



Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

JUNIOR SECONDARY PHASE

LIFE SCIENCE SYLLABUS

GRADE 8 & 9

**For implementation:
Grade 8 in 2025
and
Grade 9 in 2026**

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Life Science Syllabus Grade 8 & 9

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1. INTRODUCTION

This syllabus describes the intended learning outcomes and assessment practices for Life Science in the Junior Secondary phase within the natural sciences mainstream. The learning experiences and subsequent outcomes in the natural science subjects are tailored towards promoting the learners' knowledge and understanding of science inquiry skills and science as a human endeavour of the physical, biological and technological world of which they are part. The Life Science syllabus for the Junior Secondary phase therefore integrates natural science, social, economic, physical, mathematical and technological learning areas of the broad curriculum. Thus the themes, topics, aims, learning objectives, and competencies in the Life Science syllabus embrace the content matter in all other subjects across the curriculum.

Critical thinking, investigating phenomena, interpreting data, and applying knowledge to experimental skills are essential to understanding the value and limitations of natural scientific knowledge and methods, and their application to daily life. The application of scientific knowledge and attitudes to health and environment is of special relevance for the individual, the family, and society as a whole.

Furthermore, the Life Science syllabus is developed in a clear and simple style in order to provide new innovations in conceptual learning based on the ethos of learner-centred education. Learner-centred education presupposes that teachers have a holistic view of the learner, valuing the learner's life experience as the focal point of learning and teaching. Teachers should therefore select learning content and methods on the basis of the learners' needs within their immediate environment and community.

2. RATIONALE

Learning experiences in the natural science area are focused upon promoting the teaching and learning for understanding. Namibia, like most African countries, is rich in natural resources. The exploration of these resources requires scientific knowledge and relevant skills. The acquisition of scientific knowledge and skills presents itself as a prerequisite for a progressive national economy and the improved standard of life for our people. It is thus important for our learners to acquire knowledge and skills which will foster their understanding of the interaction of human beings and the environment in order to satisfy human needs. It must be understood that the physical and biological world around us is quite complex and therefore needs to be understood in a holistic manner by the society in order to sustain natural resources.

The sustainability of our natural resources, however, requires advanced technology through the efficient and effective usage of equipment, materials and processes. Modern technology is required in order to assist our learners and society to solve problems through planning, design, realisation, and evaluation of activities and goals.

3. AIMS

The main aim of the syllabus in the natural science area is therefore to provide basic scientific background for our learners with the hope of producing the much-needed scientists for the country. The Namibian society needs to be scientifically literate if they are to cope with the challenges of appropriate global technology requirements.

Life Science promotes the following aims in the curriculum:

Knowledge with understanding

- develop knowledge, understanding, creativity, practical and experimental skills as a solid foundation for academic training to prepare learners for creative and meaningful adult life
- help learners develop self-confidence, self-knowledge and understanding of the world in which they live, through meaningful scientific activities

Values and attitudes

- develop a sense of responsibility towards the environment, relating scientific practices to sustainable use of natural resources
- demonstrate desirable behavioural patterns and frame of mind in interacting with the environment in a manner that is protective, preserving and nurturing
- develop attitudes and practices, further knowledge and activities that promote the physical and mental health of the society
- develop and enhance respect for, understanding of, and tolerance of other people's beliefs, cultures and way of life

Scientific skills

- develop a lively, questioning, appreciative and creative intellect to enable learners to discuss issues rationally, make careful observations and analysis, think scientifically, solve problems and apply them to tasks
- promote Information Communication Technology (ICT) as a tool to enhance understanding of the learning content

Democratic principles

- promote equality of opportunity for males and females, enabling both sexes to participate equally and fully in all spheres of society and fields of employment
- lay a foundation for informed and responsible attitudes and choices towards the balance of population growth, ecological sustainability, and the quality of life for all citizens of Namibia

4. INCLUSIVE EDUCATION

Inclusive education is the right of every learner and promotes access to and participation in the full range of educational programmes and services offered by the education system in mainstream schools. It is based on the principle of supporting and celebrating the diversity found among all learners and removing all barriers to learning. The Life Science teacher in the Junior Secondary Phase should therefore accommodate learners with special educational needs by adapting this syllabus to the needs of the learner through differentiation of teaching methods and material as indicated in the *Curriculum Framework for Inclusive Education (2023)*. The adaptation for assessment of learners with special educational needs must be done as prescribed in the *Handbook for Centres (2022)* by the Directorate of National Examinations and Assessment (DNEA). The accommodations prescribed in this handbook are not only for external examinations, but apply to learners from Grades 1 to 12.

Learners who are so severely impaired that they cannot benefit from attending mainstream schools will be provided for according to their needs in learning support units, resource units or resource schools until such time that they can join a mainstream school structure, if possible. Therefore including gender perspectives is important for the science curriculum in order to raise awareness of gender stereotyping (e.g. gender roles we previously associated with doctors, nurses, farmers, artisans, mechanics, lawyers etc). Teachers are obliged to promote gender equity in all spheres of life. In all activities carried out within the scientific area of study, female learners should experience the confidence which will motivate them to continue in the natural science stream throughout their school career and beyond.

5. LINKS TO OTHER SUBJECTS AND CROSS-CURRICULAR ISSUES

The cross-curricular issues include environmental education, HIV and AIDS, population education, education for human rights and democracy (EHRD), information and communication technology (ICT) and road safety. These issues have been introduced to the formal curriculum, because each of the issues deals with particular risks and challenges in our Namibian society. They should be dealt with across all phases and in every subject where the topics overlap with the content of that subject.

All of our learners need to:

- understand the nature of these risks and challenges;
- know how they will impact our society and the quality of life of our people now and in the future;
- understand how these risks and challenges can be addressed on a national and global level;
- understand how they can play a part in addressing these risks and challenges in their own school and local community.

The main risks and challenges have been identified as:

- the challenges and risks we face if we do not care for and manage our natural resources;
- the challenges and risks caused by HIV and AIDS;
- the challenges and risks to health caused by pollution, poor sanitation and waste;
- the challenges and risks to democracy and social stability caused by inequity and governance that ignores rights and responsibilities;
- the challenges and risks we face if we do not adhere to road safety measures; and
- the challenges and risks we face because of globalisation.

Since some subjects are more suitable to address specific cross-curricular issues, those issues will receive more emphasis in those particular syllabuses.

In this syllabus the following cross-curricular issues can be dealt with in the topics as indicated:

Cross-curricular issues	Grade 8	Grade 9
Environmental Learning	4. Plants and their abiotic environment 7. Ecosystem 3. Living organisms	3. Classification of living organisms 5. Diversity of living organisms 8. Ecology
HIV and AIDS	2. Health Education	2. Health Education
ICT	1. Process skills: Hand lens and light microscope	1. Process skills: Hand lens and light microscope
EHRD	7. Environment	8. Ecology
Population education	6. Ecosystem Human impact on environment	8. Ecology: Human impact on environment
Road safety		7. Human body: Nervous system

6. APPROACH TO TEACHING AND LEARNING

The approach to teaching and learning is based on a paradigm of Learner-Centred Education (LCE) described in ministerial policy documents and the LCE conceptual framework. This approach ensures optimal quality of learning when the principles are put into practice.

The aim of learner-centred education is to develop learning with understanding, and to impart the knowledge, skills and attitudes that contribute to the development of society. The starting point for teaching and learning is the fact that the learner brings to the school a wealth of knowledge and experience gained continually from the family, the community, and through interaction with the environment. Learning in school must involve, build on, extend and challenge the learner's prior knowledge and experience

Learners learn best when they are actively involved in the learning process through a high degree of participation, contribution and production/investigation. At the same time, each learner is an individual with his/her own needs, pace of learning, experience and abilities so the teacher must be able to sense the needs of learners, the nature of the learning to be done, and how to shape learning experience accordingly. Teaching strategies must therefore be varied but flexible within well-structured sequences of lessons.

The teacher must decide, in relation to the learning objectives and competencies in Life Science curriculum to be achieved when:

- it is best to convey content directly;
- it is best to let learners discover or explore information for themselves;
- learners need directed learning;
- learners need remedial and enrichment teaching and support;
- there is a particular progression of skills or information that needs to be followed;
- learners can be allowed to find their own way through a topic or area of content.

It is important to make sure that when learners work in groups, in pairs, individually, or as a whole, for the class to be organised as appropriate to the task in hand. Co-operative and collaborative learning should be encouraged whenever possible. In such cases, tasks must be designed so that pair or group work is needed to complete it, otherwise the learners will

not see any relevance in carrying out tasks together. As the learners develop personal, social and communication skills, they can gradually be given increasing responsibility to participate in planning and evaluate their work, under the teacher's guidance.

The learning content in this syllabus is based on the Namibian context, although the themes and topics are on a variety of scales to meet international standards. Teachers are therefore urged where appropriate to use local examples to illustrate scientific issues, concepts and processes.

