Teaching Guide				
Identifying Data				2023/24
Subject (*)	Chemistry		Code	631G01107
Study programme	Grao en Náutica e Transporte Marítimo			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	First	Basic training	6
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Garcia Dopico, Maria Victoria	E-mail	victoria.gdopico@udc.es	
Lecturers	Garcia Dopico, Maria Victoria Santaballa Lopez, Juan Arturo	E-mail	victoria.gdopico@udc.es arturo.santaballa@udc.es	
Web	https://moodle.udc.es/			
General description	A Química é unha asignatura de apoio e aplicación noutras materias esenciais para esta carreira nas que se ten que dar cumprimento, no referido os aspectos fisicoquímicos, os requirimentos de formación establecidos polo Convenio internacional de formación, titulación e garda para a xente do mar (STCW). O marxe da súa orientación o entorno do transporte marítimo tamén inclúe adquisición de competencias propias dunha asignatura de formación básica a nivel universitario con aplicación noutros ámbitos laborais, en terra, nos que @s titulad@s do Grao en Náutica y Transporte Marítimo poden desenvolver a súa actividade profesional.			

Study programme competences / results	
Code	Study programme competences / results
A54	RA1C-Write, explain and transmit the theoretical knowledge acquired both orally and in writing using scientific-technical language.
A55	RA2C-Identify and relate acquired knowledge to other disciplines
A56	RA3C-Writing and interpreting technical documentation in English
A57	RA4C-Collecting and interpreting relevant data
A59	RA6C-Identify critical situations and use available means in order to resolve them effectively.
B31	RA9H-Effectively solve practical problems associated with the subject by applying the knowledge acquired.
B32	RA10H-Know, analyse, synthesise and apply the contents, fundamental concepts and applications of the subject.
B33	RA11H-Develop both individual and group work
B34	RA12H-Handle bibliographic material and computer resources.
B35	RA13H-Handle with ease the tools, techniques, equipment and/or material/instrumental of each subject.
B36	RA14H-Use information and communication technology (ICT) tools necessary for the exercise of their profession and for lifelong learning.
B54	RA53H?Transporting dangerous goods
B66	RA67H?Take precautions to prevent pollution of the environment due to the discharge of oil or chemicals.
B72	RA73H?Take precautions to prevent pollution of the environment due to the release of liquefied gases.
B74	RA75H?Minimise fire risks, and maintain a state of readiness to respond to fire emergencies at all times.
B75	RA76H?Fighting and extinguishing fires.
B78	RA79H?Take precautions to prevent pollution of the marine environment.
B79	RA80H?Observe safe working practices.
B93	RA96H?Contribute to increased maritime security by raising awareness.
C14	RA16X-Produce a report in a rigorous and systematic way.
C15	RA17X-Communicating effectively in a work environment.
C20	RA25X?Respond to emergencies
C24	RA32X?Ensuring compliance with pollution prevention requirements
C26	RA34X?Preventing, controlling and fighting fires on board
C27	RA37X?Monitoring compliance with legislative requirements

C28	RA39X?Contributing to the safety of personnel and the vessel
C34	RA55X?Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, maritime security and protection of the marine environment.
C35	RA56X?Maintaining the safety and security of the ship, crew and passengers, and the proper functioning of life-saving, fire-fighting and other safety systems

