here that information technology, such as the use of advanced software to simulate and optimise chemical processes and the use of bioinformatics (data mining, gene and protein analyses, genomics, proteomics), is becoming increasingly important.

In the study programme there is a focus on the role and importance of new developments in Biobased Chemistry and Biobased materials. Besides this the students will get familiar with practicals with Biobased sources and materials and learn about developments from oilbased economy to a more sustainable, circular and biobased economy.

Chemistry graduates are characterised by analytical, abstract-reasoning, investigative and service skills. This means that Chemistry graduates do not just ask about the 'what' and the 'how' but also about the 'why'. They consequently focus on gaining the insight that will allow them to achieve new developments. Chemistry graduates are able to work in a multidisciplinary environment. In their work they take into account the risks for people and the environment, and base their decisions on the Royal Netherlands Chemical Society's ethics chapter. They work within the legal framework that governs the tasks they are performing, and aim for the most sustainable solution possible. Chemistry graduates always follow the guidelines of a quality system, or they apply the Good Laboratory Practice (GLP) rules to their work.

In the laboratory Chemistry graduates might focus on a particular field, for example, a specialisation within the discipline, fundamental or applied research or the development of laboratory techniques. A few years into their careers they might move on to managerial positions such as project manager or head of department or to positions such as quality manager, equipment manager, instructor/supervisor, IT professional and so on. They could also end up working in the education sector, for example as a teacher or supervisor, or in a commercial position in the private sector. An HBO degree in Chemistry also forms a good basis for an academic programme in, for example, chemistry, biomedical sciences, health sciences, molecular/medical biology. Such a programme can generally be taken in an accelerated form at one of the research universities.

2.2.2 **Learning outcomes** (article 3.2 CER HZ Ba ft)

*Learning outcomes, according to DAS profile, version 3.0, June 2020.*

<b>1 Research</b>	
Within the Applied Science domain, the Bachelor of Science translates a problem provided into a research strategy and conducts the research.	
<b>1.1</b>	The student performs simple research in response to a problem statement and setup provided.
1.1a	Communicating with the client about the problem and the objective of the research
1.1b	Gaining an insight into the professional aspects of the research by studying the literature or sources provided.
1.1c	Explaining the relationship between the research question provided, sub-questions and research activities.
1.1d	Developing an approach to carrying out the research activities of a simple research assignment according to a format provided, including the planning of the work.
1.1e	Working in accordance with the work plan when carrying out the assignment and finding effective ways of achieving the intended results. Applying basic knowledge or skills.
1.1f	Summarising the data from the research activities, structuring it in the light of the research question and presenting it clearly. Reflecting critically on the results to determine whether they are realistic.
1.1g	Using the research results to formulate conclusions relating to the research question and if necessary submitting a proposal for improving the implementation of the assignment/the research.
1.1h	Reporting orally and/or in writing on the assignment in accordance with specified guidelines.
1.1i	Actively working as part of a team, processing the feedback on the work delivered to achieve better results. Being able to communicate concisely about goals and results as the work progresses.
<b>1.2</b>	The student makes a major contribution to a research strategy provided and conducts the research.
1.2a	Analysing a problem in consultation and in a coordinated way and translating it into the objectives of the research assignment.
1.2b	Gaining an insight into the problem and the professional aspects of the research by studying the literature or sources the student has selected.
1.2c	Formulating, under supervision, sub-questions and research activities regarding the research to be carried out.
1.2d	Preparing a work plan in consultation, drawing up the plan independently, taking account of any preconditions.
1.2e	Working in accordance with the work plan when carrying out the assignment. Implementing the work plan effectively and efficiently and determining whether interim adjustments are necessary on the basis of interim results. Applying relevant knowledge or skills.
1.2f	Summarising and interpreting the full or partial results in relation to the assignment/research question. Critically reflecting on the reliability of the results.
1.2g	Using the research results to formulate conclusions relating to the research question and using these to make a proposal for follow-up steps.
1.2h	Combining the results into one report in accordance with the applicable guidelines/ standard.
1.2i	Acting as a full team member in the student's working environment, where feedback and reflection lead to better results, reasoned choices and effective coordination in conducting the research. Being able to match communication on progress to the situation.
<b>1.3</b>	The student translates a problem provided into a research strategy and conducts the research.
1.3a	Analysing, independently, a problem provided and translating it into the objective of the research assignment.
1.3b	Selecting and obtaining, without assistance, scientific and other literature or sources in order to study the problem in greater depth, thereby validating the reliability of the different sources of information.
1.3c	Formulating, without assistance, sub-questions and research activities regarding the research to be carried out.
1.3d	Preparing a work plan without assistance, taking into account the interdependencies of various research activities and preconditions.
1.3e	Implementing a complex work plan effectively and efficiently and updating it as necessary in between times. Acquiring relevant knowledge and putting it into practice.
1.3f	Logically and clearly combining the full or partial results and interpreting them in relation to the research question. Performing an analysis of the reliability of the results.

1.3g	Using the research results to formulate and interpret conclusions relating to the research question. Making proposals for follow-up research based on the conclusions.
1.3h	Reporting on the research in accordance with the standard applicable in the professional field.
1.3i	Acting as a full member and working as part of a team which also contains staff from other professional field(s). Communicating independently about the relevant substantive aspects of the progress.

## 2 Experimentation

The Bachelor of Science sets up experiments under supervision and conducts them unsupervised in a systematic way and obtains reproducible and reliable results.

2.1	The student conducts an experiment according to the approach/ protocol provided and obtains replicable results.
2.1a	Explaining the objective of the experiment.
2.1b	Explaining the principle of the method and technique provided.
2.1c	Becoming proficient in the correct handling of the equipment.
2.1d	Properly preparing an experiment on the basis of a protocol/approach provided, conducting it and obtaining replicable results within the specified time and maintaining accurate and clear documentation.
2.1e	Working according to HSE standards and taking ethical and sustainability standards into account when preparing and conducting the experiment.
2.1f	Processing measurement results properly and correctly and estimating whether a result obtained is realistic.
2.1g	Giving reasons to establish whether the approach to the experiment has been followed correctly.
2.2	The student chooses a suitable protocol, adjusts it as necessary and carries it out.chooses a protocol/approach, adjusts it if necessary, implements it and obtains reproducible and reliable results.
2.2a	Choosing an approach and explaining why it is a suitable way of achieving the objective.
2.2b	Having sufficient knowledge and understanding of available methods and techniques to assess their suitability and choose the right equipment and/or device settings.
2.2c	Becoming so skilled in operating the available equipment that adjusting the settings leads to desired effects.
2.2d	Preparing a schedule for implementing a protocol/ approach, conducting the experiment and obtaining reproducible results within the specified time and maintaining accurate and clear documentation.
2.2e	Assessing whether the approach can be implemented according to HSE, ethical and sustainability standards.
2.2f	Assessing the reliability of a result on the basis of an (e.g. statistical) analysis provided.
2.2g	Giving reasons to establish whether the approach to the experiment requires improvement.
2.3	The student sets up experiments under supervision and conducts them unsupervised in a systematic way and obtains reproducible and reliable results.
2.3a	Formulating, without assistance, an approach to achieving the objective of the experiment.
2.3b	Choosing or developing suitable methods and techniques and anticipating possible experimental problems.
2.3c	Being capable of learning independently about the possibilities and limitations of the equipment to be used in order to recognise experimental problems and be able to act accordingly.
2.3d	Preparing a schedule for a number of experiments, conducting them and obtaining reproducible results within the specified time and main- taining accurate and clear documentation.
2.3e	Assessing the approach and adapting it if necessary in accordance with HSE, ethical and sustainability standards.
2.3f	Choosing a statistical or other analysis for assessing the reliability and validity of the result obtained.
2.3g	Making proposals, where necessary, to improve the approach and propose ad- ditional experiments.



#### 4 Management and coordination

The Bachelor of Science checks the work against the requirements of different management systems.

4.1		The student checks the work against the requirements of different management systems.
	4.1a	Demonstrate general knowledge of the context in which relevant management systems are set up.
	4.1b	Comply with the guidelines of relevant management systems by acting appropriately when performing own work.
	4.1c	Communicate about (compliance with) the guidelines of the relevant management systems when carrying out his work.

#### 5 Advice, procurement and sales

The Bachelor of Science familiarises himself with users' problems and/or requirements within the Applied Science domain.

5.1		The student familiarises himself with users' problems and/or requirements.
	5.1a	Listening to the client and repeating the question in your own words.
	5.1b	Describing the provided information about the context.
	5.1c	To use the technical knowledge provided to propose a possible solution.
	5.1d	To motivate the chosen solution for the question.

#### 6 Instruction, supervising, teaching and coaching

The Bachelor of Science passes his own knowledge and skills, on request, to employees (by demonstrating and explaining) within the Applied Science domain.

6.1		The student passes his own knowledge and skills, on request, to employees (by demonstrating and explaining).
	6.1a	Helping to provide fellow employees, students or trainees with instructions/demonstrations with regard to a practical test, etc.
	6.1b	Helping to supervise employees, trainees, students or course participants in the use of methods and equipment, etc.
	6.1c	Explaining things clearly.
	6.1d	Being aware of the importance of continuously developing his expertise.
	6.1e	Providing feedback, on request, on the evaluation/ assessment of the results of instructions, etc.

#### 7 Leadership and managing people

The Bachelor of Science provides employees with assistance and guidance when asked to do so.

7.1		The student provides employees with assistance and guidance when asked to do so.
	7.1a	Showing that he understands the place and role of his part of the organisation (internship/graduation project).
	7.1b	Helping to allocate tasks and work.
	7.1c	Being approachable and accessible for employees, fellow students and lecturers.
	7.1d	Being honest and reliable towards employees, fellow students and lecturers.
	7.1e	Supporting others in their initiatives.
	7.1f	Contributing to staff and progress meetings on the basis of his own work.
	7.1g	Giving a clear and unambiguous explanation or instructions about a task to be performed.
	7.1h	Giving employees an insight into the importance of the constraints of the project.

## 8 Self-management

The Bachelor of Science reflects on his own performance and development.

<b>8.1</b>	The student reflects on his own performance.	
8.1a		Working towards an established learning objective. Discussing the learning strategy and the ensuing results; being aware of the function of a learning objective and how to use it in his learning strategy.
8.1b		Identifying any need to adjust his own performance in the academic environment.
8.1c		Communicating with others about professional and ethical dilemmas and identifying professional and ethical dilemmas.
8.1d		Seeking information in order to improve his own performance.
8.1e		Critically evaluating his own actions and thinking. Being aware of the effect of his own attitude to work on others and on group members in the case of a project.
<b>8.2</b>	The student reflects on his own performance and development.	
8.2a		Determining his own learning objective and learning strategy in consultation/without assistance and reflecting on the result.
8.2b		Using feedback on his own performance to adapt to the working environment.
8.2c		Taking note of any professional and ethical dilemmas and giving his opinion on them.
8.2d		Taking on board criticism of work delivered and discussing his own performance with colleagues.
8.2e		Drawing conclusions on his actions and if necessary articulating them to others.

