basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

LIFE SCIENCES

EXAMINATION GUIDELINES

GRADE 12

2011

This guideline consists of 28 pages.

INTRODUCTION

This Examination Guideline for 2011 is designed to provide clarity on the depth and scope in terms of the content to be taught, learned and assessed in Grade 12 in 2011. This must be read in conjunction with the following documents

(i) NCS - Grades 10-12: Subject Assessment Guidelines - Life Sciences (2008)
(ii) NCS - New Content Framework in Life Sciences - Strands Document - (2007)

This examination guideline consists of the following:

1.1 Weighting of the Learning Outcomes for Grade 12 from 2011

1.2 Sequence and Weighting of Strands/Knowledge Areas for Grade 12 from 2011

1.3 Weighting of Cognitive Levels for Grade 12 from 2011

1.4 Format of the Examination Question Paper for Grade 12 from 2011

1.5 Life Sciences Grade 12 Suggested Year Planner

1.6 Elaboration of Content

1.1 WEIGHTING OF THE LEARNING OUTCOMES FOR GRADE 12 FROM 2011

Learning Outcome 1	Learning Outcome 2	Learning Outcome 3
30%	60%	10%

1.2 SEQUENCE AND WEIGHTING OF STRANDS/KNOWLEDGE AREAS FOR GRADE 12 FROM 2011

	Grade 12	Percentage (%)
Paper 1	Life at molecular, cellular and tissue levels	60%
	Diversity, change and continuity	40%
Paper 2	Life processes in plants and animals	60%
	Environmental studies	40%

1.3 WEIGHTING OF COGNITIVE LEVELS FOR GRADE 12 FROM 2011

Category Reference	Level	Cognitive Levels	Percentage
A	Lower Order (60%)	Knowledge	30
B		Comprehension	30
C	Higher Order (40 %)	Application	20
D		Analysis, Synthesis and evaluation	20

1.4 FORMAT OF THE EXAMINATION QUESTION PAPER FOR GRADE 12 FROM 2011

Sections	Types of questions	Marks
A	Short answer, objective questions such as MCQ, terminology, columns/statements and items	50
B	A variety of questions types: 2 questions of 30 marks each, divided into 3 – 4 subsections	2 x 30
C	Consists of two parts: • Data-response questions • A mini-essay (may address one or more learning outcomes)	 20 20

1.5 LIFE SCIENCES - Grade 12

Suggested Year Planner

YEAR: _____

Week	Planned Date (week ending)	Completion Date (week ending)	Topic for the week
TERM 1			
Week 1			DNA structure, replication
Week 2			RNA, protein synthesis, mutation
Week 3			Meiosis
Week 4			Genetics
Week 5			Genetics
Week 6			Genetics
Week 7			Evolution: origins
Week 8			Evolution: natural selection and speciation
Week 9			Evolution: evidence
Week 10			*Controlled Tests*
Week 11			*Controlled Tests*
TERM 2			
Week 1			Evolution: human evolution
Week 2			Evolution: evolution in present times/alternative explanations
Week 3			Plant/Animal responses to the environment
Week 4			Human nervous system
Week 5			Nerves, reflex arc
Week 6			Eye
Week 7			Ear
Week 8			Human endocrine system/Homeostasis and Temperature Regulation
Week 9			Revision
Week 10			*June Exam*
Week 11			*June Exam*
TERM 3			
Week 1			Sexual and asexual reproduction/Life cycle of plants and insects
Week 2			Reproduction in flowers/importance of seeds/reproductive strategies
Week 3			Human reproduction
Week 4			Human reproduction
Week 5			Population ecology: size of population
Week 6			Population ecology: trends in human population/social organisation
Week 7			Community structure/Community change over time
Week 8			Revision
Week 9			*Preparatory Exam*
Week 10			*Preparatory Exam*
Week 11			*Preparatory Exam*
TERM 4			
Week 1			Revision
Week 2			Revision
Week 3			Revision
Week 4			*Final Exam*
Week 5			*Final Exam*
Week 6			*Final Exam*
Week 7			*Final Exam*
Week 8			*Final Exam*
Week 9			*Final Exam*

NOTE: The number of weeks indicated per term are applicable to 2011. This has to be adjusted according to the school calendar when planning for the subsequent years.