Learning outcomes			
Learning outcomes	Study programme competences / results		
Write, explain and transmit the theoretical knowledge acquired both orally and in writing using scientific-technical language	A54		
Identify and relate acquired knowledge to other disciplines	A55		
Writing and interpreting technical documentation in English	A56		
Collecting and interpreting relevant data	A57		
Identify critical situations and use available means in order to resolve them effectively.	A59		
Effectively solve practical problems associated with the subject by applying the knowledge acquired.		B31	
Know, analyse, synthesise and apply the contents, fundamental concepts and applications of the subject.		B32	
Develop both individual and group work		B33	
Handle bibliographic material and computer resources.		B34	
Handle with ease the tools, techniques, equipment and/or material/instrumental of each subject.		B35	
Use information and communication technology (ICT) tools necessary for the exercise of their profession and for lifelong learning.		B36	
Transporting dangerous goods		B54	
Take precautions to prevent pollution of the environment due to the discharge of oil or chemicals.		B66	
Take precautions to prevent pollution of the environment due to the release of liquefied gases.		B72	
Minimise fire risks, and maintain a state of readiness to respond to fire emergencies at all times.		B74	
Fighting and extinguishing fires.		B75	
Take precautions to prevent pollution of the marine environment.		B78	
Observe safe working practices.		B79	
Contribute to increased maritime security by raising awareness.		B93	
Produce a report in a rigorous and systematic way.			C14
Communicating effectively in a work environment.			C15
Respond to emergencies			C20
Ensuring compliance with pollution prevention requirements			C24
Preventing, controlling and fighting fires on board			C26
Monitoring compliance with legislative requirements			C27
Contributing to the safety of personnel and the vessel			C28
Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, maritime security and protection of the marine environment.			C34
Maintaining the safety and security of the ship, crew and passengers, and the proper functioning of life-saving, fire-fighting and other safety systems			C35

Contents	
Topic	Sub-topic

Chapter 1: Basics Concepts in Chemistry (4 hours)	- Object of Chemistry and its relationship with maritime transport. - Atoms and molecules. - Atomic symbols and Periodic Table. - MEANING of chemical formulas. Weight laws and atomic theory. - Formulation and nomenclature of simple inorganic and organic compounds. - Amount of substance, mole and Avogadro's number. - Atomic and molecular masses. - Chemical equations and stoichiometric calculations. Types of reactions: reversible and irreversible - Ionic bond: Concept of ion. Covalent Bond: Molecular Geometry
Chapter 2: States of matter and status changes (7 hours)	------General properties of the states of matter. ------Intermolecular forces. ------Properties of ideal gases. ------ Gas. Ideal gas laws. Real gases, deviation from ideal behaviour: compressibility factor. Diffusion. Gases in ships. ------Properties of the liquid state - Density: relative and apparent. Effect of P and T on density. Plimsoll disc. Density measurement. Viscosity and its variation with temperature. Surface tension: capillarity. Variation of surface tension with temperature. -------Properties and classification of solids. - Types of solids. Metallic solids: metallic bond and conduction of electricity. Semiconductors: P-N junction. Effects of low temperatures-brittle fracture. -------Status changes: application to maritime transport - Heating and cooling curves. Liquid-vapour equilibrium: vapor pressure and boiling. Relative humidity and bubble point. Solid-liquid and solid-vapor balance. Energies associated with changes of state. Study of phase diagrams. - Application of phase changes in maritime transport: liquefied gases and their transport. The reliquefaction and refrigeration of gases. Formation and dispersion of hydrates.
Chapter 3: Solutions (2 hours)	------ Mixtures of substances. Solutions and types. Dissolution process. Units of concentration. Solubility of solids and gases in liquids. Solubility changes with T and P: Henry's law. Colligative properties. Decrease in vapor pressure: Raoult's law. Applications of vapor pressure decay and Henry's law to shipping. Ebulliscopic augmentation and cryoscopic descent: applications in maritime transport. Osmotic pressure. Electrolytic solutions and colloidal solutions

