

General Certificate of Education
Ordinary Level

Syllabus

HUMAN AND SOCIAL BIOLOGY 5096

For examination in June and November 2010

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HUMAN AND SOCIAL BIOLOGY (5096)

GCE Ordinary Level

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Notes

Information for Teachers

This booklet relates to examinations taken in the year printed on the cover. It is the normal practice of CIE to print and distribute a new version of this booklet each year. Centres should receive copies well in advance of them being required for teaching purposes.

Teachers who are about to teach syllabuses in this booklet for the first time should obtain and study the relevant past examination papers and Subject Reports.

Any queries relating to this booklet should be addressed to CIE Customer Services.

Nomenclature

The proposals in 'Signs, Symbols and Systematics (The Association for Science Education Companion to 16-19 Science, 2000)' and the recommendations on terms, units and symbols in 'Biological Nomenclature (2000)' published by the Institute of Biology, in conjunction with the ASE, will generally be adopted.

It is intended that, in order to avoid difficulties arising out of the use of l as the symbol for litre, use of dm³ in place of l or litre will be made.

Units, significant figures

Candidates should be aware that misuse of units and/or significant figures, i.e. failure to quote units where necessary, the inclusion of units in quantities defined as ratios or quoting answers to an inappropriate number of significant figures, is liable to be penalised.

Exclusions

This syllabus must not be offered in the same session with the following syllabus:

0610 Biology
0653 Combined Science
0654 Co-ordinated Sciences (Double Award)
5090 Biology
5125 Science (Physics, Biology)
5126 Science (Chemistry, Biology)
5129 Combined Science
5130 Additional Combined Science

INTRODUCTION

This syllabus is designed to emphasise the understanding and application of scientific concepts and principles rather than factual material. This approach has been adopted in recognition of the need for students to develop skills that will be of long-term value in an increasingly technological world rather than focusing on large quantities of factual material that may have only short-term relevance.

AIMS

These provide the educational purposes of following a course in this subject. Some of these aims are reflected in the assessment objectives; others are not because they cannot readily be translated into objectives that can be assessed. The aims are not listed in an order of priority.

The aims are to:

1. provide, through well designed studies of experimental and practical biological science, a worthwhile educational experience for all students, whether or not they go on to study science beyond this level and, in particular, to enable them to acquire sufficient understanding and knowledge to
 - 1.1 become confident citizens in a technological world, able to take or develop an informed interest in matters of scientific import;
 - 1.2 recognise the usefulness, and limitations, of scientific method and to appreciate its applicability in other disciplines and in everyday life;
 - 1.3 be suitably prepared and stimulated for studies beyond Ordinary Level in pure sciences, in applied sciences or in science-dependent vocational courses.
2. develop abilities and skills that
 - 2.1 are relevant to the study and practice of science;
 - 2.2 are useful in everyday life;
 - 2.3 encourage efficient and safe practice;
 - 2.4 encourage effective communication.

3. develop attitudes relevant to science such as
 - 3.1 concern for accuracy and precision;
 - 3.2 objectivity;
 - 3.3 integrity;
 - 3.4 enquiry;
 - 3.5 initiative;
 - 3.6 inventiveness.
4. stimulate interest in and care for the local and global environment.
5. promote an awareness that
 - 5.1 the study and practice of science are co-operative and cumulative activities that are subject to social, economic, technological, ethical and cultural influences and limitations;
 - 5.2 the applications of science may be both beneficial and detrimental to the individual, the community and the environment;
 - 5.3 science transcends national boundaries and that the language of science, correctly and rigorously applied, is universal.

ASSESSMENT OBJECTIVES

These describe the knowledge, skills and abilities that candidates are expected to demonstrate at the end of the course. They reflect those aspects of the aims that will be assessed.

A Knowledge with understanding

Students should be able to demonstrate knowledge and understanding in relation to:

1. scientific phenomena, facts, laws, definitions, concepts, theories;
2. scientific vocabulary, terminology and conventions (including symbols, quantities and units);
3. scientific instruments and apparatus, including techniques of operation and aspects of safety;
4. scientific quantities and their determination;
5. scientific and technological applications with their social, economic and environmental implications.

The subject content defines the factual knowledge that candidates may be required to recall and explain. Questions testing these objectives will often begin with one of the following words: *define*, *state*, *name*, *describe*, *explain* or *outline*. (See the glossary of terms at the end of this booklet.)

B Handling information and solving problems

Students should be able - using oral, written, symbolic, graphical and numerical forms of presentation - to:

1. locate, select, organise and present information from a variety of sources;
2. translate information from one form to another;
3. manipulate numerical and other data;
4. use information to identify patterns, report trends and draw inferences;
5. present reasoned explanations for phenomena, patterns and relationships;
6. make predictions and propose hypotheses;
7. solve problems.

