



REPUBLIC OF ZAMBIA

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL, TRAINING AND EARLY EDUCATION

BIOLOGY SYLLABUS

GRADE: 10 - 12



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Lusaka

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VISION

Quality, life-long education for all which is accessible, inclusive and relevant to individual, national and global needs and value systems.

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PREFACE

The syllabus was produced as a result of the Curriculum review process carried out by the Ministry of Education, Science, Vocational Training and Early Education under the auspices of the Curriculum Development Centre (CDC). The curriculum reform process started way back in 1999 when the Ministry of Education commissioned five (5) curriculum studies which were conducted by the University of Zambia. These studies were followed by a review of the lower and middle basic and primary teacher education curriculum. In 2005 the upper basic education National survey was conducted and information from learners, parents, teachers, school managers, educational administrators, tertiary institutions traditional leader's civic leaders and various stakeholders in education was collected to help design a relevant curriculum.

The recommendations provided by various stakeholders during the Upper Basic Education National survey of 2005 and National symposium on curriculum held in June 2009 guided the review process.

The review was necessitated by the need to provide an education system that would not only incorporate latest social, economic, technological and political developments but also equip learners with vital knowledge, skills and values that are necessary to contribute to the attainment of Vision 2030.

The syllabus has been reviewed in line with the Outcome Based Education principles which seek to link education to real life experiences that give learners skills to access, criticize analyse and practically apply knowledge that help them gain life skills. Its competences and general outcomes are the expected outcomes to be attained by the learners through the acquisition of knowledge, skills, techniques and values which are very important for the total development of the individual and the nation as a whole.

Effective implementation of Outcome Based Education requires that the following principles be observed: clarity of focus, Reflective designing, setting high expectations for all learners and appropriate opportunities.

It is my sincere hope that this Outcome Based syllabus will greatly improve the quality of education provided at Grade 8 and 9 as defined and recommended in various policy documents including Educating Our Future`1996 and the `Zambia Education Curriculum Framework `2013.

Chishimba Nkocha
Permanent Secretary

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL, TRAINING AND EARLY EDUCATION.

Acknowledgements

The syllabus presented here is a result of broad-based consultation involving several stakeholders within and outside the education system.

Many individuals, institutions and organizations were consulted to gather their views on the existing syllabus and to accord them an opportunity to make suggestions for the new syllabus. The Ministry of Education wishes to express heartfelt gratitude to all those who participated for their valuable contributions, which resulted in the development of this syllabus.

The Curriculum Development Centre worked closely with other sister departments and institutions to create this document. We sincerely thank the Directorate of Teacher Education and Specialized Services, the Directorate of Planning and Information, the Directorate of Human Resource and Administration, the Directorate of Open and Distance Education, the Examinations Council of Zambia, the University of Zambia, National Food and Nutrition Commission (NFNC), schools and other institutions too numerous to mention, for their steadfast support.

We pay special tribute to co-operating partners especially JICA in collaboration with Hiroshima University and UNICEF for rendering financial and technical support in the production of the syllabus.

C.N.M Sakala (Mrs.)

Director-Standard and Curriculum

MINISTRY OF EDUCATION, SCIENCE, VOCATIONAL TRAINING AND EARLY EDUCATION

Introduction

This syllabus is designed to have greater emphasis on the understanding and application of scientific concepts and principles. This approach has been adopted in recognition of the need for learners to develop skills that will be of long term value in a changing technological world rather than focusing on large quantities of factual materials which may have only short term relevance.

This syllabus is intended to:

1. Provide, through well designed studies of experimental and practical biological science, a worthwhile education experience for all learners, whether or not they go on to study Biology beyond this level and, in particular, to enable them to acquire sufficient understanding and knowledge to:
 - become confident citizens in a changing technology world, able to take or develop an informed interest in matters of scientific importance,
 - recognise the usefulness and limitations of the scientific method and to appreciate its applicability in order disciplines and in everyday life,
 - be suitably prepared for studies beyond Ordinary Level in pure sciences, in applied sciences or in science – dependent vocational courses.
2. stimulate learners to sustain their interest and the appreciation of the Biological Sciences.
3. develop abilities and skills that:
 - are relevant to the study and practice of Biological Sciences,
 - are useful in everyday life,
 - encourage efficient and safe practice,
 - encourage effective communication.
4. develop attitudes relevant to Biological Sciences such as:
 - concern for accuracy and precision,
 - objectivity,
 - integrity,
 - safety.
5. assist the development of:
 - the skills of enquiry,
 - the attitude of:
 - initiative,

- inventiveness.
- 6. stimulate interest in and care for the local and global environment.
- 7. promote an awareness that:
 - the study and practice of Biological Science is subject to social, economic, technological, ethical and cultural influences and limitations,
 - the applications of Biological Sciences may be both beneficial and detrimental to the individual, the community and the environment, and
 - Biological Sciences transcend national boundaries and that the language of Science, correctly and rigorously applied is universal.

Therefore learners are expected to acquire competences in:

1. Knowledge with understanding

Learners will demonstrate knowledge and understanding in relation to:

- biological phenomena, facts, laws, definitions, concepts and theories,
- biological vocabulary, terminology, conventions (symbols, quantities and units),
- scientific instruments and apparatus used in biology (techniques of operation and safety),
- scientific quantities and their determination, and
- biological and technological applications with their social, economical and environmental implications.

2. Handling information and solving problems

Using oral, written, symbolic, graphical and numerical materials learners will:

- locate, select, organise and present information from a variety of sources,
- translate information from one form to another,
- manipulate numerical and other data,
- use information to identify patterns, report trends and draw inferences,
- present reasoned explanations for phenomena, pattern and relationships,
- make predictions and propose hypothesis, and
- solve problems.

3. Experimental skills and investigations

Learners will:

- follow a sequence of instructions,
- use techniques, apparatus and materials,
- make and record observations, measurements and estimates,
- interpret and evaluate observations and experimental data,
- plan an investigation, select techniques, apparatus and materials, and
- evaluate methods and suggest possible improvements.

Methodology

The successful of Biology can be achieved by maximum participation by learners. This learning area that enhances creativity, analysis, problem solving and investigative approach, can be taught effectively using a variety of methods both in the classroom and outside. Learners are expected to conduct experiments, study tours, field work, group work, individual work and project work.

Assessment

Assessment outcomes describe the knowledge, skills, values and abilities that learners are expected to demonstrate at the end of the course. They reflect those aspects such as:

A. Knowledge with understanding

Learners demonstrate knowledge and understanding in relation to:

- facts, laws, definitions, concepts and theories relating to biological phenomena,
- biological vocabulary, terminology, convention (including symbols, quantities and units),
- scientific instruments and apparatus used in Biology, including techniques of operations and aspects of safety,
- scientific quantities and their determination, and
- biological and technological applications with their social, economic and environmental implications.

B. Handling information and solving problems

Using oral, written, symbolic, graphical and numerical materials learners:

- locate, select, organise and present information from a variety of sources,
- translate information from one form to another,
- manipulate numerical and other data,
- use information to identify patterns, report trends and draw inferences,

- present reasoned explanations for phenomena, patterns and relationships,
- make predictions and propose hypotheses, and
- solve problems.

C. Experimental skills and investigations

Learners:

- follow a sequence of instructions,
- use techniques, apparatus and material appropriately,
- make and record accurately and observations, measurements made,
- interpret and evaluate observations and experimental data,
- select appropriate techniques, apparatus and materials,
- evaluate methods and suggested possible improvements, and
- use experimental control.

Continuous assessment will be emphasised by using various methods of testing according to topics and themes at various levels. The examinations council of Zambia will prepare detailed procedures on how continuous assessment will be conducted by the teachers. The examination council will also develop examination syllabus to provide teachers with guidelines on the objectives to be tested. The scheme of assessment will consist of school based assessment and final examination that will be conducted by the examinations of council of Zambia.

School based assessment will be in the form of tests. Tests will be in the form of diagnostic, aptitude, achievement, oral, practice attitude and performance, learners.

Time and Period allocation

Time allocation for this syllabus is will require at least five-40 minutes periods per week

GRADE 10

General outcomes:

- Develop positive attitudes and values about living organisms and life processes.
- Demonstrate knowledge and investigative skills.
- Develop positive attitudes and values about animals and plant cells.
- Demonstrate understanding of the facts about the interaction of water with cells.
- Demonstrate an understanding of the facts about enzymes.
- Recognise the importance of nutrients to the health of living organisms.
- Demonstrate understanding of facts about photosynthesis.
- Demonstrate understanding of saprophytic nutrition.
- Develop an understanding about the basic facts of nutrition in animals
- Recognise the importance of gaseous exchange and health
- Demonstrate an understanding of respiration.

Key competences:

- Demonstrate the ability to prepare and examine specimen using a microscope.
- Show ability to carry out food tests from given food samples
- Demonstrate the ability to investigate the conditions necessary for photosynthesis
- Demonstrate the ability to control the spread of diarrhoea and malarial diseases by houseflies and mosquitoes respectively.