7. END-OF-PHASE COMPETENCIES

On entry to the Junior Secondary phase, all learners are expected to be able to manage the minimum number of specific objectives and must receive Learning Support through adapted teaching approaches, adapted materials, and assistance from peers. A small number of learners have special educational needs to a degree which requires greater individual attention, resources or assessment. Others will have impairments which do not necessarily limit cognitive and affective learning and development, e.g. the visually impaired, hearing impaired and physically challenged.

Upon completion of the Junior Secondary phase of education in Life Science, learners are expected to be able to:

Scientific processes

Know how to make and record measurements of length, volume, rate, temperature, mass, amount of substance and use SI units. Understand basic laboratory rules and know how to handle/use apparatus/equipment and follow established safety procedures with regard to their safety during scientific investigations. Use methods and skills of simple scientific models on the basis of existing and new information to communicate their investigations, analyses and conclusions using basic scientific and mathematical language and theories.

Health education

Demonstrate an understanding of how sexually transmitted infections (STIs) are spread or transmitted, prevented and treated; know the importance of immunization and the role of antibodies in the body.

Realise the impact of HIV on the immune system and know methods used to diagnose HIV; appreciate the importance of antiretroviral drug (ARV) treatment, vaccination (as a defence mechanism against infectious diseases) and traditional medicine. Apply the skills and knowledge to maintain a safe and healthy lifestyle.

Characteristics of living organisms

Understand the binomial system of nomenclature/taxonomy; know the major levels of classification and how to classify organisms, found in their locality; use simple dichotomous keys to identify organisms; demonstrate knowledge of the characteristics of living things; know and understand the three major tenets of cell theory, structure and functions of cells and their organelles.

Realise that organisms are divided into five kingdoms and the phylum chordata into five (5) major classes; know the external diagnostic features of each class.

Demonstrate an understanding of the passage of substances through diffusion, osmosis and active transport for the movement of molecules/particles.

Plants as living organisms

Understand that plants and animals (including humans) have basic requirements for maintaining life which include the need for air, water and a source of energy; know that all life forms can be classified as producers, consumers, or decomposers as they are all part of a global food chain/web.

Understand that all living organisms are composed of cells; understand that cells grow and divide to form many cells which perform specialized functions.

Know the external and internal structure and adaptations of a leaf; know the features of gaseous exchange surfaces in plants and understand the functions of the parts of a leaf.

Know and understand the features of monocotyledons and dicotyledons; realise the importance of the process of photosynthesis and know the word equation for photosynthesis.

Realise the importance of respiration and know the word equation for respiration.

Realise the importance root hairs and xylem and their role in transpiration; know examples of plants that are adapted to arid environments.

Know the structure and function of flowers as reproductive organs in plants.

Human Biology

Know the parts and functions of the digestive and breathing systems and understand the functions of the gross structures and appreciate the importance of breathing for cell respiration and realise the relationship between the rate of breathing and level of activity and how the build-up of cholesterol in the circulatory system can lead to functional disorder.

Know the gross structures of the circulatory system, the function of the heart, capillaries, arteries, veins and the components of blood and the significance of differences in muscular structure.

Know the differences between organic and inorganic and macro and micro nutrients; understand the characteristics of the main categories of nutrients and understand the functions and nutritional value of each category; know the symptoms and diseases related to a deficient nutrient and the relationship between nutrition and the health, sex and age of a person.

Know and understand the structures of the excretory and nervous systems; realise that alcohol and drug abuse affect the function of the nervous system; know that excretory system involves the lungs, skin and renal system; realise the importance of sense organs in responding to stimuli from the environment.

Know and understand the structure and function of the male and female reproductive systems; realise the importance of sex hormones including their roles in the menstrual cycle and describe the processes from conception to birth.

Ecosystem

Demonstrate an understanding of the interdependence of living organisms in their environments; understand the impact of human activities on the environment; understand the flow of energy and cycling of matter (water and carbon) through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.

Know and understand that natural resources can be depleted and damaged by pollution; know how to safeguard the environment by reducing the greenhouse effect and the release of CFCs, which cause global warming; know local and global ecological effects of global warming on the environment.

Know the role and importance of the ozone layer to living organisms and understand human activities that cause the depletion of the ozone layer; know how the physical and physiological dimensions of the environment can affect the health of people and animals.

8. SUMMARY OF THE LEARNING CONTENT

Teachers should realise that there are certain aspects of the syllabus that should not be taught as separate entities and at fixed times during the school year. These include general knowledge, field trips, project work, investigations and observations including social events.

Table: Summary of learning content for Life Science Grade 8 & 9

Grade 8		Grade 9	
Scientific Processes and Experimental Techniques			
Topic 1	Scientific processes	Topic 1	Scientific processes
Health Education			
Topic 2	Sexual health and diseases	Topic 2	The body's immune system
Living organisms			
Topic 3	Living organisms	Topic 3	Classification of living organisms
Topic 4	Passage of substances	Topic 4	Cell theory
Topic 5	Plants as living organisms	Topic 5	Diversity of living organisms
Human Biology			
Topic 6	Human Biology	Topic 6	Nutrition
-		Topic 7	Human body
Environment			
Topic 7	Ecosystem	Topic 8	Ecology

9. LEARNING CONTENT

Introduction to learning content

The learning content outlined below is designed to provide guidance to teachers as to what will be assessed in the overall evaluation of learners. It is not meant to limit, in any way, the teaching program of any particular school.

The learning content is set out in two columns headed by Topics *and* Sub-topics

The two columns are:

(a) General Objectives

(b) Specific Objectives

The **General Objectives** are derived from the topic and are the general knowledge, understanding and demonstration of skills on which learners will be assessed.

The **Specific Objectives** are the detailed and specified content of the syllabus, which learners need to master to achieve the general objectives, and on which they will be assessed.

The practical activities or demonstrations included in each topic **are considered essential** and all learners should be exposed to them, both during teaching and as preparation for assessment.

9.1 Grade 8 learning content

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 8 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
Topic 1 SCIENTIFIC PROCESSES This topic is an introduction to some of the basic scientific skills. These skills are considered basic and should not be taught in isolation, as they form an integral part of other topics and all learners should be exposed to them as a minimum requirement.	
1.1 Stating the aim (question) of an investigation	
- realise the value of investigations to understand the world around us and to check the results of other scientists - know when a test is fair or unfair	- outline that investigations are a way to find out new information, explore the world around us, develop new ideas to explain the world around us and to check the results of other scientists - explain the first steps of scientific method as: - choosing the right question or aim of the investigation - make a guess on the outcome of the results (hypothesis) - planning how to collect information or data - describe how to make a test fair by identifying an appropriate control - identify dependent (what is measured) and independent variables (what you are changing)
1.2 Estimating and measuring	
know how to estimate and measure volume, length, mass, time and temperature and use apparatus appropriately	- carry out experiments, following a sequence of diagrammatic and written instructions and record estimates and measurements - use appropriate techniques; handle apparatus/material competently and have due regard to safety - calculate magnification of an object or specimen - state the functions of the various parts of the microscope - use and manipulate a microscope - estimate or measure, volume, length, mass, time/rate and temperature - record and organise data in tables using standard measurements - convert units of volume, length, mass, and temperature

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 8 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
Topic 1 SCIENTIFIC PROCESSES This topic is an introduction to some of the basic scientific skills. These skills are considered basic and should not be taught in isolation, as they form an integral part of other topics and all learners should be exposed to them as a minimum requirement.	
1.3 Observing, classifying and drawing	
know how to observe properties of a variety of substances and group (classify) objects in a variety of ways and apply basic principles of drawing	- describe and record observations accurately of all practical activities (NOTE: observe in science should be the use of five senses: sight, smell, hearing, touch and taste – we do not usually use sense of taste as that could be dangerous; very often the conclusion and observation are confused, e.g. water boils is a conclusion while bubbles formed is the observation) - make a clear line drawing from a photograph (or other visual representation) of a specimen, indicate the magnification of the drawing and label, as required
1.4 Experimenting/investigating, recording data and presenting results	
understand the importance of recording and communicating results from experimental investigations (the use of ICT can be incorporated in this objective)	- investigate simple physiological experiments (tests for food substances, the use of litmus and Universal Indicator paper) - investigate a given practical problem, identifying appropriate apparatus, taking into account the need for safe working - record results of experimental investigations in tables and graphs (the use of ICT is suggested) - plot graphs with the appropriate title (by convention and for consistency with Mathematics and Physics, the heading will always have the dependent vs. the independent variable as a title) - draw tables of results of investigations, heading each columns of the table with the name of the physical quantity and the appropriate unit (e.g. time /s) - draw simple conclusions on the basis of data gathered