These assessment objectives cannot be precisely specified in the subject content because questions testing such skills may be based on information that is unfamiliar to the candidate. In answering such questions, candidates are required to use principles and concepts that are within the syllabus and apply them in a logical, reasoned or deductive manner to a novel situation. Questions testing these objectives will often begin with one of the following words: *discuss*, *predict*, *suggest*, *calculate* or *determine*. (See the glossary of terms at the end of this booklet.)

Weighting of Assessment Objectives**Theory Papers (Papers 1 and 2)**

- A *Knowledge with understanding*, approximately 45% of the marks
- B *Handling information and solving problems*, approximately 55% of the marks

SCHEME OF ASSESSMENT

Candidates are required to enter for both Paper 1 and Paper 2.

Paper	Type of Paper	Duration	Marks	Weighting
1	Multiple Choice	1 h	40	29%
2	Theory	2 h	100	71%

Paper 1 Theory (1 h, 40 marks)

This will consist of 40 compulsory multiple choice items of the direct choice type, based on Assessment Objectives A and B. These questions will involve four response options.

Paper 2 Theory (2 h, 100 marks) consisting of two sections

Section A will carry 55 marks and will consist of a number of compulsory structured questions based mainly on Assessment Objective B.

Section B will carry 45 marks and will consist of three compulsory questions based mainly on Assessment Objective A. Each will carry 15 marks. The last question will be presented in an either/or form.

Practical Work

Suggestions for practical work are indicated by means of an asterisk (*) but this does not preclude other experimental work being undertaken nor should all the suggestions be regarded as mandatory, although practical work may be tested. Some of the practical investigations can be carried out in groups or as class demonstrations, some can be based on photographs or models, some can be used with additional supplied data and some can be carried out individually. (In most cases, only very simple apparatus is needed, for example, test-tubes, thermometer, beaker (or tin) for use as a water-bath, a means of heating, a cutting implement, access to a hand lens and, if possible, to a microscope, Petri dishes, pressure cooker/autoclave, solutions for food tests.)

SUBJECT CONTENT

1. Characteristics of Living Organisms

Content

- 1.1 Activities of living organisms
- 1.2 Organisms affecting human health
- 1.3 Cells, the building units in organisms
- 1.4 Tissues, built up of cells
- 1.5 Organs, built up of tissues

Learning outcomes

Candidates should be able to:

- (a) define the characteristic activities of living organisms: nutrition, respiration, excretion, growth, response to stimuli, movement and reproduction;
- (b) describe viruses as non-cellular, parasitic and reproducing only in living host cells;
- (c) describe bacteria as unicellular, with a cell wall and DNA but no nucleus, some being pathogenic and some non-pathogenic and useful;
- (d) describe fungi as having a mycelium of threadlike hyphae, some being pathogenic and causing athlete's foot and ringworm (species of *Tinea*);
- (e) describe protozoa as unicellular animals, some reproducing by mitosis, others by multiple-fission, some forming gametes and spores and causing disease (malaria, caused by *Plasmodium*);
- (f) describe flatworms as multicellular animals, reproducing both sexually and asexually, with complex life histories involving at least two host organisms (blood fluke, *Schistosoma*);
- (g) describe insects as multicellular animals with exoskeletons, segmented bodies and jointed limbs, reproducing sexually, with life cycles involving several stages; some insects being vectors of disease (anopheline mosquito, housefly);
- (h) describe the structure of animal and plant cells as composed of cytoplasm, cell membrane, cell wall (plant cells and bacteria only), nucleus and nuclear membrane;
 - *mount and examine under a microscope cells from a plant epidermis (e.g. onion bulb) and cells obtained by squashing a very small portion of fresh animal liver between a slide and coverslip
- (i) describe the functions of the cell membrane in controlling the passage of materials into and out of the cytoplasm;
- (j) define and distinguish between *diffusion* and *osmosis*;
 - *carry out experiments to illustrate diffusion, (e.g. of colour diffusing into water as a coloured crystal dissolves) and osmosis (e.g. using Visking (dialysis) tubing as a membrane or using cells of onion epidermis or the large cells from the segment of a citrus fruit)
- (k) define *active transport*;
- (l) describe the structure and functions of the following tissues: epithelium (lining of trachea and covering of villus), blood and bone;

- (m) define the term *organ* with reference to the arm: bone, muscle, cartilage, fibrous tissues (tendons and ligaments).

2. Plants, Food and Humans

Content

- 2.1 Food production
2.2 The recycling of carbon and nitrogen

Learning outcomes

Candidates should be able to:

- (a) state the function of green plants as primary producers of carbohydrate and protein;
- (b) define *photosynthesis* as the production of carbohydrate from water and carbon dioxide, using light energy, in the presence of chlorophyll and with the release of oxygen;
- (c) state the dependence of all living organisms, including humans, directly or indirectly on photosynthesis;
- (d) describe the carbon cycle in terms of the fixation of carbon from carbon dioxide in photosynthesis, its transfer as carbohydrate to animals and its release back into the atmosphere as carbon dioxide, as a result of respiration;
- (e) describe the nitrogen cycle in terms of the uptake of nitrate ions from the soil by green plants and the formation of plant protein, which is then eaten by animals and converted to animal protein, broken down to urea and released as urine. This is followed by the breakdown of urea and dead animal protein by bacteria and conversion, by stages, to nitrate ions: conversion of atmospheric nitrogen to nitrate ions by nitrogen-fixing bacteria (names of specific bacteria are **not** required).

