

## Learning outcomes for the integrated study of biology and chemistry

### KNOWLEDGE

1. Interpret the fundamental chemical concepts in line with new scientific findings and in conjunction with the related sciences (mathematics, physics, biology), including the historical development of concepts.
2. Define the concepts using chemical terminology, nomenclature, units and other conventions.
3. Explain an equation of a chemical reaction considering its qualitative and quantitative significance.
4. Explain the main types of chemical reactions.
5. Compare the structure of matter and chemical reactivity.
6. Explain the structural and energy changes and the kinetics during chemical reactions and physical processes.
7. Describe important biochemical processes, structure and activity of biologically important molecules.
8. Integrate knowledge from various areas of chemistry and apply to selected examples.
9. Integrate knowledge of chemistry with knowledge of pedagogy, psychology, didactics and methodology in teaching chemistry.
10. Explain the molecular mechanisms by which DNA controls development, growth and morphological characteristics of organisms, with the application of principles and laws of inheritance at the cellular, individual and population level.
11. Analyse the association between the structure and processes that participate in reproduction, growth, and the maintenance and regulation of the life of the cell and organisms, thereby enabling the survival of living beings.
12. Interpret how developmentally similar living beings express an evolutionary and ecological connection, and outline the causes of their changes during the past and the consequences of adaptations to various conditions of life.
13. Compare different ecosystems with the application of an interdisciplinary view to studying and recognising the distribution and diversity of living beings in the biosphere, and reconstruction of cycles in nature as a consequence of natural events.
14. Analyse the function of the human body, with the application of the knowledge attained, with the aim of responsible conduct towards one's own health and the health of others.
15. Differentiate the efficacy of teaching strategies, the accompanying methods, techniques, activities and procedures for teaching courses on the scientific bases of biology and chemistry.
16. Apply scientific findings relating to teaching and learning for the purpose of creating effective biology and chemistry courses.

### SKILLS

17. Apply the fundamental rules of occupational safety in the laboratory and in field studies, with the assessment of risk in executing laboratory procedures and independent application of standard analysis methods and the interpretation of results.
18. Conceive biology and chemistry classes with experienced learning during which pupils attain a conceptual understanding of the class content, which will enable preventing the emergence of, and elimination of incorrect interpretations by pupils (misconceptions/ alternative conceptions).
19. Devise experiments in chemistry and biology classes with the presentation of guiding pupils through the conclusions to attaining the conceptual changes and explanations, with examples from daily life.

20. Teach a class in primary and secondary school in line with the teaching plan and programme, and the European and national teachings standards in that course, which is in line with the teaching strategy of learning by discovery, and teaching directed at the pupils.
21. Didactically adapt biology and chemistry classes to the pupils, after an analysis of the psychological characteristics of the class, with views to possible teaching solutions.
22. Critically use the scientific and expert literature and other relevant sources of information in teaching, and in devising the application of scientific methodologies for resolving and communication of results of biological issues in the form of pupils' research.
23. Conceive a research programme to improve teaching practices on the basis of the application of results of educational research, with a presentation of educational experiences in the teaching process.
24. Create a motivating environment for active learning, which stimulates the development of capacities, knowledge and a positive attitude of all pupils, using information and communications technology.
25. Apply effective and appropriate methods of monitoring and evaluating the work and progress of pupils, using the results of pupil evaluation results at the national and international levels for planning the teaching of chemistry and biology.
26. Implement conceived popularisation activities and education programmes for the broader community on current topics, with the development of awareness on the significance of the chemical and biological sciences for the development of society and their impacts on humans and the environment.

#### INDEPENDENCE AND RESPONSIBILITY

27. Develop professional integrity and ethical conduct in the teaching process, while accepting the needs and importance of professional and methodological development through available lifelong learning programmes.
28. Take a responsible approach to performing teaching tasks, setting clear and measurable learning goals in the teaching of biology and chemistry, in line with the teaching programme.
29. Give a critical evaluation of the executed class, with continuous consideration of possible improvements.
30. Participate in the work of teams with the adaptation of the requirements of the work environment, and appropriate communication with pupils, parents and colleagues in the school environment.