

S. Chand's

ICSE BIOLOGY

BOOK I

FOR CLASS IX



SARITA AGGARWAL



Strictly according to the Latest Syllabus for ISCE(Class IX) prescribed by the Council for Indian School Certificate Examinations

ICSE BIOLOGY

BOOK I

FOR CLASS IX

ACCORDING TO THE NEW SYLLABUS FOR CLASS IX

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PREFACE TO THE REVISED EDITION

This latest edition of ICSE Biology has been revised and upgraded to a bigger size with an attractive two colour set up. It has been thoroughly updated in accordance with the latest syllabus prescribed by the Council for the Indian School Certificate Examination (CISCE), New Dehi, for the students of class IX. The salient features of this book are :

- The body is written in simple lucid language and easy-to-understand style.
- Subject matter (encompassed in the well etched twenty chapters) is written in such a way that makes the scientific concepts clear and understandable.
- All the chapters contain new topics as per the latest syllabus.
- Information has largely been in tabular and point - wise form to provide quick learning and easy grasp of the topic.
- Well labelled illustration, diagrams, tables, figures and experiments have been given to support the text wherever necessary.
- At the end of each chapter, **Key Terms** have been given for quick summary of the chapter.
- A variety of **Review Questions**, according to the latest examination pattern, has been provided for adequate practice.

Sincere thanks, are expressed to Management and Editorial Team of S Chand & Company Pvt. Ltd. for helping in bringing out this two colour edition.

Hope this book will meet the aspirations of the students for whom it has largely been written. Suggestions for further improvement, along with constructive criticism, from teachers and students will be gratefully acknowledged. You can send them at the publishers.

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Author

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PREFACE TO THE PREVIOUS EDITION

One of the most important feature of the book is that it has been written by a teacher who has taught secondary and senior secondary classes for more than twenty five years, and is fully aware of the needs of the students. Accordingly, the book is student-centered and examination-oriented.

While writing this book, the author has attempted to visualise herself as a student. The book primarily aims at giving clarity of concepts. The content in the book is provided in a comprehensive and relevant manner. An effort has been made to cover the syllabus in a way that it caters to the individual differences of the students, the gifted, the good and the average.

Following are some of the special features of the book.

- Treatment of the subject matter is psychological as well as logical.
- Language used is very simple and within the easy comprehension of the students.
- Every possible effort has been made to clarify, elucidate and simplify concepts with the help of diagrams, illustrations and tables.
- All types of questions, i.e., objective, diagrammatic, reasoning, short answer and long answer are given in suitable proportion.

The book provides a complete and detailed coverage of all the topics of the biology syllabus framed by ICSE. It is sincerely hoped that the book will prove very helpful to students and teachers alike. The author would appreciate healthy criticism and suggestions.

AUTHOR

ACKNOWLEDGMENTS

The author wishes to express sincere thanks to her husband and daughters Shruti and Samridhi for their constant support and encouragement shown throughout the preparation of this book. She also wishes to extend gratitude to her parents without whose inspiration, this book would not have been possible.

AUTHOR

NEW SYLLABUS

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. (Protoplasm, 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 under stand 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 form E.coli). Application of biotechnology: 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, function of various parts.

A brief introduction to complete and incomplete flowers. Essential and non- essential whorls of a bisexual flower: their various parts and function. 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 example 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.
Function 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: Organ and digestive glands and their function (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) *Function 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 example of diseases caused by bacteria e.g. Tuberculosis, Tetanus, Syphilis (Venereal 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 to animals: Porifera, Coelenterata, Annelida, Platyhelminthes, Nematelminthes, 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 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.