3. Nutrition and Diet

Content

- 3.1 Classification of nutrients
3.2 Water and dietary fibre (roughage)
3.3 Sources of nutrients
3.4 Balanced diets
3.5 Preparation of food

Learning outcomes

Candidates should be able to:

- (a) list the major nutrient groups and state their sources and their uses in the body:
- carbohydrates: sugars and starch, digestible, and used as an energy source and for storage (glycogen); cellulose from plant cells, indigestible (fibre/roughage);
- proteins: used for growth and repair of tissues and as components of haemoglobin, insulin and enzymes;
- fats (lipids): used in the formation of cell membranes, as an energy source and a storage material, and as a solvent for vitamins A and D;
- *carry out Benedict's test for reducing sugars, the iodine test for starch, the biuret test for proteins and the grease spot test for fats

- (b) list the principal sources of vitamins A, C and D and of the inorganic elements calcium and iron;
- (c) relate vitamin C to the formation of epithelial tissues and thus to the healing of wounds;
- (d) relate vitamin D to the absorption of calcium ions from the ileum and to the prevention of rickets in children;
- (e) list the uses of calcium ions in the formation of bones and teeth, in blood clotting and in muscle contraction;
- (f) state the use of iron in the formation of haemoglobin and relate iron deficiency to anaemia;
- (g) outline the uses of water in the body: as a reagent in digestion (hydrolysis) of food, as a solvent, as a transport medium and as a component of body fluids and of cytoplasm;
- (h) describe the function of fibre in the evacuation of the large intestine;
- (i) outline the relative values, as sources of nutrients, of foods obtained from animals (meat, fish, eggs, milk and milk products) and of foods obtained from plant roots, tubers, stems, seeds and fruits;
- (j) define a *balanced diet* as a diet supplying sufficient (but not too much) in quality and quantities of protein, carbohydrate, fat, vitamins, minerals, fibre and energy to sustain a healthy life;
- (k) compare the differences in quantity and proportions of nutrients needed in childhood, adolescence, maturity and old age, during pregnancy and whilst breast-feeding and in relation to active and sedentary living;
- (l) define *malnutrition* as a lack of balance in the diet, either as a shortage of particular nutrients (vitamin D and rickets) or as an excess (excess carbohydrates leading to obesity and coronary heart disease);
 - *list the food and drink consumed in one week, indicating the nutrients contained
- (m) discuss the value of breast milk in feeding babies;
- (n) explain the need for hygiene in handling and preparing food;
- (o) state ways of conserving mineral ions and vitamins during the cooking of food.

4. Digestion and Absorption of Food

Content

- 4.1 Teeth and the physical breakdown of food
- 4.2 Nature and properties of enzymes
- 4.3 The alimentary canal

Learning outcomes

Candidates should be able to:

- (a) state the increase in surface area to volume ratio after chewing food;
- (b) identify from a drawing a section through a molar tooth and state the functions of the parts;
- (c) state the cause of dental decay and describe the care of teeth;
 - *demonstrate the presence of bacteria on teeth
- (d) define *enzymes* as proteins that act as biological catalysts involved in all biochemical processes including digestion, respiration and protein synthesis;
- (e) state the effects of changes in temperature and pH on the rate of enzyme activity;
 - *investigate the effects of changes in temperature and of pH on the rate of digestion of starch suspension by amylase
- (f) identify from a drawing the main structures of the alimentary canal: mouth, oesophagus, stomach, duodenum, ileum, colon, rectum, anus, gall bladder, pancreas and liver in relation to the duodenum;
- (g) describe peristalsis as a muscular movement, mixing and propelling food along the intestine;
- (h) outline the functions of the pancreas and the liver;
- (i) state the functions of amylase, protease and lipase in the production of reducing sugars, amino acids, fatty acids and glycerol;
- (j) state the main sites of the digestion of protein to polypeptides and of polypeptides to amino acids, name the enzymes involved in the stomach and duodenum and state the significance (of pH in enzyme activity);
- (k) state the main sites of the digestion of starch to maltose and maltose to glucose and name the enzymes involved;
- (l) state the need for emulsification of fats and explain how this takes place;
- (m) describe and explain the adaptation of the small intestine for the absorption of the products of digestion: folds and villi providing an increased surface area; functions of capillaries and lacteals;
- (n) describe the colon as the main region for the absorption of water;
- (o) state the need for assimilation of products of digestion by cells;
- (p) distinguish between *egestion* and *excretion*;
- (q) define *defecation*, *constipation* and *diarrhoea*.