2.2.3 **Programme structure** (article 3.3, 3.11a en 3.13 CER HZ ba ft)

<b>National name:</b>	B Chemie
<b>International name:</b>	B Chemistry
<b>Orientation:</b>	Bachelor
<b>Title conferred:</b>	Bachelor of Science (B.Sc.)
<b>Programme duration:</b>	240 study credits (EC)
<b>Course workload 'propaedeutic' phase:</b>	60 study credits (EC)
<b>Conclusion with 'propaedeutic' examination:</b>	Yes
<b>Course workload main phase:</b>	180 study credits (EC)
<b>Variant:</b>	Full-time
<b>ISAT code:</b>	34396
<b>Location:</b>	Vlissingen*
<b>Language:</b>	Dutch and English
<b>Effective date:</b>	30-11-2017
<b>Submission date</b>	29-11-2023
<b>Joint degree programme:</b>	Not applicable
<b>180 ECTS fast track:</b>	Yes

\* In the course of the year the program will move to location Middelburg

### Programme regular track 240 EC

Note

S: semester

Block: ½ semester (= quarter)

AC: Applied Chemistry

LS: Life Science

Semester	Block	Course code	EC	Title
S1	01 Food Chemistry	CU20623V2	5.00	Beer Chemistry
S1	01 Food Chemistry	CU20624V1	5.00	Chemistry 1 and Microbiology 1
S1	01 Food Chemistry	CU76012V1	2.50	Mathematics 1
S1	02 Quality Control	CU20626V2	5.00	Pool Chemistry
S1	02 Quality Control	CU20627V1	5.00	Chemistry 2 and Microbiology 2
S1	02 Quality Control	CU76013	2.50	Physics
S1	02 Quality Control	CU76014	2.50	Quality & Safety
S1	02 Quality Control	CU20637V1	1.25	Professionalization block 1 & 2
S2	03 Biobased Products & Technology	CU20629V1	5.00	Bioproduct Extraction & Analysis
S2	03 Biobased Products & Technology	CU20630V1	5.00	Organic Chemistry 1 & Cell biology 1
S2	03 Biobased Products & Technology	CU20631V2	2.50	Biobased Products & Materials
S2	04 Health & Chemistry	CU20632V1	5.00	Biologically Active Compounds
S2	04 Health & Chemistry	CU20633V1	5.00	Organic Chemistry 2 & Cell biology 2
S2	04 Health & Chemistry	CU76016	2.50	Mathematics 2
S2	04 Health & Chemistry	CU76015	2.50	Data analysis 1
S2	04 Health & Chemistry	CU20638V1	1.25	Professionalization block 3 & 4
S2	04 Health & Chemistry	CH-HZP-YEAR1-22	2.5	HZ Personality year 1
S3	05 Environmental Chemistry & Toxicology	CU24063	5.00	Environmental Chemistry & Toxicology
S3	05 Environmental Chemistry & Toxicology	CU24064	5.00	Spectroscopy 1 & Toxicology
S3	05 Environmental Chemistry & Toxicology	CU76017V2	2.50	English 1 Academic Reading
S3	05 Environmental Chemistry & Toxicology	CU76018	1.25	Data analysis 2
S3	06 Bio-organic Toolbox	CU24067	5.00	Bio-organic Toolbox
S3	06 Bio-organic Toolbox	CU24068	5.00	Organic chemistry 3 and Biochemistry 1
S3	06 Bio-organic Toolbox	CU76019	3.75	Spectroscopy 2
S3	06 Bio-organic Toolbox	CU24070	1.25	Professionalization block 5 & 6
S4	07 Forensic Science	CU24074	5.00	Forensic Science
S4	07 Forensic Science	CU24075	5.00	Spectroscopy 3 / Separations1 & DNA 1
S4	07 Forensic Science	CU76020V1	2.50	English 2 Academic Writing
S4	07 Forensic Science	CU76021	1.25	Data analysis 3
S4	08 Marine Biobased Specialties	CU24077	5.00	Marine Biobased Specialties
S4	08 Marine Biobased Specialties	CU24078	5.00	Research cycle / Separations 2 & Biochemistry 2
S4	08 Marine Biobased Specialties	CU76022V1	1.25	Student assistant
S4	08 Marine Biobased Specialties	CU76023V1	2.50	Labmanagement & Safety
S4	08 Marine Biobased Specialties	CU24080	1.25	Professionalization block 7 & 8
S4	08 Marine Biobased Specialties	CH-HZP-YEAR2-22	2.5	HZ Personality year 2
S5 - AC	09 Specialisation Applied Chemistry I	CU76000	5.0	Chromatography practice
S5 - AC	09 Specialisation Applied Chemistry I	CU76001V1	5.0	Polymer chemistry & analysis
S5 - AC	09 Specialisation Applied Chemistry I	CU76002	2.5	Circular Chemistry
S5 - LS	09 From Molecules & Cells to Human Health	CU76003	5.0	Immunology practice
S5 - LS	09 From Molecules & Cells to Human Health	CU76004	5.0	Immunology 1 & Biochemistry 3
S5 - LS	09 From Molecules & Cells to Human Health	CU13416V6	2.5	Biotechnology
S5 - AC	10 Specialisation Applied Chemistry II	CU76006V1	5.0	Circular Chemistry practice
S5 - AC	10 Specialisation Applied Chemistry II	CU76007	5.0	Advanced Chromatography
S5 - AC	10 Specialisation Applied Chemistry II	CU76008	2.5	Circular chemistry & Biopolymers
S5 - LS	10 Achievements & Challenges of Life Sciences	CU76009V1	5.0	Molecular Biology toolbox
S5 - LS	10 Achievements & Challenges of Life Sciences	CU76010	5.0	Immunology 2 & DNA 2
S5 - LS	10 Achievements & Challenges of Life Sciences	CU13415V6	2.5	Bioinformatics
S5		CU13633V5	2.5	Professionalization block 9 & 10
S5		CH-HZP-YEAR3-22	2.5	HZ Personality year 3
S6 or S7	Minor	CU05600V12	30.0	Research minor
S6 or S7	Internship	CU06725V18	27.5	Internship in company
S7		CH-HZP-YEAR4-22	2.5	HZ Personality year 4
S8	Final thesis	CU06726V16	30.0	Final Thesis & project

### Programme regular track 180 EC

See programme regular track 240 EC, semester 3 to 8. Semester 3 and 4 is the propaedeutic level.

### Regular and alternative programme

In the regular programme, the minor is programmed in the 6th semester and the internship in company in the 7th semester. In the alternative programme, the internship in company is programmed in the 6th semester and the minor in the 7th semester.

2.2.3a **Transfer with an Associate Degree certificate** (article 3.3 paragraph 4 sub I CER HZ ba ft)

*Not applicable*

2.2.3b **Language**

The study programme adheres to the following rules with regard to the language:

First year

Lessons and tests of the theoretical part will take place in two separate groups, Dutch and English.

As an exception, collective meetings will be organized (in English), for instance by guest speakers.

When the maximum number of students in the international class has not been exceeded, Dutch students are allowed to follow classes in English on a voluntary basis.

Second, third and fourth year

The language of instruction and examining is English, with the exception of the work placement / graduation phase at the request of the work placement company / company where the student completes his graduation.

The 180 ECTS track is a full English language program, with the exception of the work placement / graduation phase at the request of the work placement company / company where the student completes his graduation.

2.2.3c **Resit practicals**

No later than two weeks prior to the start of a semester, the student must indicate by means of a resit form which practicals from a previous study year he wishes to take again. If the resit form has not been submitted, the student loses his right to the first resit of a practical exam.

Resit practicals during the study year

In accordance with the CER, the programme of Chemistry provides 2 possibilities of examination for each exam. This includes the practical exams as well. Taking into consideration the organisational complexity of practicals, these resits are regulated. Resits of a practical will be planned in the resit week of the current quarter.

The precise rules for every course/practical are described in the course description.

Guidelines for the rules:

- All practical resits of each block will be scheduled in block week 10 of the same block.
- There could be several reasons why a student fails a practical. The rules for resits differ for each case.
  - a. Insufficient attendance. Attendance at a practical is mandatory. If the student fails to attend the practical due to circumstances beyond his control, the teacher and the student could agree upon an arrangement specifically for the practical. For instance, allowing the student to attend another, parallel, practical group. If there are no circumstances beyond his control, the student must retake those parts of the practical during the resit week of the current quarter.
  - b. Insufficient report. A student is allowed to redo a report for which the teacher determines the deadline. If the product remains insufficient, even after the resit, the student must retake the entire practical in the next study year.
  - c. Insufficient work place assessment: For every practical, it will be indicated if the student must retake the original practical during the resit week of the current quarter.

2.2.4 Courses 'propedeuse' phase (article 3.5, 3.11A CER HZ Ba ft)

Block 1 / Semester: S1														
CU20623V2	Title: Beer Chemistry					Number of study credits: 5			Number of contact hours: 45					
	Course manager: T.C.W. Moerdijk-Poortvliet					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals are mandatory (100%)														
<p><b>Content:</b></p> <p>Together as a learning team you are going to brew beer. You can choose between two kinds of beers, i.e. a black gold and a white beer. After the brewing process, which takes two weeks, you will bottle the beer and store it and subsequently perform various chemical and microbiological analysis. The course will be completed by a beer brewing contest.</p> <p>Besides beer brewing we provide you with the most important practice of your career in chemistry: how to work in a safe way, how to perform a weighing on an (analytical) balance and how to transfer volumes within a certain precision. In addition you are introduced to titration techniques and the use of primary and secondary standards. By titration you will determine the alcohol content of your own brewed beer. Furthermore you will be learned how to use a spectrophotometer to determine the colour unit of your beer. You will learn various ways to identify and count microorganisms, i.e. by prepare a growth medium and via inoculation making a pure culture. In addition you will perform fermentation tests.</p> <p>During the practical's you report all observations and obtained data in your lab journal according the guidelines and you will be learned how to keep up a laboratory journal.</p> <p>During most practical's you work in couples and is communication essential to be successful. The teacher will motivate you to communicate and to approach.</p>														
Compulsory literature: none														
Test code	Format					Assessment Description and type	Content Linked with learning outcomes	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							%	ECTS					
V	W	O	I	G										
TOETS01 (VT)		X		X		Individual workplace assessment ((Workplace) Assessment)	2.1a, 2.1b, 2.1c, 2.1d, 2.1e, 2.1f, 2.1g, 1.1f, 1.1h	100%	5.0	5.5	S1.9	S1.10	S1.19	S1.20

Block 1 / Semester: S1														
CU20624V1	Title: Chemistry 1 and Microbiology 1					Number of study credits: 5				Number of contact hours: 45				
	Course manager: K.F. Wannee					Compulsory: yes				Language: English / Dutch				
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b> Basic microbiological concepts and techniques are taught in context of food sciences. Understanding of microbial physiology is key in fully comprehending the relationship between microbes and food.</p> <p><b>Learning objectives:</b> TOETS02 Describe the impacts of microbiology on our society, and name the most important discoveries and developments that were made by several pioneers. Understand the principles and purposes of basic microbiological culturing techniques. Explain the principles of various microscopical techniques. Demonstrate understanding of microbial growth kinetics and a variety of methods for microbial quantification. Identify the characteristics of eukaryotic cells, and the differences with respect to prokaryotic cells. Name the physiochemical properties of cellular membranes, and explain the mechanisms of various membrane-associated transport systems. Explain how thermodynamic laws influence biochemical processes. Describe the basic features of enzymes and their role in biochemical reactions. Explain the mechanisms of various catabolic processes (oxygenic and anoxygenic) that are found in microbial cells. Demonstrate knowledge about several clinically relevant pathogens that cause food infections and poisoning.</p> <p><b>Compulsory literature:</b> Brock Biology of Microorganisms plus Pearson Mastering Microbiology with Pearson eText, Global Edition, Madigan, M. Bender, K. Buckley, Daniel Sattley, Matthew Stahl, David, 15th edition, ISBN: 9781292235226 Chemistry 7th edition incl. access mastering chemistry, McMurry, John E., 7th edition, ISBN: 9781292092867 Biology: A Global Approach plus Pearson MasteringBiology with Pearson eText, Global Edition, Campbell, Neil, 12th edition, ISBN: 9781292343150</p>														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							%	ECTS					
	V	W	O	I	G									
TOETS01 (VT)		X		X		Chemistry 1 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1f	50%	2.5	5.5	S1.8	S1.9	S1.10	S1.12
TOETS02 (VT)		X		X		Microbiology 1 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1f	50%	2.5	5.5	S1.8	S1.9	S1.10	S1.12

