

**1. General information****Course:** ATMOSPHERIC CHEMISTRY**Type:** CORE COURSE**Degree:** 340 - UNDERGRADUATE DEGREE PROGRAMME IN ENVIRONMENTAL SCIENCES**Center:** 501 - FACULTY OF ENVIRONMENTAL SCIENCES AND BIOCHEMISTRY**Year:** 2**Main language:** Spanish**Use of additional languages:****Web site:****Code:** 37317**ECTS credits:** 6**Academic year:** 2023-24**Group(s):** 40**Duration:** C2**Second language:****English Friendly:** Y**Bilingual:** N**Lecturer:** ANA MARIA RODRIGUEZ CERVANTES - Group(s): 40

Building/Office	Department	Phone number	Email	Office hours
Sabatini, despacho 0.222	QUÍMICA FÍSICA	5494	anamaria.rodriguez@uclm.es	From 10:00 to 18:00 h from Monday to Friday, by appointment by e-mail.

**Lecturer:** DIANA RODRIGUEZ RODRIGUEZ - Group(s): 40

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**2. Pre-Requisites**

Not established

**3. Justification in the curriculum, relation to other subjects and to the profession**

The subject is in the 2nd year of the degree and aims to address basic knowledge of atmospheric chemistry, such as knowing the reactions that take place in each layer of the atmosphere, the responsible species and related environmental problems.

This subject offered future graduates in Environmental Sciences the basic knowledge to access other subjects, such as Environmental Pollution, whose mastery will allow them to detect and solve environmental problems.

**4. Degree competences achieved in this course****Course competences**

Code	Description
E04	Ability to integrate experimental evidence found in field and/or laboratory studies with theoretical knowledge.
E26	Ability to assess air quality and purify air emissions
T03	To use a correct oral and written communication.

**5. Objectives or Learning Outcomes****Course learning outcomes****Description**

The student will be able to apply his or her knowledge to extract relevant information on the chemical nature of both the components of the natural environment and the pollutants, their reactivity in the environmental systems (atmosphere, soil, water and interfaces) and their toxicity or dangerousness as well as to evaluate different possibilities for their control, prevention, mitigation and remediation of pollution.

That the student is able to learn and work autonomously and to solve problems through the search for information, its analysis, interpretation and synthesis, as well as to transmit its ideas and conclusions correctly in oral and written form.

The student will be able to understand the fundamental aspects of atmospheric chemistry: to know the reactions that take place in each layer of the atmosphere, the responsible species and related environmental problems (greenhouse effect, acid rain, hole in the ozone layer, etc.), relating them to human activity.

**6. Units / Contents****Unit 1: Fundamental concepts: composition of the atmosphere, lifetimes and global cycles****Unit 2: Physics of the atmosphere****Unit 3: Atmospheric kinetics and photochemistry****Unit 4: Stratosphere chemistry****Unit 5: Troposphere chemistry****Unit 6: Aerosols. Heterogeneous chemistry****Unit 7: Evolution of climate on earth****Unit 8: Ionosphere chemistry****7. Activities, Units/Modules and Methodology**