Chapter 4: Chemistry thernodynamics and study of combustion reactions (3 hours)	------ Internal energy and enthalpy. Heats of reaction: endo and exothermic reactions. Thermochemical equations. Calorimetry. heat capacities. Hess's law. ------ Study of combustion reactions. - Combustion. Combustion heats. Fire triangle and tetrahedron: consequences. Flash point, ignition and autoignition: flammability limits. Stoichiometry of combustion reactions. Combustion gases: problems and analysis. - Types of combustion. Knowledge of the various classes of fires and their chemical characteristics. Extinction mechanisms. Use of inert gas. - Types of fuels and their most important properties. Calorific powers.
Chapter 5: Chemistry Reactivity. Control of chemical processes and equilibrium conditions (3 hours)	------ Chemical kinetics. Reaction speed. speed equation. Influence of temperature on the reaction rate. Catalysis and inhibition. ------ Equilibrium constant. Factors affecting balance. Le Chatelier's principle. Chemical kinetics and chemical equilibrium. ------ Spontaneity. entropy. 2nd law of thermodynamics. Gibbs free energy. Relationship between K and free energy. Dependence of K with temperature
Chapter 6: Reaccións en transporte marítimo (5 horas)	------ Acid-base reactions. Acid and base concept. Acid-base properties of water. Ionic product of water. pH concept. Acid and base strengths: Ka and Kb. Hydrolysis. regulatory solutions. pH measurement. Acid-base titrations. Indicators. Applications to maritime transport ------ Precipitation reactions. Solubility product. Common ion effect. Solubility and pH. Chemical composition of natural water water Hardness of water. Introduction to the problems caused by water hardness. Physicochemical composition of the marine environment: chlorinity and salinity ------ Electrochemical processes. Chemical energy. electrochemical cells. electrode potentials. Active elements. Oxidants and reducers. Thermodynamics of redox processes: Nernst equation and applications. Batteries and batteries. electrolytic processes. Faraday's Law. Electrolysis applications. or Corrosion. Types of corrosion. Iron corrosion and marine corrosion. Oxidation processes in ship chimneys. Factors that influence oxidation processes. Protection against corrosion. ------ Polymerization reactions. Peroxide formation and its control: Use of inhibitors

Chapter 7: Important considerations for the transport of chemical products on ships (1,5 hours).	------ Type of vessels. ------ Main chemical products transported. Transport of crude oil in ships: physicochemical characteristics of crude oil. ------ Dangerous goods: transport regulations. ------ Risks of transporting chemical products-Handling cargo: nuclear, biological, flammability, physical and chemical reactivity, static electricity, corrosivity, explosion, leaks and vapor clouds (BLEVE), etc. Substance compatibility. High viscosity and/or density loads. ------ Health risks: toxicity and indicators: threshold limits ------ Tank atmospheres: confined spaces. gas meters ------ Classification of dangerous goods: SOLAS Convention and IMDG Code. Labeling and packaging ------ Risk and safety phrases. MSDS Sheets
Chapter 8: Contaminación debida o transporte marítimo (1,5 horas).	------ Marpol Convention: annexes ------ MARPOL Annex I: Pollution by hydrocarbons. Characteristics of hydrocarbons. Wheatering processes. Prevention of contamination of marine environment and anti-pollution procedures. Ecological impact ------ Annex II: Pollution of harmful substances transported in bulk. Classification according to its toxicity. Special maritime transport areas ------ -Annex VI of MARPOL: Air pollution and its problems. Atmospheric emission control areas. Greenhouse gases: IMO energy efficiency plans ------ Ballast water pollution ------ Ship recycling
Laboratory practices	Work in the laboratory: standards, safety and calculation of errors. Knowledge and management of basic laboratory material. Basic operations. Determination of physicochemical magnitudes of gases, pure liquids, mixtures and solutions (especially crude oil and/or derivatives), Reactivity of chemical products from the point of view of their transport on ships. Physicochemical properties of water and aqueous solutions. Physicochemical properties of fuels and lubricants corrosion reactions emergency procedures

