

Directorate for Quality and Standards in Education.
Curriculum Management & eLearning Department



**BIOLOGY FORM V SYLLABUS
FOR STATE
SECONDARY SCHOOLS**

October 2008

BIOLOGY SYLLABUS FORM V

Introduction

The syllabus for the form V students is the final stage towards restructuring the State Schools' Biology syllabi, following the launch of the Biology SEC 2009 syllabus. The complete version of the SEC Biology syllabus can be accessed either through the University of Malta homepage (www.um.edu.mt) or directly from the URL address www.home.edu.mt/matsec.

General Aims

The following syllabus should enable students to:

- develop an awareness of the various forms of life (with special emphasis on the locally occurring organisms)
- develop a knowledge and understanding of basic anatomical and physiological characteristics of organisms
- develop an awareness of the different interactions between organisms as well as between the organisms and their environment
- develop a scientific approach to problem solving that incorporates the analysis and interpretation of experimental data
- acquire a range of communicative and manipulative skills appropriate for biology
- enhance a working knowledge of other fields of study (e.g. mathematics, chemistry, physics, and geography) that are vital for a consolidated understanding of biological concepts
- attain a positive educational experience that serves to motivate students to further their studies in biology

Required Background

Students taking up the study are expected to be familiar with the following concepts:

- mathematical concepts including the use of fractions, decimals, percentages, ratios, graphical data (line graphs, bar charts, histograms, pie charts)
- energy and its different forms
- heat transfer and insulation
- evaporation and the effects of temperature, humidity and air currents on its rate; latent heat of evaporation
- relationship between surface area and volume
- atoms, molecules, ions, compounds acids, alkali, pH
- solubility, concentration gradients, diffusion and osmosis.

Scheme of assessment

The annual examination paper consists of a written paper lasting 1 hour 45 minutes. Two papers will be set – one paper for Junior Lyceum students and one paper for students in Area Secondary Schools. Each paper consists of two sections – Section A and B.

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Section A will be common for ALL students both in Junior Lyceum and Area Secondary Schools while Section B will be different in the two types of schools. Section A comprises about eight questions with a total of 55 marks. All questions in Section A are compulsory. Section B for Junior Lyceum students includes one compulsory question of the comprehension type and four other questions of which the students are asked to select two. Students in Area Secondary schools are asked to choose THREE questions out of a selection of five questions in Section B. Each question in Section B carries 15 marks. Thus Section B amounts to a total of 45 marks.

Questions in both Sections A and B shall test the recall of biological concepts as well as the higher order skills of evaluation, analysis, data interpretation and application. The questions in the Annual form V examination paper will cover ALL the topics undertaken in the three forms of biology studies, namely forms III, IV and V.

The final mark of the annual examination is worked out by calculating the total theory mark out of 85% and then adding it to the mark attained by the student in the practical/laboratory work (out of 15%).

Practical Work

The mark attained for the practical work is based on an average of the practical lab reports presented by the student during the academic year. During the third and final year of biology studies, students must at least work out and present a total of THREE practicals, of which one must involve a problem solving investigation. The students' laboratory report files must be available for the possibility of moderation by the education officer or subject co-ordinator in charge of biology at least a week before the annual examination.

Students are reminded to adopt practical report files with five distinct sections as outlined by the SEC Biology 2009 Syllabus, namely:

- Section 1 – Problem Solving Investigations
- Section 2 – Visits and Fieldwork
- Section 3 – Investigations of Life Processes
- Section 4 – Identification and Classification of Organisms
- Section 5 – Other practicals

The write up for an experiment should be about two pages of a foolscap long including diagrams whenever possible. The write up for problem solving investigations and biology site visits should be the authentic work of the student; teachers are encouraged to advise students to avoid the blind copying of information out of textbooks/journals or the mere down loading of information from the internet.