5. Blood and the Circulatory System

Content

5.1 Composition and functions of blood

5.2 Circulation of the blood

Learning outcomes

Candidates should be able to:

- (a) identify red blood cells, phagocytes and lymphocytes from drawings and photographs;
- (b) state the function of red blood cells in terms of transport of oxygen and carbon dioxide by haemoglobin;
- (c) state the functions of white blood cells in the defence of the body against infection: phagocytosis and formation of antibodies to counteract antigens;
- (d) state the functions of plasma in the transport of the products of digestion and of carbon dioxide, urea, hormones and heat;
- (e) outline the function of platelets during the clotting of blood, soluble fibrinogen being converted to insoluble threads of fibrin;
- (f) state that clotting protects the body from loss of blood and from entry of pathogens;
- (g) identify from a drawing the structure of the heart, as seen in section from the front;
- (h) describe the action of the heart acting as a pump by contraction of muscles in the atria and ventricles, the direction of flow controlled by the tricuspid and pulmonary valves and the bicuspid and aortic valves;
- (i) describe the function of the pacemaker;
- (j) list the likely causes and effects of heart attacks;
- (k) describe the structure in relation to functions of arteries, arterioles, capillaries and veins;
- (l) describe the structure of lymph capillaries, lymph vessels and lymph nodes (glands);
- (m) name the blood vessels to and from the heart, lungs, head, liver and kidneys;
- (n) state the origin and functions of tissue fluid;
- (o) state the origin and functions of lymph.

6. Breathing and Respiration

Content

- 6.1 Breathing and gas exchange
- 6.2 Respiration and energy transfer
- 6.3 Diseases associated with tobacco smoke

Learning outcomes

Candidates should be able to:

- (a) define *breathing* as the movement of air into and out of the lungs;
- (b) describe and recognise from a drawing the arrangement of the trachea, bronchi, outline of the lungs and diaphragm, as seen in front section through the thorax;
- (c) describe the functions of the ribs, internal and external intercostal muscles, muscular and fibrous parts of the diaphragm in the process of breathing;
- (d) describe the relationship between changes in pressure and volume in the lungs during breathing;
- (e) define *gas exchange* as uptake of oxygen and release of carbon dioxide in the alveoli;
- (f) state the differences between inspired and expired air;
 - *investigate the differences in composition between inspired (atmospheric) air and expired air
- (g) define *vital capacity*;
 - *investigate differences in vital capacity in a group of students and relate it to height and to body mass
- (h) describe the effects of changes in physical activity on the rate and depth of breathing;
 - *investigate the effects of changes in physical activity on the rate and depth of breathing
- (i) describe the technique of mouth-to-mouth resuscitation;
- (j) define *respiration* as the release of energy from glucose in living cells;
- (k) state the equation for aerobic respiration, using either words or chemical symbols;
- (l) state the function of mitochondria in cells as the site of energy transfer in respiration;
- (m) list activities where energy is required: cell division, active transport, maintenance of a constant body temperature and muscle action;
- (n) list the toxic materials in cigarette smoke: particles, nicotine, tar and carbon monoxide;
- (o) state the effect of tar as a carcinogen;
- (p) discuss the effects of nicotine and carbon monoxide on the body and on a developing fetus;
- (q) describe the effects of cigarette smoke on the cilia, which form the cleaning mechanism of the lungs;
 - *investigate the tar content and acidity of cigarette smoke.

7. Skeleton, Muscles and Movement

Content

- 7.1 Structure and functions of bones and cartilage
- 7.2 Functions of the skeleton
- 7.3 Muscles and movement

Learning outcomes

Candidates should be able to:

- (a) distinguish between *bone* and *cartilage*;
- (b) describe bone as a living tissue with tough collagen fibres embedded in a matrix of hard, rigid calcium phosphate;
- (c) describe cartilage as a living tissue with cells secreting a tough, flexible, water-filled material forming a cushion-like, load-spreading covering to the bone surfaces at joints and a flexible support in the trachea;
- (d) describe the characteristics of fibrous tissue: connective tissue, white fibrous (collagen) in tendons (inelastic) and yellow elastin in ligaments (elastic);
- (e) list the functions of the skeleton: to support and protect soft tissues, to increase effectiveness of movement by providing levers, as the site of bone marrow and production of red, and some white, blood cells;
 - *examine a skeleton or model of a skeleton
- (f) distinguish between tendons (attach muscles to bones, inelastic) and ligaments (join bone to bone, elastic);
- (g) identify from a drawing and describe the action of: a hinge joint (elbow) and a ball and socket joint (shoulder);
 - *examine the structure of, and movement at, a joint from a limb of an animal
- (h) describe muscle as tissue that produces movement by contracting, using energy derived from respiration;
- (i) identify the bones of the arm and shoulder and show the origins and insertions of the biceps and triceps muscles;
- (j) explain antagonistic muscle action in the arm;
- (k) explain the role of circular muscles in peristalsis and in the movement in the iris and ciliary body of the eye.