Block 1 / Semester: S1														
CU76012V1	Title: Mathematics 1					Number of study credits: 2.5			Number of contact hours: 12					
	Course manager: L.P.J. Veraart					Compulsory: yes			Language: Dutch / English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b>            Elementary mathematics: expanding forms (removing brackets), factorising forms.            Basic algebra: Understanding and solving linear, quadratic and exponential (the number e, logarithms) equations. Solving systems of equations.            Basic trigonometry: definition of sine and cosine and the use of the unit circle.</p> <p>The course will be relying on self-study in the online environment of Sowiso. A weekly Q&amp;A session will be planned at HZ for support.</p>														
Compulsory literature: none														
Test code	Format					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	<i>Verbal/Written/Other Individually/Group</i>							%	ECTS					
TOETS01 (VT)		X		X		Mathematics 1 - Written exam (Written knowledge test)	2.1f	100%	2.5	5.5	S1.8	S1.9	S1.10	S1.12



Block 2 / Semester: S1														
CU20626V2	Title: Pool chemistry					Number of study credits: 5			Number of contact hours: 45					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals are mandatory (100%)														
<p><b>Content:</b>            Maybe you have visited a swimming pool many times, but do you know how swimmers pollute their own swimming water? Think about “pee in the pool”, perfumes, sweat, body lotion. In this course you will monitoring the chemical and microbiological parameters of a local swimming pool. Questions as how do they react with chlorine, how do these products affects our health and which kind of bacteria in swimming pools can cause serious health effects will be studied.</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Individual workplace assessment ((Workplace) Assessment)	2.1a, 2.1b, 2.1c, 2.1d, 2.1e, 2.1f, 2.1g, 1.1f, 1.1h	100%	5.0	5.5	S1.19	S1.20	S2.9	S2.10

Block 2 / Semester: S1														
CU20627V1	Title: Chemistry 2 and Microbiology 2					Number of study credits: 5			Number of contact hours:45					
	Course manager: K.F. Wannee					Compulsory: yes			Language: English / Dutch					
<b>Conditions for course participation:</b> none														
<b>Conditions for test participation:</b> none														
<b>Content:</b> Basic microbiological concepts are taught in relation to water quality and hygiene. The course focuses on infectious diseases, diagnostic detection, prevention, and treatment.														
<b>Learning objectives:</b>														
TOETS01														
Learning the basic rules of experimental design and applying this in theoretical situations and experiments.														
Knowledge of chemical reactions, calculations and behaviour and treatment of most relevant chemicals to apply safe way of working in the lab.														
Learn to apply theoretical knowledge and translate knowledge into practical approached of experiments.														
Learn to apply mathematical questions, chemical calculations to apply for experimental situation on the lab.														
TOETS02														
Name the most important cell wall structures and their functions, differences between Gram-positive and Gram-negative cell walls, and explain the principle of the Gram staining procedure.														
Elaborate on the functional role of various cellular structures in microbial locomotion.														
Demonstrate knowledge about several physical and chemical factors, and control measures that influence the growth of microbial populations.														
Understand the relation between the central dogma of molecular biology and microbial population behavior (e.g. quorum sensing).														
Show understanding of the basic structure of virus particles, the function of individual viral subunits, and the viral life cycle (e.g. retroviruses).														
Be able to discuss the interactions between humans and microbes (both beneficial and pathogenic), and government policy measures to reduce the incidence infectious diseases.														
Describe the most relevant waterborne infectious diseases and their causative agents.														
<b>Compulsory literature:</b> none														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Factor						
	V	W	O	I	G		Linked with learning outcomes	%	ECTS					
TOETS01 (VT)		X		X		Chemistry 2 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1d, 2.1f	50%	2.5	5.5	S1.18	S1.19	S1.20	S2.2
TOETS02 (VT)		X		X		Microbiology 2 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1d, 2.1f	50%	2.5	5.5	S1.18	S1.19	S1.20	S2.2

Block 2 / Semester: S1														
CU76013	Title: Physics					Number of study credits: 2.5			Number of contact hours: 25					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b></p> <p>In order to understand equipment in the laboratory we teach about light. We begin with harmonic oscillation and waves. Other topics: Light as a(n electromagnetic) wave, Snell's Law, Lenses and microscope, Lambert-Beer's Law and Polarisation.</p> <p>Electrostatics: understand what is an electrical field and electrical tension (voltage) and Coulomb's Law. Useful to understand molecular models.</p> <p>Electrical currents: Ohm's law. Serial and parallel circuits. The difference between current and voltage. Electrical power. Magnetism: The Lorentz Force. Bending of charged particles in a magnetic field. The magnetic induction of a coil and a wire.</p>														
<b>Compulsory literature:</b>														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Factor						
	V	W	O	I	G		Linked with learning outcomes	%	ECTS					
TOETS01 (VT)		X		X		Physics - Written exam (Written knowledge test)	2.1b, 2.1f	100%	2.5	5.5	S1.18	S1.19	S1.20	S2.2

Block 1 & 2/ Semester: S1														
CU76014	Title: Quality & Safety					Number of study credits: 2.5			Number of contact hours: 25					
	Course manager: M.J. van den Berge					Compulsory: yes/no			Language: English / Dutch					
Conditions for course participation: none														
<b>Conditions for test participation:</b> <ul style="list-style-type: none"> <li>Attendance of scheduled class activities are mandatory (80%)</li> <li>Passed the safety exam</li> </ul>														
<b>Content:</b> Before you can carry out an experiment in a lab, you will need to ask yourself two important questions: (1) How do I ensure that the experiment is conducted safely (people and environment)? (2) How do I ensure that my results are reliable?														
<b>Learning objectives:</b> See Content - 'Linked with learning outcomes' below.														
<b>Compulsory literature:</b> Managing safety, health and environmental risks in laboratories, Ir. Iris van 't Leven, 2nd edition, ISBN: 9789491764288														
Test code	Format					Assessment	Content	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							%	ECTS					
V	W	O	I	G										
TOETS01 (VT)			X	X		Individual practical exam ((Workplace) Assessment)	2.1d, 2.1e, 2.1f	100%	2.5	5.5	S1.17	S1.18	S1.20	S1.21

Block 1 & 2 / Semester: S1														
CU20637V1	Title: Professionalization block 1 & 2					Number of study credits: 1.25			Number of contact hours: 10					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: Attendance is mandatory. In case of ((un)foreseen, inevitable) absence, students have to contact their study coach.														
<b>Content:</b> Assignments, individual and as a group to work on personal professional skills and knowledge of the students competencies to develop toward a professional chemistry employee.														
Compulsory literature: none														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X	X	X		Individual reflection (Portfolio)	1.2i, 8.1a, 8.1b, 8.1d, 8.1e	100%	1.25	5.5	S1.19	S1.20	S2.1	S2.2

Block 3 / Semester: S2														
CU20629V1	Title: Bioproduct Extraction & Analysis					Number of study credits: 5			Number of contact hours: 45					
	Course manager: L.P.J. Veraart					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals are mandatory (100%)														
<p><b>Content:</b></p> <p>Did you wonder how long this planet can provide for fossil fuels? What other sources are available? Which role do chemists have in this particular topic? In this course you will get familiar with chemical techniques for distillation, synthesizing biochemical compounds, alternatives for fuel, yield and other bio based related chemical methods. 3 methods will be practiced: synthesizing, extraction and conversion of chemical compounds. A strong focus will be held on safety, lab preparation and accuracy of work. Workplace assessment will focus on prelabs, use of labjournal, understanding goals and teamwork attitude. An assessment form will be provided beforehand.</p>														
<b>Compulsory literature:</b>														
Test code	Format					Assessment Description and type	Content Linked with learning outcomes	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							%	ECTS					
V	W	O	I	G										
TOETS01 (VT)		X		X		Individual workplace assessment ((Workplace) Assessment)	2.1c, 2.1d, 2.1e, 2.1g	50%	2.5	5.5	S2.9	S2.10	S2.19	S2.20
TOETS02 (VT)		X			X	Reporting (Assignment)	1.1c, 1.1f, 1.1g, 1.1h, 2.1a, 2.1b, 2.1f	50%	2.5	5.5	S2.9	S2.11	S2.13	S2.15

Block 3 / Semester: S2														
CU20630V1	Title: Organic Chemistry 1 & Cell Biology 1					Number of study credits: 5			Number of contact hours: 45					
	Course manager: K.F. Wannee					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b></p> <p>A large component of this course is organic chemistry. This field is of a major importance, since it is the basis of combinations/reactions between chemicals and leading to the existence of new chemicals. Organic chemistry is related to all fields of chemistry such as: food, environment, pharmaceuticals but also petroleum industry. Biochemistry, on the other hand, relates the organic chemistry to biological components. When thinking of Biochemistry, you may think of: fatty acids, (bio) oils, enzymes, amino acids present in chemical drop-ins used in diverse industries. This course is a theoretical component of the (practical) course CU20629, adding depth to your organic chemistry knowledge, learned previously about: industrial distillation of fossil fuels; naming structures according to IUPAC regulations, chemical bonding in organic molecules. Functional group reactivity is explored starting with electrophilic addition to alkenes and alkynes.</p> <p><b>Learning objectives:</b></p> <p>TOETS02</p> <p>Explain the organization of genes and genomes in eukaryotes versus prokaryotes, and the central dogma of molecular biology; i.e. the flow of genetic information in living systems and its regulation. Be able to explain how DNA technology can be implemented to make useful (protein) products and to study gene functions.</p> <p>Describe the basic chemistry of cells. Name the basic structure and functional groups of relevant biomolecules (including sugars, proteins, lipids, and nucleic acids), and their functional roles in the cell. Discuss various eukaryotic cell structures, such as the endomembrane system, other organelles, extracellular components, and their functions.</p> <p>Describe the parts and physicochemical properties of cell membranes (including their fluidity, permeability, and interaction with proteins), and the key transport systems that facilitate translocation of molecules across cell membranes.</p>														
<p><b>Compulsory literature:</b> Organic Chemistry, Global Edition, Bruice, Paula Yurkanis, 8th edition, ISBN: 9781292160344</p>														
Test code	Format <i>Verbal/Written/Other</i> <i>Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Organic Chemistry 1 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1f	50%	2.5	5.5	S2.8	S2.9	S2.10	S2.12
TOETS02 (VT)		X		X		Cell biology 1 - Written exam (Written knowledge test)	1.1b, 2.1a, 2.1b	50%	2.5	5.5	S2.8	S2.9	S2.10	S2.12

Block 3 / Semester: S2														
CU20631V2	Title: Biobased Products & Materials					Number of study credits: 2.5			Number of contact hours: 12					
	Course manager: N.A. Wattel					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b></p> <p>Suppose you are asked to produce (Synthesize) a chemical that would bring you a lots of money , but, it will produce a lots of chemical waste. You have a dilemma: do you choose for yourself and for your company (providing jobs and selling the product making profit) or you choose for saving the planet by generating less waste by not producing the product ? This problem is a matter of ethics. Green- or Biobased chemistry, in particular renewable chemistry, creates the opportunity to improve the current earth impact of consumerism while offering a horizon of business benefit to the chemicals industry.</p> <p>This course contains a lot of background principles of ethics, statistical data, knowledge of increasing yield, biobased chemistry, and basic background knowledge and broad overview of economics, developments in politics, finance and technical topics. Scope, the bigger picture of a Biobased economy!</p>														
<b>Compulsory literature:</b>														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Description and type						
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Biobased P&E - Written exam (Written knowledge test)	1.1c, 1.1g, 8.1c	100%	2.5	5.5	S2.8	S2.9	S2.10	S2.12



