Biology 7040
(Revised for first examination in May/June 2007)

This subject may be taken at both the May/June and January examinations.

Introduction

The revised London Examinations GCE O level in Biology is designed to be an interesting and inspiring modern syllabus. It is a two year course suitable both for those for whom it is a final qualification in the subject and for those who require a sound foundation for further study. Candidates who successfully follow this syllabus will have a good understanding of Biology and its applications and will find the transition to the study of Advanced Level Biology easy to make.

Key features

- provides an up to date course of study, including aspects of modern Biology appropriate for the 21st century
- provides continuity of content and standard with the previous GCE O level syllabus in Biology
- closely follows the content of the London Examinations IGCSE in Biology (4325), allowing for smooth transition if desired
- comprehensive and detailed subject content, with amplification to guide teachers
- straightforward linear assessment
- requires no prior knowledge of Biology: the course is for candidates of various ages and backgrounds in terms of general education and lifelong learning
- clarifies the requirements at the key grades of A, C and E
- offers a full range of teacher and student support
- provides a basis for progression to GCE Advanced Subsidiary (AS) or Advanced level in Biology, or other comparable post-16 qualifications.

How does the revised syllabus differ from the previous syllabus?

It has been some years since consideration has been given to the content and format of the GCE O level Biology syllabus. The new revised O level Biology syllabus has been produced alongside the new IGCSE Biology specification and they share a number of common features. This may help teachers in their transition between the two, depending on the requirements of their particular teaching groups. The O level syllabus has been retained in its revised form to ensure continuity of the O level standard and approaches to study and assessment.

The main differences between the revised O level Biology syllabus and the previous one are that the revised O level Biology syllabus

- shows continuity but progression to a more modern biology syllabus
- has some changes in content with, for example, less emphasis on details of a range of organisms to illustrate the variety of life
- includes new content giving greater emphasis to applications of biology in a contemporary context
- retains about 80% of the content of the previous syllabus
- offers greater clarification of the detail with respect to what should be taught and what will be examined
- uses prompt words (such as *describe, recall, understand, explain*) to give guidance as to the way questions will be asked on particular syllabus topics and the nature or response expected
- lists in the syllabus content practical experiments that candidates should do or be familiar with
- has about 90% of its content common with that of IGCSE Biology (4325).

Aims

This syllabus gives students opportunities to

- develop an understanding of biological facts, concepts and principles
- obtain a balanced view of modern biology and develop a contemporary outlook on the subject
- recognise the inter-relationships between various areas of biology and, in particular, the relationship between structure and function
- make accurate observations of living organisms and preparations of biological material
- assess and interpret simple biological experiments and data from investigations
- recognise the value of experimental skills in the study of biology
- develop a working knowledge of those aspects of chemistry, physics and mathematics that are necessary for a proper understanding of biology at this level
- develop a respect for living organisms and an enjoyment of and interest in the study of living organisms
- follow a course that is complete in itself and performs a useful educational function for students not intending to study biology at a higher level
- acquire a suitable foundation and preparation for more advanced courses in biology.

Assessment objectives

The examinations will be designed to test candidates in the following areas in relation to biology.

Candidates should be able to

- demonstrate a knowledge of the topics listed in the syllabus
- demonstrate a knowledge and understanding of essential biological principles related to living organisms and their environments including the personal, social, economic and technological applications of biology in modern society
- use appropriate terminology in demonstrating this knowledge
- demonstrate knowledge and understanding of appropriate practical techniques and safety precautions
- interpret data presented in the form of tables, charts, graphs, diagrams and photographs
- apply elementary mathematics, chemistry and physics to biology
- communicate a knowledge and understanding of biology through the media of tables, charts, graphs, diagrams and concise logical prose
- apply knowledge of biology to the design and evaluation of experiments and the solution of problems including those of a personal, social, economic and technological nature
- select and organise information relevant to particular ideas in biology and to communicate this selected and organised knowledge coherently.

