

# **SCIENCE CURRICULUM**

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## **I- INTRODUCTION**

The rapid expansion of science and technology in the present century makes the renovation of its teaching a necessity from the conceptual as well as the methodological point of view. From this perspective, the new international and global tendencies towards science teaching were the main inspiration during the preparation of the curriculum.

The science curriculum presents the main concepts in a global approach based on the understanding of the scientific principles and its relation to everyday's life in the domains of health, environment, technology and ethics.

The adopted pedagogical innovation favors the mastering of the scientific method, the technics of communication and the transfer of knowledge.

The curriculum defines conceptual objectives, technical and methodological that permits the establishing of a relationship between teaching and evaluation.

Several teaching approaches are favoured in the proposed curriculum and in particular that puts the learner in a research situation which helps in the construction of personal knowledge.

## **II- GENERAL OBJECTIVES**

Science plays an important role in our everyday life. It manifests itself in all aspects of human activity. Consequently, it is important that students become life long learners of science, starting with science at school but extending science learning beyond the school years.

To achieve the above, science teaching aims to realize the following general objectives:

- Develop the learners' intellectual and practical scientific skills.
- Deepen the learner's awareness in the ability of humans to understand, invent, and create.
- Understand the nature of science and technology, their development across history, and their impact on human thought.
- Insure that learners have acquired the facts, concepts, and principles necessary to understand natural phenomena.
- Motivate students to apply basic scientific principles in all sciences.
- Explain the scientific concepts and principles behind commonly used machines and devices
- Acquire knowledge about health, environment, and safety practices and behave accordingly.
- Realize that some natural resources can be depleted and make the learner aware of the role of science in sustaining these resources.
- Encourage learners to use scientific knowledge and skills in novel situations especially in everyday life.

- Emphasize the role of scientists in the advancement of human kind.
- Encourage learners to be open to the ideas of scientists from different cultures and to their contributions in the advancement of science.
- Encourage learners to abide by such scientific values as honesty and objectivity.
- Develop the learners' scientific curiosity and orientation toward scientific research.
- Encourage learners to work independently and cooperatively in solving scientific problems.
- Make the learners aware of career possibilities in different science related areas.

### III- TABLE OF DISTRIBUTION OF PERIODS PER WEEK/YEAR

#### BASIC EDUCATION

	Elementary Level					
	FIRST CYCLE			SECOND CYCLE		
Year	First	Second	Third	Fourth	Fifth	Sixth
Number of periods per week	2	2	3	4	4	5
Number of periods per year	60	60	90	120	120	150

	<b>Intermediate Level</b>								
Year	<b>Seventh</b>			<b>Eighth</b>			<b>Ninth</b>		
Subject	<b>Physics</b>	<b>Chemistry</b>	<b>Life and Earth Sciences</b>	<b>Physics</b>	<b>Chemistry</b>	<b>Life and Earth Sciences</b>	<b>Physics</b>	<b>Chemistry</b>	<b>Life and Earth Sciences</b>
Number of periods per week	1 1/2	1 1/2	3	2	2	2	2	2	2
Number of periods per year	45	45	90	60	60	60	60	60	60

### **SECONDARY EDUCATION**

Year	<b>SECONDARY FIRST</b>			<b>SECONDARY SECOND</b>			
Section				<b>Humanities</b>		<b>Sciences</b>	
Subject	<b>Physics</b>	<b>Chemistry</b>	<b>Life Science</b>	<b>Scientific Literacy</b>	<b>Physics</b>	<b>Chemistry</b>	<b>Life Science</b>
Number of periods per week	3	2	2	3	5	3	2
Number of periods per year	90	60	60	90	150	90	60

Year	<b>SECONDARY THIRD</b>							
Section	<b>Literature and Humanities</b>	<b>Sociology and Economics</b>		<b>General Science</b>			<b>Life Sciences</b>	
Subject	<b>Scientific Literacy</b>	<b>Scientific Literacy</b>	<b>Physics</b>	<b>Chemistry</b>	<b>Life Science</b>	<b>Physics</b>	<b>Chemistry</b>	<b>Life Science</b>
Number of periods per week	3	4	7	4	-	5	5	6
Number of periods per year	90	120	210	120	-	150	150	180

## BASIC EDUCATION

### SCOPE AND SEQUENCE

#### Elementary Level

First Cycle			
Theme	Year One	Year Two	Year Three
<b>Plants and their habitats</b>	<ul style="list-style-type: none"> <li>- Growth and needs of plants.</li> </ul>	<ul style="list-style-type: none"> <li>- Parts of a garden.</li> <li>- Seasonal plants.</li> </ul>	<ul style="list-style-type: none"> <li>- Parts of a plant Forest, desert and sea plants.</li> </ul>
<b>Animals and their habitats</b>	<ul style="list-style-type: none"> <li>- Growth and needs of animals.</li> </ul>	<ul style="list-style-type: none"> <li>- Similarity, variation and difference in animals.</li> </ul>	<ul style="list-style-type: none"> <li>- Forest, desert and sea animals.</li> <li>- Sea pollution.</li> </ul>
<b>Man and his health</b>	<ul style="list-style-type: none"> <li>- Growth and needs of children.</li> <li>- Senses.</li> <li>- Keeping clean.</li> </ul>	<ul style="list-style-type: none"> <li>- Body movements.</li> <li>- Food groups.</li> <li>- Clean vegetables and fruits.</li> </ul>	<ul style="list-style-type: none"> <li>- General functions in human body.</li> <li>- Body protection.</li> </ul>
<b>Man and the environment</b>	<ul style="list-style-type: none"> <li>- Included in the other themes.</li> </ul>	<ul style="list-style-type: none"> <li>- Included in the other themes.</li> </ul>	<ul style="list-style-type: none"> <li>- Included in the other themes.</li> </ul>
<b>Matter and Energy</b>	<ul style="list-style-type: none"> <li>- The sun.</li> <li>- Clouds.</li> <li>- Air Water.</li> </ul>	<ul style="list-style-type: none"> <li>- Nonliving things.</li> <li>- Water cycle.</li> <li>- States of water.</li> </ul>	<ul style="list-style-type: none"> <li>- Heat sources.</li> <li>- Properties of states of matter.</li> <li>- Force concept.</li> </ul>
<b>Earth and the Universe</b>	<ul style="list-style-type: none"> <li>- Day and night.</li> <li>- The four seasons.</li> </ul>	<ul style="list-style-type: none"> <li>- Apparent movements of sun.</li> <li>- Movement of shadows.</li> <li>- Times of day.</li> </ul>	<ul style="list-style-type: none"> <li>- Phases of moon.</li> <li>- Temperature.</li> <li>- Breakdown of rocks.</li> </ul>

<b>Second Cycle</b>			
<b>Theme</b>	<b>Year Four</b>	<b>Year Five</b>	<b>Year Six</b>
<b>Plants and their habitats</b>	<ul style="list-style-type: none"> <li>- Fresh water habitat and its plants.</li> <li>- Classification of plants.</li> </ul>	<ul style="list-style-type: none"> <li>- Nutrition in plants Photosynthesis.</li> </ul>	<ul style="list-style-type: none"> <li>- Plant cell.</li> <li>- Reproduction in plant, Role of man.</li> </ul>
<b>Animals and their habitats</b>	<ul style="list-style-type: none"> <li>- Fresh water habitat and its plants.</li> <li>- Classification of plants.</li> </ul>	<ul style="list-style-type: none"> <li>- Nutrition in animals.</li> <li>- Adaptation and behavior.</li> <li>- Food chain.</li> </ul>	<ul style="list-style-type: none"> <li>- Animal cell.</li> <li>- Reproduction in animals, Role of man.</li> </ul>
<b>Man and his health</b>	<ul style="list-style-type: none"> <li>- Support and movement systems.</li> <li>- Food pyramid.</li> </ul>	<ul style="list-style-type: none"> <li>- Nutrients.</li> <li>- Digestive, respiratory, circulatory systems.</li> <li>- Protection from disease.</li> </ul>	<ul style="list-style-type: none"> <li>- Body structure.</li> <li>- Nervous and excretory systems.</li> <li>- Effects of smoking, etc.</li> </ul>
<b>Man and the environment</b>	<ul style="list-style-type: none"> <li>- Included in the other themes.</li> </ul>	<ul style="list-style-type: none"> <li>- Included in the other themes.</li> </ul>	<ul style="list-style-type: none"> <li>- Interaction between man and environment.</li> <li>- Pollution.</li> <li>- Insecticides.</li> </ul>
<b>Matter and Energy</b>	<ul style="list-style-type: none"> <li>- Properties of matter.</li> <li>- Mixture.</li> <li>- Magnets.</li> <li>- Electricity.</li> <li>- Sound.</li> </ul>	<ul style="list-style-type: none"> <li>- Propagation of light.</li> <li>- Flow of electricity.</li> <li>- Electric circuits.</li> <li>- Chemical substances.</li> </ul>	<ul style="list-style-type: none"> <li>- Chemical reaction.</li> <li>- Simple machines.</li> <li>- Energy.</li> <li>- Sustainable development.</li> </ul>
<b>Earth and the Universe</b>	<ul style="list-style-type: none"> <li>- Soil .</li> <li>- Formation of soil.</li> <li>- Clay.</li> <li>- Rocks.</li> <li>- Fossils.</li> </ul>	<ul style="list-style-type: none"> <li>- Solar system.</li> <li>- Spheres of the earth.</li> <li>- Atmospheric pressure.</li> </ul>	<ul style="list-style-type: none"> <li>- Earth movements.</li> <li>- Consequences.</li> <li>- Rotation of moon.</li> <li>- Satellites.</li> </ul>

## Intermediate Level

### LIFE AND EARTH SCIENCES

Theme	Grade Seven	Grade Eight	Grade Nine
<b>Nutrition</b>	<ul style="list-style-type: none"> <li>- Feeding behavior of animals.</li> <li>- Nutritional needs of plants.</li> <li>- Respiration in living things.</li> <li>- Relations between environmental conditions, body activities, and nutrition.</li> <li>- Nutrition and respiration: vital requirements.</li> </ul>		<ul style="list-style-type: none"> <li>- Digestion</li> <li>- Respiration</li> <li>- Blood circulation</li> <li>- Utilization of nutrients and of oxygen.</li> <li>- Urinary function</li> <li>- Nutrition and health</li> </ul>
<b>Reproduction and genetics</b>	<ul style="list-style-type: none"> <li>- Animal reproduction.</li> <li>- Plant reproduction.</li> </ul>	<ul style="list-style-type: none"> <li>- Puberty and adolescence.</li> <li>- Reproductive organs.</li> <li>- Functioning of the reproductive system.</li> <li>- Fertilization, development, and birth</li> <li>- Birth control.</li> <li>- Sexually transmitted diseases: AIDS.</li> </ul>	<ul style="list-style-type: none"> <li>- Chromosomes and genetic information</li> <li>- Mitosis</li> <li>- Meiosis and gene assortment Mendel's work</li> <li>- Production of useful substances for food industry and medicine by genetic engineering.</li> </ul>
<b>Inter-relationships between living things</b>	<ul style="list-style-type: none"> <li>- Study of an ecosystem.</li> <li>- Relations between organisms in ecosystems.</li> <li>- Food web in an ecosystem.</li> <li>- Man and natural equilibrium.</li> </ul>		

## LIFE AND EARTH SCIENCES

Theme	Grade Seven	Grade Eight	Grade Nine
<b>Immunology</b>		<ul style="list-style-type: none"> <li>– Immunological specificity.</li> <li>– Deficiency and disorder of the immune system.</li> <li>– Preventive and curative methods.</li> </ul>	
<b>Earth and the environment</b>		<ul style="list-style-type: none"> <li>– Geology: earth science.</li> <li>– Manifestations of earth activities.</li> <li>– Structure and dynamics of the earth.</li> <li>– Circulation of matter on earth.</li> <li>– Geology and human responsibilities.</li> </ul>	
<b>Nervous coordination and human behavior</b>			<ul style="list-style-type: none"> <li>– Nervous coordination and human behavior.</li> <li>– Response of organisms to environmental stimuli.</li> <li>– Tactile sensation.</li> <li>– Substance abuse.</li> </ul>

## CHEMISTRY

Theme	Grade Seven	Grade Eight	Grade Nine
<b>Classification and Constituents of Matter</b>	<p><b>Matter: Classification and Separation Techniques</b></p> <ul style="list-style-type: none"> <li>- Classification of matter</li> <li>- Separation techniques</li> <li>- Environmental applications</li> </ul> <p><b>Solutions, Suspensions, and Colloids</b></p> <ul style="list-style-type: none"> <li>- Solutions</li> <li>- Suspensions and Colloids</li> <li>- Environmental applications</li> </ul>	<p><b>Pure Substances</b></p> <ul style="list-style-type: none"> <li>- Elements</li> <li>- Compounds</li> <li>- Atoms, Molecules and Ions</li> <li>- Symbols and Formulas</li> <li>- Allotropes: diamond and graphite</li> </ul>	<p><b>The Atom</b></p> <ul style="list-style-type: none"> <li>- Structure of the atom</li> <li>- The Mole concept</li> <li>- Periodic table</li> </ul>
<b>Chemical Reactions and Energy</b>	<p><b>Chemical Reactions</b></p> <ul style="list-style-type: none"> <li>- Reactants and Products</li> <li>- Conservation of matter</li> <li>- Energy and chemical reactions</li> <li>- Combustion as one type of chemical reaction</li> </ul>	<p><b>Electrical Nature of Matter</b></p> <ul style="list-style-type: none"> <li>- Electrification</li> <li>- Electric discharge</li> <li>- Conductors and Insulators</li> <li>- Electricity and Safety</li> </ul> <p><b>Chemical Reactions</b></p> <ul style="list-style-type: none"> <li>- Chemical equations</li> <li>- Types of chemical reactions</li> <li>- Rate of chemical reactions</li> </ul> <p><b>Acids, Bases and Salts</b></p> <ul style="list-style-type: none"> <li>- Acidic and basic solutions</li> <li>- Acidity: Concept of pH</li> <li>- Salts</li> <li>- Applications</li> </ul>	<p><b>Chemical Bonding</b></p> <ul style="list-style-type: none"> <li>- Stability of inert gases</li> <li>- Formation of a chemical bond</li> <li>- Electron-dot symbols</li> <li>- Covalent bond</li> <li>- Ionic bond</li> </ul> <p><b>Electrochemistry</b></p> <ul style="list-style-type: none"> <li>- Electric energy from chemical reactions</li> <li>- Using electric energy to produce chemical reactions</li> <li>- Oxidation - Reduction reactions</li> </ul>

## CHEMISTRY

Theme	Grade Seven	Grade Eight	Grade Nine
<b>Organic Chemistry</b>			<b>Organic Chemistry</b> <ul style="list-style-type: none"><li>- Hydrocarbons</li><li>- Petroleum, Natural Gas and Coal</li><li>- Esterification and Saponification</li><li>- Synthetic materials</li></ul>
<b>Environment</b>			<b>Chemistry and Environment</b> <ul style="list-style-type: none"><li>- Pollution of air, water, and soil</li><li>- Addressing pollution problems</li></ul>

## PHYSICS

Theme	Grade Seven	Grade Eight	Grade Nine
<b>Matter</b>	<ul style="list-style-type: none"> <li>- Solid and liquid states</li> <li>- Gaseous state</li> <li>- Structure of matter</li> <li>- Change of state and expansion</li> </ul>		
<b>Mechanics</b>		<ul style="list-style-type: none"> <li>- Motion and speed.</li> <li>- Force: effects and classification.</li> <li>- Work, power and forms of energy.</li> </ul>	<ul style="list-style-type: none"> <li>- Equilibrium of a body under the action of two forces. Hooke's law.</li> <li>- Pressure in liquids.</li> <li>- Archimedes' principle.</li> </ul>
<b>Electricity</b>	<ul style="list-style-type: none"> <li>- Circuit</li> <li>- Measurement of current and potential difference.</li> <li>- Grouping of lamps</li> <li>- Magnets and coils</li> </ul>		<ul style="list-style-type: none"> <li>- Alternating current</li> <li>- Ohm's law and grouping of resistors</li> <li>- Power and energy</li> </ul>
<b>Heat</b>			<ul style="list-style-type: none"> <li>- Quantity of heat and transfer of heat.</li> <li>- Thermal equilibrium.</li> </ul>
<b>Waves</b>		<ul style="list-style-type: none"> <li>- Characteristics of waves - Sound waves.</li> <li>- Electromagnetic waves and colors.</li> </ul>	
<b>Optics</b>		<ul style="list-style-type: none"> <li>- Rectilinear propagation of light.</li> <li>- Reflection of light and plane mirror.</li> </ul>	<ul style="list-style-type: none"> <li>- Refraction of light.</li> <li>- Lenses and eye.</li> </ul>

## SCIENCE CURRICULUM - ELEMENTARY LEVEL

### INTRODUCTION

The Science Curriculum at the elementary school level contains basic concepts in science education, health and environmental education, and some aspects of sustainable development of local resources. The curriculum also emphasizes mental and manual science skills, values, and attitudes. It aims at bridging the gap between children's science knowledge and their daily conduct, thus making science more relevant to their life in the 21st century and to their aspirations for further education. The topics of the curriculum fall within six themes in all the grades : **plants and their habitats - animals and their habitats - man and his health - matter and energy - the earth and the universe - man and the environment.**

The content and objectives of the science curriculum for the elementary level were innovated in accordance with contemporary developments in science-technology-society and the new outlook in educational development in Lebanon. Besides that, the items were selected and organized using the criteria of interdependence, balance, sequence, and comprehensiveness. Thus, the curriculum would tend to the abilities, needs, and interests of the students.