Block 4 / Semester: S2														
CU20632V1	Title: <b>Biologically Active Compounds</b>					Number of study credits: 5			Number of contact hours: 45					
	Course manager: K.F. Wannee					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals are mandatory (100%)														
<b>Content:</b> The course focuses on the synthesis and purification of biologically active compounds. They are subsequently tested for their activity in several bioassays.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Individual workplace assessment (Workplace) Assessment)	2.1c, 2.1d, 2.1e, 2.1g	50%	2.5	5.5	S2.19	S2.20	S2.22	S2.23
TOETS02 (VT)		X			X	Reporting (Assignment)	1.1c, 1.1f, 1.1g, 1.1h, 2.1a, 2.1b, 2.1f	50%	2.5	5.5	S2.19	S2.21	S2.22	S2.23

Block 4 / Semester: S2														
CU20633V1	Title: Organic Chemistry 2 & Cell biology 2					Number of study credits: 5				Number of contact hours: 45				
	Course manager: L.P.J. Veraart					Compulsory: yes				Language: English / Dutch				
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b></p> <p>Key aspects in relation to diseases are discussed in the cell biology part; cell cycle (de)regulation, cancer, meiosis, development, and nerve system. The journey through organic chemistry in commenced with the concept of electron delocalization and resonance structures, reactions of alkyl halides, alcohols, epoxides and ethers. The concept of stereochemistry is also explored.</p> <p><b>Learning objectives:</b></p> <p>TOETS02</p> <p>Be able to name the cell cycle phases and their characteristics. Describe the stages of mitosis and meiosis, and how they alternate during the the sexual life cycles of animals, plants, and fungi. Name the key features of cellular signaling processes.</p> <p>Understand the basic mechanisms, by which the innate immune system suppresses microbial infections.</p> <p>Discuss the functions of various components of the neuronal system, such as neurons, axons, synapses, neurotransmitters, etc., and explain which events trigger an action potential and how signals are transmitted from one neuron to another.</p> <p>Explain the basic laws of inheritance as formulated by Gregor Mendel and other inheritance principles.</p> <p>Understand disease etiology at the level of the karyotype.</p> <p>Describe various gene regulation systems, including the one that directs cellular differentiation. Name differences between embryonic and adult stem cells, and address their therapeutic value.</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Organic Chemistry 2 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1d, 2.1f	50%	2.5	5.5	S2.18	S2.19	S2.20	S2.22
TOETS02 (VT)		X		X		Cell Biology 2 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1f	50%	2.5	5.5	S2.18	S2.19	S2.20	S2.22

Block 3 & 4 / Semester: S2														
CU76015	Title: Data analysis 1				Number of study credits: 2.5		Number of contact hours: 25							
	Course manager: M.J. van den Berge				Compulsory: yes		Language: English / Dutch							
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled class activities are mandatory (80%).														
<p><b>Content:</b> Before you can carry out an experiment in a lab, you will need to ask yourself two important questions: (1) How do I ensure that the experiment is conducted safely (people and environment)? (2) How do I ensure that my results are reliable? One of the essential tools to give evidence that your results are reliable is statistics. In this course you will process your laboratory data with the help of a spreadsheet program. Major topics: measures of location and spread (mean standard deviation, variance), normal distributions (samples and populations), confidence limits and intervals, principles of significance testing (one-sided and two-sided), applications of the t-test for comparing means, F-test for comparing variances, testing for outliers and the chi-squared test.</p> <p><b>Learning objectives:</b> Can setup a frequency table and construct a histogram with the help of a spreadsheet. Can explain the distinction between populations and samples in relation to statistics. Can calculate the mean, standard deviation, variance, coefficient of variation, median, modus. Can express individual results, mean and standard deviation in the correct number of significant numbers. Can describe the shape of normal distributions and make calculations based on the normal distribution parameters. Can calculate the confidence limits of a sample based on the population parameters <math>\mu</math> and <math>\sigma</math> and the confidence limit of the mean for small samples. Can explain the meaning of the concepts accuracy, error, gross error, precision, random error, systematic error, trueness Can calculate the measuring error with the calculations adding, deducting, multiplying and dividing. Can perform a Grubb's and Dixon's test to check for outliers. Can perform a t-test for comparing an experimental mean with a known value, a t-Test for comparing of two means from independent samples and a t-test for comparison of paired data (also called the paired t-test or dependent t-test for paired samples Can perform a F-test for the comparison of standard deviations. Can perform a Chi-squared test to test whether differences between observed and expected results are due to random error, or if an unforeseen factor is influencing the outcome of the experiment. Can perform a Chi-squared test to test the normality of a distribution</p>														
<p><b>Compulsory literature:</b> Statistics and Chemometrics for Analytical Chemistry, James Miller, Jane Miller, 7th edition, ISBN: 9781292186719</p>														
Test code	Format					Assessment	Content	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Description and type	Linked with learning outcomes					
	V	W	O	I	G									

TOETS01 (VT)		X		X		Data analysis 1 - Written exam (Written knowledge test)	2.1b, 2.1f	100%	2.5	5.5	S2.18	S2.19	S2.20	S2.22
--------------	--	---	--	---	--	--	------------	------	-----	-----	-------	-------	-------	-------

Block 4 / Semester: S2														
CU76016	Title: Mathematics 2					Number of study credits: 2.5			Number of contact hours: 25					
	Course manager: L.P.J. Veraart					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: none														
<b>Content:</b> Introduction to differentiation and integration. Part 1: Differentiation: More theory about functions (inverse functions etc), Limits, The first derivative as an limit and as the slope a of a tangent line, Finding the equation of a tangent line, Finding extreme values of a function and Second derivative of a function and inflection points. Part 2: Integration: Integration as the area under a graph, Integral without borders as reverse of differentiation, Integration with substitution and Partial integration.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Mathematics 2 - Written exam (Written knowledge test)	2.1b, 2.1f	100%	2.5	5.5	S2.18	S2.19	S2.20	S2.22

Block 3 & 4 / Semester: S2														
CU20638V1	Title: Professionalization block 3 & 4					Number of study credits: 1.25			Number of contact hours: 10					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: English / Dutch					
Conditions for course participation: none														
Conditions for test participation: Attendance is mandatory. In case of ((un)foreseen, inevitable) absence, students have to contact their study coach.														
<b>Content:</b> Assignments, individual and as a group to work on personal professional skills and knowledge of the students competencies to develop toward a professional chemistry employee.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)	X	X		X		Individual reflection (Portfolio)	8.1a, 8.1b, 8.1d, 8.1e	100%	1.25	5.5	S2.19	S2.20	S2.21	S2.22

Semester: S1 / S2														
CH-HZP-YEAR1-22	Title: HZ Personality year 1					Number of study credits: 2.5			Number of contact hours: N/A					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: Dutch / English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b></p> <p>Within HZ Personality you will work on skills that you think are important for your personal and professional development. You design the programme yourself and reflect on the approach you have chosen, and the insights obtained. Your study career coach will guide you in this.</p> <p>HZ Personality has three connected levels: you, others, the world. During your study time at HZ you will have to work at least one time on each of these levels in order to broaden your view and experiences on every level. The levels are translated into three themes: Personal development, Community development and Sustainable development.</p> <p><b>Learning objectives:</b></p> <p>Developing skills and attitudes to achieve personal and professional goals. Carrying out activities that contribute to sustainable development goals and community goals.</p>														
<b>Compulsory literature:</b>														
Test code	Format					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	<i>Verbal/Written/Other Individually/Group</i>							%	ECTS					
TOETS01 (VT)		X		X		Self-reflection & burden of proof (Portfolio)		100%	2.5	-	N/A	N/A	N/A	N/A

2.2.5 Main phase courses (article 3.6, 3.11A CER HZ ba ft)

Block 5 / Semester: S1														
CU24063		Title: Environmental Chemistry & Toxicology					Number of study credits: 5			Number of contact hours: 45				
		Course manager: M.J. van den Berge					Compulsory: yes			Language: English				
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals, guest lectures and excursions are mandatory (100%)														
<p><b>Content:</b></p> <p>The course focuses on the chemical and toxicological aspects of water quality. Water quality of effluent is monitored of a waste water treatment plant. Parameters such as phosphate, total nitrogen (Kjeldahl method), Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD) are monitored. Heavy metals such as lead and copper are measured in the residual product from the sludge fermentation. Besides, the effect of toxic metals is studied with various species as algae, bacteria and micro invertebrate (Artemia). Instrumental techniques as Atomic Absorption Spectroscopy (AAS), steam distillation and microwave destruction are introduced.</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Individual workplace assessment (Workplace) Assessment)	2.1c, 2.1d, 2.1e, 2.1f, 2.1g, 1.1e, 1.1f	50%	2.5	5.5	S1.9	S1.10	S1.19	S1.20
TOETS02 (VT)		X			X	Reporting (Assignment)	2.1a, 2.1b, 1.1c, 2.1f, 1.1g, 1.1h	50%	2.5	5.5	S1.9	S1.11	S1.13	S1.15



Block 5 / Semester: S1			
CU24064	<b>Title: Spectroscopy 1 &amp; Toxicology</b>	<b>Number of study credits: 5</b>	<b>Number of contact hours: 45</b>
	<b>Course manager: S.T. Popovici</b>	<b>Compulsory: yes</b>	<b>Language: English</b>
<b>Conditions for course participation:</b> none			
<b>Conditions for test participation:</b> Guest-lectures are mandatory and part of the course Prof 5&6.			
<p><b>Content:</b> The toxicology part addresses the interactions between toxicants and organisms at different levels; ecological, organismal, cellular, and molecular. Important topics include dose-response effects, organ dysfunction, ecology, heavy metals, pesticides, carcinogenesis, genetic alterations, and biotransformation. The water treatment has as goal to help you learn how to prepare and study for the practical. Self-study and co-operation is very relevant here, this part is in relation to the practical Environmental Chemistry &amp; Toxicology . Spectroscopy 1 covers (among others) techniques used in the practical Environmental Chemistry &amp; Toxicology. It has as goal to help you understand the steps involved in method development of the existed protocols. Reading of NEN and ISO norms as well as other materials is of a relevant part.</p> <p><b>Learning objectives:</b></p> <p>TOETS01</p> <p>You can interpret the meaning of each measurement technique in relation to each other (2.1b)</p> <p>You can interpret figures and graphs in relation to the parameters (2.1a)</p> <p>You can calculate with dilutions, concentrations (2.1f)</p> <p>You can assess (evaluate) the reliability of the results based on (statistical) considerations (2.1f)</p> <p>You can understand the technique AAS, UV-VIS as in equipment, calibration curve (Linear range, LOD, LOQ, dynamic range), sample taking and calculate with it (2.1b)</p> <p>TOETS02</p> <p>Acquire knowledge about the scope and history of toxicological research. Understand and apply the basic terminology, principles, and concepts of toxicology.</p> <p>Explain the main mechanisms by which toxicity is induced in animals, and several instruments for the risk assessment of toxic agents.</p> <p>Describe the main routes of toxicant disposition in animals, and explain mechanisms by which compounds may induce carcinogenesis.</p> <p>Demonstrate knowledge about the relevance of toxicants in ecology and occupation, and the effects of inhaled toxicants and their routes of clearance.</p> <p>Describe the effects of toxicants, including heavy metals, on the neuronal network, and the most common biotransformation routes that promote the elimination of toxicants. Be able to explain how heavy metals, such as mercury, enters and moves through the environment, and potentially biomagnifies.</p> <p>Discuss the effects of toxic substances on DNA, and developmental and reproductive processes. Explain what type of assays can be used to monitor the toxicity of such compounds.</p> <p>Name the most important toxicological aspects of pesticide- and food-associated xenobiotics. Hypothesize the most likely rout of entry of a(n organophosphate) pesticide. Describe the impact of organophosphates on acetylcholine esterase activity and propose a potential mechanisms for antidotes to mevinphos poisoning. Describe the global process of clinical treatment of intoxicated patients following hospitalization.</p>			
<p><b>Compulsory literature:</b> Quantitative Chemical Analysis, Harris, Daniel C, 9th edition, ISBN: 9781319154141</p>			