Weighting of assessment objectives

The allocation of marks for the whole examination will be approximately as follows:

Assessment objectives	Approximate mark allocation
Knowledge and understanding	60 — 65% (of which about one third for recall)
Application of knowledge and understanding, analysis and evaluation	35 — 40% (evenly distributed across all aspects of the objective**)**

These percentages are **not** intended to provide a precise statement of the number of marks allocated to particular assessment objectives

Scheme of assessment

The examination will consist of two written papers, each carrying 50% of the total marks.

Paper	Description	Duration	Weighting	Maximum marks
1	Written paper with structured questions (short and long)	1½ hours	50%	100
2	Written paper with structured questions and questions on a printed passage analysis of data and essays	2 hours	50%	100

Paper 1

This paper will consist of a number of compulsory short and longer structured questions. The questions will be designed to test breadth of knowledge and understanding of all sections of the syllabus and to test a range of skills. The questions may refer to or require the use of diagrams, photographs, graphs and data, and candidates may be asked to perform simple calculations. Some questions may test the application of knowledge and principles described in the syllabus to a wider range of biological situations. The style of these questions is similar to previous Paper 2 questions

Paper 2

This paper will consist of three sections with questions drawn from any part of the syllabus.

Section A (60 marks)

This section will consist of a range of compulsory structured questions. The questions may be of an interpretive nature, including the comprehension of a passage relating to an unfamiliar biological situation, or involving the analysis of data or evaluation of an investigation. Other questions may be designed to test candidates' *experience* of practical skills, including use of apparatus familiar to them, description of how they would carry out an experiment or design an investigation based on novel information provided in the question.

Section B (16 marks)

In this section, candidates must answer two questions from a choice of three. These questions will require answers with some continuous prose and may relate to descriptions or comparisons of processes familiar to candidates.

Section C (24 marks)

In this section, candidates must answer two questions from a choice of three. These longer questions will be presented as structured essays, intended to test depth of knowledge of topics in the syllabus and an understanding of biological principles.

The use of calculators is permitted in both papers. It will be assumed that candidates will be able to use an electronic calculator in connection with any calculation they may be asked to do in the examination.

Candidates will be required to demonstrate syllabus knowledge and critical understanding as follows:

Syllabus section	Approximate mark allocation across the examination papers
1. Nature and variety of living organisms	5%
2. Structures and functions in living organisms	60%
3. Reproduction and inheritance	7.5%
4. Ecology and the environment	7.5%
5. Use of biological resources	10%
6. Human health	10%

Reference to topics related to the personal, social, economic and technological applications of biology in modern society should be made in teaching any part of the syllabus.

In al sections of the syllabus, candidates may be required to perform calculations, draw graphs and describe, explain and interpret biological phenomena. Some of the question content will be unfamiliar to candidates; these questions are designed to assess data-handling skills and the ability to apply biological principles to unfamiliar information.

Syllabus content

Practical work is printed in *italics*.

Section 1: The nature and variety of living organisms

a) Characteristics of living organisms

b) Variety of living organisms

a) Characteristics of living organisms

Candidates will be assessed on their ability to

- recall that living organisms share the following basic characteristics
    - they require nutrition
    - they respire
    - they excrete their waste
    - they respond to their surroundings
    - they move
    - they control their internal conditions
    - they reproduce
    - they grow and develop.

b) Variety of living organisms

Candidates will be assessed on their ability to

- understand that there is a wide variety of living organisms and that modern biology classifies organisms on the basis of their structure and how they function
- describe the common features shared by organisms within the five main groups — plants, animals, fungi, bacteria and viruses — and for each group describe examples and their features as follows (details of life cycle and economic importance are **not** required).

  Plants: These are multicellular organisms; they contain chloroplasts and are able to carry out photosynthesis; they have cellulose cell walls; they store carbohydrates as starch or sucrose.

  Examples include flowering plants, such as a cereal (e.g. maize) and a herbaceous legume (e.g. peas or beans).

  Animals: These are multicellular organisms; they do not contain chloroplasts and are not able to carry out photosynthesis; they have no cell walls; they usually have nervous co-ordination and are able to move from one place to another; they often store carbohydrate as glycogen.

  Examples include mammals (e.g. humans) and insects (e.g. housefly).

