Universidad de Alcalá

Centro Universitario Cardenal Cisneros

STUDY GUIDE

SCIENCE OF MATTER AND ENERGY

Degree in Primary Teacher Training
Bilingual Programme
C.U. Cardenal Cisneros
Universidad de Alcalá

Academic Year 2025-26
2nd Year – 2nd Term

STUDY GUIDE

Subject:	**SCIENCE OF MATTER AND ENERGY**
Code:	**520008**
Studies:	**PRIMARY EDUCATION TEACHER TRAINING DEGREE. BILINGUAL PROGRAMME**
Department:	**TEACHING SPECIFIC SCIENCES**
Character:	**COMPULSORY**
ECTS:	**8**
Year and term:	**2nd/ 2nd Term**
Profesorado:	**Dr. D. Jesús Aguado Molina**
Assistant	**Nathan Florian**
Office hours:	**Wednesday 11:00h**
Office number	**2**
e-mail	**Jesus.aguado@cardenalcisneros.es**
Language:	**English**

1. INTRODUCTION

Since bilingual education became popular in Spain, the learning of English as a Foreign Language has evolved dramatically from being a subject in the school curriculum to being considered as a real communication tool to create meaning in most content areas. This shift must be considered in the training of future Primary Education teachers.

The subject "Science of Matter and Energy" provides a valuable set of knowledge, resources and skills to future teachers, especially oriented towards the area of knowledge of Science in Primary education.
A solid foundation in the basics of matter and energy, both from a theoretical and experimental point of view, is an essential tool for future teachers of primary education so that they can develop both their professional skills and a basis for any Experimental Science.

When carrying out any academic work, it is important to consult the teaching staff about the permitted use of artificial intelligence (AI) tools. If it is not expressly stated in the guide or instructions of the specific activity or practice, it is understood that AI should not be used in any case. It is reminded that the improper use of these technologies, such as the generation of work without express authorisation, may contribute to academic fraud. Therefore, it is recommended to review the University's regulations regarding the use of AI, to always act responsibly and transparently in the learning process and to consult the teaching staff with any doubts in this regard

Prerequisites and Recommendations

It is fundamental to be competent in Maths at a Bachillerato level.

Students should have an A2 level of English. The subject will work on developing their competence in the English language (More information can be found here: http://www.coe.int/T/DG4/Portfolio/?L=E&M=/main_pages/levels.html)

2. COMPETENCES

General competences:

This subject aims to impart a range of general and specific skills to students, as listed below:

- To effectively deal with language learning situations in multicultural and plurilingual contexts. Foster reading and critical commentary of a wide range of scientific and cultural texts contained in the school curriculum (Competencia nº 3 de las competencias propias del título de grado
- To design and regulate learning spaces in contexts of diversity that pay attention to gender equality, fairness and respect of human rights that define the values of citizenship (Competencia nº 4 de las competencias propias del título de grado).

- Competence nº 5. To promote coexistence inside and outside the classroom, resolve discipline problems and contribute to resolving conflicts peacefully. To stimulate and value students' effort, consistency and personal discipline. (Competencia nº 5 de las competencias propias del título de grado)

Specific competences:

In addition to the specific competences in the subject "TEACHING AND LEARNING THE EXPERIMENTAL SCIENCES", in this subject, the student must develop the following the following competences that appear in the table:

Competence nº 1	To understand the basic principles and fundamental laws of the experimental sciences (Biology, Geology, Physics and Chemistry).
Competence nº 3	To suggest and resolve problems associated with everyday sciences.
Competence nº 4	To value the sciences as a cultural phenomenon.
Competence nº 5	To recognise the mutual influence between science, society and technological development, as well as relevant civil conducts, with the aim of working towards a sustainable future..

3. CONTENTS

The contents are divided up as follows:

Content Blocks		Total number of classes, credits and hours
Content Blocks	**Subjects**	
Block 1: The study of the characteristics of Science	Subject 1. Scientific method and measurement: Measurement pattern, significant figures, scientific notation	0,5 ETCS
Block 2: The study of Matter	Subject 2. Matter: states of matter, main laws of conservation of mass, element, substances, mixtures.	0.5 ETCS
	Subject 3. The structure of matter: atomic theory, parts of the atom, atom, isotope and ions, periodic table of the elements	1 ETCS
	Subject 4. Chemical bonding: Metallic bonding, covalent bonding, ionic bonding and hydrogen bridges.	1 ETCS
	Subject 5: Chemical reactions: balancing chemical reactions, combustion reactions	1 ETCS
Block 3: The study of energy and its relationship with matter	Subject 6. Energy: types of energy, transformation of energy and conservation of energy	1 ETCS
	Subject 7. Motion in 1 and 2 dimensions: displacement and distance, velocity and acceleration	1 ETCS
	Subject 8. Newton's Laws: first Newton law, inertia, net force, second Newton law, third Newton law	1 ETCS
Block 4: Generic contents	Simple and complex machines, fluids pressure, light and its properties, sound and its properties	1 ETCS

