



IDENTIFYING DATA

Chemistry applied to the marine environment I

Subject	Chemistry applied to the marine environment I			
Code	V10G061V01304			
Study programme	Grado en Ciencias del Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	3rd	1st
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Couce Fortúnez, María Delfina Besada Pereira, Pedro			
Lecturers	Besada Pereira, Pedro Castro Fojo, Jesús Antonio Couce Fortúnez, María Delfina Teijeira Bautista, Marta			
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Web	http://https://mar.uvigo.es/			
General description	This subject includes the study of elements, inorganic substances and organic substances that can reach and alter the marine environment, acting as pollutants. Behaviour, influence and prevention of the effects produced by these elements, inorganic substances and organic substances in the environment will be studied. Moreover, the study of marine natural products (classification, function, pharmacological interest) will be addressed. 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	
A1	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
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
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
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.
C8	Know the main pollutants, their causes and effects in the marine and coastal environment.
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.

Expected results from this subject				
Expected results from this subject	Training and Learning Results			
To describe global cycles of the elements, including the input and output processes.	A1 A2 A3 A5	B1	C6	D1
To define and to explain concepts, principles and sources related to chemical pollution.	A1 A2 A3 A5	B1	C6 C8	D1 D5
To describe the chemical composition and speciation in seawater and to determine the mechanisms and factors that regulate it.	A1 A2 A3 A5	B1	C6	D1
To determine the processes that regulate chemical species complexation.	A1 A2 A3 A5	B1	C6	D1
To identify the toxicity mechanisms of metal ions, as well as the factors that determine and control the biomethylation processes.	A1 A2 A3 A5	B1	C6 C7 C8	D1 D5
To identify the toxicity mechanisms of the major organic pollutants.	A1 A2 A3 A5	B1	C6 C7 C8	D1 D5
To identify the most important natural products in the marine environment.	A1 A2 A3 A5	B1	C6	D1 D5
To identify the main interactions between marine organisms.	A1 A2 A3 A5	B1	C6 C7	D1
To describe the main applications of marine natural products.	A1 A2 A3 A5	B1	C6 C7	D1 D5
To analyze the results obtained in the laboratory using the theoretical concepts.	A1 A2 A3 A5	B1 B2 B3 B4	C6	D1
To develop the necessary skills for the resolution of the applications related with the subject.	A1 A2 A3 A5	B1 B2 B3 B4	C7	D1 D5

Contents	
Topic	
1. Introduction to environment	Cycles of the elements in the environment
2. Pollution of marine environment	Generalities. Major sources of pollution
3. Metal speciation	Aerobic and anaerobic environments. Pourbaix diagrams
4. Metals and metallic species	General characteristics. Effects of metal complexation with natural ligands
5. Pollution by heavy metals	Biogeochemical cycles. Methylation processes. Mechanisms of toxicity associated. Applicable defense and detoxication procedures.
6. Reactivity of pollutants non-metallic chemical species	Introduction: carbonates, nitrates, phosphates, sulfates, perchlorates
7. Radioactive pollution in marine environment	Study, behavior and control of radioactive pollutants
8. Organic pollutants in the marine water	Classification. Functional and structural description. Origin of marine pollution
9. Chemical transformations of organic compounds	Solubility of organic compounds. Reactions of organic pollutants with nucleophilic species. Redox processes. Photochemical and biological transformations
10. Types of natural products	Terpenes, steroids and carotenoids. Oxygen compounds: Phenols, lignans, coumarins, macrolides and polyethers. Nitrogenous compounds: alkaloids, peptides

11. Marine natural products and their biologic function	Metabolite transfer in marine ecosystems. Biogenesis. Incorporation of halogens: Haloperoxidases
12. Marine chemical ecology	Chemical interactions between organisms. Organic compounds of marine origin and their ecological function
13. Marine natural products in drug discovery	Organic compounds of marine origin: isolation, characterization and biological activity

Planning

	Class hours	Hours outside the classroom	Total hours
Seminars	16	24	40
Laboratory practical	12	2	14
Mentored work	0	17	17
Lecturing	24	48	72
Problem and/or exercise solving	1	0	1
Report of practices, practicum and external practices	0	4	4
Objective questions exam	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
Seminars	Seminars will be used for further working on some of the theoretical contents, and also for problems resolution as a complement of the masterclass. Students may prepare a topic of interest related with the subject.
Laboratory practical	Application of laboratory techniques in practical problems related to the subject
Mentored work	Preparation and presentation of a tutored work on a topic related to the contents
Lecturing	Theoretical classes in which the professor and students will work the basic concepts of the matter

