SUBJECT GUIDE

CHEMICAL PRINCIPLES

Academic year 2018-2019

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Fundamentals	Chemistry	1	1	6 ECTS	Fundamentals

LECTURER(S)	Postal address, telephone nº, e-mail address
• **Emilio García Fernández (EGF)**	**EGF: Dpt. Fisicoquímica**, 2nd floor, Faculty of Pharmacy. Room 202. e-mail: emiliogf@ugr.es
DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT	**TUTORSHIPS**
Food Science and Technology	**EGF:** Tuesday, Wednesday and Thursday 12:00-14:00h.

PREREQUISITES and/or RECOMMENDATIONS (if necessary)

- Suitable knowledge of Chemistry, high-school level.
- Basic knowledge on mathematical operations (logarithmic and exponential functions, use of calculator, etc.).
- It is strongly recommended to sing up to the "Introduction course" (Curso 0) arranged by the Faculty of Pharmacy.

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

- **Chemical bonds**
- **Solutions**
- **Thermodynamics and thermochemistry**
- **Chemical and phase equilibrium**
- **Acid-base equilibria and proton transfer reactions**
- **Solubility equilibria**
- **Electron transfer reactions. Redox equilibria.**

GENERAL AND PARTICULAR ABILITIES

Specific, general and transversals competencies of the Degree (According to government regulation)

CE.1: Recognize and apply physical, chemical, biological, physiological, mathematical and statistical concepts to understand and develop food science and technology.

CG.1: Be able to express oneself in Spanish in the scientific discipline

CG.2: Be able to solve problems.
CG.3: Be able to work in a team.
CG.4: Be able to apply theoretical knowledge to practical cases.
CG.8: Critical analysis.
CG.10: Be able to organize and plan.
CG.11: Be able to process the information
CG 13: Be sensitive to environmental problems.

CT2: Capacity to use fluency the ICTs.

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

DETAILED SUBJECT SYLLABUS

LECTURES:

- UNIT 1. **Chemical Bonds.** Basic principles. Periodic table. Periodic properties. Ionic networks. Covalent bond. Lewis' structures. Resonance. Hybrid orbitals. Molecular orbital theory. Metallic bond. Intermolecular forces and biological role.
- UNIT 2. **Solutions.** Classification. Concentration. Intermolecular forces and solubility. Colligative properties and applications.
- UNIT 3. **Introduction to Thermodynamics.** Thermodynamic systems. State functions. Thermodynamic equilibrium. Ideal gases. Deviations from ideal behaviour. Heat and work. First law of Thermodynamics. Internal energy. Enthalpy. Heat capacity. Spontaneous processes. Second law of Thermodynamics. Entropy. Entropy changes in reversible and irreversible processes. Entropy and equilibrium. Equilibrium and spontaneity conditions at constant temperature: Gibbs and Helmholtz functions. General condition of material equilibrium in closed systems.
- UNIT 4. **Thermochemistry.** Standard values of the thermodynamic properties. Standard enthalpy of reaction and formation. Determination of reaction enthalpy. Calorimeters. Influence of the temperature on the reaction enthalpy. Food and energy resources. Free energy of reaction and formation.
- UNIT 5. **Phase equilibrium.** Phase equilibrium, one component system. Water phase diagram. Two component systems. Liquid-liquid phase diagrams. Vapour pressure of a binary mixture. Fractional distillation. Deviations from Raoult's law and azeotropes. Solid-liquid phase diagrams. Eutectic point. Applications to food industry. Lyophilisation.
- UNIT 6. **Chemical equilibrium.** Equilibrium conditions. Law of mass action. Thermodynamic origin of the equilibrium constant. Le Chatelier's principle. Effect of pressure, concentration, and temperature on the equilibrium.
- UNIT 7. **Proton transfer reactions. Acid-base equilibria.** Strength of acids and bases. Dissociation constants. Water autoprotolysis. pH scale. pH determination in simple systems. Acid-base titrations. Buffers. Biological role of the acid-base equilibria.
- UNIT 8. **Solubility equilibria**. Solubility product. Common ion effect. Precipitation prediction. Precipitate dissolution.
- UNIT 9. **Electron transfer reactions. Redox equilibria**. Oxidation and reduction. Balancing redox reactions. Standard reduction potentials and equilibrium constant. Spontaneity and reaction direction. Applications and redox systems of biological importance. Antioxidants.

LABORATORY SESSIONS AND SEMINARS:

Seminars

- Problems solving

Laboratory sessions

- **Session 1.** ***Introduction to laboratory.***
- **Session 2.** ***Acidity measurements of olive oil, milk, and vinegar.***
- **Session 3.** ***Determination of combustion heat of food, using a calorimetric bomb.***
- **Session 4.** ***Determination of molecular mass by freezing point depression.***

READING

BASIC READINGS:

- **Chemical Principles.3ª-5ª Eds.** P. Atkins, L. Jones.
- **General chemistry. 10ª Ed.** R.H Petrucci, F. G. Herring, J. D. Madura, C. Bissonnette.
- **Química. 11ª Ed.** R. Chang, K. A. Goldsby. Ed. McGraw Hill Education
- **Physical Chemistry. 8ª Ed.** P. Atkins, J. de Paula.
- **Química de los alimentos.** E. Primo Yúfera.

COMPLEMENTARY READINGS:

- **Resolución de Problemas de Química.** A. Sánchez Coronilla.
- **Resolución de Problemas de Química General.** C. J. Willis.