*Implementation Regulations HZ CER Chemistry - full-time*

*Determined by Executive Board: 12/07/2022*

*Approval HR 12/07/2022 - recommendation programme committee: 29/04/2022*

Casarett & Doull's Essentials Of Toxicology, Curtis D. Klaassen, John B. Watkins, 3rd edition, ISBN: 9780071847087														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Spectroscopy 1 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1f	50%	2.5	5.5	S1.8	S1.9	S1.10	S1.12
TOETS02 (VT)		X		X		Toxicology - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1f	50%	2.5	5.5	S1.8	S1.9	S1.10	S1.12

Block 5 & 6 / Semester: S1														
CU76017V2	Title: English 1 Academic Reading					Number of study credits: 2.5			Number of contact hours: 25					
	Course manager: L.J. Raubenheimer					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Completion of all course assignments and quizzes														
<p><b>Content:</b> This B2/B2+ academic reading course is aimed to build on the current level of reading skills in order to progress toward an advanced level of literacy that is essential in a successful academic career. The aim is to develop the core transferable skills in critical thinking and reading that students will use throughout their program of study. In order to strengthen reading skills, students will be able to do the following: use a variety of reading strategies to comprehend challenging texts, identify the main and supporting ideas in what they read, analyze academic writing in terms of rhetorical purpose, audience, content, genre, pattern of development and stylistic features, distinguish between fact and opinion, analyze the reasoning behind an argument, take a critical stance toward ideas, raising questions, examining evidence and evaluating arguments on the basis of reason.</p> <p><b>Learning objectives:</b> TOETS01 Can scan quickly though long and complex texts, locating relevant details Can identify the main conclusion in argumentative and informative texts Can use context clues to work out the meaning of unknown words Can identify text type and structure</p> <p>TOETS02 Can take detailed notes on topics in his/her field Can summarise information from a wide range of sources, commenting on and discussing and contrasting points of view and the main themes. Can identify author's purpose and whether source is credible Can analyse the reasoning behind an argument Can present and respond to lines of argument</p>														
<b>Compulsory literature:</b>														
Test code	Format Verbal/Written/Other Individually/Group					Assessment Description and type	Content Linked with learning outcomes	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		English 1 - Written reading exam (Written knowledge test)	1.1h	50%	1.25	5.5	\$1.8	\$1.9	\$1.10	\$1.10
TOETS02 (VT)	X				X	English 1 - Verbal presentation (Presentation)	1.1h	50%	1.25	5.5	\$1.18	\$1.18	\$1.20	\$1.20

Block 5 / Semester: S1														
CU76018	Title: Data analysis 2					Number of study credits: 1.25			Number of contact hours: 12					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled class activities are mandatory (80%).														
<p><b>Content:</b> This course is a follow-up course of data analysis 1 and focus on the calibration methods in instrumental analysis: regression and correlation. Major topics of this course are correlation coefficient, errors and confidence limits in linear calibration, limits of detection, standard addition, weighted regression and outliers in regression.</p> <p><b>Learning objectives:</b> Can setup calibration curves and perform statistical calculations with a spreadsheet program Can perform a linear unweighted regression analysis Can identify outliers and calculate the limits of detection Can calculate the confidence interval of the mean for small samples. Can perform a linear weighted regression analysis</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Data analysis 2 - Written exam (Written knowledge test)	1.2f, 2.2f	100%	1.25	5.5	S1.8	S1.9	S1.10	S1.12

Block 6 / Semester: S1														
CU24067	Title: Bio-organic toolbox					Number of study credits: 5				Number of contact hours: 45				
	Course manager: L.P.J. Veraart					Compulsory: yes				Language: English				
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals are mandatory (100%)														
<b>Content:</b> This course highlights several common laboratory techniques in organic synthesis and biochemical processes, such as electrophoresis, protein-extraction, starch-isolation, steam distillation, TLC, Grignard reactions, purification techniques and analytical techniques (IR spectroscopy).														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Individual workplace assessment ((Workplace) Assessment)	2.1c, 2.1d, 2.1e, 2.1f, 2.1g, 1.1e, 1.1f	50%	2.5	5.5	S1.19	S1.20	S2.9	S2.10
TOETS02 (VT)		X			X	Reporting (Assignment)	2.1a, 2.1b, 2.1f, 1.1c, 1.1g, 1.1h	50%	2.5	5.5	S1.19	S2.1	S2.3	S2.5

Block 6 / Semester: S1														
CU24068	Title: Organic chemistry 3 and Biochemistry 1					Number of study credits: 5			Number of contact hours: 45					
	Course manager: L.P.J. Veraart					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Guest-lectures are mandatory and part of the course Prof 5&6.														
<b>Brief description of course content:</b> <b>Content:</b> The course provides the necessary theoretical knowledge for the practical (CU24067). The organic chemistry part is a continuation of the organic chemistry of courses CU20630 and CU20633. Topics: organometals, reactions of benzene and benzene derivatives and carbonyl chemistry. Biochemistry topics: Properties polysaccharides, properties proteins, enzyme kinetics.														
<b>Compulsory literature:</b>														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Description and type						
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Organic Chemistry 3 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1f	50%	2.5	5.5	S1.18	S1.19	S1.20	S2.2
TOETS02 (VT)		X		X		Biochemistry 1 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1f	50%	2.5	5.5	S1.18	S1.19	S1.20	S2.2

Block 6 / Semester: S1														
CU76019	Title: Spectroscopy 2					Number of study credits: 3.75			Number of contact hours: 25					
	Course manager: S.T. Popovici					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Guest-lectures are mandatory and part of the course Prof 5&6.														
<b>Content:</b> The theory behind spectroscopic techniques (MS, IR and NMR) are explained. Exercises involve structure determination by assessing simulated spectra.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Spectroscopy 2 - Written exam (Written knowledge test)	2.1b, 2.1f	100%	3.75	5.5	S1.18	S1.19	S1.20	S2.2

Block 5 & 6 / Semester: S1														
CU24070	Title: Professionalization block 5 & 6					Number of study credits: 1.25			Number of contact hours: 10					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: Dutch / English					
Conditions for course participation: none														
Conditions for test participation: Attendance is mandatory. In case of ((un)foreseen, inevitable) absence, students have to contact their study coach.														
Content: Assignments, individual and as a group to work on personal professional skills and knowledge of the students competencies to develop toward a professional chemistry employee.														
Compulsory literature:														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)	X	X		X		Individual reflection (Portfolio)	8.1a, 8.1b, 8.1d, 8.1e	100%	1.25	5.5	S1.19	S1.20	S2.1	S2.2



Block 7 / Semester: S2														
CU24074	Title: Forensic Science					Number of study credits: 5				Number of contact hours: 45				
	Course manager: M.J. van den Berge					Compulsory: yes				Language: English				
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals are mandatory (100%)														
Content: Introduction on basics of forensic practicals and forensic analytical methods.														
Compulsory literature:														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)	X			X		Individual workplace assessment ((Workplace) Assessment)	2.1c, 2.1d, 2.1e, 2.1g, 1.1e, 1.1f	50%	2.5	5.5	S2.9	S2.10	S2.19	S2.20
TOETS02 (VT)		X			X	Reporting (Assignment)	2.1a, 2.1b, 2.1f, 1.1c, 1.1g, 1.1h, 1.1i	50%	2.5	5.5	S2.9	S2.11	S2.13	S2.15

Block 7 / Semester: S2														
CU24075	Title: Spectroscopy 3 / Separations1 & DNA 1					Number of study credits: 5			Number of contact hours: 25					
	Course manager: N.A. Wattel					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Guest-lectures are mandatory and part of the course Prof 7&8.														
<b>Content:</b> The course provides theoretical backgrounds of forensic science and analytical techniques related to chemical profession. In Separations 1 you learn the basis of High Performance Liquid Chromatography and Gas Chromatography coupled to different detectors. You learn how to approach an analysis and make choices which make you more efficient in your work. (method development). In Spectroscopy 3 you learn the theory behind the molecular spectrometric techniques such Fluorescence.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Spectroscopy 3 / Separations1 - Exam (Written knowledge test)	2.1b, 2.1f	50%	2.5	5.5	S2.8	S2.9	S2.10	S2.12
TOETS02 (VT)		X		X		DNA 1 - Written exam (Written knowledge test)	2.1a, 2.1b, 2.1f	50%	2.5	5.5	S2.8	S2.9	S2.10	S2.12

Block 5 & 6 / Semester: S2														
CU76020V1	Title: English 2 Academic Writing					Number of study credits: 2.5			Number of contact hours: 25					
	Course manager: L.J. Raubenheimer					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Completion of all course assignments and quizzes														
<p><b>Content:</b> This B2/B2+ level course is aimed at developing students ability to write to an academic audience. Students will demonstrate and apply knowledge of basic essay and report structure, as well as improve academic and idiomatic vocabulary. They will employ the various stages of the writing process, including pre-writing, writing and revising to produce two written products.</p> <p><b>Learning objectives:</b></p> <p>TOETS01 Can write an essay which develops a perspective, giving reasons in support of or against a particular point of view and can synthesize information and arguments from a number of sources.</p> <p>TOETS02 Can summarise, report and give his/her opinion about accumulated factual information on matters within their professional field. Can evaluate different ideas or solutions to a problem.</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		English 2 - Essay (Written knowledge test)	1.1h	50%	1.25	5.5	S2.8	S2.9	S2.10	S2.10
TOETS02 (VT)		X		X		English 2 - Report (Assignment)	1.1h	50%	1.25	5.5	S2.18	S2.19	S2.20	S2.20

Block 7 / Semester: S2														
CU76021	Title: Data analysis 3					Number of study credits: 1.25			Number of contact hours: 12					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled class activities are mandatory (80%).														
<p><b>Content:</b> This course is a follow-up course of data analysis 1 and 2 and focus on the quality of analytical measurements. Major topics of this course are sampling, ANOVA, quality control, control charts (Shewhart charts) and proficiency testing scheme.</p> <p><b>Learning objectives:</b> Can setup a polynomial regression line with the help of Excel. Can perform a one-way Analysis of Variance (ANOVA) and a 'Fisher's least significant difference' test. Can setup and evaluate a Shewhart charts for mean values, for ranges and a Cusum chart. Can evaluate the results of a Proficiency Test (Z-score chart, Horwitz trumpet to predict the Relative Standard Deviation (RSD), Cochran's test for outliers, variance due to inter-laboratory differences)</p>														
<b>Compulsory literature:</b>														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Factor						
	V	W	O	I	G		Linked with learning outcomes	%	ECTS					
TOETS01 (VT)		X		X		Data analysis 3 - Written exam (Written knowledge test)	1.2f, 2.2f	100%	1.25	5.5	S2.8	S2.9	S2.10	S2.12

