UNIVERSIDADE DA CORUÑA

Teaching Guide					
Identifying Data					2014/15
Subject (*)	Cinética dos Procesos Contaminantes			Code	610311623
Study programme	Licenciado en Química				
Descriptors					
Cycle	Period	Year		Type	Credits
First and Second Cycle	1st four-month period	Fourth-Fifth		Optativa	6
Language	SpanishGalicianEnglish				
Prerequisites					
Department	Química Física e Enxeñaría Química 1				
Coordinador	Fernandez Perez, Maria Isabel		E-mail	isabel.fernandez.perez@udc.es	
Lecturers	Fernandez Perez, Maria Isabel		E-mail	isabel.fernandez.perez@udc.es	
Web	ciencias.udc.es				
General description	This subject aims, through the use of the tools of Physical Organic Chemistry, to introduce the student to the physicochemical basis of the different processes that determine the fate of pollutants once dispersed in the environment. Dispersion processes will be briefly analyzed. More detail will be devoted to the different main degradation processes: hydrolysis, complexation, reduction and oxidation reactions, photo-initiated processes, etc.				

Study programme competences	
Code	Study programme competences
A4	Coñecer os tipos principais de reacción química e as súas principais características asociadas.
A10	Coñecer a cinética do cambio químico, incluíndo a catálise e os mecanismos de reacción.
A14	Demostrar o coñecemento e comprensión de conceptos, principios e teorías relacionadas coa Química.
A15	Recoñecer e analizar novos problemas e planear estratexias para solucionalos.
A16	Adquirir, avaliar e utilizar os datos e información bibliográfica e técnica relacionada coa Química.
A22	Planificar, deseñar e desenvolver proxectos e experimentos.
A24	Explicar, de xeito comprensible, fenómenos e procesos relacionados coa Química.
A25	Relacionar a Química con outras disciplinas e recoñecer e valorar os procesos químicos na vida diaria.
B1	Aprender a aprender.
B2	Resolver problemas de forma efectiva.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar de forma colaborativa.
B6	Comportarse con ética e responsabilidade social como cidadán e como profesional.
B7	Comunicarse de maneira efectiva nun entorno de traballo.
C2	Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.
C3	Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C4	Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.
C8	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes			
Subject competencies (Learning outcomes)	Study programme competences		
- Dominar a expresión e a comprensión de forma oral e escrita dun idioma estranxeiro.			C2
- Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.			C3

- Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.			C4
- Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.			C8
- Aprender a aprender.		B1	
- Resolver problemas de forma efectiva.		B2	
- Aplicar un pensamento crítico, lóxico e creativo.		B3	
- Traballar de forma autónoma con iniciativa.		B4	
- Comunicarse de maneira efectiva nun entorno de traballo.		B7	
- Comportarse con ética e responsabilidade social como cidadán e como profesional.		B6	
- Traballar de forma colaborativa		B5	
- Coñecer os tipos principais de reacción química e as súas principais características asociadas.	A4		
- Coñecer a cinética do cambio químico, incluíndo a catálise e os mecanismos de reacción.	A10		
- Demostrar o coñecemento e comprensión de conceptos, principios e teorías relacionadas coa Química.	A14		
- Recoñecer e analizar novos problemas e planear estratexias para solucionalos.	A15		
- Adquirir, avaliar e utilizar os datos e información bibliográfica e técnica relacionada coa Química.	A16		
- Planificar, deseñar e desenvolver proxectos e experimentos.	A22		
- Explicar, de xeito comprensible, fenómenos e procesos relacionados coa Química.	A24		
- Relacionar a Química con outras disciplinas e recoñecer e valorar os procesos químicos na vida diaria.	A25		