  Fungi: These are organisms that are not able to carry out photosynthesis; their body is usually organised into a mycelium made from thread-like structures called hyphae, which contain many nuclei; some examples are single-celled; they have cell walls made of chitin; they feed by extracellular secretion of digestive enzymes onto food material and absorption of the organic products; this is known as saprotrophic nutrition; they may store carbohydrate as glycogen.

  Examples include *Mucor*, which has the typical fungal hyphal structure, and yeast which is single-celled.

  Bacteria: These are microscopic single-celled organisms; they have a simple cell structure that lacks a nucleus but contains a circular chromosome of DNA; some bacteria can carry out photosynthesis but most feed off other living or dead organisms.

  Examples include *Lactobacillus bulgaricus*, a rod-shaped bacterium used in the production of yoghurt from milk, and *Pneumococcus*, a spherical bacterium that acts as the pathogen that causes pneumonia.

  Viruses: These are small particles, smaller than bacteria; they are parasitic and can only reproduce inside living cells; they infect every type of living organism. They have a wide variety of shapes and sizes; they have no cellular structure but have a protein coat and contain one type of nucleic acid, either DNA or RNA.

  Examples include the tobacco mosaic virus that causes discolouring of the leaves of tobacco plants by preventing the formation of chloroplasts, and the influenza virus that causes ‘flu’ in humans.

Section 2: Structures and functions in living organisms

a) Levels of organisation

b) Cell structure

c) Biological molecules

d) Movement of substances into and out of cells

e) Nutrition

f) Respiration

g) Gas exchange

h) Transport

i) Excretion

j) Co-ordination and response

a) Levels of organisation

Candidates will be assessed on their ability to

- describe the levels of organisation within organisms: organelles, cells, tissues, organs and systems.

b) Cell structure

Candidates will be assessed on their ability to

- recognise cell structures, including the nucleus, cytoplasm, cell membrane, cell wall, chloroplast and vacuole
- describe the functions of the nucleus, cytoplasm, cell membrane, cell wall, chloroplast and vacuole
- describe the differences between plant and animal cells.

c) Biological molecules

Candidates will be assessed on their ability to

- recall the chemical elements present in carbohydrates, proteins and lipids (fats and oils)
- describe the structure of carbohydrates, proteins and lipids as large molecules made up from smaller basic units: starch and glycogen from simple sugars; protein from amino acids; lipid from fatty acids and glycerol
- *describe the tests for glucose, starch, lipid and protein*
- understand the role of enzymes as biological catalysts in metabolic reactions
- understand how the functioning of enzymes can be affected by changes in temperature and pH
- *describe how to carry out simple controlled experiments to illustrate how enzyme activity can be affected by changes in temperature.*

d) Movement of substances into and out of cells

Candidates will be assessed on their ability to

- recall simple definitions of diffusion, osmosis and active transport
- understand that movement of substances into and out of cells can be by diffusion, osmosis and active transport
- understand the importance in plants of turgid cells as a means of support
- understand the factors that affect the rate of movement of substances into and out of cells to include the effects of surface area to volume ratio, temperature and concentration gradient
- *describe simple experiments on diffusion and osmosis using living and non-living systems.*

e) Nutrition

Candidates will be assessed on their ability to

Flowering plants

- describe the process of photosynthesis and understand its importance in conversion of light energy to chemical energy
- recall the word equation and the balanced chemical symbol equation for photosynthesis
- understand how carbon dioxide concentration, light intensity and temperature affect the rate of photosynthesis
- explain how the structure of the leaf is adapted for photosynthesis
- recall that plants require mineral ions for growth and that magnesium ions are needed for chlorophyll and nitrate ions are needed for amino acids
- *describe simple controlled experiments to investigate photosynthesis, showing the evolution of oxygen from a water plant, the production of starch and the requirements of light, carbon dioxide and chlorophyll.*