1.6 ELABORATION OF CONTENT

TISSUES, CELLS AND MOLECULAR STUDIES

DNA – the code of life; and RNA

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Structure and functions of the nucleus	❑ Revise the structure and functions of the following parts of the nucleus: • Nuclear envelope with pores • Nucleoplasm • Chromosomes (chromatin network)	
DNA: Structure, coding and replication	❑ DNA and RNA are nucleic acids consisting of building blocks called nucleotides ❑ Location of DNA [chromosomal (genes) & mitochondrial] ❑ History of the discovery of the DNA molecule (Watson,Crick & Franklin story) ❑ Double helix configuration of DNA, with hydrogen and sugar-phosphate bonds ❑ Three components of a nucleotide as follows: • Nitrogenous bases linked by hydrogen bonds • 4 nitrogenous bases of DNA: adenine (A), thymine (T), cytosine (C), guanine (G) • Pairing of bases in DNA occurs as follows A : T and G : C • Sugar portion (deoxyribose in DNA) • Phosphate portion ❑ Functions of DNA in terms of the following: • Genes as sections of DNA, carrying hereditary information • Contains coded information for protein synthesis ❑ DNA replication under the following: • When and where it takes place • Process of DNA replication (names of enzymes involved not required) • Significance of DNA replication ❑ The DNA profiling (finger-printing) with respect to the following: • The concept of DNA profiling • Its use in forensics • Costs, ethical considerations and consequences of interpretation errors	❑ Simple process to extract DNA and examine the threads (using house-hold detergents). ❑ Make a model of DNA and draw stick diagram representing a portion of the structure of a DNA molecule (in a ladder-like form).

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
RNA: Structure	❑ Location and functions of mRNA and tRNA ❑ Structure of RNA as single stranded and consisting of nucleotides, each made up of a sugar (ribose), phosphate and nitrogen base ❑ 4 nitrogenous bases of RNA: adenine (A), uracil (U), cytosine (C), guanine (G) ❑ Similarities and differences between DNA and RNA	❑ Make a model of RNA and draw a stick diagram of a portion of a RNA molecule
Protein synthesis	❑ Proteins are made of amino acids where the sequence of the amino acids determines the type of protein (no need to memorise the names of the amino acids) ❑ The role of DNA and RNA in protein synthesis • Transcription • Double stranded DNA unzips • When the hydrogen bonds break • One strand is used as a template • To form mRNA • Using free RNA nucleotides from the nucleoplasm • The coded message for protein synthesis is thus copied onto mRNA • mRNA moves from the nucleus to the cytoplasm and attaches to the ribosome • Translation • tRNA collects amino acids • tRNAs, with amino acids attached, become arranged on the mRNA • The anticodons on the tRNAs match complementary bases on the codons of mRNA (specific codons and anticodons not to be memorised) • Amino acids become attached by peptide bonds to form the required protein • Each tRNA is released to pick up more amino acids	❑ Use cardboard models to demonstrate DNA replication and protein synthesis
Gene mutation	❑ Definition of gene mutation ❑ Effect of mutations on protein synthesis	
DNA sequences and the relationship between organisms	❑ Sequencing of DNA in providing evidence of relationships between groups of organisms (Link with grades 10 & 11- interpreting phylogenies)	

Meiosis

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Chromosomes	❑ Review of the structure of a cell (Grade 10) to identify the location of chromosomes ❑ The chromosome consists of genes made up of DNA and protein ❑ The number of chromosomes in a cell is a characteristic of an organism (for example humans have 46 chromosomes) ❑ Chromosomes which are single stranded become double stranded (two chromatids joined by a centromere) as a result of DNA replication ❑ Difference between: • Haploid(n) and diploid(2n) number of chromosomes • Sex cells (gametes) and somatic cells (body cells) • Sex chromosomes (gonosomes) and autosomes	
Meiosis	❑ Review of mitosis and the life cycle of humans to show the role of mitosis and meiosis (Grade 10) ❑ Define meiosis ❑ Site of meiosis in plants and in animals ❑ Meiosis is a continuous process but is divided into phases merely for convenience (names of phases not to be memorised). ❑ Describe the changes to the chromosomes during meiosis (outlining the events of each phase) • DNA replication takes place in Interphase, prior to meiosis • Changes to the chromosomes during meiosis • First Division (Meiosis 1) o Prophase 1 (including diagrams to show details of crossing-over) o Metaphase 1 (chromosomes align at equator in homologous pairs) o Anaphase 1 (homologous chromosomes split and start moving to the poles; cytokinesis starts) o Telophase 1 (cytokinesis complete; 2 new cells with half of the chromosome complement of the original cell) • Second Division (Meiosis 2) o Prophase 2 (chromosomes distinct) o Metaphase 2 (chromosomes align singly at the equator) o Anaphase 2 (chromosomes split at the centromere; chromatids start moving to the opposite poles; cytokinesis starts) o Telophase 2 (cytokinesis complete; 4 new cells result; each with half of the original chromosome complement and dissimilar from each other).	❑ Observe and draw prepared microscope slides or micrographs or models of cells in different stages of meiotic cell division.