		Related Competences					
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Training Activity	Methodology	(only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Lectures	E26	1.08	27	N		Master classes in which the theoretical contents will be developed. Master classes will be available to the student on virtual platforms.
Problem solving and/or case studies [ON-SITE]	Problem solving and exercises	E26	0.32	8	Y	N	In these classes, students will work on the topics presented in the lectures by solving type problems.
Laboratory practice or sessions [ON-SITE]	Practical or hands-on activities	E04 E26	0.6	15	Y	Y	Practices in the laboratory where the theoretical contents will be applied and expanded. Attendance at practices is considered a compulsory and non-recoverable activity in order to pass the subject. The evaluation of the same will be recoverable, either in the extraordinary or special call for completion
Other on-site activities [ON-SITE]	Assessment tests	E04 E26 T03	0.08	2	Y	Y	Evaluation tests on the practical contents of the subject: Two written tests will be carried out, one before starting the laboratory to assess the understanding of the practice script (non-recoverable), and another at the end of the subject, to assess the level acquired on the practical knowledge (recoverable).
Project or Topic Presentations [ON-SITE]	Group Work	E26 T03	0.16	4	Y	N	Work will be carried out in groups on a topic related to the subject, and will be presented orally in class. This activity will not be recoverable.
Writing of reports or projects [OFF-SITE]	Group Work	E26 T03	0.4	10	Y	N	
Other off-site activity [OFF-SITE]	Combination of methods	E26	0.52	13	Y	N	Various non-contact activities are carried out within the periods established by the teacher. These activities will not be recoverable.
Mid-term test [ON-SITE]	Assessment tests	E26 T03	0.08	2	Y	N	Partial test of progress on the theory of the subject: This test will take into account the theoretical knowledge of part of the subject and the resolution of problems
Final test [ON-SITE]	Assessment tests	E26 T03	0.08	2	Y	Y	There will be a final test that will take into account the theoretical knowledge of the subject and the resolution of problems.
Study and Exam Preparation [OFF-SITE]	Assessment tests	E26	2.68	67	Y	N	
Total:			6	150			
Total credits of in-class work: 2.4			Total class time hours: 60				
Total credits of out of class work: 3.6			Total hours of out of class work: 90				

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System			
Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Other methods of assessment	12.50%	0.00%	Participation in the different activities that will be proposed during the course, such as autonomous problem solving, viewing videos with questions and/or formulating questions about the subject with the "peerwise" platform. These activities will not be recoverable.
Test	15.00%	15.00%	Assessment tests on practical content: Two written tests are carried out to assess knowledge on practical content. The first test will mean 5% of the grade (non-recoverable), and the second 10% (recoverable). It will be necessary to have an average grade of 4 in the global to be able to add the grade obtained to the rest of the activities.
Oral presentations assessment	7.50%	0.00%	Work will be carried out in groups on a topic related to the subject. At the end of the course these works will be presented orally in class. The ability to work in a team will be taken into account. This activity will be non-recoverable.
Mid-term tests	32.50%	0.00%	Partial exam, eliminatory, of the first part of the subject (Issues 1-4). A minimum rating of 4 will be required to be able to release the indicated topics.

			Correct written communication will be taken into account.
Final test	32.50%	77.50%	There will be a final test that will take into account the theoretical knowledge of the subject and the resolution of problems. In case of not passing the partial test, this final test will mean 65% of the grade. In the final test, a minimum grade of 4 will be required in order to add the grade obtained in the rest of the activities. Correct written communication will be taken into account.
<b>Total:</b>	<b>100.00%</b>	<b>92.50%</b>	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

#### Evaluation criteria for the final exam:

##### Continuous assessment:

Attendance at practices is considered a compulsory and non-recoverable activity in order to pass the subject. The evaluation of the same will be recoverable, either in the extraordinary or special call for completion. The marks obtained in the oral presentation of topics and assessment of participation will be taken into account both in the ordinary and extraordinary calls.

Two tests will be carried out to evaluate practical laboratory knowledge. In order to pass the subject it is necessary to have a 4 in this section. The qualification obtained in the practices may be kept during the following academic year in case of not passing the subject.

There will be a final test that will take into account the theoretical knowledge of the subject and problem solving. In order to pass the subject it is necessary to have a 4 in this section. In any case, the subject will only be considered passed if the set of all evaluable activities results in a grade of 5 or higher (out of 10).

##### Non-continuous evaluation:

The modality assigned by default to the student will be the continuous evaluation. Any student may request the change to the non-continuous evaluation modality (before the end of the class period) by sending an email to the teacher, provided that they have not completed 50% of the evaluable activities.

Also in this modality, attendance at practices is considered as a compulsory and non-recoverable activity in order to pass the subject. The evaluation of the same will be recoverable, either in the extraordinary or special call for completion.

Two tests will be carried out to evaluate practical laboratory knowledge. In order to pass the subject it is necessary to have a 4 in this section. The qualification obtained in the practices may be kept during the following academic year in case of not passing the subject.

A final test will be carried out that will take into account the theoretical knowledge of the subject and the resolution of problems, equivalent to the final test carried out in continuous evaluation; more specific exercises that allow detecting the overcoming of knowledge and skills that could not be worked on in continuous evaluation. In order to pass the subject it is necessary to have a 4 in this section. In any case, the subject will only be considered passed if the set of all evaluable activities results in a grade of 5 or higher (out of 10).

