



## IDENTIFYING DATA

### Chemical oceanography II

Subject	Chemical oceanography II			
Code	V10G061V01209			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Nieto Palmeiro, Óscar			
Lecturers	Calle González, Inmaculada de la Nieto Palmeiro, Óscar			
E-mail	palmeiro@uvigo.es			
Web	<a href="http://http://depc07.webs.uvigo.es/">http://http://depc07.webs.uvigo.es/</a>			
General description	This subject presents the chemical methodology applied to the determination of the compounds of greatest interest in Chemical Oceanography, from sample taking to obtaining the final result.			
	English Friendly subject: International students may request from the teachers: a) resources and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

## Training and Learning Results

Code				
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B2	Plan and execute surveys in the field and laboratory work, applying basic tools and techniques for sampling, data acquisition and analysis in the water column, sea bottom and marine substratum.			
B3	Recognize and implement good practices in measurement and experimentation, and work responsibly and safely both in field surveys and in the laboratory.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C6	Acquire the fundamentals and terminology of chemical processes.			
C7	Apply to the marine and coastal environment the principles and methods used in Chemistry.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			

## Expected results from this subject

Expected results from this subject	Training and Learning Results			
Describe the foundations and the applications of the technicians of chemical analysis more usually used in the laboratory.	A2 A4	B1 B2 B3	C6 C7	D1
Know choose and use the material for the taking of sample of the water of mar.	A2 A4	B1 B2 B3	C6 C7	D1 D2
Apply the technicians of chemical analysis to the compounds of greater interest in the Chemical Oceanography.	A2 A4	B1 B2 B3 B4	C6 C7	D1 D2

Apply the experimental conditions more adapted for the determination of a chemical compound in function of the chemical reactivity.	A2 A4	B1 B2 B3 B4	C6 C7	D1 D2
Know realise all the necessary calculations to determine the final concentration of a compound in the water of sea in function of the analytical technician used.	A2 A4	B1 B2 B3 B4	C6 C7	D1 D2
Prepare the reagents and the necessary material to carry out an oceanographic campaign.	A2 A4	B1 B2 B3	C6 C7	D1 D2
New	A4	B1 B4	C7	

## Contents

Topic	
Analytical methodology (I): previous operations	The analytical methodology of chemical measurement. Sampling. Preparation of the sample.
Analytical methodology (II): measurement techniques.	Gravimetric and volumetric methods. Instrumental techniques of analysis.
Analytical methodology (III): measure and chemical references-analytical.	Accuracy and precision. Limits of confidence. Linear regression adjustment by least squares.
Determination of salinity in seawater other major compounds	Determination of the salinity: chlorinity and chlorosity. Determination of major anions and cations.
Alkalinity of seawater	Measure of the temperature and pH in seawater. Determination of the alkalinity in seawater. Physicochemical parameters related with the salinity, temperature, pH and alkalinity in seawater. Concentration profile of carbon dioxide in the water column.
Oxygen dissolved	Determination of dissolved oxygen in seawater. Concentration profile of dissolved oxygen in the water column.
Nutrients: species of N, P, Si	Determination of phosphate and silicate in seawater. Determination of nitrates, nitrites and ammonium in seawater. Concentration profiles of nutrients in the water column.
Organic matter in the oceans	Fluorimetry: Determination of humic substances and other fluorescent substances. Chromatographic techniques: determination of photosynthetic pigments.
Metals traces	Determination of trace elements in seawater.

## Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	1	1	2
Lecturing	19	50	69
Problem solving	6	18	24
Laboratory practical	20	0	20
Seminars	7	0	7
Report of practices, practicum and external practices	0	10	10
Essay questions exam	0	14	14
Objective questions exam	2	0	2
Problem and/or exercise solving	2	0	2

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

	Description
Introductory activities	In this activity, the syllabus to develop during the semester will be presented to the students, as well as the aims, competences and evaluation criteria. Likewise it will explain them the way to develop the subject along the semester, will create the groups that will make the integrated methodologies.
Lecturing	During the teaching of each topic, students will have notes on the Moovi platform on the subject to be covered in the classroom session, which will be available days before the class session. The lecturer will present the topics in the classroom and a series of questions will be asked to promote critical thinking during the classroom session. The notes will no longer be available on the Moovi platform one week after the end of the course.