8. Homeostasis: Maintaining a Steady Internal Environment

Content

- 8.1 Homeostasis
- 8.2 Regulation of body fluids
- 8.3 Regulation of body temperature
- 8.4 Regulation of blood glucose

Learning outcomes

Candidates should be able to:

- (a) define *homeostasis*;
- (b) define *excretion*;
 - *cut a longitudinal section through a mammalian kidney and identify the cortex, medulla, pyramids, pelvis and ureter
- (c) describe kidney function as a process of filtration followed by selective reabsorption of glucose, salt, urea and water, resulting in adjustment of the concentration of the blood plasma;
- (d) relate the process of filtration to blood pressure in the glomerulus, collection of filtrate in Bowman's capsule and reabsorption of materials at appropriate sections in the kidney tubule;
- (e) define *excretion* as the removal of waste products of metabolism from the blood (urea and carbon dioxide);
- (f) describe the effects of heavy sweating and diarrhoea on urine production and water balance and the function of ADH (antidiuretic hormone) on water balance;
- (g) distinguish between *heat* and *temperature*;
- (h) define *regulation of body temperature* as maintaining a steady internal temperature by balancing heat production and heat loss;
- (i) identify from a drawing the main structures involved in heat loss by the skin: sweat glands and ducts, capillaries and associated arterioles;
- (j) relate the evaporation of sweat to the concept of specific latent heat;
- (k) describe the effect of vasodilation and vasoconstriction of arterioles in the skin;
- (l) explain the mechanism of heat gain and its conservation in the body;
- (m) state that the pancreas acts as a detector of changes in the concentration of blood glucose, leading to the release of insulin;
- (n) describe the part played by the liver in the formation of insoluble glycogen in response to insulin release and its response to the release of adrenaline;
- (o) describe the effect of glucagon, released by the pancreas, on the liver and explain the part it plays in homeostatic control of the blood glucose concentration.

9. The Senses, Nervous System, Hormones and Coordination

Content

- 9.1 Perception
- 9.2 Structure and functions of the eye
- 9.3 Nervous system
- 9.4 Hormones
- 9.5 Alcohol and other drugs

Learning outcomes

Candidates should be able to:

- (a) define *sense organ*;
- (b) list the stimuli to which sense organs respond: light energy, sound energy, temperature change, touch and chemical stimuli;
 - *investigate the variation in discrimination between different temperatures and in perception of touch by different areas of the skin of the hand and forearm
- (c) describe and identify from a drawing a horizontal section through the eye and optic nerve;
 - *examine the structure of a mammalian eye (e.g. cow, sheep or goat)
- (d) describe the action of the components of the eye in forming inverted images on the retina;
- (e) describe the mechanism of focusing;
- (f) state the function of rods and cones in the retina in transforming units of light energy into nerve impulses;
- (g) describe the reflex action of the circular muscles of the iris in regulating the amount of light reaching the retina;
 - *investigate pupil reflex, blind spot and stereoscopic vision
- (h) state the main divisions of the nervous system: central nervous system (CNS) comprising brain and spinal cord and peripheral nervous system (spinal nerves);
- (i) distinguish between a *neurone* and a *nerve*;
- (j) define a *reflex action*;
- (k) explain chemical transmission at synapses;
- (l) describe and recognise from a drawing a simple spinal reflex arc;
- (m) explain the function of the sensory, intermediate and motor neurons;
- (n) relate the control of movement at the elbow in withdrawing the hand from a painful stimulus to reflex action;
 - *carry out experiments to measure reaction time and to demonstrate reflex actions
- (o) define *hormone*;

- (p) describe the functions of oestrogen and progesterone in the menstrual cycle and in pregnancy;
- (q) distinguish between quick-acting hormones (insulin) and slow-acting hormones (oestrogen);
- (r) distinguish between the hormonal and nervous control systems (chemical substance or impulse, speed of response, widespread or localised response, long-term or short-lived response);
- (s) define *drug dependence*;
- (t) describe the short-term effects of alcohol on reaction time (rate of transmission of impulses), coordination and the ability to make rational decisions;
- (u) state the short-term and long-term effects on the brain and liver of the excessive intake of alcohol;
- (v) state the physical and social effects of heroin.

10. Reproduction and the Continuity of Life

Content

- 10.1 The reproductive systems
- 10.2 Fertilisation to birth
- 10.3 Family planning
- 10.4 Units and processes of heredity
- 10.5 Monohybrid inheritance

Learning outcomes

Candidates should be able to:

- (a) define a *gamete* as either a sperm or an egg, having half the number of chromosomes found in body cells;
- (b) define *sexual reproduction*;
- (c) describe and identify from a drawing the structure of the male and female reproductive systems, as seen in side section;
- (d) state the function of testis, sperm duct, prostate gland, urethra, ovary, oviduct, uterus, cervix and vagina;
- (e) describe the menstrual cycle and the production of ova (eggs);
- (f) describe the functions of oestrogen and progesterone in the menstrual cycle and in pregnancy;
- (g) define *fertilisation* and *implantation*;
- (h) describe the development of the fetus in terms of dependence on the placenta for exchange of food materials, oxygen, urea and carbon dioxide between the maternal and fetal blood; describe the placenta as a barrier, separating maternal and fetal red blood cells; describe the passage of nicotine, alcohol and some viruses from mother to fetus through the placenta;
- (i) indicate the protective function of the amniotic fluid, in terms of even distribution of pressure around the fetus;