A science curriculum is an integrated system of content, objectives, instruction, and evaluation. The basic approach in the present curriculum is to involve students actively in the learning process. This requires, in turn, an optimum balance between theoretical presentation of knowledge and practical science activities within and outside the classroom. In addition, modern individual and cooperative learning methods, the use of educational technology facilities, and coordination of science with other subject matter areas, particularly during the first cycle in the elementary school, are recommended.

The instructional objectives for the first and second cycles were stated in terms of the well known taxonomy of educational objectives. Thus, the cognitive achievement of students could be measured by objective tests. In other words, behavioral objectives could help students to recognize what is required of them in examinations.

The achievement of mental scientific skills by students is usually measured by objective tests. However, the acquisition of manual skills, values, and attitudes are normally evaluated by observation of student behavior over an extended period of time and follow up.

## **ELEMENTARY LEVEL - FIRST CYCLE**

### **OBJECTIVES**

At the end of the first cycle, students are expected to be able to:

- Recognize the various aspects of growth and development in plants, animals, and children.
- Describe some natural habitats and the specific living organisms in them.
- Name the senses, their organs and functions, and mention the general functions of the human body.
- Classify animals and the food we eat into suitable groups.
- Observe animals, plants, and phenomena in the environment, and arrive at proper inferences based on observation and experience.
- Communicate orally, in writing, and by symbols.
- Acquire proper health and environmental personal habits.
- Name sources of heat energy, relate changes of state to heat, and infer the effects of force on objects.
- Measure length, temperature, and time by suitable devices.
- Carry out guided simple experiments and practice problem solving within the context of what is studied.
- Develop self-confidence through individual activities, exploring environment, and beginning to understand the organization of human body.
- Develop cooperation, respect, and positive interaction with others through team learning.
- Orient their inherent curiosity into interesting science activities.

## ELEMENTARY LEVEL - FIRST CYCLE

CONTENTS	
First Year	
<p><b>1- Plants and their Habitats</b></p> <ul style="list-style-type: none"><li>1.1 Plants in the children's environment.</li><li>1.2 Germination of seeds.</li><li>1.3 Growth of plants and their needs.</li><li>1.4 Protection of plants.</li></ul> <p><b>2- Animals and their Habitats</b></p> <ul style="list-style-type: none"><li>2.1 Animals in the children's environment.</li><li>2.2 Places where animals live.</li><li>2.3 Growth of animals and their needs.</li><li>2.4 Care of domestic animals.</li></ul> <p><b>3- Man and his Health</b></p> <ul style="list-style-type: none"><li>3.1 Growth and needs of children.</li><li>3.2 The senses: organs, functions, and importance.</li><li>3.3 Protection of sense organs.</li><li>3.4 Personal cleanliness, dental care.</li></ul>	<p><b>4- Matter and Energy</b></p> <ul style="list-style-type: none"><li>4.1 Importance of the sun for the Earth.</li><li>4.2 Effect of clouds on sunlight.</li><li>4.3 Role of air in moving objects.</li><li>4.4 Role of water in moving objects.</li></ul> <p><b>5- The Earth and the Universe</b></p> <ul style="list-style-type: none"><li>5.1 Concept of daylight.</li><li>5.2 Concept of night.</li><li>5.3 Concept of day.</li><li>5.4 The four seasons and their features.</li></ul>

**ELEMENTARY LEVEL - FIRST CYCLE**

<b>CONTENTS</b>	
<b>Second Year</b>	
<p><b>1- Plants and their Habitats</b></p> <ul style="list-style-type: none"><li>1.1 The garden and its components : an organized habitat.</li><li>1.2 Taking care of a garden.</li><li>1.3 Seasonal plants (a simple notion).</li><li>1.4 Role of greenhouses.</li></ul> <p><b>2- Animals and their Habitats</b></p> <ul style="list-style-type: none"><li>2.1 Similarity, difference, and variation among animals.</li><li>2.2 External features of mammals, birds, reptiles, frogs and fish.</li><li>2.3 Respiration in some animals.</li><li>2.4 Benefits of some animals.</li></ul> <p><b>3- Man and his Health</b></p> <ul style="list-style-type: none"><li>3.1 Principal parts of the human body.</li><li>3.2 Our body movements.</li><li>3.3 Care of eyes, hands, and mouth.</li><li>3.4 Food groups: their sources and importance.</li><li>3.5 Examples of traditional Lebanese cuisine.</li><li>3.6 Natural food and industrialized food.</li><li>3.7 Clean vegetables and fruits.</li></ul>	<p><b>4- Matter and Energy</b></p> <ul style="list-style-type: none"><li>4.1 Examples of nonliving things: sand, clay, pebbles, water, etc.</li><li>4.2 Properties of sand and clay in water.</li><li>4.3 Water cycle in nature (a simple notion).</li><li>4.4 The states of matter.</li><li>4.5 Role of push and pull in moving objects.</li></ul> <p><b>5- The Earth and the Universe</b></p> <ul style="list-style-type: none"><li>5.1 Apparent movement of the sun.</li><li>5.2 Movement of shadows during daylight and in relation to the sun.</li><li>5.3 Determining time: periods of daytime.</li><li>5.4 Reading the time on a clock.</li></ul>

## ELEMENTARY LEVEL - FIRST CYCLE

CONTENTS	
Third Year	
<p><b>1- Plants and their Habitats</b></p> <ul style="list-style-type: none"><li>1.1 Principal parts of a green plant.</li><li>1.2 Basic components of a habitat.</li><li>1.3 Examples of natural habitats: the forest, the desert, the sea.</li><li>1.4 Plants which grow in the forest, in the desert, in the sea.</li></ul> <p><b>2- Animals and their Habitats</b></p> <ul style="list-style-type: none"><li>2.1 The forest, the desert, the sea: natural habitats for animals.</li><li>2.2 Animals which live in the forest, in the desert, in the sea.</li><li>2.3 Sea pollution and its effect on food resources.</li><li>2.4 Children's responsibility in protecting the environment from pollution.</li></ul> <p><b>3- Man and his Health</b></p> <ul style="list-style-type: none"><li>3.1 General functions in the human body.</li><li>3.2 General notion of the systems which carry out these functions.</li><li>3.3 Basic factors of healthy growth and development.</li><li>3.4 Protecting the body to keep healthy.</li><li>3.5 Protection from accidents, first aid.</li></ul>	<p><b>4- Matter and Energy</b></p> <ul style="list-style-type: none"><li>4.1 Sources of heat.</li><li>4.2 Heat and its relation to changes of state.</li><li>4.3 Principal properties of solids, liquids, and gases.</li><li>4.4 Capacity of liquids.</li><li>4.5 Transfer of heat between hot and cold bodies.</li><li>4.6 Temperature.</li><li>4.7 Devices for moving objects easily.</li><li>4.8 Concept of force: pulling, pushing, raising objects.</li><li>4.9 Magnets and the movement of some bodies.</li></ul> <p><b>5- Earth and the Universe</b></p> <ul style="list-style-type: none"><li>5.1 Sources of the moonlight.</li><li>5.2 Phases of the moon.</li><li>5.3 The lunar month.</li><li>5.4 Temperature and its relation to weather.</li><li>5.5 Formation of winds.</li><li>5.6 Weather observation instruments, weather forecast.</li><li>5.7 Erosion of rocks: role of moving water.</li></ul>

## ELEMENTARY LEVEL - SECOND CYCLE

### OBJECTIVES

At the end of the second cycle, students are expected to be able to:

- Identify the principal groups of living organisms and their nutrition modes, and distinguish their reproduction patterns.
- Recognize the various systems in the human body, name the organs, explain their functions and activities, and describe nutrients and state their importance.
- Infer the role of cells in living organisms.
- Describe and apply some ways of protection from diseases, and precaution from accidents.
- Name the components of a natural habitat and state the characteristics of fresh water habitats, and describe man-environment interaction.
- Give a simple description of the water cycle, the oxygen cycle, the carbon cycle, and state the importance of each one.
- Name the various forms of energy, describe transformations and uses of energy in everyday life, and also describe propagation of sound and light, and the flow of electricity and heat.
- Name simple machines and explain their characteristics and everyday uses.
- Identify the solar system and its members and define the movements of the earth.
- Explain, with simple examples, the relation of science to industry and agriculture, and summarize the importance of sustainable development of resources and energy in Lebanon.
- Give examples of chemical reaction between familiar substances.
- Identify some survey, measurement, and information recording instruments.
- Carry out observations by using devices and instruments, and do scientific classification on the basis of one or two criteria.
- Carry out experiments and explain their results, plan experiments and control the variables, state expectations of what will happen in an experiment or in nature and compare them with the actual results.
- Develop a sense of beauty by observing the beauty and order in nature.
- Interact positively with the family and society by taking responsibility to keep oneself healthy and to protect the environment.
- Develop objectivity, honesty, and persistence in science activities.
- Develop science interests and a desire for excellence.

## ELEMENTARY LEVEL - SECOND CYCLE

CONTENTS	
Fourth Year	
<b>1- Plants and their Habitats</b>	<b>4- Matter and Energy</b>
1.1 Common wild plants in Lebanon	4.1 Examples of matter
1.2 Freshwater habitats	4.2 Properties of matter
1.3 Plants which grow in freshwater on the banks	4.3 Measurement of mass
1.4 Flowering plants	4.4 Mixtures and water solutions
1.5 The conifers : cedar, pine, and cyprus	4.5 Magnets: shapes, attraction and repulsion
1.6 Non flowering plants : mushrooms	4.6 Electric charges: production by friction, attraction and repulsion
1.7 Principles of plant classification	4.7 Sound and some of its properties.
1.8 Role of plants in the conservation of topsoil	4.8 Propagation of sound
1.9 Pollution of freshwater and its consequences.	4.9 How we hear
	4.10 Effect of noise on our health.
<b>2- Animals and their Habitats</b>	<b>5- The Earth and the Universe</b>
2.1 Wild animals in Lebanon	5.1 Soil and its kinds
2.2 Freshwater animals	5.2 Clay and its uses in crafts.
2.3 Vertebrates	5.3 Factors which cause soil erosion.
2.4 Non-vertebrates	5.4 Sandstone and limestone.
2.5 Principles of animal classification	5.5 Fossils in sandstone and limestone.
2.6 Social insects: bees and ants.	5.6 Breakdown of rocks and formation of soil.
	5.7 Formation of subterranean water reservoirs.
<b>3- Man and His Health</b>	
3.1 Support and movement systems : skeleton and muscles.	
3.2 Care and safety of the skeletal and muscular systems.	
3.3 Food pyramid, maintaining a balanced die.	
3.4 Malnutrition and its consequences.	

## ELEMENTARY LEVEL - SECOND CYCLE

CONTENTS	
Fifth Year	
<b>1- Plants and their habitats</b>	<b>4- Matter and Energy</b>
1.1 Patterns of nutrition in plants.	4.1 Sources of light.
1.2 Needs of green plants for producing food materials for growth and reproduction.	4.2 Solar spectrum, the colors.
1.3 Photosynthesis (a simple notion).	4.3 Passage of light through media.
1.4 Respiration in plants.	4.4 Propagation of light, reflection, refraction.
1.5 Oxygen and carbon cycles in nature (a simple notion).	4.5 How we see. Safety precautions.
1.6 Benefits of plants to man.	4.6 The electric battery, the electric current.
1.7 Adaptation of plants to their habitats.	4.7 Flow of electric current through various bodies.
<b>2- Animals and their Habitats</b>	4.8 Components of a simple electric circuit.
2.1 Patterns of nutrition among animals.	4.9 Series and parallel circuits.
2.2 Decomposers and their role in nature.	4.10 Light and magnets from electric current.
2.3 The food chain in a habitat.	4.11 Protection from electric currents.
2.4 Adaptation and behavior among animals.	4.12 The air: components, pollution.
<b>3- Man and his Health</b>	4.13 Composition of water and a notion about elements and compounds.
3.1 Nutrients: kinds, sources, functions.	<b>5- The Earth and the Universe</b>
3.2 Role of water in the human body.	5.1 The solar system and its members.
3.3 Digestive, respiratory, circulatory systems and their functions.	5.2 The Earth and its spheres.
3.4 Protection of these systems, immunization.	5.3 Atmospheric pressure: the barometer.
3.5 Food safety, food preservation, role of food technology.	5.4 Factors which modify the surface of the Earth.
3.6 System of information on the labels of manufactured food.	5.5 The water cycle and its relation to weather.

## ELEMENTARY LEVEL - SECOND CYCLE

CONTENTS	
Sixth Year	
<b>1- Plants and their habitats</b>	
1.1 Structure of green plants: plant cell, transport tubes.	
1.2 Parts of a complete flower.	
1.3 Sexual reproduction in flowering plants.	
1.4 Vegetative reproduction and its importance in agriculture.	
1.5 Man's role in the reproduction and hybridization of plants.	
<b>2- Animals and their Habitats</b>	
2.1 The animal cell.	
2.2 Reproduction in animals and aspects of adaptation.	
2.3 Man's role in the reproduction and hybridization of animals.	
2.4 Interdependence of plants and animals in a habitat.	
<b>3- Man and his Health</b>	
3.1 Structure of human body: cells, tissues, organs, systems.	
3.2 Nervous system, the skin and the urinary system.	
3.3 Start of human body maturity.	
3.4 The human body: a coordinated system.	
3.5 Benefits of medical technology.	
3.6 Effects of smoking, alcohol, and narcotics on our health.	
<b>4- Man and Environment</b>	
4.1 Definition of natural environment and its components.	
4.2 Interaction between man and environment.	
4.3 Importance of natural reservation parks.	
	4.4 Sustainable development of resources in Lebanon (a simple notion)
	4.5 Insecticides and their effect on the environment.
	4.6 Various aspects of pollution in Lebanon and its consequences.
	<b>5- Matter and Energy</b>
	5.1 Familiar chemical compounds: acids, bases, salts.
	5.2 Chemical reactions between familiar substances.
	5.3 Law of conservation of mass in chemical reactions.
	5.4 Weight and its measurement.
	5.5 Simple machines and their uses.
	5.6 Some compound machines.
	5.7 Work and power.
	5.8 Technical instruction sheets.
	5.9 Information recording and preservation equipment.
	5.10 Energy: forms, transformations, importance.
	5.11 Rules of safety and maintenance in the use of machines.
	5.12 Sustainable development of energy sources (a simple notion).
	<b>6- The Earth and the Universe</b>
	6.1 Movements of the earth around the sun.
	6.2 Consequences of the movements of the earth.
	6.3 Movement of the moon around the earth and its consequences.
	6.4 Satellites and space ships.

## **LIFE AND EARTH SCIENCES CURRICULUM - INTERMEDIATE LEVEL**

### **INTRODUCTION**

The beginning of the twenty first century witnesses a considerable progress in science and technology, as well as, their applications to man's service. This progress, thus, requires the necessity of a new orientation of teaching in response to the needs of the contemporary world. For this reason, a curriculum of clearly defined objectives, updated knowledge, new teaching methods and approaches, and varied evaluation techniques, is a primary concern of education.

The program tends to establish a relationship between technology and society with which the student has strong ties. Moreover, the program deals with a global perspective about health and the environment. This helps the student to maintain his health and the health of others, to develop a responsible behavior towards the environment, and to comprehend scientific messages transmitted by media.

By focusing on teaching scientific processes, the student becomes an active participant in a problem situation. Further, it allows the learner to acquire skills of: scientific reasoning, communication, observation and experimentation techniques, and transferring prior knowledge to new situations.

The curriculum clearly defines methodological, technical, and cognitive objectives. The latter, is selected and developed according to a vertical and a progressive coherence. The focus is on considering the students' background in order to meet their needs. The use of different approaches encourages them to construct their knowledge themselves. In this perspective, it is emphasized that evaluation must not be limited to recalled information but should also assess the skills required to be achieved.

The curriculum fosters the development of autonomy and responsibility of personal behavior in learners that are characteristics of a free citizen.

## OBJECTIVES

The actual progress of biology and its fundamental knowledge, as well as, the technology of life, and their applications for man's service requires a new orientation of teaching at the intermediate level to cope with the contemporary world requirements. Such teaching should:

- Reinforce and complete what has been acquired previously at the primary level.
- Provide students with a scientific culture necessary to help them in continuing their studies at the secondary level, or to be vocationally oriented.
- Permit students to acquire scientific processes, specifically by developing an experimental approach and problem solving activities.
- Develop in students a scientific attitude and motivate them to acquire a better autonomy.
- Encourage students to appreciate the role of empirical proofs and models in science as well as to consider and accept uncertainties of explanations and interpretations related to the observed phenomena.
- Permit students to conduct scientific messages; make scientific arguments; master the techniques of observation, experimentation, and analysis; and acquire scientific accuracy and critical thinking.
- Develop a sensibility towards bioethical issues.
- Initiate in students progressively and continually a scientific knowledge, technical performances and actual research in science and technology.
- Permit students to have tolerance and intellectual honesty while dealing with social, cultural, and environmental problems of the contemporary world.
- Permit the student to identify integrated domains within different disciplines and be able to transfer them to different fields.
- Allow the students to acquire a package of scientific knowledge necessary for the comprehension of the contemporary world and its changes with respect to life and environmental resources. This knowledge corresponds to fundamental notions emerging from biological and geological concepts covered at the intermediate level: behavior, nutrition and metabolism, biological renewal, reproduction and genetics, interdependence of living things, and dynamics of the earth.
- Foster in students the understanding of the most common manifestations of the human functioning and adopting a behavioral attitude towards hygiene and prevention according to acquired knowledge.
- Allow the student to identify the essential biological, physical, and geological components of the environment and to understand their relations that initiate the development of an open and a responsible behavior toward environmental problems: management of media and resources, preservation of species, and risk prevention.
- Make the student aware of the organization of the living world, its unity and diversity.