Observations	These sub-themes(1) have been developed in such a way that they serve as a basis for other subjects, specific to the maritime professional activity of this degree, to comply with column 2, Knowledge, Understanding and Sufficiency, of the STCW Convention, modified by Manila 2010, from the following Tables: (1): Obtaining the competencies established in Column 1 of the respective STCW Tables, are completed with the passing of the related contents in complementary subjects such as Naval Hygiene and Occupational Risks. ? Table A-V/1-1-1. Specification of the minimum standards of competence in basic training for cargo operations in oil and chemical tankers. ? Table A-V/1-1-2. Specification of the minimum standards of competence in advanced training for oil tanker cargo operations. ? Chart A-V/1-1-3. Specification of minimum competency standards in advanced training for chemical tanker cargo operations ? Table A-V/1-2-1. Specification of the minimum standards of competence in basic training for cargo operations in tankers for the transport of liquefied gas. ? Table A-V/1-2-2. Specification of the minimum standards of competence in advanced training for cargo operations in tankers for the transport of liquefied gas.
The development and improvement of these contents serves as a basis for other subjects in which specific competences of the degree will be acquired, which will guarantee the knowledge, understanding and sufficiency of the competences included in table AII/2, of the STCW Agreement, related to the Management level of First Deck Officer of the Merchant Navy, without limitation of gross tonnage and Captain of the Merchant Navy up to a maximum of 3000 GT.	Table A-II/2 of the STCW Agreement. Specification of the minimum competency standards applicable to Captains and first deck officers of ships with a gross tonnage equal to or greater than 500 GT.
Gender perspective.	The contents of the course will take into account the gender perspective.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A55 B31 B32 B33 B34 B35 B36 B93 C15	27	40.5	67.5
Laboratory practice	A54 A55 A56 A57 A59 B31 B32 B33 B34 B35 B36 B54 B66 B75 B78 B79 B93 C14 C15 C20 C24	9	9	18
Seminar	A54 A55 A56 A57 A59 B31 B32 B33 B34 B35 B36 B54 B72 B74 B75 B78 B93 C26	16	24	40

Multiple-choice questions	A8 A9 A10 A11 A29 A31 A33 A38 B1 B2 B3 B4 B5 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 C1 C2 C3 C6	0	8	8
Mixed objective/subjective test	A54 A55 A56 A57 A59 B31 B32 B33 B34 B35 B36 B54 B66 B72 B74 B75 B78 B79 B93 C14 C15 C20 C24 C26 C27 C28 C34 C35	2	9	11
Simulation	A54 A55 A56 A57 A59 B31 B32 B33 B34 B35 B36 B54 B66 B72 B74 B75 B78 B79 B93 C14 C15 C20 C24 C26 C27 C28 C34 C35	2	2	4
Personalized attention		1.5	0	1.5
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Guest lecture / keynote speech	? Duration of one hour and will be taught at the indicated time according to the calendar approved by the board of the center. ? The classes will be of the magisterial lesson type in which the teacher will present the subjects of the subject with the help of the necessary audiovisual means, indicating to the students the most important thing to take into account when studying and recommending chapters of the most important books. suitable for further compression. ? Student participation in classes will be encouraged, however, in seminar classes and tutorials, students have more opportunity to resolve any doubts that may have arisen during their study. ? The teacher will give the students copies of all the audiovisual material that will be used in the classes, as well as other types of complementary material, to serve as a study guide. The delivery will be made through the virtual platform of the University or through the reprography service of the center.
Laboratory practice	? Compulsory attendance. ? They will be carried out in the Chemistry laboratory on the days and times indicated by the teacher, in groups of preferably 10 students. ? At the end, the student must submit a laboratory notebook (in electronic format) for evaluation. ? Failure to attend laboratory practices means failing the subject. In very justified cases, their assistance can be replaced by preparing a practical exam related to the practices that were not carried out.
Seminar	? They allow the teacher to know the degree and the learning errors, the deficiencies and limitations in the use of the work tools. ? They will be taught at the end of a theoretical block of the program and practical cases will be raised or doubts will be resolved.
Multiple-choice questions	Throughout the course, using the virtual campus, a series of tests can be carried out to evaluate the learning of the concepts, skills, competencies and abilities associated with the subject.
Mixed objective/subjective test	? Final exam of up to 3-4 hours duration that will have short questions and problems. Among the questions there will be a part with questions about laboratory practices

Simulation	Computer simulations of those topics that require it will be carried out. For this purpose, students will be summoned in advance to attend the computer room.