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS

	❑ Importance of meiosis:
	• In the reduction of chromosome number from diploid to haploid
	• In the production of gametes
	• As a mechanism to introduce genetic variation through:
	  • Crossing-over
	  • The random arrangement of chromosomes at the equator
	
	❑ Consequences of abnormal meiosis leading to Down's Syndrome (chromosome pair 21 does not separate/non-disjunction)
	
	❑ Polyploidy and biotechnology and its advantages in agriculture such as the production of larger flowers, fruits and storage organs
	
	❑ Mitosis and meiosis with respect to:
	
	• Where each process occurs
	• The purpose of each type of cell division
	• Similarities and differences	

Genetics and Genetic Engineering

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Introduction	❑ Definition of genetics ❑ Mendel as the father of genetics and his experiments in developing the: • Concept of dominance • Law of segregation	
Concepts in inheritance	❑ Definitions of the following genetic concepts: • **Genes** as small portions of DNA and protein • **Alleles** as genes controlling the same characteristic, example eye colour • **Dominant** and **recessive** genes and alleles • **Monohybrid** crosses • **Phenotype** and **genotype** • **Homozygous** (pure-bred) and **heterozygous** (hybrid) • **Complete dominance** – e.g. tongue rolling • **Incomplete/partial dominance** – e.g. pink snapdragons, sickle cell anaemia • **Co-dominance** – e.g. blood groups • **Multiple alleles** – e.g. blood groups • **Polygenic inheritance** – e.g. skin colour, height • **Sex-linked characteristics** – e.g. haemophilia, colour blindness • **Karyotype** • **Cloning** • **Genetic modification** • **Human genome** ❑ Mutations : • Difference between gene mutation and chromosomal aberration • Point and frameshift mutations • Mutations introduce variation • Effect of mutations on natural selection • The effect of mutations in causing altered characteristics leading to diseases/disorders such: - Albinism – absence of pigmentation - Haemophilia – absence of blood clotting factors - Sickle cell anaemia – abnormal red blood corpuscles	❑ Conduct surveys and draw bar graphs of incidence of dominant and recessive characteristics amongst learners such as: • Attached(recessive)/unattached ear lobes (dominant) • Rolled (dominant)/unrolled tongue(recessive) • Straight little finger (recessive)/ bent little finger(dominant) ❑ Make interpretations on given karyotypes of organisms

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Genetics problems	❑ Solving of mohohybrid genetic problems (up to F_2/second generation) based on: • Complete dominance • Incomplete dominance • Co–dominance • Inheritance of sex • Inheritance of haemophilia and colour blindness as sex-linked characteristics ❑ Interpretation of pedigree diagrams	

Genetic engineering, ethics and legislation	❑ The importance of genetic engineering:
	• In medicine
	  • Production of, e.g. hormones, such as insulin
	  • Production of vaccines
	• In agriculture:
	  • Production of genetically modified crops which may be pest-resistant, drought-resistant, improved quality, etc.
	
	❑ Brief description of, and ethics & legislation around:
	• Genetic testing and genetic counselling
	• Genetic engineering (including selective breeding)
	• Cloning
	