## INTERMEDIATE LEVEL- LIFE AND EARTH SCIENCES

CONTENTS	
Grade Seven	
<b>1- Nutrition</b>	
This part deals with the behavioral aspects of animals related to how they recognize, obtain and consume their food.	
The study about food consumption is limited to the transformation of food into nutrients that can be utilized by the organism.	
The organic matter produced by chlorophyllic plants or consumed by non-chlorophyllic plants and animals is used for body construction.	
The study of transfer of matter between the producers, consumers and decomposers will be the first entry to provoke the students' sensibilities toward the environment.	
<b>1.1 Feeding behavior of animals</b>	
<ul style="list-style-type: none"><li>- Means of obtaining food in animals.</li><li>- Capturing, and digesting food.</li></ul>	
<b>1.2 Nutritional needs of plants</b>	
<ul style="list-style-type: none"><li>- Chlorophyllic plants.</li><li>- Non-chlorophyllic plants.</li></ul>	
<b>1.3 Respiration in living things</b>	
<ul style="list-style-type: none"><li>- Animal respiration</li><li>- Plant respiration</li><li>- Fermentation</li></ul>	
<b>1.4 Relation between environmental conditions, body activities, and nutrition</b>	
<ul style="list-style-type: none"><li>- Relationships between food energy and body activity requirements.</li><li>- From passive to active life : hibernation and germination.</li></ul>	
<b>1.5 Nutrition and respiration: vital requirements</b>	
<ul style="list-style-type: none"><li>- Importance of nutrition and respiration at the level of the organism.</li><li>- Importance of nutrition and respiration at the level of the habitat.</li></ul>	

## CONTENTS

### Grade Seven

#### **2- Reproduction**

This part clarifies the significance of sexual reproduction in contrast to vegetative reproduction.

The study of different modes of sexual reproduction in animals is exposed in a behavioral way.

##### **2.1 Animal reproduction**

- Courtship in animals during sexual reproduction.
- Fertilization
- Development

##### **2.2 Plant reproduction**

- Reproduction of flowering plants.
- Reproduction of non-flowering plants.
- Significance of reproduction.

#### **3- Inter-relationships between living things**

This part deals with the relationships between living things and the influence of environmental factors.

The study of food webs leads to the concept of transformation and cycling of matter.

The multiple applications of productivity (agriculture, animal raising) focuses on Man's responsibilities towards the management of dynamic equilibrium in nature.

##### **3.1 Study of an ecosystem**

##### **3.2 Relations between organisms in ecosystems**

##### **3.3 Food web in an ecosystem**

##### **3.4 Man and natural equilibrium**

## INTERMEDIATE LEVEL- LIFE AND EARTH SCIENCES

### CONTENTS

#### Grade Eight

#### 1- Human reproduction

This part includes an overview of biological phenomena taking place from puberty until birth and lactation.

Birth control is converged in a social context in order to develop in students the respect of life and their responsibilities as future citizens and parents.

As for sexually transmitted diseases, there is an emphasis on their prevention, which is a personal and social necessity.

##### 1.1 Puberty and adolescence

##### 1.2 Reproductive organs

##### 1.3 Functioning of the reproductive system

##### 1.4 Fertilization, development, and birth

##### 1.5 Birth control

##### 1.6 Sexually transmitted diseases: AIDS

#### 2- Immunology

Responses of the immune system are identified through the analysis of reactions of the organisms to certain microbial infections and blood transfusion.

The distinction between specific and non specific responses is covered, as well as, notions of disorders and deficiencies of the immune system.

Different means of defense developed by man to prevent and fight diseases are also dealt with.

##### 2.1 Immunological specificity

- Characteristics and mechanism of an immune reaction.
- Antimicrobial defense.
- Organ and tissue transplantation.
- Blood transfusion.

##### 2.2 Deficiencies and disorders of the immune system.

- AIDS and allergies.

##### 2.3 Preventive and curative methods

- Vaccination and serotherapy.
- Aseptic and antiseptic procedures, chemotherapy and the use of antibodies.

## INTERMEDIATE LEVEL- LIFE AND EARTH SCIENCES

### CONTENTS

#### Grade Eight

#### **3- Earth and the environment**

This part deals with the concrete geodynamic manifestations of the earth activity.

This leads to the study of changes starting from rocks to landscape which constitutes the life frame work of Man.

The study of geology, particularly, the relationship between man and earth, contributes to develop in students a sense of space and long time responsibility towards the environment (problems of renewable and non renewable natural resources).

##### **3.1 Geology: earth science**

- Rock beds.
- The use of rocks by Man.

##### **3.2 Manifestations of earth activity**

- Volcanoes, earthquakes, and rock deformation.

##### **3.3 Structure and dynamics of earth**

##### **3.4 Circulation of matter in earth**

##### **3.5 Geology and human responsibilities**

- Conservation and management of underground water, fossil fuels, and soil.
- Detection and prevention of natural disasters.

## INTERMEDIATE LEVEL- LIFE AND EARTH SCIENCES

### CONTENTS

#### Grade Nine

#### **1- Nutrition and metabolism**

The study of nutritional functions covered in the first year is considered as the basis for the study of nutrition at the molecular and cellular level. The diversity of functional activities of man are studied in a global perspective. While explaining different functions, anatomy of systems is also explained when needed.

Practicing a well balanced diet is in favor of fostering health education and comprehending the causes of nutritional diseases.

##### **1.1 Transformation of food into nutrients: digestion.**

##### **1.2 Uptake of oxygen and release of carbon dioxide in the organism: respiration.**

##### **1.3 Transport and distribution of nutrients and oxygen to organs: blood circulation.**

##### **1.4 Use of nutrients and oxygen.**

- Oxidation of nutrients and energy liberation.
- Synthesis of organic materials, cellular growth and proliferation.

##### **1.5 Regulation of internal body fluids: urinary function**

##### **1.6 Nutrition and health**

- Varied and balanced diets.
- Criteria of a balanced diet.

#### **2- Nervous coordination and human behavior**

The study of a number of reactions in response to external stimuli gives evidence of the involvement of receptors, conductors, nervous centers and effector organs. Voluntary and involuntary reactions are considered. This leads to the study of the elaboration of tactile sensations, sensory receptors in the skin, and the notion of a neuron and a synapse. These phenomena are explained at the cellular level.

Raising the awareness of the dangers of tobacco, alcohol, and drug abuse is emphasized to promote the individual responsibilities in society.

##### **2.1 Responses of organisms to environmental stimuli**

##### **2.2 Tactile sensations**

##### **2.3 Substance abuse**

## INTERMEDIATE LEVEL- LIFE AND EARTH SCIENCES

### CONTENTS

#### Grade Nine

### **3- Reproduction and genetics**

This part explains sexual reproduction at the chromosomal and cellular levels to understand genetic assortment.

It covers ethical and medical issues resulting from genetic engineering.

#### **3.1 Chromosomes and genetic information.**

- Hereditary traits and genetic program.
- Sex determination.
- Chromosomes, vehicles of heredity.

#### **3.2 Mitosis**

- Multiplication of the zygote.
- Transmission of information in cells.

#### **3.3 Meiosis and gene assortment**

- Sexual reproduction and maintaining the karyotype of the species.
- Sexual reproduction and exchange of genetic material.

#### **3.4 Mendel's work.**

#### **3.5 Production of useful substances for the food industry and medicine by genetic engineering.**

## CHEMISTRY CURRICULUM - INTERMEDIATE LEVEL

### INTRODUCTION

Four major themes integrate the chemistry topics studied at the intermediate level: Classification and constituents of matter, chemical reactions and energy, organic chemistry, and environment. However, while “chemistry and the environment” is presented in a separate chapter at the Grade 9 level, the environment is a central theme that permeates all the topics covered at all three grades of the intermediate level.

The emphasis in the chemistry program at this level is on the conceptual and practical aspects of chemistry and on the interplay between the macro- and micro natures of this subject. It avoids, to some extent, the use of mathematical applications in presenting the topics. This program strives to acquaint students with chemicals used in the laboratory and in everyday life, while, at the same time, making them aware of the risks involved in and safety measures needed for working with chemicals. Finally, the program aims at providing students with a better understanding of the role of chemistry in causing and solving environmental problems.

### OBJECTIVES

By the end of the intermediate level, students should:

#### 1- Understand that:

- Matter is discontinuous.
- Chemical compounds are formed of a limited number of elements.
- Chemical change involves the production of new substances.
- Energy accompanies chemical change.
- Chemical bonds involve the redistribution of electrons around the nucleus.
- Matter is conserved during chemical change.
- Chemical reactions proceed at different rates.
- Carbon is the fundamental element in organic compounds.
- Symbols, formulas, and equations constitute the language of chemistry.

**2- Acquire skills in:**

- Scientific observation.
- Classification according to various criteria.
- Experimentation using a variety of techniques.
- Constructing models, simple devices, and setting up experimental apparatus.
- Organization and interpretation of data.
- Selection and use of scientific reference materials.
- Using precise scientific language.
- Using scientific information in novel situations.

**3- Acquire attitudes and orientations to:**

- Perceive the close relationship among chemistry, technology, and industry.
- Identify careers in chemistry.
- Practice safety measures when using chemicals.
- Develop cooperative skills by working in groups.
- Appreciate such scientific values as objectivity, honesty, open-mindedness, tolerance of differing viewpoints, and respect for manual work.
- Develop positive attitudes toward and interest in science.
- Appreciate the role of chemistry in improving the standard of living.
- Be aware of the close inter-relationships between chemistry, other sciences, and technology.

## INTERMEDIATE LEVEL- CHEMISTRY CURRICULUM

CONTENTS	
Grade Seven	
<b>1- Matter: Classification and Separation Techniques</b>	
<b>1.1 Classification of Matter</b>	
<ul style="list-style-type: none"><li>- Solid, Liquid, Gas.</li><li>- Mixtures, Pure Substances.</li><li>- Homogeneous, Heterogeneous Mixtures.</li></ul>	
<b>1.2 Separation Techniques</b>	
<ul style="list-style-type: none"><li>- Separating Heterogeneous Mixtures: Decantation, Filtration, Centrifugation and other techniques.</li><li>- Separating Homogeneous Mixtures: Distillation, Crystallization, Chromatography and other techniques.</li><li>- Limitations of separation techniques.</li></ul>	
<b>1.3 Environmental Applications</b>	
<ul style="list-style-type: none"><li>- Water Purification</li><li>- Home and Industrial Filters.</li></ul>	
<b>2- Solutions, Suspensions and Colloids</b>	
<b>2.1 Solutions</b>	
<ul style="list-style-type: none"><li>- Liquid Solutions: Aqueous and Non-aqueous solutions, Concentrated and Dilute solutions.</li><li>- Gaseous and Solid Solutions.</li><li>- Solubility: Saturated solutions, Rate of dissolving and Factors influencing solubility.</li></ul>	
<b>2.2 Suspensions and Colloids</b>	
<b>2.3 Environmental Applications</b>	
<ul style="list-style-type: none"><li>- Dilution of toxic wastes.</li><li>- Importance of nutrition and respiration at the level of the habitat.</li></ul>	

## CONTENTS

### Grade Seven

#### **3- Chemical Reactions**

##### **3.1 Reactants and Products**

##### **3.2 Conservation of matter**

##### **3.3 Energy and Chemical Reactions:**

- Heat Energy, Electrical Energy and Light

##### **3.4 Combustion as one type of chemical reaction**

- Combustion reactions need oxygen
- Complete and Incomplete combustion reactions
- Energy and combustion reactions
- Slow and Rapid combustion reactions
- Pollution due to combustion reactions
- Safety (Laboratory, House, Forests...).

## INTERMEDIATE LEVEL- CHEMISTRY CURRICULUM

CONTENTS	
Grade Eight	
<b>1- Electrical Nature of Matter</b>	<b>3- Chemical Reactions</b>
<b>1.1 Electrification</b>	<b>3.1 Chemical Equations</b>
<b>1.2 Electric Discharge</b>	– Word equations and using symbols and formulas
<b>1.3 Conductors and Insulators</b>	– Balancing chemical equations
<b>1.4 Electricity and Safety</b>	<b>3.2 Types of Chemical Reactions</b>
<b>2- Pure Substances</b>	– Decomposition reactions
<b>2.1 Elements</b>	– Synthesis reactions
– Metals and Non-metals	– Displacement reactions: (single and double)
<b>2.2 Compounds</b>	<b>3.3 Rate of Chemical Reactions</b>
<b>2.3 Atoms, Molecules and Ions</b>	<b>4- Acids, Bases and Salts</b>
– Electrical Nature of atoms	<b>3.1 Acidic and Basic Solutions</b>
– Molecules	– Common acids and bases
– Mono- and Polyatomic ions	– Properties of acids and bases
– Anions and Cations	<b>3.2 Acidity: Concept of pH</b>
<b>2.4 Symbols and Formulas</b>	<b>3.3 Salts</b>
<b>2.5 Allotropes: diamond and graphite</b>	– Salt formation
	– Tests to identify some ions
	<b>3.4 Applications</b>
	– Acid Rain, Antacids, Fertilizers

## INTERMEDIATE LEVEL- CHEMISTRY CURRICULUM

CONTENTS	
Grade Nine	
<b>1- The Atom</b>	
<b>1.1 Structure of the Atom</b>	
<ul style="list-style-type: none"><li>- Development of the Atomic Model across history</li><li>- Constituents of the nucleus</li><li>- Energy levels</li><li>- Atomic Number, Mass Number, Atomic Mass</li><li>- Isotopes</li><li>- Electron configuration</li></ul>	
<b>1.2 The Mole concept</b>	
<b>1.3 Periodic Table</b>	
<b>2- Chemical Bonding</b>	
<b>2.1 Stability of the inert gases</b>	
<b>2.2 Formation of a chemical bond</b>	
<b>2.3 Electron-dot symbols</b>	
<b>2.4 Covalent bond</b>	
<b>2.5 Ionic bond</b>	
<b>3- Electrochemistry</b>	
<b>3.1 Electric energy from chemical reactions</b>	
<ul style="list-style-type: none"><li>- Applications: Electrochemical cells.</li></ul>	
	<b>3.2 Using electric energy to produce chemical reactions</b>
	<ul style="list-style-type: none"><li>- Applications: Electrolysis of water, electroplating, cathodic protection</li></ul>
	<b>3.3 Oxidation - Reduction reactions</b>
	<b>4- Organic Chemistry</b>
	<b>4.1 Hydrocarbons</b>
	<ul style="list-style-type: none"><li>- Aliphatic hydrocarbons</li><li>- Aromatic hydrocarbons</li></ul>
	<b>4.2 Petroleum, Natural Gas and Coal</b>
	<b>4.3 Esterification and Saponification</b>
	<b>4.4 Synthetic Materials</b>
	<b>5- Chemistry and Environment</b>
	<b>5.1 Pollution of Air, Water, and Soil</b>
	<ul style="list-style-type: none"><li>- Pollutants and their sources</li><li>- Effects of pollution</li></ul>
	<b>5.2 Addressing pollution problems</b>

## **PHYSICS CURRICULUM - INTERMEDIATE LEVEL**

### **INTRODUCTION**

Scientific and technological advances require the revision of the science curriculum, especially that of physics. Furthermore, the results of research on physics teaching point to the necessity of defining teaching objectives and of including modern methods of evaluation in the curriculum.

The curriculum shows the relation between physics, technology, and society. It is supposed to adapt to the needs and abilities of the student, to make him/her aware of the problems of security and the misuse of energy, to develop a responsible attitude towards his environment and to understand some of the scientific messages emitted by the media.

This curriculum takes into account the diversity of pupils and their previous knowledge, and enables the pupil to master some simple experimental techniques.

It is expected that the curriculum will enable the pupil in grade seven to acquire a scientific attitude based on observation, initiation to experimental work, and help him/her use some measuring instruments. The pupil will be able to observe and analyze physical phenomena surrounding him/her.

However, in grade eight, the curriculum aims to help the pupil to acquire some of the elements of scientific method and to develop a positive attitude towards the environment, thus allowing him/her to value some of the information transmitted by the media, and teaching him/her some important concepts relative to his/her environment.

In grade nine, the curriculum is supposed to stimulate the pupil's curiosity by increasing his/her information about his/her environment and enables him/her to analyse certain surrounding phenomena, and acquire some practical skills.

## OBJECTIVES

Teaching physics at the intermediate level should:

- contribute to the realization of the general objectives of teaching science.
- reinforce and complete the scientific knowledge acquired at the primary level.
- insure the necessary background knowledge for the pupil to pursue academic studies or shift to technical and professional education.
- reveal the specific character of physics and its relation to other sciences.
- awaken scientific vocations.
- provide the pupil with scientific education based on the knowledge of physical facts and concepts.
- prepare the pupil for the experimental method which develops the abilities of observation, measurement, collecting data, interpretation, and verification.
- prepare the pupil for the understanding of scientific messages found in diagrams, graphs and media.
- prepare the pupil for correct scientific expressions by using appropriate terminology and simple mathematical formalism.
- prepare the pupil to work in groups.
- make the pupil aware of the problems of energy.

## INTERMEDIATE LEVEL- PHYSICS CURRICULUM

CONTENTS	
<b>Grade Seven</b>	
<b>1- Matter</b>	
1.4	Solid and liquid states.
1.5	Gaseous state.
1.6	Structure of matter.
1.7	Change of state and expansion.
<b>2- Electricity</b>	
2.1	Circuit.
2.2	Measurement of current and potential difference.
2.3	Grouping of lamps.
2.4	Magnets and coils.
<b>Grade Eight</b>	
<b>1- Mechanics</b>	
1.1	Motion and speed.
1.2	Force: effects and classification.
1.3	Work , power, and forms of energy.
<b>2- Waves</b>	
2.1	Characteristics of waves.
2.2	Sound waves.
2.3	Electromagnetic waves and colors.
<b>3- Optics</b>	
3.1	Rectilinear propagation of light.
3.2	Reflection of light and plane mirror.