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Introducing Biology

LEARNING OBJECTIVES

VARIOUS BRANCHES OF BIOLOGY LIVING AND NON-LIVING THINGS

1. Light Microscope
 - What is the difference between living, non-living, dead things ?
2. Electron Microscope

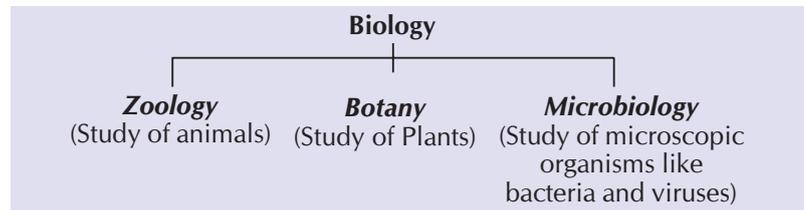
LIGHT AND ELECTRON MICROSCOPE

The science that deals with the study of living things is called **biology**. The term biology is derived from two Greek words (*bios* meaning life and *logos* meaning study of).

Biology helps us to understand the structure and functioning of organisms.

VARIOUS BRANCHES OF BIOLOGY

Traditionally, the subject biology has been divided with two major branches—**zoology** (study of animals) and **botany** (study of plants). With the invention of microscope in the sixteenth century, it became possible to study very small microscopic organisms and this created another subdivision **microbiology** (study of microorganisms). It includes two very important subjects **bacteriology** (study of bacteria) and **virology** (study of viruses).



The above branches are further divided into a number of finer branches on the basis of the specific part of the organism studied.

1. **Morphology** : Study of external form and structure of organisms.
2. **Anatomy** : Study of internal structure of the organism or its parts.
3. **Histology** : Study of the microscopic structure of tissues
4. **Cytology** : Study of the cells i.e., structure and function of its various components.
5. **Physiology** : It deals with the functions of various organ systems or parts of the organism like nutrition, photosynthesis, respiration, excretion etc.
6. **Embryology** : It is the study of all the events from fertilisation of egg to the development of embryo.
7. **Taxonomy** : It deals with the identification, naming and classification of organisms.

8. **Paleobiology** : It includes the study of fossils i.e., remains of plants and animals that lived millions of years ago.
9. **Ecology** : It is the study of organisms in relation to the environment around them, that includes their living and non-living surroundings.
10. **Genetics** : It is the study of inheritance of characters. It includes heredity and variations.
11. **Evolution** : It deals with the study of all phenomenon by which simple forms of life changed into more complex forms leading finally to the appearance of highest evolved types like man and flowering plants.

Depending on the group of organisms studied, specific terms are used in biology

- Bacteriology** : Study of bacteria
Virology : Study of viruses
Mycology : Study of fungi
Entomology : Study of insects
Ornithology : Study of birds

With the discovery of new scientific methods, it has become easier to observe very small dimensions of the cells also. Table 1 given below gives us an idea how different branches of biology are related to the structures we study.

Table 1 Different branches of biology on the basis of the structure studied

Branch of biology	Definition	Examples of the structure studied	Eyes or instrument used for observation
Morphology	Study of external form and structure of organisms	Shape and texture of leaves, stems etc.	Eyes
Anatomy (also called internal morphology)	Study of internal organs	Internal structure of leaf, stem, stomach and liver etc.	Eyes, simple lenses and light microscope
Histology	Study of tissues	Parenchyma, Epithelial tissue	Light microscope
Cell biology	Study of structural and functional aspects of cells and their components	Structure and functions of mitochondria, ribosomes and nucleus etc.	Light microscope, X-ray microscope and other high resolution microscopes
Molecular biology	Study of structure, nature and arrangement of molecules in a cell	Structure of DNA, RNA, enzymes and proteins etc.	Electron microscope, X-ray microscope and other high resolution microscopes.

There are many other branches of biology which deal with the various life processes and how an organism multiplies or forms identical copies of itself, its evolution over millions of years and its relationship with the environment. Some of these are given in Table 2.