Problem solving	During the classroom sessions dedicated to "Problem solving", students will learn how to calculate concentrations of compounds of oceanographic interest in seawater from data usually obtained in the laboratory. The statements of these problems and their resolution will be available on the Moovi platform.
Laboratory practical	<p>Students will carry out laboratory practicals on the determination of chemical parameters characteristic of seawater as well as chemical compounds of interest in chemical oceanography:</p> <ul style="list-style-type: none"> <li>- Chlorosity and chlorinity.</li> <li>- Total alkalinity.</li> <li>- Dissolved oxygen.</li> <li>- Phosphate in seawater.</li> <li>- Metals in seawater by atomic spectroscopy.</li> </ul> <p>The practical reports must be submitted in the stipulated time, be original and will be evaluated by the teacher according to the evaluation criteria published on the Moovi platform.</p> <p>Unjustified absence from one of the practical sessions will result in the non-evaluation of this part of the course, which must be repeated in the following year.</p> <p>Students who took this part of the course during the academic year 2022-23 and obtained a grade equal to or higher than 5 points are not obliged to take this part of the course.</p>
Seminars	<p>In seminar session 1, students will carry out an original project related to a boat trip to carry out a chemical oceanography study. In session 2, students will carry out the necessary calculations for the preparation of reagents to be able to carry out the determinations programmed in the boat trip planned in session 1. In sessions 3 and 4, students will carry out the construction of depth profiles from data obtained in a laboratory. After the seminar sessions, students will have to answer questionnaires that will appear on the Moovi platform by the stipulated deadline.</p> <p>Unjustified absence from one of the practical sessions will result in the non-evaluation of this part of the course, which must be repeated in the following year.</p> <p>Students who took this part of the course during the academic year 2022-23 and obtained a grade equal to or higher than 5 points are not obliged to take this part of the course.</p>

#### Personalized assistance

Methodologies	Description
Laboratory practical	The student who wishes it will be able to attend personalized tutorials to solve doubts, mainly in the schedules indicated at the University website. To optimize the time, it is necessary for the student to contact the teacher well in advance. These tutorials can be done in person in the offices of the teachers or through the virtual offices that the teachers have in <a href="https://campusremotouvigo.gal">campusremotouvigo.gal</a> . Likewise, any doubts that arise to the student can be formulated through the forums that are enabled for this on the Moovi platform.
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Problem solving	The student who wishes it will be able to attend personalized tutorials to solve doubts, mainly in the schedules at the University website. To optimize the time, it is necessary for the student to contact the teacher well in advance. These tutorials can be done in person in the offices of the teachers or through the virtual offices that the teachers have in <a href="https://campusremotouvigo.gal">campusremotouvigo.gal</a> . Likewise, any doubts that arise to the student can be formulated through the forums that are enabled for this on the Moovi platform.