Humans

- understand that a balanced diet should include carbohydrate, protein, lipid, vitamins, minerals, water and dietary fibre
- recall sources and describe functions of carbohydrate, protein, lipid (fats and oils), vitamins A, C and D, and the mineral ions calcium and iron
- understand that energy requirements vary with activity levels, age and pregnancy
- recognise the structures of the human alimentary canal and describe in outline the functions of the mouth, oesophagus, stomach, small intestine, large intestine, and pancreas
- understand the processes of ingestion, digestion, absorption, assimilation and egestion
- explain how and why food is moved through the gut by peristalsis
- understand the role of digestive enzymes to include the digestion of starch to glucose by amylase and maltase, the digestion of proteins to amino acids by proteases and the digestion of lipids to fatty acids and glycerol by lipases

- recall that bile is produced by the liver and stored in the gall bladder, and understand the role of bile in neutralising stomach acid and emulsifying lipids
- explain how the structure of a villus helps absorption of the products of digestion in the small intestine
- *recall how to carry out a simple experiment to determine the energy content in a food sample.*

f) Respiration

Candidates will be assessed on their ability to

- recall that the process of respiration releases energy in living organisms
- describe the differences between aerobic and anaerobic respiration
- recall the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms
- recall the word equation for anaerobic respiration in plants and in animals
- *describe simple controlled experiments to demonstrate the evolution of carbon dioxide and heat from respiring seeds or other suitable living organisms.*

g) Gas exchange

Candidates will be assessed on their ability to

- understand the role of diffusion in gas exchange.

Flowering plants

- understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis
- understand that respiration continues during the day and night, but that the net exchange of carbon dioxide and oxygen depends on the intensity of light
- explain how the structure of the leaf is adapted for gas exchange
- describe the role of stomata in gas exchange
- *describe simple controlled experiments to investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator.*

Humans

- recall the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes
- understand the role of the intercostal muscles and the diaphragm in ventilation
- explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries
- understand the biological consequences of smoking in relation to the lungs and the circulatory system
- *describe a simple experiment to investigate the effect of exercise on breathing in humans.*

h) Transport

Candidates will be assessed on their ability to

- understand why simple, unicellular organisms can rely on diffusion for movement of substances in and out of the cell
- understand the need for a transport system in multicellular organisms.

Flowering plants

- describe the position of phloem and xylem in a stem
- describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant
- describe the role of the xylem in transporting water and mineral salts from the roots to other parts of the plant
- explain how water is absorbed by root hair cells
- recall that transpiration is the evaporation of water from the surface of a plant
- explain how the rate of transpiration is affected by changes in humidity, wind speed, temperature and light intensity
- *describe experiments that investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot.*

Humans

- recall the composition of the blood: red blood cells, white blood cells, platelets and plasma
- understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones and heat energy
- describe the adaptations of red blood cells for the transport of oxygen, including shape, structure and the presence of haemoglobin
- describe the role of white blood cells in preventing disease by ingestion of micro-organisms and the production of antibodies to destroy micro-organisms
- recall that platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms
- describe the structure of the heart and how it functions
- understand that the heart rate changes during exercise and under the influence of adrenaline
- describe the structure of arteries, veins and capillaries and understand their roles
- recall the general plan of the circulation system to include the blood vessels to and from the heart, the lungs, the liver and the kidneys.

i) Excretion

Candidates will be assessed on their ability to

Flowering plants

- recall the origin of carbon dioxide and oxygen as waste products of metabolism and their loss from the stomata of a leaf.

Humans

- recall that the lungs, kidneys and skin are organs of excretion
- understand how the kidney carries out its roles of excretion and of osmoregulation
- describe the structure of the urinary system, including the kidneys, ureters, bladder and urethra
- describe the structure of a nephron, to include Bowman's capsule and glomerulus, convoluted tubules, loop of Henlé and collecting duct
- describe ultrafiltration in the Bowman's capsule and the composition of the glomerular filtrate
- understand that water is reabsorbed into the blood from the collecting duct
- understand that selective reabsorption of glucose occurs at the proximal convoluted tubule
- describe the role of ADH in regulating the water content of the blood
- recall that urine contains water, urea and salts.

j) Co-ordination and response

Candidates will be assessed on their ability to

- understand that organisms are able to respond to changes in their environment
- understand that homeostasis is the maintenance of a constant internal environment and that body water content and body temperature are both examples of homeostasis
- understand that a co-ordinated response requires a stimulus, a receptor and an effector.