#### Specifications for the resit/retake exam:

Attendance at practices is considered a compulsory and non-recoverable activity in order to pass the subject. The evaluation of the same will be recoverable, in the extraordinary call. In order to pass the subject it is necessary to have a 4 in this section. The qualification obtained in the practices may be kept during the following academic year in case of not passing the subject.

The marks obtained throughout the course in the oral presentation of topics and assessment of participation will be taken into account in this extraordinary call, although they are not recoverable.

There will be a final test that will take into account the theoretical knowledge of the subject and problem solving. In order to pass the subject it is necessary to have a 4 in this section. In any case, the subject will only be considered passed if the set of all evaluable activities results in a grade of 5 or higher (out of 10).

#### Specifications for the second resit / retake exam:

Attendance at practices is considered a compulsory and non-recoverable activity in order to pass the subject. The evaluation of the same will be recoverable in the special call for completion.

To pass this call there will only be one final test that will account for 100% of the grade and that will include the theoretical and practical knowledge of the subject and problem solving.

9. Assignments, course calendar and important dates	
Not related to the syllabus/contents	
Hours	hours
Project or Topic Presentations [PRESENCIAL][Group Work]	4
Writing of reports or projects [AUTÓNOMA][Group Work]	10
Other off-site activity [AUTÓNOMA][Combination of methods]	12
Mid-term test [PRESENCIAL][Assessment tests]	2
Final test [PRESENCIAL][Assessment tests]	2
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	67
Unit 1 (de 8): Fundamental concepts: composition of the atmosphere, lifetimes and global cycles	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	15
Other on-site activities [PRESENCIAL][Assessment tests]	2
Unit 2 (de 8): Physics of the atmosphere	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	2
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Unit 3 (de 8): Atmospheric kinetics and photochemistry	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
Unit 4 (de 8): Stratosphere chemistry	
Activities	Hours
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	2

<b>Unit 5 (de 8): Troposphere chemistry</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	6
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	3
<b>Unit 6 (de 8): Aerosols. Heterogeneous chemistry</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	4
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	1
<b>Unit 7 (de 8): Evolution of climate on earth</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	3
<b>Unit 8 (de 8): Ionosphere chemistry</b>	
<b>Activities</b>	<b>Hours</b>
Class Attendance (theory) [PRESENCIAL][Lectures]	2
<b>Global activity</b>	
<b>Activities</b>	<b>hours</b>
Final test [PRESENCIAL][Assessment tests]	2
Writing of reports or projects [AUTÓNOMA][Group Work]	10
Other off-site activity [AUTÓNOMA][Combination of methods]	12
Class Attendance (theory) [PRESENCIAL][Lectures]	27
Problem solving and/or case studies [PRESENCIAL][Problem solving and exercises]	9
Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities]	15
Other on-site activities [PRESENCIAL][Assessment tests]	2
Project or Topic Presentations [PRESENCIAL][Group Work]	4
Mid-term test [PRESENCIAL][Assessment tests]	2
Study and Exam Preparation [AUTÓNOMA][Assessment tests]	67
<b>Total horas: 150</b>	

10. Bibliography and Sources						
Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
JACOB, D. J.	Introduction to Atmospheric Chemistry	Princeton University Press		ISBN: 0691001855	1999	
SEINFELD, J. H., PANDIS, S. N.	Atmospheric Chemistry and Physics: From Air Pollution to Climate Change	John Wiley and Sons		ISBN: 0471178152	1998	
WAYNE, R. P.	Chemistry of Atmospheres: An Introduction to the Chemistry of the Atmosphere of Earth, the Planets and Their Satellites	Oxford Science Publications		ISBN: 019850375-X	2000	
FIGUERUELO, J. E., MARINO, M.	Química Física del Ambiente y de los Procesos Medioambientales	Reverté		ISBN: 84-291-7903-8	2004	
FINLAYSON-PITTS, B. J.; PITTS, J. N.	Chemistry of the Upper and Lower Atmosphere	Academic Press		ISBN: 012257060-X	2000	