	❑ Beliefs, attitudes and values concerning genetic diseases	

DIVERSITY, CHANGE AND CONTINUITY

Evolution

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Introduction	❑ Difference between a hypothesis and a theory ❑ Evolution is regarded as a scientific theory consisting of overarching explanations of hypotheses that have been tested and verified over time	
Origin of an idea about origins	➢ **Erasmus Darwin** (1731 – 1802) ❑ Ideas on evolution that were proposed by Erasmus Darwin: • All life developed from simple forms • There are similarities amongst various organisms • Artificial selection and metamorphosis showed how changes may have occurred ➢ **Jean Baptiste de Lamarck** (1744 – 1829): ❑ Two ideas of Lamarck in explaining evolution: • Use and disuse • Inheritance of modified characteristics ❑ Examples of the application of Lamarck's theory (such as in the long neck of giraffe or the legs of snake) ❑ Reasons for Lamarck's theory being rejected by most life scientists today ➢ **Alfred Wallace** (1823 – 1913) ❑ Natural selection as an explanation for evolution ➢ **Charles Darwin** (1809 – 1882) ❑ Charles Darwin's Theory of Evolution by Natural Selection under the following headings: • The historical development: • Darwin's 5-year voyage around the world in the HMS Beagle, collecting specimens and keeping notes of plants, animals seen and geography of countries visited • **Publication of Darwin's *On the Origin of the Species* in 1859**	

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Evolution by natural selection (Charles Darwin)	❑ The observations on which Darwin based his theory: • Organisms of a species produce a large number of offspring • The offspring show a great deal of variation • Of the large number of offspring produced, only a few survive • Characteristics are inherited from surviving parents to offspring ❑ Explanation of Darwin's theory of evolution by natural selection ❑ Examples of the application of Darwin's theory (such as in the long neck of giraffe or the legs of snakes) ❑ Similarities and differences between natural and artificial selection ❑ Artificial selection illustrated by using one example of a domesticated animal species and one crop species	❑ Conduct a practical activity to show the variation that exists within the offspring of a species and that not all offspring survive such as by planting mustard seeds, observing the appearance of the seedlings and recording the proportion of seeds that germinate/seedlings that survive for a certain period of time. ❑ Demonstration of principles of natural selection through camouflage and avoidance of predation, using e.g. games, models.
Formation of a new species	❑ Species as a group of organisms that can interbreed and produce fertile offspring ❑ Speciation as a mechanism for producing new species ❑ Extinction as the elimination of a species from the world ❑ Definition of allopatric (through geographic isolation) and sympatric speciation (through various reproductive isolation mechanisms) ❑ Examples of reproductive isolation mechanisms: • Breeding at different times of the year • Species-specific courtship behaviour (animals) • Adaptation to different pollinators (plants) • Infertile offspring (e.g. mules) ❑ Explanation of allopatric speciation through geographic isolation using an example such as the Galapagos finches or mammals on different land masses ❑ Explanation of sympatric speciation using an example such as the cichlid fishes in Lake Malawi	

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Evidence for evolution	❑ The theory of evolution emerges from different lines of evidence and the contribution of many scientists: • Fossil record (Grade 10) • Modification by descent (Grade 11) • Biogeography (Grade 11) • Genetics (Grade 12) ❑ Differences in the appearance of organisms within a species due to variations caused by: • Meiosis (crossing over and random arrangement of chromosomes) • Mutations • Random mating • Random fertilisation	
Human evolution	❑ Interpretation of a phylogenetic tree to show the place of the family Hominidae in the animal kingdom ❑ Characteristics that we share with other primates ❑ Characteristics that make us different from other primates ❑ Changes in structure that characterise human evolution • Bipedalism (Shift of foramen magnum to a more forward position) • A more rounded skull and increased cranium size • A flatter face due to: • Less sloping forehead • Less protruding jaws (decreased prognathous) • A more developed chin • A more rounded jaw • Increased size of skeleton • Change in dentition ❑ Progressive evolution of the above listed features from the ape-like beings to the humans: (using fossil evidence where indicated) • Ape-like beings • First apes on the same line of development as humans • First bipedal primates • Australopithecines (Mrs Ples, Taung child, Little foot, Lucy, *Australopithecus sediba* or karabo) • *Homo habilis* (Handyman) • *Homo erectus* • *Homo sapiens* (modern humans, Florisbad man)	❑ Map out the sequence of human evolution from ape-like ancestor around 5 mya to modern Homo sapiens. Emphasize the fossils found in Africa, and the simultaneous existence of several species at various times in the past. (Trends in human evolution ; australopithecines like Mrs Ples, Taung child, Little Foot, Lucy, Karabo.)

