Cambridge Assessment

O Level

Biology

Session: 1957
Type: Syllabus
Code: 30

BIOLOGY

Although the special animal and plant studies required are set out in separate sections of the syllabus it is assumed that they will be integrated by frequent cross-reference and comparison in the teaching.

The interdependence and unity of life should be emphasised throughout. The differences should be noted between living and non-living matter and between plants and animals.

Not only is a knowledge of the structure and physiology of animals and plants in the schedule required but consideration of their natural history and ecology is also essential, and evidence of this approach will be expected in the written answers. Personal observations on living organisms should be made wherever possible and great importance should be attached to experimental work. When the cellular structure of particular animal or plant organs is being considered this should, wherever possible, be demonstrated by means of the microscope or a microprojector. For most purposes a hand lens is sufficient; detailed knowledge of cell structure will not be required except where specifically indicated in the syllabus.

No questions will be set on evolution but the idea of evolution should be introduced and illustrated at relevant points in the course. It is hoped that teachers will at least outline the evidences for evolution from the occurrence of fossils and very simple morphology. In the same way, the general discussion of reproduction should include brief reference to the facts of heredity, although no questions will be set on the laws of inheritance.

Alternatives for Oversea Centres. Alternatives suitable for sections marked * are given on p. 50.

Syllabus

1. The general elementary structure and physiology of a mammal.

(*a*) The main structural features of a mammal including the general arrangement of the internal organs. External features in relation to habits and environment.

(*b*) The general plan of the skeleton and its functions. Different types of joints as illustrated by the shoulder, hip and the elbow and the way muscles act on bones to cause movement. The structure and function of vertebrae: atlas, axis, cervical, thoracic and lumbar vertebrae.

Notes

It is suggested that a small mammal, e.g. rabbit, rat, or guinea-pig be used for most of the work, but it is important that there should be frequent reference to man.

Candidates should be made familiar with the appearance and position of the internal organs referred to in the syllabus through actual dissections shown them by the teacher. They will not be expected to reproduce from memory drawings of complete dissections they have seen.

Details of the structure of the skull are not required, nor are the names of the individual bones of the pelvis. A vertebra should be regarded as being composed of a body (centrum) carrying arches, neural spine and transverse processes with facets for articulation. The names of the articulatory processes will not be required.

Syllabus	Notes
(*c*) The structure of a tooth and its insertion in the jawbone. Incisors, canines, premolars and molars. The relation of dentition to diet as illustrated by man, a herbivore and a carnivore.	
(*d*) The alimentary canal. Food substances and diet. Digestion, including the functions of the liver and pancreas. Absorption, transport and utilisation of digested food. The function of the liver in the general body metabolism.	Tests for reducing sugar, starch, protein (one test only), and fats should be carried out by the candidate. The importance of vitamins and enzymes should be stressed. Names of specific enzymes will only be required in the case of ptyalin, rennin and pepsin, but candidates should understand that there are specific enzymes in the small intestine acting on proteins, carbohydrates and fats. The action of ptyalin, rennin, and pepsin should be studied experimentally.
(*e*) The main features of the circulatory system. The structure of the heart. Structure and functions of the blood. Capillary circulation.	Names will be required only of main blood vessels of the liver and kidney and those entering and leaving the heart. Blood should be examined microscopically. To demonstrate capillary circulation a tadpole's gill or tail can be used or a frog can be conveniently anaesthetised (for at least an hour) by immersion for 20 min. in a 1% solution of urethane; the capillaries can be seen in the web between the toes.
(*f*) Respiration. The respiratory organs and the mechanism of breathing. Tissue respiration. The role of oxygen in the operation of energy for the activities of the living body.	
(*g*) Excretion by kidneys, sweat glands, lungs. Elementary treatment of the structure of the kidney and of filtration and reabsorption.	The kidney should be treated as comprising cortex and medulla and consisting of a branched system of tubules, well supplied with blood-vessels, leading to the ureter. Details of the courses of the tubules and their blood-vessels will not be required.
(*h*) Structure and functions of the skin.	A vertical section of the skin should be examined with the aid of a microscope or a microprojector.
(*i*) Regulation of body temperature and the importance of the maintenance of a constant body temperature.	

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Syllabus	Notes
(*j*) A simplified account of the brain and spinal cord. Reflex action and how it differs from voluntary action. The principal sense organs, their position and function. The structure of the eye and ear simply treated. The use of spectacles for the correction of long sight and short sight.	Only the external structure of the brain is required, but reference should be made to the distribution of white and grey matter. The ear should be treated as consisting of a cochlea sensitive to vibrations and semicircular canals sensitive to position; questions involving detailed structure of the membranous labyrinth will not be set.
(*k*) The co-ordination of the body functions by means of hormones, e.g. thyroxin, adrenalin and insulin.	Names of other hormones will not be expected.
(*l*) The reproductive organs and a general outline of the development, nutrition, respiration, and birth of the embryo.	Details of the cell divisions and the anatomy of the embryo are not required.
2. (*a*) *External features, habits, movements, and life history of a fish (including gills), a frog, a bird, and a small mammal.	Candidates will be expected to study living examples, and to make records from their own observations. They should consider how the animals are adapted to their environment and type of life. No more detail is expected than can be seen with the aid of a hand lens.
(*b*) *Development of frog from fertilisation to complete metamorphosis.	Candidates will not be expected to know any details of cleavage, but they will be expected to have examined the different stages with the aid of a hand lens.
3. Insects. The general characteristics of insects as illustrated by a study of the external features of a cockroach.	Knowledge of the individual joints of the mouth-parts or other appendages will not be expected.
*Outlines of the life history, mode of life, and the economic importance of: cockroach, butterfly (or moth), mosquito, house-fly, green-fly, clothes moth, honey-bee.	Candidates should make their own observations of the insects in their natural surroundings, and these should be supplemented by records made from living specimens in the laboratory.
4. *The microscopic appearance and movements of *Amoeba* (or *Paramecium*, excluding details of conjugation) and *Hydra*, including an elementary knowledge of their methods of nutrition and reproduction.	The appearance and movements of *Amoeba* should be demonstrated under the microscope, using a $\frac{2}{3}$ in. objective, or with a microprojector. High powers of resolution are not required.