## INTERMEDIATE LEVEL- PHYSICS CURRICULUM

CONTENTS	
Grade Nine	
<b>1- Optics</b>	
1.1	Refraction of light.
1.2	Lenses and eye.
<b>2- Electricity</b>	
2.1	Alternating current.
2.2	Ohm's law and grouping of resistors.
2.3	Power and energy.
<b>3- Heat</b>	
3.1	Quantity and transfer of heat.
3.2	Thermal equilibrium.
<b>4- Mechanics</b>	
4.1	Equilibrium of a body under the action of two forces. Hooke's law.
4.2	Pressure in liquids.
4.3	Archimedes' principle.

**SECONDARY EDUCATION**

**LIFE SCIENCE CURRICULUM**

## **SECTIONS: LITERATURE AND HUMANITIES, SOCIOLOGY AND ECONOMICS**

### **INTRODUCTION**

The science curriculum in the Letters and Humanities and in Sociology and Economics sections, forms with mathematics and technology a common core aimed at the development of scientific literacy as it relates to today's world and prepares for tomorrow's.

The scientific content includes topics in biology, chemistry, and physics selected carefully to provide the background for understanding the latest scientific developments, which shape modern society. The student, hence, equipped with the necessary skills and knowledge, will be able to engage intelligently in public discourse and debate in matters of technical and scientific concern, interact positively with the environment, and address health problems and consumer concerns.

The topics selected for these two sections focus on the application of biological knowledge in health and environmental domains.

The curriculum of the second year of the secondary level deals with defense mechanisms in man, reproduction and human heredity. In the third year the program focuses on nutrition and neurobiology as well as their impact on health.

The curriculum for the Sociology and Economics section further includes an outline of the human genome project and modern techniques in genetic engineering that are important in animal and plant productivity and in chemical industry.

In addition to academic concerns, the curriculum fosters the development of autonomy and responsibility that are required qualities for a good citizen.

### **OBJECTIVES**

The teaching of science should permit students to:

- Acquire the scientific terminology and knowledge necessary for everyday life.
- Perceive the current scientific information used in the media.
- Understand the interaction of science, technology, and society.
- Make responsible decisions related to health and environmental problems of every day life.
- Develop sensibilities towards bioethical, economic and social problems.
- Understand the scope of contributions of science and scientists to the intellectual development of mankind.
- Conduct scientific processes and acquire scientific attitudes for attaining better autonomy.

**SCOPE AND SEQUENCE - Literature and Humanities Section**

Theme	First Year	Second Year	Third Year
<p><b>Functional organization of living things</b></p>	<p><b>Nutrition and structure of chlorophyllic vascular plants</b></p> <ul style="list-style-type: none"> <li>- Autotrophy and photosynthesis.</li> <li>- Uptake and transport of nutrients in plants.</li> <li>- Use of the products of photosynthesis.</li> </ul> <p><b>Communication and organization in animals</b></p> <ul style="list-style-type: none"> <li>- Nervous communication.                             <ul style="list-style-type: none"> <li>o Communication systems.</li> <li>o Essential characteristics for nervous communication.</li> </ul> </li> <li>- Hormonal communication.                             <ul style="list-style-type: none"> <li>o Communication systems.</li> <li>o Essential characteristics for hormonal communication.</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>- Social communication.</li> <li>- Nervous communication</li> <li>- Hormonal communication</li> <li>- Substance abuse</li> <li>- Biological rhythms</li> </ul>
<p><b>Plant productivity and environmental factors</b></p>	<ul style="list-style-type: none"> <li>- Crop productivity improvement.</li> <li>- Environmental factors affecting plant productivity.</li> </ul>		
<p><b>Control and protection of the environment</b></p>	<ul style="list-style-type: none"> <li>- Pollution, conservation and protection of fresh water.</li> <li>- Degradation, conservation and protection of soil.</li> </ul>		

Theme	First Year	Second Year	Third Year
<b>Reproduction and heredity</b>		<ul style="list-style-type: none"> <li>- Physiology of human reproduction.</li> <li>- Fertilization and birth.</li> <li>- Birth control.</li> <li>- Sexually-transmitted diseases.</li> <li>- Chromosomes.</li> <li>- Chromosomal and gene abnormalities</li> <li>- Human diversity.</li> </ul>	
<b>Immunology and health</b>		<ul style="list-style-type: none"> <li>- Body defenses in Man</li> <li>- Specific immune defenses</li> <li>- Deficiencies and disorders of the immune system</li> <li>- immune response supports</li> </ul>	
<b>Nutrition and health</b>			<ul style="list-style-type: none"> <li>- Dietary habits.</li> <li>- Basic principles for a balanced diet.</li> <li>- Nutritionally-caused diseases: characteristics, causes and prevention.</li> <li>- Biological renewal.</li> </ul>
<b>Theories of evolution</b>			<ul style="list-style-type: none"> <li>- The process of evolution through molecular Biology and Paleontology.</li> <li>- From old theory to the synthetic theory.</li> </ul>

**SCOPE AND SEQUENCE - Sociology and Economics Section**

Theme	First Year	Second Year	Third Year
<p><b>Functional organization of living things</b></p>	<p><b>Nutrition and structure of chlorophyllic vascular plants.</b></p> <ul style="list-style-type: none"> <li>- Autotrophy and photosynthesis.</li> <li>- Uptake and transport of nutrients in plants.</li> <li>- Use of the products of photosynthesis.</li> </ul> <p><b>Communication and organization in animals</b></p> <ul style="list-style-type: none"> <li>- Nervous communication.                             <ul style="list-style-type: none"> <li>o Communication systems.</li> <li>o Essential characteristics for nervous communication.</li> </ul> </li> <li>- Hormonal communication.                             <ul style="list-style-type: none"> <li>o Communication systems.</li> <li>o Essential characteristics for hormonal communication.</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>- Social communication.</li> <li>- Nervous communication</li> <li>- Hormonal communication</li> <li>- Substance abuse</li> <li>- Biological rhythms</li> </ul>
<p><b>Plant productivity and environmental factors</b></p>	<ul style="list-style-type: none"> <li>- Crop productivity improvement.</li> <li>- Environmental factors affecting plant productivity.</li> </ul>		
<p><b>Control and protection of the environment</b></p>	<ul style="list-style-type: none"> <li>- Pollution, conservation and protection of fresh water.</li> <li>- Degradation, conservation and protection of soil.</li> </ul>		

<b>Theme</b>	<b>First Year</b>	<b>Second Year</b>	<b>Third Year</b>
<b>Reproduction and Heredity</b>		<ul style="list-style-type: none"> <li>- Physiology of human reproduction.</li> <li>- Fertilization and birth.</li> <li>- Birth control.</li> <li>- Sexually-transmitted diseases.</li> <li>- Chromosomes.</li> <li>- Chromosomal and gene abnormalities.</li> <li>- Human diversity.</li> </ul>	
<b>Immunology and Health</b>		<ul style="list-style-type: none"> <li>- Body defenses in Man.</li> <li>- Specific immune defenses.</li> <li>- Deficiencies and disorders of the immune system.</li> <li>- immune response supports.</li> </ul>	
<b>Nutrition and Health</b>			<ul style="list-style-type: none"> <li>- Dietary habits.</li> <li>- Basic principles for a balanced diet.</li> <li>- Nutritionally-caused diseases: characteristics, causes and prevention.</li> <li>- Biological renewal.</li> </ul>
<b>Theories of evolution</b>			<ul style="list-style-type: none"> <li>- The process of evolution through molecular Biology and Paleontology.</li> <li>- From old theory to the synthetic theory.</li> </ul>
<b>Science and Economy</b>			<ul style="list-style-type: none"> <li>- Biotechnology and immunology</li> <li>- Improvement of the species.</li> <li>- Industrial breeding and agricultural research.</li> <li>- Biotechnology and the environment</li> </ul>

## **SECTIONS: GENERAL SCIENCES . LIFE SCIENCES**

### **INTRODUCTION**

At a time of rapid advancement in the science of Biology is witnessing , it is imperative to construct a curriculum that provides new innovations in conceptual learning and pedagogy. In this perspective, new trends of international curricula were adopted to promote science teaching.

In this curriculum biological information is offered as key concepts rather than an unlimited number of facts. Teaching concepts, thus, helps students explore ideas through a global approach that fosters the comprehension of fundamental life processes, starting at the molecular level and culminating with the biosphere.

A major part of the program is devoted to the study of the nature of the human species as a biological and cultural entity. Accordingly, the new program provides students with basic knowledge of biology in relation to their every day lives in connection with health, technology, environment, and bioethics.

Beyond that, the curriculum emphasizes scientific methods and processes as a bridge towards knowledge and problem solving. Students are, thus, considered as active participants rather than passive ones in the learning process. The curriculum, therefore, focuses on skills development such as practicing scientific processes and critical thinking, the handling of scientific techniques, communicating, and transferring knowledge.

Towards this goal, the topics are thus, chosen and sequenced along different class levels from the simplest to the most complex. Most of the information presented, builds up on new learning and reinforces previous learning so as to provide a continuous coherence with logical connections. As a result, the understanding and the application of concepts are favored over the memorization of information. Similarly, the exploration of ideas is favored over excessive terminology.

Continuous assessments accompanying the learning is another innovation of the new curriculum. This can help in the evaluation of students' achievements and in providing feedback ,for the teacher on the learning processes.

Briefly, various teaching approaches are adopted to suit the individual needs of students and classrooms.

We hope that in addition to the students' biological backgrounds, this curriculum will succeed in developing individuality and responsibility that are vital tools for every citizen.

## OBJECTIVES

Studying biology gives the students an opportunity to explore and comprehend the natural world and to recognize the critical importance of biology in the life. In this context, the objectives of biology teaching are meant to:

- Permit students, through learning key-concepts, to discover:
  - the importance of solar energy as an imperative requirement for the maintenance of life
  - the living world, its unity, diversity, and evolution
  - the organization of the biosphere in correlated systems.
- Permit students to acquire and practice the scientific processes of problem solving.
- Contribute to the development of scientific observation and analysis as well as scientific precision, critical thinking, and argumentation.
- Encourage students to appreciate the importance of models and accept uncertainties in the explain above and interpretation of observed phenomena.
- Develop a scientific attitude in students.
- Promote scientific literacy based on a global and coherent view of life in students.
- Orients the students to take decisions for their future education and career.
- Develop individual responsibility in students with regard to health, environment, technology, and protection of natural resources
- Develop the students' sensibilities about bioethical issues.
- Develop skills and knowledge in students that help them make informed decisions.

**SCOPE AND SEQUENCE - General Sciences Section**

Theme	First Year	Second Year	Third Year
<p><b>Functional organization of living things</b></p>	<p><b>Nutrition and structure of chlorophyllic vascular plants</b></p> <ul style="list-style-type: none"> <li>- Autotrophy and photosynthesis.</li> <li>- Uptake and transport of nutrients in plants.</li> <li>- Use of the products of photosynthesis.</li> </ul> <p><b>Communication and organization in animals</b></p> <ul style="list-style-type: none"> <li>- Nervous communication.                             <ul style="list-style-type: none"> <li>o Communication systems.</li> <li>o Essential characteristics for nervous communication.</li> </ul> </li> <li>- Hormonal communication.                             <ul style="list-style-type: none"> <li>o Communication systems.</li> <li>o Essential characteristics for hormonal communication.</li> </ul> </li> </ul>		
<p><b>Plant productivity and environmental factors</b></p>	<ul style="list-style-type: none"> <li>- Crop productivity improvement.</li> <li>- Environmental factors affecting plant productivity.</li> </ul>		
<p><b>Control and protection of the environment</b></p>	<ul style="list-style-type: none"> <li>- Pollution, conservation and protection of fresh water.</li> <li>- Degradation, conservation and protection of soil.</li> </ul>		

Theme	First Year	Second Year	Third Year
<b>Functional characteristics of living systems at the cellular level</b>		<b>Genetic information</b> <ul style="list-style-type: none"> <li>- Diversity of organisms: procaryotes and eucaryotes.</li> <li>- <b>DNA</b>, genetic information, and the cell cycle.</li> <li>- From gene to protein.</li> <li>- Enzymes as biological catalysts.</li> <li>- Genetic make up of living things.</li> </ul> <b>Molecular turnover and metabolic energy</b> <ul style="list-style-type: none"> <li>- Molecular turnover.</li> <li>- Use of energy by organisms.</li> <li>- Cellular energy.</li> <li>- Energy metabolism</li> </ul>	
<b>Interdependence between living things and their relations with the environment</b>		<ul style="list-style-type: none"> <li>- Converting light energy into chemical energy.</li> <li>- Energy flow and the carbon cycle in ecosystems.</li> <li>- The human impact on the carbon cycle.</li> </ul>	
<b>Nutrition and Health</b>		<ul style="list-style-type: none"> <li>- Dietary habits</li> <li>- Basic principles for a balanced diet</li> <li>- Diet related diseases: characteristics, causes, and prevention.</li> </ul>	

**SCOPE AND SEQUENCE - Life Sciences Section**

Theme	First Year	Second Year	Third Year
<p><b>Functional organization of living things</b></p>	<p><b>Nutrition and structure of chlorophyllic vascular plants</b></p> <ul style="list-style-type: none"> <li>- Autotrophy and photosynthesis.</li> <li>- Uptake and transport of nutrients in plants.</li> <li>- Use of the products of photosynthesis.</li> </ul> <p><b>Communication and organization in animals</b></p> <ul style="list-style-type: none"> <li>- Nervous communication.                             <ul style="list-style-type: none"> <li>o Communication systems.</li> <li>o Essential characteristics for nervous communication.</li> </ul> </li> <li>- Hormonal communication.                             <ul style="list-style-type: none"> <li>o Communication systems.</li> <li>o Essential characteristics for hormonal communication.</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>- Properties of nervous centers</li> <li>- Function of neurons.</li> <li>- Example of a cerebral activity: voluntary movement.</li> <li>- Neurotransmitters and medical applications.</li> </ul>
<p><b>Plant productivity and environmental factors</b></p>	<ul style="list-style-type: none"> <li>- Crop productivity improvement.</li> <li>- Environmental factors affecting plant productivity.</li> </ul>		
<p><b>Control and protection of the environment</b></p>	<ul style="list-style-type: none"> <li>- Pollution, conservation and protection of fresh water.</li> <li>- Degradation, conservation and protection of soil.</li> </ul>		

Theme	First Year	Second Year	Third Year
<b>Functional characteristics of living systems at the cellular level</b>		<b>Genetic information</b> <ul style="list-style-type: none"> <li>- Diversity of organisms: procaryotes and eucaryotes.</li> <li>- <b>DNA</b>, genetic information, and the cell cycle.</li> <li>- From gene to protein.</li> <li>- Enzymes as biological catalysts.</li> <li>- Genetic make up of living things.</li> </ul> <b>Molecular turnover and metabolic energy</b> <ul style="list-style-type: none"> <li>- Molecular turnover.</li> <li>- Use of energy by organisms.</li> <li>- Cellular energy.</li> <li>- Energy metabolism</li> </ul>	<ul style="list-style-type: none"> <li>- Genetic polymorphism.</li> <li>- Meiosis and the exchange of genetic material.</li> <li>- Population genetics.</li> <li>- Human genetics, preventive measures, and bioethical issues</li> </ul>
<b>Interdependence between living things and their relations with the environment</b>		<ul style="list-style-type: none"> <li>- Converting light energy into chemical energy.</li> <li>- Energy flow and the carbon cycle in ecosystems.</li> <li>- The human impact on the carbon cycle.</li> </ul>	
<b>Nutrition and Health</b>		<ul style="list-style-type: none"> <li>- Dietary habits</li> <li>- Basic principles for a balanced diet</li> <li>- Diet related diseases: characteristics, causes, and prevention.</li> </ul>	

Theme	First Year	Second Year	Third Year
<b>Immunology</b>			<ul style="list-style-type: none"> <li>- Self and non-self.</li> <li>- Acquiring immune competence.</li> <li>- Development of immune responses.</li> <li>- Malfunctioning and failure of the immune system.</li> </ul>
<b>Systems of regulation and functional unity of organisms</b>			<ul style="list-style-type: none"> <li>- Regulation of glycemia.</li> <li>- Regulation of arterial pressure.</li> <li>- Regulation of sex hormone levels.</li> <li>- Control of reproduction.</li> </ul>
<b>Systems of regulation and functional unity of organisms</b>			<ul style="list-style-type: none"> <li>- Phylogenic relationships between organisms.</li> <li>- Mechanism of evolution.</li> <li>- Human evolution.</li> </ul>

## FIRST SECONDARY

### CONTENTS

#### 1- Functional organization of living things

The first part of the program focuses on the study of the functional organization of an organism at different levels of complexity. The necessity of the cooperation between different cells to accomplish biological functions that make up a unified functional organism are discussed. This part includes the nutrition of vascular chlorophyllic plants and communication in animals

##### 1.1 Nutrition and structure of chlorophyllic vascular plants

- 1.1.1 Autotrophy and photosynthesis.
- 1.1.2 Uptake and transport of nutrients in plants.
- 1.1.3 Use of the products of photosynthesis.

##### 2.1 Communication and organization in animal

- 1.2.1 Nervous communication.
  - Communication systems
  - Essential characteristics for nervous communication
- 1.2.2 Hormonal communication
  - Communication systems.
  - Essential characteristics for hormonal communication.

#### 2- Plant productivity, and environmental factors

The second part of the program shows that the functions of plants depend on their genetic program and the environmental factors surrounding them. The impact of human practices on plant productivity is clearly dealt with in this section.