Block 8 / Semester: S2														
CU24077	Title: Marine Biobased Specialties					Number of study credits: 5			Number of contact hours: 45					
	Course manager: T.C.W. Moerdijk-Poortvliet					Compulsory: yes			Language: English					
<b>Conditions for course participation:</b> none														
<b>Conditions for test participation:</b> Attendance of scheduled practicals are mandatory (100%)														
<b>Content:</b> This course focuses on the students practical research skills, which included dynamics of teamwork, finding and citing published information, and experimental design. The course is in close cooperation with the research group Marine Biobased Specialties and will include their research subjects. Includes separation techniques.														
<b>Compulsory literature:</b>														
Test code	Format Verbal/Written/Other Individually/Group					Assessment Description and type	Content Linked with learning outcomes	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Individual workplace assessment ((Workplace) Assessment)	2.1c, 2.1d, 2.1e, 2.1f, 2.1g, 1.1e, 1.1f	50%	2.5	5.5	S2.19	S2.20	S2.22	S2.23
TOETS02 (VT)		X			X	Reporting (Assignment)	2.1a, 2.1b, 2.1f, 1.1a, 1.1b, 1.1c, 1.1d, 1.1g, 1.1h	50%	2.5	5.5	S2.19	S2.21	S2.22	S2.23

Block 8 / Semester: S2														
CU24078	Title: Research cycle / Separations 2 & Biochemistry 2					Number of study credits: 5			Number of contact hours: 45					
	Course manager: T.C.W. Moerdijk-Poortvliet					Compulsory: yes			Language: English					
<b>Conditions for course participation:</b> none														
<b>Conditions for test participation:</b> Guest-lectures are mandatory and part of the course Prof 7&8.														
<b>Content:</b> This course focuses on the students practical research skills, which included dynamics of teamwork, finding and citing published information, and experimental design. The course is in close cooperation with the research group Marine Biobased Specialties and will include their research subjects.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)	X			X		Research cycle - Oral exam (Criterion-referenced assessment)	2.1a, 2.1b, 2.1d, 2.1f	50%	2.5	5.5	S2.18	S2.19	S2.20	S2.22
TOETS02 (VT)		X		X		Separations 2 & Biochemistry 2 - Exam (Written knowledge test)	2.1a, 2.1b, 2.1d, 2.1f	50%	2.5	5.5	S2.18	S2.19	S2.20	S2.22

Block 5 to 10 / Semester: S2														
CU76022V1	Title: Student assistant					Number of study credits: 1.25			Number of contact hours: N/A					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: Dutch / English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b> This work often involves informing colleagues, visitors or business contacts about a company, activities and results. For example, you may need to show new colleagues the ropes, explain how to operate a piece of equipment or how an analysis method works, or instruct them on a new or optimised work process. The objective of this course is to gain experience in instructing, teaching and supervising.</p> <p><b>Learning objectives:</b> See Content - 'Linked with learning outcomes' below.</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Student assistant - Reflection (Portfolio)	6.1a, 6.1b, 6.1c, 6.1d, 6.1e	100%	1.25	5.5	N/A	N/A	N/A	N/A

Block 8 / Semester: S2														
CU76023V1	Title: Labmanagement & Safety					Number of study credits: 2.5			Number of contact hours: 15					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled class activities are mandatory (80%). Guest lectures are always mandatory.														
<p><b>Content:</b> The course is an introduction to general safety and safety topics related to chemicals and the production, processing, transport and storage of chemicals, including the legal aspects and a person's own responsibility.</p> <p><b>Learning objectives:</b> See Content - 'Linked with learning outcomes' below.</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X			X	Labmanagement & Safety - Report (Assignment)	1.2f, 1.2h, 4.1a, 4.1b, 4.1c	100%	2.5	5.5	S2.19	S2.21	S2.22	S2.23



Block 7 & 8 / Semester: S2														
CU24080	Title: Professionalization block 7 & 8					Number of study credits: 1.25			Number of contact hours: 10					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Attendance is mandatory. In case of ((un)foreseen, inevitable) absence, students have to contact their study coach.														
Content: Assignments, individual and as a group to work on personal professional skills and knowledge of the students competencies to develop toward a professional chemistry employee.														
Compulsory literature:														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)	X	X		X		Individual reflection (Portfolio)	5.1a, 5.1b, 5.1c, 5.1d 8.1a, 8.1b, 8.1d, 8.1e	100%	1.25	5.5	S2.19	S2.20	S2.21	S2.22

Block 9 & 10 / Semester: S1														
CU13633V5	Title: Professionalization block 9 &10					Number of study credits: 2.5			Number of contact hours:					
	Course manager: T.C.W. Moerdijk-Poortvliet					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: attendance is mandatory. In case of ((un)foreseen, inevitable) absence, students have to contact their study coach.														
<b>Content:</b> This course comprises the following activities: - Study progress - Orientation on profession - Personal development - Just in time workshops - Finding a suitable internship - Guest lectures														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)	X	X		X		Individual reflection (Portfolio)	8.2b, 8.2a, 8.2d, 8.2e	100%	2.5	5.5	S1.19	S1.20	S2.1	S2.2

Semester: S1 / S2														
CH-HZP-YEAR2-22	Title: HZ Personality year 2					Number of study credits: 2.5			Number of contact hours: N/A					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: Dutch / English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b></p> <p>Within HZ Personality you will work on skills that you think are important for your personal and professional development. You design the programme yourself and reflect on the approach you have chosen, and the insights obtained. Your study career coach will guide you in this.</p> <p>HZ Personality has three connected levels: you, others, the world. During your study time at HZ you will have to work at least one time on each of these levels in order to broaden your view and experiences on every level. The levels are translated into three themes: Personal development, Community development and Sustainable development</p> <p><b>Learning objectives:</b></p> <p>Developing skills and attitudes to achieve personal and professional goals. Carrying out activities that contribute to sustainable development goals and community goals.</p> <p><b>Compulsory literature:</b></p>														
Test code	Format					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	<i>Verbal/Written/Other Individually/Group</i>							%	ECTS					
TOETS01 (VT)		X		X		Self-reflection & burden of proof (Portfolio)		100%	2.5	-	N/A	N/A	N/A	N/A

## SPECIALISATION APPLIED CHEMISTRY

Block 9 / Semester: S1														
CU76000	Title: Chromatography practice					Number of study credits: 5			Number of contact hours: 45					
	Course manager: S.T. Popovici					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals, guest lectures and excursions are mandatory (100%). Note the formative exam from course CU76001 is related to the mark of Attitude during lab lessons.														
<b>Content:</b> This practical is an advanced application of the theory obtained in Blok 7 and 8 (Separations). You will design and perform your own experimental approach starting from published scientific literature. Method development is a relevant part of this class as well as your own preparation and understanding of the topics. You will get hands-on experience with techniques such: HPLC-UV, GC-FID, Headspace-GC-FID, GC-MS. Sample preparation is an important part of the class as well as the reporting of the data and co-operation within your practical-team.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Report on practical work (Assignment)	1.2c, 1.2d, 1.2g, 1.2h	25%	1.25	5.5	S1.9	S1.11	S1.13	S1.15
TOETS02 (VT)		X			X	Report on troubleshooting (Assignment)	2.2c, 1.2f	40%	2.0	5.5	S1.9	S1.11	S1.13	S1.15
TOETS03 (VT)	X	X		X		Individual workplace assessment ((Workplace) Assessment)	1.2f, 2.2g, 8.1d	35%	1.75	5.5	S1.9	S1.10	S1.19	S1.20

Block 9 / Semester: S1														
CU76001V1	Title: Polymer chemistry & analysis					Number of study credits: 5			Number of contact hours: 25					
	Course manager: L.P.J. Veraart					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b> This course provides an introduction to the chemical structure of the most common polymers, formation mechanisms and their physical properties. In addition, you will also discuss polymer processing techniques and analytical techniques. Special attention is dedicated to analysis by means of Size Exclusion Chromatography. Separations techniques and especially troubleshooting are highlighted. Part of the course is an on-site practical in a company.</p>														
<p><b>Compulsory literature:</b> Chemistry of polymers,, Nicholson, John W., 4th edition, ISBN: 9781849733915</p>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Polymer chemistry & analysis - Exam (Written knowledge test)	2.1f, 2.2a, 2.2b 1.1c, 1.1 d, 8.1d, 1.2h	100%	5.0	5.5	S1.8	S1.9	S1.10	S1.12

Block 9 / Semester: S1														
CU76002	Title: Circular Chemistry					Number of study credits: 2.5				Number of contact hours: 12				
	Course manager: T.C.W. Moerdijk-Poortvliet					Compulsory: yes				Language: English				
Conditions for course participation: none														
Conditions for test participation: complete the formative assignment and formative literature review assignment of this course														
<p><b>Content:</b></p> <p>The solution to rising fossil fuels prices, depletion of raw materials and the reduction of greenhouse gases is the development of green chemicals and sustainable production processes. This course is an introduction to the biobased economy, biobased products and biobased chemical techniques. With regards to the importance of the transition of an economy based on oil to a circular and biobased economy awareness will be created. Together we will discuss the consequences of making choices and the ethical behavior of the student.</p> <p>All knowledge acquired in previous Chemistry courses will be useful during this course. The principles of Green Chemistry will be discussed. Guest speakers will provide the link with practice. Because the subject of Biobased Chemistry is in development, you will frequently use peer reviewed literature.</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Final exam (Written knowledge test)		100%	2.5	5.5	S1.8	S1.9	S1.10	S1.12

Block 10 / Semester: S1														
CU76006V1	Title: Circular Chemistry practice					Number of study credits: 5			Number of contact hours: 45					
	Course manager: T.C.W. Moerdijk-Poortvliet					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals, guest lectures and excursions are mandatory (100%). Complete the formative assignment and formative literature review assignment of this course.														
<b>Content:</b> In a practical assignment you will apply your acquired knowledge and deepen it further. You will investigate regional biomass (such as marine algae) as potential renewable resource. The research will be done in collaboration with the research group 'Marine Biobased Specialties'. In a student group you will independently develop a protocol to extract and quantify an interesting chemical component from marine biomass. You will be supervised by the teacher and get his/her help in making a plan of approach. This practical part is also a good preparation for the upcoming minor, internship and final graduation.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X			X	Report practical work (Assignment)	1.2c, 1.2d, 1.2e, 1.2g, 1.2i 2.2c, 2.2d, 2.2e, 6.1d	100%	5.0	5.5	S1.19	S2.1	S2.3	S2.5

Block 10 / Semester: S1														
CU76007	Title: Advanced Chromatography					Number of study credits: 5				Number of contact hours: 45				
	Course manager: S.T. Popovici					Compulsory: yes				Language: English				
Conditions for course participation: none														
Conditions for test participation: 100% attendance at excursions and guest lectures														
<b>Content:</b> This course is a follow-up of the separation part of block 7,8 and 9. The focus is solving troubleshooting casus from practical situations, adding new knowledge of advanced level such new developments in chromatography and two-dimensional chromatography (GCxGC and LCxLC) in combination to lab visits and guest lectures to international companies such Dow Benelux, Sabic and Restek.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Advanced Chromatography - Written exam (Written knowledge test)	2.1f, 2.2f, 1.1c, 2.2b	70%	3.5	5.5	S1.18	S1.19	S1.20	S2.2
TOETS02 (VT)			X		X	Advanced Chromatography - Presentation (Presentation)	2.2b, 1.1 h	30%	1.5	5.5	S1.11 – S1.17	N/A	S1.11 – S1.17	N/A