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
	❑ The contribution of African fossils to the understanding of human evolution • Fossils found in the Cradle of Humankind and scientists' interpretation of these fossils • Fossils found in the Great Rift Valley an their interpretation (Nutcracker man, Handy man, Toumai) ❑ The 'Out of Africa' hypothesis with regard to: • Fossil evidence for the 'Out of Africa' hypothesis (Mrs Ples, Taung child, Little foot, Karabo, Nutcracker man, Handy man,Toumai) • Migration of *Homo erectus* from Africa into the rest of the world • Genetic evidence for the "out of Africa' hypothesis (DNA from Y chromosomes and mito-chondrial DNA)	
Evolution in present times	❑ Examples of evolution by natural selection still occurring in present times: • Use of DDT and consequent resistance to DDT in insects can be explained in terms of natural selection • Development of resistant strains of tuberculosis-causing bacteria (MDR and XDR) to anti-biotics	
Alternative explanations	❑ The conflict that existed and still exists between religion and science with respect to evolution ❑ Cultural and religious explanations for the origin and development of life on earth ❑ Science is limited to explaining physical structures and events but not spiritual or faith-based matters and that both are important to humans, but in different ways	

LIFE PROCESSES IN PLANTS AND ANIMALS

Responding to the Environment and Reproduction

Responding to the Environment

Plant responses to the environment

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Plant hormones	❑ General functions of the following plant hormones: • Auxins • Gibberellins • Abscisic acid ❑ Role of auxins in geotropism through the regulation of differential growth ❑ Role of auxins in phototropism through the regulation of differential growth ❑ Uses of plant hormones in agriculture: • Auxins as herbicides • Auxins to control apical dominance • Auxins and gibberellins to increase/stimulate fruit development	❑ Investigate geotropism and phototropism by controlling variables
Plant defense mechanism	❑ The role of the following as plant defense mechanisms • Chemicals (protection against infection from pathogenic micro-organisms and from being eaten by herbivores) • Thorns (protection from being eaten by animals/to reduce water loss)	

Animal responses to the environment

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Introduction	❑ Hormones and nerves enable animals to: • Respond to internal and external changes • Co-ordinate the various activities of the body	❑ Observations of the response of some invertebrates, e.g. wood lice, to light and humidity
Human nervous system	❑ The need for a nervous system in humans in terms of: • Reaction to stimuli (stimuli can be external and internal) • Co-ordination of the various activities of the body	
Central nervous system	❑ Location and functions of: • Cerebrum • Hypothalamus • Cerebellum • Medulla oblongata • Spinal cord	❑ Model of human brain ❑ Observe and draw the external structure of the brain
	❑ Effects of certain drugs on the central nervous system: • Dagga • Heroin • Ecstasy • Tik	
Peripheral nervous system	❑ Location and functions of the peripheral nervous system	
Autonomic nervous system	❑ Location and functions of autonomic nervous system (sympathetic and para-sympathetic)	
Disorders of the CNS	❑ Causes, symptoms, treatment of any ONE of the following diseases/disorders of the nervous system: Alzheimer's Disease, Attention Deficit Disorder OR Depression.	

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Structure and functioning of a nerve	❑ Generalised structure of a neuron including: nucleus, cell body, cytoplasm, myelin sheath, axon and dendrites ❑ Structure and functions of the three types of neurons ❑ The nerve is composed of nerve fibres held together by connective tissue ❑ Transmission of nerve impulses along neurons and across synapses using neurotransmitters (no detail of electrical charges is necessary)	❑ Labelled drawings to show the three types of neurons from microscope slides/micrographs
The simple reflex arc	❑ Difference between a reflex action and a reflex arc ❑ Structure of a simple reflex arc (receptor, sensory neuron, dorsal root of spinal nerve, spinal cord, inter-neuron, motor neuron, ventral root of spinal nerve,effector) ❑ Functioning of a simple reflex arc, using an example ❑ Significance of a reflex arc	❑ Observe microscope slides and draw and LABEL the cross section through the spinal cord

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Receptors	❑ Receptors detect a variety of different stimuli such as light, sound, touch, temperature, pressure, pain and chemicals (taste and smell) (No structure and names necessary except for receptors of eye and ear)	❑ Model of the eye ❑ Observe pupillary mechanism ❑ Dissect and draw a diagram of the mammalian eye
Human eye	❑ Structure and functions of the different parts of the human eye ❑ Functioning of the human eye in terms of: • Formation of an image (including role of rods and cones) • Binocular vision • Accommodation • Pupil reflex/pupillary mechanism ❑ Adaptations of the various parts of the eye for their functions ❑ Nature and treatment (glasses and surgery) of the following visual defects: • Short-sightedness • Long-sightedness • Astigmatism • Cataracts	❑ Demonstration of the blind spot ❑ Model of the ear

