

Academic Year: (2022 / 2023)

Review date: 20-06-2022

Department assigned to the subject: Materials Science and Engineering and Chemical Engineering Department

Coordinating teacher: TORRES CARRASCO, MANUEL

Type: Basic Core ECTS Credits : 6.0

Year : 1 Semester : 1

Branch of knowledge: Engineering and Architecture

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

It is recommended to have studied chemistry in previous courses or take the "Course 0 (<https://www.uc3m.es/grado/informacion-practica/cursos-cero>)" given by UC3M to reinforce the subject:

DESCRIPTION OF CONTENTS: PROGRAMME

1. Atomic structure of matter: Hydrogen Atom. Quantum numbers, electronic configurations. Periodic Table and Periodic Properties.
2. Molecular structure: Bonding, H₂ Molecule, Bond Valence Theory. Molecular Orbital (MO) Theory: diatomic and polyatomic molecules. Hybridization.
3. Inorganic chemistry. Hydrogen; halogen and noble gases group; nitrogen and oxygen group; carbon, metals and transition metals groups.
4. Gases and liquids. Kinetic theory of gases, Ideal gases and real gases, Liquids, Conductivity of electrolyte solutions, Mobility and interactions between ions. Solutions: Thermodynamic description of solutions. Properties of solutions. Colligative properties.
5. Solids: Chemical bond in solids. Types of solids: ionic, metallic and macromolecular. Cohesion Energies. Crystal structure
6. Introduction to phase transitions. Phase diagrams of a single component. Phase diagrams of two components.
7. Thermochemistry: Energy changes in chemical reaction, Enthalpy of State Change and enthalpy of reaction. Heat Capacity. Entropy and free energy of reaction. Spontaneity. Calculation of thermodynamic magnitudes in chemical reactions.
8. Chemical Equilibrium: Nature. Equilibrium Constants. Factors that affect chemical equilibrium (pressure, temperature, concentration, partial pressure)
9. Chemical equilibrium in aqueous solutions: Acids and bases. Acidity and basicity constants. pH: Scale and calculation. Salts and hydrolysis. Acids and polyprotic bases. Buffer solutions. Titrations
10. Solubility Equilibrium: Solubility Product Constant. Common ion effect. Selective precipitation
11. Chemical kinetics: reaction rate, methods for determining the kinetic equation, reaction mechanism, activation energy, unimolecular reactions, kinetics of complex reactions: chain reactions, polymerization

LEARNING ACTIVITIES AND METHODOLOGY

AF1. THEORETICAL-PRACTICAL CLASSES. Knowledge and concepts students must acquire. Receive course notes and will have basic reference texts. Students partake in exercises to resolve practical problems.

AF2. TUTORING SESSIONS. Individualized attendance (individual tutoring) or in-group (group tutoring) for students with a teacher. Subjects with 6 credits have 4 hours of tutoring/ 100% on-site attendance.

AF3. STUDENT INDIVIDUAL WORK OR GROUP WORK. Subjects with 6 credits have 98 hours/0% on-site.

AF8. WORKSHOPS AND LABORATORY SESSIONS. Subjects with 6 credits have 8 hours/100% on-site instruction.

AF9. FINAL EXAM. Global assessment of knowledge, skills and capacities acquired throughout the course. It entails 4 hours/100% on-site.

MD1. THEORY CLASS. Classroom presentations by the teacher with IT and audiovisual support in which the subject's main concepts are developed, while providing material and bibliography to complement student learning.

MD2. PRACTICAL CLASS. Resolution of practical cases and problem, posed by the teacher, and carried out individually or in a group.

MD3. TUTORING SESSIONS. Individualized attendance (individual tutoring sessions) or in-group (group tutoring sessions) for students with teacher as tutor. Subjects with 6 credits have 4 hours of

tutoring/100% on-site.

MD6. LABORATORY PRACTICAL SESSIONS. Applied/experimental learning/teaching in workshops and laboratories under the tutor's supervision.

ASSESSMENT SYSTEM

The evaluation will be composed of a final written exam (worths 50% of the final mark) and a continuous evaluation (50%). It is mandatory to achieve a minimum mark of 4/10 in the final written exam. Besides, laboratory practices are mandatory for being assessed.

The continuous evaluation will have two parts:

- (i) Test and Work: Individual tests, and collaborative work, during the course. Worth 40% of the mark.
- (ii) Laboratory: Four laboratory practices, solving a questionnaire or test at the beginning of the lab session regarding to the laboratory instructions (to assess the prior preparation from the student). In addition, a final report an/or a final test, regarding lab practices, will be evaluated. Laboratory mark worths 10%.

% end-of-term-examination:	50
% of continuous assessment (assignments, laboratory, practicals...):	50

BASIC BIBLIOGRAPHY

- Catherine E. Housecroft, Alan G. Sharpe Química Inorgánica, Pearson Prentice Hall, 2006
- Ira N. Levine Fisicoquímica Vol. 1, McGraw-Hill, 2013
- Jaume Casabó i Gispert Estructural atómica y enlace químico, Reverté, 2013
- LOTHAR BEYER, V. FERNÁNDEZ Química Inorgánica, Ariel Ciencia, 2000
- O. MO ROMERO Enlace Química y estructura molecular, Calamo Producciones, 2002
- O. MO ROMERO Enlace Químico y estructura molecular, Calamo Producciones, 2002
- P.W. ATKINS, L. JONES Chemical Principles, W.H. Freeman & Co, 2001
- R. CHANG Chemistry, McGraw-Hill Science, 2006
- Ralph H. Petrucci, et al. Química general : principios y aplicaciones modernas, Pearson Educación, 2011

BASIC ELECTRONIC RESOURCES

- . Dynamic Periodic Table: <http://ptable.com/>