Block 10 / Semester: S1														
CU76008	Title: Circular chemistry & Biopolymers					Number of study credits: 2.5			Number of contact hours:					
	Course manager: T.C.W. Moerdijk-Poortvliet					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b> You will study in a specific topic of biobased chemistry (e.g. biodiesel, packing material, biopolymers, biobased colors, etc.). You will compare fossil fuel products with products that are produced in a biobased way and you are able to name the pros and cons. You will study companies that produce biobased products. By means of literature research, you increase your knowledge about the topic you have chosen. For completion you will write a literature review on your biobased chemistry topic with the aim that your fellow students can use this review as reference work. In addition, you share the knowledge gained with your fellow students by giving a presentation. After this presentation, your findings will be discussed with both teacher and fellow students.</p>														
<b>Compulsory literature:</b>														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							%	ECTS					
	V	W	O	I	G		Linked with learning outcomes							
TOETS01 (VT)			X		X	Literature review & Presentation (Presentation)	2.2f, 1.1c, 2.2b	100%	2.5	5.5	S1.18	S1.19	S1.20	S2.2

**SPECIALISATION LIFE SCIENCES**

Block 9 / Semester: S1														
CU76003	Title: Immunology practice					Number of study credits: 5			Number of contact hours: 45					
	Course manager: N.A. Wattel					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals, guest lectures and excursions are mandatory (100%)														
<b>Content:</b> In this course you will study bacteria and viruses, and the mechanisms by which they cause disease. In addition, you will become acquainted with the complex reaction of our immune system to invading microorganisms.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X			X	Report practical work (Assignment)	1.2g, 1.2h	60%	3.0	5.5	S1.9	S1.11	S1.13	S1.15
TOETS02 (VT)	X			X		Practical work ((Workplace) Assessment)	1.2b, 1.2d, 1.2e, 1.2g, 1.2h, 2.2d, 2.2g, 8.1b, 1.2f, 8.1e, 7.1b, 7.1c	40%	2.0	5.5	S1.9	S1.10	S1.19	S1.20

Block 9 / Semester: S1														
CU76004	Title: Immunology 1 & Biochemistry 3					Number of study credits: 5			Number of contact hours: 45					
	Course manager: N.A. Wattel					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b></p> <p><b>Immunology 1.</b> In this course you will study bacteria and viruses, and the mechanisms by which they cause disease. In addition, you will become acquainted with the complex reaction of our immune system to invading microorganisms.</p> <p><b>Biochemistry 3.</b> All life forms are similar at the molecular level. The processes by which they acquire and use energy, grow, replicate, and adapt follow similar basic rules. Biochemistry studies these processes, from metabolism of unicellular bacteria to cellular communication in mammals. In this course we will deal with the basic chemistry of life, the structure and function of proteins and how to study them. Furthermore this course addresses the energy metabolism of sugars, fats and amino acids, and how all these factors are related to the lifestyle and living environment of the organism.</p> <p><b>Learning objectives:</b></p> <p>TOETS02</p> <p>Describe functionally relevant molecular interactions between diverse biomolecules, and explain the purpose and principle of several biochemical analysis methods.</p> <p>Understand biochemical routes, including energy trafficking, and human anatomy related to digestion and absorption of nutrients.</p> <p>Describe how catabolic processes, ranging from glycolysis to oxidative phosphorylation, are able to produce ATP.</p> <p>Be able to explain how fats are oxidized and synthesized, and how these processes are related to other major metabolic pathways.</p> <p>Understand how various metabolites, such as amino acids, can be used to build glycogen and fat stores.</p> <p>Distinguish various metabolic control systems, and describe their basic mechanisms and purposes.</p>														
<p><b>Compulsory literature:</b></p> <p>Biochemistry and Molecular Biology, Elliot, D. Elliot, W. Papachristodoulou, L., 6th edition, ISBN: 9780198768111</p> <p>Basic Immunology, Abbas, Abul K., 5th edition, ISBN: 9780323390828</p>														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							%	ECTS					
TOETS01 (VT)		X		X		Immunology 1 - Written exam (Written knowledge test)	1.2a, 1.2d, 2.2a, 2.2b	50%	2.5	5.5	S1.8	S1.9	S1.10	S1.12
TOETS02 (VT)		X		X		Biochemistry 3 - Written exam (Written knowledge test)	1.2b, 2.2a	50%	2.5	5.5	S1.8	S1.9	S1.10	S1.12

Block 9 / Semester: S1														
CU13416V6	Title: Biotechnology					Number of study credits: 2.5			Number of contact hours:					
	Course manager: K.F. Wannee					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b> Subjects from the previous life science courses will be reinterpreted in the context of the diverse and multidisciplinary biotechnological workforce that the students will become part of. Biotechnology draws knowledge and expertise from many basic sciences and combines that knowledge in a wide array of applications.</p> <p><b>Learning objectives:</b> See Content - <i>Linked with learning outcomes</i> below.</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)			X	X		Active participation, including preparation and reflection (Portfolio)	1.2b, 8.2c	100%	2.5	5.5	S1.19	S2.1	S2.3	S2.5

Block 10 / Semester: S1														
CU76009V1	Title: Molecular Biology toolbox					Number of study credits: 5			Number of contact hours:					
	Course manager: K.F. Wannee					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: Attendance of scheduled practicals are mandatory (100%)														
<p><b>Content:</b> In this course you will develop more advanced skills in molecular biology research; starting with protocol development, up to executing experiments of your own mini project. The techniques that you will learn are e.g. recombinant DNA technology, genetic screening, purification and (activity) analysis of proteins, mammalian cell culturing, and transfection.</p> <p><b>Learning objectives:</b> See Content - <i>Linked with learning outcomes</i> below.</p>														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X			X	Research report (Assignment)	1.2a, 1.2b, 1.2c, 1.2d, 1.2e, 1.2g, 1.2h, 1.2i, 2.2a, 2.2b, 2.2d, 2.2g	100%	5.0	5.5	S1.19	S2.1	S2.3	S2.5

Block 10 / Semester: S1														
CU76010	Title: Immunology 2 & DNA 2				Number of study credits: 5		Number of contact hours:							
	Course manager: K.F. Wannee				Compulsory: yes		Language: English							
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b></p> <p><b>Immunology 2.</b> In this course you will study bacteria and viruses, and the mechanisms by which they cause disease. In addition, you will become acquainted with the complex reaction of our immune system to invading microorganisms.</p> <p><b>DNA2.</b> The completion of the Human Genome Project (HUGO), in which the entire human DNA sequence was determined, marked the beginning of a new era of scientific and technological development on the field of genetics. The speed of genetic sequencing techniques has increased, and the accompanying costs have plummeted. Sequencing the first human genome took 10 years and costed nearly \$3,000,000,000. Nowadays, over a decade after its completion, the same procedure takes roughly a week at a cost of \$10,000. The knowledge we have gained about human genetic diversity enables us to determine not only gender but also geographic origin, hair and eye colour of unidentified persons (CSI). Screening unborn children for genetic diseases (e.g. Down Syndrome) can now be performed by extracting foetal DNA from the blood of the mother instead of taking a sample of amniotic fluid, which entails the risk of inducing abortion. We can use a genetic profile to determine whether someone is at risk of developing certain forms of cancer (e.g. breast cancer). Besides human genetics, genomic screens are now common practice in breeding new variants of plants that are resistant against drought or pests. Genetic engineering has produced cotton plants that produce their own insecticides, and it enables us to produce human insulin in bioreactors to provide therapeutics for the treatment of diabetic patients. Genetics is everywhere in our society, and in this course we will study its principles, techniques, and application from basic single gene cloning to genome wide screening, and whole genome sequencing.</p> <p><b>Learning objectives:</b></p> <p>TOETS03</p> <p>Understand the principles and purposes of various advanced PCR applications, including PCR-RFLP, PCR-VNTR, and RT-PCR.</p> <p>Describe the gene cloning procedure, including conventional, TOPO, and linkers/adapters methods.</p> <p>Distinguish genomic from cDNA libraries, name their characteristic features, and be able to explain how to perform their screening.</p> <p>Demonstrate knowledge about gene expression assay principles, such as Northern blotting, yeast hybrid screens, DNase footprinting, promoter-probe vector systems, and differential transcriptome profiling (e.g. cDNA microarrays).</p> <p>Be able to describe various expression vectors, their most important structural elements, and their compatible hosts (bacterial, yeast, and mammalian). Also explain how and why affinity purification tags (e.g. 6xHis) or detection tags (e.g. myc and HA) may need to be fused to expressed target proteins.</p> <p>Acquire knowledge about the purpose and principles, by which animals and plants can be transgenically altered.</p>														
<p><b>Compulsory literature:</b></p> <p>From Genes to Genomes: Concepts and Applications of DNA Technology (softcover), Plant, N.D., Schantz, M. Von, Dale, J.W., 3rd edition, ISBN: 9780470683859</p>														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Factor						
	V	W	O	I	G		Linked with learning outcomes	%	ECTS					

TOETS01 (VT)		X		X		Immunology 2 - Written exam (Written knowledge test)	1.2a, 1.2d, 2.2a, 2.2b	40%	2.0	5.5	S1.18	S1.19	S1.20	S2.2
TOETS02 (VT)	X			X		Immunology 2 - Presentation (Presentation)	6.1c	10%	0.5	5.5	S1.11 – S1.17	N/A	S1.11 – S1.17	N/A
TOETS03 (VT)		X		X		DNA2 - Written exam (Written knowledge test)	1.2b, 2.2a, 2.2b	50%	2.5	5.5	S1.18	S1.19	S1.20	S2.2

Block 10 / Semester: S1														
CU13415V6	Title: Bioinformatics					Number of study credits: 2.5			Number of contact hours:					
	Course manager: K.F. Wannee					Compulsory: yes			Language: English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Brief description of course content:</b></p> <p><b>Content:</b></p> <p>Data is everywhere. Due to the enormous decrease in sequencing costs and the technical ease by which sequences can be determined, biomolecular research is becoming swamped by a deluge of data. You will need to make sense of it all, and this is where information technology comes into play. Besides storing and managing data – an achievement in itself – it is also necessary to share and compare the sequences to reveal ‘invisible’ patterns of similarities and differences, the biological relevance of sequence variants, and the evolution mechanisms underlying the enormous sequence variation that unites and distinguishes all life forms. Although bioinformatics itself is a scientific discipline that combines mathematics, information sciences, and biology, in this course we will primarily focus on the practical part, asking the following questions: ‘What can I actually learn from this sequence?’ and ‘How on earth should I begin?’</p> <p><b>Learning objectives:</b></p> <p>To explore public biological data resources to learn about a topic of interest - Life Cycle of SARS-CoV-2.</p> <p>(a) To examine the evolutionary relationships between different Coronavirus strains, using the amino acid sequence of the Main Protease. (b) To compare the structures of the Main Protease from SARS and SARS-CoV-2.</p> <p>To explore the structure of RNA dependent RNA Polymerase (RdRP) using RCSB Mol.</p> <p>To visualize and explore the structures of the SARS-CoV-2 Spike protein, ACE2 receptor, and their binding using data from the Protein Data Bank and the RCSB Mol visualization tool.</p> <p>To explore the structure and interactions of interleukin-6 (IL-6) to its receptor and to a humanized antibody that binds to it Using RCSB Mol and figure out if the antibodies can help manage the cytokine storm.</p> <p>(a) To explore the Structure of RNA dependent RNA Polymerase (RdRP) bound to Remdesivir using RCSB Mol to understand how it can block replication. (b) To explore the structures of Spike Protein Receptor Binding Domain (RBD) bound to ACE2 and Antibodies Using RCSB PDB Mol and figure out if the antibodies are neutralizing.</p>														
<b>Compulsory literature:</b>														
Test code	Format					Assessment	Content	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Description and type						
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)	X	X		X		Oral presentation and written assignments (Presentation)	1.2f, 1.2h	100%	2.5	5.5	S1.18	S1.19	S1.20	S2.2