4. METHODOLOGIES OF TEACHING-LEARNING-TRAINING ACTIVITIES

The total time that each student should dedicate in order to achieve the objectives of this study programme is 200 hours, of which 66 will be contact hours in the classroom or the laboratory, with the teacher. These 66 contact hours are divided into three modules following different teaching-learning methods that will help the student to develop the aforementioned competences:

- Theory classes (45 hours): Large group classes
- Practical classes (18 hours): Medium group classes
- Seminars (3 hours): Seminar group classes

The rest of the hours dedicated to the learning process of this subject (134 hours) correspond to both the student's autonomous work and individual study and work in groups outside of class hours.

P/A	Modality	Location	Description
CLASS TIMETABLE	Theory Classes	Different classrooms depending on the requirements of each session 	Classes are imparted by the teacher through a method of explanation with the support of multimedia and the digital board in order to facilitate assimilation of the contents. The classes will be based on magisterial presentations by the teacher, synthesis of the basic and fundamental contents of each topic, analysis activities, discussion, deepening and reinforcing theory.
	Practical Classes	Different classrooms depending on the requirements of each session 	Exercise and problem solving, practical laboratory classes, group work and oral presentations.
	Seminars/Workshops	Classroom 	Group and personalised tutorials, debates and collaborative learning activities.
	Tutorial	Office 	Individual advice and guidance
SELF-STUDY	Group Work		Group work of practical activities.
	Individual Work		Study, exam preparation, searching for resources, carrying out and studying activities.

The subject is associated with the Development of Academic Skills in CUCC Degree Degrees program, specifically with **oral presentations**, so, it includes activities that will be evaluated therein and that are explained later

4.1. Distribution of credits

Total number of hours: 200	
Number of contact hours: 66	45 hours of theory class 18 hours of practical class 3 hours of seminars 2 hours assessment tasks
Number of hours of student self-study: 132	132 hours of self-study

The remaining hours dedicated to this subject (134 hours) correspond both to student self-study, as well as individual study in group work outside of the class.

4.2. Methodological strategies, teaching materials and resources

Links to online resources will be provided in each subject block and topic in order to reinforce and deepen knowledge.

In each topic when considered appropriate, different laboratory sessions will be provided aimed at completing the student's education.

In this subject, some classes will be conducted as interdisciplinary learning experiences in collaboration with other subjects from the semester study programme

5. ASSESSMENT: assessment criteria, marking criteria and assessment procedures

According to the European Commission of Education and Learning, ECTS credits are based on the workload that the student needs to develop to achieve the proposed learning outcomes. This includes both theoretical and practical classes as well as participation in seminars, projects, activities and also personal work time and evaluation tests required to acquire a series of skills.

The evaluation criteria describe what the student is expected to know, understand and be able to do after successfully completing the teaching-learning process. As this is a theoretical-practical subject, both the acquisition of knowledge and the application of procedures and the development of skills will be valued. To achieve this, throughout the course several activities will be proposed that will facilitate the student's progress both in the classroom, with the support of the teacher, and independently.

1. Knowledge and comprehension of the basic concepts of the subject.

2. Undertaking practical activities both in the laboratory and the classroom or in any location, which are based on contents related to matter or energy for the acquisition and promotion of scientific methods and attitudes and respect for the environment.

3. Acquisition by the student of habits of observation and scientific motivation regarding natural chemical and physical phenomena, above all those related with matter and energy.

4. Development of abilities and skills enabling the student to use scientific material and instrument design to implement their experiences and practices.

5. Clear, precise and correct use of language and vocabulary in presentations and class work.

6. Interest in learning and active participation.

7. Ability to work in a group.

8. Ability to research, analyse and synthesise scientific information.

Relationship between the specific competences and the assessment criteria:

Competences	Assessment criteria
To understand the basic principles and fundamental laws of the experimental sciences (Biology, Geology, Physics and Chemistry).	- Knowledge and comprehension of the basic concepts of the subject. - Interest in learning and active participation. - Clear, precise and correct use of language and vocabulary in presentations and class work.
To suggest and solve problems associated with everyday sciences.	- Undertaking practical activities both in the laboratory and the classroom or in any location, which are based on contents related to matter or energy for the acquisition and promotion of scientific methods and attitudes and respect for the environment. - Ability to work in a group. - Ability to research, analyse and synthesise scientific information. - Interest in learning and active participation. - Development of abilities and skills enabling the student to use scientific material and instrument design to implement their experiences and practices.
To value the sciences as a cultural phenomenon.	- Ability to research, analyse and synthesise scientific information. - Undertaking practical activities both in the laboratory and the classroom or in any location, which are based on contents related to matter or energy for the acquisition and promotion of scientific methods and attitudes and respect for the environment.

