SUBJECT GUIDE **Academic year 2016-2017**

Basic Chemical Principles

Updated in the last meeting of Department 24/06/2016

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Chemistry	Basic Chemical Principles	1º	1º	6	Basic

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DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT

Degree in Pharmacy

PREREQUISITES and/or RECOMMENDATIONS (if necessary)

To take this course you need to have adequate knowledge:

- Basic math operations.
- Have previously studied the formation science option

BRIEF ACCOUNT OF THE SUBJECT PROGRAMME (ACCORDING TO THE DEGREE)

- Atomic structure
- Electronic configurations
- The periodic system
- Covalent bond, ionic bond, metallic bond, intermolecular forces.
- Reactions in aqueous solution: acid-base, oxidation-reduction and precipitations equilibria.

GENERAL AND PARTICULAR ABILITIES

A. General skills

- Identify, design, collect, analyze, control and produce drugs and medicines, and other products and raw materials of medical interest for human or veterinary use.
- Learn to apply the scientific method and acquire skills in handling legislation, sources of information, literature, protocol development and other aspects that are necessary considered for the design and critical assessment of preclinical and clinical trials.
- Design, implement and evaluate reagents, clinical analytical methods and techniques, knowing the basics of clinical analyzes, and the characteristics and contents of the reports of laboratory diagnosis.
- Develop health and hygiene analysis, especially those related to food and the environment.
- Develop information and communication skills, both oral and written, to deal with patients and users of

the center where you are working. Promote and collaboration capabilities in multidisciplinary teams and those related to other health professionals.

B. Specific skills

- Identify, design, collect, analyze and produce active ingredients, drugs and another products and materials of sanitary interest.
- Select appropriate techniques and procedures in the design, implementation and evaluation of reagents, methods and analytical techniques.
- Perform standard laboratory procedures including the use of scientific equipment for synthesis and analysis, including appropriate instrumentation.
- Estimating the risks associated with the use of chemical and laboratory procedures.
- To know the physical and chemical characteristics of the substances used for the manufacture of medicines.
- To know and understand the characteristics of reactions in solution, the different states of matter and the principles of thermodynamics and its application to pharmaceutical sciences.
- Understanding the properties of the elements and their compounds, and their application in the pharmaceutical field.

OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)

- Knowing the atomic structure and radioactive processes bound to the nucleus.
- Knowing the electronic structure, the Periodic Table and the relationship between the electronic configurations of the elements and their properties.
- Understand the role of different chemical elements in biological systems in relation to their electronic configuration.
- Know the different binding models, relate the chemical properties of the compounds with the type of bond that is established between the ions, atoms or molecules. Relate the physical properties of pharmaceutical preparations establishing interactions between its components.
- Processes known acid-base and redox taking place in solution, perform calculations for proper development of the acid-base balance and for the use of antioxidants in the pharmaceutical preparations.

DETAILED SUBJECT SYLLABUS

Unit 1. - Chemical Reactions I: Acid-Base Reactions.
Acid-base concept: Arrhenius and Bronsted Lowry and Lewis models. Relative strengths of acids and bases in aqueous solution dissociation constants. PH buffer solutions. Buffers and biological systems. Significance of acid-base reactions and buffers solutions in pharmaceutical preparations.

Unit 2.- Chemical Reactions II: Oxidation Reduction Reactions.
Definition and general principles. Concept of half-reaction potential and normal potential. Influence of temperature and concentration on potential: Nernst equation. Antioxidants concept and mechanism of action. Concentration cells. Some redox reactions of biological interest.

Unit 3.- Chemical reactions III: precipitation reactions.
Solubility definition. Relationship between solubility and solubility product constant. Factors affecting solubility. Solubility in relation to the solvent. Some precipitation reactions of biological interest.