##### 2.1 Crop productivity improvement.

##### 2.2 Environmental factors affecting plant productivity.

#### 3- Control and protection of the environment

This part of the program shows that terrestrial ecosystems (water and soil) are in a fragile state of equilibrium. Man's everyday activities affect the equilibrium of these ecosystems. The understanding of the different ecosystems and their dynamic interactions with the biosphere are necessary to raise the students' awareness about their responsibilities towards the protection of the environment.

##### 3.1 Pollution, conservation and protection of fresh water.

##### 3.2 Degradation, conservation and protection of soil.

## SECOND SECONDARY: Humanities Section

### CONTENTS

#### 1- Reproduction and heredity

##### 1.1 Physiology of human reproduction

- The menstrual cycle
- Regulation of the menstrual cycle (ovary and pituitary control)

##### 1.2 Fertilization and birth

- Fertilization
- Embryo and fetal development
- Birth and lactation

##### 1.3 Birth control

- Contraceptives and abortions
- Medically assisted procreation technique
- Birth control and bioethical problems

##### 1.4 Sexually transmitted diseases

##### 1.5 Chromosomes

- Human karyotype
- Transmission of chromosomes through sexual reproduction
- Chromosomes and gene transmission

##### 1.6 Genetic and chromosomal abnormalities

- Chromosomal aberrations
- Gene abnormalities
- Prenatal diagnosis

##### 1.7 Human diversity

- Polymorphism and uniqueness of man
- Cause of genetic diversity
- Consequence of genetic polymorphism

#### 2- Immunology and health

##### 2.1 Body defenses in man

- Non specific defense methods: Inflammation, phagocytosis
- Specific defense methods: humoral and cell mediated

##### 2.2 Specific immune defenses

- Blymphocytes
- Tlymphocytes, and antibodies

##### 2.3 Deficiencies and disorders of the immune system

- Allergies, auto-immune diseases, immune deficiency, AIDS

##### 2.4 Immune response supports

- Vaccination, serotherapy, and bone marrow transplantation.

## SECOND SECONDARY: Sciences Section

### CONTENTS

#### 1- Functional characteristics of living systems at the cellular level

Studying the functional characteristics of living systems at the cellular level allows the explanation of some fundamental aspects of biology.

This part of the program includes the genetic make-up of living things, molecular turnover, and energy metabolism.

Emphasis is placed upon the effect of the “predetermined genetic” programming of organisms on their need for nutrients.

##### 1.1 Genetic information

- 1.1.1 Diversity of organisms: prokaryotes and eucaryotes
- 1.1.2 DNA, genetic information, and the cell cycle.
- 1.1.3 From gene to protein
- 1.1.4 Enzymes as biological catalysts
- 1.1.5 Genetic make up of living things

##### 1.2 Molecular turnover and metabolic energy

- 1.2.1 Molecular turnover
- 1.2.2 Use of energy by organisms
- 1.2.3 Cellular energy
- 1.2.4 Energy metabolism in Man

#### 2- Interdependence between living things and their relations with the environment

The study of the interactions between organisms among themselves and with their surroundings permits awareness of human responsibilities towards preserving the environment. It explains how the equilibrium of the biosphere is maintained from solar energy through photosynthesis and cellular respiration, as well as through the biogeochemical cycles of matter.

**2.1 Converting light energy into chemical energy.**

**2.2 Energy flow and the carbon cycle in ecosystems.**

**2.3 The human impact on the carbon cycle.**

#### 3- Nutrition and health

The purpose of this section is to explain the need for a diversity of feeding habits and the requirements of a balanced diet. Both favor maintaining normal body functions and in preventing diseases caused by malnutrition.

**3.1 Dietary habits**

**3.2 Basic principles of a balanced diet**

**3.3 Diet related diseases: characteristics, causes, and prevention.**

## THIRD SECONDARY: Literature and Humanities Section

### CONTENTS

#### 1- Nutrition and health

##### 1.1 Diversity of food habits

##### 1.2 The basic principles of a balanced diet

- Quantitative needs (energy)
- Qualitative needs: vitamins, amino acids, fatty acids, and mineral substances.

##### 1.3 Nutritionally caused diseases:

- Characteristics, causes, and prevention
- Diseases caused by nutritional excess: cardiovascular diseases, obesity
- Diseases caused by nutritional deficiency: marasmus, kwashiorkor

##### 1.4 Biological renewal

- Food, digestion, and assimilation
- Synthesis of molecules

#### 2- Neurobiology, human behavior, and health

##### 2.1 Social communication

- Aggressiveness, dominance, emotional and stress reactions

##### 2.2 Nervous communication

- Nervous messages
- Synaptic transmission: neurotransmitters, synaptic inhibition and stimulation, chemical perturbation of a synapse parkinson's disease, Alzheimer disease...
- Cerebral activity and conditional reflexes : the cerebrum and conscious perception, simple reflexes, voluntary action, conditional reflexes.

## CONTENTS

### **2.3 Hormonal communication**

- Characteristics of the hormonal message: elaboration and transportation of hormonal messages, action of hormones.
- Neurohormonal integration: complementarity of the nervous and hormonal systems, role of the hypothalamus.

### **2.4 Substance abuse**

- Common characteristics: addiction, tolerance, dependence.
- Effects of drugs, tobacco, and alcohol on the organism.

### **2.5 Biological rhythms**

- Synchronization of endogenic rhythms
- Applications of chronobiology.

## **3- Theories of evolution**

**3.1 The process of evolution through molecular biology and paleontology.**

**3.2 From old theories to the synthetic theory.**

## THIRD SECONDARY: Sociology and Economics Section

### CONTENTS

#### 1- Nutrition and health

##### 1.1 Diversity of food habits

##### 1.2 The basic principle for a balanced diet

- Quantitative needs (energy )
- Qualitative needs: vitamins, amino acids, fatty acids, and mineral substances

##### 1.3 Nutritionally caused diseases:

- Characteristics, causes, and prevention
- Diseases caused by nutritional excess: cardiovascular diseases, obesity
- Diseases caused by nutritional deficiency: marasmus, kwashiorkor

##### 1.4 Biological renewal

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- Synthesis of molecules

#### 2- Neurobiology, human behavior, and health

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## CONTENTS

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### **2.5 Biological rhythms**

- Synchronization of endogenic rhythms
- Applications of chronobiology

## **3- Theories of evolution**

### **3.1 The process of evolution through molecular biology and paleontology**

### **3.2 From old theories to the synthetic theory**

## **4- Science and economy**

### **4.1 Biotechnology and immunology**

- Principles of genetic engineering.
- Applications of genetic engineering: production of substances of medical interest (insulin, vaccines...), and specific antibodies (pregnancy test, cancer oncogenesis).

### **4.2 Improvement of the species: hybridization, selection and genetic experimentation.**

### **4.3 Industrial breeding and agricultural research: selection of productive races and research of new food sources...**

### **4.4 Biotechnology and the environment.**

## THIRD SECONDARY: Life Sciences Section

### CONTENTS

#### 1- Human genetics

This part forms continuum the genetics program covered in the second year of the secondary cycle. It reveals the importance of genetic polymorphism, the mechanisms leading to this polymorphism by **DNA** modifications and the exchange of genetic material. Nevertheless, ethical issues resulting from genetic engineering and gene therapy are considered.

**1.1 Genetic polymorphism.**

**1.2 Meiosis and the exchange of genetic material.**

**1.3 Population genetics.**

**1.4 Human genetics, preventive measures, and bioethical issues.**

#### 2- Immunology

Genetic material covered earlier supports the understanding and the study of immunology. This part illustrates the polymorphic expression of the immunoglobulin genes and explains how the molecular characteristics determining the immunological identity of an individual are maintained. It also emphasizes the notion of the non-self that leads to the immune reactions by cell and humoral mediation. It integrates the study of the non-self with the development of specific immune reactions such as tissue rejection and defense against bacterial and viral infections. It introduces auto-immune diseases, cancer, and immune system deficiency diseases such as AIDS.

**2.1 Self and non-self.**

**2.2 Acquiring immune competence.**

**2.3 Development of immune responses.**

**2.4 Malfunctioning and failure of the immune system.**

#### 3- Neurophysiology

This part has as prerequisite information studied in the first secondary year that deals with the function and the organization of the nervous system. It studies mechanisms that allow the nervous centers to process the sensory information they receive and to send coordinated messages to effector organs. The study of an integrated nerve response is illustrated by coordinated movements.

The biochemical aspects of the functioning of the nervous centers contribute to the understanding of human behavior with emphasis on their medical applications.

## CONTENTS

**3.1 Properties of nervous centers.**

**3.2 Function of neurons.**

**3.3 Example of a cerebral activity: voluntary movement.**

**3.4 Neurotransmitters and medical applications.**

### **4- Systems of regulation and functional unity of organisms**

This part covers the functioning of some regulatory systems in an organism in the following cases: glycemia, arterial pressure, and sex hormone level. The functional unity of an organism is clarified by neuro-humoral integration. In addition, bioethical problems related to birth control methods are discussed in this part.

**4.1 Regulation of glycemia.**

**4.2 Regulation of arterial pressure.**

**4.3 Regulation of sex hormone level.**

**4.4 Control of reproduction.**

### **5- Evolution of living things**

Ancestral relationships of living things contribute to the understanding of the molecular mechanisms of evolution by genetic innovations and their conservation.

The study of human evolution illustrates the interactions between biological evolution and the environment

**5.1 Phylogenic relationships between organisms.**

**5.2 Mechanism of evolution.**

**5.3 Human evolution.**

**SECONDARY EDUCATION**

**CHEMISTRY CURRICULUM**

## **SECTIONS: LITERATURE AND HUMANITIES, SOCIOLOGY AND ECONOMICS**

### **INTRODUCTION**

Life in modern societies is related directly to science and technology. All educational systems should emphasize a scientific culture that allows citizens to lead active productive lives. Although some students are oriented to the literary fields, they still deal with social economical, and political problems that have important scientific aspects.

The prevalence of the natural or synthetic molecules in our present life-style, necessitate a realistic understanding of these molecules that are consumed as food and drink, as medicinal drugs, and prosthetics, as well as those that are used in the form of various articles in different fields. Thus, we study soaps and detergents, polymers, pesticides, food chemistry, perfumes and cosmetics, current medicinal drugs, the treatment of wastes, chemistry and economy. This teaching does not prepare form future chemists, but it tends to develop the basic elements of a true scientific culture that answers largely to the applications of science in everyday life. The scientific culture in chemistry contributes to the application of scientific methodology and techniques. Establish the way of using science, its methodology and its techniques.

### **OBJECTIVES**

The teaching of scientific culture should permit students to:

- Acquire the scientific terminology and knowledge necessary in everyday life.
- Understand the current scientific information used in the media.
- Understand the interaction of science, technology, and society.
- Make responsible decisions related to health and environmental problems in everyday life.
- Develop sensibilities towards bioethical, economical and social problems.
- Understand the scope of contributions of science and scientists to the intellectual development of mankind.
- Conduct scientific processes and acquire scientific attitudes for attaining a better autonomy.

**SCOPE AND SEQUENCE: Literature and Humanities Section**

<b>Theme</b>	<b>First Year</b>	<b>Second Year</b>	<b>Third Year</b>
<b>Matter: Constitution, structural properties, bonding between particles</b>	<ul style="list-style-type: none"> <li>- Atoms</li> <li>- Molecules</li> <li>- Ions</li> </ul>	<ul style="list-style-type: none"> <li>- Soaps and detergents.</li> <li>- Synthetic polymers.</li> </ul>	<ul style="list-style-type: none"> <li>- Food chemistry.</li> </ul>
<b>Chemical reactions and energy</b>	<ul style="list-style-type: none"> <li>- Chemical reactions.</li> </ul>		<ul style="list-style-type: none"> <li>- Food chemistry.</li> </ul>
<b>Raw materials Chemical industry</b>	<ul style="list-style-type: none"> <li>- Fertilizers.</li> </ul>	<ul style="list-style-type: none"> <li>- Soaps and detergents. Synthetic polymers. Pesticides.</li> </ul>	<ul style="list-style-type: none"> <li>- Food chemistry.</li> <li>- Perfumes and cosmetics.</li> <li>- Current medicinal drugs.</li> </ul>
<b>States of matter</b>	<ul style="list-style-type: none"> <li>- Water</li> </ul>		
<b>Aqueous acidic and basic solutions</b>	<ul style="list-style-type: none"> <li>- Acids and Bases.</li> </ul>		
<b>Chemical analysis</b>	<ul style="list-style-type: none"> <li>- Qualitative analysis.</li> <li>- Volumetric analysis.</li> </ul>		
<b>Pollution</b>	<ul style="list-style-type: none"> <li>- Atmospheric pollution.</li> </ul>	<ul style="list-style-type: none"> <li>- Detergents: Impact on the environment.</li> <li>- Pesticides.</li> </ul>	

**SCOPE AND SEQUENCE - Sociology and Economics Section**

<b>Theme</b>	<b>First Year</b>	<b>Second Year</b>	<b>Third Year</b>
<b>Matter: Constitution, structural properties, bonding between particles</b>	<ul style="list-style-type: none"> <li>- Atoms</li> <li>- Molecules</li> <li>- Ions.</li> </ul>	<ul style="list-style-type: none"> <li>- Soaps and detergents.</li> <li>- Synthetic polymers.</li> </ul>	<ul style="list-style-type: none"> <li>- Food chemistry.</li> </ul>
<b>Chemical reactions and energy</b>	<ul style="list-style-type: none"> <li>- Chemical reactions.</li> </ul>		<ul style="list-style-type: none"> <li>- Food chemistry.</li> </ul>
<b>Raw materials Chemical industry</b>	<ul style="list-style-type: none"> <li>- Fertilizers.</li> </ul>	<ul style="list-style-type: none"> <li>- Soaps and detergents.</li> <li>- Synthetic polymers. Pesticides.</li> </ul>	<ul style="list-style-type: none"> <li>- Food chemistry.</li> <li>- Perfumes and cosmetics.</li> <li>- Current medicinal drugs.</li> <li>- Chemistry and economy.</li> </ul>
<b>States of matter</b>	<ul style="list-style-type: none"> <li>- Water</li> </ul>		
<b>Aqueous acidic and basic solutions</b>	<ul style="list-style-type: none"> <li>- Acids and Bases.</li> </ul>		
<b>Chemical analysis</b>	<ul style="list-style-type: none"> <li>- Qualitative analysis.</li> <li>- Volumetric analysis.</li> </ul>		
<b>Pollution</b>	<ul style="list-style-type: none"> <li>- Atmospheric pollution.</li> </ul>	<ul style="list-style-type: none"> <li>- Detergents: Impact on the environment.</li> <li>- Pesticides.</li> </ul>	<ul style="list-style-type: none"> <li>- Treatment of wastes.</li> </ul>

## **SECTIONS: GENERAL SCIENCES , LIFE SCIENCES**

### **INTRODUCTION**

Human activities in modern societies are the products of progress in sciences and technology.

This progress is incited and animated by man's growing potential for creativity and aims at ensuring the well-being of the society.

This progress, however, cannot continue, develop, and improve without training scientific minds capable of learning, planning, communicating, appraising, and inventing.

Such a task is assured by the school, then by the university, and by all sorts of training institutions that ensure an organized transfer of the ever-growing knowledge resulting from scientific research.

In order for us to attain our objectives, and as a consequence of the permanent advancement of the scientific heritage, it is essential for us to make a parallel reorganization of curriculum, develop the contents of programs, modify the instructional methods and improve the system of evaluation

The objectives are formulated in a manner that satisfy the fact that Chemistry involves science, technology, careers, impact on the environment, and choices for the consumer.

- The contents of the program were worked out following a logic of construction based on the following considerations:
- The characteristics of the current scholastic knowledge of Chemistry.
- The requirements of the different domains of Chemistry.
- The conceivable diverse destinations of the students.
- Compatibility with the new goals and objectives set for education

The instructional methods provide an efficient means for attaining objectives. They indicate the conditions, the means, the processes, the approaches, and the methods that render teaching and training effective.

Assessment that (according to Ketele) is a measure of the match between a set of information and a set of appropriate criteria of fixed objectives, allows the instructor to make judgments on the students' abilities, to measure what they have learned, to evaluate the effectiveness of the teaching method, and to take decisions.

The Chemistry programs at the secondary level take into consideration the following points.

- Actualization of the knowledge and the concepts so that they reflect, in the best possible way, the level of progress, the state of advancement, and the higher level knowledge acquired by the student
- The level of assimilation of chemistry and its technologies by the general public
- Establishing a link between scholastic knowledge of Chemistry and future career. Evidently, this is related to the quality and diversity of chemical industrialization of societies and to the existence of jobs based on chemical training.

- The association of knowledge of Chemistry with the surrounding world.
- This expresses itself by the prominence of different manifestations of chemistry in everyday life.
- The link with other branches of science and their technologies.
- The potential of Chemistry in the contest for ameliorating the quality of life of the modern society.
- Giving students a scientific culture that enhances their level of comprehension and improves their attitudes.
- The importance of the function of representation of scientific theories and the associations linking the representations with scientific knowledge.
- The didactic transposition that transforms a scientific knowledge into a knowledge for teaching. It involves extracting knowledge from its developed context; this is the process of decontextualization, followed by the contextualization of this knowledge in language accessible to students. The didactic transposition is an important step in the conception of the contents of the chemistry program.
- Keeping pace with emerging innovations. This means that the contents of the programs must be continuously updated and amended.
- The level of intellectual maturity and competence of the student.
- The importance of experimentation on the acquired knowledge, and learning the techniques doing so.

These themes when developed, generate a conceptual aspect and a practical aspect. They serve :

- Introducing the fundamental concepts of Chemistry.
- Providing simplified explanation for complex phenomena.
- Demonstrating the important place Chemistry holds in everyday life and in the global economy.
- Estimating the risks associated with the use of chemical products and taking safety measures. Safeguarding public health and the ecological equilibrium.
- Understanding the proposed solutions for abating pollution.
- Better communication with the student.
- The familiarization of students with the quantitative aspect of chemical reactions. This is achieved primarily through the use of the mole as a basis for expressing quantity of matter.
- The development of the scientific process and a model of representation.
- The passage from the macroscopic world to the microscopic world or vice versa.

