



# Mawhiba Academic Enrichment Program

Introduction To the  
Enrichment Units

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## Mawhiba academic enrichment program

Mawhiba academic enrichment program is one of the most important global methods used to enrich the knowledge of gifted students. This program includes a scientific enrichment content representing 75% and a skill content representing 25% of the total weight of the program. From this standpoint, Mawhiba designed a variety of enrichment units to enrich and deepen students' knowledge and experiences and challenging their abilities in a number of scientific fields within four main tracks: engineering sciences, medical, biological and chemical sciences, physics, earth and space sciences, and computer sciences and applied mathematics in cooperation with the best international expert houses in the field of Giftedness and creativity, provided with progressive levels of knowledge; with the aim of continuing to build quality cumulative scientific experiences, which increase in depth and diversity as students' progress in participation year after year.

Due to the importance of the skill aspect, Mawhiba included in this program a set of skill packages that deal with building basic and important life skills for gifted students, and contribute to the development of personal, social, and innovative skills that keep pace with the skills of the twenty-first century, such as communication skills, leadership, critical and creative thinking, decision-making, problem-solving, digital security, and other skills.

## Physics between theory and application

### Stage: Excellence

### Path: Physics, Earth & Space Sciences

#### Unit description

This unit covers material ordinarily included in an algebra-based introductory physics unit. Topics covered include Newtonian mechanics, wave motion, optics, electricity and magnetism, and circuits. In labs, students learn to measure and analyze error; determine gravitational acceleration; and experiment with refraction and diffraction of light, waves, simple circuit analysis, and the magnetic deflection of electrons. The purpose of the unit is for students to learn physical laws, practice problem solving techniques, and acquire ability to communicate scientific results to a general audience.

#### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

- Leadership and social influence
- Creative thinking and innovation
- Values of citizenship and pride in the national personality
- emotional intelligence
- The initiative
- Overcoming challenges
- Decision making

#### Program components

- A specialized enrichment scientific unit.
- Practical activities and scientific projects.
- Skill activities.

#### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face) or in virtual classes (distance learning).

## Chemistry applications

### Stage: Excellence

### Path: Medical, Biological and Chemical Sciences

#### Unit description

From artificial sweeteners in diet soft drinks to batteries in electric cars, applications of chemistry are integral to our everyday lives. In this unit, students investigate topics in chemistry as a means to solving simulated real-world problems.

Students begin the unit with an exploration of the importance of water in their everyday lives. This introduces them to the periodic table, atomic structure, and chemical bonding. In the laboratory, students investigate solubility and test water samples to identify potential toxins. They also create and maintain daily logs of their water usage.

Similarly, students examine other topics such as the biochemistry of food and pharmaceuticals using real-life scenarios simulated in the classroom. For instance, students may conduct calorimetric experiments and prepare biodiesel in their investigation of alternative fuels or prepare aspirin during their exploration of the healing and toxic properties of pharmaceuticals.

This unit emphasizes learning concepts in a laboratory setting to demonstrate how chemistry affects our everyday lives. Students leave the unit better prepared for high school chemistry and with a greater understanding of how chemistry is used to improve the world around them.

#### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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#### Program components

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#### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face)

## Biomedical sciences

### Stage: Excellence

### Path: Medical, Biological and Chemical Sciences

#### Unit description

Why does our face turn red when we sweat? What does our appendix do? Is it true that your nose gets longer if you tell a lie? In the Introduction to the Biomedical Sciences, we will answer these questions and more. This unit is an introduction to human biology and the science of medicine. Drawing upon basic biological and chemical concepts, students explore the intricate anatomical and physiological mechanisms underlying normal human function. Students then investigate homeostatic imbalances that cause diseases. Lab work covers techniques in histology, anatomy and physiology (including dissections), and biochemistry. Additionally, students learn to read critically and respond to articles in scientific journals and the popular media.

Students learn how to ask scientific questions, hypothesize, and experiment in order to interpret biomedical phenomena. By the end of the unit, students acquire an understanding of major concepts in medicine and an enhanced ability to work in groups and individually to relate the structure of our bodies and their organs to their functions.