Contents	
Topic	**Sub-topic**
Revisión de conceptos sobre Reactividade Química	Bases físicas dos procesos químicos. Cinética e termodinámica dos procesos químicos. Relacións de enerxía libre. Ferramentas para elucidar mecanismos de reacción.
Compartimentos medioambientais e distribución de contaminantes	Compartimentos ambientais: atmósfera, hidrosfera, fases sólidas. Compostos orgánicos e inorgánicos no medio ambiente. Procesos físicos sufridos polos contaminantes no medio: evaporación, transporte, reparto entre fases.
Mecanismos de degradación por hidrólise.	Características cinéticas dos mecanismos de hidrólise. Mecanismos de sustitución nucleofílica. Mecanismos de adición-eliminación. Catálise nas reaccións de hidrólise en sistemas naturais: catálisise ácido-base, metálica, sobre superficies e arcillas, outros procesos de catálise.
Procesos de complexación.	Mecanismo dos procesos de complexación.
Procesos de adsorción.	Cinética dos procesos de adsorción. Isotermas de adsorción. Catálise e fotocatálise heteroxénea.
Mecanismos de procesos de oxidación - reducción.	Oxidación por oxíxeno, superóxido, oxíxeno singlete, ozono, peróxido de hidróxeno, radicais hidroxilo, radical peroxilo, radicais alcoxilo, etc. Oxidación sobre superficies: arcillas, óxidos, etc. Oxidacións térmicas: pirólise, combustión, incineración, oxidación húmeda. Oxidación de gases. Chuva ácida. Procesos de reducción: axentes reductores de interese ambiental, transformacións por reducción.

Mecanismos de reaccións que implican desinfectantes.	Reaccións dos halóxenos en disolución acuosa. Reaccións de derivados de halóxenos: haloaminas, óxidos de cloro. Reaccións do ozono. Reaccións superficiais dos desinfectantes. Procesos de tratamento de augas.
Procesos fotofísicos e fotoquímicos.	A luz solar. Procesos fotofísicos. Mecanismos de desactivación de estados excitados. Reactividade de estados excitados. Excímeros e exciplexos. Procesos fotoquímicos: fotólise directa, fotosensitización, fotoionización, etc. Procesos fotoquímicos na atmósfera. Procesos fotoquímicos nas augas naturais. Fotoquímica na interfase: interfases aire-auga, sólido-auga e sólido-aire. Fotorreaccións particularmente relevantes. Procesos fotoquímicos en tratamento de augas.
Procesos radioquímicos.	Radiación e medio ambiente. Química da radiación e radioquímica. Radiólise, oxidación monoelectrónica e reducción monoelectrónica. Procesos radioquímicos.
Mecanismos de reacción en medios organizados.	Micelas, vesículas, coloides, ciclodextrinas.
Aplicacións prácticas.	Casos prácticos sobre o efecto e os procesos de degradación de: hidrocarburos, xabróns e deterxentes, pesticidas, cosméticos, fármacos, celulosa e lignina, polímeros e plásticos, etc. Casos prácticos sobre outras modalidades de contaminación: radiación, luz, ruido, etc.
Prácticas de laboratorio	Experimentos relacionados coa distribución, dispersión e /ou, degradación de contaminantes no medio ambiente

Planning			
Methodologies / tests	Ordinary class hours	Student?s personal work hours	Total hours
Events academic / information	1	0	1
Laboratory practice	12	6	18
Problem solving	4	24	28
Objective test	2	0	2
Oral presentation	1	3	4
Guest lecture / keynote speech	36	54	90
ICT practicals	0	6	6
Personalized attention	1	0	1
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
Methodologies	Description
Events academic / information	One full session is reserved to attend some event associated with the topic of the subject. Should this not take place, this session would be devoted to an additional problems solution session.
Laboratory practice	The student will develop a small experimental project associated with the topic of the subject. He/she should prepare a brief report in the typical style of technical and / or scientific reports, including at least, an abstract, keyworkds, introduction, materials and equipment and procedures, results and discussion, conclussion and references.

Problem solving	Each set of problems / questions will contain some to be solved at home and handed out in a fixed amount of time to the lecturer. Once this has been done, a representative smaple of all the rest will be solved at the class. The problems / questions may include case studies.
Objective test	Each student will have to pass an examination, where he/she should show the ability to face and solve problems and or brief questions independently, without external help, except for those considered to be necessary by the lecturer, in a fixed amount of time.
Oral presentation	The students will present orally, and share with their peers, the result of the experimental project they developed in the lab. These presentations will be subject to peer-review between all students.
Guest lecture / keynote speech	The lecturer will describe and explain the key points of the different topics contained in the subject, pointing out which other points the students should work on independently to acquire the expected competences.
ICT practicals	The students will be assigned a topic to develop appropriate contents and introduce them in the Wikipedia, so that the result is globally accesible. The student will lear how to develop wikis, using appropriate tools for this task.

