SCIENCE (52)

PAPER 3: BIOLOGY

Aims:

1. To acquire the knowledge of the economic importance of plants and animals.
2. To develop an understanding of the inter-relationship between sustainability and environmental adaptations.
3. To develop an understanding of the interdependence of plants and animals so as to enable pupils to acquire a clearer comprehension of the significance of life and its importance in human welfare.
4. To understand the capacities and limitations of all the biological and economic activities so as to be able to use them for a better quality of life.
5. To acquire the ability to observe, experiment, hypothesise, infer, handle equipment accurately and make correct recordings.

CLASS IX

There will be one paper of one and half-hours duration of 80 Marks and Internal Assessment of Practical Work Carrying 20 Marks.

*The paper will be divided into **two** sections, Section I (40 marks) and Section II (40 marks).*

***Section I (compulsory)** will contain short answer questions on the entire syllabus.*

***Section II** will contain **six** questions. Candidates will be required to answer any **four** of these **six** questions.*

1. Basic Biology

(i) The cell, a unit of life, protoplasm, basic difference between prokaryotic and eukaryotic cell; differences between an animal and a plant cell.

A basic understanding of the cell theory, structure of plant and animal cell with functions of various cell organelles. (Protoplam, Cytoplasm, Cell Wall, Cell Membrane, Nucleus, Nucleolous, Mitochondria, Endoplasmic Reticulum, Ribosome, Golgibodies, Plastids, Lysosomes, Centrosome and Vacuole). Difference between a plant cell and an animal cell should be mainly discussed with respect to cell wall, centrosome and vacuoles and plastids.

(ii) Tissues: Types of plant and animal tissues.

To be taught in brief with respect to location, basic structure and function, giving typical examples of their location so as to enable pupils to understand their role in different physiological processes in plants and animals.

2. Flowering Plants

(i) Vegetative Propagation: Artificial methods, advantages and disadvantages. Economic importance of artificial propagation, Hybridisation.and Micro Propagation. Brief idea of Biotechnology and its applications role in medicine and industry.

The concept in brief with suitable examples.

Artificial methods: cutting, grafting and layering with examples. Advantages and disadvantages of vegetative reproduction to be discussed.

Economic importance of artificial propagation.

Hybridization: Meaning and benefits.

Micro Propagation: meaning, uses and limitations.

Brief idea of biotechnology (example -human insulin from E.coli). Applications of biotechnology: in medicine - penicillin and tetracycline. In industry (example - cheese, vinegar, yogurt, alcoholic beverages; synthesis of vitamins namely vitamin C and enzymes - namely lipase).

(ii) Flower: Structure of a bisexual flower, functions of various parts.

A brief introduction to complete and incomplete flowers. Essential and non-essential whorls of a bisexual flower; their various parts and functions. Use of charts or actual specimens help enhance clarity of concepts.

Inflorescence and placentation (types are not required in both cases).

(iii) Pollination: self and cross-pollination.

Explanation, advantages and disadvantages of self and cross-pollination, agents of pollination and the characteristic features of flowers pollinated by various agents to be discussed.

(iv) Fertilisation.

Events taking place between pollination and fertilisation should be discussed up to fusion of male gamete with egg cell in the embryo sac. Students should be familiar with the terms double fertilization and triple fusion. Fruit and Seed (definition) and significance of Fruit and Seed.

3. Plant Physiology

(i) Structure of dicot and monocot seeds, Germination of seeds, types, and conditions for seed germination.

Structure and germination of Bean seed and Maize grain. Differences between hypogeal and epigeal germination. Conditions for seed germination should be dealt with by experiments.

(ii) Respiration in plants: outline of the process, gaseous exchange.

A brief outline of the process mentioning the term Glycolysis, Krebs cycle and their significance. Reference to be made to Aerobic and anaerobic respiration with chemical equations in each case. Experiments on gaseous exchange and on heat production.

4. Diversity in living organisms

(i) A brief outline of five Kingdom classification:

Main characteristics of each kingdom with suitable examples Monera, Protista, Fungi, Plantae (Thallophyta, Bryophyta, Pteridophyta and Spermatophyta) and Animalia (Non-chordates from Porifera to Echinodermata and Chordates - all five Classes)

(ii) Economic importance of Bacteria:

Economic importance of bacteria:

Useful role of bacteria - medicine (antibiotics, serums and vaccines); agriculture; (nitrogen fixing, nitrifying and denitrifying bacteria) and industry (curing of tea, tanning of leather)

Harmful role of bacteria in spoilage of food, disease in plants and animals, bio-weapons, denitrification.