- (j) describe the three stages of birth: opening (dilation), delivery and afterbirth;
- (k) describe family planning as a means of limiting the number of children in a family and spacing births, thus giving both mother and children a better chance of receiving adequate nutrition and other resources and of developing good health;
- (l) explain methods of birth control, stating practical advantages and disadvantages; rhythm (safe period), condom (sheath), cap; intrauterine device (IUD, coil and loop), oral contraceptive pill, sterilisation (vasectomy for males and tying of oviducts for females);
- (m) define *inheritance* as the transmission of genetic information (genes) from one generation to the next;
- (n) define a *gene* as a length of DNA coding for a particular characteristic and distinguish clearly between the terms *gene* and *allele*;
- (o) state that genes are carried on thread-like structures, made of protein and DNA, called chromosomes;
- (p) state the function of ribosomes in cells in the formation of protein;
- (q) define *mitosis* as a nuclear division resulting in the formation of two nuclei with the same chromosome number, and the same genetic content, as the original nucleus;
- (r) define *meiosis* as a nuclear division resulting in a halving of the chromosome number and the production of variation during the formation of gamete cells;
- (s) define the terms *dominant* and *recessive*;
- (t) using symbols, draw and interpret diagrams to show the genetic characteristics of the offspring from a monohybrid cross;
- (u) using symbols, draw and interpret diagrams to show the inheritance of sex.

11. Health and Disease

Content

11.1 Health and disease

11.2 Non-transmissible diseases and disorders

11.3 Transmissible diseases

Influenza

AIDS (acquired immune deficiency syndrome)

Gonorrhoea

Ringworm

Typhoid

Tuberculosis

Cholera

Malaria

Schistosomiasis (Bilharzia)

Learning outcomes

Candidates should be able to:

- (a) define *good health* as a state of physical and mental wellbeing, dependent on receiving a balanced diet and on appropriate physical and mental activity;
- (b) define *disease* as a loss of health resulting from a disturbance of the normal processes of the body, due to various causes such as malnutrition, infectious organisms degeneration of organs/tissues or environmental pollutants;
- (c) define *nutritional deficiency disease*, as illustrated by rickets;
- (d) define *degenerative disease*, as illustrated by coronary heart disease;
- (e) define *inherited disorders*, as illustrated by sickle cell anaemia;
- (f) distinguish between signs of a disease (e.g. rash, high temperature) that can be seen or measured and symptoms (e.g. pain) that can only be described by the patient;
- (g) state the chief signs of influenza, name the pathogen (a virus), the method of spread (droplet or airborne) and the methods of limiting spread;
- (h) state the chief signs and symptoms of AIDS, state the pathogen (human immunodeficiency virus, HIV) and the methods of spread: sexual intercourse, use of contaminated needles for injecting drugs, blood transfusion and state the methods of limiting spread;
- (i) state the chief signs and symptoms of gonorrhoea and state the pathogen (a bacterium) and the method of spread;
- (j) state the chief signs and symptoms of ringworm, name the pathogen (a fungus) and state the method of spread (contact);
- (k) state the chief signs and symptoms of typhoid, name the pathogen (a bacterium) and methods of spread: contamination of human food by food handlers and by houseflies - control of spread by sanitary disposal of faeces, preventing access for houseflies to faeces, careful washing of hands after using the toilet and tracing of carriers, followed by medical treatment;
- (l) state the chief signs and symptoms of tuberculosis (TB), name the pathogen as a bacterium (*Mycobacterium tuberculosis*), capable of forming spores and therefore of surviving drying; method of spread; control by good ventilation, avoiding overcrowding, avoiding spitting, BCG vaccination, early diagnosis by mass X-ray, drug treatment;
- (m) state the chief signs and symptoms of cholera, name the pathogen as a bacterium (vibrio), spread by water contaminated with bacteria from human faeces; describe control by sanitary disposal of faeces and thorough chlorination of drinking water; occurrence and significance of epidemics;
- (n) state the chief signs and symptoms of malaria; name the pathogen as a protozoan (*Plasmodium*) transmitted only by the bite of an infected, female anopheline mosquito: life cycle of the mosquito and the importance of understanding the life cycle in devising means of control:
destruction of breeding sites, destruction of mosquito larvae, pupae and adults by appropriate means (including biological control of the larvae using *Bacillus thuringiensis*, the need to prevent mosquitoes biting patients already suffering from malaria;

- (o) - state the symptoms of schistosomiasis (bilharzia);
- name the pathogen as a flatworm (blood fluke), *Schistosoma mansoni*, invading blood vessels of the gut;
- outline the life cycle of the parasite and the part played by the water snail (secondary host) for completion of the life cycle; methods of controlling spread of parasite and control of secondary host.