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|---|--|--|---|--|---|
| | | | KNOWLEDGE | SKILLS | VALUES |
| 10.1 LIVING ORGANISMS AND LIFE PROCESSES | 10.1.1 Characteristics of Living Organisms | 10.1.1.1 Identify the characteristics of living organisms. | <ul style="list-style-type: none"> The characteristics of living organisms: Feeding, breathing, reproducing, growing, locomotion, sensitivity and excretion. Living organisms and non-living things. Life processes of living organisms: Metabolism (Catabolism and anabolism). Include the role of enzymes. | <ul style="list-style-type: none"> Communicating information on the characteristics of living organisms Comparing Living and non-Living organisms Communicating Metabolism and the role of enzymes | <ul style="list-style-type: none"> Appreciating characteristics of living organisms Asking questions for more understanding Appreciating life processes and role of enzymes |
| | | 10.1.1.2 Distinguish between living organisms and non-living things. | | | |
| | | 10.1.1.3 Describe life processes of living organisms. | | | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|---|--------------------|--|---|---|---|
| | | | KNOWLEDGE | SKILLS | VALUES |
| 10.2 CELL STRUCTURE AND ORGANISATION | 10.2.1 Microscopes | 10.2.1.1 Demonstrate the correct use of a microscope | <ul style="list-style-type: none"> How to use a microscope: Focussing, mounting a slide, observing. Preparation and mounting a microscope slide | <ul style="list-style-type: none"> Demonstrating the correct use of a microscope Observing specimen | <ul style="list-style-type: none"> Cooperating in class activities Knowing the safety rules of microscope |
| | | 10.2.1.2 Prepare specimen using a microscope | | | |
| | | 10.2.1.3 Calculate magnification of specimen. | <ul style="list-style-type: none"> Magnification of specimen: as the ratio of linear dimensions of the drawing to that of specimen. | <ul style="list-style-type: none"> Measuring the size of the specimen and drawing Comparing the sizes of the specimen and the Drawing | <ul style="list-style-type: none"> Cooperating in class activities Participating in observation actively |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|-------|------------------------------------|---|--|---|--|
| | | | KNOWLEDGE | SKILLS | VALUES |
| | 10.2.2 Cell Structure and Function | 10.2.2.1 Investigate the structure of cells and functions of the organelles | <ul style="list-style-type: none"> Structure and functions of cells: Nucleus, cytoplasm, membrane, mitochondrion, ribosome, Golgi bodies, endoplasmic reticulum, chloroplasts, cell wall | <ul style="list-style-type: none"> <i>Investigating</i> the detailed structure of the cell <i>Comparing</i> the functions of cells in a chart | <ul style="list-style-type: none"> <i>Appreciating</i> the structure of the cell <i>Cooperating</i> in group activities |
| | | 10.2.2.2 Distinguish between plant and animal cell structure. | <ul style="list-style-type: none"> Differences between plant and animal cells: Refer to the presence of chloroplast and cell wall in plant cells. | <ul style="list-style-type: none"> <i>Comparing</i> the structures of plant and animal cells | <ul style="list-style-type: none"> <i>Appreciating</i> the structural differences of the two types of cell |
| | | 10.2.2.3 Relate cell structure to functions | <ul style="list-style-type: none"> Relationship between structure and functions of cell: Animals (Nerve cells, blood cells, muscle cells) and Plants (root hair cells, spongy cells, phloem cells and xylem cells) and their functions. | <ul style="list-style-type: none"> <i>Inferring</i> the relationship between the structure of the cell to the function | <ul style="list-style-type: none"> <i>Appreciating</i> the relation between cell structure and function <i>Participating</i> in class discussion |
| | 10.2.3 Cell Organisation | 10.2.3.1 Describe cell organisation in multicellular organisms. | <ul style="list-style-type: none"> Cell organization: Cell, tissue, organ, system and organism. | <ul style="list-style-type: none"> <i>Classifying</i> cells as tissues, organs, system and organism organisation | <ul style="list-style-type: none"> <i>Being</i> aware of different levels of cell organisation |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|-------|----------------|--|--|---|--|
| | | | KNOWLEDGE | SKILLS | VALUES |
| | 10.2.4 Tissues | <p>10.2.4.1 Identify tissues in plants and animals.</p> <p>10.2.4.2 Explain the general functions of each tissue</p> | <ul style="list-style-type: none"> Plants (palisade, phloem, epidermis, xylem , spongy) and Animals (muscle, bone, nerves, blood) General functions of tissues: e.g. Muscle, epithelium, phloem | <ul style="list-style-type: none"> Observing different animal and plant tissues and the functions Communicating the function of tissues | <ul style="list-style-type: none"> Cooperating in class activities Asking questions for more understanding |
| | 10.2.5 Organs | <p>10.2.5.1 Identify organs in plants and animals</p> <p>10.2.5.2 Explain the general function of each organ</p> | <ul style="list-style-type: none"> Organs in plants and animals: Plants (leaves, roots, stems, fruits, flowers), Animals (heart, liver, brain, lungs, kidneys) General functions of plants (leaves, roots, stems, fruits flowers), animals (heart, liver, brain, lungs, kidneys) | <ul style="list-style-type: none"> Classifying different kinds of animal and plant organs Comparing functions of each organ. | <ul style="list-style-type: none"> Being aware of organs in plants and animals. Appreciating the functions of plant and animal organs Participating in class activity |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|-------|---|--|--|---|---|
| | | | KNOWLEDGE | SKILLS | VALUES |
| | 10.2.6 Diffusion, Osmosis and Active transport. | <p>10.2.6.1 Describe the processes of diffusion and osmosis</p> <p>10.2.6.2 Explain the effects and importance of diffusion and osmosis in living organisms</p> <p>10.2.6.3 Describe what active transport is.</p> | <ul style="list-style-type: none"> • Process of diffusion and osmosis: Diffusion: Refer to movement of solutes into and out of the cell across the membrane; Osmosis as the movement of water molecules into and out of the cell • Effects and importance of diffusion and osmosis: Plasmolysis, turgidity, lysis and crenation • Active transport: Refer to uptake of mineral salts by root hair cells from the soil against concentration gradient. | <ul style="list-style-type: none"> • Communicating the processes of osmosis and diffusion • Investigating the effects of diffusion and osmosis (Isotonic, hypertonic and hypotonic solutions) • Analysing information on active transport in plants | <ul style="list-style-type: none"> • Appreciating the processes of diffusion and osmosis • Cooperating the class activity • Being aware of the uptake of mineral salts by roots against a concentration gradient. |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|---------------------|---|---|--|--|---|
| | | | KNOWLEDGE | SKILLS | VALUES |
| 10.3 ENZYMES | 10.3.1 Characteristics of enzymes | <p>10.3.1.1 Investigate characteristics of Enzymes.</p> <p>10.3.1.2 Demonstrate the effects of temperature and pH on enzyme action</p> <p>10.3.1.3 Explain industrial application of enzymes.</p> | <ul style="list-style-type: none"> • Characteristics of enzymes: optimum temperature, pH, specificity of enzymes • Effects of temperature and pH on enzyme action (Refer to optimum temperature, and pH) • Industrial application of enzymes baking, brewing and biological washing powder. | <ul style="list-style-type: none"> • <i>Investigating</i> characteristics of enzymes. • <i>Investigating</i> the effects of pH and temperature on enzyme action. • <i>Communicating</i> industrial usage of enzymes | <ul style="list-style-type: none"> • <i>Appreciating</i> the characteristics of enzymes. • <i>Participating</i> actively in class activities. • <i>Appreciating</i> the role of enzymes in industrial processes. |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|----------------|-----------------------------|---|--|--|--|
| | | | KNOWLEDGE | SKILLS | VALUES |
| 10.4 NUTRIENTS | 10.4.1 Classes of Nutrients | 10.4.1.1 Investigate the presence of nutrients in food samples. 10.4.1.2 Identify good sources of nutrients | <ul style="list-style-type: none"> • Nutrients in food: carrying out food tests on reducing sugars, starch, proteins, fats and oils • Sources of nutrients: Refer to sources of carbohydrates, proteins, lipids, Vitamins | <ul style="list-style-type: none"> • <i>Investigating</i> the presence of nutrients in different food samples • <i>Comparing</i> the sources of good nutrients | <ul style="list-style-type: none"> • <i>Being</i> aware of the presence of nutrients in food samples • <i>Participating</i> the class discussion actively |
| | 10.4.2 Disorders | 10.4.2.1 Describe the importance of nutrients, salts, vitamins and roughage to the body. 10.4.2.2 Identify nutritional related disorders/ conditions | <ul style="list-style-type: none"> • Importance of carbohydrates, proteins, lipids, roughage, water, vitamins and salts • Disease due to nutritional deficiency: e.g. kwashiorkor, marasmus, goitre, scurvy, rickets, anaemia, obesity | <ul style="list-style-type: none"> • <i>Communicating</i> the importance of nutrients • <i>Predicting</i> the effects of deficiency of nutrients | <ul style="list-style-type: none"> • <i>Appreciating</i> the importance of nutrients • <i>Cooperating</i> class activity |
| | 10.4.3 Dietary Needs | 10.4.3.1 Design a balanced diet for people with different conditions. | <ul style="list-style-type: none"> • Well-balanced diet: Refer to diets of the aged, pregnant woman, lactating woman, sick person, pre-school aged, sportsman and the youth. | <ul style="list-style-type: none"> • <i>Planning</i> balanced diet for people with different conditions | <ul style="list-style-type: none"> • <i>Actively participating</i> in class activities. • Being aware of requirements for people with different conditions. • <i>Applying</i> the idea of balanced diet in their daily life |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|-------|------------------------|---|--|--|--|
| | | | KNOWLEDGE | SKILLS | VALUES |
| | 10.4.4 Plant Nutrients | 10.4.4.1 Describe the micro and macro plant nutrients | <ul style="list-style-type: none"> • Micro and macro plant nutrients: Refer to Macro: nitrogen, potassium, phosphorus (NPK) Micro: calcium, magnesium, sulphur boron, copper, iron) | <ul style="list-style-type: none"> • <i>Comparing</i> effects of plant micro and macro nutrients. | <ul style="list-style-type: none"> • <i>Asking</i> questions for more understanding • <i>Participating</i> in class activity |
| | | 10.4.4.2 Describe deficiency diseases of macro and micro plant nutrients. | <ul style="list-style-type: none"> • Deficiency diseases: Chlorosis, stunted growth, leaf flecking. | <ul style="list-style-type: none"> • <i>Investigating</i> deficiency diseases in plants. | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|---------------------------------|---|---|--|---|--|
| | | | KNOWLEDGE | SKILLS | VALUES |
| 10.5 NUTRITION IN PLANTS | 10.5.1 External and Internal Structure of a Leaf. | 10.5.1.1 Describe the external and internal structure of a leaf. | <ul style="list-style-type: none"> External and internal structure of a leaf: External structure: Veins and Lamina. Internal structure: Epidermis, stomata, palisade and spongy mesophyll cells, phloem and xylem, chloroplasts | <ul style="list-style-type: none"> <i>Examining</i> the external and internal structures of a leaf <i>Experimenting</i> on the necessity for photosynthesis | <ul style="list-style-type: none"> <i>Appreciating</i> the external and internal structure of a leaf. <i>Asking</i> questions for more understanding. <i>Appreciating</i> the stages of photosynthesis <i>Caring</i> for plant life. Being aware of storage organs in plants. |
| | | 10.5.1.2 Investigate factors necessary for photosynthesis. | <ul style="list-style-type: none"> Factors necessary for photosynthesis: Carrying out investigations on the necessity of carbon dioxide, water, chlorophyll and light energy to photosynthesis | <ul style="list-style-type: none"> <i>Inferring</i> the factors of photosynthesis | |
| | | 10.5.1.3 Describe the light and dark reactions of photosynthesis. | <ul style="list-style-type: none"> Light and dark reactions including chemical equations for photosynthesis | <ul style="list-style-type: none"> <i>Interpreting</i> the equation for photosynthesis | |
| | | 10.5.1.4 Describe the fate of glucose in plants. | <ul style="list-style-type: none"> Utilization of glucose in plants (converted to sucrose and starch, used in respiration, conversion into proteins, cellulose and lipids) | <ul style="list-style-type: none"> <i>Communicating</i> information on the fate of glucose in leaves | |
| | | 10.5.1.5 Describe the importance of nutrients in plant. | <ul style="list-style-type: none"> Source of food for all life forms, maintains levels of CO₂ and O₂ in atmosphere: | <ul style="list-style-type: none"> <i>Communicating</i> the importance of photosynthesis. | |
| | | 10.5.1.6 Identify storage organs of plants. | <ul style="list-style-type: none"> Refer to storage of nutrients in Seeds, roots, stems, leaves, fruits, rhizomes, corns and tubers. | | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|---|-----------------|---|---|--|--|
| | | | KNOWLEDGE | SKILLS | VALUES |
| 10.6 SAPROPHYTIC NUTRITION | 10.6.1 Rhizopus | 10.6.1.1. Investigate the structure of Rhizopus or Mucor. | <ul style="list-style-type: none"> • Structure of Rhizopus or Mucor: Mycelium (hyphae, sporangium, sporangiophore, stolons, rhizoids) • Functions of the parts of Rhizopus: Refer to Mycelium (hyphae, sporangium, sporangiophore, stolons and rhizoids) • Saprophytic nutrition: Feeding on dead or decaying matter. It involves secretion of enzymes onto the food by the saprotrophs (extracellular digestion) • Importance of saprophytic nutrition: Recycle of nutrients. Decomposition of dead organic matter. • Symbiosis/Mutualism, and Parasitism | <ul style="list-style-type: none"> • <i>Investigating</i> the structure of rhizopus and mucor • <i>Communicating</i> information on the structure of Rhizopus and mucor. • <i>Interpreting</i> stages in extracellular digestion • <i>Analysing</i> the importance of saprophytic nutrition • <i>Communicating</i> types of saprophytic nutrition | <ul style="list-style-type: none"> • <i>Developing</i> curiosity in investigation • <i>Appreciating</i> functions of the parts of Rhizopus • <i>Cooperating</i> with others • <i>Listening</i> to others with respect • <i>Appreciating</i> the importance of saprophytic nutrition. • <i>Asking</i> more questions. |