(iii) Economic importance of Fungi:

Economic importance of Fungi:

Useful role of Fungi in breweries, bakeries, cheese processing, mushroom cultivation (Processes of manufacture not required in each case).

5. Human Anatomy and Physiology

(a) Nutrition:

(i): Classes of food: balanced diet. Malnutrition and deficiency diseases.

Functions of carbohydrates, fats, proteins, mineral salts (calcium, iodine, iron and sodium), vitamins and water in proper functioning of the body to be discussed. Sources of vitamins, their functions and deficiency diseases to be discussed. Students should be familiar with the term 'Balanced Diet'. Importance of cellulose in our diet should be discussed. Students should be taught about Kwashiorkor and Marasmus.

(ii) the structure of a tooth, different types of teeth.

Structure of a tooth to be discussed with the help of a diagram. Functions of different types of teeth must also be taught.

(iii) Digestive System: Organs and digestive glands and their functions (including enzymes and their functions in digestion; absorption,

utilisation of digested food); tests for reducing sugar, starch, protein and fats.

Organs and their functions; functions of saliva; brief idea of peristalsis; digestion in various parts of alimentary canal. Tests for sugar, starch, protein and fats.

(b) Movement and Locomotion:

(i) *Functions of human skeleton*

(ii) Axial and Appendicular Skeleton

(iii) Types of joints – immovable, slightly movable and freely movable (hinge joint, ball and socket joint, gliding joint, pivot joint.)

(c) Structure and functions of skin.

Various parts of the skin and their functions to be taught with the help of diagrams; heat regulation, vasodilation, vasoconstriction to be explained.

(d) Respiratory System: Organs; mechanism of breathing; tissue respiration, heat production.

Differences between anaerobic respiration in plants and in man. Brief idea of respiratory volumes, effect of altitude on breathing and asphyxiation should be taught. Role of diaphragm and intercostals muscles in breathing must be explained to provide a clear idea of breathing process. Brief idea of gaseous transport and tissue respiration to be given.

6. Health and Hygiene

Cause of diseases:

(i) Bacteria - *types of bacteria, bacterial control, three examples of diseases caused by bacteria e.g. Tuberculosis, Tetanus, Syphilis (Veneral disease).*

(ii) Virus - *nature of viruses, three examples of viral diseases e.g. Poliomyelitis, Mumps, Rabies, etc. Introduction to HIV, its outline structure and spread.*

(iii) Parasites - *two examples, roundworm, tapeworm and their control.*

(iv) Brief idea of endemic, epidemic, pandemic, and sporadic.

(v) Hygiene*: simple personal hygiene and social conditions affecting this. Disease carriers (vectors) flies, rats and cockroaches, contamination of water, waterborne diseases.*

General idea of personal hygiene, public hygiene and sanitation, control of housefly, mosquitoes, cockroaches and rats (life history not required). Water borne diseases like cholera, dysentery and Hepatitis.

INTERNAL ASSESSMENT OF PRACTICAL WORK

The practical work will be designed to test the ability of the candidates to make accurate observations from specimens of plants and animals. For this, candidates should be familiar with the use of a hand lens of not less than x 6 *magnification. They should be trained to make both simple and accurate drawings and brief notes as a means of recording their observations.*

The practical examiners will assume that candidates would have carried out the practical work outlined below.

NOTE: Candidates are expected to have a basic idea of plant morphology.

PLANT LIFE

(i) The examination of an onion peel under the microscope to study various parts of the cell.

Students should be given an idea of removal of onion peel, staining, mounting the specimen and handling the microscope. They should observe the structures and draw labelled diagrams.

(ii) A cross-pollinated flower to be examined and identified and the parts to be studied and labelled e.g. Hibiscus.

Specimens should be provided to the students from which they should be asked to draw diagrams showing the various parts.

The flower to be discussed in order of the four whorls with diagrams of the complete flower, reproductive parts and T.S of ovary to show the arrangement of ovules. Students should draw directly from the specimen provided so that they have a clear idea of the whorls and their location.

(iii) Specimens of germinating seeds with plumule and radicle (the bean seed and maize grain) for

examination, identification, drawing and labelling the parts.