Personalized attention	
Methodologies	**Description**
Laboratory practice Problem solving ICT practicals	The lecturers will set appointments to the students in order to follow their learning process and help improve it. The students will be free to consult with the lecturers during their individual tutory hours, as long as they are not attending other students.

Assessment		
Methodologies	**Description**	**Qualification**
Laboratory practice	The student will develop a small experimental project associated with the topic of the subject. Then, he/she should prepare a brief report in the typical style of technical and / or scientific reports, including at least, an abstract, keyworkds, introduction, materials and equipment and procedures, results and discussion, conclussion and references. The evaluation will take into account the different steps involved: preparation of the experiment(s), development, understanding, analysis, ability to communicate the results, report, etc.	25
Problem solving	Each set of problems /questions will contain some to be solved at home and handed out in a fixed amount of time to the lecturer. This may include some case studies. Once this has been done, a representative amount of the rest will be solved at the class. The evaluation will take into account the ability to analyze the different situations, propose and discuss different potential solutions and the level of comprehension of the concepts involved.	10
ICT practicals	The students will be assigned a topic to develop and introduce in the Wikipedia, or a similar tool, so that the result produced by the student is globally accesible. Thus, the student will lear how to work with TICs, using the appropriate tools for this task. The evaluation will take into account the way the concepts are presented, their accesibility, clarity, accuracy and concretion.	5
Objective test	Each student will have to face a conceptual examination, where he/she should show the ability to face and solve problems and or brief questions independently in a fixed allocated time. The evaluation will take into account the quality of the results obtained within the given time.	50
Oral presentation	The students will have to present orally, and share with their peers, the result of their experimental project developed at the lab. The evaluation will take into account the capacity to communicate own results, clarity, quality, accuracy, etc.	10

Assessment comments

* A positive assesment of the experimental part (practical lessons) of the subject is compulsory to pass the subject.

* In order to pass the subject, the student should obtain, both in the examination and in the rest of activities, a mark not lower than 4.0, and get, once the qualifications for all the activities are added, a mark not lower than 5.0.

* Upon agreement between the student and the lecturers, the qualifications for the laboratory lessons, seminars and tutorials could be kept for the examination in September. Under this assumption, the qualification of the examination in September would only replace that obtained in the corresponding examination in February. As for extraordinary examinations, this is not necessarily of application, since the subject is taught in the first semester, so all possible activities, and specially the laboratory lessons should be attended.

* The get the qualification of "not presented" ("non presentado"), the students should not have participated in more than 25% of the programmed assesed activities. In other case the above describe procedure would be applied.

* As for succesive academic terms, the process of teaching - learning, including the assesment, refers to an academic year. Hence, the whole assesment would start over againg with every new academic term, including all the assesed activities that are programmed for the new term.

Sources of information	
Basic	- SCHWARZENBACH, R.P.; GSCHWEND, P.M.; IMBODEN, D.M. (2003). Environmental Organic Chemistry. New York, John Wiley & Sons, Inc. - CANLE L., M. (2009). Materiais da asignatura no campus virtual da UDC. A Coruña - LARSON, R.A.; WEBER, E.J. (1994). Reaction Mechanisms in Environmental Organic Chemistry. Cambridge (MA, USA), Lewis Publishers - MASKILL, H. (1993). The Physical Basis of Organic Chemistry. Oxford (U.K.), Oxford Univ. Press
Complementary	- STUMM, W. (1996). Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters. New York, John Wiley & Sons - BAILEY, R.A.; CLARK, H.M.; FERRIS, J.P.; KRAUSE, S.; STRONG, R.L. (2003). Chemistry of the Environment. New York, Academic Press - VAN LOON, G.W.; DUFFY, S.J. (2000). Environmental Chemistry. A Global Perspective. Oxford, Oxford Univ. Press - BAIRD, C. (2001). Química Ambiental. Barcelona, Ed. Reverté, S.A. - SPIRO., T.G.; STIGLIANI, W.M. (2004). Química Medioambiental. Madrid, Pearson Educación, S.A. - MASKILL, H. (1999). Structure and Reactivity in Organic Chemistry. Oxford, Oxford Univ. Press

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
The literature recommeded for this subject is rather disperse in the bibliography, so a regular attendance to lessons is highly recommended in order to follow the course.