Universidad Carlos III de Madrid
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COURSE: CHEMISTRY		
DEGREE: BACHELOR DEGREE IN AEROSPACE ENGINEERING	YEAR: 1st	TERM: 2nd

La asignatura tiene 29 sesiones que se distribuyen a lo largo de 14 semanas. Los laboratorios pueden situarse en cualquiera de ellas. Semanalmente el alumnos tendrá dos sesiones, excepto en un caso que serán tres.

WEEKLY PLANNING

WEEK	SESSION	GENERAL DESCRIPTION	GROUP (mark X)		Session in a different room	Session with 2 professors	WEEKLY PROGRAMMING FOR STUDENT		
			MASTER CLASS/ LECTURES	GROUP SEMINARS			DESCRIPTION	CLASS HOURS	HOMEWORK HOURS (Max. 7h per week)
1	1	Introduction to the Course: General Course Structure, Regulations and Grading. **TOPIC 0. Introduction to Chemistry**	X		NO		Basics of the atomic structure. Atomic number, mass number and isotopes. Introduction to the periodic table. Atoms, molecules and ions. The international system of units. Chemical Equations. Stoichiometry.	1.66	5
1	2	**TOPIC 0. Exercises on Topic 0**		X	NO		Chemical Equations. Stoichiometry.	1.66	
2	3	**TOPIC 1. The Atomic Structure. Periodic Properties**	X		NO		Basics of the Quantum theory. The periodic table. Periodic properties of the elements. (Atomic Radius, Ionic Radius, Ionization Energy, Electron Affinity, Electronegativity)	1.66	7
2	4	**TOPIC 1. Worked examples and Exercises in class**		X	NO		Practice on exercises in Electronic Structure and Periodic Properties of the elements.	1.66	

3	5	**TOPIC 2. Chemical Bonding**	X		NO		Basic Concepts. The Ionic Bond. The Covalent Bond. Valence-Shell Electron-Pair Repulsion Models. Valence Bond Theory. Hybridization of Atomic Orbitals. Molecular orbital theory. The Metallic Bond. Intermolecular Forces.	1.66	7
3	6	**TOPIC 2. Worked examples and Exercises in class**		X	NO		Exercises on Chemical Bonding. Molecular shape and electronic geometry. Molecule Polarity. Use of the different bond theories.	1.66	
4	7	**TOPIC 3. States of Matter (I): Gases and Liquids (I).**	X		NO		General properties of the different states of matter. Gases Laws. Ideal Gas Equation. Real Gases. General properties of liquids. Solubility. Vapor Pressure. Clausius Equation.	1.66	5
4	8	**TOPIC 3. Worked examples and Exercises in class**		X	NO		Use of Gases Laws. Vapor Pressure and Clausius Equation.	1.66	
5	9	**TOPIC 3. States of Matter (II): Liquids (II), Solids. Colligative Properties of Solutions.**	X		NO		Phase diagrams (One or Two components). Colligative Properties of Solutions.	1.66	5
5	10	**TOPIC 3. Worked examples and Exercises in class**		X	NO		Exercises on Binary Phase diagrams and Colligative Properties of Solutions.	1.66	
6	11	**TOPIC 4. Thermochemistry (I)**	X		NO		Some terminology. State functions. Pressure-Volume Work. The First Law of Thermodynamics. Enthalpy and chemical reactions. Hess's Law. Heat Capacity. The Second Law of Thermodynamics: Entropy and order Spontaneous changes, reversibility and chemical equilibrium. Entropy and the Third law of thermodynamics. Spontaneous change: Free energy.	1.66	7
6	12	**TOPIC 4. Worked examples and Exercises in class**		X	NO		Exercises on the main thermodynamic functions and their use in Chemical reactions. **TEST 1**	1.66	
7	13	**TOPIC 4. Thermochemistry (II)**	X		NO		Thermochemical cycles and their use in Chemical Reactions.	1.66	5
7	14	**TOPIC 4. Worked examples and Exercises in class**		X	NO		Exercises on Thermochemical cycles and their use in Chemical Reactions such as combustion reactions.	1.66	
8	15	**TOPIC 5. Chemical Equilibrium**	X		NO		Introduction and concept of Chemical Equilibrium. Reversible reactions. Equilibrium Constants. Homogeneous and Heterogeneous Equilibria. Free Energy and Chemical Equilibrium. Factors that affect Chemical Equilibrium. Le Châtelier's Principle. Variation of K with temperature: The Clausius-Clapeyron Equation	1.66	5
8	16	**TOPIC 5. Worked examples and Exercises in class**		X	NO		Problems and exercises on equilibrium constants, concentrations of reactants and products in systems at equilibrium. Factors affecting chemical equilibrium.	1.66	
9	17	**TOPIC 6. Acid-Base and Solubility Equilibrium**	X		NO		Basic Concepts. Acid-base theories. The Acid-Base Properties of Water. The Self-Ionization of Water. pH Scale. The ionization	1.66	7