Personalized assistance

Methodologies	Description
Lecturing	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutorial hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h D. Couce: tuesday, wednesday and thursday from 12:00 to 14:00 h
Seminars	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutorial hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h D. Couce: tuesday, wednesday and thursday from 12:00 to 14:00 h
Laboratory practical	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutorial hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h J. Castro: tuesday and thursday from 10:00 to 13:00 h
Mentored work	Tutoring, support and motivation in the learning process, in the classroom, personally in the professor's office as well as through e-mail or the virtual campus. Students willing so could attend personal tutorials to solve doubts and/or uncertainties, which will mainly take place during the timetables indicated. To better optimise the procedure, the student is requested to previously contact his/her teacher with reasonable anticipation. Tutorial hours: P. Besada: monday, wednesday and thursday from 11:00 to 13:00 h D. Couce: tuesday, wednesday and thursday from 12:00 to 14:00 h

Assessment

	Description	Qualification	Training and Learning Results			
Mentored work	Students will carry out a brief tutored work, evaluating the report presented and its presentation	25	A1 A2 A3 A5	B1 C8	C6 D5	D1

Problem and/or exercise solving	The student will have to resolve and deliver the questionnaires proposed in the classroom. It will value the participation and attitude of the student, his capacity to relate and apply the concepts purchased.	10	A1 A2 A3 A5	B1 	C6 C7 C8	D1
Report of practices, practicum and external practices	Students must present a report of the virtual practices carried out. Attendance at the laboratory sessions as well as preparation of the report is compulsory to get promoted. The attitude in the lab sessions, the skills and the understanding of the experimental techniques used will be evaluated.	25	A1 A2 A3 A5	B1 B2 B3 B4	C6 C7	D1 D5
Objective questions exam	Final exam in which the theoretical contents of the subject worked in the master sessions and in the seminars will be evaluated. The contents of this subject are divided in two blocks (Chapters 1-7 and 8-13) so the test will also be divided into two parts. To get promoted the student must obtain a minimum of 3.5 out of 10 in each of the two parts into which the exam is divided.	40	A1 A2 A3 A5	B1 	C6 C7 C8	D1

Other comments on the Evaluation

The official exam schedule can be checked at the following link:

<http://mar.uvigo.es/alumnado/examenes/>

The final qualification will be the sum of all paragraphs whenever the required minimum is reached. If the required minimum is not reached the final qualification will be the one of the final exam.

The participation of the student in the laboratory sessions, in the tutored work or in any exam will involve the condition of presented and the assignment of a score.

The percentages in each of the paragraphs will be maintained in the 2nd assesment call (July).

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, 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).**

Students are strongly requested to fulfil a honest and responsible behaviour. It is consider inadmissible any kind of fraud (copy or plagiarism) aimed to falsify the level of knowledge and skills achieved in exams, evaluations, reports or any kind of teacher´s proposed work. Fraudulent behaviour may involve failing the subject during a whole academic year. An internal record of these actions will be kept to request, in case of reincidence, the opening of a disciplinary file.

Sources of information

Basic Bibliography

I. Bodek, W.J. Lyman, W.F. Reehl y D.H. Rosenblatt, **Environmental Inorganic Chemistry**, Pergamon Press, 1988
R.P. Schwarzenbach, P.M. Gschwend, D.M. Imboden, **Environmental Organic Chemistry**, 2, John Wiley & Sons Inc, 2003
R. Chang, **Química**, 11, Mc Graw Hill, 2013
P. Yurkanis Bruice, **Química Orgánica**, 5, Prentice Hall México, 2007

Complementary Bibliography

S. E. Manahan, **Environmental chemistry**, 9, CRC Press, 2009
H. G. Seiler, H. Sigel, A. Sigel, **Handbook on toxicity of inorganic compounds**, Marcel Dekker, 1988
J. W. Moore, **Inorganic Contaminants of Surface Water**, Springer, 1991
Paul M. Dewick, **Medicinal natural products: A biosynthetic approach**, 3, John Wiley & Sons Inc, 2009
J. B. McClintock, B.J. Baker, **Marine chemical ecology**, CRC Press, 2001
M.A. Martínez Grau, A.G. Csáky, **Técnicas experimentales en síntesis orgánica**, 2, Síntesis, 2012

Journal of Natural Products,

Natural Products Reports,

Marine Chemistry,

Marine Pollution Bulletin,

Recommendations

Subjects that continue the syllabus

Marine contamination/V10G061V01401

Subjects that it is recommended to have taken before

Chemistry: Chemistry I/V10G061V01105

Chemical oceanography I/V10G061V01204