Unit 4.-The Atom.
Introduction: Evolution and current concept of atom: the standard model. The atomic nucleus: constituents, structure, stability and nuclear reactions. Nuclear properties of biomedical interest. Extranuclear Structure: Introduction. Atomic Models based on classical mechanics: Atomic Model Bohr-Sommerfeld. Atomic model according to Wave Mechanics. Electronic configuration of multielectron atoms.

Unit 5.-Periodic Table of the Chemical Elements.
The Periodic Table: Description and types of items. Non-periodic and periodic properties of the chemical elements. Relationship between the chemical properties of the elements and their participation in the functioning of biological systems.

Unit 6.- Chemical Bond I: Model electrostatic. Ionic bond.
Chemical bonding: Definition and models. Electrostatic model. Application of electrostatic model systems to study anion-cation (ionic lattices): stoichiometry of ionic networks, networks and energy ionic lattice types. Characteristic properties of ionic compounds. Lattice defects. Ion polarization and partial covalent nature of the ionic bond.

Unit 7.- Chemical Bond II: Electron sharing model. The covalent bond.
Introduction. Valence bond theory (EVT): Application of VTE the study of the molecular species. Theory of electron pair repulsion of the valence shell. Molecular orbital theory (TOM): Application of the TOM the study of simple molecular species.

Unit 8.- Chemical Bond III: Bonding in coordination compounds.
Introduction to the nature of coordination compounds: nomenclature, geometry and isomerism. Model Application to Covalent bond: Stereochemistry and binding energy. Model Application to Electrostatic bond: crystal field theory (CBT), energy splitting and crystal field stabilization. Stability. Factors affecting the stability of the complexes: chelate effect and effect macrochelate. Stability assessment. Stability constants. Coordination compounds in aqueous solution.

Unit 9.- Chemical Bond IV: Bonding in Metals and Intermolecular Forces.
Introduction. Metal Networks. General properties of metals. Covalent Model Application: Stereochemistry and energy bands. Conductors, semiconductors and insulators. Model electrostatic application to the study of crosslinks: links by Van der Waals forces. Hydrogen bonds; π- π interactions between aromatic rings. General properties of substances that have their origin in intermolecular bonds. Hydrogen bonds and biological systems.

Practical syllabus.

Practice 1. - Introduction to working in the lab.

Practice 2. - Preparation of solutions.

Practice 3.- Solutions titrations: acid-base titration, oxidation-reduction titration.

Practice 4. - Preparation of buffers solutions.

Practice 5. - Precipitation Reactions

READING

1.- Ralph H. Petrucci, F. Geoffrey Herring, Jeffry D. Madura y Carey Bissonnette. General Chemistry: principles and modern applications. Pearson Ed., S.A., Madrid, 2011.
2.- E. Colacio Rodriguez. Fundamentos de enlace y estructura de la materia. Base Universitaria. Editorial Anaya, 2004 (Madrid).
3.- Jonnes Atkins. Chemistry Principles. The paths of discovery. Panamericana.
4.- Raymond Chang. Chemistry. Ed., 9. McGraw Hill, 2007.
5.- Stanitski Moore, Wood and Kotz. The World of Chemistry. Pearson
6.- Química. Un proyecto de la ACS. Reverté, 2005.
7.- Antonio Navarrete y A. García. La Resolución de problemas de Química. Base Universitaria. Ed. Anaya, 2004.
8.- Cristóbal Valenzuela. Química General e Inorgánica para estudiantes de Farmacia. Universidad de Granada, 2002.
9.- W.R. Petterson. Fundamentals of chemical nomenclature. Editorial Reverté, , Año 2012

RECOMMENDED INTERNET LINKS

- Peridic system: http://www.mcgraw-hill.es/bcv/tabla_periodica/element/elemento1.html
- Orbital Viewer: Free software for visualizing atomic and molecular orbitals: http://www.orbitals.com/orb/ov.html
- Inorganic Department web site: http://farmacia.ugr.es/cont.php?sec=5&pag=1#26
- http://prado.ugr.es/moodle/