							constant. Strength of Acids and Bases. Relationship between the ionization constants of acids and their conjugate bases. Polyprotic Acids Acid-Base Properties of Salts. Hydrolisys. The Common-Ion Effect in Acid-Base Equilibria. Buffer solutions. Solubility. Solubility Equilibria. The Common Ion Effect.		
9	18	**TOPIC 6. Worked examples and Exercises in class**		X	NO		Exercises on Chemical equilibrium in Acid-Base solutions. Salt Hydrolisys. Solubility Equilibrium.	1.66	
10	19	**TOPIC 7. Electrochemistry**	X		NO		Concept of Oxidation and Reduction. Cell Types. Redox Reactions Potentials. Spontaneity of Redox Reactions. The effect of Concentration on the Potential. Faraday's law. Examples of Galvanic and Electrolytic Processes. Redox processes in aqueous solutions. Corrosion Cells. Cathodic Protection and Passivation	1.66	7
10	20	**TOPIC 7. Worked examples and Exercises in class**		X	NO			1.66	
11	21	**TOPIC 8. Chemical Kinetics**	X		NO		Rate of reaction. Rate laws and reaction order. Arrhenius' Law. Reaction mechanisms. Heterogeneous reactions. Homogeneous and heterogeneous catalysis. Chemical reactors. Heterogeneous reactors.	1.66	5
11	22	**TOPIC 8. Worked examples and Exercises in class**		X	NO		Worked examples and Exercises on TOPIC 8. **TEST 2**	1.66	
12	23	**TOPIC 9. Organic Chemistry (I)**	X		NO		Introduction to Organic Chemistry. Nomenclature. Hydrocarbons. Aliphatic Hydrocarbons. Aromatic Hydrocarbons. Physical Properties of Organic Compounds. Isomerism. Organic Reactions.	1.66	6
12	24	**TOPIC 9. Exercises on Organic Chemistry**		X	NO		Worked examples and exercises on general properties of Organic Compounds and reactions.	1.66	5
13	25	**TOPIC 9. Organic Chemistry (II). Fossil Fuels**	X		NO		Fossil Fuels. Crude oil, Natural Gas and Coal. Energetic Exploitation of Fossil Fuels. Industrial Exploitation of Fossil Fuels. Petrochemical Industry and Carbochemistry Alternative Fuels.	1.66	6
13	26	**TOPIC 9. Exercises on Fossil Fuels**		X	NO		Combustion reactions of the main fossil fuels. Recall on thermochemistry concepts.	1.66	
14	27	**TOPIC 10. Introduction to Chemical Engineering**	X		NO		Basic Principles and Concepts in Chemical Engineering. Classification of basic operations. Macroscopic balances Mass Balances. Basic operations. Mass transfer operations. Heat transfer operations. Heat and mass transfer operations. Momentum transfer operations	1.66	7

14	28	**TOPIC 10. Exercises on Chemical Engineering**		X	NO		Exercises on Mass balance in Chemical Operations	1.66	7
	29						**TEST 3**	1.66	
							Subtotal 1	**48.14**	**96**
							Total 1 *(Hours of class and student homework in weeks 1-14)*	**144.14**	
4		LABORATORY SESSION 1. Separation of a mixture			X (Lab. 1.0E02)	X		1.66	4
6		LABORATORY SESSION 2. Acid-Base Titration			X (Lab. 1.0E02)	X		1.66	4
8		LABORATORY SESSION 3. Measurement of Electrochemical Potentials			X (Lab. 1.0E02)	X		1.66	4
10		LABORATORY SESSION 4. Chemical Kinetics			X (Lab. 1.0E02)	X		1.66	4
							Subtotal 2	**6.6**	**16**
							Total 2 *(Hours of class and student homework for laboratory sessions in weeks 1-14)*	**22.6**	
15		Tutorials, handing in, etc…						7	
16		Assessment and final exam				X		3	
17									
18									
							Subtotal 3	**3**	
							Total 3 *(Hours of class and estimated student workload in weeks 15-18)*	**3**	
TOTAL *(Total 1 + Total 2. + Total 3. Maximum 180 hours)*								**169.4**	