Human ear	❑ Structure and functions of the different parts of the human ear ❑ Functioning of the human ear in: • Hearing (include the role of the organ of Corti without mention of its structure) • Balance ❑ Adaptations of the various parts of the ear for their functions ❑ Cause and treatment of the following hearing defects: • Middle ear infections (treatment using grommets) • Deafness (treatment using hearing aids and cochlear implants) ❑ The link between hearing defects and speech disorders ❑ The use of sign language by deaf people ❑ Attitudes towards blind and deaf people ❑ The rights of blind and deaf people	

Human Endocrine System

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Introduction	❑ Definition of chemical co-ordination ❑ Differences between endocrine and exocrine glands ❑ Characteristics of hormones: • Organic chemical messengers • Mostly protein in nature • May have several specific effects on organs and thus control a wide variety of activities • Do not operate in isolation but form an integrated system	❑ Identify endocrine glands on a human torso
Endocrine glands	❑ Location and the functions of hormones produced by the following endocrine glands in the body: • Hypothalamus (ADH) • Pituitary (GH, TSH, FSH, LH, prolactin) • Adrenal (adrenalin, aldosterone) • Pancreatic islets/islets of Langerhans (insulin, glucagon) • Ovary (oestrogen, progesterone) • Testis (testosterone) • Thyroid glands (thyroxin) ❑ Negative feedback: • Principle of negative feedback • Negative feedback mechanism using TSH and thyroxine as an example	
Medical disorders	❑ Causes, prevention, symptoms and management of each of the following: • Diabetes • Thyroid disorders • Growth disorders • Infertility	

Temperature regulation

Temperature regulation	❑ Structure and functions of the different parts of the skin ❑ Need to regulate body temperature in humans ❑ Role of each of the following in temperature regulation: • Sweating • Vasodilation • Vasoconstriction ❑ Adaptations of parts of the skin for thermoregulation ❑ Definitions of hypothermia and hyperthermia ❑ Preventative measures for hypothermia and hyperthermia	❑ Observe and draw prepared microscope slide of section through human skin or use micrograph or model. ❑ Use reference materials to research behavioural, physical or physiological adaptations for thermoregulation in three different kinds of animals such as: • Reptiles • Mammals • Birds

Reproduction

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Comparing asexual and sexual reproduction	❑ Definition of asexual and sexual reproduction ❑ Advantages and disadvantages of asexual reproduction ❑ Advantages and disadvantages of sexual reproduction ❑ Role of asexual reproduction in the propagation of plants	
Life cycles of plants	❑ Definitions of the following terms: • Alternation of generations • Haploid • Diploid ❑ Draw a schematic diagram of the life cycles of the following plants to highlight the alternation of generations: • A moss • A flower *No details of the reproductive structures is necessary, the focus is on the concepts*	

CONTENT	ELABORATION SUGGESTED SEQUENCE	INVESTIGATIONS
Life cycles of insects	❑ Definitions of metamorphosis, complete metamorphosis and incomplete metamorphosis ❑ Schematic diagram to illustrate life cycles with complete and incomplete metamorphosis ❑ Advantages and disadvantages of complete metamorphosis ❑ Advantages and disadvantages of incomplete metamorphosis	
Flowers as reproductive structures	❑ Definition of pollination ❑ Difference between self and cross pollination ❑ The seed develops from the ovule and the fruit develops from the ovary ❑ Significance of seeds in terms of the following: • Dispersal of the species and reduction of competition • Storage of food and survival of harsh weather conditions while being dormant • Protection of the embryo • Providing the seedling with food from the cotyledons ❑ Importance of seeds as a source of food ❑ The use of seed banks to maintain biodiversity	❑ Observe and describe the adaptations of a named South African example of : • A wind-pollinated flower, e.g. grass, maize • An insect-pollinated flower, e.g. *Erythrina* • A bird-pollinated flower, e.g *Aloe*
Diversity of Reproductive strategies in some animals	❑ Role of the following reproductive strategies in animals in maximizing reproductive success in different environments (using relevant examples): • Courtship • External fertilisation vs Internal fertilisation • Ovipary, ovovivipary and vivipary • Amniotic egg • Precocial and altricial development • Parental care ❑ The harvesting of eggs for human consumption	❑ Using reference materials, describe the reproductive strategies of ONE chosen animal species and analyse how effective these strategies are to its survival