## OBJECTIVES

Science and technology represent the essential bases of modern civilization. Chemistry which is a conspicuous part of science and technology fashions, by its different chemical productions, the everyday life of man kind. It occupies its prominent place in the universe as a result of the incessant transformations that give rise to matter and energy.

Chemical products are not presented in laboratories only, and chemical reaction do not take place only in test tubes. on the contrary, our existence depends to a great extent on chemical products, and chemical reactions; they are an integral part of our life. in fact, the living planet is very chemical; cells are made up of molecules, and an infinite number of reactions in the body produce living organisms that govern the bodys internal and external functions.

In the professional world, there are a variety of careers needing chemical training. Examples are: engineers, technicians, professors, dentists, medial doctors, analytical chemists, industrial chemists, argochemists, nutritionists and dietitians, pharmacologists, quality controllers, researchers, etc...

It is therefore essential to build vocations for these careers.

Consequently, the curricular objectives cover, besides the fundamentals of Chemistry, topics dealing with chemical technologies, careers needing chemical training, the environment for the consumer.

### **Chemistry knowledge:**

The Chemistry program of the second and third years aims at imparting a group of coherent notions that supplement the ones tackled during the previous years. This prepares the students for their university studies and gives them a foundation in Chemistry which helps them cope better with modern life. These notions include:

- Classification of matter according to various criteria.
- Techniques of separation, identification measuring and analyzing properties.
- Particulate nature of matter at the level of the atom, the molecule, and the ion.
- Subatomic particles, their characteristics. The distribution of electrons in energy levels, sublevels and orbitals.
- Formation of infinitely large number of compounds from a limited number of elements.
- The language of chemistry that comprises symbols, formulas, equations and representations.
- Chemical reactions of transformations. Energy exchanged during a chemical reaction.
- Spontaneous and nonspontaneous reactions.
- Reactions between matter and electricity .
- The chemical bond, distribution of electrons and properties related to this distribution.
- Conservation of matter and energy during a chemical transformation.
- Rates of chemical reactions: chemical kinetics.

- Chemical equilibrium and its significance in an industrial process.
- The particularity of carbon in making carbon-carbon chains of organic compound.
- Physical and chemical properties of chemicals and their interpretation.
- The principles and processes of manufacturing and developing .
- The production of synthetic molecules that replace natural products to meet the needs of the consumer.
- The manufacturing of chemical products that do not have natural counterparts. Examples are: glass, ceramics, composite materials, alloy...
- The production of synthetic materials that have the same structure and properties as natural ones.
- Aqueous solutions and their particular importance in Chemistry.

### **Chemical techniques:**

The essential objective is to bring to the fore the industrial applications and the adopted technologies that reveal the usefulness of Chemistry in different domains such as : food and beverage, medicines, textiles, cosmetics, detergents, pesticides, transportation, explosives, construction materials, etc.... we equally aim at exposing the methods of exploitation of the natural resources of energy and raw materials.

### **Careers needing chemical training:**

For the student to be able to choose a future career, subject matter of Chemistry should focus attention on the link between the chemistry learned at school and careers needing chemical training.

### **The environment and safety measures:**

In modern societies, every citizen uses a large number of chemical products that can present risks and dangers to health, the prevention of accidents, and the protection of the environment deserve special attention. It is, therefore, of paramount importance that the students are better acquainted with chemical products and are taught the proper methods of handling and using them.

### **Sound choices for the consumer:**

In our everyday life, we are subjected in a remarkable way to the influence of different aspects of marketing (audio-visual publicity, journals, magazines, daily papers, specialized broadcasting ...) that use a terminology increasingly burdened enriched with scientific terms such as: aspirin pH=8, soaps with glycerin, detergents with enzymes, thermosetting plastics....It is therefore vital for the general public to be familiarized with this terminology so that the choice of consumer products is not arbitrary but based on common sense.

### SCOPE AND SEQUENCE - General Sciences Section

Theme	First Year	Second Year	Third Year
<b>Matter: Constitution, structural properties, bonding between particles</b>	<ul style="list-style-type: none"> <li>- Atoms</li> <li>- Molecules</li> <li>- Ions</li> </ul>	<ul style="list-style-type: none"> <li>- Atomic orbitals.</li> </ul>	
<b>Chemical reactions and energy</b>	<ul style="list-style-type: none"> <li>- Chemical reactions.</li> </ul>	<ul style="list-style-type: none"> <li>- Thermochemistry. Electrochemistry.</li> </ul>	<ul style="list-style-type: none"> <li>- Chemical kinetics.</li> <li>- Chemical equilibrium.</li> </ul>
<b>Organic chemistry</b>		<ul style="list-style-type: none"> <li>- Organic chemistry - I.</li> </ul>	<ul style="list-style-type: none"> <li>- Organic chemistry - II.</li> </ul>
<b>Raw materials Chemical industry</b>	<ul style="list-style-type: none"> <li>- Fertilizers.</li> </ul>	<ul style="list-style-type: none"> <li>- Petroleum and natural gas.</li> <li>- Industrial chemistry.</li> <li>- Metallurgy: Metals and alloys.</li> </ul>	<ul style="list-style-type: none"> <li>- Polymers.</li> </ul>
<b>States of Matter</b>	<ul style="list-style-type: none"> <li>- Water.</li> </ul>		<ul style="list-style-type: none"> <li>- The Gaseous State.</li> </ul>
<b>Aqueous acidic and basic solutions</b>	<ul style="list-style-type: none"> <li>- Acids and bases.</li> </ul>		<ul style="list-style-type: none"> <li>- Acid - Base reactions in aqueous solutions.</li> <li>- Titration using pH meter.</li> </ul>
<b>Chemical analysis</b>	<ul style="list-style-type: none"> <li>- Qualitative analysis.</li> <li>- Volumetric analysis.</li> </ul>	<ul style="list-style-type: none"> <li>- Elemental analysis</li> </ul>	<ul style="list-style-type: none"> <li>- Acid-Base titration using titration curves of pH.</li> </ul>
<b>Pollution</b>	<ul style="list-style-type: none"> <li>- Atmospheric pollution.</li> </ul>	<ul style="list-style-type: none"> <li>- Pollution and treatment of wastes.</li> </ul>	<ul style="list-style-type: none"> <li>- Pollution due to polymers.</li> </ul>

### SCOPE AND SEQUENCE - Life Sciences Section

Theme	First Year	Second Year	Third Year
<b>Matter: Constitution, structural properties, bonding between particles</b>	<ul style="list-style-type: none"> <li>- Atoms,</li> <li>- Molecules</li> <li>- Ions.</li> </ul>	<ul style="list-style-type: none"> <li>- Atomic orbitals.</li> </ul>	
<b>Chemical reactions and energy</b>	<ul style="list-style-type: none"> <li>- Chemical reactions.</li> </ul>	<ul style="list-style-type: none"> <li>- Thermochemistry. Electrochemistry.</li> </ul>	<ul style="list-style-type: none"> <li>- Chemical kinetics. Chemical equilibrium.</li> </ul>
<b>Organic chemistry</b>		<ul style="list-style-type: none"> <li>- Organic chemistry - I.</li> </ul>	<ul style="list-style-type: none"> <li>- Organic chemistry - II.</li> </ul>
<b>Raw materials. Chemical industry</b>	<ul style="list-style-type: none"> <li>- Fertilizers.</li> </ul>	<ul style="list-style-type: none"> <li>- Petroleum and natural gas.</li> <li>- Industrial chemistry.</li> <li>- Metallurgy : Metals and alloys.</li> </ul>	<ul style="list-style-type: none"> <li>- Polymers.</li> <li>- Soaps and detergents.</li> <li>- Current medicinal drugs.</li> <li>- New materials.</li> </ul>
<b>States of Matter</b>	<ul style="list-style-type: none"> <li>- Water.</li> </ul>		<ul style="list-style-type: none"> <li>- The gaseous state.</li> </ul>
<b>Aqueous acidic and basic solutions</b>	<ul style="list-style-type: none"> <li>- Acids and bases.</li> </ul>		<ul style="list-style-type: none"> <li>- Acid - Base reactions in aqueous solutions.</li> <li>- Titration using pH meter.</li> </ul>
<b>Chemical analysis</b>	<ul style="list-style-type: none"> <li>- Qualitative analysis.</li> <li>- Volumetric analysis.</li> </ul>	<ul style="list-style-type: none"> <li>- Elemental analysis</li> </ul>	<ul style="list-style-type: none"> <li>- Acid-Base titration using titration curves of pH.</li> </ul>
<b>Pollution</b>	<ul style="list-style-type: none"> <li>- Atmospheric pollution.</li> </ul>	<ul style="list-style-type: none"> <li>- Pollution and treatment of wastes.</li> </ul>	<ul style="list-style-type: none"> <li>- Pollution due to polymers.</li> </ul>

## FIRST SECONDARY

CONTENTS	
<b>1- Atoms</b> <ul style="list-style-type: none"><li>1.1 Structure</li><li>1.2 Electron Configuration</li><li>1.3 Periodic Classification of the Elements</li><li>1.4 Mole of atoms</li></ul>	
<b>2- Molecules</b> <ul style="list-style-type: none"><li>2.1 Formation and representation</li><li>2.2 Covalent chemical bond</li><li>2.3 Shapes of molecules based on the Valence Shell Electron Pair Repulsion (VSEPR) theory</li><li>2.4 Electronegativity and Pauling's scale</li><li>2.5 Mole of molecules</li></ul>	
<b>3- Ions</b> <ul style="list-style-type: none"><li>3.1 Existence of ions</li><li>3.2 Monoatomic ions</li><li>3.3 Polyatomic ions</li><li>3.4 Mole of ions</li><li>3.5 Ionic compounds: crystal lattice, ionic bond, formula unit</li></ul>	
<b>4- Chemical reactions</b> <ul style="list-style-type: none"><li>4.1 Chemical transformation</li><li>4.2 Representation of chemical reaction by an equation</li><li>4.3 Stoichiometric coefficients</li><li>4.4 Characteristics of chemical reactions</li><li>4.5 Electrons involved in a reaction</li><li>4.6 Quantitative aspect</li></ul>	
<b>5- Water</b> <ul style="list-style-type: none"><li>5.1 Natural and pure water</li><li>5.2 Structure</li><li>5.3 Physical properties</li><li>5.4 Dissolving property of water</li></ul>	<ul style="list-style-type: none"><li>5.5 Characteristics of aqueous solutions</li><li>5.6 The different kinds of water</li><li>5.7 Obtaining potable water</li></ul>
	<b>6- Acids and Bases</b> <ul style="list-style-type: none"><li>6.1 Acidity and pH</li><li>6.2 Definition: Arrhenius and Bronsted</li><li>6.3 Acidic solution: Classification, nomenclature and reactions</li><li>6.4 Basic solution: Nomenclature and reactions</li><li>6.5 Salts: Definition and reactions</li><li>6.6 Volumetric analysis: Acid-base titration using colored indicators</li></ul>
	<b>7- Qualitative analysis</b> <ul style="list-style-type: none"><li>7.1 Analytical characteristics of some ions</li><li>7.2 Test to identify some ions</li></ul>
	<b>8- Fertilizers</b> <ul style="list-style-type: none"><li>8.1 Plants' need for nutrients</li><li>8.2 Characteristics of the nutritive medium</li><li>8.3 Necessity for providing nutritive elements</li><li>8.4 Classification of fertilizers</li><li>8.5 Pollution due to use of fertilizers</li></ul>
	<b>9- Atmospheric pollution</b> <ul style="list-style-type: none"><li>9.1 Composition of clear air</li><li>9.2 Polluted air: Pollutants and their sources</li><li>9.3 Acid rain</li><li>9.4 Green house effect</li><li>9.5 The hole in the ozone layer</li><li>9.6 Smog</li><li>9.7 Fight against pollution</li></ul>

## SECOND SECONDARY: Humanities Section

CONTENTS	
<p><b>1- Soaps and Detergents</b></p> <p><b>1.1 Soaps</b></p> <ul style="list-style-type: none"><li>- Preparation</li><li>- Composition</li><li>- Solubility in water and its variation with the nature of the used water</li><li>- Principle of detergency</li><li>- The different varieties and their characteristics</li></ul> <p><b>1.2 Detergents</b></p> <ul style="list-style-type: none"><li>- Composition and properties.</li><li>- Preparation and characteristics of the principal types of detergents.</li><li>- Impact on the environment.</li></ul> <p><b>2- Synthetic Polymers</b></p> <ul style="list-style-type: none"><li>- Presentation and nomenclature</li><li>- Properties and classification.</li><li>- Synthesis of polymers.</li><li>- Problems of pollution</li></ul>	<p><b>3- Pesticides</b></p> <p><b>1.1 Pesticides</b></p> <ul style="list-style-type: none"><li>- Classification<ul style="list-style-type: none"><li>o Herbicides.</li><li>o Insecticides</li><li>o Fungicides.</li></ul></li><li>- Toxicity LD50.</li><li>- Study of the active materials of some pesticides.</li><li>- Resistance of insects.</li><li>- Degradation and impact on the environment.</li></ul> <p><b>1.2 Chemical communication among insects</b></p> <ul style="list-style-type: none"><li>- Pheromones.</li><li>- Allelochemicals.</li></ul> <p><b>1.3 Future strategy</b></p> <ul style="list-style-type: none"><li>- Propesticides</li><li>- Biopesticides</li></ul>

## SECOND SECONDARY: Sciences Section

### CONTENTS

#### 1- Thermo chemistry

- 1.1 Heat of reaction at constant pressure,  $\Delta H$ .
- 1.2 Heat of reaction at constant volume,  $\Delta V$ .
- 1.3 Heat of formation
- 1.4 Hess' Law

#### 2- Electrochemistry

- 2.1 Oxidation and reduction Oxidant and reductant Redox half reactions
- 2.2 The half reaction  $H^+/H_2$
- 2.3 Redox potential
- 2.4 Electrochemical classification of reduction half-reactions
- 2.5 Balancing redox reactions
- 2.6 Cells and batteries
- 2.7 Electrolysis
- 2.8 Redox titrations

#### 3- Industrial Inorganic Chemistry

- 3.1 Study the principles for manufacturing: Ammonia, nitric acid, sulfuric acid, hydrochloric acid, phosphoric acid and sodium hydroxide.
- 3.2 Utilization of the preceding products as raw materials in the chemical industry
- 3.3 Cement and glass

#### Metallurgy: Metals and Alloys

- 4.1 Extraction of iron, copper, aluminum, gold and preparation of some alloys
- 4.2 Utilization, protection and recycling.

#### 5- Atomic Orbitals

- 5.1 Probabilistic approach that leads to the notion of atomic orbitals
- 5.2 Representations of the s and p atomic orbitals
- 5.3 Hybridization of atomic orbitals
- 5.4 Molecular shape of some molecules

#### 6- Organic chemistry - I

- 6.1 Elemental analysis
- 6.2 Molecular formula, structural formula, isomerism
- 6.3 Hydrocarbons: Alkanes, alkenes, alkynes and benzene
  - Nomenclature
  - Structure
  - Isomerism
  - Physical properties
  - Reactions
  - Applications

#### 7- Petroleum and natural gas

- 7.1 Origin of petroleum and natural gas
- 7.2 Petroleum refining: fractional distillation, cracking and reforming
- 7.3 Petroleum as a source of energy and raw materials
- 7.4 Natural gas

#### 8- Pollution

- 8.1 Industrial wastes and their impact on the environment
- 8.2 Household wastes and their impact on the environment
- 8.3 Treatment of wastes and fight against pollution.