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Syllabus	Notes
5. Flowering Plants.	
(*a*) Outlines of the external morphology of a herbaceous plant.	
(*b*) *Characteristic features of at least **three** of the following trees in summer and in winter: ash, beech, birch, elm, horse chestnut, larch, oak, plane (or sycamore), Scots pine, willow.	The study of a tree should include a very elementary treatment of secondary thickening, including formation and functions of bark, (paying attention only to features that can be seen with the aid of a hand lens), and the part played by the absciss layer during leaf-fall.
(*c*) Stem, root and leaf to be treated with reference to their functions and to experiments in plant physiology. (See section 6 below.)	
The internal structure of stem, leaf and root.	Candidates will be expected to have examined by microscope or microprojector transverse sections of the stem, leaf and root of a herbaceous dicotyledon, e.g. sunflower, but they will not be required to reproduce from memory drawings showing details of cell structures.
(*d*) The parts of a flower and their functions. The detailed mechanism of pollination in not more than three insect-pollinated flowers and one wind-pollinated flower. Fertilisation and the development of fruits.	Fertilisation should be treated without reference to microscopic detail other than the growth of the pollen tube and fusion of nuclei. This should be studied, where possible, in the same flower as a sequence of pollination.
(*e*) Fruit and seed dispersal.	Candidates should be familiar with two examples each of wind-dispersal and animal-dispersal (an internal and an external method), and one example of self-dispersal.
(*f*) The structure and germination of seeds.	Candidates will be expected to have seen one example of epigeal and one of hypogeal germination.
(*g*) Herbaceous perennials illustrating different types of storage organs and vegetative reproduction.	Examples of vegetative reproduction should be chosen, as far as possible, for their ecological or economic importance. Vegetative reproduction and reproduction by seed should be compared.

Syllabus	Notes
6. Plant Physiology.	
(*a*) The processes of diffusion and osmosis. The absorption of water and mineral salts. The importance of turgor. Water or sand cultures.	These processes should be shown with an artificial cell and with living material.
(*b*) The rise of water up the xylem vessels.	The path should be demonstrated by the use of dyes. Questions will not be set on causative forces.
(*c*) The process of transpiration.	Experimental work should include the loss in weight of a potted plant or of a leafy shoot in a test-tube, the use of cobalt chloride paper, and the effect of external conditions on the rate of water loss. When a potometer is used, its limitations should be stressed.
(*d*) Photosynthesis: the nature of the process itself, and the use of the manufactured food. The great importance of photosynthesis to life in general.	The candidates should be able to show by experiments the necessity for light, carbon dioxide and chlorophyll; the formation of starch and the output of oxygen.
(*e*) Respiration: the nature of the process and its significance in other vital activities. The carbon cycle and energy exchange. Food chains.	Experiments should be carried out on gaseous exchanges, and on heat production. Links should be made here with the animal kingdom, showing the interdependence of animals and plants. Food chains: at least one should be chosen from the local environment.
(*f*) Growth and its relations to external stimuli.	This should include the regions of growth in root and shoot, geotropic response of primary roots and shoots, phototropism of shoots and hydrotropism of roots.
(*g*) Conditions for seed germination, and further conditions for subsequent healthy growth of seedlings into mature plants.	

Syllabus	Notes
(*h*) Soils: their constituents, and their characteristics.	Candidates will be expected to have carried out simple experiments on the physical properties of soil. They should know how to determine the amount of air, water and humus (by ignition), and how to compare capillarity and porosity of different samples of soil.
(*i*) *The nitrogen cycle, including the living organisms, which play a part in it.	Names of individual bacteria are not required.
Manuring and the rotation of crops.	
7. *Microscopic Plants. Structure, nutrition, and life-history of *Spirogyra* and *Mucor* (or other mould fungus).	This should be simply treated.
8. *Ecology. The relation of plants and animals to their environment based on studies of	A question on this section will always be set in the paper Biology I, but there will be a sufficient number of questions in the paper to allow candidates who have not had opportunities of making observations in the countryside, a good choice without answering the question in ecology.
(*a*) aquatic habitats (seashore between the tide marks or ponds or streams or marshes);	
(*b*) terrestrial habitats (grassland or lawns or gardens or hedgerows or woods).	
9. Some of the questions will assume a knowledge of the subject-matter of the following paragraphs, but direct questions on the more general principles will be avoided:	
(*a*) A brief treatment of saprophytic and parasitic modes of nutrition. Disease bacteria and the chief methods of combating them.	
(*b*) Cell structure of plants and animals demonstrated by means of a microscope or a microprojector. Cell wall, nucleus, and cytoplasm for one simple cell. Elementary notion of cell differentiation in association with function illustrated by reference to some of the different types of cell present in different organs or tissues.	