| | | 10.6.1.2 State the functions of the parts of Rhizopus. | | | |
| | | 10.6.1.3 Describe what saprophytic nutrition is. | | | |
| | | 10.6.1.4 Explain the importance of saprophytic nutrition. | | | |
| | | 10.6.1.5 State other types of saprophytic nutrition. | | | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|--|-----------------------------|---|--|--|--|
| | | | KNOWLEDGE | SKILLS | VALUES |
| 10.7 NUTRITION IN ANIMALS | 10.7.1 Dentition in Mammals | <p>10.7.1.1 Identify the external structure and function of the human teeth.</p> <p>10.7.1.2 Describe the internal structure and function of the human tooth.</p> <p>10.7.1.3 Describe the dental formulae of a dog and human being.</p> <p>10.7.1.4 Identify the differences in dentition of carnivores, herbivores and omnivores.</p> <p>10.7.1.5 Describe causes, signs and symptoms of gum disease and tooth decay.</p> | <ul style="list-style-type: none"> • External structure of teeth: Crown, neck and root. • External Functions of teeth: such as incisors, canines, premolars and molars. • Internal structure of the human tooth: Dentine, Cement, Pulp Cavity, Nerve Endings, Blood Vessels,(longitudinal section) • Internal function of teeth • Dental formulae: Dog i:3/3 c:1/1 pm:4/4 m:2/3, Man i:2/2 c:1/1 pm:2/2 m3/3 • Differences in dentition of carnivores, omnivores and herbivores: Refer to type of teeth present, function and the number of each type of teeth present in man, dog and goat • Causes, signs and symptoms of gum disease and tooth decay • Ways of preventing tooth decay | <ul style="list-style-type: none"> • Observing the external parts and functions of teeth. • Identifying the internal parts and functions of a tooth. • Comparing dental formulae of different animals • Comparing dentitions of carnivores, herbivores and omnivores • Communicating Causes, signs and symptoms of gum disease and tooth decay | <ul style="list-style-type: none"> • Appreciating the structure and function of teeth. • Being aware of internal parts and function of teeth. • Applying knowledge on prevention of dental diseases • Caring for teeth • Being aware of causes, signs, symptoms and prevention of tooth decay. |
| | 10.7.2 Holozoic Nutrition | <p>10.7.2.1 State the main processes in holozoic nutrition.</p> <p>10.7.2.2 Identify the main</p> | <ul style="list-style-type: none"> • Processes in holozoic: nutrition Ingestion, digestion, absorption, assimilation and egestion. • The alimentary canal and associated organs (liver and | <ul style="list-style-type: none"> • Communicating main processes of holozoic nutrition. • Investigating the | <ul style="list-style-type: none"> • Being aware of the main processes of holozoic nutrition. • Participating in |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
|-------|-----------|--|--|--|---|
| | | | KNOWLEDGE | SKILLS | VALUES |
| | | <p>regions of the alimentary canal and associated organs.</p> <p>10.7.2.3 Describe the processes of digestion, absorption and assimilation of nutrients.</p> <p>10.7.2.4 Investigate the common ailments of the alimentary canal.</p> <p>10.7.2.5 Describe the metabolic functions of the liver.</p> <p>10.7.2.6 Describe the effects of common ailments of the liver.</p> | <p>pancreas)</p> <ul style="list-style-type: none"> • Functions of the parts of the alimentary canal and associated organs • Processes of digestion, absorption and assimilation of nutrients: Digestion, absorption and assimilation of proteins, carbohydrates, and lipids. -Role of hepatic portal vein -Absorption of vitamins and mineral salts • Dehydration (loss of mineral salts and loss of fluids) and inflammation of the alimentary canal • Metabolic functions of the liver: Deamination, detoxification, production of bile, regulation of blood sugar, storage of glycogen, vitamins and iron • Effects of common ailments of the liver: Poor bile formation, high blood sugar, low blood sugar and high toxin levels in the blood. | <p>main regions of the alimentary and the functions.</p> <ul style="list-style-type: none"> • Comparing the processes of digestion, absorption and assimilation. • Investigating the common ailments of the alimentary canal. • Communicating the metabolic functions of the liver. • Investigating the common ailments of the liver | <p>class activity.</p> <ul style="list-style-type: none"> • Developing curiosity • Actively participating in group discussions. |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 10.8 RESPIRATORY SYSTEM | 10.8.1 Gaseous exchange | 10.8.1.1 Describe the respiratory organs of animals. | <ul style="list-style-type: none"> Respiratory organs of various animals: Insects (spiracles, trachea and tracheoles), Fish (operculum, mouth, gills), Humans (nostrils, trachea, bronchi, bronchioles, alveoli) | <ul style="list-style-type: none"> Observing respiratory organs of different animals using models. | <ul style="list-style-type: none"> Cooperating in group activity |
| | | 10.8.1.2 Describe the mechanism of gaseous exchange in animals. | <ul style="list-style-type: none"> Mechanism of inspiration and expiration in an insect, fish and human being: Refer to diffusion of gases in respiratory organs of humans, fish and insect. | <ul style="list-style-type: none"> Comparing the different types of respiratory organs | <ul style="list-style-type: none"> Giving presentation |
| | | 10.8.1.3 Describe the composition of inspired and expired air. | <ul style="list-style-type: none"> Composition of inspired and expired air: Refer to composition of oxygen, carbon dioxide, nitrogen, moisture, dust | <ul style="list-style-type: none"> Analysing the mechanism of gaseous exchange in animals | <ul style="list-style-type: none"> Listening to others with respect |
| | | 10.8.1.5 Describe the adverse effects of air pollutants on health of human beings. | <ul style="list-style-type: none"> Effects of pollutants: Refer to Cigarette smoke (nicotine and tar), sulphur dioxide and carbon monoxide | <ul style="list-style-type: none"> Comparing the composition of inspired and expired air | <ul style="list-style-type: none"> Developing curiosity |
| | | 10.8.1.6 Explain gaseous exchange in green plants. | <ul style="list-style-type: none"> Gaseous exchange in green plants: During day time all the carbon dioxide produced from respiration is used up by photosynthesis. Oxygen from photosynthesis is used up during respiration | <ul style="list-style-type: none"> Communicating the effects of air pollutants | <ul style="list-style-type: none"> Appreciating the release of oxygen during respiration by green plants. |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | 10.8.2 Types of Respiration | <p>10.8.2.1 Describe types of tissue respiration.</p> <p>10.8.2.2 Describe the production of adenosine triphosphate.</p> <p>10.8.2.3 Investigate the production of carbon dioxide during respiration.</p> <p>10.8.2.4 State ways in which respiration is important.</p> <p>10.8.2.5 Explain the industrial applications of respiration</p> | <ul style="list-style-type: none"> • Types of respiration: Aerobic and anaerobic respiration • Production of adenosine triphosphate Equations (word and chemical) • Production of carbon dioxide during respiration Formation of ATP from ADP and P (Experiment to show production of CO₂ during aerobic and anaerobic respiration) • Importance of ATP in cells: Production of biological energy, Maintenance of levels of CO₂ and O₂ in atmosphere • Industrial applications of respiration: Baking, brewing, dairy, sewage treatment. | <ul style="list-style-type: none"> • Comparing aerobic and anaerobic respiration • Communicating formation and importance of ATP • Investigating production of Carbon dioxide during respiration • Communicating ways in which respiration is important • Investigating the process of respiration in industry. | <ul style="list-style-type: none"> • Being aware of types of tissue respiration. • Appreciating the formation of ATP from ADP and P, and its importance. • Asking questions for more understanding • Valuing the importance of respiration. • Appreciating the industrial application of respiration. |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 10.9 HEALTH | 10.9.1 Diseases | 10.9.1.1 Describe what good health is. | <ul style="list-style-type: none"> • Good health: Refer to physical, mental and social well being, dependent on receiving a balanced diet and an appropriate physical and mental activity. | <ul style="list-style-type: none"> • Communicating information on good health • Interpreting the meaning of the term disease. • Classifying diseases into different groups. • Communicating causative agents, signs and symptoms of pathogenic diseases. | <ul style="list-style-type: none"> • Appreciating good health. • Asking questions for a better understanding of the meaning of the term disease. • Appreciating various types of diseases • Applying the knowledge on preventing disease in daily life |
| | | 10.9.1.2 Define disease. | <ul style="list-style-type: none"> • Definition of disease: Refer to loss of health resulting from disturbances of the normal processes of the body. | | |
| | | 10.9.1.3 Describe various types of diseases | <ul style="list-style-type: none"> • Types of diseases: Deficiency diseases, Genetic diseases, Pathogenic diseases, Social diseases, Mental illness, and Ageing and degenerative diseases. | | |
| | | 10.9.1.4 Describe causative agents, signs and symptoms, methods of transmission and control. | <ul style="list-style-type: none"> • Agents, symptoms, methods of transmission and control of disease: Refer to the following diseases: Cholera, Malaria and Bilharzia (Schistosomiasis). | | |
| | 10.9.2 HIV and AIDS | 10.9.2.1 Describe ways of HIV transmission | <ul style="list-style-type: none"> • Ways of HIV transmission: Sexual intercourse with an infected person, sharing contaminated body fluids, sharing un sterilised instruments. | <ul style="list-style-type: none"> • Communicating ways of transmission of HIV • Communicating dangers of having multiple sexual partners • Communicating ways of safe sexual practices. | <ul style="list-style-type: none"> • Being aware of HIV transmission. • Being aware of dangers of having multiple sexual partners. • Being aware of safe sexual practices. |
| | | 10.9.2.2 Explain the dangers of having multiple sexual partners. | <ul style="list-style-type: none"> • Dangers of multiple sexual partners: Risk of contracting STIs' including HIV, unintended pregnancy, disintegration of families | | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | | 10.9.2.3 Describe ways of safe sexual practices. | <ul style="list-style-type: none"> Safe sexual practices: Abstinence, Consistence and correct use of condoms, VCT Services | <ul style="list-style-type: none"> Investigating causes of stigma to people living with HIV and AIDS. Communicating ways of reducing discrimination to people living with HIV and AIDS | <ul style="list-style-type: none"> Being assertive to sexual advances. Showing empathy to people living with HIV/AIDS. Sympathising with people living HIV/AIDS. |
| | | 10.9.2.4 Identify the causes of stigma to people living with HIV and AIDS | <ul style="list-style-type: none"> Causes of stigma: Fear, myth, lack of support groups, lack of information on the available services | | |
| | | 10.9.2.5 Describe ways of reducing discrimination to people living with HIV and AIDS. | <ul style="list-style-type: none"> Ways of reducing stigma: Support, care, treatment (ART) and advocacy. | | |
| | 10.9.3 Immunity | 10.9.3.1 Explain the term of immunity to disease. | <ul style="list-style-type: none"> Define immunity to disease: Refer to active, passive artificial and natural immunity. | <ul style="list-style-type: none"> Communicating information on immunity to disease Investigating the importance of immune system Identifying factors that reduce immunity to pathogenic diseases Communicating the importance of immunisation | <ul style="list-style-type: none"> Asking questions for better understanding of immunity. Relating the importance of immunity. Being aware of factors that reduce immunity to pathogenic diseases. Appreciating the importance of immunisation. |
| | | 10.9.3.2 Investigate the importance of the immune system. | <ul style="list-style-type: none"> Importance of the immune system (Refer to control of diseases). | | |
| | | 10.9.3.3 Describe the factors that reduce immunity to pathogenic diseases | <ul style="list-style-type: none"> Factors reducing immunity: Diet, repeated invasions by pathogens and development of resistant strains of the pathogens | | |
| | | 10.9.3.4 Explain the importance of immunisation. | <ul style="list-style-type: none"> Importance of immunisation: refer to induced active immunity | | |
| | 10.9.4 The Life Cycle | 10.9.4.1 Describe the life cycle of a housefly. | <ul style="list-style-type: none"> Life cycle of housefly: Egg, larva, pupa and adult | <ul style="list-style-type: none"> Investigating life cycles of a housefly | <ul style="list-style-type: none"> Appreciating the life cycle of |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | of the Housefly and the Mosquito. | 10.9.4.2 Describe the life cycle of a mosquito. | <ul style="list-style-type: none"> Life cycle of a mosquito: Egg, larva, pupa and adult | and mosquito <ul style="list-style-type: none"> Identifying the relationship between cause of disease and effect of houseflies and mosquitoes Inferring the control of malaria to the life cycle of the mosquito Investigating the control of water borne diseases to the life cycle of the housefly | housefly and mosquito. <ul style="list-style-type: none"> Being aware of the role of houseflies and mosquitoes in spreading diseases. |
| 10.9.4.3 Explain the role of houseflies and mosquitoes in the spreading of diseases. | | <ul style="list-style-type: none"> Role of Houseflies: Vectors in the spread of dysentery, cholera, typhoid. Role of Mosquito: Vector for malaria. | | | |
| 10.9.4.4 Relate the control of malaria to the life cycle of the mosquito. | | <ul style="list-style-type: none"> Control of malaria: (Refer to use of biological and chemical control) | | | |
| 10.9.4.5 Relate the control of water borne diseases to the life cycle of the housefly. | | <ul style="list-style-type: none"> Control of water borne disease: such as dysentery, cholera, typhoid and the life cycle of the housefly. | | | |