Flowering plants

- understand that plants respond to stimuli
- describe the geotropic responses of roots and stems
- describe positive phototropism of stems
- understand that phototropic responses in stems are the result of differential growth caused by auxin
- *recall controlled experiments to demonstrate phototropic and geotropic plant growth responses.*

Humans

- describe how responses can be controlled by nervous or by hormonal communication and understand the differences between the two systems
- recall that the central nervous system consists of the brain and spinal cord and is linked to sense organs by nerves
- understand that stimulation of receptors in the sense organs sends electrical impulses along nerves into and out of the central nervous system, resulting in rapid responses
- describe the structure and functioning of a simple reflex arc illustrated by the withdrawal of a finger from a hot object

- describe the structure and function of the eye as a receptor
- understand the function of the eye in focusing near and distant objects, and in responding to changes in light intensity
- describe the role of the skin in temperature regulation, with reference to sweating, vasoconstriction and vasodilation
- understand the sources, roles and effects of the following hormones: ADH, adrenaline, insulin, testosterone, progesterone and oestrogen.

Section 3: Reproduction and inheritance

a) Reproduction

b) Inheritance

a) Reproduction

Candidates will be assessed on their ability to

- describe the differences between sexual and asexual reproduction
- understand that fertilisation involves the fusion of a male and female gamete to produce a zygote.

Flowering plants

- describe the structures of an insect-pollinated and a wind-pollinated flower and explain how each is adapted for pollination
- describe pollination and the growth of the pollen tube
- understand that fertilisation leads to seed and fruit formation
- recall the conditions needed for seed germination
- understand how germinating seeds utilise food reserves until the seedling can carry out photosynthesis
- understand that plants can reproduce asexually by natural methods (illustrated by runners), and by artificial methods (illustrated by cuttings).

Humans

- recall the structure and function of the male and female reproductive systems
- understand the roles of oestrogen and progesterone in the menstrual cycle
- recall that fertilisation produces a zygote that undergoes cell division and develops into an embryo
- describe the role of the placenta in the nutrition of the developing embryo
- understand how the developing embryo is protected by amniotic fluid
- recall the roles of oestrogen and testosterone in the development of secondary sexual characteristics.

b) Inheritance

- recall that the nucleus of a cell contains chromosomes on which genes are located
- understand that a gene is a section of a molecule of DNA
- understand that genes exist in alternative forms called alleles which give rise to differences in inherited characteristics
- recall the meaning of the terms dominant, recessive, homozygous, heterozygous, phenotype, genotype and co-dominance
- describe patterns of monohybrid inheritance using a genetic diagram
- understand how to interpret family pedigrees
- predict probabilities of outcomes from monohybrid crosses
- recall that the sex of a person is controlled by one pair of chromosomes, XX in a female and XY in a male
- describe the determination of the sex of offspring at fertilisation, using a genetic diagram
- understand that division of a diploid cell by mitosis produces two cells which contain identical sets of chromosomes
- understand that mitosis occurs during growth, repair, cloning and asexual reproduction
- understand that division of a cell by meiosis produces four cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes
- understand that random fertilisation produces genetic variation of offspring
- recall that in human cells the diploid number of chromosomes is 46 and the haploid number is 23
- understand that variation within a species can be genetic, environmental, or a combination of both
- recall that mutation is a rare, random change in genetic material that can be inherited
- understand that many mutations are harmful but some are neutral and a few are beneficial
- understand that mutant organisms can increase in a population by natural selection
- understand that the incidence of mutations can be increased by exposure to ionising radiation (e.g. gamma rays, X-rays and ultraviolet rays) and some chemical mutagens (e.g. chemicals in tobacco).

