

4. National Academic Reference Standards For Chemistry

Chemistry is the science which provides the concepts, knowledge, principles and theories necessary for the intellectual framework of understanding the properties of atoms and molecules as well as the relationship between structure and reactivity from fundamentals to the frontiers of current research. The study of chemistry focuses strongly on a wide range of analytical and practical skills required to practice the subject. Chemistry enables students to examine changes of materials during physical and chemical processes, and learn how to observe and measure results. Chemistry in turn, draws on the facts and theory of physics and mathematics as tools necessary to evaluate and express quantitative chemical information. Therefore, knowledge of the dynamic and the evolving science of chemistry is essential to the discovery, understanding and development of other sciences such as biology, medicine, pharmacy, materials science, engineering and many other related sciences.

Studying for a degree in Chemistry is a sound basis for the students where they can extend their knowledge of the subject and develop many of the scientific and employability skills which are necessary for most occupations. Therefore, chemists can have opportunities to work as scientists in research activities in governmental agencies and private laboratories. They can be employed as product developers and quality control of manufactures in the industrial sectors. Chemists can utilize their wide chemistry

knowledge and skills in other areas such as sales representative for chemical products, pharmaceuticals or laboratory equipment. In addition, chemistry graduates can be involved in educational institutions.

The Academic Reference Standards represent general expectations about the standards for the award of qualifications at the B.Sc degree in chemistry, and articulate the attributes and capabilities that the graduates should be able to demonstrate. Regardless of the institution, the undergraduates of chemistry programs should provide students with an education in the main branches of chemistry, namely:

1. Analytical chemistry: study of the structure, composition and analysis of substances,
2. Inorganic chemistry: study of non-carbon-based compounds,
3. Organic chemistry: study of carbon-based compounds,
4. Physical chemistry: application of concepts and laws to study the characteristics of atoms and molecules as well as chemical reactions,
5. Computational chemistry: study of the principles and theories of quantum mechanics.

4.1. The Attributes of a Chemist

In addition to the general attributes of the basic science graduates, the chemist must develop a group of attributes which are the ability to:

- 4.1.1. Design and conduct experimental work, critically evaluate the outcomes, review and report on practice.
- 4.1.2. Have knowledge and experience of working with relevant and advanced laboratory techniques.
- 4.1.3. Participate in and review quality control processes, manage risks and organize time to finish jobs.
- 4.1.4. Demonstrate wide background knowledge related to the different branches of chemistry.

4.2. Knowledge and Understanding

In addition to the general knowledge acquired by the basic science graduates, the chemist should be able to demonstrate knowledge and understanding of:

- 4.2.1. Chemical concepts, nomenclature, formulae and units.
- 4.2.2. Characteristics of the different states of the matter and elements including trends within the periodic table and the related theories.
- 4.2.3. The principles, procedures and techniques used in chemical analysis, characterization and structural investigations of different chemical compounds.
- 4.2.4. The major types of chemical reactions, their characteristics and mechanisms as well as their kinetics including catalysis.

- 4.2.5. The principles of thermodynamics and quantum mechanics including their applications in chemistry.
- 4.2.6. The constitution and properties of the different chemical compounds, including the main synthetic pathways and the relation between the properties of individual atoms and molecules.
- 4.2.7. The current issues of chemical research and technological development.

4.3. Practical and Professional skills:

The Graduates of Chemistry Program must be able to:

- 4.3.1. Assess risk in laboratory work taking into consideration the specific hazards associated with the use of chemical materials as well as the safe and proper operation of the laboratory techniques.
- 4.3.2. Conduct standard laboratory procedures involved in analytical and synthetic work.
- 4.3.3. Monitor by observation and measurements the chemical properties or changes, including systematic recording and technical reporting.
- 4.3.4. Use computational packages and tools in chemical investigations.

4.4. Intellectual skills

The Graduates of Chemistry Program must be able to:

- 4.4.1. Differentiate between the different states of the matter, elements and compounds based on the recognition and quantification of the properties.
- 4.4.2. Employ computational software's and data-processing skills in handling of chemical information and analysis of chemical data.
- 4.4.3. Explain concepts and determine the efficiency of chemical systems by applying mathematical expressions.
- 4.4.4. Analyze chemical data to identify and confirm chemical structures as well as determine chemical composition.
- 4.4.5. Propose and conclude mechanisms for physical and chemical processes.

6. National Academic Reference Standards For Biological Sciences

The study of biological sciences emphasizes on understanding of life's basic processes for biological elements including respiration, metabolism, movement, sensation and digestion. In addition, biological sciences are concerned with the environmental aspects, including ecosystem composition, protection, conservation, economics, utilization, interaction, competition and breeding between the biological elements of the ecosystem. The study of biological sciences serve as basic information for a wide range of disciplines such as medicine, pharmacology, veterinary medicine, dental medicine and agriculture. It contributes effectively to the human health which is the wealth of the nation, and disease fundamentals through the study of the microorganisms together with the development of new vaccines, drugs and antibiotics.

Biological sciences of the basic science sector given under a number of specializations such as: entomology, botany and zoology. In addition to, the sub-disciplines within this area that focus on particular groups of organisms such as microbiology and other interdisciplinary specializations as biotechnology.

There are various job opportunities for biologist as researcher in academic, educational and environmental institutions. Other work opportunities are in drug, biotechnology, food, agricultural, chemical, biological supplies, forensic sectors and others.

6.1. Attributes of a Biologist

In addition to the general attributes, the graduates must be able to:

- 6.1.1 Understand the life's basic processes in relation to organisms and ecosystems.
- 6.1.2. Recognize, understand and assess different levels of organization in biological systems.
- 6.1.3. Identify and characterize different communities and ecosystems supporting the biological organism.
- 6.1.4. Be acquainted with the modern subjects and bio-techniques.

6.2. Knowledge and understanding in biological sciences

In addition to the knowledge mentioned in the general part for the Basic Sciences graduates, the Biologist must know and understand the:

- 6.2.1. Life of representative Taxa in different disciplines from cellular to organism.
- 6.2.2. Physiological aspects of organisms.
- 6.2.3. Taxa limit and the characteristic habitat features of representative organisms.
- 6.2.4. Processes and mechanisms in different ecosystems.
- 6.2.5. Theories applied for interpreting and analyzing biological information.

- 6.2.6. Complexity and diversity of organisms through the study of genetics, developmental stages and evolution.

6.3. Professional and Practical Skills

The Graduates of Biological Sciences programs must be able to:

- 6.3.1. Solve Biological problems by a variety of methods including computers and other recent tools.
- 6.3.2. Collect, record and analyze biological data using appropriate techniques in the field and laboratory.
- 6.3.3. Apply field and laboratory investigations of living systems in an ethical and responsible manner.
- 6.3.4. Select a representative sample considering its validity, accuracy and reliability during collection.

6.4. Intellectual Skills

The Graduates of Biological Sciences programs must be able to:

- 6.4.1. Interpret the subject-related knowledge to solve problems.
- 6.4.2. Formulate data and select the proper mechanism for their setting within a theoretical framework.

- 6.4.3. Assess the interrelationships and the impact of a specific organism on its ecosystem.
- 6.4.4. Evaluate the ecosystem, its conservation, economics and sustainability.
- 6.4.5. Interpret biological data and respond to a variety of information sources.