Table 2 Some important branches of biology

Branch of biology	Definition	Examples
Physiology	Study of various life processes of an organism.	Photosynthesis, respiration, digestion etc.
Embryology	Study of events from formation of gametes to fertilisation to the development of embryo.	Structure of ovum and sperm, Development of embryo etc.
Ecology	Study of inter-relationships between living organisms and the environment.	Food chains, Energy pyramids, Recycling of nutrients etc.
Evolution	Study of development of complex organisms from pre-existing simpler organisms over millions of years on earth. Study of origin of new species and their adaptations.	Origin of life, similarities and differences between man and ape and tracing of their common ancestors etc.
Genetics	Study of heredity and variations.	Genes, Inheritance of characters from parents to offsprings etc.
Exobiology	Study of life outside earth on other planets.	Life on Moon or Mars etc.

LIVING AND NON-LIVING THINGS

We all know that plants, animals, bacteria and fungi are living and rocks, bricks and stones are non-living. Viruses can neither be put in living or non-living things. Now the question is how do we instantly recognise a living thing from a non-living? All living things perform certain basic functions or life processes given below which are not present in non-living things.

Some of the life processes common to all living things are:

1. All living things have a basic unit of life, the **cell**. In unicellular organisms, a single cell carries out all vital functions of life, whereas in multicellular organisms, a number of cells unite together, get specialised and perform various functions.
2. **Metabolism:** Living things carry out and control numerous chemical processes. They need a constant supply of energy for all the activities they do. Various life processes that occur within a living organism are termed **metabolism**. The metabolic activities could be **anabolic** (building up of materials) or **catabolic** (breaking up of materials).

Metabolism	=	Catabolism	+	Anabolism
		(breaking down)		(building up)
Growth	=	Anabolism is more than catabolism		
Degeneration	=	Catabolism is more than anabolism		

Non-living things do not show any metabolism.

3. **Growth and repair:** It is defined as an **irreversible** increase in weight, size or volume of an organism. The living organisms can produce new parts and replace old ones. Non-living things like a broken vase or a torn cloth cannot repair themselves on their own.
4. **Response to stimulation:** All living things give response to a change in their surroundings. The animals respond to changes in light intensity, **sound, touch, heat** etc. Similarly plants also **respond to sunlight**, gravity, climate, length of day etc.
5. **Reproduction:** Living things have **the ability to produce their own kind**. The resemblance of the offsprings to their parents is an important characteristic of life. Non-living things cannot reproduce, for example a glass bottle would remain as it is and cannot multiply into two.
6. **Adaptability:** The living things undergo morphological and physiological modifications to adapt themselves to the environment. A fish is adapted to live in water, a cactus in a desert, a monkey on a tree and likewise.
7. **Evolution:** All living things show the ability to change and evolve slowly over millions of years. Present day man or other living things were not the same in the past. They have organisms that existed on earth. To be able to cope up with the surroundings, they have undergone remarkable changes.

What is the difference between Living, Non-living and Dead things?

Living things

All living things have certain common **life processes** like they metabolise food, respire, grow, reproduce, respond to environment and may show movement.

Living things include all kinds of plants, animals whether small, big or microscopic. They all have a **life span** that is they live for sometime and then die or perish. During their life they may give rise to offsprings (new organisms of their own kind).

Examples : Insects, earthworm, bird, human beings, mango plant, bacteria, etc.

Non living things

A non living object is the one that cannot grow from within, cannot reproduce and has no life cycle.

Such an object had **never been living**.

Examples : Rocks, stones, glass, car etc.

Dead things

It includes the things that **had been living at some point of time**. They were made up of living cells and formed part of a living organism earlier but now they are no longer living and are dead.

Examples : Leather (it is a part of animal skin) and dry wood (a part of plants) etc.