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 8 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
TOPIC 2 HEALTH EDUCATION	
2.1 Sexual health/ diseases	
• know STIs common to Namibia and understand how STIs are spread/transmitted, prevented and treated • know birth control methods	• list STIs common in Namibia (gonorrhoea, syphilis, HIV and AIDS) • conduct a research about the dangers of STIs • discuss the spread, symptoms, effects, prevention and treatment of gonorrhoea and syphilis • discuss the effects of STIs on one's health • identify and describe the variety of contraceptives and distinguish between those that prevent and those that will not prevent the transmission of STIs and HIV • interview a health worker about the importance of abstinence and the use of condoms • collect diagrams/contraceptive from local health centre, clinic or hospital • demonstrate by means of a role play how one can make appropriate decisions based on sexual behaviour
2.2 Immunisation	
• realise the types and importance of immunisation and understand the importance of antibodies	• define immunisation as a method of increasing a patient's defence against infection • describe the types of immunity and discuss the role of antibodies in immunity • investigate and report on types of immunity

GENERAL OBJECTIVES <i>Learners will:</i>		GRADE 8 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>	
Topic 3 CHARACTERISTICS OF LIVING ORGANISMS AND THE MICROSCOPE			
3.1 Characteristics of living organisms			
• know how to apply the characteristics to identify organisms in their locality • realise that organisms are divided into five kingdoms and know diagnostic features of each group • understand the principles of grouping and classifying organisms		• list and define the characteristics of living organisms • list five kingdoms of living organisms: Prokaryotes, Protocista, Fungi, Plantae and Animalia • outline the differences among the five kingdoms (Animalia, Prokaryotes, Protocista, Fungi and Plantae) • compare and classify organisms into kingdoms on the basis of their structure • collect different organisms from local environment and classify them into their kingdoms (take safety precautions), prepared slides may be used for prokaryotes and protocista • state the importance of classifying organisms • identify organisms using a simple dichotomous key	
3.2 Plant and animal cells			
• know the basic structure of cells and understand that cells are modified for specific functions		• define a cell as a basic unit of life • define a tissue as a group of similar cells working together to perform a particular function • define an organ as a group of different tissues working together to perform a particular function • define an organ system as a group of organs performing several closely related functions • identify and describe the basic structure of plant cells (onion and geranium cells) and animal cells (liver cells) • describe the differences between a typical plant and animal cell • use photo-micro graphs to observe and draw animal and plant cells	
3.3 The microscope			
• know the parts of the microscope and their functions		• state the functions of the various parts of the microscope • make temporary slides of animal and plant cells • use microscopes to observe the structure of animal and plant cells • calculate magnification of an object or specimen	

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 8 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
TOPIC 4 PASSAGE OF SUBSTANCES	
4.1 Movement of particles and molecules	
appreciate that diffusion, osmosis and active transport are important processes for the movement of molecules/particles	- define diffusion as the movement of molecules from a region of their higher concentration to a region of their lower concentration, down a concentration gradient - discuss the importance of diffusion for living organisms - define osmosis as the passage of water molecules from a region of their higher water potential to a region of their lower water potential, through a partially permeable membrane - investigate how diffusion and osmosis takes place in living tissue (potato strip), ammonia or using tea bags and artificial cell (Visking tubing) - define active transport as the movement of ions (substances) from a region of their lower concentration to a region of their higher concentration against a concentration gradient

GENERAL OBJECTIVES		GRADE 8 SPECIFIC OBJECTIVES	
Learners will:		Learners should be able to:	
Topic 5 PLANTS AS LIVING ORGANISMS			
5.1 Structure and function of the leaves			
know the external and internal structure of a leaf and understand the functions of its parts		- identify and label the external and internal structure of a leaf of a dicotyledonous plant and outline the functions of each part - observe, draw and interpret prepared slides of transverse sections of the leaf - collect a leaf of elodea or geranium, and view the internal structure under a microscope or hand lens (follow the procedures of preparing a wet mount) prepared slides can also be used	
5.2 Food production in flowering plants			
- realise the importance of the process of photosynthesis in plants and know the word equation for photosynthesis - understand how leaves are suited for photosynthesis		- define photosynthesis as a process by which light energy is trapped by chlorophyll and used to synthesise carbohydrates (glucose) from carbon dioxide and water - state the word equation for photosynthesis - describe how leaves are adapted for photosynthesis - describe the basic process of photosynthesis and relate its importance to living organisms - investigate the effects of light; chlorophyll and carbon dioxide on starch production - test for the presence of starch in variegated leaves and compare their results - investigate how leaves from different species are adapted for photosynthesis - list the features of gaseous exchange surfaces in plants - investigate the features of gaseous exchange surfaces of plants	
5.3 Cell respiration			
know the features of gaseous exchange surfaces in plants and understand the significance of plant respiration		- describe how plant leaves are adapted to gaseous exchange - define aerobic respiration as a breakdown of glucose to release energy in the presence of oxygen - define anaerobic respiration as a breakdown of glucose to release energy in the absence of oxygen - state the word equation for aerobic respiration - discuss the significance of respiration for plants - carry out simple experiments to illustrate respiration in plants (e.g. germinating seeds)	

GENERAL OBJECTIVES <i>Learners will:</i>		GRADE 8 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>	
Topic 5 PLANTS AS LIVING ORGANISMS			
5.4 Roots and water absorption			
know the concept of osmosis and its role in the absorption of water and understand how materials enter and move through a plant (ref. osmosis, active transport		- relate osmosis to the net movement of water from the soil into the root hair cells, root hair cells into the roots and from cell to cell throughout the plant - describe the structure and the functions of root hair cells - outline how the root hair cell is adapted for its function - draw and label the structure of a root hair cell - describe how water moves from the soil into a root hair - do simple experiments to demonstrate osmosis in living cells and artificial cells - investigate how substances move by means of osmosis	
5.5 Plant water relations			
realise the importance of water absorption for plant processes, understand the structure and functions of root hairs and xylem in their role of transpiration		- identify the structural components of xylem and describe water transport in the xylem - investigate the structure of xylem in a celery stalk (using a hand lens or a microscope) - define transpiration as the passage of water vapour into the atmosphere through the aerial parts of plants - describe the importance of transpiration in the upward movement of water in a plant - explain the importance of water in plant processes - investigate the importance of water in plant processes - do simple experiments to illustrate differences in transpiration due to the number of stomata per unit area - investigate the role of transpiration in the upward movement of water in plants	
5.6 Adaptations of plants to arid conditions			
know examples of plants that are adapted to arid environments and the importance of these adaptations		- identify examples of local plants that are adapted to arid conditions - describe how local plants are adapted to arid conditions - discuss the importance of the adaptations for the plant - collect samples of plants adapted to arid conditions as found in their locality; investigate how leaves of different species are adapted to the environment and discuss their importance for the plant's survival	

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 8 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
Topic 5 PLANTS AS LIVING ORGANISMS	
5.7 Reproduction in Plants	
• know the structures and functions of flowers as reproductive organs in plants	• describe the structure and function of flower parts • observe and draw the parts of the flower • define pollination as a transfer of pollen grains from the anther to receptive stigma • define fertilization as the fusion of male and female gametes • describe fertilisation process and seed formation • define seed dispersal as the transfer of seed away from the parent plant • list the agents of seed dispersal • investigate the features of different seeds in their local environment and relate to how they are dispersed

GENERAL OBJECTIVES <i>Learners will:</i>		GRADE 8 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>	
Topic 6 HUMAN BIOLOGY			
6.1 Human digestive system			
know the parts and functions of the digestive system and understand the process of digestion		- list the various parts of the digestive system and outline the functions of each - draw and label the parts of the digestive system - describe the process of swallowing and peristalsis - identify different types of teeth and state their functions - describe the importance of proper care of teeth - make models of the different types of teeth - distinguish between chemical and mechanical digestion	
6.2 Breathing system and gaseous exchange			
- know the gross structure of the breathing system and appreciate the importance of breathing for cell respiration - know the significance of the gaseous exchange surfaces and understand the rate of breathing and level of activity - know that pollution and smoking can impair the functions of the respiratory system		- identify the various parts of the breathing system and outline the functions of each part - make a model of the breathing system - outline the mechanism of breathing - discuss the importance of breathing for cell respiration - list the features of the gaseous exchange surfaces in humans - discuss the significance of these features for maintenance of life - discuss gaseous exchange at the alveoli - suggest how different levels of activity can influence the rate of breathing - list and discuss how air pollution and smoking affect the breathing system - make a model of a respiratory system using two liter plastic bottles, balloons, straw and rubber bungs - investigate the effect of smoking on lungs using cotton wool	