Personalized attention	
Methodologies	**Description**
Seminar Simulation	Doubts that the student may have regarding the theory taught in the lectures, problem solving and laboratory topics will be resolved. Likewise, the student will be guided, in a personalized way, in the study strategy of the subject. Tutorials, in groups or personally, will be carried out through the TEAMS application. They can also be carried out using the virtual campus and/or email.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Laboratory practice	A54 A55 A56 A57 A59 B31 B32 B33 B34 B35 B36 B54 B66 B75 B78 B79 B93 C14 C15 C20 C24	? This assessment will be 20% of the final grade: 10% completion of the practices 10% preparation of the laboratory notebook and 5% resolution of the question on laboratory practices in the exam ? Failure to attend laboratory practices means failing the subject. In very justified cases, their assistance can be replaced by preparing a practical exam related to the practices that were not carried out.	25
Simulation	A54 A55 A56 A57 A59 B31 B32 B33 B34 B35 B36 B54 B66 B72 B74 B75 B78 B79 B93 C14 C15 C20 C24 C26 C27 C28 C34 C35	The assessment of this part of the course will count for 5% of the total grade. The student must obtain results with simulation programs and know how to interpret them, submitting a report.	5
Multiple-choice questions	A8 A9 A10 A11 A29 A31 A33 A38 B1 B2 B3 B4 B5 B7 B8 B9 B10 B11 B12 B13 B14 B15 B16 C1 C2 C3 C6	Throughout the course, at the end of each topic, multiple choice tests will be carried out during class hours. These tests have the objective of helping the student to bring the subject up to date.	10
Mixed objective/subjective test	A54 A55 A56 A57 A59 B31 B32 B33 B34 B35 B36 B54 B66 B72 B74 B75 B78 B79 B93 C14 C15 C20 C24 C26 C27 C28 C34 C35	? The exam grade will be equivalent to 55% of the course grade (25% theory-35% problems). ? A grade lower than 4 in theory or in problems will mean failing the course. Those notes between a 4-5 may be compensated with the other evaluations. If not, the grade for the compensable part could be taken into account until the second opportunity within the same academic year. ? If partials are taken, in order to pass the subject they must all have a grade higher than 4 (both in theory and in problems). The averages obtained from the theory and from the problems between both partials, when they are between 4-5, can be compensated with the scores of the other evaluable activities. If this is not the case, the mark of the compensable part (average of the theory or average of problems) can be maintained until the first or second opportunity within the same academic year. This means that in the final exams there will be no partials	60
Others			

Assessment comments
Requirements to pass a subject:To pass a subject it will always be necessary to obtain, both in the objective test and in the simulation in the laboratory practices, a grade of no less than 4.0 out of 10, and to achieve a minimum global grade of 5.0 out of 10 (the contribution of each available activity is to indicated in this teaching guide.According to the professors, the students who do not pass in the first opportunity -as indicated in the previous section- can keep, for a second opportunity, the qualifications obtained in other avaliable activities with a qualification equal to or greater than 4.0 out of 10. Or the same as before o Approved implies receiving a minimum overall grade of 5.0 out of 10 (the contribution of each available activity is indicated in this teaching guide).In both opportunities of not completing a minimum grade of 4 out of 10, choose the activities for which it has previously been established, however, at a weighted average equal to or greater than 5 out of 10, the subject will appear failed with a qualification of 4.5 out of 10 In this case, the student will have three days to redo these activities, preventing, whenever possible, that a delivery does not coincide with the exam period of the corresponding opportunity.Any student who carries out evaluable activities will be considered as presented as long as they represent more than 40% of the overall grade. As far as successive academic years are concerned, the teaching-learning process, including evaluation, refers to one academic year, and, therefore, all activities must be carried out again with the new academic year. The evaluation criteria contemplated in tables A-II/1, La-II/2, La-III/1 and La-III/2 of the STCW Code, and its amendments, related to this matter, will be applied. During the completion of the objective test, on either occasion, except as otherwise indicated, the use of any device with Internet access is prohibited. Despite the fact that it is not advisable to bring said devices to said activity, a space may be set up for their storage, without implying any type of responsibility on the part of the UDC, the School or the teachers present during the objective test. If during the completion of the objective test, there is evidence of the use of these devices, the student will automatically be expelled from the classroom, the objective test qualified with a failing and the address of the center will be informed in writing according to the corresponding regulations. For what students achieve with recognition of part-time dedication and academic exemption from attendance, the above criteria apply.As far as successive academic years are concerned, the teaching-learning process, including evaluation, refers to one academic year, and, therefore, all activities must be carried out again with the new academic year.A fraudulent performance of the tests or evaluation activities will directly imply the qualification of suspense '0' in the matter in the corresponding call, thus invalidating any qualification obtained in all the evaluation activities for the extraordinary call. Article 11, section 4 b), of the UDC Student Disciplinary Regulation: Qualification of fail in the call in which the offense is committed and respect for the matter in which it was committed: the student will be graded with "fail" (numerical grade 0) in the corresponding call of the academic year, both if the offense is committed on the first opportunity and on the second. For this, their qualification will be modified in the first opportunity certificate, if necessary. ---------- ---------- ---------- The evaluation system complies with the competence evaluation criteria included in Column 4 of the following tables of the STCW Convention, modified by Manila 2010: · Table A-V/1-1-1. Specification of the minimum standards of competence in basic training for cargo operations in oil and chemical tankers. · Table A-V/1-1-2. Specification of the minimum standards of competence in advanced training for oil tanker cargo operations. · Table A-V/1-1-3. Specification of the minimum competency standards in advanced training for chemical cargo operations · Table A-V/1-2-1. Specification of the minimum standards of competence in basic training for cargo operations in tankers for the transport of liquefied gas. · Table A-V/1-2-2. Specification of the minimum standards of competence in advanced training for cargo operations in tankers for the transport of liquefied gas.

