

**SCIENCE (52)**  
**BIOLOGY**  
**SCIENCE Paper - 3**

**CLASS X**

There will be one paper of **two 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<sub>1</sub>, S, G<sub>2</sub>) and Mitotic phase.*

*Cell Division:*

- *Mitosis and its stages.*
- *A basic understanding of Meiosis as a reduction division (stages not required).*
- *A brief idea of homologous chromosomes and crossing over leading to variations.*
- *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.

- *The three laws of Mendel.*
- *Monohybrid cross – phenotype and genotype. Mendel's experiments on inheritance taking 7 pairs of contrasting features of garden pea.*
- *The following terms to be covered: gene, allele, heterozygous, homozygous, dominant, recessive, mutation, variation, phenotype, genotype, homologous chromosomes, autosomes, sex chromosomes.*

- *Inheritance in Humans – A few characters and their traits. Tongue rolling as an example of 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 rise of water up to the xylem; Forces responsible for ascent of sap.

- *Understanding of the processes related to absorption of water by the roots.*
- *Characteristics of roots, which make them suitable for absorbing water.*
- *Structure of a single full-grown root hair.*
- *A general idea of Cohesive, Adhesive forces and transpirational pull.*
- *Experiments to show the conduction of water through the xylem.*

- (ii) Transpiration - process and significance. Ganong's potometer and its limitations. The factors affecting rate of transpiration. Experiments on transpiration. A brief idea of guttation and bleeding.

- *Concept of transpiration and its importance to plants*
- *Experiments related to transpiration:*
  - (a) *Loss in weight of a potted plant or a leafy shoot in a test tube as a result of transpiration.*
  - (b) *Use of cobalt chloride paper to demonstrate unequal rate of transpiration in a dorsiventral leaf.*
- *Adaptations in plants to reduce transpiration.*
- *A brief idea of guttation and bleeding.*

(iii) Photosynthesis: the process and its importance to life in general; experiments to show the necessity of light, carbon dioxide, chlorophyll, formation of starch and release of oxygen.

- *The process and significance of Photosynthesis.*
- *The internal structure of chloroplast to be explained to give an idea of the site of light and dark reactions.*
- *Overall balanced chemical equation to represent photosynthesis.*
- *Introduction of the terms "photochemical" for light phase and "biosynthetic" for dark phases.*
- *Light reaction - activation of chlorophyll followed by photolysis of water, release of O<sub>2</sub>, formation of ATP (photophosphorylation) and NADPH.*
- *Dark reaction - only combination of hydrogen released by NADP with CO<sub>2</sub> to form glucose. (detailed equations are not required).*
- *Adaptations in plants for photosynthesis.*
- *Experiments with regard to the factors essential for photosynthesis; emphasis on destarching and the steps involved in starch test.*

### 3. Human Anatomy and Physiology

(i) Circulatory System: Blood and lymph, the structure and working of the heart, blood vessels, circulation of blood (only names of the main blood vessels entering and leaving the heart, liver and kidney will be required). Lymphatic system.

- *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; reasons for the same.*
- *A brief idea of blood coagulation.*
- *Structure and working of the heart along with names of the main blood vessels entering and leaving the heart, the liver and the kidney.*

- *Concept of systole and diastole; concept of double circulation.*
- *Brief idea of pulse and blood pressure.*
- *Blood vessels: artery, vein and capillary to be explained with the help of diagrams to bring out the relationship between their structure and function.*
- *Brief idea of the lymphatic organs: spleen and tonsils.*
- *ABO blood group system, Rh factor.*
- *Significance of the hepatic portal system.*

(ii) Excretory System: A brief introduction to the excretory organs; parts of the urinary system; structure and function of the kidneys; blood vessels associated with kidneys; structure and function of nephron

- *A brief idea of different excretory organs in the human body.*
- *External and internal structure of the kidney;*
- *Parts of the urinary system along with the blood vessels entering and leaving the kidney; functions of various parts of the urinary system (emphasis on diagram with correct labelling). A general idea of the structure of a kidney tubule/ nephron.*
- *A brief idea of ultra-filtration (emphasis on the diagram of malpighian capsule); 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 action.

Sense organs – Eye: Structure, functions, defects and corrective measures: Ear: Parts and functions of the ear.

- *Parts of a neuron.*
- *Various parts of the external structure of the brain and its primary parts: Medulla Oblongata, Cerebrum, Cerebellum, Thalamus, Hypothalamus and Pons; their functions.*
- *Reference to the distribution of white and gray matter in Brain and Spinal cord.*

- *Voluntary and involuntary actions – meaning with examples.*
  - *Diagrammatic explanation of the reflex arc, showing the pathway from receptor to effector.*
  - *A brief idea of the peripheral and autonomic nervous system in regulating body activities.*
  - *Differences between natural and acquired reflex.*
  - *External and Internal structure and functions of the Eye and Ear and their various parts.*
  - *A brief idea of stereoscopic vision, adaptation and accommodation of eye.*
  - *Defects of the eye (myopia, hyperopia, hypermetropia, presbyopia, astigmatism and cataract) and corrective measures (diagrams included for myopia and hyperopia only)*
  - *The course of perception of sound in human ear.*
  - *Role of ear in maintaining balance of the body.*
- (iv) Endocrine System: General study of the following glands: Adrenal, Pancreas, Thyroid and Pituitary. Endocrine and Exocrine glands.
- *Differences between Endocrine and Exocrine glands.*
  - *Exact location and shape of the endocrine glands in the human body.*
  - *Hormones secreted by the following glands: Pancreas: insulin and glucagon; Thyroid: only thyroxin; Adrenal gland: Cortical hormones and adrenaline; Pituitary: growth hormone, tropic hormones, ADH and oxytocin, TSH, ACTH, Gonado Tropic Hormones.*
  - *Effects of hypo secretion and hyper secretion of hormones.*

## INTERNAL ASSESSMENT OF PRACTICAL WORK

The practical work is designed to test the ability of the candidates to make an accurate observation from specimens of plants and animals.

### PLANT LIFE

- (i) Observation of permanent slides of stages of mitosis.
- (ii) Experiments demonstrating:
  - Diffusion: using potassium permanganate in water.
  - Osmosis: Thistle Funnel experiment and potato osmoscope.
  - Absorption: using a small herbaceous plant.
- (iii) Experiments on Transpiration:
  - demonstration of the process using a Bell Jar.
  - demonstration of unequal transpiration in a dorsiventral leaf using cobalt chloride paper.
  - demonstration of uptake of water and the rate of transpiration using Ganong's potometer.
- (iv) Experiments on Photosynthesis:
  - to show the necessity of light, carbon dioxide and chlorophyll-for photosynthesis.
  - to show the release of O<sub>2</sub> during photosynthesis using hydrilla / elodea.

### ANIMAL LIFE

- (i) Identification of the structures of the urinary system, heart and kidney (internal structure) and brain (external view) through models and charts
- (ii) The identification of different types of blood cells under a microscope.
- (iii) Identification of the internal structure of the Ear and Eye (Through models and charts).
- (iv) Identification and location of selected endocrine glands: Adrenal, Pancreas, Thyroid and Pituitary glands with the help of a model or chart.

## 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 online entry of marks on the Council's CAREERS portal by the due date.

### 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.