To recognise the mutual influence between science, society and technological development, as well as relevant civil conducts, with the aim of working towards a sustainable future.	- Undertaking practical activities both in the laboratory and the classroom or in any location, which are based on contents related to matter or energy for the acquisition and promotion of scientific methods and attitudes and respect for the environment. - Ability to work in a group. - Ability to research, analyse and synthesise scientific information. - Interest in learning and active participation.

Assessment criteria:

Criteria	Definition
Knowledge and comprehension of the basic concepts of the subject.	• Accurately expresses and defines concepts. • Knows how to apply concepts to examples and to solve problems. • Relates different concepts.
Undertaking practical activities both in the laboratory and the classroom or in any location, which are based on contents related to matter or energy for the acquisition and promotion of scientific methods and attitudes and respect for the environment.	• Is able to perform activities related to scientific contents, making use of the laboratory, the class or any other space.
Acquisition by the student of habits of observation and scientific motivation regarding natural chemical and physical phenomena, above all those related with matter and energy.	• Applies knowledge acquired in practical and theory classes in nature.
Development of abilities and skills enabling the student to use scientific material and instrument design to implement their experiences and practices. as.	• Is familiar with and knows how to use different scientific and laboratory instruments and materials.
Clear, precise and correct use of language and vocabulary in presentations and class work.	• Uses learned language. • Does not have any grammatical errors. • Expresses him/herself correctly using scientific language.
Interest in learning and active participation.	• Carries out unassessed work • Hands in assessed work • Participates in class • Volunteers for extra activities when required
Ability to work in a group.	• Is able to work in a group • Carries out group activities in a coordinated and participative manner • Helps fellow group members to overcome difficulties that arise
Ability to research, analyse and synthesise scientific information.	• Is able to write a bibliographic index properly • Is able to cite and use texts in his/her work without committing plagiarism. • Is able to find material to complete the contents provided in the class

Resultados de aprendizaje

Los resultados de aprendizaje recogidos en la memoria de verificación del título de Maestro de Educación Primaria correspondientes a esta asignatura son:

LEARNING OUTCOMES: SCIENCE OF MATTER AND ENERGY	Code
To state and apply the basic principles and concepts of the experimental sciences in everyday and teaching contexts.	**RACE 1**
To understand the historical development and cultural significance of the main fields of experimental sciences.	**RACE 3**
To identify the connections between natural sciences, society, technology, and the environment, and their impact on daily life.	**RACE 4**

Assessment procedure

In order to pass the subject, students must demonstrate through certain assessment criteria, that they have achieved all of the competences set out in this study guide. This assessment procedure is based on the "Normativa reguladora de los procesos de evaluación de aprendizajes de la Universidad de Alcalá". It is available for download in the link: (https://www.uah.es/export/sites/uah/es/conoce-la-uah/organizacion-y-gobierno/.galleries/Galeria-Secretaria-General/Normativa-Evaluacion-Aprendizajes.pdf)

This regulation establishes, among others, the following guidelines:

1. It has an ordinary call in the month of May and an extraordinary call in the month of June.
2. The ordinary call will be developed under the continuous evaluation modality.
3. If any student cannot follow the continuous evaluation in the ordinary call, they must request the final evaluation from the subject teacher who will forward it to the Deputy Director of Academic Planning in the request prepared for this purpose. This request will be submitted in the first two weeks of class and may or may not be accepted.
4. The extraordinary call is planned for students who do not pass the ordinary call and may be in both continuous and final modality (a student who has not passed the continuous evaluation in the ordinary call would go to the extraordinary call in the same modality).

Students are required to complete all of the assessed work presented in this study guide and to have, at least, a mark of 5 in every assessment work. This includes continuous and final assessment, both in the ordinary and extraordinary examination periods.

Attendance to seminars and group presentations is a compulsory and essential part of the continuous evaluation. If a student fails to attend two of these sessions without presenting an absence note, he/she must sit the final evaluation exam.

Complete or partial coping of any activity or project is forbidden and it implies to fail the subject. This includes continuous and final assessment, both in the ordinary and extraordinary examination periods

During the development of the evaluation tests, the guidelines set out in the Regulations that establish the Rules of Coexistence of the University of Alcalá must be followed, as well as the possible implications of irregularities committed during said tests, including the consequences for committing academic fraud according to the Student Disciplinary Regime Regulations of the University of Alcalá.