Human Reproduction

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Introduction	❑ Schematic outline of the human life cycle to show the role of meiosis, mitosis and fertilisation	
Structure of the male and female reproductive systems of humans	❑ The male reproductive system: • Location and functions of the testes • Diagram showing epididymis, vas deferens. ejaculatory ducts and urethra, and the functions of each part • Diagram of the accessory glands : seminal vesicles, prostate glands and Cowper's glands and the functions of each part • Development of the secondary male characteristics during puberty under the influence of testosterone ❑ The female reproductive system: • Location and functions of the ovaries • Internal structure of ovary to show Graafian follicles in different stages of development with ova, and corpus luteum and the functions of each part • Identification on a diagram of the: ◦ Fallopian tubes with the ovaries, and the functions of each part ◦ Uterus with uterine wall lined by endometrium, and the functions of each part ◦ Vagina and its external opening, the vulva, and the functions of each part • Development of the secondary female characteristics during puberty under the influence of oestrogen and progesterone	❑ Study of the male and female reproductive systems of humans using charts, models ❑ Observe and draw from prepared microscope slides or micrographs of a cross-section of the testis and the ovary

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Gametogenesis	❑ Definitions of each of the following terms: • Gametogenesis • Oogenesis • Spermatogenesis ❑ Describe spermatogenesis as follows: • Epithelial cells in the testes undergo mitosis to form diploid spermatocytes • Each diploid spermatocyte in the seminiferous tubules of the testes undergoes meiosis • Four (4) haploid spermatids are formed • Each spermatid matures to form a haploid spermatozoan ❑ Structure of sperm cell and function of each part (acrosome, head with haploid nucleus, middle portion with mitochondria and a tail) ❑ Describe oogenesis as follows: • Before puberty, epithelial cells in the ovary divide by mitosis to form primary follicles • A diploid oocyte in the primary follicle enlarges and undergoes meiosis • Of the 4 haploid cells that result, only one survives to become a haploid mature ovum ❑ Structure and function of different parts of an ovum (layer of jelly, haploid nucleus, cytoplasm)	❑ Drawing of a labelled sperm cell and ovum from microscope slide
Ovulation and menstruation	❑ The menstrual cycle includes the uterine and ovarian cycles ❑ Events in the ovarian cycle • Young Graafian follicles in various stages of development • Mature Graafian follicle • Ovulation • Transformation into corpus luteum ❑ Uterine cycle: changes that take place in the in the wall of the uterus until the endometrium tears away accompanied by bleeding (menstruation) ❑ Hormonal control of the menstrual cycle (ovarian and uterine cycles) with reference to the action of FSH, oestrogen, LH and progesterone ❑ Negative feedback mechanism involving FSH, LH, oestrogen and progesterone	

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Fertilisation and implantation	❑ Definition of copulation and fertilisation ❑ Location and process of fertilisation ❑ Development of the zygote into a morula and then into a blastocyst and then into an embryo ❑ Implantation, including the role of oestrogen and progesterone in maintaining pregnancy	
Gestation	❑ Identification and functions of the following parts of the developing embryo: • chorion and chorionic villi • amnion, amniotic cavity and amniotic fluid • umbilical cord (including umbilical artery and umbilical vein) and placenta • chorion ❑ Three stages of the natural birth process (labour, expulsion of baby, release of the afterbirth)	
Contraception	❑ Definition of birth control/contraception ❑ Role of different methods in contraception: • Natural methods: withdrawal and the rhythm method • Barrier methods: condom, femidon and IUD • Chemical/drug treatment: spermcides, contraceptive pill, contraceptive injections • Surgical methods: sterilsation ❑ Effect of contraceptive pills on the production of FSH ❑ Beliefs and attitudes of different cultures on the use of contraceptives	❑ Investigate the attitudes and beliefs of different cultures on the use of contraceptives
Sexually Transmitted Diseases	❑ Causes, transmission, symptoms, treatment and prevention of : • Syphilis • Gonorrhoea	