#### Assessment

Description	Qualification Training and Learning Results
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Lecturing	The students, during two sessions of classroom teaching, will make in each of them a questionnaire type test with 20 questions on the topics that have been taught to date. This questioned will be accessible from the Moovi platform for all those students present in the classroom and will have a maximum time of 20 minutes to do so. Each well-answered question will have a value of 0.50 points and the poorly answered questions will subtract 0.25 points each. Unanswered questions will not add or subtract points. The final grade of these two tests shall be calculated with the geometric mean of the grades obtained.	7.5	A2 B1 C6 D1 A4 B2 C7 D2 B3
Problem solving	The students, during two classroom teaching sessions, will solve in each of them a problem on the calculation of the concentration of a compound of interest in oceanography, using a method of chemical analysis, from the data normally obtained in a laboratory work, and express the result with the correct significant units and figures. This problem will be accessible from the Moovi platform for all students present in the classroom and will have a maximum time of 25 minutes to do it. The result obtained shall be evaluated. The final grade of these two tests shall be calculated with the geometric mean of the grades obtained.	7.5	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4
Laboratory practical	The laboratory practicals are compulsory for all students and will be evaluated according to the work done during the laboratory sessions, according to quality criteria published on the Moovi platform.	3.75	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4
Report of practices, practicum and external practices	The laboratory work and the practical report will be assessed by the teaching staff according to previously established criteria based on rubrics that will be published on the Moovi platform. In the event that the work is not original (it is a copy of another work or from the network), the teacher will not evaluate the work.	21.25	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4
Essay questions exam	At the end of each seminar session, students will have to answer a questionnaire accessible on the Moovi platform within the established deadline.	25	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4
Objective questions exam	In the final exams, students will have to take a multiple-choice exam in which they will answer 40 questions on the aspects presented in the Master Class sessions. In each question, students will select a single answer that they consider correct. Each correctly answered question will be worth 0.250 points and incorrectly answered questions will subtract 0.125 points. Unanswered questions will neither add nor subtract points each.	17.5	A2 B1 C6 D1 A4 B2 C7 D2 B3
Problem and/or exercise solving	The problems will consist of calculating the concentration of a compound of interest in oceanography, using a method of chemical analysis, from data normally obtained in laboratory work, and expressing the result with the correct units and significant figures. The result obtained will be evaluated, as well as the clarity and reasoning used to arrive at it. The final examination will consist of the solution of three problems of this type and the mark for each problem will appear in the statement of the examination.	17.5	A2 B1 C6 D1 A4 B2 C7 D2 B3 B4

### Other comments on the Evaluation

The date, time and place of the evaluation tests will be published on the official website of the Faculty of Marine Sciences: <http://mar.uvigo.es/alumnado/examenes/>

The subject consists of four main blocks and the score of each of them is weighted with 25% on the final grade:

1.- Part of theory: which is divided into "*Objective questions exam*", 17.5%, and the tests included in "*Lecturing*", 7.5%. To consider passed this part, students will have to obtain a grade equal to or greater than 5 points in each of the tests.

2.- Part of problems: which is divided into "*Problem and/or exercise solving*", 17.5% and the tests included in "*Problem solving*", 7.5%. To consider passed this part, students will have to obtain a grade equal to or greater than 5 points in each of the tests.

3.- Seminar work (Essay questions exam, 25%). The average score of the seminars will be calculated with the geometric mean obtained with the qualifications of each of the questionnaires carried out. To be considered passed this test, students will have to obtain a grade equal to or greater than 5 points.

4.- Laboratory practice. The work carried out in the laboratory (3.75%, 1.5 points out of 10) and the corresponding practice report (21.25%, 8.5 points out of 10) will be evaluated following criteria that will be published in the Moovi platform. The average grade of laboratory practice shall be calculated on the basis of the geometric mean of the grades obtained in each of the practices. To be considered passed this test, students will have to obtain a grade equal to or greater than 5 points.

To pass the subject you will need to pass with a minimum of 5 points out of 10 in each of these blocks. If the minimum mark is not exceeded in any of the blocks, the maximum mark which may be entered in the Minutes shall be 4,5 points.

If the grade obtained in the "*Objective questions exam*" is equal to or greater than 5 points and, in turn, higher than that

achieved in the "Lecturing" tests, the total grade that will be in Block 1 will be the "Objective questions exam". If the grade obtained in the "Problem and/or exercises solving" is equal to or greater than 5 points and, in turn, higher than the one achieved in the "Problem Solving" tests, the total grade in Block 2 shall be that of "Problem and/or exercises solving".