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The syllabus

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| Part 1 Keeping Alive | | |
| Learning outcomes: <ul style="list-style-type: none"> • to know the two main co-ordination systems and distinguish between nervous and hormonal coordination • to list the main endocrine glands and their hormonal secretions • to understand the role of hormones in body metabolism • to know the different parts of the nervous system and the related functions • to appreciate the role of different types of neurones in the transmission of impulses • to know the path followed by an impulse as it travels along a reflex arc | | |
| a. Functioning as a whole | Co-ordination of body functions in humans involving hormonal and nervous control. | <i>Appreciation of the need for the co-ordination of body functions. That two co-ordinating systems are required: (i) one involving a slow but sustained action that usually has long-term effects on the body, and (ii) one that is quick and achieves immediate, short-term control over specific body parts.</i> |
| | Positions of the main endocrine glands: pituitary, thyroid, pancreas, adrenals, ovaries and testes. | <i>Candidates are expected to show the position of the main endocrine glands through the use of a simple diagram of the body plan of a human.</i> |
| | Feedback control in hormonal secretion | <i>The role of insulin and glucagon in the control of blood-glucose level as a specific example of feedback control in hormone secretion.</i> |
| | The central nervous system: The structure and functioning of different parts of the brain | <i>Structure and functioning of the cerebral hemispheres, the cerebellum and the medulla oblongata. Functioning of the motor, sensory and association areas in the brain.</i> |
| | The spinal cord and associated spinal nerves. Transmission of impulses by neurones. | <i>The reflex arc including the types of neurones involved. Details of impulse transmission are not required, but students must be aware of the gap (synapse) between adjacent neurones.</i> <i>Candidates are expected to use simple diagrams to explain the path taken by a nerve impulse as it travels along the reflex arc.</i> |
| Learning outcomes: <ul style="list-style-type: none"> • to know the basic structure and the role of genetic material • to appreciate the effect of mutations caused by different mutagens • to distinguish between the two main types of cell division • to know the basic rules of monohybrid inheritance • to know the way in which sex is determined in humans and the transmission of sex-linked traits • to understand the basic principles of genetic engineering and the uses of it | | |
| b. The blueprint of life | The DNA molecule. Chromosomes as the sites of DNA. A gene as a section of DNA controlling an identifiable characteristic. The role of DNA in protein synthesis. Alleles as alternative forms of a gene. | <i>Only a basic knowledge of nucleic acids and the structure of DNA is required. Details of protein synthesis are not required. Candidates should appreciate that the sequence of bases on the DNA strand determines the sequence of amino acids and therefore the type of protein (i.e. characteristics) that will be produced.</i> |

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| | Mutations and mutagens. | |
| | Mitosis as a process of cell division leading to the exact duplication of genetic material. Meiosis as a process of cell division leading to halving of chromosome number and the production of variations in genetic material. | <i>Knowledge of cell division should be confined to an understanding of the significance of both processes and the sites where they occur, in flowering plants and humans. Candidates are not expected to draw the different stages of Mitosis or Meiosis. However, they are expected to be able to put diagrams representing the different stages of Mitosis and Meiosis in sequence.</i> |
| | Diploid and haploid nuclei. Fusion of gametes. Variation resulting from exchange of genetic material and random fertilisation. | <i>An awareness of variation within a species and recognition that not all variation is inherited.</i> |
| | Inherited and non-inherited variation. Continuous and discontinuous variations. Monohybrid cross, dominant and recessive alleles. Codominance. Phenotypes and genotypes, homozygous and heterozygous genotypes. | <i>Monohybrid ratios illustrated by simple breeding experiments with a quantitative treatment of results. The recessive backcross related to the monohybrid experiment.</i> |
| | Sex determination in humans and sex-linked characteristics. | <i>It is suggested that candidates become familiar with the identification of sex-linked characteristics through the study of specific cases, like haemophilia and colour blindness .</i> |
| | Principles, uses and possible hazards of genetic engineering. Cloning of plants of economic importance. Principles of tissue culturing. | <i>Treatment of the process of genetic engineering should include the use of enzymes to cut and join gene DNA and vector DNA to form recombinant DNA. The use of plasmids and viruses as vectors to insert recombinant DNA into cells. Production of human insulin by genetically engineered bacteria.</i> |
| <p>Learning outcomes:</p> <ul style="list-style-type: none"> • to know the structure and function of the male and female human reproductive systems • to know and understand the various stages involved in the reproduction process in humans • to know the hormones and their specific roles in reproduction • to list the different methods of family planning and know their advantages and disadvantages | | |
| c. Increasing in numbers | Sexual reproduction in humans: Structure and function of the male and female reproductive organs. Menstrual cycle, copulation, fertilisation, nutrition and protection of the embryo, birth and parental care. | <i>Anatomical details of embryological development are not required.</i> |
| | The role of hormones in the menstrual cycle, gametogenesis and the development of secondary sexual characteristics. | <i>Hormones studied should include FSH, LH, oestrogens, progesterone and testosterone.</i> |
| | Methods of family planning. | <i>Natural family planning as exemplified by the thermal and the mucus (Billing's) method.</i> |

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| | | <i>Artificial family planning as exemplified by the use of the condom, diaphragm, contraceptive pill, vasectomy and tubal ligation.</i> |
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Part 2: Living together

Learning outcomes:

- to understand the recycling process of substances such as nitrogen, carbon and water
- to appreciate the effect of human activities on the environment (including air, water and land)
- to understand the effects of pollutants on other organisms and on human health
- to know of possible control strategies to limit pollution effects

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| a. Management of resources | Natural cycles: carbon, nitrogen and water cycles. | <i>The emphasis should be on the fact that in natural cycles, resources are being used and replenished continuously. Candidates should appreciate that when natural cycles are upset, resources start depleting and wastes accumulate resulting in pollution problems. Moreover, remedial steps tend to re-establish upset natural cycles.</i> |
| | Use and misuse of living resources. | <i>Extinction of a species due to habitat destruction and / or overhunting. The need for nature reserves and the enforcement of laws to preserve wildlife. Unequal distribution and wastage of food leading to famine in certain world regions. Finding alternative food sources (e.g. fish farming and animal husbandry).</i> |
| | Land use and misuse in agriculture and urbanisation. | <i>Overgrazing, deforestation and bad agricultural practices leading to soil erosion and the spread of desertification. Contour ploughing, strip cropping and terracing as ways of reducing soil erosion. Use of persistent and biodegradable pesticides in agriculture. Population explosion leading to an increased need for land clearing for more food production (through agriculture) and more living space.</i> |
| | Specific examples of air, sea water, fresh water and land pollution and their effects on the environment. Possible solutions to prevent pollutant levels from increasing. | <i>CFC's and activities leading to the depletion of ozone from the atmosphere. The environmental effects of the thinning out of the ozone layer. Use of ozone-friendly products and the economic ban of products containing substances that damage the ozone layer. Formation of acid rain and its effects on vegetation, organisms and buildings; together with possible effective control methods such as the use of low-sulphur fuel in power stations. <i>Eutrophication, oil spillage and sewage as examples of water pollution. Causes, effects on the environment and possible solutions to these problems (e.g. the role of aerobic saprophytic bacteria in sewage treatment plants). Examples of land pollution should include dumping of rubbish and building debris, land reclamation projects on garigue, increased lead content in soils and high nitrate levels in the water table due to the excessive use of artificial fertiliser in agriculture. Possible solutions to these problems could include reducing waste production, recycling of waste, making better use of available space and the use of natural fertiliser.</i></i> |

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List of suggested practical work

The following is a list of suggested practical work that complements the coursework outlined in the syllabus. Teachers and students are reminded that they can work out and present other valid practicals not included in the list.

Practicals marked with an asterisk (*) are possible problem solving investigations.

1. Variation in humans and/or other organisms
Caution: Great care must be exercised when genetic data (such as eye colour, blood group, hair colour) is collected and discussed as it may highlight cases of adoption or illegitimacy. Furthermore, variation studies (such as on height, weight and heart beat) may highlight widely divergent individuals in a group. The use of data attained from anonymous sources is recommended.
2. *Conducting a long term air/water/land pollution study in a particular habitat.
3. *Survey related to issues of family planning/birth control methods, birth methods, or prevalent hormonal disorders such as diabetes. (Students are reminded that confidentiality is maintained throughout.)
4. Viewing prepared slides such as of the nerve cell, T.S. of a spinal cord, section through the testis/ovary etc under the microscope.
5. Simple experiments to show co-ordination of body functions in humans including nervous control. Reaction time measurement.
6. Biology Site visits:
 - a. Biotechnology Centre
 - b. Recycling Plant
 - c. Nature Reserve
 - d. Centre for Renewable Energy.

It is recommended that biology students compile the following form and attach it as the front page of their Lab Report Book. The number of practicals within each section can vary according to the practical work performed in class, however students must observe the guidelines related to the maximum number of practicals within each section as stipulated by the SEC Biology 2009 Syllabus.

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| <div style="border: 1px solid black; border-radius: 15px; padding: 10px; width: 80%; margin: auto;"> Insert School Logo </div> | Student's Name: _____ Class: _____ Academic year: _____ |
|--|---|
| PRACTICAL TITLE | MARK |
| <i>Section 1 Problem Solving Investigations</i> | |
| 1. | |
| 2. | |
| 3. | |
| <i>Section 2 Visits & Fieldwork</i> | |
| 4. | |
| 5. | |
| 6. | |
| <i>Section 3 Investigations of Life Processes</i> | |
| 7. | |
| 8. | |
| 9. | |
| 10. | |
| 11. | |
| <i>Section 4 Identification & Classification of Organisms</i> | |
| 12. | |
| 13. | |
| <i>Section 5 Other practicals</i> | |
| 14. | |
| 15. | |
| Average mark (to the nearest whole number) | |

Student's signature: _____ Date: _____