GENERAL OBJECTIVES <i>Learners will:</i>		GRADE 8 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>	
Topic 7 ECOSYSTEM			
7.1 People, food and environment			
understand why hunters and nomads became the farmers of today, the need for sustainable farming and realise how the population growth will result in possible depletion of natural resources and environmental problems		- outline how natural resources were used by our predecessors who were mainly hunters and nomads and discuss why they gradually became farmers - recognise why it is important to consider sustainability when farming and the environmental problems which might occur if sustainability is not considered - explain how the needs of the growing Namibian population will increase the use of natural resources and may lead to environmental problems - conduct a research/survey on human activity and how it reduces the earth's carrying capacity for people and other organisms e.g. population growth and availability of food, deforestation, fishing - interview the elders in your community on how hunters and gatherers survived	
7.2 Interaction in an ecosystem			
know and understand the interactions in an ecosystem		- discuss the role of sun in an ecosystem and its significance in the transfer of energy - describe energy flow, food chains and food webs - describe the relationship between abiotic and biotic factors of an ecosystem - investigate and report on the influence of abiotic and biotic factors on living organisms in the environment (school or home)	
7.3 Cycling of nutrients in an ecosystem			
appreciate the role of sunlight in an ecosystem and its significance in the transfer of energy		- describe the major ecological cycles with reference to water and carbon cycles - draw a diagram illustrating how energy flows within a particular ecosystem	
7.4 Pollution			
- realise that natural resources can be depleted and damaged by pollution - acknowledge that an understanding of pollution is important to safeguard the environment		- list and discuss examples of local pollution - recognise that natural resources can be depleted and damaged by pollution - apply knowledge and understanding of pollution in safeguarding the environment - investigate the influence of gas from matchsticks on seedlings in a closed environment and relate it to the effects of pollution on plants	

9.1 Grade 9 learning content

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
TOPIC 1 SCIENTIFIC PROCESSES This topic is an introduction to some of the basic scientific skills. The skills in this topic should not be taught in isolation as they form an integral part of the other topics and should be integrated into the content during teaching.	
1.1 Stating the aim (question) of an investigation	
- realise the value of investigations to understand the world around us and to check the results of other scientists - know when a test is fair or unfair	- outline that investigations are a way to find out new information, explore the world around us, develop new ideas to explain the world around us and to check the results of other scientists - explain the first steps of scientific method as: - choosing the right question or aim of the investigation - make a guess on the outcome of the results (hypothesis) - planning how to collect information or data - explain/describe how to make a test fair by identifying an appropriate control - identify dependent (what is measured) independent variables (what you are changing) - explain direct proportionality and inverse proportionality
1.2 Estimating and measuring	
know how to estimate and measure volume, length, mass, time and temperature and use apparatus appropriately	- follow a sequence of diagrammatic and written instructions and record estimates and measurements - use appropriate techniques; handle apparatus/material competently and have due regard to safety - calculate magnification - estimate or measure, volume, length, mass, time/rate and temperature - records and organise data using standard measurements - convert units of volume, length, mass, and temperature

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
1.3 Observing, classifying and drawing	
know how to observe properties of a variety of substances and group (classify) objects in a variety of ways and apply basic principles of drawing	- describe and record observations accurately of all practical activities (NOTE: observe in science should be the use of five senses: sight, smell, hearing, touch and taste – we do not usually use sense of taste as that could be dangerous; very often the conclusion and observation are confused, e.g. water boils is a conclusion while bubbles formed is the observation) - apply basic process skills included in a series of activities (e.g. using microscopes, and making drawings of plant and animal specimen/cells) - make a clear line drawing of a specimen provided, indicate the magnification of the drawing and label, as required
1.4 Plan and carry out investigations, recording data and presenting results	
understand the importance of recording and communicating results from experimental investigations (the use of ICT can be incorporated in this objective)	- perform simple physiological experiments, e.g. tests for food substances and the use of hydrogen carbonate indicator, litmus and Universal Indicator paper - use a scalpel or a razor blade, forceps, scissors and mounted needles skilfully - investigate a given practical problem, identifying appropriate apparatus, taking into account the need for safe working - record results of experimental investigations in tables and graphs (the use of ICT is suggested) - plot graphs with the appropriate title (by convention and for consistency with Mathematics and Physics, the heading will always have the dependent vs. the independent variable as a title) - draw up/tabulate results of an investigation in tables, heading each column of the table with the name of the physical quantity and the appropriate unit (e.g. time /s) - draw simple conclusions on the basis of data gathered - use grade-appropriate science and technology terminology correctly

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
Topic 2 THE BODY'S IMMUNE SYSTEM	
2.1 HIV transmission and the immune system	
• know and understand how HIV is transmitted and know the difference in attitudes towards an HIV positive person and an AIDS patient • realise that HIV destroys the immune system of the body, know how HIV is diagnosed and appreciate the importance of ARV treatment and the role they play in prolonging life	• describe how human immunodeficiency virus (HIV) is transmitted and name the body fluids that can be infected with HIV • discuss the difference in attitudes towards an HIV positive person and an acquired immunodeficiency syndrome (AIDS) patient • list the components of an immune system and outline the basic functions of each component • describe how HIV destroys the immune system of the body and outline how HIV is diagnosed (the blood tests used to diagnose the presence of human immunodeficiency virus (HIV): enzyme-linked immunosorbent assay (ELISA), immunoblotting technique, Deoxyribonucleic acid-polymerase chain reaction (DNA-PCR) • outline what each of these tests reveal with regard to HIV • list the examples of Antiretroviral drug (ARV) drugs common to Namibia, explain their importance in prolonging life, and discuss their possible side effects • carry out HIV simulation testing game (ELISA testing game) • investigate and collect statistics on the impact of AIDS in Namibia and plot a graph

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
2.2 Infectious diseases	
understand the social implications and transmission of common infectious diseases in Namibia	- list common infectious diseases in Namibia and discuss their social implications: Malaria, TB, Cholera, Polio - outline different ways of transmission of infectious diseases - describe the life cycle of the malaria parasite - outline the symptoms of malaria, the impact of malaria on one's health and discuss ways of treating the disease - demonstrate with a role play, using a potato, how pathogens can be transmitted - collect information from a health centre, clinic or hospital on how to reduce the prevalence of malaria
2.3 Prevention and curing of diseases	
- understand vaccination as a defense mechanism against infectious diseases and realise the importance of traditional medicine in the prevention of diseases - realise the types and importance of immunization and understand the importance of antibodies	- define immunisation as a method of protecting against diseases by provoking an immune response - recognise vaccination as a defence mechanism against infectious diseases - describe the types of immunity and discuss the role of antibodies in immunity - explain vaccination as an immunization process - discuss the importance and role of traditional medicine in the treatment of diseases: Aloe, Bitter bush, Mopane, !Nara - collect and report on locally used examples of traditional medicine and discuss how and what they are used for - investigate the success or failure rate of the government's immunisation programme

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
Topic 3 CLASSIFICATION OF LIVING ORGANISMS	
3.1 Taxonomy and major levels of classification	
realise the importance of taxonomy and know the major levels of classification	- define taxonomy as the branch of biology that deals with the identification and naming of living things - list the seven major levels of classification - discuss the importance of classifying organisms - outline and identify the principles used to classify organisms - collect local plant and animal species as examples to classify
3.2 The binomial system of nomenclature	
- understand the binomial system of nomenclature - understand the relationship between classification and evolution and know how to use a dichotomous key	- define the binomial system as a system using a two word Latin name (genus and species) to identify a specific type of organism - describe the basic rules of writing binomial names - outline the process of evolution - discuss the relationship between classification and evolution - use a given dichotomous key to identify organisms

GENERAL OBJECTIVES <i>Learners will:</i>		GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>	
Topic 4 THEORY OF CELL			
4.1 Types of cells			
- understand cell theory and know different types of cells and importance of various cell structures of a eukaryotic cell - realise that organisms can be unicellular or multicellular; understand the structural and functional relationship among cells, tissues, organs and systems - know the difference between permeable and a partially permeable membranes and the basic structure of a plasma membrane		- outline the three major tenets of cell theory - compare eukaryotic and prokaryotic cells (plants, animals and bacteria) - prepare wet mounts of cells (onion cells, cheek cells and leaf epidermis) - list various structures of a eukaryotic cell and describe their functions - construct a cell model with various structures - differentiate between unicellular and multicellular organisms - describe the structural and functional relationship among cells, tissues, organs and systems (plants and animals) - distinguish between a permeable and a partially permeable membrane - investigate the process of permeability using teabags (or elodea, epidermis, onion leaf, parenchyma cells, tomato) - describe the structure of a plasma membrane and relate the structure to its various functions (no reference to fluid mosaic model) - discuss the significance of osmosis, diffusion and active transport to living organisms - investigate the process of diffusion and relate it to temperature and its importance to human bodies - investigate osmosis using living cells (potato) and a dialysis tube	
4.2 Cell specialisation			
realise that cells are modified for specific function		- relate the structure of the following cells to their function: - ciliated cell - red blood cell - root hair cell - xylem vessel - study prepared slides of cells and make drawings thereof	

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
Topic 5 DIVERSITY OF ORGANISMS	
5.1 Kingdom Plantae and Animalia	
• know the diagnostic features of monocotyledonous and dicotyledonous plants • realise that chordates are divided into five (5) major classes • know the external diagnostic features of fish and recognise the importance of fish consumption for healthy living	• describe the diagnostic features of a monocotyledonous and a dicotyledonous plant as found in their local environment • identify and describe the features of the five major classes of the phylum Chordata • describe the external diagnostic features of fish (tilapia or trout) • outline the adaptations of tilapia or trout to the Namibian environment • discuss the economic importance of tilapia or trout for Namibia • suggest the importance of eating fish to enhance healthy living • collect diagrams of Animals, Bacteria, Protocista, Fungi, Monocotyledon and Dicotyledon plants and study their differences and similarities