### THIRD SECONDARY: Literature and Humanities Section

<b>CONTENTS</b>	
<p><b>1- Food Chemistry</b></p> <p><b>1.1 The constituents of foods</b></p> <ul style="list-style-type: none"><li>- Nature: Carbohydrates, lipids, proteins, minerals, vitamins</li><li>- Average composition of the principal foods</li><li>- Contribution of nutrients</li></ul> <p><b>1.2 Catabolism of carbohydrates, lipids and proteins</b></p> <p><b>1.3 The principal foods</b></p> <ul style="list-style-type: none"><li>- Cereals - bread</li><li>- Vegetal proteins</li><li>- Proteins of microorganisms</li><li>- Milk and dairy products</li><li>- Meats</li><li>- Eggs</li><li>- Fatty substances</li><li>- Additives</li></ul> <p><b>1.4 Food diet</b></p> <p><b>2- Perfumes and Cosmetics</b></p> <p><b>2.1 Definition</b></p> <p><b>2.2 The principal formulations</b></p> <ul style="list-style-type: none"><li>- Hygiene products</li><li>- Care products</li><li>- Well-being products</li></ul>	<p><b>2.3 Composition</b></p> <ul style="list-style-type: none"><li>- Vehicle or excipient</li><li>- Preservatives</li><li>- Colorings</li><li>- Perfumes</li><li>- Active elements</li></ul> <p><b>2.4 Properties</b></p> <ul style="list-style-type: none"><li>- Hydrating substances</li><li>- Softening substances</li><li>- Anti-age products</li><li>- Biological products stimulating cellular activity</li><li>- Astringent substances</li><li>- Slimming products</li></ul> <p><b>2.5 Risks of uses</b></p> <p><b>2.6 Economical aspect</b></p> <p><b>3- Current Medicinal Drugs</b></p> <p><b>3.1 Analgesics</b></p> <p><b>3.2 Anesthetics</b></p> <p><b>3.3 Antacids</b></p> <p><b>3.4 Anti-inflammatory</b></p> <p><b>3.5 Antibiotics</b></p> <p><b>3.6 Tranquilizers</b></p> <p><b>3.7 Antidepressants</b></p>

## THIRD SECONDARY: Sociology and Economics Section

CONTENTS	
<p><b>1- Food Chemistry</b></p> <p><b>1.1 The constituents of foods</b></p> <ul style="list-style-type: none"><li>- Nature: Carbohydrates, lipids, proteins, minerals, vitamins</li><li>- Average composition of the principal foods</li><li>- Contribution of nutrients</li></ul> <p><b>1.2 Catabolism of carbohydrates, lipids and proteins</b></p> <p><b>1.3 The principal foods</b></p> <ul style="list-style-type: none"><li>- Cereals - bread</li><li>- Vegetal proteins</li><li>- Proteins of microorganisms</li><li>- Milk and dairy products</li><li>- Meats</li><li>- Eggs</li><li>- Fatty substances</li><li>- Additives</li></ul> <p><b>1.4 Food diet</b></p> <p><b>2- Perfumes and Cosmetics</b></p> <p><b>2.1 Definition</b></p> <p><b>2.2 The principal formulations</b></p> <ul style="list-style-type: none"><li>- Hygiene products</li><li>- Care products</li><li>- Well-being products</li></ul> <p><b>2.3 Composition</b></p> <ul style="list-style-type: none"><li>- Vehicle or excipient</li><li>- Preservatives</li><li>- Colorings</li><li>- Perfumes</li><li>- Active elements</li></ul>	<p><b>2.4 Properties</b></p> <ul style="list-style-type: none"><li>- Hydrating substances</li><li>- Softening substances</li><li>- Anti-age products</li><li>- Biological products stimulating cellular activity</li><li>- Astringent substances</li><li>- Slimming products</li></ul> <p><b>2.5 Risks of uses</b></p> <p><b>2.6 Economical aspect</b></p> <p><b>3- Current Medicinal Drugs</b></p> <ul style="list-style-type: none"><li>▪ Analgesics</li><li>▪ Anesthetics</li><li>▪ Antacids</li><li>▪ Anti-inflammatory</li><li>▪ Antibiotics</li><li>▪ Tranquilizers</li><li>▪ Antidepressants</li></ul> <p><b>4- Treatment of Wastes</b></p> <p>4.1 Nature of wastes</p> <p>4.2 Treatments</p> <p><b>5- Chemistry and Economy</b></p> <p>5.1 Some important chemical products</p> <p>5.2 Socio-political and economical information concerning some materials</p> <p>5.3 Representations of the given information and how to act according to expectations</p> <p>5.4 How to invest in the domain of chemistry</p>

## THIRD SECONDARY: General Sciences Section

### CONTENTS

#### 1- The Gaseous State

- 1.1 Partial pressure in a mixture of ideal gases
- 1.2 Total pressure
- 1.3 Mole fraction
- 1.4 Relation between total pressure and partial pressures
- 1.5 Mean molar mass of a gas mixture

#### 2- Chemical Kinetics

- 2.1 Rate of formation and rate of disappearance of a substance
- 2.2 Graphs of kinetics data, average rate, instantaneous rate and initial rate
- 2.3 Factors influencing reaction rates rate constant
- 2.4 Order of reaction : first order, second order and zero order
- 2.5 Half-life of a reaction
- 2.6 Catalysis

#### 3- Chemical Equilibrium

- 3.1 Homogeneous equilibrium in the liquid phase. Equilibrium constant  $K_C$
- 3.2 Homogeneous equilibrium in the gas phase. Equilibrium constants  $K_C$  and  $K_p$
- 3.3 Heterogeneous equilibrium. Equilibrium constants  $K_C$  and  $K_p$
- 3.4 Shifting equilibria: Le Chatelier's Principle
- 3.5 Solubility equilibria and the solubility product

## CONTENTS

### 4- Acid- Base Reactions in Aqueous Solutions. The pH Scale

- 4.1 Definition and measurement of pH
- 4.2 Study of the pH changes that occur during the reaction between a solution of strong acid and a solution of strong base.
- 4.3 Equivalence point.
- 4.4 Acid-base titration using pH meter
- 4.5 Weak acid, weak base, conjugate acid-base pair, acid ionization constant.
- 4.6 Classification of acid-base conjugate pairs
- 4.7 Study of the pH changes that occur during the reaction between a solution of a weak acid and a solution of a strong base
- 4.8 Titration of a weak acid using pH meter
- 4.9 Study of the pH changes that occur during the reaction between a solution of a weak base and a solution of a strong acid
- 4.10 Titration of a weak base using pH meter
- 4.11 Buffer solutions

### 5- Organic Chemistry - II

Study of the nomenclature, structure, isomerism, and some typical reactions for each of the functions :

- 5.1 Alcohol
- 5.2 Aldehyde and Ketone
- 5.3 Carboxylic acids and derivatives

### 6- Polymers

- 6.1 Natural polymers and synthetic polymers
- 6.2 Characteristics and uses
- 6.3 Economic aspect
- 6.4 Impact on the environment

## THIRD SECONDARY: Life Sciences Section

### CONTENTS

#### 1- The Gaseous State

- 1.1 Partial pressure in a mixture of ideal gases
- 1.2 Total pressure
- 1.3 Mole fraction
- 1.4 Relation between total pressure and partial pressures
- 1.5 Mean molar mass of a gas mixture

#### 2- Chemical Kinetics

- 2.1 Rate of formation and rate of disappearance of a substance
- 2.2 Graphs of kinetics data, average rate, instantaneous rate and initial rate
- 2.3 Factors influencing reaction rates rate constant
- 2.4 Order of reaction : first order, second order and zero order
- 2.5 Half-life of a reaction
- 2.6 Catalysis

#### 3- Chemical Equilibrium

- 3.1 Homogeneous equilibrium in the liquid phase. Equilibrium constant  $K_C$
- 3.2 Homogeneous equilibrium in the gas phase. Equilibrium constants  $K_C$  and  $K_p$
- 3.3 Heterogeneous equilibrium. Equilibrium constants  $K_C$  and  $K_p$
- 3.4 Shifting equilibria: Le Chatelier's Principle
- 3.5 Solubility equilibria and the solubility product

## CONTENTS

### 4- Acid- Base Reactions in Aqueous Solutions. The pH Scale

- 4.1 Definition and measurement of pH
- 4.2 Study of the pH changes that occur during the reaction between a solution of strong acid and a solution of strong base.
- 4.3 Equivalence point.
- 4.4 Acid-base titration using pH meter
- 4.5 Weak acid, weak base, conjugate acid-base pair, acid ionization constant.
- 4.6 Classification of acid-base conjugate pairs
- 4.7 Study of the pH changes that occur during the reaction between a solution of a weak acid and a solution of a strong base
- 4.8 Titration of a weak acid using pH meter
- 4.9 Study of the pH changes that occur during the reaction between a solution of a weak base and a solution of a strong acid
- 4.10 Titration of a weak base using pH meter
- 4.11 Buffer solutions

### 5- Organic Chemistry - II

Study of the nomenclature, structure, isomerism, and some typical reactions for each of the functions

- 5.1 Alcohol
- 5.2 Aldehyde and Ketone
- 5.3 Carboxylic acids and derivatives
- 5.4 Aliphatic amines
- 5.5  $\alpha$ - Amino acids

### 6- Polymers

- 6.1 Natural polymers and synthetic polymers
- 6.2 Characteristics and uses
- 6.3 Economic aspect
- 6.4 Impact on the environment

## CONTENTS

### **7- Soaps and Detergents**

- 7.1 Preparation of soaps
- 7.2 Principle of detergents
- 7.3 Synthetic detergents
  - Composition
  - Properties
  - Surfactants
  - Builders (active additives)
  - Bleaching agents
  - Additives
  - Complexing agents

### **8- Current Medicinal Drugs**

- Analgesics, anesthetics, antacids, anti-inflammatory, antibiotics, tranquilizers, antidepressants

### **9- New Materials**

- 9.1 Ceramics: Development, properties and uses
- 9.2 Composite materials: Development, properties, and uses.

**SECONDARY EDUCATION**

**PHYSICS CURRICULUM**

## **SECTIONS: LITERATURE AND HUMANITIES, SOCIOLOGY AND ECONOMICS**

### **INTRODUCTION**

The science curriculum for the two sections: Literature and Humanities, and Sociology and Economics, is part of a common core of learning, encompassing mathematics and technology, whose main goal is developing science literacy as it relates to today's world and prepares for tomorrow.

The topics in the curriculum include themes in Biology, Chemistry and Physics selected carefully to provide the background for understanding the latest scientific developments which shape up the modern society. They are selected so that the students can concentrate on learning a basic set of ideas and skills that enable them to engage intelligently in public discourse and debate matters of scientific and technical concern, to think critically and independently, to lead an interesting, responsible, and productive life, and to interact positively with the environment and address the health problems and consumer concerns.

The basic physical ideas in general, and energy in particular, are distributed as follows:

The second secondary (Humanities section) contains the following topics: electricity, light and sound with a special emphasis on domestic and car applications, lasers, microwaves, optical instruments, musical instruments. The program focuses also on energy considerations, pollution and its effects on our health and our environment.

The program of the third secondary (Literature and Humanities sections) contains the following topics: energy, radioactivity and universe with special highlights on the historical development of science, transformation of energy, radiation (detection and protection) and their effects on our health and our environment. In addition, the curriculum of the Sociology and Economics section treats the economical aspects of energy.

### **OBJECTIVES**

The teaching of science should allow students to:

- Acquire the scientific terminology, knowledge, and skills necessary for every day's life.
- Understand the current scientific information used in the media.
- Understand the relation between science, technology, and society.
- Make responsible decisions related to health and environmental problems in everyday life.
- Become aware of bioethical, economical and social issues.
- Appreciate the scope of the contribution of science and scientists to the intellectual development of mankind.
- Conduct scientific processes and acquire scientific attitudes for attaining better autonomy.

**SCOPE AND SEQUENCE: Literature and Humanities Section**

Theme	First Year	Second Year	Third Year
<b>Electricity</b>	<ul style="list-style-type: none"> <li>- Electrostatics: electric charge and Coulomb's law.</li> <li>- Potential difference, electric current, resistance, energy and power.</li> <li>- Generators, receivers, electric circuits.</li> </ul>	<ul style="list-style-type: none"> <li>- Generalities: direct and alternating current, potential difference, power, receiver.</li> <li>- Production of electric energy: batteries, accumulators, power stations.</li> <li>- Transport of electric energy. Transformers.</li> <li>- Consumption of electric energy (forms and cost). Electricity at home: circuits and machines. Electricity in the car: circuits and elements.</li> <li>- Dangers of electricity. Electrocutation. Precautions. Pollution due to power plants.</li> </ul>	
<b>Mechanics</b>	<ul style="list-style-type: none"> <li>- Kinematics of rectilinear translation : motion, velocity and acceleration.</li> <li>- Forces and interactions.</li> <li>- Laws of motion.</li> <li>- Gravitational interaction</li> </ul>		<p><b>Energy</b></p> <ul style="list-style-type: none"> <li>- Work. Forms of energy: mechanical, thermal, chemical electrical and nuclear.</li> <li>- Sources and transformations of energy.</li> <li>- Equivalence between mass and energy.</li> <li>- Pollution.</li> </ul>
<b>Waves</b>	<ul style="list-style-type: none"> <li>- Mechanical waves: characteristics, transverse and longitudinal waves, associated phenomena.</li> <li>- Light waves: characteristics.</li> </ul>	<p><b>Light</b></p> <ul style="list-style-type: none"> <li>- Aspects of light propagation, frequency wavelength, sources, absorption, emission and spectrum.</li> <li>- Radiation energy. Microwave ovens</li> <li>- Lasers: properties, applications in medicine.</li> <li>- Effects on health.</li> </ul>	

Theme	First Year	Second Year	Third Year
		<p><b>Sound</b></p> <ul style="list-style-type: none"> <li>- Sound waves: nature, propagation, frequency, wavelength, sources.</li> <li>- Musical instruments: strings and tubes.</li> <li>- The human ear as a detector, Ultrasound and applications.</li> <li>- Acoustic energy.</li> <li>- Noise and its effects on the human ear.</li> </ul>	
<b>Optics</b>	<ul style="list-style-type: none"> <li>- Reflection and mirrors.</li> <li>- Refraction and lenses.</li> <li>- Application to some optical instruments.</li> </ul>	<ul style="list-style-type: none"> <li>- Optical systems: microscope, optical fibres, eye.</li> </ul>	
<b>Modern Physics</b>			<p><b>Radioactivity</b></p> <ul style="list-style-type: none"> <li>- Natural and artificial sources.</li> <li>- Spontaneous and stimulated nuclear reactions (fission and fusion).</li> <li>- Effects on health and environment.</li> <li>- Detection and protection (acceptable doses).</li> </ul> <p><b>Universe</b></p> <ul style="list-style-type: none"> <li>- Historical development of astronomy.</li> <li>- The solar system.</li> <li>- Evolution and dimensions of the universe.</li> <li>- Instruments of observation: telescopes, radiotelescopes.</li> <li>- Space stations and satellites.</li> <li>- Cosmology: Big Bang, age of the Universe, Hubble's law , black holes.</li> </ul>

## SCOPE AND SEQUENCE - Sociology and Economics Section

Theme	First Year	Second Year	Third Year
<b>Electricity</b>	<ul style="list-style-type: none"> <li>- Electrostatics: electric charge and Coulomb's law.</li> <li>- Potential difference, electric current, resistance, energy and power.</li> <li>- Generators, receivers, electric circuits.</li> </ul>	<ul style="list-style-type: none"> <li>- Generalities: direct and alternating current, potential difference, power, receiver.</li> <li>- Production of electric energy: batteries, accumulators, power stations.</li> <li>- Transport of electric energy. Transformers.</li> <li>- Consumption of electric energy (forms and cost). Electricity at home: circuits and machines. Electricity in the car: circuits and elements.</li> <li>- Dangers of electricity. Electrocutation. Precautions. Pollution due to power plants.</li> </ul>	
<b>Mechanics</b>	<ul style="list-style-type: none"> <li>- Kinematics of rectilinear translation: motion, velocity and acceleration.</li> <li>- Forces and interactions.</li> <li>- Laws of motion.</li> <li>- Gravitational interaction</li> </ul>		<p><b>Energy</b></p> <ul style="list-style-type: none"> <li>- Work. Forms of energy: mechanical, thermal, chemical electrical and nuclear.</li> <li>- Sources and transformations of energy.</li> <li>- Equivalence between mass and energy.</li> <li>- Pollution.</li> </ul> <p><b>Energy and economy</b></p> <ul style="list-style-type: none"> <li>- Petrol : extraction, reserves, offer and demand, prices, revenues, international organizations.</li> <li>- Transport: cars, diesel, fuel and pollution, electric car.</li> <li>- Research on new sources of energy.</li> </ul>
<b>Waves</b>	<ul style="list-style-type: none"> <li>- Mechanical waves: characteristics, transverse and longitudinal waves, associated phenomena.</li> <li>- Light waves: characteristics.</li> </ul>	<p><b>Light</b></p> <ul style="list-style-type: none"> <li>- Aspects of light propagation, frequency wavelength , sources, absorption, emission and spectrum.</li> <li>- Radiation energy. Microwave ovens</li> </ul>	

Theme	First Year	Second Year	Third Year
		<ul style="list-style-type: none"> <li>- Lasers: properties, applications in medicine.</li> <li>- Effects on health.</li> </ul> <p><b>Sound</b></p> <ul style="list-style-type: none"> <li>- Sound waves: nature, propagation, frequency, wavelength, sources.</li> <li>- Musical instruments: strings and tubes.</li> <li>- The human ear as a detector, Ultrasound and applications.</li> <li>- Acoustic energy.</li> <li>- Noise and its effects on the human ear.</li> </ul>	
<b>Optics</b>	<ul style="list-style-type: none"> <li>- Reflection and mirrors.</li> <li>- Refraction and lenses.</li> <li>- Application to some optical instruments.</li> </ul>	<ul style="list-style-type: none"> <li>- Optical systems: microscope, optical fibres, eye.</li> </ul>	
<b>Modern Physics</b>			<p><b>Radioactivity</b></p> <ul style="list-style-type: none"> <li>- Natural and artificial sources.</li> <li>- Spontaneous and stimulated nuclear reactions (fission and fusion).</li> <li>- Effects on health and environment.</li> <li>- Detection and protection (acceptable doses).</li> </ul> <p><b>Universe</b></p> <ul style="list-style-type: none"> <li>- Historical development of astronomy.</li> <li>- The solar system.</li> <li>- Evolution and dimensions of the universe.</li> <li>- Instruments of observation: telescopes, radiotelescopes.</li> <li>- Space stations and satellites.</li> <li>- Cosmology: Big Bang, age of the Universe, Hubble's law, black holes.</li> </ul>

## **SECTIONS: GENERAL SCIENCES , LIFE SCIENCES**

### **INTRODUCTION**

This curriculum aims to help secondary school students develop their scientific knowledge and their practical skills. It also aims to familiarize students with the scientific method in an accessible and simple way through group work and experimentation. On one hand, it allows a good assimilation of the physics concepts directly related to the environment, health, and everyday social life. On the other hand, it provides an understanding of the universe, the basis of modern technology, and recent discoveries.

The Physics Curriculum is adjusted to serve the needs and abilities of the students. It takes into consideration their individual differences and their previous knowledge, and favors several teaching approaches, where the natural phenomena will serve as a starting point for knowledge acquisition. A minimum amount of experimental work will be done by the teacher in the form of demonstrations and by the students in the form of laboratory experiments. The available audio-visual means, media and computers will be used whenever possible.

The use of mathematics will be limited in order not to mask the physics contents. Some physical formulae might be given without mathematical derivation.

