VNIVERSITAT DE VALÈNCIA

Course Guide
34226 History of Chemistry

COURSE DATA

Data Subject	
Code	34226
Name	History of Chemistry
Cycle	Grade
ECTS Credits	4.5
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Faculty of Chemistry	4	Second term

Subject-matter

Degree	Subject-matter	Character
1110 - Degree in Chemistry	18 - History of Chemistry	Optional

Coordination

Name	Department
BERTOMEU SANCHEZ, JOSE RAMON	225 - History of Science and Documentation

SUMMARY

This course provides an overview of the history of science and reviews the general concepts of science, technology and society. It also improves students' skills and techniques and encourages them to develop an appropriate attitude to working in chemistry-related areas in industry, research and education. Students review conclusions from the main studies conducted on the history of chemistry with regard to alchemy, the scientific revolution, the chemical revolution, the science professions, science and gender, atomic theory and the periodic system, environmental history, the social image of chemistry, science and religion, the chemical industry, and the relationship between science, technology and society (STS), with special attention given to chemistry in the 20th century. Students also learn about the connections between science education and the history of science in order to study the pedagogical uses of the history of science and its multiple advantages in science education. The topics are selected and arranged in accordance with a balanced mixture of chronological and thematic sequences based on major problems throughout the history of chemistry. While each chapter follows a chronological sequence, each also presents a particular perspective or selected topic (science and religion, science and gender, technology and society, scientific terminology, scientific revolutions, disciplines and professions, science-teaching practices) that transcends the chronological boundaries of each period.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

None

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1108 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.
- Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Learn autonomously.
- Demonstrate the ability to adapt to new situations.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.
- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.
- Evaluate, interpret and synthesise chemical data and information.
- Relate theory and experimentation.
- Recognise and evaluate chemical processes in daily life.
- Understand the qualitative and quantitative aspects of chemical problems.
- Develop sustainable and environmentally friendly methods.
- Relate chemistry with other disciplines.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.

- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

The previous section includes the competences contained in the document VERIFICA. This subject addresses part of the learning results of the matter HISTORY OF CHEMISTRY that allow to acquire specific knowledge of chemistry, cognitive skills and general skills recommended by the EUROPEAN CHEMISTRY THEMATIC NETWORK (ECTN) for the Chemistry Eurobachelor® Label. The following table lists the learning outcomes acquired in the subject HISTORY OF CHEMISTRY related to the competences of the degree in Chemistry.

COMPETENCES AND COGNITIVE SKILLS	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject History of Chemistry that contemplate the learning outcomes EUROBACHELOR®
Ability to demonstrate knowledge and understanding of the facts, concepts, principles and fundamental theories related to the topics mentioned above.	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry..(CE13).
Ability to apply this knowledge and understanding to the solution of common qualitative and quantitative problems.	Understand the qualitative and quantitative aspects of chemical problems..(CE24).
Competences for the evaluation,	Evaluate, interpret and synthesise chemical data and

interpretation and synthesis of information and chemical data.	information..(CE16).
Competences to present and argue scientific issues orally and in writing to a specialized audience.	Relate chemistry with other disciplines.(CE26). Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate. (CG6). Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences..(CB4).

GENERAL COMPETENCES	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject History of Chemistry that contemplate the learning outcomes EUROBACHELOR®
Ability to apply practical knowledge to solve problems related to qualitative and quantitative information.	Relate theory and experimentation..(CE22). Recognise and evaluate chemical processes in daily life..(CE23). Understand the qualitative and quantitative aspects of chemical problems..(CE24).
Competences in information management, in relation to primary and secondary sources, including information retrieval through on-line searches.	Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate..(CG6).
Ability to adapt to new situations and make decisions.	Demonstrate the ability to adapt to new situations..(CG9). Students must have the ability to gather and interpret relevant data (usually in their field of study) to make

	judgements that take relevant social, scientific or ethical issues into consideration..(CB3).
Competences in oral and written communication, in one of the main European languages, in addition to the language of the country of origin.	Demonstrate ability to work in teams both in interdisciplinary teams and in an international context..(CG5). Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7). Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community. (CT1). Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences..(CB4). Have basic skills in the use of information and communication technology and properly manage the information obtained.(CT2).
Study skills necessary for professional development. These will include the ability to work autonomously.	Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation..(CG3). Demonstrate ability to work in teams both in interdisciplinary teams and in an international context..(CG5). Learn autonomously.(CG8). Demonstrate the ability to adapt to new situations..(CG9). Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.(CB5).
Ethical commitment to the European Code of Conduct: http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf	Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.(CG10). Demonstrate a commitment to ethics, equality values

	and social responsibility as a citizen and as a professional. (CG7). Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration. (CB3).

These competences are organized through the following teaching-learning routes according to the conceptual topoi related to the area:

1. Ability to correctly handle the basic concepts of chemistry by studying the historical development of chemical ideas and practices.

2. Skills related to teaching and thinking critically on teaching methods, as well as ability to innovate in science teaching by using history of chemistry in the classroom.

3. Ability to information management with gender perspective.

4. Developing reading, oral and written skills.

5. Skills to work in teams adopting serious, professional and gender practices.

6. Ability to think critically the professional identity of chemistry, its social image and its role in society with a gender perspective and with sensitivity to environmental issues and sustainability.

7. Understanding the cultural meaning of chemistry and its bibliographic and material heritage with a gender perspective.