GRADE 11

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| <p>General Outcomes:</p> <ul style="list-style-type: none">• Demonstrate understanding of transport and storage in plant.• Develop investigative skills.• Demonstrate understanding of the circulatory system in humans• Acquire knowledge and values about homeostasis.• Recognise the importance of excretion and the endocrine system.• Demonstrate an understanding of the nervous system and sense organs.• Demonstrate understanding of the Skeleton and locomotion.• Demonstrate understanding of tropic and taxic responses• Demonstrate an understanding of plant growth and development | <p>Key Competences:</p> <ul style="list-style-type: none">• Show the ability to investigate the conditions necessary for transpiration• Show ability to demonstrate the conditions necessary for germination of seeds.• Show ability to identify different joints in mammals and insects |
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| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 11.1 TRANSPORT AND STORAGE IN PLANTS | 11.1.1 Transport in Plants. | 11.1.1.1 Describe the external and internal structure of roots and stems. | <ul style="list-style-type: none"> External and internal structure of roots and stems: Refer to Cross section and longitudinal section of roots and stems (xylem and phloem of herbaceous dicot and monocot anatomy) | <ul style="list-style-type: none"> Investigating the external and internal structure of a dicot and monocot root and stem. Predicting the movement of water and mineral salts in roots Analysing the movement of water and transport of mineral salts up the plant. Analysing the movement of organic solutes in phloem Communicating the process of transpiration Investigating factors that affect the rate of transpiration Observing adaptive features in plants that reduce excess | <ul style="list-style-type: none"> Asking questions for better understanding of the structures of roots and stems. Developing curiosity Cooperating in group discussions Giving presentation Sharing ideas with others Listening to others with respect |
| | | 11.1.1.2 Describe absorption of water and uptake of mineral salts by roots. | <ul style="list-style-type: none"> The role of roots: absorption of water (osmosis), uptake of mineral salts (Active transport) | | |
| | | 11.1.1.3 Describe the movement of water and transport of mineral salts from the roots to the leaves. | <ul style="list-style-type: none"> Movement of water and transport of mineral salts: Root pressure, capillarity(refer to adhesion and cohesion forces), transpiration stream | | |
| | | 11.1.1.4 Describe the movement of organic solutes in phloem. | <ul style="list-style-type: none"> Movement of organic solutes: Refer to translocation of carbohydrates and amino acids in phloem | | |
| | | 11.1.1.5 Demonstrate the process of transpiration. | <ul style="list-style-type: none"> Process of transpiration: Refer to loss of water vapour through the stomata, opening and closing of stomata. Use a simple photometer | | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | | 11.1.1.6 Investigate factors that affect the rate of Transpiration | <ul style="list-style-type: none"> Factors affecting transpiration: Humidity; Temperature; deforestation; Light intensity; and Speed of wind | loss of water <ul style="list-style-type: none"> <i>Analysing</i> the significance of transpiration. | |
| | | 11.1.1.7 Describe adaptive features of a leaf to reduce excess loss of water. | <ul style="list-style-type: none"> Adaptive features of a leaf: Reduction of leaf surface, shading of leaves, reducing the number of stomata | | |
| | | 11.1.1.8 Explain the significance of transpiration in plants. | <ul style="list-style-type: none"> Significance of transpiration: Refer to water cycle, cooling effect in plants, absorption of mineral ions, provides water for photosynthesis | | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 11.2 TRANSPORT IN MAN | 11.2.1 Blood | 11.2.1.1 Identify the composition of blood. | <ul style="list-style-type: none"> Composition of blood: Solid (leucocytes, erythrocytes, thrombocytes), Liquid (plasma). | <ul style="list-style-type: none"> Classifying the components of blood | <ul style="list-style-type: none"> Being aware of the composition of blood. |
| | | 11.2.1.2 Explain the functions of blood. | <ul style="list-style-type: none"> Functions of blood: Transporting oxygen and carbon dioxide, nutrients, mineral salts, vitamins, water, hormones, heat, metabolic wastes, fighting disease, and blood clotting | <ul style="list-style-type: none"> Comparing the functions of blood | <ul style="list-style-type: none"> Appreciating the functions of blood. |
| | | 11.2.1.3 Distinguish between the red and the white blood cells. | <ul style="list-style-type: none"> Structural and functional differences of red blood cells(erythrocytes) and white blood cells (leucocytes) | <ul style="list-style-type: none"> Comparing structural and functional differences between RBC and WBC | <ul style="list-style-type: none"> Developing curiosity |
| | | 11.2.1.4 Identify the sites where the blood cells are produced | <ul style="list-style-type: none"> Sites of production of blood: RBCs-Bone marrow. WBCs-Bone marrow, lymph nodes, thymus and spleen. Platelets- Bone marrow | <ul style="list-style-type: none"> Investigating the sites where the blood cells are produced | <ul style="list-style-type: none"> Asking questions for better understanding |
| | | 11.2.1.5 Explain the process of blood clotting | <ul style="list-style-type: none"> Process of blood clotting: Change of enzyme prothrombin to thrombin, fibrinogen to fibrin and role of calcium ions and thromboplastin. | <ul style="list-style-type: none"> Communicating the process of blood clotting | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | 11.2.2 Blood Groups | <p>11.2.2.1 Describe the ABO blood groups</p> <p>11.2.2.2 Explain the importance of determining the blood groups and Rhesus factors.</p> <p>11.2.2.3 Explain the donor-recipient compatibility of blood groups.</p> <p>11.2.2.4 Explain the importance of screening the blood for purpose of transfusion.</p> | <ul style="list-style-type: none"> • Blood groups: Refer to blood types A,B,AB and O, antigens and antibodies • Importance of blood groups: Refer to blood transfusions and transplants; the danger of Rhesus positive blood to the foetus (haemolytic disease) • Donor-Recipient compatibility of Blood: Refer to antibody and Antigen reaction when bloods of different groups are mixed. • Importance of screening blood: Refer to risk of transmission of HIV and Hepatitis B by blood donors | <ul style="list-style-type: none"> • Classifying blood into groups according to the antigens they carry. • Analysing the importance of determining of blood groups and rhesus factors • Communicating the donor - recipient compatibility of blood groups. • Communicating importance of screening the blood for purpose of transfusion | <ul style="list-style-type: none"> • Appreciating different blood types. • Being aware of the donor – recipient compatibility of blood groups. |
| | 11.2.3 Blood Disorders | 11.2.3.1 Investigate common blood disorders | <ul style="list-style-type: none"> • Blood disorders: Leukaemia, sickle cell, anaemia and haemophilia | <ul style="list-style-type: none"> • Communicating information on common blood disorders | <ul style="list-style-type: none"> • Showing empathy to people with blood disorders. |
| | 11.2.4 The Heart | <p>11.2.4.1 Describe the structure of the human heart.</p> <p>11.2.4.2 Describe how the heart functions.</p> | <ul style="list-style-type: none"> • Structure of the heart: Refer to chambers, valves, vessels, including coronary arteries • Functioning of the heart: diastole and systole (Include pulse rate and heart beat). | <ul style="list-style-type: none"> • Observing the structure of the human heart with a model • Communicating information on how the heart functions | <ul style="list-style-type: none"> • Asking questions for more understanding • Developing curiosity • Applying ways of preventing coronary heart |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | | 11.2.4.3 Explain the causes of coronary heart disease. | <ul style="list-style-type: none"> Causes of coronary diseases: Include diet, stress, smoking and pollution. | <ul style="list-style-type: none"> Communicating the causes of coronary heart diseases | diseases. |
| | | 11.2.4.4 Describe ways of preventing coronary heart diseases | <ul style="list-style-type: none"> Ways of preventing coronary diseases: Good diet and importance of exercises. | <ul style="list-style-type: none"> Communicating ways of preventing coronary heart diseases | |
| | 11.2.5 Lymphatic System | 11.2.5.1 Describe the structure of the lymphatic system in relation to blood circulatory system. | <ul style="list-style-type: none"> Structure of the lymphatic system and relationship with blood circulatory system | <ul style="list-style-type: none"> Relating the structure of lymphatic system to blood circulatory system | <ul style="list-style-type: none"> Actively participating in group discussion |
| | | 11.2.5.2 Compare tissue fluid and lymph to blood. | <ul style="list-style-type: none"> Tissue fluid, lymph and blood (include composition and functions of tissue fluid and lymph) | <ul style="list-style-type: none"> Comparing the relationship of tissue fluid and lymph to blood | <ul style="list-style-type: none"> Cooperating in group activity |
| | | 11.2.5.3 Describe the flow of lymph. | <ul style="list-style-type: none"> Flow of lymph: Refer to the lymphatic system | <ul style="list-style-type: none"> Communicating information on the flow of lymph in the lymphatic system. | <ul style="list-style-type: none"> Giving presentation |
| | | 11.2.5.4 Describe the function of lymph nodes in disease prevention. | <ul style="list-style-type: none"> The function of lymph nodes: Disease prevention, (STIs, TB, injury). | <ul style="list-style-type: none"> Investigating the function of lymph nodes in disease prevention | <ul style="list-style-type: none"> Listening to others with respect |
| | 11.2.6 Circulatory Systems | 11.2.6.1 Describe types of blood circulatory systems. | <ul style="list-style-type: none"> Types of blood circulatory systems Closed and open circulatory systems | <ul style="list-style-type: none"> Communicating circulatory systems | <ul style="list-style-type: none"> Actively participating in class discussion. |
| | | 11.2.6.2 Describe double circulation. | <ul style="list-style-type: none"> Double circulation: Pulmonary and systemic circulation | <ul style="list-style-type: none"> Investigating double circulation Comparing single and double blood | <ul style="list-style-type: none"> Cooperating in group activity Listening to others with |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | | <p>11.2.6.3 Distinguish between the single and double circulation.</p> <p>11.2.6.4 Identify the main blood vessels in the double circulatory system</p> <p>11.2.6.5 Compare the structure and functions of arteries, veins and capillaries.</p> <p>11.2.6.6 Describe the structure of lymph vessels.</p> | <ul style="list-style-type: none"> • Single and double circulation • Blood vessels: Arteries and Veins to and from the heart, lungs, head, limbs, intestines, liver and the kidneys • Structure and functions of Arteries, veins and capillaries (transverse sections). • Structure of lymph vessels: Refer to transverse section. | <p>circulation</p> <ul style="list-style-type: none"> • Identifying the main blood vessels in the double circulatory system • Comparing the structures and functions of arteries, veins and capillaries • Observing the structure of lymph vessels using models. | <p>respect</p> <ul style="list-style-type: none"> • Accepting responsibility for one's behaviour |
| 11.3 EXCRETION | 11.3.1 Excretion | <p>11.3.1.1 Describe the process of excretion.</p> <p>11.3.1.2 Explain the importance of excretion to animals.</p> | <ul style="list-style-type: none"> • Process of excretion: Refer to removal of toxic metabolic waste: Animals (Carbon dioxide, Nitrogenous wastes,) Plants (latex) • Importance of excretion: Refer to Removal of unwanted by-products and toxic wastes; Regulation of water content of body fluids and pH. | <ul style="list-style-type: none"> • Investigating the process of excretion • Communicating the importance of removing of metabolic wastes | <ul style="list-style-type: none"> • Appreciating the process and importance of excretion • Participating in group activity |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | 11.3.2 The Kidney | <p>11.3.2.1 Identify the internal structure of the kidneys.</p> <p>11.3.2.2 Explain the mechanism of excretion in the kidney.</p> <p>11.3.2.3 Identify common disorders and diseases associated with the kidney.</p> | <ul style="list-style-type: none"> Internal structure of the kidneys: Cortex, medulla, pelvis, structure of nephron, inlet and outlet of blood vessels. Mechanism of excretion in the kidney Refer to ultra -filtration and selective re-absorption, osmoregulation Kidney failure (refer to infections, high blood pressure and low blood pressure) and remedies (dialysis machine and kidney transplant) | <ul style="list-style-type: none"> Observing the internal structure of kidneys using models and specimen Communicating the mechanism of ultra-filtration and re-absorption of substances in the kidneys Identifying common disorders and disease associated with the kidney. | <ul style="list-style-type: none"> Being aware of the structure of the kidneys. Appreciating the mechanism of excretion by the kidneys. Being aware of common disease and disorders. |
| | 11.3.3 The Lungs | 11.3.3.1 Investigate the role of lungs in excretion. | <ul style="list-style-type: none"> Roles of lungs: Refer to elimination of carbon dioxide | <ul style="list-style-type: none"> Investigating the role of the lungs in eliminating carbon dioxide | <ul style="list-style-type: none"> Appreciating the role of lungs in excretion |
| | 11.3.4 The Human Skin | <p>11.3.4.1 Identify the structure of the human skin.</p> <p>11.3.4.2 Describe the role of the human skin in excretion.</p> | <ul style="list-style-type: none"> Structure of the human skin: Refer to the Epidermis, dermis and adipose tissue and associated structures. Role of the human skin Removal of salts, urea and excess water as waste products. | <ul style="list-style-type: none"> Identifying the structures of the human skin Analysing the roles of the human skin | <ul style="list-style-type: none"> Asking questions for more understanding Cooperating in group activity |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 11.4 HOMEOSTASIS AND OSMOREGULATION | 11.4.1 Homeostasis | 11.4.1.1 Describe what homeostasis is. | <ul style="list-style-type: none"> • Homeostasis: Refer to maintaining of constant internal environment (blood temperature, contents of tissue fluid, salts, water concentration). • Organs of homeostasis: Kidney, skin and the liver • Role of the kidney: water/salt ion balance (Refer to the role of Anti Diuretic Hormone (ADH)) • Mechanism of Thermoregulation: Overheating (Vasodilation and sweating), Overcooling (vasoconstriction and shivering) • Role of the liver in the regulation of the blood sugar (conversion of glucose to glycogen and vice versa. Amino acids and glycerol to glucose) and body temperature. | <ul style="list-style-type: none"> • Analysing maintenance of constant internal environment • Investigating important organs in homeostasis • Communicating the role of the kidney in osmoregulation • Analysing the mechanism of thermoregulation by the skin • Communicating the role of the liver in regulating blood sugar and body temperature | <ul style="list-style-type: none"> • Participating in group discussion • Cooperating in class activity • Listening to others with respect • Giving presentation • Accepting responsibility for one's behavior |
| | | 11.4.1.2 Identify important organs in homeostasis. | | | |
| 11.5 THE ENDOCRINE SYSTEM | 11.5.1 Hormones | 11.5.1.1 Describe what hormones is. | <ul style="list-style-type: none"> • Hormones: Refer to regulatory chemicals transported by blood to target organs. • Endocrine glands: Pituitary, pancreas, adrenal and thyroid, testes and ovaries | <ul style="list-style-type: none"> • Communicating information on hormones as regulatory chemicals transported by blood to target organs | <ul style="list-style-type: none"> • Cooperating in class activity • Being aware of the endocrine glands • Developing curiosity |
| | | 11.5.1.2 Identify the endocrine glands in a human being. | | | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | | <p>11.5.1.3 Identify the hormones produced by the pancreas, adrenal, thyroid and pituitary glands.</p> <p>11.5.1.4 Describe the functions of thyroxine, insulin, glucagon and adrenaline.</p> | <ul style="list-style-type: none"> Hormones produced by the pancreas: Insulin and glucagon: Adrenal: Adrenaline, Thyroid: Thyroxine Pituitary: ADH, TSH, FSH, GH Functions of Hormones: Thyroxine, insulin and adrenaline (Refer to the effects of over and under secretion of hormones) | <ul style="list-style-type: none"> Identifying endocrine glands on the charts Investigating hormones produced by some endocrine glands Communicating functions of thyroxine, insulin, glucagon and adrenaline | |
| 11.6 THE NERVOUS SYSTEM AND SENSE ORGANS | 11.6.1 The nervous System | <p>11.6.1.1 Identify main parts of the nervous system in a human being.</p> <p>11.6.1.2 Describe what neurones are.</p> <p>11.6.1.3 Explain the path taken by an impulse through a spinal reflex arc.</p> <p>11.6.1.4 Describe what the spinal, cranial and the conditioned reflex actions are</p> <p>11.6.1.5 Identify the main</p> | <ul style="list-style-type: none"> Main parts of nervous system: Brain, spinal cord and nerves. Functions of Neurones: Refer to functions of sensory, motor and relaying neurones Spinal reflex arc: Movement of an impulse through sensory neurone to the CNS and to effectors Spinal reflex (knee jerk); Cranial reflex (blinking, coughing, response to light intensity) Conditioned reflex (Pavlov's experiment) Main parts of the brain: | <ul style="list-style-type: none"> Communicating the main parts of the nervous system Investigating functions of neurones Investigating a spinal reflex arc Comparing different reflex actions Communicating the main parts of the brain | <ul style="list-style-type: none"> Appreciating the functions of neurones Actively participating in group activities Appreciating the main parts of the human brain Developing curiosity on the functions of the fore and hind brain Being aware of the effects of abuse of drugs on the nervous system |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | <p>parts of the brain of a human being.</p> <p>11.6.1.6 Explain the functions of the forebrain and the hindbrain.</p> <p>11.6.1.7 Describe the effects of abuse of drugs on the nervous system</p> <p>11.6.1.8 Explain the effects of tetanus infection.</p> | <p>Cerebral hemispheres, cerebellum, Hypothalamus and medulla oblongata.</p> <ul style="list-style-type: none"> • Functions of fore brain (cerebrum and hypothalamus) and hind brain(cerebellum and medulla oblongata) • Effects of drug abuse: Affect the breathing centre of the brain (depressants), destroy the neurones, Increase reaction time • Effects of tetanus infections: Refer to damage to brain cells and impairment of nerve tissue | <ul style="list-style-type: none"> • Communicating functions of the forebrain and hindbrain • Inferring effects of abuse of drugs • Communicating effects of tetanus the brain and nerve tissues | <ul style="list-style-type: none"> • Asking questions for more understanding • Listening to others with respect • Giving presentation |
| | 11.6.2 Sense organs | <p>11.6.2.1 Identify the external and internal structures of the human eye.</p> <p>11.6.2.2 Explain the functions of the parts of eye.</p> <p>11.6.2.3 Describe the accommodation of the eye.</p> <p>11.6.2.4 Describe the causes</p> | <ul style="list-style-type: none"> • External and internal structures of the human eyes: External structures (Sclera, cornea, iris, pupil) include eyebrows and eyelashes: Internal (include lens, humours ,layers and optic nerve) • Functions of parts of eye: Pupil, Iris, Cornea, Tear gland, Conjunctiva, Sclera, retina • Accommodation of the eye: Refer to the process of producing a focused image of near and distant objects on the retina • The causes of short and long | <ul style="list-style-type: none"> • Investigating external and internal structures of the human eye • Communicating functions of parts of the eye • Analysing focusing of an image on the retina • Communicating causes of short and long | <ul style="list-style-type: none"> • Appreciating the functions of the eye • Developing curiosity in understanding accommodation of the eye • Being aware of causes and correction of short and long sightedness • Arousing curiosity on causes and methods of |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | <p>of short and long sightedness.</p> <p>11.6.2.5 Explain the correction of short and long sight.</p> <p>11.6.2.7 Investigate the common causes and methods of preventing blindness.</p> <p>11.6.2.8 Describe the structure of the human ears.</p> <p>11.6.2.9 Explain the functions of the parts of the ear.</p> <p>11.6.2.10 Describe causes and methods of preventing deafness.</p> <p>11.6.2.11 Describe the role of the skin as a sense organ</p> | <p>sightedness: <i>Refer</i> to loss of elasticity of the lens and abnormal eye ball and age</p> <ul style="list-style-type: none"> • Correction of short (use concave lens) and long sight (use convex lens) • Causes and methods of preventing blindness: (Vit A deficiency, filarial worm, physical injury and diabetes mellitus) Prevention (foods rich in Vitamin A, surgery and other measures) • Major parts of the ear: outer, middle and inner ears • Functions of each part of the ear: include eardrum, ossicles, Eustachian tube, cochlea and semi circular canals • Causes and methods of preventing deafness Causes: Methods of cleaning the ears; noise and disease. • Role of skin: Refer to Sensory receptors for heat, pain, touch and pressure | <p>sightedness</p> <ul style="list-style-type: none"> • Analysing correction of short and long sightedness • Investigating the common causes and methods of preventing blindness • Communicating major parts of the ear • Analysing functions of the parts of the ear • Communicating causes and methods of preventing deafness • Communicating role of the skin as a sense organ | <p>preventing</p> <ul style="list-style-type: none"> • Participating in class discussion actively. • Giving presentation • Listening to others with respect • Accepting responsibility of one's behavior |

