

**National Academic Reference Standards  
(NARS)  
Basic Sciences  
January 2009  
1st Edition**

**Chemistry** is the science which deals with the study of atoms and molecules with a great emphasize on their structures, properties, synthesis, and how they interact with each other to create new molecules. Its range and compass are enormous, from the simplest compounds like sodium chloride up to huge and complex biological molecules such as DNA and proteins which form the basis of life itself.

## **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 16 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.

### **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:

1. Knowledge of chemical concepts, foundations, laws and terms in various branches of chemistry (organic, analytical, physical, inorganic, biological, industrial and nuclear)
2. Familiarity with the properties of chemical elements and compounds and their relationship to the mechanisms of their reactions.
3. Knowledge of chemical analysis methods and techniques used
4. Familiarity with the principles of safety and security in chemistry laboratories
5. Knowing the advantages of educational technologies and distinguishing between the types of educational technologies available.
6. Optimum use of relevant information technology that enables him to search for the required information and adopt distance learning and self-learning, taking into account the ethical and professional rules.

7. Develop new concepts and choose appropriate solutions to solve environmental, societal and industrial problems.

8. Use scientific facts and theories to interpret and analyze experimental results.

9. Know the relationship of chemistry to the environment.

10. Design and conduct experimental work, critically evaluate the outcomes, review and report on practice.

11. Have knowledge and experience of working with relevant and advanced laboratory techniques.

12. Participate in and review quality control processes, manage risks and organize time to finish jobs.

13. Demonstrate wide background knowledge related to the different branches of chemistry.

### **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:

1. Chemical concepts, nomenclature, formulae and units.
2. Characteristics of the different states of the matter and elements including trends within the periodic table and the related theories.
3. The principles, procedures and techniques used in chemical analysis, characterization and structural investigations of different chemical compounds.
4. The major types of chemical reactions, their characteristics and mechanisms as well as their kinetics including catalysis.
5. The principles of thermodynamics and quantum mechanics including their applications in chemistry.
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.

7. The current issues of chemical research and technological development.

**Practical and Professional skills:**

**The Graduates of Chemistry Program must be able to:**

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.
2. Conduct standard laboratory procedures involved in analytical and synthetic work.
3. Monitor by observation and measurements the chemical properties or changes, including systematic recording and technical reporting.
4. Use computational packages and tools in chemical investigations.

**Intellectual skills The Graduates of Chemistry Program must be able to:**

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

## II. Curriculum Structure

area	Percentage	Tolerance
Basic Science	28	27-29
Humanities(including language)	6	5-7
Specialty (professional)	50	48-52
Computer and IT	6	5-7
Research and graduation project	2	1-3
Others (Discretionary)	8	7-9