Foundations and Teaching of Chemistry and Geology (800438)
ECTS credits: 6
Third year, first term

CHEMISTRY

Program and course goals

The goals of the first part of the subject, devoted to chemistry, are:

- To get to know the usage of atomic and molecular diagrams (AMD's) as a tool to teach basic chemistry at a primary education level.
    - To develop an awareness of the possibilities of qualitative and visual didactic approaches as ways for adapting content knowledge to different teaching/learning contexts.
    - To employ AMD's to recognize individual patterns of learning and development, and to use them to design activities adapted to the social, cognitive, emotional and linguistic variability of a primary education classroom.
- To develop a basic operational model of the microstructure of matter, with an emphasis on the different states of aggregation, the difference between elements and compounds, and on the idea of chemical change as microscopic re-ordering.
- To manage some basic concepts of and procedures of the discipline, so that the prospective teacher is able to create learning experiences that make the foundations of the microscopic structure of matter accessible and meaningful for learners at a primary education level.
    - To acquire a command of some basic chemistry laboratory operations, with an emphasis in security and self-protection issues, and on environmental protection.
- Apply chemistry content knowledge in a creative, non-dogmatic, way, so that it can be used to engage the prospective learners in critical thinking, creativity, and collaborative problem solving related to actual issues.

Skills

- General: Design, plan and evaluate learning-teaching processes regarding experimental sciences field within the official syllabus.
- Transverse: team work, ICTs, environmental education, etc.
- Specific: Foundations of chemistry and everyday life problems associated to basic chemistry. The importance of chemistry on sustainable development and environmental rationality.

Aditional skills in chemistry

- To develop critical thinking skills & a basic understanding of how the science works.
- Become familiar with some basic chemistry laboratory operations.
- To develop models of chemical processes suitable to be taught at a primary level.

Presentation format and methodology

The course will consist of practical lectures, in-class discussions, in-class exercises and laboratory activities. The blackboard will be extensively used in order to *build* atomic and molecular representations in an interaction with the students, instead of presenting these diagrams as ready-made results. Group work will be encouraged in order to take advantage of the experience of the students who have more experience in chemistry.

Exams and Grading

The part grade will be based on a final exam. Due to the practical character of the course, attendance is compulsory.

References

- Allan G. Harrison y David F. Treagust, A typology of school science models, International Journal of Science Education, 20, pp. 1011-1026, 2000.
- Patrick J. Garnett, Pamela J. Garnett y Mark W. Hackling, Students' Alternative Conceptions in Chemistry: A Review of Research and Implications for Teaching and Learning, Studies in Science Education, 25(1), pp. 69-96, 1995.
- Dorothy Gabel, Improving Teaching and Learning through Chemistry Education Research: A Look to the Future, Journal of Chemical Education, 76(4), P. 548, 1999.
- R. Harwood and Ian Lodge. Cambridge IGCSE Chemistry: Coursebook and Workbook. Cambridge University Press, 2014.
- L. Ryan and R. Norris. Cambridge International AS and A Level Chemistry (second edition). Cambridge University Press, 2014.
- R. Harwood, T. Chadwick. Breakthrough to CLIL for Chemistry. Cambridge University Press. 2015.
- John T. Moore. Chemistry For Dummies, 2nd Edition. Wiley, 2016.
- John T. Moore. Chemistry II For Dummies. Wiley, 2012.
- John T. Moore. Chemistry Essentials For Dummies. Wiley, 2010.

GEOLOGY

General program of contents and course objectives

This course provides a wide-ranging introduction to the principles of Geology. These are concerned with the form and functioning of the natural environment and how they change over various timescales. In addition, typical learning difficulties of Primary Education students will be conveniently discussed as well as the corresponding official syllabus.

Skills

- General: Design, plan and evaluate learning-teaching processes regarding experimental sciences field within the official syllabus.
- Transverse: team work, ICTs, environmental education, etc.
- Specific: Basics of Geology and everyday life problems associated to Geology. Influence of Geology on sustainable development and environmental rationality.

Aditional skills in Geology

- To develop critical thinking skills & a basic understanding of how the science works.
- Become familiar with some of the observational methods, reasoning processes and analytical tools used by geologists to understand the Earth and its history.
- Learn the basic scientific concepts and principles, essentially the current paradigm for how the Earth and its systems interact to produce what we see.

Contents

The science of geology is traditionally divided into two broad disciplines: physical and historical. This course will focus primarily on physical geology through an examination of the basic

structure and composition of the materials that comprise the Earth, and the processes that underlie major geologic phenomena. Thus, the course is divided into the following broad subject areas:

- Part I. Structure and composition of Earth: a view of the main parts (or spheres) of Earth: atmosphere, hydrosphere, the solid Earth (rocks and minerals i.e. the materials which comprise the surface, crust and interior), and biosphere.
- Part II. Earth as a dynamic system: internal processes (volcanic activity, earthquakes, plate tectonics and mountain building), external processes (physical/chemical weathering, erosion (transport of materials) by gravity, running water, ice and wind) and the landforms created by the interaction of internal and external processes;
- Part III. Earth's place in the Solar System and the Earth-Sun and Earth-Moon systems.

Throughout the course, an emphasis will be placed on how geological phenomena are linked together into large scale systems and how these systems may interact to create the geological features one can observe.

Presentation format and methodology

The course will consist of practical lectures, in-class discussions, in-class exercises and short video clips. Essentially, methodology is based on a "flipped classroom". Lectures will be based primarily on multimedia presentations, plus some classroom handouts and some lab experiments (lab coat and safety glasses could be demanded). Lectures might include digital interactive class demonstrations.

Exams and Grading

The "Geology" grade will be based on a final exam (60%), plus the activities (40%). Important, an average mark equal or greater than five (5) is required to pass the course both in the activities and the official exam.

References

- E.J. Tarbuck, F.K. Lutgens. Earth Science. Pearson 14th Ed. 2015.
- F.K. Lutgens, E.J. Tarbuck, D.G. Tasa. MasteringGeology™ with eText for Essentials of Geology. Pearson. 12th Ed.
- E. Tarbuck, F. Lutgens, D. Tasa, K. Pinzke. Applications and Investigations in Earth Science. Pearson, 2014
- A.M. Spooner. Geology For Dummies. Wiley, 2011.
- G. Cambers, S. Sibley Cambridge IGCSE Geography Second Edition. Cambridge University Press, 2015.
- Stephen Pincock, Mark Frary. The Origins of the Universe for Dummies.Wiley, 2007.
- C.A. Heatwole, Ruth I. Shirey. Geography For Dummies. Wiley, 2002.