

National Academic Reference Standards (NARS)

Basic Sciences

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1st Edition

Introduction to Basic Sciences Education

The aim of science is to understand the nature and justification of scientific knowledge. Basic Sciences including, physics chemistry, biosciences, earth science and mathematics, furnish the basis for all scientific disciplines.

Physics is concerned with the observation, understanding and prediction of natural phenomena and the behavior of man-made systems. It deals with profound questions about the nature of the universe and with some of the most important practical, environmental technology issues. Its scope is broad and involves mathematical theories, experiments and observation, computing technology, materials, nuclear energy and magnetism.

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.

The **biosciences** are the study of life and life-related topics at all levels of complexity from molecules to populations. Studies in biosciences encourage the understanding of multidisciplinary life aspects including physical and chemical nature at different

complexity. They also include biostatistics, bioinformatics and related advanced techniques.

Earth science is the science which attempts an intelligent interpretation of the phenomena resulting from the natural processes acting on and in the earth. It is a broad science and has a number of disciplines such as geology and geophysics.

Mathematics is one of the oldest and fundamental sciences. It constitutes a body of established facts, achieved by a reliable method, verified by practice, and agreed on by qualified experts. It develops investigative mathematical computational modeling and establishes new principles.

I. National Academic Reference Standards

1. National Academic Reference Standards

1.1. General Attributes of the Graduates of Basic Sciences

The graduates must be able to:

- 1.1.1. Recognize the role of Basic Sciences in the development of society.
- 1.1.2. Develop scientific approaches that meet community needs considering economic, environmental, social, ethical, and safety requirements.
- 1.1.3. Utilize scientific facts and theories to analyze and interpret practical data.
- 1.1.4. Collect, analyze, and present data using appropriate formats and techniques.
- 1.1.5. Postulate concepts and choose appropriate solutions to solve problems on scientific basis.
- 1.1.6. Apply effectively information technology relevant to the field.
- 1.1.7. Participate effectively in a multidisciplinary teamwork and be flexible for adaptation, decision making and working under contradictory conditions as well as exhibiting the sense of beauty and neatness.
- 1.1.8. Adopt self and long life-learning and participate effectively in research activities.

- 1.1.9. Deal with scientific data in Arabic, English or other languages.

1.2. Knowledge and Understanding

Graduates must acquire knowledge and understanding of:

- 1.2.1. The related basic scientific facts, concepts, principles and techniques.
- 1.2.2. The relevant theories and their applications.
- 1.2.3. The processes and mechanisms supporting the structure and function of the specific topics.
- 1.3. The related terminology, nomenclature and classification systems.
- 1.2.4. The theories and methods applied for interpreting and analyzing data related to discipline.
- 1.2.5. The developmental progress of the program-related knowledge.
- 1.2.6. The relation between the studied topics and the environment.

1.3. Practical and Professional Skills

The graduates must be able to:

- 1.3.1. Plan, design, process and report on the investigated data, using appropriate techniques and considering scientific guidance.
- 1.3.2. Apply techniques and tools considering scientific ethics.

1.3.3. Solve problems using a range of formats and approaches.

1.3.4. Identify and criticize the different methods used in addressing subject related issues.

1.4. Intellectual Skills

The graduates must be able to:

1.4.1. Differentiate between subject-related theories and assess their concepts and principles.

1.4.2. Analyze, synthesize, assess and interpret qualitatively and quantitatively science relevant data.

1.4.3. Develop lines of argument and appropriate judgments in accordance with scientific theories and concepts.

1.4.4. Postulate and deduce mechanisms and procedures to handle scientific problems.

1.4.5. Construct several related and integrated information to confirm, make evidence and test hypotheses.

1.5. General and Transferable Skills

The graduates must be able to:

1.5.1. Use information and communication technology effectively.

1.5.2. Identify roles and responsibilities, and their performing manner.

1.5.3. Think independently, set tasks and solve problems on scientific basis.

- 1.5.4. Work in groups effectively; manage time, collaborate and communicate with others positively.
- 1.5.5. Consider community linked problems, ethics and traditions.
- 1.5.6. Acquire self- and long life-learning.
- 1.5.7. Apply scientific models, systems, and tools effectively.
- 1.5.8. Deal with scientific patents considering property right.
- 1.6.9. Exhibit the sense of beauty and neatness

2. National Academic Reference Standards for Physics

Physics is the study of energy and behavior of single atom and its components. Physics is the foundation upon which the other physical sciences are based such as; astronomy, chemistry and geology. The beauty of physics lies in the simplicity of the fundamental physical theories and assumptions that can alter and expand our view of the world around us. Like all sciences, physics is based on experimental observations and quantitative measurements. The main objective of physics is to use a limited number of fundamental laws that govern natural phenomena to develop theories that can predict the results of future experiment.