Population and community ecology

Population ecology

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Introduction	❑ Definition and relationship amongst the following: • species • community • ecological niche • habitat • ecosytem • population • ecology	
Size of a population	❑ Definition and impact on population size of the following: • Natality • Mortality • Dispersal (including immigration, emigration and migration) ❑ Aspects of population fluctuation and regulation • Carrying capacity • Environmental resistance/limiting factors and its impact on population growth • The effect of annual and seasonal fluctuations on population size ❑ Characteristics of the following growth patterns/forms • Geometric growth form (J-shaped curve) • Logistic growth form (S-shaped curve) ❑ Methods to determine population size, population demographics and population movements • Direct technique (census) • Indirect technique – simple sampling and mark recapture	❑ Mark-recapture or simple sampling as a technique for determining population size
Human population	❑ Trends in human population growth up to 1650 and then from 1650 to the present moment and possible reasons for the trend ❑ Forecasts of the human population growth in South Africa over the next 20 years ❑ Interpretation of graphs showing human population age and gender distributions of different countries (developing and developed) ❑ Implications of further human population growth for the natural environment: • The meaning of the term 'ecological footprint' • Comparison of the ecological footprint of people in developing and developed countries • The effects of high population growth on the environment	

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
	❑ Tensions and issues around human demands versus conservation of the natural environment using any ONE of the following examples : • The hunting industry • Sustainable harvesting of natural resources • Creation and management of game reserves	
Social organisation	❑ Examples of social organisation that enhance survival • The formation of herds or flocks as a predator avoidance strategy • The formation of packs as a successful hunting strategy, e.g. wild dogs • Animals with dominant breeding pairs • Division of labour among members of a colony (termite colonies or bees or naked mole rats)	❑ Use books, videos, TV programmes to research social organisation of ONE bird or mammal species in South Africa. Present report as a written assignment, poster or oral presentation.

Community Structure

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Interactions in a community	❑ A community as a group of populations (producers, consumers and decomposers) living together in the same habitat. ❑ Definitions of producers, consumers (herbivores, carnivores, omnivores) and decomposers ❑ Interactions in a community and its effect on population size of other species in the community: • PREDATION • TWO examples of predation from the South African context. • COMPETITION • Intraspecific competition: competition between organisms of the same species depending on the same resources like food, space, shelter, water and access to mates. • Interspecific competition: competition between organisms of different species depending on the same resources e.g. light, space, water, shelter, food. • An example of competitive exclusion: competition in which one of the two competing species is much more successful that the other such that the successful species survives and the other species disappears	

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
	• Resource partitioning: competition in which competing species coexist in the same habitat since they use the resources slightly differently - At least ONE example of resource partitioning among plants, e.g. in a forest ecosystem - At least ONE example of resource partitioning amongst animals, e.g. coexisting shorebirds/coexisting large herbivores in an African savanna/coexisting predators like lions and leopards. • SYMBIOSIS • Definition of symbiosis as close association of two organisms such that one or both benefit from the association • Three types of symbiosis (mutualism, commensalisms and parasitism) ➢ **Parasitism** • Definition of parasitism as a relationship in which one of the species benefits and the other is harmed by the relationship • Scientists regard parasitism as a form of predation since the parasite feeds on the other organism and may kill it • TWO examples of parasitism in the Southern African context • The incidence of parasitic infections in different parts of South Africa related to humans and domestic animals and the influence of sanitation and play habits (e.g. swimming in rivers) on parasitic infections ➢ **Mutualism** • Definition of mutualism as the symbiotic relationship in which both of the species benefit from the association. • TWO South African examples of mutualistic relationships ➢ **Commensalism** • Definition of commensalism as two species living together where one species benefits and the other neither benefits nor suffers disadvantage • TWO South African examples of commensalism	

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Human influence on community structure	❑ Debates on decisions to intervene and control community structures, e.g. the culling of elephants. ❑ The impact of human settlements on community structures,e.g. iron age settlements, agriculture, cities. ❑ Aesthetic value placed on South Africa's biodiversity by South Africans	

Community change over time

CONTENT	ELABORATION/SUGGESTED SEQUENCE	INVESTIGATIONS
Ecological Succession	❑ Definition of ecological succession ❑ Primary succession as the sequence of organisms that occupy a new habitat. Pioneer plants are replaced by a succession of species ❑ Secondary succession as the sequence of organisms that occupy a disturbed habitat or when an established community has been disturbed in a catastrophic manner	❑ Investigate and identify at least ONE example of primary and ONE example of secondary succession in a local environment, e.g. school grounds ❑ Investigate community structure within a habitat and changes to this structure as the habitat changes. • Use at least ONE sampling method, e.g. quadrats, transects, traps or direct observation. • Discuss the importance of random sampling.