Section 4: Ecology and the environment

a) The organism in the environment

b) Feeding relationships

c) Cycles within ecosystems

d) Human influences on the environment

a) The organism in the environment

Candidates will be assessed on their ability to

- understand the terms population, community, habitat and ecosystem
- describe the use of quadrats as a technique for sampling the distribution of organisms in their habitats
- *recall the use of quadrats to estimate the population size of an organism in two different areas.*

b) Feeding relationships

Candidates will be assessed on their ability to

- recall the names given to different trophic levels to include producers, primary, secondary and tertiary consumers and decomposers
- understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer
- understand the transfer of substances and of energy along a food chain
- explain why only about 10% of energy is transferred from one trophic level to the next.

c) Cycles within ecosystems

Candidates will be assessed on their ability to

- describe the stages in the water cycle, including evaporation, transpiration, condensation and precipitation
- describe the stages in the carbon cycle, including respiration, photosynthesis, decomposition and combustion
- describe the stages in the nitrogen cycle, including the roles of nitrogen fixing bacteria, decomposers, nitrifying bacteria and denitrifying bacteria (specific names of bacteria are not required).

d) Human influences on the environment

Candidates will be assessed on their ability to

- understand the biological consequences of pollution of air by sulphur dioxide and by carbon monoxide

- recall that water vapour, carbon dioxide, nitrous oxide, methane and CFCs are greenhouse gases
- understand how human activities contribute to greenhouse gases
- understand how an increase in greenhouse gases results in an enhanced greenhouse effect and that this may lead to global warming and its consequences
- understand the biological consequences of pollution of water by sewage including increases in the number of micro-organisms causing depletion of oxygen
- understand that eutrophication can result from leached minerals from fertiliser
- understand the effects of deforestation, including leaching, soil erosion, disturbance of the water cycle and of the balance in atmospheric oxygen and carbon dioxide
- explain the biological consequences of overfishing and overgrazing.

Section 5: Use of biological resources

a) Food production

b) Selective breeding

c) Genetic modification

d) Cloning

a) Food production

Candidates will be assessed on their ability to

Crop plants

- describe how glasshouses and polythene tunnels can be used to increase the yield of certain crops
- understand the effects on crop yield of increased carbon dioxide and increased temperature in glasshouses
- understand the use of fertiliser to increase crop yield
- understand the reasons for pest control and the advantages and disadvantages of using pesticides and biological control with crop plants.

Micro-organisms

- understand the role of yeast in the production of beer
- *describe a simple experiment to investigate carbon dioxide production by yeast, in different conditions*
- understand the role of bacteria (*Lactobacillus*) in the production of yoghurt
- interpret and label a diagram of an industrial fermenter and explain the need to provide suitable conditions in the fermenter, including aseptic precautions, nutrients, optimum temperature and pH, oxygenation and agitation, for the growth of micro-organisms.

Fish farming

- explain the methods which are used to farm large numbers of fish to provide a source of protein, including maintenance of water quality, control of intraspecific and interspecific predation, control of disease, removal of waste products, quality and frequency of feeding and the use of selective breeding.

b) Selective breeding

Candidates will be assessed on their ability to

- understand that plants with desired characteristics can be developed by selective breeding (illustrated by increased yield and reduction of stem length in wheat)
- understand that animals with desired characteristics can be developed by selective breeding (illustrated by increased yield of meat and milk in cattle).

c) Genetic modification (genetic engineering)

Candidates will be assessed on their ability to

- describe a DNA molecule as two strands coiled to form a double helix, the strands being linked by a series of paired bases: adenine (A) with thymine (T), and cytosine (C) with guanine (G)
- describe the use of restriction enzymes to cut DNA at specific sites and ligase enzymes to join pieces of DNA together
- describe how plasmids and viruses can act as vectors, which take up pieces of DNA, then insert this recombinant DNA into other cells
- understand that large amounts of human insulin can be manufactured from genetically modified bacteria that are grown in a fermenter
- evaluate the potential for using genetically modified plants to improve food production (illustrated by plants with improved resistance to disease)
- recall that the term transgenic means the transfer of genetic material from one species to a different species.

d) Cloning

Candidates will be assessed on their ability to

- describe the process of micropropagation (tissue culture) in which small pieces of plants (explants) are grown *in vitro* using nutrient media
- understand how micropropagation can be used to produce commercial quantities of identical plants (clones) with desirable characteristics
- describe the stages in the production of cloned mammals involving the introduction of a diploid nucleus from a mature cell into an enucleated egg cell, illustrated by Dolly the sheep
- evaluate the potential for using cloned transgenic animals, for example, to produce commercial quantities of human antibodies or organs for transplantation**.**