Evaluation of the student's work will test the objectives of the teaching process. It will be based on problems and examples reflecting real situations with practical data.

The curriculum of the first secondary class is common to all students; its program takes into consideration the difficulty that some students face in using mathematical formalism. The themes, laws, and concepts taken at the intermediate level are repeated and reinforced in order to give a general knowledge accessible to all. The program of this year allows the student to choose between the scientific and the literary sections; it gives the students the elements needed by either of the two sections.

The program of the second year (scientific sections) introduces some theories of physics: the kinetic theory of gases and electromagnetism.

The program of the third year-general sciences section and life science ssection - offers the students a global view of Physics, of its theories and technological applications. However, the details of the content and the applications included are not the same in the two sections.

The following objectives are common to the three years (first year secondary, second and third year scientific sections).

## OBJECTIVES

The object of teaching physics at the secondary level is to contribute to the achievement of the general objectives of science teaching, and to emphasize the specific nature of physics and its relations with other scientific disciplines.

This teaching, based on the knowledge acquired at the intermediate level, aims to :

- Give the students a scientific knowledge through:
  - enlarging the scope of their knowledge,
  - interpretation of scientific observations,
  - understanding laws, models, and theories of natural phenomena,
  - relating physical laws to technological applications.
- Appreciate the scope of the contribution of science and scientists to the intellectual development of mankind.
- Prepare the students for scientific careers based on physics and awaken their scientific vocations.
- Make students aware of the scientific method with all the rigor, intellectual honesty and critical thinking it requires. This consists of :
  - practicing the experimental method in order to develop the skills of observation, data collection, and interpretation of results,
  - the mathematical formulation of the laws of physics and the construction of models,
  - the resolution of concrete problems.
- Make the students understand the scientific messages contained in diagrams, graphs and media.
- Train students to express themselves scientifically through the use of the appropriate terminology and abstract representations.
- Train students to work in groups through experimental work and discussions.
- Contribute to make students behave as responsible citizens that are able to make decisions based on scientific attitudes.
- Make students aware of the development of the ideas in physics and their interaction with the development of human thought.

## SCOPE AND SEQUENCE - General Sciences Section

Theme	First Year	Second Year	Third Year
<b>Electricity</b>	<ul style="list-style-type: none"> <li>- Electrostatics: electric charge and Coulomb's law.</li> <li>- Potential difference, electric current, resistance, energy and power.</li> <li>- Generators, receivers, electric circuits.</li> </ul>	<ul style="list-style-type: none"> <li>- Electrostatics: electric field and potential energy.</li> <li>- Capacitors: capacitance, energy, grouping, effects of dielectrics.</li> <li>- Electromagnetism: magnetic field and electromagnetic force.</li> <li>- Motion of charged particles in a uniform electric field and in a uniform magnetic field when <math>\mathbf{v} \perp \mathbf{B}</math>. Applications.</li> </ul>	<ul style="list-style-type: none"> <li>- Electromagnetic induction.</li> <li>- Alternating sinusoidal currents: sources circuits, power.</li> <li>- Transformers and transmission of electric energy.</li> <li>- Applications.</li> </ul>
<b>Electronics</b>		<ul style="list-style-type: none"> <li>- Semi-conductors: conduction, types, P-N junction, <math>i(v)</math> characteristics, applications.</li> <li>- Transistors : functioning and applications.</li> <li>- Operational amplifier: functioning and applications.</li> </ul>	
<b>Mechanics</b>	<ul style="list-style-type: none"> <li>- Kinematics of rectilinear translation: motion, velocity and acceleration.</li> <li>- Forces and interactions.</li> <li>- Laws of motion.</li> <li>- Gravitational interaction.</li> </ul>	<ul style="list-style-type: none"> <li>- Plane motion of a particle. Applications: projectile and satellite, Kepler's laws.</li> <li>- Material systems. Center of mass.</li> <li>- Rotational dynamics. Applications</li> <li>- Work and energy: work of a constant force, power, variation of gravitational potential energy, kinetic energy and work-energy theorem, mechanical energy and its conservation.</li> </ul>	<ul style="list-style-type: none"> <li>- Conservation laws: linear momentum, angular momentum, energy. Applications.</li> <li>- Fluid mechanics: pressure of a liquid, surface tension, Bernoulli's equation and viscosity.</li> <li>- Oscillations: simple harmonic motion, notions about forced and damped oscillations, resonance</li> </ul>
<b>Heat</b>		<ul style="list-style-type: none"> <li>- Ideal gases : laws and equation of state.</li> <li>- Kinetic theory of gases: pressure, kinetic energy, and temperature.</li> <li>- Change of state.</li> <li>- Thermal equilibrium: Zeroth law of thermodynamics.</li> <li>- First law of thermodynamics.</li> <li>- Heat engines and efficiencies.</li> </ul>	

<b>Theme</b>	<b>First Year</b>	<b>Second Year</b>	<b>Third Year</b>
<b>Waves</b>	<ul style="list-style-type: none"> <li>- Mechanical waves: characteristics, transverse and longitudinal waves, associated phenomena.</li> <li>- Light waves: characteristics.</li> </ul>	<ul style="list-style-type: none"> <li>- Reflection and superposition of waves.</li> <li>- Standing waves.</li> <li>- Sound waves: energy. Doppler's effect, musical sounds, biological effects.</li> </ul>	
<b>Optics</b>	<ul style="list-style-type: none"> <li>- Reflection and mirrors.</li> <li>- Refraction and lenses.</li> <li>- Application on some optical instruments.</li> </ul>		<ul style="list-style-type: none"> <li>- Wave aspect of light: characteristics, coherent light, electromagnetic spectrum. Linear polarization, diffraction, interference</li> <li>- Particle aspect: quantization of energy and photoelectric effect.</li> </ul>
<b>Modern Physics</b>			<ul style="list-style-type: none"> <li>- Atoms: atomic models, energy levels, spectra and lasers.</li> <li>- Nuclei: composition, radioactivity, nuclear reactions (fusion and fission), effects of radiation on living organisms. Application.</li> <li>- The universe: the Big Bang and the expansion of the universe. Life and death of stars.</li> </ul>

### SCOPE AND SEQUENCE - Life Sciences Section

Theme	First Year	Second Year	Third Year
<b>Electricity</b>	<ul style="list-style-type: none"> <li>- Electrostatics: electric charge and Coulomb's law.</li> <li>- Potential difference, electric current, resistance, energy and power.</li> <li>- Generators, receivers, electric circuits.</li> </ul>	<ul style="list-style-type: none"> <li>- Electrostatics: electric field and potential energy.</li> <li>- Capacitors: capacitance, energy, grouping, effects of dielectrics.</li> <li>- Electromagnetism: magnetic field and electromagnetic force.</li> <li>- Motion of charged particles in a uniform electric field and in a uniform magnetic field when <math>\mathbf{v} \perp \mathbf{B}</math>. Applications.</li> </ul>	<ul style="list-style-type: none"> <li>- Electromagnetic induction.</li> <li>- Alternating sinusoidal currents: sources circuits, power.</li> <li>- Transformers and transmission of electric energy.</li> <li>- Applications.</li> </ul>
<b>Electronics</b>		<ul style="list-style-type: none"> <li>- Semi-conductors: conduction, types, P-N junction, <math>i(v)</math> characteristics, applications.</li> <li>- Transistors : functioning and applications.</li> <li>- Operational amplifier: functioning and applications.</li> </ul>	
<b>Mechanics</b>	<ul style="list-style-type: none"> <li>- Kinematics of rectilinear translation: motion, velocity and acceleration.</li> <li>- Forces and interactions.</li> <li>- Laws of motion.</li> <li>- Gravitational interaction.</li> </ul>	<ul style="list-style-type: none"> <li>- Plane motion of a particle. Applications: projectile and satellite, Kepler's laws.</li> <li>- Material systems. Center of mass.</li> <li>- Rotational dynamics. Applications</li> <li>- Work and energy: work of a constant force, power, variation of gravitational potential energy, kinetic energy and work-energy theorem, mechanical energy and its conservation.</li> </ul>	<ul style="list-style-type: none"> <li>- Conservation laws: linear momentum, angular momentum, energy. Applications.</li> <li>- Fluid mechanics: pressure of a liquid, surface tension, Bernoulli's equation and viscosity.</li> <li>- Oscillations: simple harmonic motion, notions about forced and damped oscillations, resonance.</li> </ul>
<b>Heat</b>		<ul style="list-style-type: none"> <li>- Ideal gases : laws and equation of state.</li> <li>- Kinetic theory of gases: pressure, kinetic energy, and temperature.</li> <li>- Change of state.</li> <li>- Thermal equilibrium: Zeroth law of thermodynamics.</li> <li>- First law of thermodynamics.</li> <li>- Heat engines and efficiencies.</li> </ul>	

<b>Theme</b>	<b>First Year</b>	<b>Second Year</b>	<b>Third Year</b>
<b>Waves</b>	<ul style="list-style-type: none"> <li>- Mechanical waves: characteristics, transverse and longitudinal waves, associated phenomena.</li> <li>- Light waves: characteristics.</li> </ul>	<ul style="list-style-type: none"> <li>- Reflection and superposition of waves.</li> <li>- Standing waves.</li> <li>- Sound waves: energy. Doppler's effect, musical sounds, biological effects.</li> </ul>	
<b>Optics</b>	<ul style="list-style-type: none"> <li>- Reflection and mirrors.</li> <li>- Refraction and lenses.</li> <li>- Application on some optical instruments.</li> </ul>		<ul style="list-style-type: none"> <li>- Wave aspect of light: characteristics, coherent light, electromagnetic spectrum. Linear polarization, diffraction, interference</li> <li>- Particle aspect: quantization of energy and photoelectric effect.</li> </ul>
<b>Modern Physics</b>			<ul style="list-style-type: none"> <li>- Atoms: atomic models, energy levels, spectra and lasers.</li> <li>- Nuclei: composition, radioactivity, nuclear reactions (fusion and fission), effects of radiation on living organisms. Application.</li> </ul>

## FIRST SECONDARY

### CONTENTS

#### 1- Electricity

- 1.1 Electrostatics: electric charge and Coulomb's law.
- 1.2 Potential difference.
- 1.3 Electric current.
- 1.4 Resistance, energy and power.
- 1.5 Generators.
- 1.6 Receivers.
- 1.7 Electric circuits.

#### 2- Waves

- 2.1 Mechanical waves: characteristics, transverse and longitudinal waves, associated phenomena.
- 2.2 Light waves: characteristics.

#### 3- Optics

- 3.1 Reflection and mirrors.
- 3.2 Refraction and lenses.
- 3.3 Applications to some optical instruments.

#### 4- Mechanics

- 4.1 Kinematics of rectilinear translation: motion, velocity and acceleration.
- 4.2 Forces and interactions.
- 4.3 Laws of motion.
- 4.4 Gravitational interaction.

## SECOND SECONDARY: Humanities Section

### 1- Electricity

- 1.1 Generalities: direct and alternating current, potential difference, power, receivers.
- 1.2 Production of electric energy: batteries, accumulators and power stations.
- 1.3 Transport of electric energy. Transformers.
- 1.4 Consumption of electric energy (forms and cost). Electricity at home: circuits and machines. Electricity in the car: circuits and elements.
- 1.5 Dangers of electricity. Electrocutation. Precautions. Pollution due to power stations.

### 2- Waves and light

- 2.1 Aspects of light, propagation, frequency, wavelength, sources, absorption, emission and spectrum.
- 2.2 Optical systems, microscope, optical fibers, eye.
- 2.3 Radiation energy. Microwave ovens.
- 2.4 Lasers: properties, applications in medicine.
- 2.5 Effects on health.

### 3- Sound

- 3.1 Sound waves: nature, propagation, frequency, wave length, sources.
- 3.2 Musical instruments: strings and tubes.
- 3.3 The human ear as a detector, ultrasound and applications.
- 3.4 Acoustic energy.
- 3.5 Noise and its effects on the human ear.

## SECOND SECONDARY: Sciences Section

### CONTENTS

#### 1- Waves

- 1.1 Reflection and superposition of waves.
- 1.2 Standing waves.
- 1.3 Sound waves: energy, Doppler effect, musical sounds, biological effects

#### 2- Mechanics

- 2.1 Plane motion of a particle. Applications: projectile and satellite. Kepler's laws.
- 2.2 Material systems. Center of mass.
- 2.3 Rotational dynamics. Applications.
- 2.4 Work and energy: work of a constant force, power, variation of gravitational potential energy, kinetic energy and work-energy theorem, mechanical energy and its conservation.

#### 3- Heat

- 3.1 Ideal gases: laws and equation of state.
- 3.2 Kinetic theory of gases: pressure, kinetic energy and temperature
- 3.3 Change of state.
- 3.4 Thermal equilibrium: Zeroth law of thermodynamics.
- 3.5 First law of thermodynamics.
- 3.6 Heat engines and efficiencies.

#### 4- Electricity

- 4.1 Electrostatics: electric field and potential energy.
- 4.2 Capacitors: capacitance, energy, grouping and effects of dielectrics.
- 4.3 Electromagnetism: magnetic field and electromagnetic force.
- 4.4 Motion of charged particles in a uniform electric field and in a uniform magnetic field with.  $v \perp B$ . Applications: oscilloscope and cyclotron.

#### 5- Electronics

- 5.1 Semi - conductors: conduction, types, P-N Junction,  $i - v$  diagram, applications
- 5.2 Transistors: functioning and applications
- 5.3 Operational amplifier: functioning and applications.

## THIRD SECONDARY: Literature and Humanities Section

### CONTENTS

#### 1- Energy

- 1.1 Work. Forms of energy: mechanical, thermal, chemical, electrical and nuclear energy.
- 1.2 Sources and transformation of energy.
- 1.3 Equivalence between mass and energy.
- 1.4 Pollution.

#### 2- Radioactivity

- 2.1 Natural and artificial sources.
- 2.2 Spontaneous and stimulated nuclear reactions (fission and fusion).
- 2.3 Effects on health and environment.
- 2.4 Detection and protection (acceptable doses).

#### 3- The Universe

- 3.1 Historical development of astronomy.
- 3.2 The solar system.
- 3.3 Evolution and dimensions of the universe.
- 3.4 Instruments of observations: telescopes, radiotelescopes.
- 3.5 Space stations and satellites.
- 3.6 Cosmology: Big Bang, age of the universe, Hubble's law, black holes.

## THIRD SECONDARY: Sociology and Economics Section

### CONTENTS

#### 1- Energy

- 1.1 Work. Forms of energy: mechanical, thermal, chemical, electrical and nuclear energy.
- 1.2 Sources and transformation of energy.
- 1.3 Equivalence between mass and energy.
- 1.4 Pollution.

#### 2- Radioactivity

- 2.1 Natural and artificial sources.
- 2.2 Spontaneous and stimulated nuclear reactions (fission and fusion).
- 2.3 Effects on health and environment.
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#### 3- The Universe

- 3.1 Historical development of astronomy.
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- 3.4 Instruments of observations: telescopes, radiotelescopes.
- 3.5 Space stations and satellites.
- 3.6 Cosmology: age of the universe, Hubble's law, black holes.

#### 4- Energy and Economy

- 4.1 Petroleum: extraction, reserves, supply and demand, revenues, international organizations.
- 4.2 Transport: cars, diesel, fuel and pollution, electric car.
- 4.3 Research on new sources of energy.

### THIRD SECONDARY: General Sciences Section

#### CONTENTS

##### 1- Mechanics

- 1.1 Conservation laws: linear momentum, angular momentum, energy. Applications.
- 1.2 Fluid dynamics: Bernoulli's equation.
- 1.3 Oscillations: simple harmonic motion, notion about forced and damped oscillations, resonance.
- 1.4 Special relativity: Einstein's postulates and their consequences. Equivalence of mass and energy.

##### 2- Electricity

- 2.1 Electromagnetism: electromagnetic induction, laws of Faraday and Lenz, coil, generator, motor.
- 2.2 Alternating sinusoidal current: sources, circuits, power. Applications: transformer and transmission of electric energy.
- 2.3 Electromagnetic oscillations. Applications.

##### 3- Optics

- 3.1 Wave aspect of light: characteristics, coherent light, electromagnetic spectrum, plane polarization, interference.
- 3.2 Particle aspect of light : quantization of energy and photoelectric effect.

##### 4- Atom, Nucleus and Universe

- 4.1 Atoms: atomic models, energy levels, spectra and lasers.
- 4.2 Nucleus: composition, radioactivity. Nuclear reactions fusion and fission. Effects of radiations on living organisms. Applications.
- 4.3 Universe : big bang and expansion of the universe, life and death of stars.

## THIRD SECONDARY: Life Sciences Section

### CONTENTS

#### 1- Mechanics

- 1.1 Conservation laws: linear momentum, angular momentum, energy. Applications.
- 1.2 Fluid mechanics: pressure of a liquid, surface tension, Bernoulli's equation and viscosity.
- 1.3 Oscillations: simple harmonic motion, notions about forced and damped oscillations, resonance.

#### 2- Electricity

- 2.1 Electromagnetism: electromagnetic induction, laws of Faraday and Lenz.
- 2.2 Alternating sinusoidal current: sources, circuits, and power.
- 2.3 Transformer and transmission of electric energy.
- 2.4 Applications.

#### 3- Optics

- 3.1 Wave aspect of light: characteristics, coherent light, electromagnetic spectrum, plane polarization, diffraction, two-slit interference.
- 3.2 Particle aspect of light: quantization of energy and photoelectric effect

#### 4- Atom and Nucleus

- 4.1 Atoms: atomic models, energy levels, spectra and lasers.
- 4.2 Nuclei: composition, radioactivity, nuclear reactions fusion and fission. Effects of radiation on living organisms.
- 4.3 Applications.