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| | | | KNOWLEDGE | SKILLS | VALUES |
| 11.7 THE SKELETON AND LOCOMOTION | 11.7.1 Skeleton | 11.7.1.1 Identify various types of skeleton. 11.7.1.2 Describe the functions of the skeleton. | <ul style="list-style-type: none"> • Types of skeleton: endoskeleton, exoskeleton, hydrostatic • Functions of skeleton: Support, protection, structure and locomotion | <ul style="list-style-type: none"> • Comparing various types of skeleton • Classifying functions of the skeleton | <ul style="list-style-type: none"> • Developing curiosity • Cooperating in class activity |
| | 11.7.2 The Skeleton of an Insect | 11.7.2.1 Investigate the structure and composition of an exoskeleton. 11.7.2.2 Identify joints and muscles in the limbs of a grasshopper. | <ul style="list-style-type: none"> • Structure and composition of an exoskeleton: Refer to the position and composition of a skeleton of an insect • Joints and attachment of muscle (flexors and extensors) in the limbs of a grasshopper | <ul style="list-style-type: none"> • Investigating the structure and composition of an exoskeleton • Observing joints and muscles in the limbs of a grasshopper | <ul style="list-style-type: none"> • Developing curiosity • Cooperating in group activity • Listening to others with respect |
| | 11.7.3 The Mammalian Skeleton | 11.7.3.1 Identify the bones of the axial and the appendicular skeletons. 11.7.3.2 Explain a bone as a living tissue. | <ul style="list-style-type: none"> • Types of Skeleton: Axial skeleton (skull, vertebral column), Appendicular skeleton (girdles, limbs) • A tissue of bone: Refer to living cells in bones, production of red blood cells. (Include bone marrow cancer and TB) | <ul style="list-style-type: none"> • Observing bones of the axial and appendicular skeletons • Communicating information on the living cells in bones | <ul style="list-style-type: none"> • Actively participating in class activities • Giving presentation |
| | 11.7.4 Muscles and Joints | 11.7.4.1 Describe the structure of a skeletal muscle. | <ul style="list-style-type: none"> • Structure of skeletal muscle: Refer to shape and amount of mitochondria | <ul style="list-style-type: none"> • Observing the structure of the skeletal muscle. | <ul style="list-style-type: none"> • Actively participating in learning activities |

