Chemistry I

Academic Year: (2019 / 2020) **Review date: 14/05/2019 16:00:50**

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

OBJECTIVES

CB1. Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
CB2. Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues
CB4. Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences
CB5. Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
CG2. Learn new methods and technologies from basic scientific and technical knowledge, and being able to adapt to new situations.
CG3. Solve problems with initiative, decision making, creativity, and communicate and transmit knowledge, skills and abilities, understanding the ethical, social and professional responsibility of the engineering activity. Capacity for leadership, innovation and entrepreneurial spirit.
CG4. Solve mathematical, physical, chemical, biological and technological problems that may arise within the framework of the applications of quantum technologies, nanotechnology, biology, micro- and nano-electronics and photonics in various fields of engineering.
CG5. Use the theoretical and practical knowledge acquired in the definition, approach and resolution of problems in the framework of the exercise of their profession.
CE1. Solve mathematical problems that may arise in engineering and apply knowledge of linear algebra, differential and integral calculus, numerical methods, numerical algorithms, statistics, differential equations and in partial derivatives, complex and transformed variables.
CE22. Design, plan and estimate the costs of an engineering project.
CT1. Work in multidisciplinary and international teams as well as organize and plan work making the right decisions based on available information, gathering and interpreting relevant data to make judgments and critical thinking within the area of study.
RA1. To have acquired sufficient knowledge and proved a sufficiently deep comprehension of the basic principles, both theoretical and practical, and methodology of the more important fields in science and technology as to be able to work successfully in them;
RA2. To be able, using arguments, strategies and procedures developed by themselves, to apply their knowledge and abilities to the successful solution of complex technological problems that require creating and innovative thinking;
RA3. To be able to search for, collect and interpret relevant information and data to back up their conclusions including, whenever needed, the consideration of any social, scientific and ethical aspects relevant in their field of study;
RA6. To be aware of their own shortcomings and formative needs in their field of specialty, and to be

able to plan and organize their own training with a high degree of independence.

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 hydrolisis. 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 mustacquire. 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

% end-of-term-examination/test:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

The evaluation will be composed of a final written exam (worths 60% of the final mark) and a continuous evaluation (40%). 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 30% of the mark.

% end-of-term-examination/test:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

(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%.

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

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- 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/