Physicists are expected to become investigators in industrial or research institutions. They can also have careers as air navigators and instrument manufacturers, scientific reporters, technical consultants and university staff members. They can also be employed in information technology companies, educational institutions and health care organizations.

2.1. The Attributes of a Physicist

In addition to the general attributes of basic sciences graduates, the physics graduates must be able to:

- 2.1.1. Demonstrate a good basic knowledge of structural and functional aspects of physical systems at many spatial scales, from single molecule to the whole system.
- 2.1.2. Connect fundamental ideas about the physical behavior of matter and energy to system's structure and function.

2.2. Knowledge and Understanding

In addition to the general knowledge acquired by Basic Sciences graduates, the physics graduates must know and understand the:

- 2.2.1. Characteristics and physical properties of matter.
- 2.2.2. Static and dynamic properties of fluids.
- 2.2.3. The Basics of Electricity.
- 2.2.4. Concepts of electromagnetism.
- 2.2.5. Principles of heat transfer and thermodynamics.
- 2.2.6. Theoretical and practical aspects of optics, nuclear physics and other related branches.
- 2.2.7. Application of advanced physical techniques.
- 2.2.8. Basics and mechanisms of energy transfer.

2.3. Practical and Professional skills

In addition to the general skills acquired by Basic Sciences graduates, the physicist must be able to:

- 2.3.1. Apply mathematical tools and techniques to analyze and interpret experimental results.
- 2.3.2. Implant comprehensive physical knowledge and understanding as well as intellectual skills in research tasks.
- 2.3.3. Use the national standards for laboratory equipment which are essential for practical research work.
- 2.3.4. Present theoretical and experimental results in understandable forms such as tables and graphs.

2.4. Intellectual skills

In addition to the general skills acquired by Basic Sciences graduates, the physicist must be able to:

- 2.4.1. Utilize theories of physics to interpret physical phenomena.
- 2.4.2. Apply appropriate physical principles to create and analyze system components.
- 2.4.3. Choose optimum solutions for physical problems based on analytical thinking.

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

III. Glossary

1. Institution

A University, faculty or higher institute providing education programs leading to a first university degree or a higher degree (Master's or Doctorate).

2. Graduates Attributes

Competencies expected from the graduates based on the acquired knowledge and skills gained upon completion of a particular program.

3. National Academic Reference Standards (NARS)

Reference points designed by NAQAAE to outline / describe the expected minimum knowledge and skills necessary to fulfill the requirements of a program of study.

4. Academic Standards

Reference points defined by an institution comprising the collective knowledge and skills to be gained by the graduates of a particular program. The academic standards should surpass the NARS, and be approved by NAQAAE.

5. Subject Benchmark Statements

Guideline statements that detail what can be expected of a graduates in terms of the learning outcomes to satisfy the standards set for the program. They enable the outcomes to be compared, reviewed and evaluated against agreed upon standards.

6. The Program

A set of educational courses and activities designed by the institution to determine the systematic learning progress. The program also imparts the intended competencies required for the award of an academic degree.

7. Intended Learning Outcomes (ILOs)

Subject-specific knowledge, understanding and skills intended by the institution to be gained by the learners completing a particular educational activity. The ILOs emphasize what is expected that learners will be able to do as a result of a learning activity.

8. Knowledge and Understanding

Knowledge is the intended information to be gained from an educational activity including facts, terms, theories and basic concepts. Understanding involves comprehending and

grasping the meaning or the underlying explanation of scientific objects.

9. Intellectual Skills

Learning and cognitive capabilities that involve critical thinking and creativity. These include application, analysis, synthesis and evaluation of information.

10. Professional and Practical Skills

Application of specialized knowledge, training and proficiency in a subject or field to attain successful career development and personal advancement.

11. General and Transferable Skills

Skills that are not subject-specific and commonly needed in education, employment, life-long learning and self development. These skills include communication, team work, numeracy, independent learning, interpersonal relationship, and problem solving... etc.

IV. References

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