COURSE GUIDE FOR

CHEMICAL PRINCIPLES

Academic year 2020-21

(Date last update: 08/07/2020)

(Date approved in Department Council: 30/06/2020)

MODULE	SUBJECT MATTER	YEAR	SEMESTER	CREDITS	TYPE
Basics	Chemistry	1	1	6 ECTS	Core

TEACHING STAFF[1]	CONTACT INFORMATION (address, telephone number, email, etc.)
Emilio García Fernández (EGF)	**EGF: Dpt. Fisicoquímica**, 2nd floor, Faculty of Pharmacy. Room 202. e-mail: emiliogf@ugr.es
	TIMETABLE FOR TUTORIALS OR LINK TO WEBSITE
	EGF: Monday, Tuesdays and Wednesday, 12:00h-14:00h. http://fisicoquimica.ugr.es/pages/docencia/curso_2021/_doc/horariotutorias2021
BELONGS TO UNDERGRADUATE DEGREE PROGRAMME	AND ALSO TO OTHER UNDERGRADUATE DEGREE PROGRAMMES
Degree in Food Science and Technology	

PREREQUISITES OR RECOMMENDATIONS (where applicable)

- 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 DESCRIPTION OF CONTENT (ACCORDING TO OFFICIAL VALIDATION REPORT)

- **Chemical bonds**
- **Solutions**
- **Thermodynamics and thermochemistry**
- **Chemical and phase equilibrium**

[1] Consult any updates in Acceso Identificado > Aplicaciones > Ordenación Docente

(∞) This course guide should be filled in according to UGR regulations on assessment of student learning: (http://secretariageneral.ugr.es/pages/normativa/fichasugr/ncg7121/!)

- **Acid-base equilibria and proton transfer reactions**
- **Solubility equilibria**
- **Electron transfer reactions. Redox equilibria**.

GENERAL AND SPECIFIC COMPETENCES

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 AS EXPECTED LEARNING OUTCOMES)

At the end of this subject, the student is expected to be able to:

• Generalize the chemical bases necessary to undertake subsequent studies with a high degree of autonomy.
• Differentiate between the different types of chemical bond and their specific characteristics, insisting on the importance of intermolecular forces in the physical-chemical properties of matter and biological systems.
• Know how to calculate and express in its different forms the concentration of solutions.
• Deduce and enunciate the basic principles of Thermodynamics and Thermochemistry.
• Determine the caloric content of food, and relate it to the basics of Thermochemistry.
• Interpret phase equilibria in systems of one or more components and their application to the food industry.
• Apply laws and factors that affect chemical equilibria.
• Write and adjust a complete chemical reaction, identifying limiting and excess reagents for the calculation of reaction yields.
• Recognize common acids and bases and their strength, understanding the concept of pH and its scale.
• Identify neutralization reactions and establish their analytical use in volumetrics, with the help of reversible indicators.
• Calculate the solubility of partially insoluble compounds, predict the formation of precipitates and establish measures of displacement of the solubility equilibria to dissolve the precipitates.
• Recognize oxidation reactions – reduction, identifying oxidizing and reducing agents.
• Adjust redox reactions, assigning number of oxidation to reagents and semi-reaction products, and using normal potentials to calculate equilibrium constants and direction of spontaneity.
• Operate properly in a chemistry laboratory, emphasizing the appropriate safety and quality measures.

DETAILED SYLLABUS

THEORETICAL SYLLABUS:

- 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***.

BIBLIOGRAPHY

- 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.

RECOMMENDED LINKS

- Full on-line book (Access from UGR network): Química General. 10ª Ed. R.H Petrucci, F. G. Herring, J. D. Madura, C. Bissonnette. Ed. Pearson. http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1262
- Full on-line book (Access from UGR network): Química - Una introducción a la química general orgánica y biológica. Karen C. Timberlake. Ed. Pearson. http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1263
- (In English) Free-access to Chemistry subjects. Universidad de California - Davis: *https://chem.libretexts.org/*
- (on-line) Fisicoquímica. I.N Levine: https://granatensis.ugr.es/permalink/34CBUA_UGR/qmbd75/alma991007296109704990
- (In English) Apps and simulations about chemical and physical issues. PhET. Universidad de Colorado: *https://phet.colorado.edu/en/simulations/category/chemistry*
- Periodic Table (University of Oxford): *http://www.chem.ox.ac.uk/vrchemistry/pt/*
- (IUPAC) : https://iupac.org/
- High-School chemistry lessons: *http://www.quimitube.com/*
- Royal Society of Chemistry – Learn Chemistry : http://www.rsc.org/learn-chemistry
- American Chemical Society: http://www.acs.org/education
- On-line resources at UGR library: https://granatensis.ugr.es/

TEACHING METHODOLOGY

- Lectures for theroy contents
- Practical seminars regarding application problems of each lesson
- Practical lessons in the laboratory
- Quiz and test from online platforms for continuous evaluation

ASSESSMENT (ASSESSMENT INSTRUMENTS, CRITERIA AND PERCENTAGE VALUEOF FINAL OVERALL MARK, ETC.)

All the evaluation processes will be carried out according to the normative of the University of Granada.

1. Ordinary call

- Written exams about theoretical concepts. Percentage of the final mark: 50-55%.
  There will be a mid-course exam and a final exam.
  The qualification considered in this section will be the mark obtained in the final exam. If the subject has been passed by overcoming both mid-course and final exam, the qualification will be the average between them.

- Written exams about mathematic resolution of application problems. Percentage of the final mark: 30-25%.
  There will be a mid-course exam and a final exam.
  The qualification considered in this section will be the mark obtained in the final exam. If the subject

has been passed by overcoming both mid-course and final exam, the qualification will be the average between them.