Semester: S1 / S2														
CH-HZP-YEAR3-22	Title: HZ Personality year 3					Number of study credits: 2.5			Number of contact hours: N/A					
	Course manager: M.J. van den Berge					Compulsory: yes			Language: Dutch / English					
Conditions for course participation: none														
Conditions for test participation: none														
<p><b>Content:</b></p> <p>Within HZ Personality you will work on skills that you think are important for your personal and professional development. You design the programme yourself and reflect on the approach you have chosen, and the insights obtained. Your study career coach will guide you in this.</p> <p>HZ Personality has three connected levels: you, others, the world. During your study time at HZ you will have to work at least one time on each of these levels in order to broaden your view and experiences on every level. The levels are translated into three themes: Personal development, Community development and Sustainable development.</p> <p><b>Learning objectives:</b></p> <p>Developing skills and attitudes to achieve personal and professional goals. Carrying out activities that contribute to sustainable development goals and community goals.</p>														
<b>Compulsory literature:</b>														
Test code	Format					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	<i>Verbal/Written/Other Individually/Group</i>							%	ECTS					
	V	W	O	I	G									
TOETS01 (VT)		X		X		Self-reflection & burden of proof (Portfolio)		100%	2.5	-	N/A	N/A	N/A	N/A

Semester: S2														
CU05600V12		Title: Research minor					Number of study credits: 30			Number of contact hours:				
		Course manager: K.F. Wannee					Compulsory: no			Language: English / Dutch				
Conditions for course participation: see article 3.8 paragraph 4 CER HZ														
Conditions for test participation: none														
<b>Content:</b> In the Chemistry research minor, you will learn in the familiar environment of the HZ how to conduct assignment-led research. The assignment may have been provided by an internal research group such as OG Aquaculture or an external party such as Philips or Applied Instruments. You are responsible for the complete assignment. This includes defining research questions, performing in-depth research, presenting and discussing results, and writing a report.														
<b>Compulsory literature:</b>														
Test code	Format					Assessment	Content	Weighting		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Factor						
	V	W	O	I	G		Linked with learning outcomes	%	ECTS					
TOETS01 (VT)		W			I	Report, presentation and defence (Assignment)	1.2a, 1.2b, 1.2c, 1.2d, 1.2e, 1.2f, 1.2g, 1.2h, 1.2i, 2.2a, 2.2b, 2.2c, 2.2d, 2.2f, 2.2g, 5.1a, 5.1c	60%	18.0	5.5	N/A	N/A	N/A	N/A
TOETS02 (VT)		W		I		Portfolio (Portfolio)	5.1a, 5.1c, 8.2a, 8.2b, 8.2e	40%	12.0	5.5	N/A	N/A	N/A	N/A

Semester: S1 / S2														
CU06725V18	Title: Internship in company					Number of study credits: 27.5				Number of contact hours:				
	Course manager: S.T. Popovici					Compulsory: yes				Language: Dutch / English				
<b>Conditions for course participation:</b> See article 2.2.8 IR CER HZ														
<b>Conditions for test participation:</b> The in-company functioning (Appendix 4) must be graded with at least 5,5. At insufficient level, the internship must be done all over again (at same or different location).														
<b>Content:</b> Carry out one or more assignments that help you acquire the competences (learning objectives) recorded in the internship plan.														
<b>Compulsory literature:</b>														
Test code	Format Verbal/Written/Other Individually/Group					Assessment Description and type	Content Linked with learning outcomes	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)		X		X		Internship report (Assignment)	1.2b, 1.3h, 1.3a, 1.3c	60%	16.5	5.5	N/A	N/A	N/A	N/A
TOETS02 (VT)	X	X		X		Final Evaluation (portfolio with evidence) (Portfolio)	1.3e, 8.2a, 8.2b, 8.2d, 8.2e, 1.2f, 7.1c, 1.2a, 1.3f	20%	5.5	5.5	N/A	N/A	N/A	N/A
TOETS03 (VT)	X	X		X		Company evaluation ((Workplace) Assessment)	1.3e, 8.1d, 1.2f, 7.1c, 1.2a, 1.3f	20%	5.5	5.5	N/A	N/A	N/A	N/A

Semester: S1 / S2														
CH-HZP-YEAR4-22	Title: HZ Personality year 4					Number of study credits: 2.5				Number of contact hours: N/A				
	Course manager: M.J. van den Berge					Compulsory: yes				Language: Dutch / English				
Conditions for course participation: none														
Conditions for test participation: none														
<b>Brief description of course content:</b> <b>Content:</b> Within HZ Personality you will work on skills that you think are important for your personal and professional development. You design the programme yourself and reflect on the approach you have chosen, and the insights obtained. Your study career coach will guide you in this. HZ Personality has three connected levels: you, others, the world. During your study time at HZ you will have to work at least one time on each of these levels in order to broaden your view and experiences on every level. The levels are translated into three themes: Personal development, Community development and Sustainable development.														
<b>Learning objectives:</b> Developing skills and attitudes to achieve personal and professional goals. Carrying out activities that contribute to sustainable development goals and community goals.														
<b>Compulsory literature:</b>														
Test code	Format					Assessment	Content	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	Verbal/Written/Other Individually/Group							Description and type	Linked with learning outcomes					
	V	W	O	I	G									
TOETS01 (VT)		X		X		Self-reflection & burden of proof (Portfolio)		100%	2.5	-	N/A	N/A	N/A	N/A

Semester: S1 / S2														
CU06726V16	Title: Final Thesis & project					Number of study credits: 30			Number of contact hours:					
	Course manager: S.T. Popovici					Compulsory: yes			Language: English / Dutch					
<b>Conditions for course participation:</b> See article 2.2.11 IR CER HZ														
<b>Conditions for test participation:</b> The in-company functioning (Appendix 4) must be graded with at least 5,5. At insufficient level, the graduation internship must be done all over again (at same or different location)														
<b>Brief description of course content:</b> Conduct research: complex, practical assignment in complex situation, independent research, select from relevant methods.														
<b>Compulsory literature:</b>														
Test code	Format <i>Verbal/Written/Other Individually/Group</i>					Assessment <i>Description and type</i>	Content <i>Linked with learning outcomes</i>	Weighting Factor		Minimum score	Planning test in week	Inspection of work in week	Resit scheduled in week	Inspection of resit in week
	V	W	O	I	G			%	ECTS					
TOETS01 (VT)	X	X		X		Final assessment of research competency (Assignment)	1.3g, 1.3h, 1.3i, 1.3a, 1.3c, 1.3b, 2.3a, 2.3b, 2.3f, 2.3g	60%	18.0	5.5	N/A	N/A	N/A	N/A
TOETS02 (VT)	X	X		X		Final assessment of performance and prof (Portfolio)	1.3e, 8.2a, 8.2b, 8.2d, 8.2e, 7.1d, 1.3d, 1.3f, 4.1a, 2.3c, 5.1a,	20%	6.0	5.5	N/A	N/A	N/A	N/A
TOETS03 (VT)	X	X		X		Company evaluation ((Workplace) Assessment)	1.3e, 1.3d, 1.3f, 4.1a, 2.3c, 2.3d	20%	6.0	5.5	N/A	N/A	N/A	N/A

2.2.6 **HZ Personality** (article 3.12 CER HZ Ba ft)

The curriculum reserves 10 study credits (ECTS) for HZ Personality. HZ Personality is spread over the curriculum as much as possible. With this learning pathway, HZ gives students space to personalize their own development during their studies, increases the possibilities for domain-transcending exploration and stimulates broad social engagement.

**Cohort 2021-2022 & cohort 2022-2023**

See policy HZ Personality published on [www.hz.nl](http://www.hz.nl).

For each activity, an accompanying Personal Development Plan is mandatory, as described at the HZ.learn page of Chemistry and with support of the Study Coach.

**Transition arrangement Cohort 2020-2021 and before**

Students can choose activities of the following categories:

Category	Course code	Credits
1 Management activities	VCCU76011-1	1.25
	VCCU76011-2	1.25
2 Information & promotion activities	VCCU76012-1	1.25
	VCCU76012-2	1.25
3 Social & cultural activities	VCCU76013-1	1.25
	VCCU76013-2	1.25
4 Coaching activities	VCCU76014-1	1.25
	VCCU76014-2	1.25
5 Project activities	VCCU76015-1	1.25
	VCCU76015-2	1.25
6 Training activities and courses	VCCU76016-1	1.25
	VCCU76016-2	1.25

Additional restrictions:

There is a maximum of 2.5 EC to be done within one single category.

For each activity, an accompanying Personal Development Plan is mandatory, as described at the HZ.learn page of Chemistry and with support of the Study Coach.

2.2.7 **Specialisations** (article 3.10 CER HZ Ba ft)

The Chemistry programme offers the following majors:

- Applied Chemistry
- Life Sciences

Students choose one of these majors by delivering a motivational letter. For additional information see programme descriptions. These can be found on the HZ website and are available from the Academy Office.

2.2.8 **Internship** (article 3.9 CER HZ Ba ft)

In order to participate in a work placement (Internship), the propaedeutic phase has to be completed and at least 30 ECTS of the main phase. Students are free to start with workplacement or to start with minorship.

For information on the graduation/graduation internship, securing an internship and its assessment, please refer to 'Graduation' in the general student manual and in the programme-specific student manual. These can be found on the Chemistry HZ Learn page and are available at the Academy Office.

2.2.9 **Minor** (article 3.8 CER HZ Ba ft)

In order to participate in a minor, the propaedeutic phase has to be completed and at least 30 ECTS of the main phase. Students are free to start with workplacement or to start with minorship.

2.2.10 **Participation in international exchange programme** (article 4.5 CER HZ Ba ft)

Exchange programme is provided via International office (Article 4.5 CER HZ)  
Exchange programme is provided via 'Kies op maat' minorships.

2.2.11 **Graduation** (article 3.9 CER HZ Ba ft)

In order to participate in the graduation phase of the Chemistry programme (semester 8), the student has to have no more than 10 ECTS unpassed, besides the 30 ECTS of the graduation phase. The actual graduation manual is applicable for each student, starting a graduation.

For information on the graduation/graduation internship, securing an internship and its assessment, please refer to 'Graduation' in the general student manual and in the programme-specific student manual. These can be found on the Chemistry website and are available from the Academy Office.

2.2.12 **Transition arrangement** (art. 6.2 paragraph 11 HZ CER)

Transition arrangement implementation HZ Personality. See article 2.2.6.

## **2.3 Study recommendation**

- 2.3.1. **Conditions for registration for programme after NBSA** (article 8.1, paragraph 9 HZ CER Ba ft)  
Student with a formal negative study advice from the HZ Exam Committee are not allowed for a new enrolment in the Chemistry program of the HZ within three years after the negative study advice.

## **2.4 Experiment (article 9.4 CER HZ ba ft)**

- 2.4.1 This year, the programme is participating in an experiment under the pilot project group Flexibilisation. The programme would like to experience the results of participation in this project. Students are not affected by this. The student registers for courses and tests. A registration period has been set for tests that are taken during the regular exam week (block week 8) and the resit week (block week 10). See HZ Learn for the registration periods. Registration for the courses of block 1 and block 2 is done by the chemistry department.



## CHAPTER 3 ESTABLISHMENT

- 3.1.1 The duration of the implementation regulations is the same as the duration of the HZ Education and Examination Regulations Bachelor programme full-time 2022-2023.
- 3.1.2 These Course and Examination Regulations were established by the Executive Board on 12/07/2022.