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| | | <p>11.7.4.2 Demonstrate the action of antagonistic muscles.</p> <p>11.7.4.3 Compare the ball and socket joint and the hinge joint.</p> <p>11.7.4.4 Identify the parts and functions of the synovial joint.</p> <p>11.7.4.5 Compare the joints, muscle attachment and movement in endoskeletons with those of exoskeletons</p> | <ul style="list-style-type: none"> • Action of antagonistic muscles: Refer to contraction and relaxation of biceps and triceps; circular and longitudinal muscles in iris • Joints: Refer to structure and movement of Ball and socket, and hinge joints. (Also refer to joint disorders e.g. gout) • Parts and functions of the synovial joint: Refer to Functions of the cartilage, ligament, capsule synovial fluid and membrane. • Muscle attachment and movement in an endoskeleton and exoskeleton. | <ul style="list-style-type: none"> • Demonstrating the action of antagonistic muscles. • Comparing the Ball and socket joint to the Hinge joint • Classifying the parts and functions of the synovial joint in a chart • Comparing similarities and differences between exoskeleton and endoskeleton. | <ul style="list-style-type: none"> • Asking questions for more understanding • Giving presentation • Accepting responsibility for one's behavior |
| 11.8 TROPIC AND TAXIC RESPONSES | 11.8.1 Tropic Responses | <p>11.8.1.1 Describe what tropic response is.</p> <p>11.8.1.2 Demonstrate growth responses exhibited by plants.</p> <p>11.8.1.3 Explain the effects of light energy and gravity on the growth of plants.</p> | <ul style="list-style-type: none"> • Tropic response: Growth responses in plants to water, light, chemicals and gravity • Growth responses: Phototropism, geotropism Hydrotropism and chemotropism in plants • Effects of light energy and gravity on growth of shoots and roots (Refer to the Auxin theory). | <ul style="list-style-type: none"> • Communicating growth responses in plants • Observing growth responses exhibited by plant • Analysing effects of light energy and gravity on the growth of roots and shoots | <ul style="list-style-type: none"> • Being aware of tropic responses in plants • Developing curiosity in growth response exhibited by plants • Listening to others with respect |

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| | 11.8.2 Taxic Responses | 11.8.2.1 Describe what taxic response is. 11.8.2.2 Explain responses exhibited by invertebrates. | <ul style="list-style-type: none"> • Taxic response: Movement of animals in response to stimulus (refer to light) • Responses exhibited by invertebrates: Refer to movement of woodlice and cockroaches to light | <ul style="list-style-type: none"> • Communicating movement of animals in response to stimulus • Observing movement of invertebrates in response to light | <ul style="list-style-type: none"> • Participating in class discussion • Cooperating in group activity |
| 11.9 GROWTH AND DEVELOPMENT | 11.9.1 Growth in Plants | 11.9.1.1 Explain the meaning of growth. | <ul style="list-style-type: none"> • Growth: Increase in number of cells, dry mass, complexity and size | <ul style="list-style-type: none"> • Communicating meaning of growth in organisms | <ul style="list-style-type: none"> • Appreciating meaning of growth |
| | | 11.9.1.2 Identify the regions of growth in stems and roots. | <ul style="list-style-type: none"> • Regions of growth in stems and roots: cell division ,elongation and differentiation | <ul style="list-style-type: none"> • Observing growth regions in stem and roots | <ul style="list-style-type: none"> • Being aware of the regions of growth in stem and roots |
| | | 11.9.1.3 Identify differentiated cells in plants. | <ul style="list-style-type: none"> • Differentiated cells: Refer to meristematic region differentiating into collenchymas, parenchyma, cambium, sclerenchyma, phloem, and xylem | <ul style="list-style-type: none"> • Observing differentiated cells in plants | <ul style="list-style-type: none"> • Asking questions to learn more about differentiated cells in plants |
| | | 11.9.1.4 Explain the differentiation of primary and secondary tissues in plants. | <ul style="list-style-type: none"> • Differentiation of primary and secondary tissues in plants | <ul style="list-style-type: none"> • Communicating differentiation of primary and secondary tissues in plants | |
| | 11.9.2 Germination and Development | 11.9.2.1 Distinguish the structure of a dicotyledonous and a monocotyledonous seed. | <ul style="list-style-type: none"> • Structure of a dicot and a monocot seed. | <ul style="list-style-type: none"> • Comparing structure of a dicot and monocot seed | <ul style="list-style-type: none"> • Appreciating the structure of a dicot and monocot seed |

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| | | | KNOWLEDGE | SKILLS | VALUES |
| | | <p>11.9.2.2 Investigate conditions necessary for germination.</p> <p>11.9.2.3 Demonstrate hypogeal and epigeal germination.</p> | <ul style="list-style-type: none"> • Conditions for germination: Suitable temperature, water and oxygen • Hypogeal and Epigeal germination: Epigeal (refer elongation of epicotyls in dicots) and hypogeal (refer to elongation of hypocotyls in monocots) germination | <ul style="list-style-type: none"> • Investigating the conditions necessary for germination • Recording the data of observation • Observing hypogeal and epigeal germination | <ul style="list-style-type: none"> • Appreciating the conditions necessary for germination • Cooperating in class activities • Knowing the safety rule of observation |

GRADE 12

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| <p>General outcomes:</p> <ul style="list-style-type: none">• Demonstrate understanding of asexual reproduction.• Demonstrate understanding of vegetative reproduction• Develop investigative skills• Demonstrate understanding of sexual reproduction in flowering plants.• Demonstrate understanding of sexual reproduction in animals.• Demonstrate understanding of genetics• Demonstrate knowledge, attitudes and values about plants and animals.• Acquire knowledge and value of soil.• Develop knowledge, positive attitudes and values about ecology.• Demonstrate knowledge, attitudes and values about population. | <p>Key Competences</p> <ul style="list-style-type: none">• Demonstrate the ability to identify the reproductive parts in flowering plants• Show the ability to demonstrate variation of characteristics in plants and animals• Demonstrate the ability to identify and classify different species of animals and plants• Demonstrate the ability to investigate the composition of soil.• Demonstrate the ability to design a food chain in a given ecosystem |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 12.1. ASEXUAL REPRODUCTION | 12.1.1 Reproduction in Fungi, Amoeba and Bacteria | 12.1.1.1 Describe the different types of reproduction. | <ul style="list-style-type: none"> Types of reproduction: Refer to asexual and sexual reproduction | <ul style="list-style-type: none"> Comparing different types of reproduction | <ul style="list-style-type: none"> Appreciating asexual reproduction in unicellular organisms |
| | | 12.1.1.2 Describe asexual reproduction in unicellular organisms. | <ul style="list-style-type: none"> Asexual reproduction in unicellular organisms (Refer to budding in yeast cells and bacteria, binary fission in amoeba) | <ul style="list-style-type: none"> Communicating information on reproduction in unicellular organisms | <ul style="list-style-type: none"> Actively participating in class activities. |
| | | 12.1.1.3 Describe the sexual and asexual reproduction in fungus. | <ul style="list-style-type: none"> Asexual and sexual reproduction in fungus (Refer to spores and zygospore) | <ul style="list-style-type: none"> Analysing the two types of reproduction in fungus | <ul style="list-style-type: none"> Appreciating importance of fungi and bacteria |
| | | 12.1.1.4 Explain the importance of fungi and bacteria. | <ul style="list-style-type: none"> Decomposition of organic matter and nutrient recycling. -Disease causing effects e.g. Ringworm and Bacillary dysentery. Production of a food and alcohol, source of food (mushroom) | <ul style="list-style-type: none"> Communicating importance of fungi and bacteria | <ul style="list-style-type: none"> Giving presentation Listening to others with respect |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | 12.1.2 Vegetative Reproduction | <p>12.1.2.1 Describe different methods of natural propagation.</p> <p>12.1.2.2 Investigate different methods of artificial propagation.</p> <p>12.1.2.3 Explain the advantages and disadvantages of vegetative propagation.</p> | <ul style="list-style-type: none"> • Different methods of natural propagation: Runners, rhizomes, corms, buds, suckers, stem tubers, root tubers, bulbs • Methods of artificial propagation: Refer budding, cuttings, grafting, layering • Advantages and disadvantages of vegetative propagation Advantages: cheap, genetic stability Disadvantages: overcrowding, no genetic variation. | <ul style="list-style-type: none"> • Comparing different methods of natural propagation • Investigating different methods of artificial propagation • Communicating advantages and disadvantages of vegetative propagation | <ul style="list-style-type: none"> • Being aware of different methods of natural propagation • Questioning new ideas in order to fully understand them. • Being aware of advantages and disadvantages of vegetative propagation. |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 12.2 SEXUAL REPRODUCTION IN FLOWERING PLANTS | 12.2.1 Reproduction in Plants | 12.2.1.1 Identify the parts of a typical flower. 12.2.1.2 Describe the functions of various parts of a flower. | <ul style="list-style-type: none"> Parts of a Flower: Calyx, corolla, pistil, stamens, receptacle Functions of parts of a flower: Refer to Calyx, corolla, pistil, stamens, receptacle | <ul style="list-style-type: none"> Observing parts of a typical flower Comparing various functions of parts a flower | <ul style="list-style-type: none"> Developing curiosity to learn more about reproduction in plants. Being aware of functions of parts of a flower. |
| | 12.2.2 Pollination | 12.2.2.1 Distinguish between two different types of pollination. 12.2.2.2 Distinguish between wind and insect pollination. 12.2.2.3 Describe the process of fertilization in flowers. 12.2.2.4 Investigate ways in which seeds and dispersed. 12.2.2.5 Explain the adaptation of fruits and seeds to mode of dispersal. 12.2.2.7 Explain the importance of fruit and seed dispersal. | <ul style="list-style-type: none"> Types of pollination: self pollination and cross pollination Wind and insect pollination (Include adaptive structures of wind and insect pollinated flowers) Process of fertilization in flowers: leading to fusion of male and female gametes include seed and fruit formation Seed dispersal: Refer to water, wind, animals and self mechanism. Adaptation of fruits and seeds: Scent, shape, colour of various parts Importance of dispersal: For plant propagation, plant preservation and survival | <ul style="list-style-type: none"> Comparing self and cross pollination Comparing wind and insect pollination Communicating information on the process of fertilization in plants Investigating seed and fruit dispersal Observing adaptive features for dispersal Communicating the importance of seed dispersal | <ul style="list-style-type: none"> Appreciating the two different types of pollination Participating in class discussions in order to understand wind and insect pollination Appreciating the process of fertilization in flowering plants Developing curiosity |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 12.3 REPRODUCTION IN ANIMALS | 12.3.1 Sexual Reproduction in Animals | 12.3.1.1 Describe the process of reproduction in a frog. | <ul style="list-style-type: none"> • Process of reproduction in frogs: Refer to number of eggs laid, nature of fertilisation, care of young (metamorphosis is not needed) | <ul style="list-style-type: none"> • <i>Communicating</i> the process of reproduction in a frog | <ul style="list-style-type: none"> • <i>Asking</i> questions in order to learn more about the reproduction in frogs • <i>Appreciating</i> animal life • <i>Cooperating</i> in class activity • <i>Listening</i> to others with respect |
| | | 12.3.1.2 Identify male and female reproductive organs in human beings. | <ul style="list-style-type: none"> • Reproductive organs: Male (Testes, Epididymis, sperm duct, urethra, penis, prostate gland, seminal vesicle) and female(ovaries, oviduct, uterus, cervix, vagina) | <ul style="list-style-type: none"> • <i>Identifying</i> the differences between male and female reproductive organs • <i>Communicating</i> functions of different reproductive organs | |
| | | 12.3.1.3 Explain the functions of the different organs of the human reproductive system. | <ul style="list-style-type: none"> • Functions of different organs: Testes, Epididymis, sperm duct, urethra, penis, prostate gland, seminal vesicle) and female(ovaries, oviduct, uterus, cervix, vagina) | <ul style="list-style-type: none"> • <i>Investigating</i> biological changes associated with sexual development • <i>Communicating</i> menstrual cycle in humans | |
| | | 12.3.1.4 Describe the biological changes associated with sexual development in human beings. | <ul style="list-style-type: none"> • Biological changes: Primary and secondary characteristics. (Include formation of gametes and onset of menstruation, role of hormones), Stimulating the production of sperms and ova | <ul style="list-style-type: none"> • <i>Investigating</i> processes of fertilization and implantation • <i>Investigating</i> causes of infertility in humans • <i>Communicating</i> the | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| | | 12.3.1.5 Describe the menstrual cycle. | <ul style="list-style-type: none"> Menstrual cycle: Stages, follicular growth and ovulation; roles of hormones (FSH, LH, Oestrogen, progesterone) | <ul style="list-style-type: none"> development of the embryo in the uterus | |
| | | 12.3.1.6 Explain the processes of fertilisation and implantation in human beings. | <ul style="list-style-type: none"> Processes of fertilisation and implantation: Fusing of sperm and ovum in oviducts; Implantation of embryo to the uterus wall | <ul style="list-style-type: none"> <i>Communicating</i> health risks associated with foetal development | |
| | | 12.3.1.7 Identify causes of infertility in human beings | <ul style="list-style-type: none"> Causes of infertility: Alcoholism, weak sperms, fibroids, blocked oviducts, ovulation disorders, STIs | <ul style="list-style-type: none"> <i>Communicating</i> knowledge on healthy pregnancy and safe childbirth | |
| | | 12.3.1.8 Describe development of the embryo in the uterus. | <ul style="list-style-type: none"> Development of embryo: Refer to the functions of amnion, amniotic fluid, umbilical cord and placenta | | |
| | | 12.3.1.9 Describe health risks associated with foetal development | <ul style="list-style-type: none"> Health Risks: Poor nutrition, smoking, alcohol and drugs/ herbal medicines during pregnancy | | |
| | | 12.3.1.10 Describe healthy pregnancy and safe child birth | <ul style="list-style-type: none"> Healthy pregnancy: Antenatal services, good nutrition, exercise, giving birth at a health facility, | | |