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
Topic 6 NUTRITION	
6.1 Nutrients	
• know the different nutrients and understand their functions • understand the difference between organic and inorganic nutrients • know the difference between macro and micro nutrients • know the nutritional value of food, the symptoms and diseases related to a deficient nutrient and the relationship between nutrition and the health, sex and age of a person	• list the main nutrients (carbohydrates, proteins, fats, vitamins, mineral salts, water and fibres) • outline the differences between organic and inorganic nutrients • describe and explain the main functions of different nutrients (carbohydrates, proteins, fats, vitamins and mineral salts, as well as water and fibres) • identify and give examples of foods which are the main sources of different nutrients • distinguish between macro and micro nutrients • define balanced diet as a diet that consists of all nutrients in the right proportions to meet the body's requirements • suggest a diet required by people of different age and sex performing the same or different activities • explain why people of different age and sex have different energy requirements • identify and describe the symptoms and diseases caused by a lack of proteins, iron, calcium/vitamin D and vitamin C • carry out food tests for starch, proteins and fats • collect labels of nutrients from various sources and determine the nutritional value of the food substance • analyse food composition tables and food labels and calculate the energy value for different age and different activities • make a list of food you wish to be eating for the next five (5) days, determine its nutritional value and report how you would improve your diet to make it a balanced diet

GENERAL OBJECTIVES <i>Learners will:</i>		GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>	
Topic 7 HUMAN BODY			
7.1 Circulatory system			
• know the structures of the circulatory system, their functions including the components of blood • realise that pulse rate is related to activity and how the build-up of cholesterol impact on the circulatory system • realise the importance of a healthy lifestyle and good living conditions for an effective circulatory system		• identify and name the structures of the circulatory system • outline the functions of the heart, arteries, veins, capillaries and components of blood (plasma, platelets, white and red blood cells) • describe the gross structure of the heart • dissect the heart of a goat or sheep and observe the gross structure • discuss how pulse rate is related to different levels of an activity • demonstrate how to take a pulse rate • investigate the influence of exercise on pulse rate • explain how the build-up of cholesterol in the circulatory system can lead to functional disorders • suggest how the need for healthy lifestyle and living conditions contribute to the maintenance of an effective circulatory system	
7.2 Excretion and water balance			
• know the main excretory organs • know the structures of the renal system • realise the involvement of the lungs, skin and renal system in excretion and the importance of keeping a balance between intake and loss of water from the body		• define excretion as the process of removing the waste products of metabolism and substances in excess from the body • list the main excretory organs in the body • identify the structures of the renal system • discuss the functions of the lungs, skin and the renal system in excretion • identify the waste products expelled from the organs involved in excretion • discuss the importance of maintaining a balance between intake and loss of water • make a model of the renal system	

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
7.3 Nervous system and hormonal control	
• know the structures and functions of the nervous system and realise that alcohol and drug abuse affect its function • know the functions of hormones that are produced in different glands and realise the importance of sense organs in responding to stimuli from the environment	• identify the components of the nervous system and outline their function • discuss the functions of the nervous system • describe the effects of alcohol and drug abuse on the nervous system • discuss the influence of drug abuse on families and the community • identify the location of major endocrine glands in the body and describe the functions of the hormones they produce • draw an annotated diagram of the major glands in the body • define a hormone as a chemical produced by an endocrine gland which alter the activity of target cells • explain the effects of growth hormone, thyroxine, insulin and adrenaline on the body • state the five sense organs and the stimuli they respond to • make a model of the neuron and nervous system using beads, clay, play dough, or Styrofoam • make a model of the brain lobes using different coloured clay
7.4 Skeleton and muscles	
• know different types of muscles, found in the body, and understand how the skeleton and muscles support and enable movement	• list and describe different types of muscles and determine where each is found in the body • discuss how the skeleton and muscles are organized to support, protect and move the body

GENERAL OBJECTIVES <i>Learners will:</i>	GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>
7.5 Human reproduction	
• know the structures and function of the female and male reproductive systems and the roles of related hormones in the development of secondary sexual characteristics at puberty • understand the roles played by oestrogen and progesterone in the menstrual cycle	• identify the structures of female and male reproductive systems • outline the functions of each part of the reproductive systems (male and female) • discuss the effects of testosterone, oestrogen and progesterone in the development of secondary sexual characteristics at puberty • describe the menstrual cycle and the role of oestrogen and progesterone in the menstrual cycle
7.6 Conception, pregnancy and birth	
• understand conception and the development of a foetus throughout pregnancy, and realise the role of the placenta, amniotic fluid and the uterus in the development of a foetus • acknowledge that the lifestyle and health of the expectant mother influences the development and health of a foetus and know the process of birth	• describe conception and the development of a foetus throughout pregnancy • describe the function of the placenta, amniotic fluid and the uterus in the development of a foetus • suggest how the development and health of a foetus are affected by the lifestyle of the expectant mother • describe the process of birth

GENERAL OBJECTIVES <i>Learners will:</i>		GRADE 9 SPECIFIC OBJECTIVES <i>Learners should be able to:</i>	
Topic 8 ECOLOGY			
8.1 Global warming			
- understand how some gases create a greenhouse effect causing global warming - know local and global ecological effects of global warming on the environment		- distinguish between the greenhouse effect and global warming - identify carbon dioxide, methane, chlorofluorocarbon (CFCs) and nitrous oxide as gases causing global warming - list and describe the activities that release carbon dioxide, methane, CFCs and nitrous oxide into the atmosphere - suggest and discuss ways of how to reduce the release of gases causing global warming - describe local and global ecological effects of global warming - predict and discuss how life in Namibia might be changed by global warming - investigate and report on the impact of global warming on the ecosystem	
8.2 Depletion of the ozone layer			
- realise the role and importance of the ozone layer to living organisms - know human activities which cause the depletion of the ozone and how the use and release of CFCs can be reduced		- describe the ozone layer and explain its importance in protecting organisms - list the most important human activities that release CFCs - describe how CFCs deplete the ozone layer - suggest methods which can reduce the release of CFCs	

10. ASSESSMENT

A learner-centred curriculum and learner-centred teaching encompass a broad range of knowledge and skills which are relevant to the knowledge-based society. The specific objectives in the syllabus state what understanding and skills a learner must demonstrate as a result of this teaching-learning process, and which objectives will be assessed. However, it is intended that the curriculum should focus on learning, not on assessment and examination. Assessment and examination are only to support learning.

10.1 Types and methods of assessment

Continuous assessment

In order to capture the full range and levels of competence, a variety of formal and informal continuous assessment situations is needed to give a complete picture of the learner's progress and achievements in all subjects. Continuous assessment must be clear, simple and manageable, and explicitly anchored in learner-centred principles and practice. Teachers must provide a reliable and valid assessment of the learner's performance in the specific objectives. The information gathered about the learners' progress and achievements should be used to give feedback to the learners about their strong and weak points, i.e. where they are doing well, and why, and where, how and why they need to improve. The parents should be informed regularly about the progress of their children in all subjects, be encouraged to acknowledge achievements, and given suggestions as to how they can support the child's learning activities.

The learner's progress and achievements in this subject must be reported to parents in the school report.

Formative and summative assessment

The two modes of assessment used are formative continuous assessment and summative assessment. Formative continuous assessment is any assessment made during the school year in order to improve learning and to help shape and direct the teaching-learning process. Assessment has a formative role for learners if and when:

- it is used to motivate them to extend their knowledge and skills, establish sound values, and to promote healthy habits of study
- assessment tasks help learners to solve problems intelligently by using what they have learnt
- the teacher uses the information to improve teaching methods and learning materials

Summative assessment is an assessment made at the end of the school year based on the accumulated total of the progress and achievements of the learner throughout the year in a given subject, together with any end-of-year tests or examinations. The result of summative assessment is a single end-of-year promotion grade.

Informal and formal methods

The teacher must assess how well each learner is mastering the specific objectives described in the syllabus and from this gain a picture of the all-round progress of the learner. To a large extent, this can be done in an informal way and in their participation in general, through structured observation of each learner's progress in learning and practice situations while they are investigating things, interpreting phenomena and data, applying knowledge, communicating and making value judgements.

When it is necessary to structure assessment more formally, the teacher should as far as possible use situations similar to ordinary learning and practice situations to assess the competency of the learner. Formal written and oral tests can be used to assess only a limited range of specific objectives and therefore should not take up a great deal of time. Short tests should be limited to part of a lesson and only in exceptional cases use up a whole lesson.

Evaluation

Information from informal and formal continuous assessment is to be used by the teacher to ascertain where it is necessary to adapt methods and material to the individual progress and needs of each learner. At the end of each main unit of teaching and at the end of each term, the teacher, together with the learners, should evaluate the learning-teaching process in terms of tasks completed, participation, what the learners have learnt, and what can be done to improve the working atmosphere in and achievements of the class.