In case of not reaching the minimum score in blocks 1.- and/or 2.-, the part of the "Objective questions exam" and/or "Problem and/or exercise solving" not passed will have to be taken again in the 2nd opportunity exam.

In case of not reaching the minimum score in block 3.-, the students, individually, will have to carry out again the questionnaires of those sessions of seminars in which it has obtained a qualification inferior to 5 points in the term that the/the corresponding teacher will consider appropriate.

In case of not reaching the minimum score in blocks 4.-, the students will have to send again the reports of practices with the relevant corrections, in the time that the/the corresponding teacher will consider appropriate.

The performance by the students of any test shown in the table above will be taken into account immediately for the final grade and will appear in the minutes as a student presented in the corresponding call.

The unjustified absence to one of the sessions of seminars and/or practices, blocks 3.- and 4.-, supposes the non evaluation of the corresponding block, being repeated in the following course.

The ratings and each of the blocks will be published on the Moovi platform, indicating the date, time and place of the corresponding revisions.

**Global assessment option.** The application for this evaluation option must be submitted in the time and manner determined by the Center, which will be published prior to the academic start. Given the experimental nature of the practices and seminars, attendance at them is mandatory to be eligible for this evaluation option. **Failure to attend the practices, with no justified cause invalidates this possibility, as well as the opportunity for extraordinary evaluation (2nd opportunity).**

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#### Sources of information

##### Basic Bibliography

Grasshof K., Kremling K., Ehrhardt M. (Eds.), **Methods of Seawater Analysis**, 3, Wile-VCH, 1999

Aminot A., K  rouel R. (Eds.), **Hydrolog   des   cosyst  mes marins: param  tres et analyses**, Editions Quae,

Harris D.C., **An  lisis Qu  mico Cuantitativo**, Revert  ,

Millero F.J., Sohn M.L., **Chemical Oceanography**, 4, CRC Press, 2013

##### Complementary Bibliography

Aminot A., Chaussep  d M. (Eds.), **Manuel des Analyses Chimiques en Milieu Marin**, CNEXO,

Parsons T.R., Maita Y., Lalli C.M., **A Manual of Chemical and Biological Methods of Seawater Analysis**, Pergamon Press,

Skoog D.A., West D.M., Holler F.J., (Crouch S.R.), **Fundamentos de Qu  mica Anal  tica**, McGraw-Hill o Revert  ,

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Gianguzza A., **Marine chemistry: an environmental analytical chemistry approach**, Springer,

Libes S.M., **Introduction to Marine Biogeochemistry**, 2, Academic Press,

Chester R., **Marine Geochemistry**, 2, Blackwell Science,

Bearmean G. (ed.), **Sewater: its composition, properties and behaviour**, 2, The Open University. Pergamon Press,

Horwitz W., Latimer G.W., **Official methods of analysis of AOAC International**, 18, AOAC International, cop.,

Miller J.N., Miller J.C., **Estad  stica y Quimiometr   para Qu  mica Anal  tica**, Prentice-Hall,

Burriel F., Lucena F., Arribas S., Hern  ndez J., **Qu  mica Anal  tica Cualitativa**, 14, Paraninfo,

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#### Recommendations

##### Subjects that continue the syllabus

Chemistry applied to the marine environment II/V10G061V01309

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##### Subjects that it is recommended to have taken before

Chemistry: Chemistry I/V10G061V01105

Chemistry: Chemistry 2/V10G061V01110

Chemical oceanography I/V10G061V01204

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#### Other comments

It is assumed that students are familiar with the following chemistry concepts before starting the course:

- chemical formulation and nomenclature
- calculation of concentrations
- adjustments of basic chemical reactions and calculation of stoichiometric ratios.

It is also assumed that students are able to teach themselves how to use a scientific calculator, especially with regard to the calculation of basic statistical parameters (arithmetic mean and standard deviation), and the adjustment of a linear plot by least squares.

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