8. Capacity for organization and planning research work with special attention to sources of chemical information.

9. Knowing and using chemical terminology, its origins and current features.

10. Knowing the working methods of chemistry, understanding the relationship between interpretations and experimental data and the relationship between qualitative and quantitative data.

11. Knowing the changing relationships of chemistry with other disciplines, the processes of specialization and creation of subdisciplines, as well as their relationships with industry and the activities of daily life.

12. Promoting autonomous learning, know-how and capacity to adapt to new situations.

Regarding the Sustainable Development Goals (SDGs), it is expected that students will be able to acquire a permanent sensitivity to quality, the environment, sustainable development, particularly on areas related to air quality and the sustainable management of water (SDG 6) and of raw materials and energy sources (SDG 7) as well as sustainable and environmentally-compatible development (SDG 11-15).

Acquire permanent sensitivity and commitment to high standards of quality and occupational risk prevention (GC10).

Acquire a permanent sensitivity and commitment for the prevention of occupational hazards (CG10).

Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7), with the ability to think critically over the role of chemistry in addressing relevant issues related to poverty eradication (SDG 1), the fight against hunger and the path to food security (SDG 2) and the advancement of public and occupational health (SDG 3).

Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration. (CB3), on issues related to responsible consumption (SDG 12), climate change (SDG 13) and environmental conservation (SDG 14-15)

DESCRIPTION OF CONTENTS

1. The History of Science

Introduction. The history of science. Methodology. Sources. Problems and approaches. Main periods.

2. Chemical technology

Technological systems. Concepts, definitions and classifications. Chemistry-related techniques in prehistory. Fire. Salt. Pottery and ceramics. Glassmaking. Making dyes. Mining and the origins of metallurgy. Metals in antiquity.

3. Alchemy

The origins of alchemy. Sources and main traditions. The geographical and chronological framework. Alchemy in China and India. Classical Greek science. The origins of Greek science. Myths and rational explanation. Pre-Socratic philosophers and theories on the constitution of matter. Hellenistic alchemy. Arabic alchemy. Alchemy in the Middle Ages.

4. The Scientific Revolution

Scientific revolutions. Concept and debates. Spaces, problems, methods and protagonists of the scientific revolution. Science and religion. Alchemy and the origins of modern science.

5. The Chemical Revolution

Eighteenth-century chemistry. Pneumatic chemistry. Antoine Lavoisier and the crucial year (1772). The "discovery" of oxygen. The table of simple substances and the notion of chemical composition. The new chemical terminology. Chemistry, medicine and industry. The spread of chemical revolution. Chemistry in late 18th-century Spain.

6. Atomic Theory and the Periodic System

John Dalton's atomic theory. Origin and general characteristics. Atoms and chemical equivalents. Atomic models and quantum mechanics. Periodic classification of the chemical elements. General characteristics of the first classifications of elements. The problems of atomic weights. The Periodic Table: an example of multiple discovery. The explanation of the periodic system.

7. Disciplines and Professions

Scientific disciplines and school disciplines. The origin of chemistry and its relationship to other disciplines. Chemistry in classrooms throughout history. Chemical sub-fields. Science as a profession. Science and gender. The literature of chemistry. The popularization of chemistry.

8. The Chemical Industry

The main chemical industries: history and overview. The industrial revolutions and chemistry. Environmental problems and the chemical industry. The pharmaceutical industry. Patents and the chemical industry.

9. History and Science Education

Using history in science education. Scientific biographies. The history of science in science textbooks. Classic experiments in the classroom. The history of science education.

10. Twentieth-Century Chemistry

The main features of big science. Science and technology in the 20th century. Technoscience. Science and the military industry: chemical weapons and atomic energy. New sub-fields. The social image of chemistry. Environmental problems. The new molecular sciences at the beginning of the 21st century.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Tutorials	7,00	100
Attendance at events and external activities	3,00	0
Development of group work	15,00	0
Development of individual work	15,00	0
Study and independent work	7,50	0
Preparation of evaluation activities	15,00	0
Preparing lectures	6,00	0
Resolution of case studies	6,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The course includes lectures, practical sessions, seminars and tutorial activities.The lectures introduce the outlinesof thementioned topics Practical activities are complements to the lectures introducing new perspectives(biographical, thematic, methodological, etc..) and new views of the main topics included inthe syllabus. Students are encouraged toadopt an active and meaningful learning through the frequent use of the recommended bibliography and the development of practical activities in the classroom.The seminars include several activities such as summary and discussion of selected papers, presentations and discussions ontopics covered in previous lectures, so students can develop some of the skills which had been previously described.

EVALUATION

• Written examinations [30 %] . Minimum score required: 4 (out of 10).

• Evaluation of tutorial sessions and group seminars (participation and work submitted), papers and oral presentations . [40 %].

• Evaluation of student activities based on regular class attendance and classroom activities, participation in debates and the student's degree of involvement in the teaching-learning process [30 %].

Final warning

Copying or plagiarism of any assignment that is part of the evaluation will make it impossible to pass the course, and the student will be subject to the appropriate disciplinary procedures.

Please note that, according to Article 13 d) of the University Student Statute (RD 1791/2010, December 30), "*it is the duty of a student to refrain from using or cooperating in fraudulent procedures in evaluation tests, in the work performed or in official University documents*".

REFERENCES

Basic

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- BROCK, W. H. Historia de la química. Madrid: Alianza, 1998.
- FARA, P. Breve historia de la ciencia. Barcelona: Ariel, 2009.

Additional

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