Criterion-referenced grades

When grades are awarded in continuous assessment, it is essential that they reflect the learner's actual level of achievement in the specific objectives, and are not related to how well other learners are achieving these objectives or to the idea that a fixed percentage of the learners must always be awarded a Grade A, B, C, and so on (norm-referencing). In criterion-referenced assessment, each letter grade must have a descriptor for what the learner must demonstrate in order to be awarded the grade. Grade descriptors must be developed for each subject for each year. It is important that teachers in each department/section work together to have a shared understanding of what the grade descriptors mean, and how to apply them in continuous assessment, so that grades are awarded correctly and consistently across subjects. Only then will the assessment results be reliable.

Conducting and recording assessment

Continuous assessment should be planned and programmed at the beginning of the year, and kept as simple as possible. Marks given for class activities, practical activities, project work, assignments, homework and short tests may be recorded for continuous assessment.

10.2 Grade descriptors

The scheme of assessment is intended to encourage positive achievement by all learners. The learner's summative achievement in the specific objectives will be shown in letter grades A to E, where A is the highest and E the lowest grade for learners achieving minimum competency level. In cases where a learner has not reached the minimum level of competency a U will be awarded. The description must be interpreted in relation to the content specified by the Life Science syllabus but are not designed to define that content. The description for expected outcomes for grades A to E is provided below:

When letter grades are awarded, it is essential that they reflect the learner's actual level of achievement in relation to the specific objectives. The relation between the letter grades and specific objectives is shown in the table below. As far as possible a letter grade should be used as the mark instead of a percentage.

Grade	% Range	Grade descriptions
A	80%+	Achieved objectives exceptionally well. The learner is outstanding in all areas of competency.
B	70-79%	Achieved objectives very well. The learner's achievement lies substantially above average requirements and the learner is highly proficient in most areas of competency.
C	60-69%	Achieved objectives well. The learner has mastered the specific objectives and can apply them in unknown situations and contexts.
D	50-59%	Achieved objectives satisfactorily. The learner's achievement corresponds to average requirements. The learner may be in need of learning support in some areas.
E	40-49%	Achieved the minimum number of objectives to be considered competent. The learner may not have achieved all the specific objectives, but the learner's achievement is sufficient to exceed the minimum competency level. The learner is in need of learning support in most areas.
U	0-39%	Ungraded. The learner has not been able to reach a minimum level of competency in the objectives, even with extensive help from the teacher. The learner is seriously in need of learning support.

10.3 Assessment objectives

The assessment objectives for Life Science are:

Assessment objective A: Knowledge with understanding

Learners should be able to demonstrate knowledge and understanding in relation to:

- scientific language, terminology, symbols, quantities and units;
- instruments and apparatus, including techniques of operation and aspects of safety;
- the use of scientific facts, concepts, patterns and principles.

The objective is made up of specific objectives which require the learner to identify, give examples, name, list, state, indicate, give reasons, suggest ways, recognise, define, discuss and to outline.

Assessment objective B: Handling information, application and solving problems

The learners, using written, symbolic, graphical and numerical material, should be able to:

- analyse novel situations in a logical and deductive manner;
- locate, select, organise and present information from a variety of sources;
- translate information from one form to another;
- use information to identify patterns, report trends and draw inferences;
- present reasoned explanations for phenomena, patterns and relationships;
- make a value judgement about scientific and technological applications and their social, economic and environmental implications;
- solve problems.

This objective is made up of specific objectives which require the learner to predict, relate, describe, calculate, find, estimate, determine, sketch and select, analyse, extract and analyse, synthesize, compare and discuss, deduce, explain, distinguish, suggest, interpret, differentiate and evaluate.

Assessment objective C: *Practical (experimental and investigative) skills*

Learners should be able to:

- use and organise techniques, apparatus and materials;
- observe, measure and record;
- handle, process and evaluate experimental observations and data;
- plan investigations.

10.4 Continuous assessment: detailed guidelines

A specified number of continuous assessment activities per term should be selected, graded and recorded. Not more than two assessments per term are to be topic tests. These continuous assessments must be carefully planned and marked according to a marking scheme, marking criteria or memorandum. Detailed guidance can be found in the Continuous Assessment Manual for Life Science. The criteria used, to assess activities other than tests, should be given to the learner before the assessment activity. Evidence of the work produced by good, average and low-achieving learners, as well as the written assignment and marking scheme, has to be kept at school until the end of the next year. Teachers can choose to grade and/or record more than the required continuous assessments if it is necessary for formative purposes. An end-of-year summative grade will be based only on the assessment tasks described in the syllabus. Not more than forty percent (40%) of the summative grade may be based on tests, which include topic tests and end-of-term tests.

Types of continuous assessment tasks

In Life Science in the Junior Secondary phase the continuous assessment tasks are as follows:

Practical investigations: These are assessments of practical skills done during a practical activity where learners are required to plan and carry out investigations, and collect, report and analyse information. Except for one big investigation or project during the first or second term, these activities should assess not more than two skills at a time and should count 5 to 15 marks each.

Topic tasks: These are activities that most teachers already use in their day-to-day teaching. These are recorded, assessed activities that could introduce a topic, be used during the teaching of a topic and /or revision a topic. They may well include assessment involving specific objectives to do with locating information, conducting surveys, analysing information or presenting information. Topic tasks will involve assessments of specific objectives in all assessment objectives; however, not all assessment objectives need to be present in every topic task. The greatest emphasis should be placed on assessment objectives B and C to meet the weighting shown in the Test Specification Grid in section 10.12

Projects: A project is a longer assignment than a topic task or practical investigation, and gives learners an opportunity to complete an investigation into one of the themes / topics outlined in the syllabus. This type of investigation will enable the teacher and learner to pursue a topic in greater depth and in a more lively and creative way than possible with short discrete topic tasks or practical investigations. The project should count 30 marks and the final mark should be divided by two (to give 15 marks – same as the practical investigations) when entered into the record forms under 'Practical Investigation' in the second term.

Topic tests: Completed topics should be concluded with a test indicating the achievements of the learners in these topics.

End-of-semester test: This will be a more comprehensive topic test of the term's work. No homework should be assigned during the time of writing the End-of-term tests.

Summary of continuous assessment tasks

Continuous assessment Grade 8 and 9						
	Term 1		Term 2		Term 3	
Components	Number & marks	Total	Number & marks	Total	Number & marks	Total
Practical Investigations	2×15	30	1×15	15	1×10	10
Projects			$(1 \times 30) \div 2$	15		
Topic tasks	2×10	20	2×10	20	2×10	20
Topic tests	$(2 \times 20) \div 2$	20	$(2 \times 20) \div 2$	20	$(2 \times 20) \div 2$	20
End-of-term test	$(1 \times 65) \times 2$	130	$(1 \times 65) \times 2$	130		
Term marks		200		200		50
Weighted term mark (report mark)		$(200 \div 2)$ 100		$(200 \div 2)$ 100		

The continuous assessment (CA) marks for the first and second term is converted to a mark out of 100 (weighted mark). Only this should be used for the report at the end of term 1 and 2.

Learners should not write an examination at the end of the first and second term, but only an end of term test.

10.5 End-of-year examinations: detailed guidelines

In Grade 8 there will be an internal end-of-year examination. The purpose of this examination is to focus on how well learners can demonstrate their thinking, communication, and problem-solving skills related to the areas of the syllabus which are most essential for continuing in the next grade. Preparing for and conducting this examination should not take up more than two weeks altogether right at the end of the year.

The description of the various papers for the written examination is as follows:

Written examination Grades 8			
Grades	Description of paper	Duration	Marks
8 and 9	Written Examination This will consist of ONE paper consisting of two sections: Section A: 30 Multiple choice questions (30 marks) Section B: Variety of structured questions (100 marks)	2 hours 30 minutes	130

There will be a semi-national external examination at the end of Grade 9. These papers will be set by DNEA and will be marked regionally. Samples will be moderated by DNEA. The purpose of the examination is to assess how far each learner can demonstrate his/her achievement in reaching the specific objectives as a preparation for everyday life and for further studies or training, and to what extent the system as a whole is enabling learners to achieve optimally.

Promotion marks

For Life Science in Grades 8 - 9 Continuous Assessment contributes 35% to the summative assessment mark and the end-of-year examination contributes 65%. The weighting of each assessment component is as follows:

Component	Description	Marks	Weighting
Written examination	Section A:	30	15%
	Section B:	100	50%
Continuous assessment	Topic tasks, Topic tests, Practical investigations/Projects	70	35%
Total Marks			100%

The promotion marks are calculated as follows:

Promotion mark Grade 8 and 9				
	Term 1	Term 2	Term 3	Total
Semester mark	70	70	50	190
CA mark	$190 \div 19 \times 70$			70
End-of-year examination	130 Marks			130
Promotion mark	$\text{Average Semester Mark} + \text{End-of-year Examination} \div 2$ $200 \div 2$			100

10.6 Specification grid

The Specification grid below indicates the weighting allocated to each objective for both Continuous Assessment and for the Written Examination.