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| | | | avoiding taking harmful substances to the body. | | |
| | 12.3.2 Birth Control | <p>12.3.2.1 Explain some methods of birth control.</p> <p>12.3.2.2 Describe the benefits and possible risks of using contraceptives</p> | <ul style="list-style-type: none"> • Method of birth control: Refer to mechanical (Condoms, IUDs) surgical, hormonal and natural • Benefits and Risks of Contraceptives: Benefits: Planned families, Risks: side effects (Disturbed menstrual cycle, weight gain, and hormonal imbalance) | <ul style="list-style-type: none"> • <i>Comparing</i> different methods of birth control • <i>Communicating</i> benefits of using contraceptives | <ul style="list-style-type: none"> • <i>Appreciating</i> different methods of birth control • <i>Asking</i> questions in order to understand new ideas about contraceptives |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 12.4 GENETICS | 12.4.1 Variation in Plant and Animal Species | 12.4.1.1 Describe terms used in the study of genetics. | <ul style="list-style-type: none"> Terms used in the study of genetics: Gene, allele, chromosome, genotype, phenotype, dominant gene, recessive gene. | <ul style="list-style-type: none"> Communicating terms in genetics. | <ul style="list-style-type: none"> Developing curiosity in understanding variations in human beings Asking questions to learn more about continuous and discontinuous variation Participating in group discussion Cooperating in class activity Listening to others with respect |
| | | 12.4.1.2 Describe the variations in human beings. | <ul style="list-style-type: none"> Variation in human being: Eye colour, skin colour, finger print, tongue rolling, height, ear lobes). | <ul style="list-style-type: none"> Classifying variations in human beings Observing variations of flowers in the locality | |
| | | 12.4.1.3 Observe variations in flowering plants. | <ul style="list-style-type: none"> Variations in flowering plant: Fruit structure and scent, height (tall, dwarf. Include leaf size, shape, and weight). | <ul style="list-style-type: none"> Comparing continuous and discontinuous variation in species | |
| | | 12.4.1.4 Distinguish between continuous and discontinuous variations. | <ul style="list-style-type: none"> Continuous and discontinuous variations in human being: Continuous(refer to height ,skin colour, body mass) and discontinuous variations (eye colour, blood group, sex and tongue rolling) | <ul style="list-style-type: none"> Communicating factors that cause variations among plant and animals of the same species | |
| | | 12.4.1.5 Describe the factors that cause variations among plant and animals of the same species. | <ul style="list-style-type: none"> Factors that cause variations: Refer to climatic factors, nutrition, soils. | | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | 12.4.2 Cell Division and Chromosomes | <p>12.4.2.1 Describe the stages of cell division.</p> <p>12.4.2.3 Explain the importance of mitosis and meiosis.</p> | <ul style="list-style-type: none"> • Stages of cell division in mitosis and meiosis: (Refer to chromosome and double strand of DNA). • Importance of mitosis and meiosis: Refer to growth and reproduction. Include uncontrolled cell division(cancer) | <ul style="list-style-type: none"> • Comparing stages of cell division • Communicating importance of mitosis and meiosis | <ul style="list-style-type: none"> • Appreciating the stages of cell division • Appreciating the importance of mitosis and meiosis |
| | 12.4.3 Inheritance | <p>12.4.3.1 Explain what a monohybrid inheritance is.</p> <p>12.4.3.2 Demonstrate the inheritance of human characteristics using the crossings</p> <p>12.4.3.3 Explain the factors that determine the sex of a human being.</p> <p>12.4.3.4 Explain the inheritance of sex linked characteristics.</p> | <ul style="list-style-type: none"> • Monohybrid crosses: Refer to homozygous, heterozygous recessive, dominant, F₁, F₂ generation, offspring, ratio, gene, chromosomes, alleles, phenotype and genotype, gamete. • Inheritance of human characteristics: Refer to height, eye colour, albinism, sickle cell. • Sex of a human being: (Refer to X and Y chromosomes) • Inheritance of sex linked to characteristics (Refer to red, green colour blindness and haemophilia). | <ul style="list-style-type: none"> • Interpreting chromosomes and the genes they carry. • Inferring the genotype and phenotype of the offspring. • Demonstrating the inheritance of characteristics using the crosses. • Communicating information on the X and Y chromosomes. | <ul style="list-style-type: none"> • Asking questions in order to understand the outcomes of monohybrid crossings • Developing curiosity to learn more about inheritance of human characteristics • Appreciating sex determination in human being • Giving presentation • Appreciating the mechanism of inheritance blood groups • Accepting responsibility of one's behavior |

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| | | | KNOWLEDGE | SKILLS | VALUES |
| | | 12.4.3.5 Describe the mechanism of ABO blood groups inheritance. | <ul style="list-style-type: none"> Mechanism of ABO blood groups inheritance: Refer to alleles I^A, I^B, I^O; dominance, co-dominance and recessive | <ul style="list-style-type: none"> Analyzing the mechanism of ABO blood groups inheritance | |
| | 12.4.4 Mutation | <p>12.4.4.1 Describe what mutation is.</p> <p>12.4.4.2 Identify the causes of mutation.</p> <p>12.4.4.4 Explain effects of mutation.</p> <p>12.4.4.5 Describe the uses of mutations</p> | <ul style="list-style-type: none"> Mutation (refer to permanent changes in structure of chromosomes and genes). Causes of mutation: Natural radiation (nuclear emission, and x-rays, ultra-violet light). Effects of mutation: Down's Syndrome, haemophilia, sickle cell anaemia Uses of mutations: Induced mutation in Agriculture. (Polyploidy plants). | <ul style="list-style-type: none"> Communicating information on mutation Investigating causes of mutations Investigating effects of mutations Communicating uses of mutations | <ul style="list-style-type: none"> Being aware of permanent changes in structure of chromosomes and genes Asking questions in order to understand mutation Awareness of effects of mutation Appreciating the uses of mutations |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 12.5 CLASSIFICATION OF PLANTS AND ANIMALS | 12.5.1 Classification | 12.5.1.1 Identify various types of plants. | <ul style="list-style-type: none"> Types of plants: Chlorophytes (Algae), Bryophytes (mosses, ferns), coniferous plants and flowering plants. | <ul style="list-style-type: none"> Classifying plants into different phyla. | <ul style="list-style-type: none"> Appreciating various characteristic features of different types of plants Appreciating characteristic features of different animals Asking questions in order to formulate simple dichotomous keys for plants and animals Actively participating in class activities. |
| | | 12.5.1.2 Identify various types of animals. | <ul style="list-style-type: none"> Types of mammals: reptiles, amphibians, birds, arthropods and protozoa. | <ul style="list-style-type: none"> Classifying animals into their classes. Formulating classification keys. Applying use of a classification key. | |
| | | 12.5.1.3 Formulate a simple key for classification of plants and animals. | <ul style="list-style-type: none"> Simple keys for classification: Refer to Dichotomous keys. | | |
| | | 12.5.1.4 Use a simple classification key to identify plants and animals. | <ul style="list-style-type: none"> Identify classes of vertebrates and common invertebrates using simple classification keys. | | |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 12.6 THE SOIL | 12.6.1 Soil Composition and Fertility. | 12.6.1.1 Demonstrate soil composition. | <ul style="list-style-type: none"> • Soil composition: Air, micro-organism, soil particles, humus | <ul style="list-style-type: none"> • Observing the composition of soil using a soil sample | <ul style="list-style-type: none"> • Appreciating soil composition |
| | | 12.6.1.2 Describe the types of soil and their properties. | <ul style="list-style-type: none"> • Types and Properties of soil: types; Clay, Loam and sand soils | <ul style="list-style-type: none"> • Classifying the types of soils and their properties. | <ul style="list-style-type: none"> • Appreciating different types of soil |
| | | 12.6.1.3 Describe factors that make soil fertile. | <ul style="list-style-type: none"> • Factors that make soil fertile: Air, micro organisms, moisture, mineral elements, organic matter, pH | <ul style="list-style-type: none"> • Communicating factors that make soil fertile. | <ul style="list-style-type: none"> • Cooperating in group activities |
| | | 12.6.1.4 Investigate causes of loss of fertility in soil. | <ul style="list-style-type: none"> • Causes of loss of fertility in soil: Deforestation, poor farming methods, late burning, overgrazing, leaching, harvesting | <ul style="list-style-type: none"> • Investigating causes of loss of fertility in soil. | <ul style="list-style-type: none"> • Being aware of factors that make soil fertile |
| | | 12.6.1.5 Explain methods of improving and retaining soil fertility. | <ul style="list-style-type: none"> • Methods of improving and retaining soil fertility: Suitable pH, weeding, application of fertiliser, crop rotation, conservation farming | <ul style="list-style-type: none"> • Communicating methods of improving and retaining soil fertility | <ul style="list-style-type: none"> • Asking questions in order to identify causes of soil fertility |
| | | 12.6.1.6 Determine the distribution of earth worms in different types of soils | <ul style="list-style-type: none"> • Distribution of earth worms: Refer to sand, loam, clay of different acidity, alkalinity, moisture or water and plant population | <ul style="list-style-type: none"> • Investigating the distribution of earth worms in different types of soils | <ul style="list-style-type: none"> • Developing curiosity in the distribution of earth worms in different types of soils |