CONTINUOUS ASSESSMENT. Ordinary and extraordinary examinations

Continuous assessment for the ordinary and extraordinary examinations will be assessed according to the following tools:

1. Written exams
2. Group work
3. Subject dossier
4. Class work and participation

The relationship between the assessment criteria and the percentage weighting are displayed in the following table:

		Assessment tool		
Criteria	**%**	Class work and participation	Group work	Written exam
Knowledge and comprehension of the basic concepts of the subject.	28	X	X	X
Undertaking practical activities both in the laboratory and the classroom or in any location, which are based on contents related to matter or energy for the acquisition and promotion of scientific methods and attitudes and respect for the environment.	10		X	
Acquisition by the student of habits of observation and scientific motivation regarding natural chemical and physical phenomena, above all those related with matter and energy.	12	X	X	X
Development of abilities and skills enabling the student to use scientific material and instrument design to implement their experiences and practices.	5		X	
Clear, precise and correct use of language and vocabulary in presentations and class work.	17		X	X
Interest in learning and active participation.	8	X	X	
Ability to work in a group.	15	X	X	
Ability to research, analyse and synthesise scientific information.	5		X	
Finnal mark		20	40	40

FINAL ASSESSMENT. Ordinary and extraordinary examinations

Criteria	%	Assessment tool
Knowledge and comprehension of the basic concepts of the subject.	38	Written exams
Undertaking practical activities both in the laboratory and the classroom or in any location, which are based on contents related to matter or energy for the acquisition and promotion of scientific methods and attitudes and respect for the environment.	10	Written exams
Acquisition by the student of habits of observation and scientific motivation regarding natural chemical and physical phenomena, above all those related with matter and energy.	17	Written exams
Development of abilities and skills enabling the student to use scientific material and instrument design to implement their experiences and practices.	5	Written exams
Clear, precise and correct use of language and vocabulary in presentations and class work.	17	Written exams
Interest in learning and active participation.	3	Written exams
Ability to work in a group.	5	Written exams
Ability to research, analyse and synthesise scientific information.	5	Written exams

During all assessment tasks, the guidelines established in the University of Alcalá Coexistence Regulations must be followed, as well as the possible implications of irregularities committed during those tasks, including the consequences for committing academic fraud, according to the Disciplinary Regulations for Students of the University of Alcalá.

The teaching-learning methodology and the evaluation process will be adjusted when necessary, with the guidance of the CUCC Guidance Service and/or the Unit for Attention to Diversity of the UAH to apply curricular adaptations to students with specific needs, upon submission of documentation certifying such need.

6. BIBLIOGRAPHY

Basic Bibliography

Chang, R., & Overby, J. (2011). General Chemistry: The Essential Concepts, Sixth Edition. In *The McGraw-Hill Companies* (Vol. 73, Issue 11).

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García-Carmona, A., & Criado, A. M. (2013). Enseñanza de la Energía en primaria. *Revista de Investigación y Experiencias Didácticas*, *31.3*, 87–102.

Lahera Claramonte, J. (2009). *Fundamentos de Física para el grado de Magisterio. Una antología de textos y problemas comentados y evaluados*. CCS.

Nácher González, E., & Pastor Carpi, S. (2025). *La formación de los elementos químicos: la física del origen de la materia* (Vol. 1). Consejo Superior de Investigaciones Científicas; Los Libros de la Catarata.

Owen, S. (2011). Option A: Modern Analytical Chemistry. *Chemistry for the IB Diploma*, 1–51.

Pro Bueno, A. de. (2014). *La energía : uso, consumo y ahorro energético en la vida cotidiana*. Graó.

Tipler, P. A., & Mosca, G. (2010). *Physics for scientist and engineers* (6th ed., Vol. 1). Reverté.

Tsokos, K. A. (2010). Physics for the IB Diploma. In *Physics for the IB Diploma*. https://doi.org/10.1017/cbo9780511863011

Additional Bibliography

- Several links to websites will be provide in each topic in order to complement the course contents.
- International Bureau of Weights and Measures (December 2022)

Books of issues and problems

- Bermejo Martínez, F. y Paz Castro, M. (1995). *Mil problemas de Química general y sus fundamentos.* Paraninfo.
- Butler, I. S. y Grosser, A. E. (1995). *Problemas de Química*. Reverté.
- López Cancio, J. A. (2000). *Problemas de Química.* Pearson Prentice Hall.
- Díaz Díaz, J. L. y otros (1985). *La Física en problemas: análisis dimensional, sistemas de unidades.* Alhambra.
- González, F. A. (1997). *La Física en problemas*. Tebar Flores.