Assessment objectives for written examination			
Components	Weighting	Paper 1 Section A	Paper 1 Section B
Objective A Knowledge with understanding	30%	9 marks	30 marks
Objective B Handling information, application & solving problems	65%	20 marks	65 marks
Objective C Practical (experimental and investigative) skills	5%	1 mark	5 marks
Total	100%	30 marks	100 marks

Assessment objectives for continuous assessment	
Components	Weighting
Objective A Knowledge with understanding	10%
Objective B Handling information, application & solving problems	40%
Objective C Practical (experimental and investigative) skills	50%
Total	100%

11 ASSESSMENT CRITERIA

Notes on practical assessment of objective C

The general skills listed for Objective C: Practical (Experimental and Investigative) skills are related to the basic specific objectives considered most suitable for continuous assessment. Hence, Objective C basic specific objectives are assessed mostly as part of CA.

It is therefore recommended that a minimum of FIVE practical investigations should be assessed and recorded. One of the investigations during the second term should be a project or a practical investigation that will allow at least three major skills to be demonstrated by learners.

The criteria for assessment of practical exercises are set below:

The general skills listed for Objective C: Practical (Experimental and Investigative) skills are related to the basic specific objectives considered most suitable for continuous assessment. Hence, Objective C basic specific objectives are assessed mostly as part of CA.

Assessment rubric for skill A: Practical techniques

This includes experiments, handling and organising apparatus and materials, developing apparatus from readily available materials, following instructions to carry out an experiment, and showing due regard for safety in conducting experiments.

Teachers should use the following 5 point scale when evaluating the performance tasks of Skill A:

Points	General criteria for practical techniques
5	The assessed skill is performed well above average, neatly and independently, with little or no support or guidance from the teacher.
4	The assessed skill is performed above average with little or no support or guidance from the teacher.
3	The assessed skill is performed at an average level with some support or guidance from the teacher.
2	The assessed skill is performed below average with some support or guidance from the teacher.
1	The assessed skill is performed well below average, requiring pronounced support or guidance from the teacher.
0	This mark is only given when the learner is not assessed due to non-participation without valid reason*

*If a learner is absent or not participating with a valid reason, she/he should be given an opportunity to perform the involved skill or ability at a later stage.

Notes on the assessment of Skills B, C and D

Skill B: Observing, measuring and recording

This includes writing down detailed quantitative and qualitative data, reading scales and tabulating results.

Skill C: Handling, processing and evaluating data

This includes inferring conclusions from data, processing numerical data, drawing graphs and charts and dealing approximately with anomalous or inconsistent results.

Skill D: Planning and carrying out investigations

This includes analysing a practical problem systematically and producing a logical plan for an investigation.

These skills are made up of specific objectives which require the learner to report to their class, collect, locate and display investigations and conclusions, collect and present a report, collect and present information, write an essay, conduct a survey, design and carry out a project, demonstrate skills practically, produce a poster, write a news report, carry out and analyse information and data.

ANNEXE A: PRACTICAL ASSESSMENT (INVESTIGATIONS DURING CONTINUOUS ASSESSMENT AND 6 MARKS DURING THE EXAMINATION)

The Practical Investigations and some questions (alternative to practical) in the examination:

- require the same experimental skills to be developed and learned
- require the understanding of the same experimental contexts
- test the same assessment objective, Assessment Objective C

Learners are expected to be made familiar with the following experimental contexts:

- simple quantitative experiments, including measurements of:
 - volume of gases and liquids
 - masses
 - temperatures
 - times
 - lengths
- diffusion
- osmosis
- food tests
- rates of enzyme catalysed reactions, including judging end-points, e.g. colour changes
- pH and the use of hydrogen-carbonate indicator, litmus paper and universal indicator
- photosynthesis (rate and limiting factors)
- transpiration (rate and limiting factors)
- heart rate and breathing rate
- respiration
- observation of seeds and flower structures
- germination
- observe images of biological specimens (under microscopes)
- make clear line drawings of biological specimens, calculating the magnification or actual size and providing labels
- use simple apparatus to carry out experiments

Learners maybe required to do the following during a **Practical Investigation**:

- **demonstrate knowledge of how to use apparatus and materials, including following a sequence of written or diagrammatic instructions:**
 - identify apparatus from diagrams
 - observe specimens through the microscope or hand lens
 - draw or label diagrams of biological specimens
 - describe food tests
 - describe how to test the pH of a solution or substance
 - describe how to ensure accuracy of observations and data collection
- **plan experiments and investigations:**
 - identify the dependent and independent variables
 - explain why certain variables should be kept constant
 - describe the experimental procedures, including a suitable control experiment
 - suggest safety precautions
 - make reasonable predications of expected results
 - record the results of the experiments appropriately
 - process the results of an experiment and draw up a reasonable conclusion

- **make and record observations, and measurements and estimates:**
 - take readings from apparatus or from diagrams of apparatus with appropriate precision
 - take sufficient observations or measurements, including repeats to increase accuracy
 - record qualitative observations from tests e.g. food tests
 - record observations and measurements in tables with appropriate units
- **Interpret and evaluate experimental data and observations:**
 - present data graphically
 - analyse and interpret data and observations, including data presented graphically
 - do not extrapolate
 - describe and explain the trend shown by the graphs with support evidence of readings from the graphs
 - evaluate the quality of observations and data, identifying any anomalous results and suggesting appropriate actions or solutions
- **evaluate methods and suggest possible improvements:**
 - evaluate experimental procedures, methods and techniques, including the use of control
 - identify possible sources of error
 - suggest possible improvements to the apparatus, experimental procedures, methods and techniques

ANNEXE B: APPARATUS, MATERIALS AND REAGENTS

These lists give items learners should be familiar with using, whether they are doing practical work or writing an alternative to practical test. These items should be available for use in the practical experiments. These lists are not exhaustive and improvisation can also be applied.

Every effort is made to limit the resources required by schools and so minimise the costs. Experiments are designed around basic apparatus and materials which should be available in most school laboratories or are easily obtainable.

Hazard codes are used where relevant and learners should be familiar with the meanings of these codes and terms but will not be assessed on them.

C	corrosive	MH	moderate hazard
HH	health hazard	T	acutely toxic
F	flammable	O	oxidising
N	hazardous to the aquatic environment		

Learners must be provided with appropriate safety equipment, such as **suitable eye protection** and **gloves** during practical experiments.

Chemicals, reagents and indicators

The list below is not intended to be comprehensive but shows the types of chemicals, reagents and indicators that learners should be familiar with.

- Benedict's solution
- Biuret reagent
- carbohydrates (starch, glucose, sucrose), proteins, lipids
- DCPIP
- dilute acid
- dilute alkali
- distilled or deionised water
- Ethanol
- Indicators (universal indicator solution, hydrogen carbonate indicator, litmus solution)
- Hydrogen peroxide solution
- Iodine in potassium iodide solution (iodine solution)
- Limewater
- methylene blue dye
- petroleum jelly (Vaseline® or similar)
- sodium chloride
- sodium hydrogen carbonate (sodium bicarbonate)

Apparatus

- balance to measure up to 500g, with precision of at least 0.1 g
- microscopes (at least one or two)
- beakers (various sizes, 100cm³ , 250cm³)
- bungs to fit small test-tubes and large test-tubes
- bungs with delivery tubes to fit small test-tubes and large test-tubes
- filter funnels
- filter paper
- forceps

- glass rods
- hand lenses (at least $\times 6$ magnification)
- lamps for photosynthesis experiments
- means of cutting biological materials (e.g. scalpels or sharp knives)
- means of writing on glassware (e.g. wax pencils or water-resistant markers)
- measuring cylinders (e.g. 10, 25 and 100cm³)
- mounted needles or seekers or long pins with large heads
- rulers, graduated in mm
- scissors
- partially permeable membrane (e.g. Visking or dialysis tubing)
- Pasteur or dropping pipette
- Petri dishes
- stopwatches, reading to 1 s or better
- syringes (various sizes, 1 cm³, 5cm³, 10cm³)
- test-tubes – small (125mm $\times$ 15mm) and large (150mm $\times$ 25mm)
- test-tube racks and test-tube holders
- thermometers, -10°C to $+110^{\circ}\text{C}$, with 1 $^{\circ}\text{C}$ graduations
- wash bottles
- white tiles or other suitable cutting surfaces