Section 6: Human health

a) Pathogenic diseases

b) Disorders and conditions of the human body

a) Pathogenic diseases

Candidates will be assessed on their ability to

- recall the term pathogen and know that pathogens may be protoctists, bacteria, fungi or viruses
- describe how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to a pathogen
- understand that vaccination may protect against future exposure to a pathogen
- understand that vaccination results in the manufacture of memory cells, which enable future antibody production to the pathogen to occur sooner, faster, and in greater quantity
- describe how the effects of disease in a population can be reduced by immunisation
- describe how antibiotics can be used to reduce bacterial infection and understand how resistance to antibiotics can increase in bacterial populations
- recall that malaria is an example of a disease caused by a *plasmodium* (a protoctist)
- understand how malaria is transmitted by an insect vector and recall methods to control malaria by destroying the insect vector and by prevention of infection
- describe amoebic dysentery as an example of a disease caused by a protoctist. Recall its symptoms, treatment, method of transmission and how its spread can be prevented
- describe cholera as an example of a disease caused by a bacterium. Recall its symptoms, method of transmission and how its spread can be prevented
- describe AIDS as an example of a disease caused by a virus (HIV). Recall its symptoms, method of transmission and how its spread can be prevented.

b) Disorders and conditions of the human body

Candidates will be assessed on their ability to

- understand that there are disorders of the human body caused by a variety of factors, including environmental, dietary and lifestyle
- understand that if individuals do not receive a balanced diet (see section 2e) they may become malnourished or obese
- understand how a lack of protein can lead to the condition known as kwashiorkor
- recall the effects of lack of certain vitamins (illustrated by A, C and D) and certain mineral ions (calcium and iron) (see section 2e)
- understand how excess energy intake in the diet (particularly from carbohydrates and lipids) can lead to obesity
- understand the harmful effects of obesity on the heart and circulatory system
- understand how tobacco smoking affects the breathing and circulatory systems (see section 2g).

Grade descriptions

The following grade descriptions indicate the level of attainment characteristic of the given grade at GCE O level. They give an indication of the standard of achievement and required learning outcomes at each specified grade. The descriptions should be interpreted in relation to the content outlined in the syllabus; they are **not** designed to define the content. In practice, the grade awarded will depend on the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of the examination may be balanced by better performances in others.

Grade A

Candidates recall a wide range of biological knowledge from all areas of the syllabus. They consistently show good understanding of biological concepts. For example, they show understanding of the movement of water into, through and out of a plant and of osmoregulation in the body as an example of a homeostatic mechanism. Candidates are able to draw on their wider biological knowledge and apply this to a range of situations, such as the interpretation of data from contexts that may be unfamiliar to them. They make good use of appropriate scientific terminology and accurately carry out a range of calculations making use of relevant mathematical skills. Candidates are able to formulate a plan for a practical investigation that could be carried out in relation to a novel proposal presented to them and describe a method that reflects good understanding of an appropriate practical approach. Candidates select biological knowledge relevant to most situations and write answers that are presented clearly and logically, providing detailed descriptions of structures and functions with coherent explanations as required. In particular, longer questions are answered to an appropriate depth and ideas are communicated effectively.

Grade C

Candidates recall a range of biological knowledge from most areas of the syllabus. They often show accurate knowledge and understanding of biological concepts and are able to apply this biological knowledge to some situations, such as the interpretation of data from contexts that are familiar to them. They are able to use scientific terminology and to carry out relatively straightforward calculations making use of their mathematical skills. Candidates show a knowledge of practical techniques but attempts to design a practical investigation that could be carried out in relation to a novel proposal presented to them is likely to lack appropriate detail. Candidates select biological knowledge relevant to some situations but their responses may be displayed consistently across the questions set or may vary between being quite good and poor on different questions. Their answers show some logic and coherence, with suitable descriptions of structures and functions but some explanations are limited or irrelevant. Longer questions may be answered to a depth that is sometimes superficial.