#### The skills that students will acquire

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#### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face)

## Principles of Engineering Design

### Stage: Excellence

### Path: Engineering science

#### Unit description

Students in this unit work primarily in teams to solve real-world and simulated problems in the field of engineering. Case studies of actual engineering projects are used to demonstrate principles of design. For example, students may analyze the failure of the O-ring on the space shuttle Challenger to investigate how components in a system function together and the significance of manufacturing tolerances. Alternatively, they may review the Tacoma Narrows Bridge collapse to understand how inadequate knowledge of materials and insufficient testing can lead to failure.

Student teams construct and test their own working models and prototypes, such as green buildings, amphibious vehicles, electrical circuits, or gliders. They learn the physics behind their designs, covering aspects of mechanics, electricity and magnetism, and fluids.

As a part of the engineering design process, students weigh economic and ethical considerations along with technological ones. Students submit written reports for review. They leave the class with a broader view of the field of engineering and a deeper understanding of the day-to-day work of engineers. Moreover, they leave with skills and knowledge they can apply to developing innovative solutions to real-world engineering challenges in their own lives and communities.

#### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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#### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face) or in virtual classes (distance learning).

## Electrical engineering

**Stage: excellence**

**Path: Engineering science**

### Unit description

The first transistor, created at Bell Laboratories in 1947, was about 4 cm in size. Today millions of transistors fit on a single computer processor chip about the size of a postage stamp. Innovations, such as the miniaturization of the transistor, are hallmarks of the exciting and challenging field of electrical engineering.

In this unit, students begin by learning the basics of current, voltage, resistance, energy, and magnetism. For instance, they map the electric field lines generated by an electric charge. They apply their conceptual understanding as they draw and construct series and parallel circuits, working with resistors, capacitors, inductors, diodes, and transistors.

Students study electromagnetism—one of the most important physical principles in modern electronics—and examine its applications to practical, everyday devices such as motors, lifting magnets, and stereo speakers. They construct breadboard models of similar devices using mathematical tools such as Ohm's Law and Kirchoff's Laws to guide their circuit designs.

Finally, students are exposed to cutting edge topics in the field, including the physics behind solar cells and solid-state electronics. Students leave the unit with a better understanding of electrical engineering and its many applications to everyday life.

### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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## Cryptology

**Stage: excellence**

**Path: Computer Science & Applied Mathematics**

### Unit description

Cryptology is the study of designing systems for encoding/decoding messages, as well as the study of cryptanalysis—the unauthorized decryption of a message. In this unit, students begin their journey with an introduction to many early manual techniques for creating and breaking ciphers such as cipher wheels, the Caesar shift, monoalphabetic substitution, and the Vigenère cipher. The students then move into more complicated manual encryption systems, such as the key grid systems of Playfair and ADFGVX, which conclude with the modular matrix-based system of the Hill cipher. They study the cipher machine Enigma and its historical significance before making their own paper Enigma machine simulators. They learn about modern digital encryption techniques, including RSA public key cryptography and El Gamal cryptosystems. Delving deeper into modern techniques, students explore how data stored and transmitted by computer can be secured with digital encryption. Discussions about the strengths and vulnerabilities of each encryption system enable students to attack and decrypt messages using techniques such as frequency analysis and cribbing. Students apply what they learn to encrypt and decrypt their own secret writing.

The historical context of cryptography and cryptographic devices is provided to further develop understanding of this branch of mathematics. By studying the inventors of cipher systems, students are able to understand the context for which necessity mandated new cipher systems to emerge. For example, students examine the design and fallibility of the German Enigma Machine, one of the most important cryptographic devices in history. The historical study of the cryptosystems students explore also helps them to develop ideas for how to make the current systems they study as strong as possible.

### The skills that students will acquire

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### How to implement the program

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## Mechanical Engineering

**Stage: excellence**

**Path: Engineering science**

### Unit description

In this unit, students are introduced to the broad field of mechanical engineering and its focus on the principles of motion, energy, and force. Students review and extend their understanding of physics and engineering principles through activities and experiments. Students learn about the engineering design process and put that knowledge into practice as they construct and test their own working models and prototypes, such as a self-propelled projective vehicle. After learning about stress, strain, and gear usage, students are challenged to design and build a prototype for an amusement park ride. Students are introduced to fluid mechanics and use what they learn to design and build a working water fountain.

Students write design proposals, create free-body diagrams, craft engineering drawings by hand, and use computer-aided design to create models from drawings. Throughout the unit, the lessons and activities are designed with the goal of providing students with a broader view of mechanical engineering and a deeper understanding of the day-to-day work of mechanical engineers.

### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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### Program components

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- Skill activities.

### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face)

## Biotechnology

### Stage: Excellence

### Path: Medical, Biological and Chemical Sciences

#### Unit description

The Human Genome Project has already sequenced all of the approximately 20,000 genes in human DNA. How did scientists gather this information? What opportunities does it provide for curing congenital diseases or cancer? What ethical questions does it pose in terms of privacy rights or reproduction? This unit introduces students to the biology, technology, and the potential of genetics.

Students first learn or review fundamental principles of cell biology and genetics, including mitosis, meiosis, and Mendelian inheritance. Next, they turn to the structure and function of DNA and RNA, sources and types of mutations, genetic biotechnology, and biotechnology applications. Lab work includes isolating the DNA molecule from common bacteria and splitting DNA sequences using restriction enzymes. Students also explore biotechnology careers, model and perform polymerase chain reaction (PCR), and conduct gel electrophoresis.

Students explore current research in biotechnology and use their new knowledge to deliberate on the significance of genetics in society and the future of genetic inquiry and technology.

#### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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## Renewable Energy

**Stage: Excellence**

**Path: Engineering science**

### Unit description

How can the world produce enough energy for a population predicted to hit nine billion people by 2040? Can we make a more efficient car without fossil fuels at the pump or the electricity source? Can we wean ourselves off fossil fuels and limit global warming? Are renewables the answers to all of these questions?

Renewable Energy is an introduction to renewable energy resources in a context of global energy production, consumption, and innovation. The unit draws from many fields of science (physics, engineering, earth and environmental science, biology, atmospheric science, and chemistry) as well as public policy, geopolitics, economics, and statistics. This unit examines the major types of renewable energy, including direct solar energy, indirect solar energy (wind energy, hydropower, wave energy, bioenergy, and tidal) and non-solar renewable energy (geothermal). It compares renewable energy to non-renewable energy sources (coal, oil, natural gas, and nuclear). Students study the energy system from cradle to grave to cradle, from inputs and source materials to generation, storage, distribution to consumption, waste, and broader impacts. Additional topics include electricity and transportation, environmental and economic implications, world energy consumption and production, climate change, and the future of energy.

### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face)

## Anatomy and Physiology

### Stage: Excellence

### Path: Medical, Biological and Chemical Sciences

#### Unit description

Anatomy and Physiology provides the foundations of the structure and function of the human body. The unit begins with an overview of regions of the human body. Students learn about each body system's structure and function. Each day focuses on one of the body systems including the skeletal, muscular, integumentary, circulatory, respiratory, immune, endocrine, reproductive, digestive, and excretory systems. Throughout each unit students perform lab experiments and hands on activities to have a strong understanding of the material.

#### The skills that students will acquire

Students will be able to build and develop basic skills, such as "teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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#### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face)

## Flight Science

### Stage: Excellence

### Path: Engineering science

### Unit description

From the sketches of Leonardo da Vinci to the expeditions of Amelia Earhart, humans have long struggled to unlock the mysteries of flight. In this unit, students study and explore the science, engineering, and design involved in the wonders of flight.

Students learn about the science behind the flight of gliders, balloons, airplanes, and rockets. Topics include buoyancy, kinematics, fluid flow, Newton's laws, and the four forces of aerodynamics: lift, weight, thrust, and drag. Students pay particular attention to the various lift theories and how the wing of an airplane generates lift. They design, construct, and test model aircraft. Students investigate the engineering process and how engineers make choices to meet the design goals for a particular aircraft, such as finding the best wing plan for a glider to fly the farthest distance or the best nose and wing design for a rocket to fly the highest height. They also explore orbital motion and rocket science. Students leave the unit with an understanding of the science that makes flight possible.

### The skills that students will acquire

Students will be able to build and develop basic skills, such as "teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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### Program components

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### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face)

## Cyber Security

### Stage: Excellence

### Path: Computer Science & Applied Mathematics

#### Unit description

Students in this unit will introduce to the most important basic concepts in cybersecurity and cryptography, nature of the security threats facing computer systems and how to protect them from intrusions, and students shall be introduced to functions related to this field.

Furthermore, students will learn how to use digital evidence and solve their information security problems using programming languages. Moreover, the focus of the science module shall increase to include case studies in the field of cybersecurity and cryptography, and building on the same for developing projects for groups of students.

#### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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#### Program components

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- Skill activities.

#### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face)

## Data Science & Artificial Intelligence

### Stage: Excellence

### Path: Computer Science & Applied Mathematics

#### Unit description

This unit focus on the relationship between artificial intelligence, data and computer science by studying basic concepts in programming, system implementation, machine learning and data processing on a large scale.

students shall learn how to design, manufacture, and evaluate smart systems through conducting scientific activities that train them to solve problems from experiments that occurred, and how to use computer science in dealing with data and understand the consequences that may result on society because of misuse. They will explore future jobs that suit them if they continue to study this field, they will explore concepts and algorithms through Python software.

At the end of the unit, students are expected to demonstrate experience in sources used in computer programs (Computer Library) associated with machine learning and knowledge of artificial intelligence principles, and that students shall be able to design their own simplified intelligent systems.

#### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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#### Program components

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- Practical activities and scientific projects.
- Skill activities.

#### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face)



## Actuarial and Financial Mathematics

**Stage: Excellence**

**Path: Computer Science & Applied Mathematics**

### Unit description

students shall learn the importance and origins of actuarial and financial mathematics, math operations on dates, periods, simple and compound interest, periodic payments, loans and depreciation of fixed assets, Evaluation of cash flow series, calculate probabilities using a life table, incorporation of uncertainty into the cash flow resulting from investment and death, simulation of uncertain cash flows, application of actuarial methods to life insurance and forecasting the expected average of human life, and how to use actuarial mathematics in financial resources, investments, banking and insurance.

### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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### How to implement the program

The program, with its scientific and skill components will be implemented in attendance (face to face).

## Geological Treasures

### Stage: Excellence

### Path: Physics, Earth & Space Sciences

#### Unit description

Students in this unit can review the mineral and rock resources in the Kingdom of Saudi Arabia in terms of knowing their types, uses, investing them and its impact in supporting the national economy and means of preserving and sustaining.

#### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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#### How to implement the program

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## Architecture and Creative Design

### Stage: Excellence

### Path: Engineering science

#### Unit description

The cornerstone of this program, which is presented as an enrichment unit, revolves around nurturing gifted students in the fields of creative design, architecture, urban planning, sustainability, and Saudi architectural heritage. The foundation of the program lies in creative design, which is the creation of a plan, system, or measurable human interaction such as architectural plans, engineering drawings, and other disciplines in commercial designs. The term design can represent different dimensions in various disciplines, whether it is the design of the final product or during the design process. Design encompasses various elements and principles that require consideration of functional needs alongside aesthetic details, in addition to social, economic, and environmental factors, whether for the final product or during the design process.

This program is designed to introduce gifted students to the fundamental concepts of design in the disciplines of urban planning, architecture, and interior design. It utilizes the principle of studio-based learning (SBL), which focuses on learning through practice by solving problems in an environment that simulates the design studio work in Saudi universities and designing real projects. The program emphasizes producing a final project that integrates disciplines by addressing a set of practical design problems in the Saudi city, the residential neighborhood, and then in designing the housing unit, concluding with the design of a living room unit in the housing over 3 weeks at a rate of 4 hours over 15 days.

This program serves as a gateway to provide students with the essential knowledge and skills in the specialization, while also allowing students to work in teams, in addition to getting to know other gifted students and collaborating with them to produce urban, architectural, and interior design projects. These will be showcased at the end of the program in a dedicated exhibition.

In addition to the scientific material, this unit aims to refine the skills of gifted students and assist them in achieving the following, in addition to the scientific content provided in the program:

- Understanding the fundamentals of urban planning, architecture, and interior design disciplines through learning by practice via studio-based learning (SBL).
- Understanding the design process and the different needs of the residential neighborhood, housing, and living room.
- Designing an integrated project for the user by producing the residential neighborhood unit, and the applied drawings for the housing and living room.
- Learning time management, teamwork, and self-development to achieve better products.

#### The skills that students will acquire

Students will be able to build and develop basic skills, such as “teamwork, problem solving, reading, and analyzing scientific literature, demonstrating understanding through oral and written communication, in addition to several targeted skills, which are provided through training packages appropriate to the age group, provided by Specialized and trained staff, including:

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#### How to implement the program

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Thank you

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