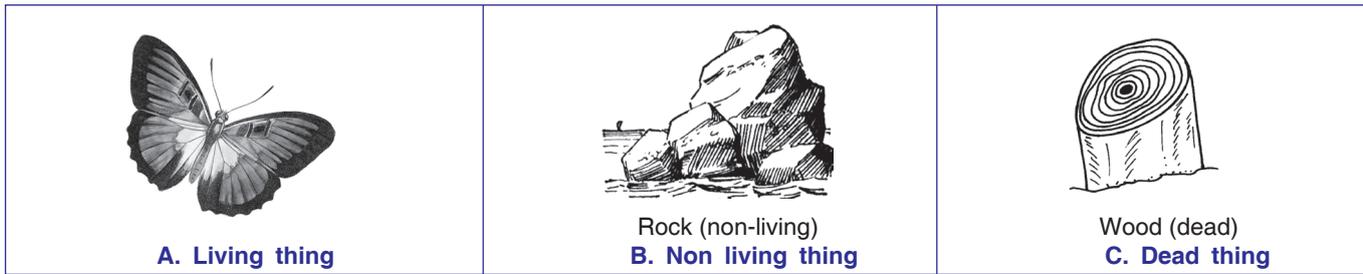
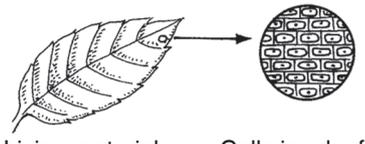
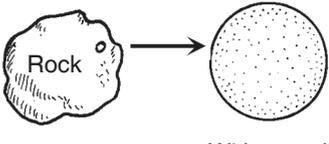
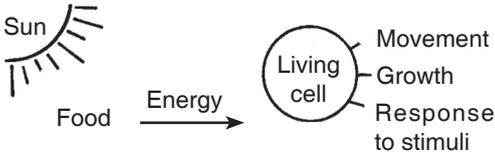
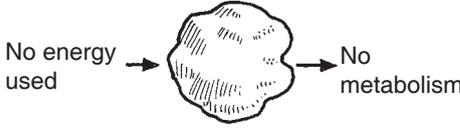
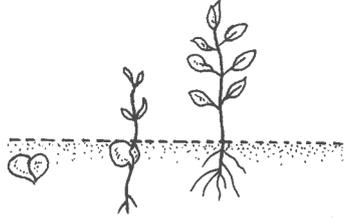
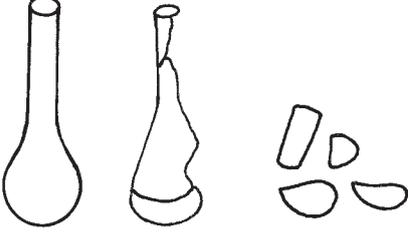
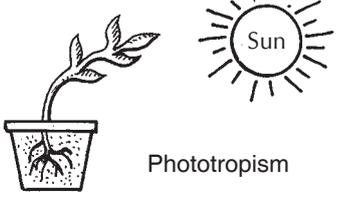
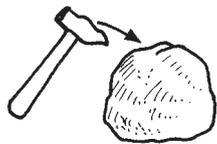
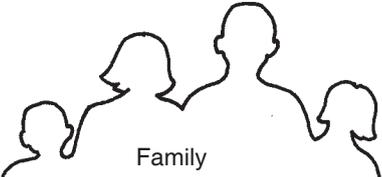
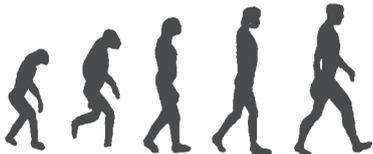


Table 3 Differences between Living and Non-living things

Characteristic features	Living things	Non-living things
1. Cellular structure	 Living material Cells in a leaf	 Rock Without cells
2. Metabolism	 Sun Food Energy Living cell Movement Growth Response to stimuli	 No energy used No metabolism
3. Growth	 A seed growing into a seedling and then a plant	 Broken vase-can not grow or repair itself
4. Response	 Phototropism	 No response
5. Reproduction	 Family	Cannot reproduce
6. Evolution		 Same after million of years later



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