| TOPIC | SUB-TOPIC | SPECIFIC OUTCOMES | CONTENT | | |
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| | | | KNOWLEDGE | SKILLS | VALUES |
| 12.7 ECOLOGY | 12.7.1 Biotic and Abiotic Interactions. | 12.7.1.1 Explain the term ecology. 12.7.1.2 Explain the terms used in ecology | <ul style="list-style-type: none"> Ecology: Interaction of organisms with their environment Ecological terms: Habitat, niche, population, community (Refer to specialisation and adaptation to a specific habitat) | <ul style="list-style-type: none"> Communicating the term ecology Communicating terms used in ecology | <ul style="list-style-type: none"> Appreciating interaction of organisms with their environment Asking questions in order to understand terms used in ecology |
| | 12.7.2 Feeding Relationships and Energy Flow | 12.7.2.1 Design a food chain. 12.7.2.2 Design a food web. 12.7.2.3 Describe the way energy flows along food chains and food webs. 12.7.2.4 Describe the efficiency of energy transfer between trophic levels. 12.7.2.5 Construct pyramids of numbers, bio-mass and energy | <ul style="list-style-type: none"> Food Chain: Producer, Consumer and Decomposer. Food web (Relate the food chain to development of a food web). Energy flow: Refer to ultimate source of energy as being sunlight; non-cyclical nature of energy flow. Efficiency of energy transfer between trophic levels (Refer to 90% loss of energy at each level). Pyramids of numbers, bio-mass and energy (Refer to diagrammatic representation) | <ul style="list-style-type: none"> Designing a food chain Formulating a model of food web Designing the way energy flows along trophic levels Analysing the efficiency of energy transfer between trophic levels Constructing pyramids of numbers, biomass and energy | <ul style="list-style-type: none"> Appreciating linear and webbed feeding relationships Appreciating flow and efficiency of energy Developing curiosity about pyramids of numbers, bio-mass and energy Participating in group activity Giving presentation Listening to others with respect |

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| | 12.7.3 Population | <p>12.7.3.1 Explain the term population.</p> <p>12.7.3.2 Investigate factors that cause change in population size.</p> <p>12.7.3.3 Interpret population data.</p> | <ul style="list-style-type: none"> Population: Refer to different species in a community. Change in population size: Refer to natural disasters, disease, immigration, emigration, and wars. Refer to graphs, histograms, tables and pie charts | <ul style="list-style-type: none"> Communicating the term population Investigating factors that cause change in population size Collecting population data Interpreting population data | <ul style="list-style-type: none"> Being aware of population, factors that cause change in population size Appreciating population data. |
| | 12.7.4 Carbon and Nitrogen, Water Cycles | <p>12.7.4.1 Describe how carbon and nitrogen are cycled within an ecosystem.</p> <p>12.7.4.2 Describe what the water cycle is.</p> | <ul style="list-style-type: none"> Carbon and nitrogen cycles: Include the roles of micro-organisms Water cycle (Relate to human and environmental factors) | <ul style="list-style-type: none"> Communicating how carbon and nitrogen are cycled Collecting the data on water cycle Formulating the cycle of water in environment | <ul style="list-style-type: none"> Appreciating the water cycle Participating in group discussion Giving presentation Listening to others with respect |
| | 12.7.5 Ecosystem | <p>12.7.5.1 Investigate key features of an ecosystem.</p> <p>12.7.5.2 Explain the effects of Agriculture on an ecosystem.</p> <p>12.7.5.3 Describe the effects of deforestation on soil stability and climate.</p> | <ul style="list-style-type: none"> Features of an ecosystem: Community and Non-living part of environment (Use a pond as an example). Effects of agriculture on ecosystem: Refer to water, soil and air pollution. Effects of deforestation: Soil erosion, global warming. | <ul style="list-style-type: none"> Investigating key features of an ecosystem Communicating the effects of Agriculture on an ecosystem. Analysing effects of deforestation on soil stability and climate | <ul style="list-style-type: none"> Being aware of effects of agriculture on an ecosystem Being aware of effects of deforestation on soil stability and climate Participating in group discussion Listening to others with respect |

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| | 12.7.6 Pollution | <p>12.7.6.1 Describe the undesirable effects of pollution.</p> <p>12.7.6.2 Determine measures to prevent pollution.</p> | <ul style="list-style-type: none"> • Undesirable effects of pollution on water, air and land • Measures to prevent pollution: Refer to waste management. Use of filters in chimneys. Include the conversion of sulphur dioxide to sulphuric acid by passing it through a tank of water | <ul style="list-style-type: none"> • Analysing undesirable effects of pollution on our life • Communicating measures to prevent pollution | <ul style="list-style-type: none"> • Caring for the environment by understanding the undesirable effects of pollution • Applying preventive measures of pollution to daily life |
| | 12.7.7 Conservation | <p>12.7.7.1 Identify the importance of conserving plant and animal species.</p> <p>12.7.7.2 Explain how to reuse, reduce and recycle materials.</p> <p>12.7.7.3 Investigate the importance of sustainable use of resources</p> | <ul style="list-style-type: none"> • Importance of conserving plant and animal species (Refer to endangered species) • 3Rs: Reduce, Reuse, Recycle • Sustainable use of resources: Avoid deforestation, over fishing, over hunting; encourage game keeping | <ul style="list-style-type: none"> • Communicating the importance of conserving plant and animal species • Investigating the ways of 3Rs • Investigating the importance of sustainable use of resources | <ul style="list-style-type: none"> • Being aware of the importance of conserving plant and animal species • Applying the idea of 3Rs to daily life • Caring for the sustainable use of resources |
| | 12.7.8 Bio-diversity | <p>12.7.8.1 Investigate diversity of organisms in a given locality.</p> <p>12.7.8.2 Investigate the importance of diversity of organisms in given locality</p> <p>12.7.8.3 Explain how some organisms are adapted to the</p> | <ul style="list-style-type: none"> • Bio-diversity: Refer to school grounds, a pond or nearby wetland organic reserves. • Importance of biological diversity: Refer to equilibrium of organisms in the ecosystem • Adaptations of organisms: Refer to adaptive | <ul style="list-style-type: none"> • Investigating diversity of organisms in a given locality • Communicating importance of organisms in a given locality • Observing adaptive characteristics of organisms in an | <ul style="list-style-type: none"> • Appreciating different species of organisms in a given locality • Developing curiosity in the adaptation of organisms in the environment • Conserving organisms for |

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| | | <p>environment</p> <p>12.7.8.4 Investigate the impact of human activity on organisms</p> <p>12.7.8.5 Describe the economic reasons for maintaining bio-diversity.</p> | <p>characteristics of fish, insects, mammals and plants.</p> <ul style="list-style-type: none"> • Impact of human activities on organisms: Refer to hunting, fishing, and charcoal production. Also refer to the threatened extinction of the African elephant. • Maintaining biodiversity: Refer to tourism, medicinal plants and animal, source of food. | <p>environment</p> <ul style="list-style-type: none"> • Investigating the impact of human activity on organisms • Communicating economic reasons for maintaining bio diversity | <p>future generations</p> <ul style="list-style-type: none"> • Appreciating economic importance of maintaining biodiversity • Applying the idea of bio-diversity to daily life |
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APPENDIX 1: SCOPE & SEQUENCE CHART

The following table shows the “Scope and Sequence” of Biology syllabus from G10 to G12.

| GRADE 10 | | GRADE 11 | | GRADE 12 | |
|--|--|--------------------------------------|----------------------------|--------------------------------------|---|
| TOPIC | SUB-TOPIC | TOPIC | SUB-TOPIC | TOPIC | SUB-TOPIC |
| 1.0: Living Organisms and life processes | 10.1.2 Characteristics of living organisms | 1.0: Transport and storage in Plants | 11.1.1 Transport in plants | 1.0: Asexual reproduction | 12.1.1 Reproduction in fungi, amoeba and bacteria |
| 2.0: Cells | 10.2.1 Microscopes | 2.0: Transport in Human | 11.2.1 Blood | | 2.0: Sexual Reproduction in Flowering Plants |
| | 10.2.2 Cell Structure and Function | | 11.2.2 Blood Groups | 12.2.1 Reproduction in plants | |
| | 10.2.3 Cell Organisation | | 11.2.3 Blood disorders | 12.2.2 Pollination | |
| | 10.2.4 Tissues | | 11.2.4 The heart | 3.0: Reproduction in Animals | 12.3.1 Sexual reproduction in animals |
| | 10.2.5 Organs | | 11.2.5 Lymphatic system | | 12.3.2 Birth Control |
| | 10.2.6 Diffusion, Osmosis and Active transport | | 11.2.6 Circulatory systems | 4.0: Genetics | 12.4.1 Variation in plant and animal species |
| 3.0: Enzymes | 10.3.1 Characteristics of enzymes | 3.0: Excretion | 11.3.1 Excretion | 12.4.2 Cell division and Chromosomes | |
| 4.0: Nutrients | 10.4.1 Classes of nutrients | | 11.3.2 The kidney | | 12.4.3 Inheritance |
| | | | 11.3.3 The lungs | | |
| | 10.4.2 Disorders | | 11.3.4 The human skin | | 5.0: Classification of Plants and Animals |
| | 10.4.3 Dietary needs | 4.0: Homeostasis | 11.4.1 Homeostasis | 6.0: The Soil | 12.6.1 Soil Composition |
| 10.4.4 Plant | | | | | |

| GRADE 10 | | GRADE 11 | | GRADE 12 | |
|----------------------------|--|--|------------------------------------|--------------|--|
| TOPIC | SUB-TOPIC | TOPIC | SUB-TOPIC | TOPIC | SUB-TOPIC |
| | Nutrients | | | | and fertility |
| 5.0: Nutrients in Plants | 10.5.1 External and internal structure of a leaf | 5.0: The Endocrine system | 11.5.1 Hormones | 7.0: Ecology | 12.7.1 Biotic and abiotic interactions |
| 6.0: Saprophytic nutrition | 10.6.1 Rhizopus | 6.0: The Nervous system and Sense organs | 11.6.1 The nervous system | | 12.7.2 Feeding relationships and energy flow |
| 7.0: Nutrition in animals | 10.7.1 Dentition in mammals | | 11.6.2 Sense organs | | 12.7.3 Population |
| | 10.7.2 Holozoic nutrition | 7.0: The Skeleton and locomotion | 11.7.1 Skeleton | | 12.7.4 Carbon and nitrogen, Water cycles |
| 8.0: Respiration | 10.8.1 Gaseous exchange | | 11.7.2 The skeleton of an insect | | 12.7.5 Ecosystem |
| | 10.8.2 Types of Respiration | | 11.7.3 The mammalian skeleton | | 12.7.6 Pollution |
| 9.0: Health | 10.9.1 Diseases | | 11.7.4 Muscles and joints | | 12.7.7 Conservation |
| | 10.9.2 HIV and AIDS | 8.0: Tropic and Taxic responses | 11.8.1 Tropic responses | | 12.7.8 Bio-diversity |
| | 10.9.3 Immunity | | 11.8.2 Taxic Responses | | |
| | 10.9.4 The life cycle of the housefly and the mosquito | 9.0: Growth and development | 11.9.1 Growth in Plants | | |
| | | | 11.9.2 Germination and development | | |