Grade E

Candidates recall some biological knowledge from different areas of the syllabus but their knowledge and understanding are likely to be uneven. They demonstrate a limited understanding of how biological knowledge can be used to interpret data or other information in contexts that are familiar to them. They show that they can make some use of basic scientific terminology and are able to carry out simple calculations. Candidates show limited knowledge of practical techniques and usually lack understanding of how to design a complete practical investigation that could be carried out in relation to a novel proposal presented to them. Candidates select only limited biological knowledge in their answers to questions and their responses are likely to be displayed inconsistently across the questions set. Their answers show limited logic or coherence, and descriptions of structures and functions often lack detail. Explanations are usually limited or irrelevant. Longer questions may be answered superficially.

Subject-specific information

Units and nomenclature

In the written papers and tests, the units and the nomenclature used will conform to the recommendations contained in the following booklets

Biological Nomenclature: Recommendations on Terms, Units and Symbols (Institute of Biology (IOB), 2000)

Signs, Symbols and Systematics, The ASE Companion to 16-19 Science – 1st Ed (Association of Science Education (ASE), 2000)

Required background in mathematics and other sciences

Candidates are expected to be familiar with the following terms and concepts in mathematics, chemistry and physics and to be able to use and apply them in their study of this biology syllabus: decimals, fractions, percentages, ratios, means; tabulated data; graphs (line, bar, histograms), pie charts, linear scales; solids, liquids, gases; elements, ions, salts; acids, alkalis, pH; composition of air; oxidation, combustion; solubility; diffusion (including osmosis), diffusion gradients; heat transfer by conduction, convection and radiation; insulation; temperature, humidity, evaporation; different forms of energy: light, heat, chemical, electrical; the use of energy in movement.

Safe practice

Attention is drawn to the need for safe practice when candidates carry out laboratory investigations or observe demonstrations. Particular attention is drawn to the possible hazards associated with electrical equipment, the handling of microorganisms, and ionising radiations. Strict aseptic conditions should be used when undertaking practical work. Reference must be made to local health and safety regulations, and widely accepted publications such as

COSHH; *Guidance for Schools* (HSC ,1989) (HMSO) ISBN 011 885 5115

Topics in Safety – 3rd Ed, Association for Science Education (ASE, 2001) ISBN 086 357 3169

CLEAPSS Laboratory Handbook and Hazards, available from Consortium of Local Education Authorities for the Provision of Service Sciences (CLEAPSS). School Science to members or associates only.

Students with particular requirements

Regulations and guidance relating to candidates with special requirements are published annually by the Joint Council for Qualifications in the UK and are circulated to Examinations Officers. Further copies of guidance documentation may be obtained from Edexcel International Customer Services. Contact details are given at the end of this syllabus. Edexcel International will assess whether or not special consideration or concessions can be made for candidates with particular requirements.

Textbooks and other resources

Title	ISBN
Particularly recommended:	
Longman Biology for IGCSE – Phil Bradfield and Steve Potter	1 405 80206 5
IGCSE Biology – D. G. Mackean (John Murray, 2002)	0 7195 8053 6
Biology–Mary Jones and Geoff Jones (Cambridge University Press, 2002)	0 521 89117 5
Biology – Michael Roberts and Neil Ingram (Nelson Thornes, 2001)	0 7487 6238 8
Other useful textbooks:	
Biology, for Higher Tier – Brian Beckett and RoseMarie Gallagher (New Coordinated Science) (Oxford, 2001)	0 19 914819 8
Target Science – Biology, Foundation Tier – David Coppock (Oxford, 2001)	0 19 914826 0
Key Science - Biology – David Applin (Nelson Thornes, 2002)	0 7487 6241 8

Support and training

Training

A programme of INSET courses covering various aspects of the syllabus and its assessment will be arranged by Edexcel International on a regular basis. Full details may be obtained from Edexcel International Customer Services. Contact details are given below.

Edexcel Publications

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Fax: +44 (0) 1623 450481

E-mail: intpublications@linneydirect.com

- Revised Specimen papers and mark schemes will be available in 2006 to support this syllabus
- Student Study Guide will be available in 2006

Contact details of Edexcel International Customer Services

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www.edexcel.org.uk/international