Seeds soaked in water should be provided. The students themselves should see the external and internal structure so that they can identify the various parts and draw and label them.

ANIMAL LIFE

(i) The examination of a human cheek cell under the microscope to study various parts of the cell.

Students should be given an idea of staining, mounting the specimen and handling the microscope. They should observe the structures and draw labelled diagrams

(ii) Identification of sugar, starch, protein and fat.

Students should perform different tests for identification and write down their observations and inference in tabular form.

(iii) Examination and identification of specimens belonging to the following groups of animals: Porifera, Coelenterata, Annelida, Platyhelminthes, Nemathelminthes, Arthropoda. Mollusca and Echinodermata.

The specimens or models of the given groups of animals should be shown to the students and reasons for their identification in that particular group should be given. Diagrams should be drawn as observed in the specimens and not from the books. Only those structures that are observed should be drawn and labelled.

(iv) Study of different types of movable joints in human beings.

(v) Identification of the structure of the following organs through specimens/models and charts:, Lung.and skin.

(vi) Experiments to show the mechanism of breathing.

Bell jar experiment should be discussed. Comparison should be made with the human lungs and respiratory tract to show the mechanism of breathing.

CLASS X

*There will be one paper of **one** and **half-hours** duration of 80 marks and Internal Assessment of practical work carrying 20 marks.*

*The paper will be divided into **two** sections, Section I (40 marks) and Section II (40 marks).*

***Section I (compulsory)** will contain short answer questions on the entire syllabus.*

***Section II** will contain **six** questions. Candidates will be required to answer any **four** of these **six** questions.*

1. Basic Biology

(i) Cell Cycle and Cell Division:

Cell cycle – Interphase (G_1, S, G_2) and M.phase

Cell Division: Mitosis and its stages. A basic understanding of Meiosis as a reduction division (stages not required). Significance and major differences between mitotic and meiotic division.

(ii) Structure of chromosome:

Basic structure of chromosome with elementary understanding of terms such as chromatin, chromatid, gene structure of DNA and centromere.

(iii) Genetics: Mendel's laws of inheritance and sex linked inheritance of diseases.

Monohybrid cross, dihybrid cross. The following terms to be covered: gene, allele, heterozygous, homozygous, dominant, recessive, mutation, variation, phenotype, genotype. Sex determination in human beings.

Sex linked inheritance of diseases to include haemophilia and colour blindness (only criss cross inheritance).

2. Plant Physiology

(i) Absorption by roots, imbibition; diffusion and osmosis; osmotic pressure, root pressure; turgidity and flaccidity; plasmolysis and deplasmolysis,; the absorption of water and minerals, active and passive transport (in brief); the importance of root hair.

Characteristics of roots, which make them suitable for absorbing water, should be discussed with the process of absorption. Structure of a single full-grown root hair should be explained.

(ii) The rise of water up to the xylem; a general idea of Cohesive, Adhesive forces and transpirational pull); demonstrated by the use of dyes.

Experiments to show the conduction of water through the xylem should be discussed. Mention of the causative forces must be made for better understanding but as per the syllabus.

(iii) Transpiration, process and significance; experimental work includes the loss in weight of a potted plant or 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; Ganong's potometer and its limitations should be stressed.

Mechanism of stomatal transpiration must be explained so that concept of the process is clear. Adaptations in plants to reduce transpiration to be discussed. A brief idea of guttation and bleeding should be given.

(iv) Photosynthesis: the nature of the process itself and the great importance of photosynthesis to life in general; experiments to show the necessity of light, carbon dioxide & chlorophyll and also the formation of starch and the output of oxygen; carbon cycle.

The internal structure of chloroplast should be explained to give an idea of the site of light and dark reaction. Opening and closing of stomata should be explained. Teachers should stress upon the importance of a correct balanced chemical equation. The terms "photochemical" for light phase and "biosynthetic" for dark phase must be introduced. In the light reaction, activation of chlorophyll molecule followed by photolysis, release of O_2, formation of ATP and NADPH should be taught. In the dark reaction (detailed equations are not required), only combination of hydrogen released by NADP with CO_2 to form glucose to be discussed.

Adaptations in a plant for photosynthesis and experiments with regard to the factors essential for the process should be discussed.

3. Human Anatomy and Physiology

(i) Circulatory System: Main features; the structure and working of the heart, blood vessels, structure and functions of blood and circulation of blood (only names of the main blood vessels entering and leaving the heart, liver and kidney will be required).