Sources of information

Basic	- Chang, R. (2017). Química (12ª Ed.). McGraw Hill - Petrucci, R. H. (2017). QUIMICA GENERAL (11ª ED.): PRINCIPIOS Y APLICACIONES MODERNAS. Pearson - López Cancio, J.A. (2000). Problemas de química. Prentice Hall - Peris Tortejada, M. (1992). Cuestiones de química general. Universidad Politécnica de Valencia - Frid Chris (2017). Marine Pollution . Oxford university press - Shackelford, James F. (2015). Introduction to materials science for engineers . Pearson - Silos Rodríguez, José María (2008). Manual de lucha contra la contaminación por hidrocarburos . Cádiz : Servicio de Publicaciones de la Universidad de Cádiz - (2013). Chemical tankers : a pocket safety guide.. Edinburgh : Witherby Publishing Limited - Garcés, Andrés (2009). Prácticas de química general y del medio ambiente . Universidad Rey Juan Carlos, ed. - N. González D., C. Orozco B., A. Pérez S. (2011). Problemas Resueltos de Química Aplicada. Paraninfo S.A. - J. Vale P., C. Fernández P., M. A.R. Piñero, M. Alcalde M., R. Villegas S., L. Vilches A., B. Navarr (2004). Problemas Resueltos de Química para Ingeniería. THOMSON - M. D. Reboiras (2010). Cuestiones de opción múltiple de química general. Abecedario - M.D. Reboiras (2007). Problemas resueltos de química. La ciencia básica. Thomson - Bretherick, L (2007). Bretherick's handbook of reactive chemical hazards . elsevier - Carrau Mellado, Reyes (2011). Manual de prácticas de química aplicada al buque. . Santa Cruz de Tenerife : ARTE Comunicación Visual, 2011 - Segovia Martínez, Miguel J. (2016). Química fundamental y aplicada a la ingeniería : problemas resueltos y cuestiones de teoría. - (). .
Complementary	

Recommendations
Subjects that it is recommended to have taken before
Mathematics I/631G01101
Subjects that are recommended to be taken simultaneously
Mathematics II/631G01106
Subjects that continue the syllabus
/ Electricity and Electronics/631G01206 / Maritime Safety /631G01211 Marine and atmospheric pollution/631G01304 Tankers/631G01308 International Codes and Conventions/631G01313 / /
Other comments
Recoméndase o/a estudiante repasa-los conceptos teóricos introducidos nas clases de teoría mediante a resolución de cuestións e exercicios propostos que figuran o final de cada tema nos libros recomendados.Desaconséllase estudiar ÚNICAMENTE polos apuntes de clase que NUNCA deben substituir á consulta de cualquera dos libros recomendados.Pode resultar moi ÚTIL empregar as horas de titoría para clarexar as dúbidas e profundizar nos coñecementos asociados á asignatura.