IM SYLLABUS (2024)

BIOLOGY IM 05

SYLLABUS

Biology Syllabus	**IM 05**	(Available in September) 1 Paper (3 hours)

Introduction
The intermediate level syllabus in biology is intended either for candidates who have studied biology at a lower level but who wish to widen their knowledge of the subject, or for those candidates who have never studied biology, but who still feel that a good understanding of the subject may be useful.

Aims
- To provide an insight in science and its relevance to the human condition particularly to candidates having an arts and humanities orientation.
- To develop an understanding of biological facts, principles and concepts.
- To appreciate that biological principles are applicable to everyday life experiences.
- To enable candidates to appreciate the impact of human activities on the environment.
- To help candidates develop a respect for all life forms and a respect for the uniqueness of individual organisms.
- To promote an interest in, and enjoyment of, the study of life processes and living organisms.

Examination
One three hour paper will be set consisting of two sections. Section A will be compulsory and will consist of short-answer questions, while section B will offer a choice of structured questions. Both sections carry equal marks.

Syllabus
The following sections of the syllabus are not meant to be treated separately and independently of each other. On the contrary, the teaching of biology should aim at the appreciation of unified biological principles. Where possible and appropriate, local examples should be used. The notes in italic are meant for general guidance only.

TOPIC I CELLS AND THEIR FUNCTIONS

1.1 The basic nature of life

Cellular Respiration.
Aerobic and anaerobic respiration as a means of ATP production: glycolysis as a common pathway to both aerobic and anaerobic respiration and involving the oxidation of glucose to pyruvate with a net gain in ATP and reduced NAD; anaerobic respiration involving the production of ethanol or lactate as by-products and the regeneration of NAD; aerobic respiration as a highly efficient process involving ATP production; Krebs cycle invoving a series of oxidation steps that generate high energy reduced co-enzymes; oxidative phosphorylation leading to aerobic generation of ATP via a chain of electron carriers.

Respiratory pathways are not required but the principles should be understood.

ATP as the energy currency in the cell.
Simple outline of mitochondrial structure and function.
Metabolic rates: definition and factors which affect metabolic rate (e.g. temperature, hormones, gender).

Photosynthesis.
Structure of a mesophytic leaf and its adaptations for gas exchange and photosynthesis.
Simple outline of chloroplast structure and function.
Internal and external factors affecting photosynthetic rate.
Chlorophylls and accessory pigments.
Outline of light dependent and light independent reactions (*only definitions and functions required*).

Details of pathways are not required but processes should be considered only in such detail as to show that the light dependent stage provides ATP and reducing power to drive the light independent reaction.

1.2 Cell theory

Basic cell structure. Definition of organelle. The relative sizes of molecules, cell membrane thickness, viruses, bacteria, organelles and cells, using appropriate SI units.

Appreciation of relative size is required, such as molecules (1 nm), thickness of membranes (10 nm), viruses (100 nm), bacteria (1 μm), organelles (up to 10 μm), cells (up to 100 μm). The three dimensional nature/shape of cells should be emphasised.

Explanation of the importance of the surface area to volume ratio as a factor limiting cell size.

1.3 Prokaryotic cell structure

The structure of a generalised prokaryotic cell as exemplified by a bacterium.

Classification of prokaryotes and the Gram stain are not required.

One function for each of the following: ribosomes, slime capsule, cell wall, flagellum, cell surface membrane, plasmid and naked nucleic acid.

1.4 Eukaryotic cell structure

The ultrastructure of a generalised animal and plant cell as seen in electron micrographs.
The structure and function of each of these: ribosome, rough endoplasmic reticulum (RER), lysosome, Golgi apparatus, mitochondrion, nucleus and chloroplast.

Similarities and differences between prokaryotic and eukaryotic cells.
Composition and function of the plant cell wall.

The composition of the plant cell wall should be considered only in terms of cellulose microfibrils.

1.5 Membranes

Diagram showing the fluid mosaic model of a cell membrane including the phospholipid bilayer, cholesterol, glycoproteins and intrinsic and extrinsic proteins.
Characterisation of the outside of the cell membrane (outer face) and the links with the protruding proteins.

Variations in composition related to type of membrane, and the functions of cholesterol and glycoproteins are not required.

Explanation of how the hydrophobic and hydrophilic properties of phospholipids help to maintain the structure of cell membranes.
Definition of diffusion and osmosis as examples of passive transport.
Description of active transport across membranes including the roles of protein carriers, ATP and a concentration gradient.

TOPIC 2 THE CHEMISTRY OF LIFE

2.1 Atoms, ions and molecules

Awareness that the three commonest elements of life are carbon, hydrogen and oxygen and that a variety of other elements are needed by living organisms including nitrogen, sulphur, phosphorus, iron and potassium.

The proportions of the elements are not required.

Outline description of the difference between an atom and an ion.
Ions only in terms of being charged particles.