Composition of blood (Structure and functions of RBC, WBC and platelets). Brief idea of tissue fluid and lymph. Increase in efficiency of mammalian red blood cells due to absence of certain organelles should be explained with reasons. A brief idea of blood coagulation. Structure of vein, artery and capillary should be explained with the help of diagrams to bring out clearly the relationship between their structure and function. ABO blood group system, Rh factor; concept of double circulation; concept systole and diastole; blood pressure. Reference to portal system should be made. Working of the heart along with names of the main blood vessels entering and leaving the heart, the liver and the kidney must be taught. Examination of a blood smear under a microscope.

(ii) Excretory System: Elementary treatment of the structure and function of the kidneys; the kidneys 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 not required).

External and internal structure of the kidney; parts of the excretory system along with the blood vessels entering and leaving it should be taught with the help of charts or models. Students should be able to draw the diagrams with correct labelling and know the functions of various parts. A general idea of the structure of a kidney tubule nephron should be given. A brief idea of ultra filtration, selective reabsorption and tubular secretion in relation to the composition of blood plasma and urine formed.

(iii) Nervous system: Structure of Neuron; central, autonomous and peripheral nervous system (in brief); brain and spinal cord; reflex action and how it differs from voluntary reflex.

Sense organs – Eye and ear; Eye defects and corrective measures (myopia, hypermetropia, presbiopia, astigmatism and cataract).

Various parts of the external structure of the brain and its parts (Medulla Oblongata, Cerebrum, Cerebellum, Thalamus, Hypothalamus) and their functions; reference should be made to the distribution of white and gray matter internally. Diagrammatic explanation of the reflex arc, showing the pathway from receptor to effector, differences between natural and acquired reflex should be taught. Structure and function of the Eye and Ear and their various parts. The external and V.S. of the eye must be taught with a brief idea of stereoscopic vision. The course of perception of sound in human ear. Role of ear in maintaining balance.

(iv) Endocrine System: General study of the following glands: Adrenal, Pancreas, Thyroid and Pituitary. Difference in Endocrine and Exocrine glands.

Correct location and shape of the gland in the human body should be discussed along with the hormones they secrete (Pancreas: insulin and glucagon to be taught; Thyroid: only thyroxin to be taught). Effects of hypo secretion and hyper secretion of hormones must be discussed. The term tropic hormones should be explained in the study of pituitary. Brief idea of feedback mechanism must be given.

(v) The Reproductive System: Organs, fertilisation and a general outline of nutrition and respiration of the embryo. (Menstrual cycle: outline of menstrual cycle.

Functions of organs and accessory glands must be discussed. An idea of secondary sexual characters, structure and functions of the various parts of the sperm and an egg. Fertilization, implantation, placenta, foetal

membranes, gestation and parturition identical and fraternal twins to be explained briefly.

(vi) Population: Problems posed by the increase in population in India; population control.

Main reasons for the sharp rise in human population in India and in the world . The terms demography, population density, birth rate, death rate and growth rate of population should be explained. Methods of population control to be taught.

4. Physical Health and Hygiene

(i) Aids to health: an understanding of the use and action of the following - vaccination; immunisation; antitoxin; serum; antiseptics; disinfectants; penicillin; sulphonamide drugs; First Aid.

An idea of local defense system and their merits, active and passive immunity, difference between antiseptics and disinfectants to be discussed. Basic principles of first aid to be taught.

(ii) Health organisations: Red Cross, WHO; common health problems in India.

Major activities of Red Cross and WHO should be discussed. Common health problems in India.

INTERNAL ASSESSMENT OF PRACTICAL WORK

The practical work will be designed to test the ability of the candidates to make accurate observation from specimens of plants and animals. For this, the candidates should be familiar with the use of a hand lens of not less than x6 *magnification. Candidates should be trained to make simple and accurate drawings and brief notes as a means of recording their observations.*

The practical examiners will assume that candidates would have carried out the practical work outlined below.

PLANT LIFE

(i) Observation of permanent slides of mitosis.

Self-explanatory.

(ii) Experiments indicating osmosis, diffusion and absorption.

The teacher should give a demonstration and then the students should perform the experiments in order to have a better understanding of the processes.

(iii) Physiological experiments on transpiration to be set up by the teacher and the pupils to identify the products, draw and label the apparatus.