12. Control of Disease

Content

12.1 Personal hygiene

12.2 Control of the organisms that cause disease

Learning outcomes

Candidates should be able to:

- (a) discuss the importance of cleaning the body, particularly the pubic and anal regions and the hands, after contact with faeces and urine;
- (b) discuss the meaning and importance of the sanitary disposal of faeces, urine and sputum;
- (c) discuss the control of sexually transmitted diseases;
- (d) define *sterilization*;
*demonstrate the presence of microorganisms in water, air and food
- (e) describe the use of high temperature as a means of destroying pathogens in cooking and steam sterilization;
- (f) describe the use of chemical sterilisation agents, with particular reference to the use of chlorine;
- (g) distinguish between antiseptics that inhibit the reproduction of bacteria and disinfectants that kill bacteria but also damage human tissue;
*investigate the effects of disinfectants on bacterial growth
- (h) define *antibiotics*;
- (i) discuss the use of antibiotics, illustrated by the use of penicillin in the treatment of gonorrhoea;
- (j) state the principles of controlling a disease by controlling the vector that transmits the pathogens, illustrated by methods of controlling mosquitoes (including biological control by the use of *Bacillus thuringiensis*) (malaria) and houseflies (typhoid);
- (k) explain the need for knowing the life cycle and habits of the Anopheles mosquito and housefly as vectors;
*examine all stages in the life cycle of the Anopheles mosquito and the housefly.

13. Immunity and Immunisation

Content

13.1 Immunity

Learning outcomes

Candidates should be able to:

- (a) define *immunity* to disease;
- (b) define *active immunity*, illustrated by immunity to tuberculosis gained naturally during recovery from the disease and artificially through BCG vaccination;
- (c) define *passive immunity*, illustrated by immunity to tetanus gained by injection with immune serum;
- (d) discuss the differences between *active*, *passive*, *artificial* and *natural immunity*;
- (e) discuss the WHO campaign that eliminated smallpox and the immunisation programme to control tuberculosis.

14. Community Health

Content

14.1 Sewage disposal

14.2 Safe drinking water

14.3 Refuse disposal

Learning outcomes

Candidates should be able to:

- (a) define *sewage*;
- (b) state the risks from leaving sewage untreated and exposed to rain and flies;
- (c) identify from a drawing a section through a pit latrine and describe the functions of the parts;
- (d) state the reasons for the careful siting of pit latrines in relation to water sources;
- (e) describe the large-scale treatment of sewage by **either** the biological filter (trickle filter) method **or** the activated sludge method;
- (f) state the part played by microorganisms in making sewage harmless and the effluent safe for discharge into a river;
- (g) compare the relative purity of water from e.g. rivers, canals, shallow wells, boreholes and rainwater;
- (h) discuss the effects of boiling water for drinking;
- (i) describe the large-scale treatment of water from a river, lake or canal by **either** the slow sand filter method **or** the rapid sand filter method;
- (j) state the dangers from allowing domestic waste to accumulate around living quarters: attraction of houseflies and provision of suitable conditions for breeding; attraction of rats and mice (vectors of disease);

- (k) state the reasons for, and the methods of, controlling the breeding of houseflies;
- (l) relate the life cycle of the housefly to the need for the regular emptying of bins for domestic waste;
- (m) state the methods of disposal of domestic refuse: burying, burning, incineration (total destruction by burning at very high temperature) and compacting refuse at communal sites to make it more difficult for rats to penetrate.

15. Pollution

Content

15.1 Air pollution

15.2 Water pollution

Learning outcomes

Candidates should be able to:

- (a) define *pollution*;
- (b) state the toxic components of motor exhaust fumes: carbon monoxide and nitrogen oxides;
- (c) describe the effects of lead on the body;
- (d) describe the undesirable effects of water pollution by: discharge of untreated sewage (cholera and schistosomiasis); discharge of chemical waste from industrial plants; run-off of chemicals (fertilisers, pesticides and herbicides) and discharge of oil.

RESOURCE LIST - 5096

Teachers may find reference to the following books helpful.

- Beckett, Brian S *Illustrated Human and Social Biology* (1981) Oxford University Press
<http://www4.oup.co.uk/> ISBN: 0199140650
- Gadd, P *Human and Social Biology for the Tropics* (4th Edition 1993) MacMillan
<http://www.macmillan.co.uk/> ISBN: 0333552806
- Givens, P & Reiss M *Human Biology and Health Studies* (2002) Nelson Thornes
 ISBN 0174900600
- Mackean, D G *Human Life* (1988) John Murray <http://www.johnmurray.co.uk>
 ISBN: 0719545005
- Mackean, D G &
 Jones, B *Introduction to Human and Social Biology* (1985) John Murray
<http://www.johnmurray.co.uk> ISBN: 0719541670

CD-ROM

BIOSCOPE biological microscope simulation (Edition 2004) ISBN 1845650263 Cambridge-Hitachi, Shaftesbury Road, Cambridge, CB2 2BS, UK, www.cambridge-hitachi.com
 Includes 56 slide sets of plant and animal specimens, with features that give the feeling of a real microscope. Paper-based tasks (in Word and PDF format), each of 45 to 60 minutes duration, accompany the slides.