- Practical lessons. Percentage of the final mark: 10%.
  It is compulsory to attend to all practical lessons. The global mark is divided in two tasks:
  - Laboratory book 30%
  - Exam about practical contents : 70%

- Continuous evaluation and attending to theoretical classes. 10%.

2. Extraordinary call and single final evaluation

- Written exams about theoretical concepts. Percentage of the final mark: 55-60%.
  There will be a mid-course exam and a final exam.
  The qualification considered in this section will be the mark obtained in the final exam. If the subject has been passed by overcoming both mid-course and final exam, the qualification will be the average between them.

- Written exams about mathematic resolution of application problems. Percentage of the final mark: 35-30%.
  There will be a mid-course exam and a final exam.
  The qualification considered in this section will be the mark obtained in the final exam. If the subject has been passed by overcoming both mid-course and final exam, the qualification will be the average between them.
- Practical lessons. Percentage of the final mark: 10%.

DESCRIPTION OF THE EXERCISES WHICH WILL CONSTITUTE SINGLE FINAL ASSESSMENT AS ESTABLISHED IN UGR REGULATIONS

- This description is reported in the assessment section

SCENARIO A (ON-CAMPUS AND REMOTE TEACHING AND LEARNING COMBINED)

TUTORIALS

TIMETABLE (According to Official Academic Organization Plan)	TOOLS FOR TUTORIALS (Indicate which digital tools will be used for tutorials)
https://fisicoquimica.ugr.es/pages/docencia/curso_2021/_doc/horariotutorias2021	There will be both on-site and virtual tutorials. Proposed telematic media are: Forums in virtual platform (PRADO) . e-mail

MEASURES TAKEN TO ADAPT TEACHING METHODOLOGY

- **Theory lessons**: Teaching methodology will be the same proposed in the previous section about "teaching methodology". In this case, the master classes will be broadcasted in real time to those students that can not attend if the number of people in the classes is limited by the health situation.
- **Practical lessons**: Due to the limited capacity of the facilities of the faculty there will be two days of practical lessons in the lab and two days of virtual lessons, concerning to the theoretical aspects of the two on-site tasks.
- **Continuous evaluation** .In these cases methodology will be the same proposed in the previous section

about “teaching methodology” and there will be preferentially developed on-site. In case there will be capacity limitation virtual media will be used (Google Meet, PRADO Kahoot, etc).

MEDIDAS DE ADAPTACIÓN DE LA EVALUACIÓN (Instrumentos, criterios y porcentajes sobre la calificación final)

Ordinary assessment session

- Adaptative measures have only been proposed for the practical lessons. The written exams of this section will be in virtual through the PRADO platform. The percentages are those described in the assesment section

Extraordinary assessment session

- Adaptative measures have only been proposed for the practical lessons. The written examns of this section will be in virtual through the PRADO platform. The percentages are those described in the assesment section.

  For those students that have attended to the practical lessons and have not passed the exam there will be a virutal written exam in the PRADO platform.

  Those students that have not atended to the practical lessons will have to pass a practical exam in the laboratory. The evaluation will be carried out by the teachers in charge of the practical lessons.

Single final assessment

- There is no adaptative measures in this type of assessment

SCENARIO B (ONCAMPUS ACTIVITY SUSPENDED)

TUTORIALS

TIMETABLE (According to Official Academic Organization Plan)	TOOLS FOR TUTORIALS (Indicate which digital tools will be used for tutorials)
https://fisicoquimica.ugr.es/pages/docencia/curso_2021/_doc/horariotutorias2021	There will exclusively virtual tutorials. Proposed telematic media are: Forums in virtual platform (PRADO) -Google meet -email communication

MEASURES TAKEN TO ADAPT TEACHING METHODOLOGY

- Theory:
  - Synchrony classes through Google-Meet
  - Recorded videos of the theoretical lessons.
- Practial lessons:
  - All the practical lessons will be virtual and attending is compulsory by Google-Meet videoconference.
- Seminars:

- The seminars related with the application problems will be taught by Google Meet. Students will provide the solutions by PRADO or email.
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- Continuous assessment:
  - Quiz, test and games through PRADO, SWAD and Kahoot.

MEASURES TAKEN TO ADAPT ASSESSMENT (Instruments, criteria and percentage of final overall mark)

Ordinary assessment session

- Written exams about theoretical concepts. . Percentage of the final mark: 45-50%.
  Individual exams by PRADO platform.

- Written exams about theoretical concepts. . Percentage of the final mark: 25 - 30%.
  Individual exams by PRADO platform

- Practical lessons assessment. Percentage of the final mark: 10%, divided in two tasks:
  Laboratory book 30%
  Exam about practical contents : 70%

- Continuous assessment. Percentage of the final mark: 20-10%.

Extraordinary assessment session

- Written exams about theoretical concepts. . Percentage of the final mark: 55-60%.
  - Individual exams by PRADO platform.
- Written exams about theoretical concepts. . Percentage of the final mark: 30 - 35%.
  Individual exams by PRADO platform

- Practical lessons assessment. Percentage of the final mark: 10%,

Single final assessment

- Written exams about theoretical concepts. . Percentage of the final mark: 55-60%.
  Individual exams by PRADO platform.

- Written exams about theoretical concepts. . Percentage of the final mark: 35 - 30%.
  Individual exams by PRADO platform

- Practical lessons assessment. Percentage of the final mark: 10%,
  For those students that have attended to the practical lessons and have not passed the exam there will be a virutal written exam in the PRADO platform.

  Those students that have not atended to the practical lessons will have to pass a practical exam in the laboratory. The evaluation will be carried out by the teachers in charge of the practical lessons

ADDITIONAL INFORMATION (if necessary)

The move to scenario A to scenario B will be impossed by the health authorities determination due to the evolution of the pandemic caused by COVID-19.