The teacher should set up the experiment stepwise so that the student gets a clear idea of the aim, apparatus, procedure and result of the experiment. For transpiration experiments the $CoCl_2$ paper should be kept in a dessicator and its importance should be explained. Limitations for the use of Ganong's potometer should be given.

(iv) Experiments to show the necessity of light, carbon dioxide and chlorophyll essential for photosynthesis; release of O_2 during photosynthesis. Candidates to write down their observations and draw and label the apparat*us.*

Importance of destarching the plant before the experiment should be discussed. Diagrams should be drawn with the correct labelling. Pupils should be able to analyse the result.

ANIMAL LIFE

(i) Identification of the structure of the urinary system, heart (internal structure) and brain (external view) through models and charts

(ii) The identification of different types of blood cells under a microscope.

Different types of WBCs should be observed. Teacher should point out the differences between red blood cells and white blood cells. Ratio of red blood cells to white blood cells should be discussed.

(iii) The structure of the Ear and an Eye (candidates will be required to identify each structure in the models of these organs).

Models should be shown and students should draw correct labelled diagrams.

(iv) Identification and location of selected endocrine glands (Adrenal, Pancreas, Thyroid and Pituitary glands) with the help of a model or chart.

Correct labelled diagram to be drawn.

(v) Compiling material for a First Aid box.

Self-explanatory.

EVALUATION

The practical work/project work are to be evaluated by the subject teacher and by an External Examiner. (The External Examiner may be a teacher nominated by the Head of the school, who could be from the faculty, **but not teaching the subject in the relevant section/class**. For example, a teacher of Biology of Class VIII may be deputed to be an External Examiner for Class X, Biology projects.)

The Internal Examiner and the External Examiner will assess the practical work/project work independently.

Award of marks (20 Marks)

Subject Teacher (Internal Examiner)	10 marks
External Examiner	10 marks

The total marks obtained out of 20 are to be sent to the Council by the Head of the school.

The Head of the school will be responsible for the entry of marks on the mark sheets provided by the Council.

INTERNAL ASSESSMENT IN SCIENCE - GUIDELINES FOR MARKING WITH GRADES

Criteria	Preparation	Procedure/ Testing	Observation	Inference/ Results	Presentation
Grade I (4 marks)	Follows instructions (written, oral, diagrammatic) with understanding; modifies if needed. Familiarity with and safe use of apparatus, materials, techniques.	Analyses problem systematically. Recognises a number of variables and attempts to control them to build a logical plan of investigation.	Records data/observations without being given a format. Comments upon, recognises use of instruments, degree of accuracy. Recording is systematic.	Processes data without format. Recognises and comments upon sources of error. Can deal with unexpected results, suggesting modifications.	Presentation is accurate and good. Appropriate techniques are well used.
Grade II (3 marks)	Follows instructions to perform experiment with step-by-step operations. Awareness of safety. Familiarity with apparatus, materials and techniques.	Specifies sequence of operation; gives reasons for any change in procedure. Can deal with two variables, controlling one.	Makes relevant observations. No assistance is needed for recording format that is appropriate.	Processes data appropriately as per a given format. Draws qualitative conclusions consistent with required results.	Presentation is adequate. Appropriate techniques are used.
Grade III (2 marks)	Follows instructions to perform a single operation at a time. Safety awareness. Familiarity with apparatus & materials.	Develops simple experimental strategy. Trial and error modifications made to proceed with the experiment.	Detailed instructions needed to record observations. Format required to record results.	Processes data approximately with a detailed format provided. Draws observations qualitative conclusions as required.	Presentation is reasonable, but disorganised in some places. Overwriting ; rough work is untidy.
Grade IV (1 mark)	Follows some instructions to perform a single practical operation . Casual about safety. Manages to use apparatus & materials.	Struggles through the experiment. Follows very obvious experimental strategy.	Format required to record observations/ readings, but tends to make mistakes in recording.	Even when detailed format is provided, struggles or makes errors while processing data. Reaches conclusions with help.	Presentation is poor and disorganised but follows an acceptable sequence. Rough work missing or untidy.
Grade V (0 marks)	Not able to follow instructions or proceed with practical work without full assistance. Unaware of safety.	Cannot proceed with the experiment without help from time to time.	Even when format is given, recording is faulty or irrelevant.	Cannot process results, nor draw conclusions, even with considerable help.	Presentation unacceptable; disorganised, untidy/ poor. Rough work missing.