ANNEXE C: GLOSSARY OF COMMAND WORDS USED IN SCIENCE TEACHING AND ASSESSMENT ACTIVITIES

Analyse	Examine information in detail to discover patterns and relationships, or to study and determine relationship or accuracy
Apply/use	Emphasises the correct use of a equipment's, procedures, rules or facts, e.g. a child may be able to use a Bunsen burner, but not do so correctly or have no regard to safety
Calculate	A numerical answer is required - working must be shown
Classify	To arrange or organise according to systematic groups, classes, properties, characteristics or categories
Collect data/samples	Pose questions, select sources and/or design questionnaires. Physically collect samples
Compare / differentiate	To explain the resemblances, similarities or differences between two or more numbers, objects, or figures by considering their attributes/characteristics; or to determine if two or more items, entries or variables are the same and if not, identify differences and give a reason for your answer
Distinguish/ identify	Tell apart, show or indicate the difference between, find out what is unique about a material or situation Example: Distinguish between a heat and solar energy
Construct/draw/record	Make an accurate drawing, graphs, tables, charts or representation by using mathematical instruments and/or rules. In case of diagrams, make detailed drawing with heading and all relevant labels. In graph work or charts, an accurate to scale curves or lines should be given with a heading and relevant labels and units. In tables the heading and labels should be given. In tables the units should be given in the heading of the columns or with each entry but not both
Convert	Change from one unit of measure to another
Deduce	Use the information provided to come to a conclusion, e.g. reference to a law or principles, or the necessary reasoning is to be included in the answer
Define	A literal statement is required
Describe / observe	Write down what you do, or what you would see, hear, feel, smell and taste, in as much detail as possible with due regards to safety
Design	Make a plan or drawing to show the appearance of something before it is made
Determine	Use the information given to work out the answer – no working
Discrete data	Individually separate data, e.g. colour of cars – as opposed to continuous data, such as height
Discuss	Give a critical account of the points involved in the topic
Estimate	Implies a reasoned statement or calculation about something. Produce an approximate answer using rational, logical

	procedures (e.g., rounding for numbers and benchmarks for measures)
Evaluate	Use the information provided to make a judgement about something
Explain	Give a reason for your answer
Find	A general term which means calculate, determine or measure
Give / state / write down / express	Write down your answer
Interpret	Reasoning or some reference to theory, depending on the content; explain the meaning of something
Investigate	Examine a problem in a systematic way
List	Give a number of points, generally each of one word
Name	Identify by mentioning the name of something
Outline	Give a brief answer writing down the main points
Predict	To determine the next step or value (to make an educated guess), based on evidence or a pattern; make a logical deduction either from your own knowledge or from the information given in the question or both
Recognise	Be aware of a fact or problem
Relate	Find the relationship between one or more variables
Select	Choose from a number of alternatives
Sketch	Make a rough drawing that shows the salient or distinguishing features of an object; in diagrams, make a simple, freehand drawing and in graph work, the shape and/or position of the curve should be given
Study	Use the information or data provided to investigate a problem in a systematic way
Suggest	Use your knowledge of the context of the problem and mathematical procedures to give what you think is the best strategy to use or answer to the question use your knowledge of science and the information in the question to give what you think is the best answer

ANNEXE D: TERMINOLOGY, UNITS, SYMBOLS AND PRESENTATION OF DATA IN LIFE SCIENCE

2.1 Numbers

The decimal point will be placed on the line, e.g. 52.35.

Numbers from 1000 to 9999 will be printed without commas or spaces.

Numbers greater than or equal to 10 000 will be printed without commas. A space will be left between each group of three whole numbers, e.g. 4 256 789.

2.2 Units

The International System of units will be used (SI units). Units will be indicated in the singular not in the plural, e.g. 28 kg.

(a) SI units commonly used in Life Science are listed below.		
N.B. Care should be taken in the use of mass and weight. In most biological contexts, the term mass is correct, e.g. dry mass, biomass		
Quantity	Name of unit	Symbol for unit
length	kilometre	km
metre	m	
centimetre	cm	
millimetre	mm	
micrometre	μm	
mass (align to kg)	tonne (1000 kg)	(no symbol)
kilogram	kg	
gram	g	
milligram	mg	
microgram	μg	
time	year	y
day	d	
hour	h	
minute	min	
second	s (not sec)	
amount of substance	mole	Mol
(b) Derived SI units are listed below		
energy	Kilojoule or joule (calorie is obsolete)	kJ or J
(c) Recommended units for area, volume and density are listed below		
area	hectare = 10^4 m^2	ha
	square meter	m^2
	square decimetre	dm^2
	square centimetre	cm^2
	square millimetre	mm^2
volume	cubic kilometre	km^3
	cubic meter	m^3
	cubic decimetre (preferred to litre)	dm^3 (not l)
	cubic centimetre	cm^3 (not ml)
	cubic millimetre	mm^3
density	kilogram per cubic metre	kg m^{-3}
	gram per cubic centimetre	g cm^{-3}
(d) Use of solidus		
The solidus (/) will be used for a quotient, e.g. m/s for metres per second.		

2.3 Presentation of data

(a) Tables

- (i) Each column of a table will be headed with the physical quantity and the appropriate unit, e.g. time/s. There are three acceptable methods of stating units, e.g. metre per second or m per s or m s^{-1} .
- (ii) The column headings of the table can then be directly transferred to the axes of a constructed graph.

(b) Graphs

- (i) The independent variable should be plotted on the x-axis (horizontal axis) and the dependent variable plotted on the y-axis (vertical).
- (ii) Each axis will be labelled with the physical quantity and the appropriate unit, e.g. time/s.
- (iii) The graph is the whole diagrammatic presentation. It may have one or several curves plotted on it.
- (iv) Curves and lines joining points on the graph should be referred to as 'curves'.
- (v) Points on the curve should be clearly marked as crosses (x) or encircled dots (⊙). If a further curve is included, vertical crosses (+) may be used to mark the points.

(c) Pie charts

These should be drawn with the sectors in rank order, largest first, beginning at 'noon' and proceeding clockwise. Pie Charts should preferably contain no more than six sectors.

(d) Bar charts

These are drawn when one of the variables is not numerical, e.g. percentage of vitamin C in different fruits. They should be made up of narrow blocks of equal width that do **not** touch.

(e) Column graphs

These are drawn when plotting frequency graphs from discrete data, e.g. frequency of occurrence of leaves with different numbers of prickles or pods with different numbers of seeds. They should be made up of narrow blocks of equal width that do **not** touch.

(f) Histograms

These are drawn when plotting frequency graphs with continuous data, e.g. frequency of occurrence of leaves of different lengths. The blocks should be drawn in order of increasing or decreasing magnitude and they **should** be touching.

2.4 Taxonomy

Taxonomy is the study of the principles of the organisation of taxa into hierarchies. There are seven levels of taxon – kingdom, phylum, class, order, family, genus and species. These may be used when teaching the concept and use of a classificatory system, the variety of organisms, and the binomial system. The following should apply:

- (a) Five kingdoms are now recognised as:

prokaryotes	(Prokaryotae), including bacteria and blue-green bacteria
protocists	(Protoctista), including green, red and brown algae and protozoan
fungi	(Fungi)
plants	(Plantae)
animals	(Animalia)

The viruses cannot be fitted into this classificatory system.

- (b) The binomial system of naming gives each organism a two-word name. The first word is the generic name and the second word is the trivial name, e.g. *Homo sapiens*. The trivial name should never be used by itself.
- (c) Generic and trivial names are distinguished from the rest of the text either by underlining (when written or typed) or by set in italic (in print).
- (d) The generic name always takes an initial capital letter. It can be accepted as shorthand for the species name where the intent is obvious, e.g. *Plasmodium*, and in these circumstances can stand alone.
- (e) The common name should not normally be written with an initial capital letter, e.g. cat and dog. The exception is *Man*, where it is the common name for a species where the two sexes are distinguished by the terms man and woman.
- (f) A species is not easy to define but an acceptable general definition is as follows.
'A group of organisms capable of interbreeding and producing fertile offspring.'

2.5 Terminology

- (a) Wherever possible, English terms should be used in preference to Latin or Greek terms, e.g. the term red blood cell should be used and not erythrocyte.
- (b) Generalised terms should be stated in English, e.g. small intestine.
- (c) Where no suitable English terms exist, Latinised terms are unavoidable and will need to be used, e.g. atrium, bronchus, villi.

ANNEXE E: ASSESSMENT RECORD SHEET FOR GRADE 8 AND 9 (TERM 1 AND 2)

ASSESSMENT RECORD SHEET: LIFE SCIENCE

Grade: Year: School: Teacher:

Name of learner	Term 1											Term 2										
	Practical Investigation		Topic Task		Topic Test		Total Topic test (40 ÷ 2)	CA mark	End of Term Test (65 x 2)	Term mark (70 + 130)	Weighted Term Mark (200 ÷ 2)	Practical Investigation	Project (30 ÷ 2)	Topic Task		Topic Test		Total Topic test (40 ÷ 2)	CA mark	End of Term Test (65 x 2)	Term mark (70 + 130)	Weighted term mark (200 ÷ 2)
	1	2	1	2	1	2						1	1	1	2	1	2					
	15	15	10	10	20	20	20	70	130	200	100	15	15	10	10	20	20	20	70	130	200	100

Term 1
Moderator
Rank

Signature
Date

Term 2
Moderator
Rank

Signature.....
Date

ANNEXE F: ASSESSMENT RECORD SHEET FOR GRADE 8 AND 9 [TERM 3]

ASSESSMENT RECORD SHEET: LIFE SCIENCE

Grade: **Year:** **School:** **Teacher:**

[illegible]

Moderator Signature Rank Date



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