Experiment Simulator (Edition 2005) ISBN 1845651405 Cambridge-Hitachi, Shaftesbury Road, Cambridge, CB2 2BS, UK, www.cambridge-hitachi.com.
 Like the bioscope developed by Cambridge Assessment, and providing six simulated science experiments to inspire and support pupil learning. Includes excellent worksheets and teacher notes.

The websites listed below are relevant for use with this syllabus:

- <http://www.health.org/kidsarea/funstuff/brain/alcohol.htm> Alcohol
<http://www.cellsalive.com/> Cells
<http://sln.fi.edu/biosci/heart.html> Heart
<http://www.lungusa.org/diseases/lungemphysem.html> Lungs
<http://www.bbc.co.uk/schools/gcsebitesize/biology/humans/nutritionrev1.shtml> Nutrition
<http://www.ace.orst.edu/info/extoxnet/faqs/safedrink/sewage.htm> Pollution

GLOSSARY OF TERMS USED IN BIOLOGICAL SCIENCES PAPERS

During the moderation of a question paper, care is taken to ensure that the paper and its individual questions are, in relation to the syllabus, fair as regards balance, overall difficulty and suitability. Attention is also paid to the wording of questions to ensure that it is as concise and as unambiguous as possible. In many instances, Examiners are able to make appropriate allowance for an interpretation that differs, but acceptably so, from the one intended.

It is hoped that the glossary (which is relevant only to biology, human and social biology and agriculture) will prove helpful to candidates as a guide (i.e. it is neither exhaustive nor definitive). The glossary has been deliberately kept brief not only with respect to the number of terms included but also to the descriptions of their meanings. Candidates should appreciate that the meaning of a term must depend, in part, on its context.

1. *Define* (the term(s)...) is intended literally, only a formal statement or equivalent paraphrase being required.
2. *What is meant by* (the term(s)...) normally implies that a definition should be given, together with some relevant comment on the significance or context of the term(s) concerned, especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value.
3. *State* implies a concise answer with little or no supporting argument (e.g. a numerical answer that can readily be obtained 'by inspection').
4. *List* requires a number of points, generally each of one word, with no elaboration. Where a given number of points is specified, this should not be exceeded.
- 5 (a) *Explain* may imply reasoning or some reference to theory, depending on the context. It is another way of asking candidates to give reasons for. The candidate needs to leave the examiner in no doubt **why** something happens.
 - (b) *Give a reason/Give reasons* is another way of asking candidates to explain **why** something happens.
- 6 (a) *Describe*, the data or information given in a graph, table or diagram, requires the candidate to state the key points that can be seen in the stimulus material. Where possible, reference should be made to numbers drawn from the stimulus material.
 - (b) *Describe*, a process, requires the candidate to give a step by step written statement of what happens during the process.
Describe and *explain* may be coupled, as may *state* and *explain*.
7. *Discuss* requires the candidate to give a critical account of the points involved in the topic.
8. *Outline* implies brevity (i.e. restricting the answer to giving essentials).
9. *Predict* implies that the candidate is not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answers extracted in an earlier part of the question.
Predict also implies a concise answer, with no supporting statement required.
10. *Deduce* is used in a similar way to *predict* except that some supporting statement is required (e.g. reference to a law/principle, or the necessary reasoning is to be included in the answer).
11. *Suggest* is used in two main contexts (i.e. either to imply that there is no unique answer (e.g. in chemistry, two or more substances may satisfy the given conditions describing an 'unknown') or to imply that candidates are expected to apply their general knowledge to a 'novel' situation, one that may be formally 'not in the syllabus').
12. *Find* is a general term that may variously be interpreted as *calculate*, *measure*, *determine*, etc.
13. *Calculate* is used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved.

GLOSSARY OF TERMS

14. *Measure* implies that the quantity concerned can be directly obtained from a suitable measuring instrument (e.g. length, using a rule, or mass, using a balance).
15. *Determine* often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula (e.g. the Young modulus, relative molecular mass).
16. *Estimate* implies a reasoned order of magnitude statement or calculation of the quantity concerned, making such simplifying assumptions as may be necessary about points of principle and about the values of quantities not otherwise included in the question.
17. *Sketch*, when applied to graph work, implies that the shape and/or position of the curve need only be qualitatively correct, but candidates should be aware that, depending on the context, some quantitative aspects may be looked for (e.g. passing through the origin, having an intercept, asymptote or discontinuity at a particular value).

In diagrams, *sketch* implies that a simple, freehand drawing is acceptable; nevertheless, care should be taken over proportions and the clear exposition of important details.

In all questions, the number of marks allocated are shown on the examination paper and should be used as a guide by candidates to how much detail to give. In describing a process the mark allocation should guide the candidate about how many steps to include. In explaining why something happens, it guides the candidate how many reasons to give, or how much detail to give for each reason.